**Baker Environmental, Inc.**
*A Unit of Michael Baker Corporation*

Airside Business Park
100 Airside Drive
Moon Township, PA 15108
Office: 412-269-6300
Fax: 412-375-3995

July 20, 2007

U.S. Environmental Protection Agency - Region II
290 Broadway – 22nd Floor
New York, New York 10007-1866

Attn: Mr. Adolph Everett, P.E.
Chief, RCRA Programs Branch

Re: Contract N62470-02-D-3052
Navy CLEAN, District III
Contract Task Orders (CTO) 0121 and 0110
U.S. Naval Activity Puerto Rico (NAPR)
Navy Responses to EPA Comments dated May 29, 2007
EPA I.D. No. PR2170027203

Dear Mr. Everett:

Baker Environmental, Inc. (Baker), on behalf of the Navy, is pleased to provide you with the attached Navy Responses to EPA Comments dated May 29, 2007. These comments were on the Draft Phase I RCRA Facility Investigation Report for SWMU 68, Naval Activity Puerto Rico dated March 26, 2007; and the Final RCRA Facility Investigation Report for SWMU 14, Naval Activity Puerto Rico dated March 23, 2007.

Upon EPA approval of the Navy response to comments the Navy will modify the documents as outlined in the responses and submit Final documents for the sites covered in the EPA comments. If you have questions regarding this submittal, please contact Mr. Mark E. Davidson at (843) 743-2135. Additional distribution has been made as indicated below.

Sincerely,

**BAKER ENVIRONMENTAL, INC.**

Mark E. Kimes

Mark E. Kimes, P.E.
Activity Manager

MEK/lp
Attachments

cc: Ms. Jean Mann, NAVFAC Atlantic – Code AQ119 (letter only)
Mr. David Criswell, BRAC PMO SE (letter only)
Mr. Jeffrey G. Meyers, Navy BRAC PMO SE (letter only)
Mr. Mark Davidson, Navy BRAC PMO SE (1 copy)
Mr. Pedro Ruiz, NAPR (1 copy)
Mr. Tim Gordon, US EPA Region II (1 copy)
Mr. Matt Larry, TechLaw Inc. (1 copy)
Mr. Carl Soderberg, US EPA Caribbean Office (1 copy)
Mr. Manny Vargas, PR EQB (1 copy)
Ms. Yarissa Martinez, PR EQB (1 copy)
Mr. Felix Lopez, U.S. F&WS (1 copy)
Mr. John Swenfurth, CH2M Hill Tampa (1 copy)

**NAVY RESPONSES TO EPA COMMENTS DATED MAY 29, 2007**

**EPA COMENTS ON THE NAVAL ACTIVITY PUERTO RICO PHASE I RCRA FACILITY INVESTIGATION REPORT FOR SWMU 68 – FORMER SOUTHERN FIRE TRAINING AREA DATED MARCH 26, 2007**

Draft Phase I RFI Report for SWMU 68 (former Southern Fire Training Area)

EPA does not fully concur with the conclusions and recommendations made in Section 6.0 of the Draft Phase I RFI Report (the Report) for SWMU 68 (former Southern Fire Training Area), submitted on behalf of the Navy by Mr. Mark Kimes' (of Baker Environmental) letter of March 26, 2007. Specifically, EPA does not fully concur with the statement in Section 6.1 that " . . . it is concluded that no impact to the groundwater is present due to past Navy operations." Also, EPA does not concur with the statement in Section 6.2 of the Report that "No additional investigations are warranted ... "

While EPA does concur with the recommendation given in Section 6.2 of the Report that due to "the presence of lead in the surface soil . . . . . .a very limited remedial action for surface soil (excavation and disposal with confirmatory sampling) is warranted", EPA is concerned that no actions are proposed to address vanadium in the surface and subsurface soils and the groundwater.

EPA notes that although lead concentration of 53 mg/kg found in the surface soil at 68SB08, exceeded the Region IX residential PRG of 40 mg/kg and the base-wide background concentration of 22 mg/kg indicated in the October 17, 2006 "Revised Final Summary for Environmental Background Concentrations for Inorganic Constituents Report" (the Background Report), lead concentrations in the other 10 surface soil samples at SWMU 68 were below both the PRGs and the site-wide background concentrations. Whereas the vanadium concentrations found at SWMU 68 exceeded the corresponding industrial and/or residential PRGs in all 11 of the surface soils samples analyzed and in all 22 of the subsurface soil samples analyzed. Likewise in the groundwater at SWMU 68 the vanadium concentration exceeds its tap water PRG of 3.6 ug/l in all 7 of the samples analyzed. While the maximum vanadium groundwater concentration measured in the groundwater at SWMU 68 of 210 ug/L (estimated) is less than the base-wide background concentration indicated in the October 17, 2006 "Revised Final Summary for Environmental Background Concentrations for Inorganic Constituents Report" (the Background Report), that maximum concentration (210 ug/L) is more than 50 times greater than the corresponding tap water PRG of 3.6 ug/l vanadium. EPA is concerned that the vanadium concentrations measured at SWMU 68 may not be fully ascribable to natural background concentrations. It should further be noted that the deeper subsurface soil sample (68SB04-02) collected at 12-14 feet below grade in boring 68SB04, had a vanadium concentration of 440 mg/kg, which exceeds not only the corresponding residential and industrial PRGs of 7.8 and 102 respectively, but also the indicated "background" concentration of 434 mg/kg established in the Background Report.

In addition, arsenic was found in all 11 surface soil samples at SWMU 68 at concentrations exceeding the Region IX residential PRG, and exceeding the industrial PRG at 4 of the 11 locations. Yet only one of the surface soil samples (68SB02) exceeded the base-wide background surface soil concentration for arsenic of 2.65 mg/kg indicated in the October 17, 2006 Background Report. However, 3 of the 11 subsurface surface soil samples (locations 68SB01, SB02 and SB04), found arsenic concentrations exceeding both the Region IX residential and the

industrial PRGs and the base-wide background concentration for subsurface soils of 1.59 mg/kg arsenic, indicated in the October 17, 2006 Background Report.

EPA notes that none of the base-wide surface soil and groundwater background samples (in the 2006 Background Report) were collected in the vicinity of SWMU 68; however, 3 of the base-wide subsurface soil background samples (14E-SB-02-02, 14E-SB03-02,and 14 E-SB0I-04) were collected during the 2004 Environmental Conditions of Property (ECP) investigations at what subsequently became identified as SWMU 68, and all 3 may have been impacted by contamination, based on reported indications of "DRO" (diesel range organics) in those samples.

EPA also notes that the October 17, 2006 Background Report offered no explanation as to why such elevated vanadium concentrations would be naturally occurring. Thus EPA is concerned that the base-wide background concentrations for arsenic, lead, and particularly vanadium, established in the October 17, 2006 Background Report, may not be fully representative of natural background conditions in the SWMU 68 area and/or may have been impacted by contaminant releases.

**Navy Response to EPA General Comment:** The USEPA concerns discussed above are addressed in the Responses to USEPA Comment Nos. 1 through 4 below for SWMU 68.

Prior to our approving the Draft Phase I RFI report and its conclusion in Section 6.1 of the Report that "It is evident from analysis obtained during the Phase I RFI investigation that there has been very little impact on the environment due to Navy activities at SWMU 68." (Section 6.1), EPA requests that the Navy submit, within 45 days of your receipt of this letter, the following:

1) a proposal for implementing additional background sampling for vanadium in surface and subsurface soils and groundwater, in order to more conclusively determine whether or not the elevated vanadium concentrations measured in the surface and subsurface soils and groundwater at SWMU 68 are in-fact natural occurring and not the result of releases from SWMU 68 (or another SWMU or AOC);

**Navy Response to EPA Comment #1:** The Navy does not believe that additional background sampling is warranted to demonstrate that vanadium concentrations measured in SWMU 68 soils and groundwater are naturally occurring. A comparison of the vanadium background surface soil analytical data summarized in the Revised Final Summary Report for Environmental Background Concentrations of Inorganic Compounds (Baker, 2006) to USGS vanadium data for Puerto Rico is shown in Table 1. The USGS data were previously presented and discussed in the document entitled Final Corrective Measures Study Investigation Report for SWMU 9 (Baker, 2003). As evidenced by Table 1, the range of vanadium concentrations within the NAPR background data set falls within the range of concentrations within the USGS data set. This comparison indicates that the NAPR background surface soil data are representative of background conditions for Puerto Rico.

A probability plot of the NAPR background surface soil vanadium data set (see Figure 1) supports the conclusion that the background surface soil data are representative of background conditions. A probability plot is a graph of concentration values plotted against their cumulative probabilities. Probability plots can be used to estimate background concentration ranges by identifying outliers and differentiating between separate populations within the data set (i.e., a population that represents background conditions and a population that represents contamination). A continuous straight-line plot with no large gaps indicates that the data represent a naturally occurring population. An inflection point or discontinuity in a probability plot may indicate the

threshold separating two populations in the data set. If concentrations in the upper range depart from the line or trend shown on the probability plot (i.e., a distinct increase in slope), then the upper range of the concentration distribution likely represents a separate population (i.e., contamination). As evidenced by Figure 1, the upper range of concentration values within the surface soil background data set do not deviate in an upward direction from the trend shown on the probability plot, supporting the conclusion that the NAPR background surface soil data set is representative of background conditions.

USGS background data for subsurface soil and groundwater are not available; therefore, a comparison of NAPR background subsurface soil and groundwater vanadium concentrations to island-wide background data could not be performed. However, identical to surface soil, probability plots for the NAPR background subsurface soil and groundwater vanadium data (see Figures 2 and 3, respectively) indicate that the subsurface soil and groundwater background data sets represent a single population with no indication of contamination (i.e., upper range of concentration values do not deviate in an upward direction).

The discussion presented above demonstrates that the NAPR background vanadium data sets for surface soil, subsurface soil, and groundwater are representative of background conditions. Statistical comparisons of the SWMU 68 vanadium surface soil, subsurface soil, and groundwater analytical data to NAPR background analytical data can be used to determine if concentrations in SWMU 68 abiotic media are elevated above background conditions. The statistical comparisons, conducted in accordance with Navy guidance (NFESC, 2002 and 2004), are presented in Tables 2, 3, and 4, respectively for surface soil, subsurface soil, and groundwater. As evidenced by the tables, the statistical methods evaluating the mean of the distributions (Satterthwaite's t-test or two-sample t-test), as well as the statistical methods evaluating the right-tail of the distributions (quantile test and slippage test) concluded that the distribution of vanadium concentrations in each media are not statistically elevated above background concentrations, indicating that this metal is not likely to be site-related. The descriptive statistics presented in each table also support the conclusion of the distributional statistics. For each medium, the maximum, mean, and 95% UCL background concentration exceeds maximum, mean, and 95% UCL concentrations for SWMU 68.

In summary, the Navy does not believe that additional background sampling is warranted to demonstrate that vanadium concentrations measured in SWMU 68 soils and groundwater are naturally occurring. The Navy believes that the evaluations presented above adequately demonstrate that the NAPR background surface soil, subsurface soil, and groundwater data sets are representative of background conditions. Furthermore, descriptive and distributional statistics indicate that vanadium concentrations in SWMU 68 surface soil, subsurface soil, and groundwater are equivalent to background concentrations.

References:

Baker Environmental In. (Baker). 2006. Final Summary Report for Environmental Background Concentrations of Inorganic Compounds, Naval Activity Puerto Rico, Ceiba, Puerto Rico. September 15, 2006.

Baker. 2003. Final Corrective Measures Study Investigation Report for SWMU 9, Naval Station Roosevelt Roads, Ceiba, Puerto Rico. April 25, 2003.

Naval Facilities Engineering Command (NFESC). 2004. Guidance for Environmental Background Analysis: Volume III: Groundwater. NFESC User's Guide UG-2059-ENV. April 2004.

NFESC. 2002. Guidance for Environmental Background Analysis. Volume I: Soil. NFESC User's Guide UG-2049-ENV. April 2003.

2) a proposal for addressing the potential human health risks resulting from vanadium in the surface and subsurface soils and in groundwater at SWMU 68, if the additional background sampling does not more conclusively demonstrate that the vanadium concentrations encountered at SWMU 68 are attributable to natural occurring conditions;

**Navy Response to EPA Comment #2:** Based on the discussion presented in the Response to Comment No. 1 above, the Navy does not believe that a proposal to address potential human health risks from vanadium in SWMU 68 surface soil, subsurface soil, and groundwater is warranted. The discussion presented evidence demonstrating that vanadium concentrations in the NAPR background surface soil, subsurface soil, and groundwater data sets, as well as vanadium concentrations in the SWMU 68 surface soil, subsurface soil and groundwater data sets are representative of background conditions. Navy policy on the use of background chemical levels states that "the action level for the remediation of sites should be risk-based, should not be below background levels, and should target the risk associated with the chemicals of concern or contaminant concentration exceeding background chemical levels."

3) a proposal for addressing the potential human health risks resulting from lead and arsenic in the surface and subsurface soils at SWMU 68; and

**Navy Response to EPA Comment #3:** Responses to the request to submit a proposal for addressing the potential human health risks resulting from lead and arsenic in the surface and subsurface soils at SWMU 68 are presented separately below.

**Lead**

The residential and industrial soil screening values for noncarcinogenic compounds that were used in the comparison to SWMU 68 surface and subsurface soil analytical data were derived by dividing the USEPA Region IX residential and industrial soil preliminary remediation goals (PRGs) (USEPA 2004) by a factor of 10. For most noncarcinogenic compounds, USEPA Region IX PRGs are based on a target hazard quotient [HQ] of 1.0. By dividing the PRGs for noncarcinogenic compounds by a factor of 10, potential synergistic effects among these compounds are accounted for. However, the Region IX residential and industrial PRGs for lead are Action Levels (USEPA, 1994) that are not based on an HQ of 1.0. Therefore, the Draft Phase I RFI Report mistakenly applied a factor of 10 to each value.

When the correct soil screening values are applied to the analytical data (residential and industrial soil Action Levels [400 mg/kg and 800 mg/kg, respectively], none of the lead concentrations in the SWMU-specific soil samples (Phase I RFI Report and ECP surface and subsurface soil samples) exceed the USEPA residential and industrial soil Action Levels. Given that (1) all lead detections at SWMU 68 are less than the USEPA residential and industrial soil Action Levels, and (2) lead concentrations have been delineated at the SWMU, the limited remedial action for surface soil recommended in Section 6.2 of the Draft Phase I RFI Report is not warranted. Therefore, Tables 5-1 and 5-2 and associated text in Sections 5.2 and 6.1 will be revised to reflect the correct USEPA Region IX soil PRG values (Action Levels). The text in Section 6.2 also will

be revised to eliminate the recommendation for a limited remedial action for surface soil (excavation and disposal with confirmation sampling) to address potential human health risks since all surface soil lead detections are less than the residential and industrial soil Action Levels

Although remediation addressing potential human health risks from lead in surface soil is not warranted based on the discussion presented above, a comparison of the Phase II RFI and ECP surface soil analytical data to an ecological-based soil screening value indicates that remediation is warranted to address potential ecological risks. Lead concentrations detected in two surface soil samples collected during the ECP investigation (230 mg/kg in 14E-SS01 and 150 mg/kg in 14E-SS04 [see Appendix D of the Phase I RFI report]) exceed a literature-based surface soil toxicological threshold for this metal (120 mg/kg). The toxicological threshold represents a ecological soil screening level (Eco SSL) for terrestrial plants (USEPA, 2005). Lead concentrations in these two samples also are elevated above NAPR background surface soil concentrations. Therefore, the text within Section 6.0 of the Phase I RFI Report will be revised to include a recommendation for a limited removal action for surface soil to address potential ecological risks. Revisions will include a comparison of the ECP surface soil analytical data to ecological-based soil screening values and background concentrations to ensure that other chemicals detected in samples collected during the ECP investigation do not warrant remediation to address potential ecological risks.

The revisions to the Phase I RFI Report indicated above will be completed once concurrence is reached with the USEPA for all responses related to SWMU 68. A proposal addressing the potential ecological risks resulting from lead (and any other chemical identified during revisions to the Phase I RFI Report) in surface soil at SWMU 68 also will be prepared at this time.

**Arsenic**

Probability plots for the NAPR background surface and subsurface soil arsenic data sets are included as Figures 4 and 5. As evidenced by the figures, the upper range of concentration values within both data sets do not deviate in an upward direction from the trend shown on the probability plots, indicating that the NAPR background surface and subsurface soil data sets are representative of background conditions.

Statistical comparisons of the SWMU 68 surface soil and subsurface soil arsenic analytical data to NAPR background analytical data for arsenic are presented in Tables 5 and 6, respectively. As evidenced by Table 5, the statistical method evaluating the mean of the distributions (Gehan test) concluded that arsenic concentrations in SWMU 68 surface soil are elevated above background concentrations. However, the statistical methods evaluating the right-tail of the distribution (quantile test and slippage test) concluded that SWMU 68 arsenic concentrations in surface soil are not elevated above background concentrations. To further evaluate the SWMU 68 surface soil arsenic analytical data, a probability plot based on a combined SWMU 68 and NAPR background data set was prepared (see Figure 6). As evidenced by the figure, the upper range of concentrations values for the combined data set (comprised of SWMU 68 analytical data) do not deviate in an upward direction from the trend shown on the plot. This indicates that the SWMU 68 and background surface soil data represent a single population with no indication of contamination.

The conclusions drawn from the subsurface soil statistical comparisons (see Table 6) also are contradictory. The statistical method evaluating the mean of the distributions (Gehan test) concluded that arsenic concentrations in SWMU 68 subsurface soil are elevated above background concentrations. However, the statistical methods evaluating the right-tail of the

distribution (quantile test and slippage test) concluded that SWMU 68 arsenic concentrations in subsurface soil are not elevated above background. A probability plot based on a combined SWMU 68 and NAPR background data set support the conclusion of the Gehan test (see Figure 7). The upper range of concentration values depart in an upward direction from the trend shown on the probability plot (a distinct increase in slope), indicating that this portion of the concentration distribution (comprised of SWMU 68 analytical data) represents a separate population. In this case, the lower range concentrations are likely to represent background conditions, while the upper range concentrations are likely to represent contamination.

The distributional statistics (Table 6) and probability plot for the combined SWMU 68 and NAPR background subsurface soil data set (Figure 7) indicate that arsenic concentrations in SWMU 68 subsurface soil are elevated above background concentrations. In order to evaluate potential human health risks from arsenic in soil at SWMU 68, preliminary risk calculations were performed under a future residential exposure scenario. To present a complete exposure scenario, arsenic concentrations in surface and subsurface soil were evaluated together by combining surface and subsurface soil analytical data from the Phase II ECP Report and the Draft Phase I RFI Report to form a total soil data set. However, analytical results for samples collected from depths greater than 10 feet below ground surface (bgs) were eliminated from this combined data set because residential exposures beyond this depth are not likely. USEPA ProUCL Version 3.00.02 software was used to determine the distribution of the data set and calculate the exposure point concentration (EPC). The distribution and EPC (95 percent Upper Confidence Limit of the mean) for arsenic are presented in Table 7, while exposure parameters used in the preliminary risk calculations are presented in Table 8. The results of the preliminary risk calculations are presented in Tables 9 (future adult resident) and 10 (future child resident). As evidenced by Tables 9 and 10, there are no unacceptable carcinogenic or noncarcinogenic risks calculated from potential exposure to arsenic in soil at SWMU 68. Furthermore, the low carcinogenic and noncarcinogenic risk levels calculated demonstrate that arsenic in soil would not be a risk driver if a baseline human health risk assessment (HHRA) was conducted.

In summary, distributional statistics and probability plots indicate that arsenic concentrations in SWMU 68 subsurface soil are elevated above background concentrations. However, preliminary risk calculations indicate that there are no unacceptable carcinogenic or noncarcinogenic risks associated with this metal. Therefore, the Navy does not believe that a proposal addressing the potential human health risks resulting from arsenic in the surface and subsurface soils at SWMU 68 is warranted.

References:

United States Environmental Protection Agency (USEPA). (2005). Ecological Soil Screening Levels for Lead (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-70.

USEPA. 2004. United States Environmental Protection Agency Region IX Preliminary Remediation Goals. http://www.epa.gov/region09/waste/sfund/prg/index.htm. October 2004.

USEPA. 1994. Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities. OSWER Directive No. 9355.4-12. Office of Emergency and Remedial Response, Washington, D.C. EPA/540/F-94/043, PB94-963282.

4) written responses and/or an addendum to the SWMU 68 Draft Phase I RFI Report, which address the additional comments given in the enclosed Technical Review, prepared for us by our consultant, TechLaw, Inc.

**Navy Response to EPA Comment #4:** Written responses to the TechLaw, Inc. comments are provided as an attachment to this response to comments. The Draft Phase I RFI Report will be revised to address Navy responses to these comments once concurrence is reached with the USEPA for all responses to comments related to SWMU 68.

**TECHLAW, Inc. COMENTS ON THE NAVAL ACTIVITY PUERTO RICO PHASE I RCRA FACILITY INVESTIGATION REPORT FOR SWMU 68 – FORMER SOUTHERN FIRE TRAINING AREA DATED MARCH 26, 2007**

**GENERAL COMMENTS**

1. This Report does not include a discussion of investigation derived wastes (IDW) or associated IDW sampling. According to Section 3.5.2 of the approved Work Plan, two IDW samples were to be collected, and these samples were to be analyzed to provide information necessary to properly dispose of any IDW generated. Provide discussion related to IDW during the investigation and rationale for any deviations from the approved Work Plan.

**Navy Response to TechLaw General Comment #1:** Soil cuttings from the subsurface soil sampling, as well as from the temporary monitor wells, were placed back into the boring from which they came since no significant contamination was encountered. No IDW samples were collected during this investigation, since no soil cuttings were generated and disposable drilling and sampling equipment was used (GeoProbe liners, disposable stainless-steel spoons, and peristaltic tubing) therefore no liquid decontamination was required and no fluids were generated. The report will be updated to include a discussion pertaining to no IDW sample collection.

2. This Report does not provide discussion regarding decontamination activities associated with this investigation. According to Section 3.5.3 of the approved Work Plan, decontamination was to take place "in accordance with the EPA approved RCRA Facility Investigation Work Plans." Revise the report to include a discussion of decontamination activities conducted during this investigation.

**Navy Response to TechLaw General Comment #2:** As discussed previously, no decontamination activities were conducted during this investigation because disposable sampling equipment and drilling equipment were used. The report will be updated providing a discussion of the use of disposable equipment resulting in no decontamination activities.

**SPECIFIC COMMENTS**

1. **Section 4.0 2006 RCRA Facility Investigation Activities, Page 4-1:** This section does not include a discussion of the apparent soil boring (SB) 03 collapse and resulting lack of groundwater samples at this location. According to the field notes presented in Appendix A.l, SB 03 collapsed and a temporary well (TW) could not be installed. Section 4.0, however, states that a TW was not installed at SB 03 "due to a lack of water because of

the lean clay observed in the boring samples." Revise the document to address this discrepancy by including a discussion and explanation of the collapse at SB 03.

**Navy Response to TechLaw Specific Comment #1:** A temporary well was not installed in SB 03 due to the lack of water found during drilling. As indicated on the boring log, a very lean white and red clay was encountered throughout much of the borehole. The boring was left open overnight to determine water production in the clay. A significant rain event overnight resulted in water accumulation in the boring from surface water runoff caused by the rain event. Sand and silt located within the first five feet of the boring were washed down the borehole. The report will be updated providing a more detailed discussion of SB 03.

2. **Section 4.1 Soil Boring Advancement and Temporary Well Installation, Page 4-1:** This section indicates that 10-foot screens were used in the TWs; however, Section 3.2, Monitor Well Installation Program, in the approved Work Plan, states that 5-foot screens would be installed. Revise the Report to address this discrepancy.

**Navy Response to TechLaw Specific Comment #2:** A longer screen was placed in the boreholes for the temporary wells because of the lack of a definitive water bearing zone observed. A longer screen was used to potentially allow for more water recovery during groundwater sampling. The report will be modified to reflect this field decision.

3. **Section 4.2.2 Groundwater, Page 4-2:** This section does not provide sufficient rationale for excluding certain analyses for groundwater samples collected from TW 01, 02, and 09. According to this section, the low flow conditions at the site required that these three samples undergo a more limited chemical analysis. Provide additional discussion in this section as to the rationale used for determining which specific analyses to exclude in each of the three samples.

**Navy Response to TechLaw Specific Comment #3:** The rationale for sample collection at low water producing temporary wells went as follows:

Volatile Organic Compounds first;
Total Petroleum Hydrocarbons, Diesel Range Organics, second;
Total Petroleum Hydrocarbons, Gasoline Range Organics, third;
Polyaromatic Hydrocarbons, fourth;
Dissolved Metals, fifth;
Polychlorinated Biphenyls, sixth;
Semi-Volatile Organic Compounds, seventh;
Cyanide, eighth;
Sulfide, ninth;
Total Metals, tenth.

The only exception to this rationale was the mixing of some bottles collected at TW 01 and TW02 due to their close proximity to each other. An attempt was made to cover each parameter set between the two locations. The report will be updated to reflect the sample collection rationale for the low producing temporary wells.

4. **Section 4.2.2 Groundwater, Page 4-2:** There is a discrepancy regarding which analyses were conducted on the groundwater sample from TW 02. Section 4.2.2, as well as supporting information in Table 4-1 Summary of 2006 RFI Surface Soil, Subsurface Soil,

and Groundwater Sampling and Analysis, indicates that TW 02 was not analyzed for dissolved metals. Section 5.4 Groundwater and Table 5-3, Summary of Detected Results - Groundwater, however, present results for dissolved metals. Additionally, the field log included in Appendix A.l indicates that dissolved metals were analyzed for this sample. Address this discrepancy by revising the appropriate section and corresponding table.

**Navy Response to TechLaw Specific Comment #4:** Dissolved metals were collected at temporary well TW 02 and a revised Table 4-1 will be provided showing the dissolved metals concentrations for TW 02.

5. **Section 4.3.5 Equipment Rinsates, Page 4-4:** It does not appear that enough rinsate samples were collected during this investigation. According to Section 3.4.2 of the approved Work Plan, as defined by EPA guidance, the rinsate sampling frequency was to be "one sample per day per media or one sample per 20 individual media samples collected, whichever is more frequent." Based upon the number of sampling days (three each for soil and groundwater), a minimum of six rinsate samples should have been collected. However, according to Section 4.3.5, only three rinsate samples were collected, while Appendix A.2 identifies five rinsate samples that were collected. Additionally, according to Appendix A.2 Chain of Custody, rinsate samples were not collected prior to using the equipment each day, but rather were collected at the end of the day. Add discussion related to potential error associated with the timing of sampling and the lack of sufficient samples collected.

**Navy Response to TechLaw Specific Comment #5:** Since disposable sampling equipment was used and no sampling equipment was decontaminated in the field, the equipment rinsates were only used to determine residual impacts from the clean disposable equipment and not to verify decontamination procedures. The timing of equipment rinsate sample collection therefore is irrelevant. The additional day(s) to collect groundwater from the low producing temporary wells was not factored into the total number of equipment rinsates collected. The report will be updated to include the rationale for equipment rinsate sample collection.

6. **Section 6.1 Conclusions, Page 6-1:** This section states that "arsenic is naturally occurring at NAPR, and statistical comparison testing *may* conclude that the concentrations found are not significantly above background." The sampling results presented in Section 5.0 Nature and Extent of Contamination identify a cluster of several samples above both residential preliminary remediation goals (PRGs) and background screening levels on the northern portion of the Site. Since this contamination is generally located on the northern portion of the site, and has not been adequately bounded to the north by additional sampling, the statistical comparison testing results supporting the above statement should be included in the Report. If this statement cannot be supported by a statistical analysis, identify additional arsenic characterization and remediation as an activity for future work at SWMU 68.

**Navy Response to TechLaw Specific Comment #6:** A discussion and statistical analysis related to arsenic concentrations in SWMU 68 surface and subsurface soil was previously presented in the Response to USEPA Comment No. 3 for SWMU 68. The discussion includes results of statistical evaluations comparing SWMU 68 surface and subsurface soil analytical data to NAPR background analytical data, as well as preliminary risk calculations performed under a future residential exposure scenario.

**EPA COMENTS ON THE NAVAL ACTIVITY PUERTO RICO**
**FINAL RCRA FACILITY INVESTIGATION REPORT FOR SWMU 14 – FORMER**
**"CRASH-CREW" FIRE TRAINING AREA**
**DATED MARCH 26, 2007**

Final RFI Report for SWMU 14 (former "Crash-Crew" Fire Training Area)

EPA has completed its review of the Final RFI Report for SWMU 14 (former "Crash-Crew" Fire Training Area), submitted on behalf of the Navy by Mr. Mark Kimes' (of Baker Environmental) letter of March 23, 2007, and determined that it is not fully acceptable. Section 8.12 of the SWMU 14 RFI Report (Conclusions and Recommendations), states that there are unacceptable potential risks a present from benzene and vanadium in the groundwater and from possible ingestion of, and dermal contact with, vanadium at elevated concentrations in surface and subsurface soils. However, no clear recommendations are made with regards to addressing those indicated potential risks.

As discussed previously for SWMU 68, EPA is concerned that the base-wide background concentrations for vanadium, established in the October 17, 2006 Background Report, may not be fully representative of natural background conditions. EPA notes that the October 17, 2006 Background Report offered no explanation as to why such elevated vanadium concentrations would be naturally occurring.

In addition, in Section 8.2 (Conclusions and Recommendations) of the SWMU 14 RFI Report, it is recommended that " ... soil samples be collected from the [drainage] ditch [leading from the original fire training pit to a freshwater wetland] to determine if a release has ever occurred." However, no proposal for such sampling was included with the RFI Report and no time frame for submitting it is given.

**Navy Response to EPA General Comment:** The USEPA concerns discussed above are addressed in the Responses to USEPA Comment Nos. 1 through 6 below for SWMU 14.

Prior to our approving the RFI Report for SWMU 14, EPA requests that the Navy submit, within 45 days of your receipt of this letter, the following:

1) a proposal for sampling the drainage ditch leading from the original fire training pit to a freshwater wetland, to determine if a release has ever occurred;

**Navy Response to EPA Comment #1:** A draft additional data collection work plan in support of the ecological risk assessment (ERA) at SWMU 14 will be submitted to the USEPA on or before July 20, 2007. The draft work plan will present a proposed drainage ditch soil sampling and analytical program.

2) a proposal for completing an ecological risk evaluation, to evaluate potential impacts caused by releases from SWMU 14, including impacts from releases found in the drainage ditch leading from the original fire training pit to a freshwater wetland, if releases are found;

**Navy Response to EPA Comment #2:** The screening-level ecological risk assessment (SERA), included as Section 7 of the Final RFI Report for SWMU 14, will be revised to include an evaluation of the drainage ditch soil analytical data. Step 3a of the Navy ERA process (refinement of conservative exposure assumptions) also will be conducted and included with the

revised SERA. The draft additional data collection work plan discussed in the Response to USEPA Comment No. 1 above for SWMU 14 will include a schedule for completion of the ERA through Step 3a of the Navy ERA process.

3) a proposal for additional background sampling for vanadium in surface and subsurface soils and groundwater to be implemented so as to more conclusively determine whether or not the elevated vanadium concentrations measured in the surface and subsurface soils and groundwater at SWMU 14 are in-fact natural occurring, and not the result of releases from SWMU 14 (or another SWMU or AOC);

**Navy Response to EPA Comment #3:** The Navy does not believe that additional background sampling is warranted to demonstrate that vanadium concentrations measured in SWMU 14 soils and groundwater are naturally occurring. As discussed in the Response to USEPA Comment No. 1 above for SWMU 68, the range of vanadium detections in the NAPR background surface soil data set fall within the range of vanadium detections in the USGS data set for Puerto Rico. The probability plots for NAPR background surface soil, subsurface soil, and groundwater (see Figures 1, 2, and 3) also demonstrate that the NAPR background data sets are representative of background conditions.

4) a proposal for addressing the potential human health risks resulting from vanadium in the surface and subsurface soils and groundwater at SWMU 14, should that additional background sampling not more conclusively demonstrate that the vanadium concentrations encountered at SWMU 14 are attributable to natural occurring conditions;

**Navy Response to EPA Comment #4:** the Navy does not believe that a proposal to address potential human health risks from vanadium in SWMU 14 surface soil, subsurface soil, and groundwater is warranted. A statistical comparison of the SWMU 14 vanadium subsurface soil analytical data to NAPR background subsurface soil analytical data is presented in Table 11. The statistical methods evaluating the mean of the distributions (two-sample t-test) and right tail of the distribution (quantile test and slippage test) concluded that the distribution of vanadium concentrations in SWMU 14 subsurface soil are not statistically elevated above background subsurface soil concentrations. A probability plot based on a combined SWMU 14 and NAPR background vanadium subsurface soil data set (see Figure 8) also indicates that the SWMU 14 subsurface soil are representative of background conditions. As evidenced by the figure, the upper range of concentrations values for the combined data set (which includes SWMU 14 analytical data) do not deviate in an upward direction from the trend shown on the plot. This indicates that the SWMU 14 and NAPR background subsurface soil data represent a single population with no indication of contamination.

Statistical comparisons of the SWMU 14 vanadium surface soil and groundwater data to NAPR background surface soil and groundwater data could not be performed due to the low number of data points within the SWMU 14 data sets (4 for surface soil and 2 for groundwater). However, surface soil and groundwater probability plots based on the combined data sets (see Figures 9 and 10, respectively) demonstrate that the SWMU 14 and NAPR background surface soil and groundwater data sets represent single populations with no indication of contamination. It is noted that there is some scatter above the trend shown on the groundwater probability plot throughout most of the concentration distribution; however, no clear deviation in an upward direction is evident. The scatter is likely due to the inclusion of analytical data for background samples 5GW04 (non-detect result) and 11GW24 (an apparent outlier).

In summary, the probability plots for the NAPR background data sets demonstrate that the NAPR surface soil, subsurface soil, and groundwater background data sets are representative of background conditions (see the Response to USEPA Comment No. 3 above for SWMU 14). Furthermore, the statistical comparisons performed on the SWMU 14 and NAPR background subsurface soil data sets indicate that subsurface soil concentrations in SWMU 14 subsurface soil are not elevated above background conditions. Finally, probability plots based on combined SWMU 14 and NAPR background surface soil, subsurface soil, and ground water data sets do not indicate that SWMU 14 concentrations are elevated above background concentrations. Based on this analysis, the Navy does not believe that a proposal to address potential human health risks from vanadium in SWMU 14 surface soil, subsurface soil, and groundwater is warranted.

5) a proposal for addressing the potential human health risks associated with the dissolved benzene in the groundwater impacted by SWMU 14 releases; and

**Navy Response to EPA Comment #5:** A proposal addressing potential human health risks associated with the dissolved benzene in SWMU14 groundwater will be prepared once the ERA presented in the Final Phase II RFI Report is revised to include analytical results for soil samples collected from the drainage ditch. This will ensure that all potential human health and ecological risks are addressed concurrently.

6) written responses and/or an addendum to the SWMU 14 RFI Report, which addresses the additional comments given in the enclosed Technical Review, prepared by our consultant, TechLaw, Inc.

**Navy Response to EPA Comment #6:** Written responses to the TechLaw, Inc. comments are provided as an attachment to this response to comments. Based on these responses, revisions to the Final Phase II RFI Report are not necessary.

## TECHLAW, Inc. COMENTS ON THE NAVAL ACTIVITY PUERTO RICO RCRA FACILITY INVESTIGATION REPORT FOR SWMU 14 – FIRE TRAINING AREA DATED MARCH 23, 2007

### GENERAL COMMENTS

1. **Evaluation of Response to EPA General Comment 1:** The Navy's response to Comment 1 appears to be partially adequate. The Navy stated that it would incorporate discussion into Section 6.3.1, Potential Human Receptors, to clarify why only future resident adults, and not future resident children, are being evaluated for inhalation of volatiles in the groundwater. The statement added to the discussion, "Exposure to groundwater as a potable source will be assessed, which includes exposure via ingestion and dermal contact and inhalation while showering (adults only) or bathing," does not clarify why inhalation exposures to children are not being addressed. Revise the document to clarify why exposures to future resident children are not being assessed.

**Navy Response to TechLaw General Comment #1:** Section 6.3.1 was previously revised and incorporated into the March 23, 2007 Final document in response to the January 18, 2007 EPA General Comment 1. Specifically, the following text was added to the fourth paragraph of Section 6.3.1:

"Exposure to groundwater as a potable source will be assessed, which includes exposure via ingestion and dermal contact and inhalation while showering (adults only) or bathing. Inhalation of volatiles in groundwater while showering was evaluated only for the future residential adult. Young children are not expected to shower and therefore, are not evaluated for exposure to inhalation of VOCs in groundwater. Rather, young children are evaluated for dermal contact exposure to groundwater while bathing."

2. **Evaluation of Response to EPA General Comment 2:** The Navy's response to Comment 2 appears to be partially adequate. The Navy indicated that it would update the Human Health Risk Assessment (HHRA) to include vapor intrusion from contaminated groundwater for future resident receptors. The reports text was adequately updated to reflect this determination; however, Appendix H, Table 1, Selection of Exposure Pathways, still does not identify future adult residents and future construction workers as potential receptors based on the vapor migration to indoor air pathway. Update Appendix H, Table 1 to agree with the comment response and the report text.

**Navy Response to TechLaw General Comment #2:** Table 1 of Appendix H was previously revised and incorporated into the March 23, 2007 Final document in response to the January 18, 2007 EPA General Comment 2. Specifically, in the column titled "Type of Analysis" in the final version of Table 1, the word *qualitative* was changed to *quantitative* for the future residents to indicate that this pathway was quantitatively evaluated in the final HHRA.

**SPECIFIC COMMENTS**

1. **Evaluation of Response to EPA Specific Comment 8:** The Navy's response to Comment 8 appears to be partially adequate. The Navy stated that it would clarify Section 6.4.3, Dermal Absorption Efficiency, to indicate that this analysis was not used in the HHRA, but rather was included for the readers' benefit. The sentences added to the beginning and end of this section provide clarification while also appearing to conflict with the bulk of the discussion. Specifically, statements indicating that factors "were obtained," rather than "can be obtained," lead the reader to believe this analysis was conducted for this HHRA. Modify this section further to more clearly identify the Dermal Absorption Efficiency section as reference information that was not included in HHRA efforts.

**Navy Response to TechLaw Specific Comment #1:** Comment noted. However, the text will not be revised based on the following rationale. It is recognized that the numerical values for the toxicity criteria did not change (based on the assumption of 100% absorption efficiency for each COPC), thus leading the reader to infer that there was no analysis conducted of dermal absorption efficiency. However, as Section 6.4.3 appropriately indicates, the analysis was conducted and the steps outlined in the guidance were applied when examining all toxicity criteria for use in the HHRA. The last sentence of the paragraph states that the oral to dermal adjustment factors used in HHRA for SWMU 14 were all 100 percent, not that the analysis was not conducted. Therefore, the use of the statement, "were obtained," accurately represents that the analysis was conducted.

# TABLES

**TABLE 1**
**COMPARISON OF NAPR BACKGROUND VANADIUM SURFACE SOIL CONCENTRATIONS TO USGS ISLAND-WIDE ANALYTICAL DATA FOR PUERTO RICO**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| NAPR Background | | | | | USGS Island-Wide | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **No. of Positive Detections/No. of Samples** | **Range of Positive Detections (mg/kg)** | **Range of Non-Detects (mg/kg)** | **Maximum Detected Concentration (mg/kg)** | **Arithmatic Mean (mg/kg)** | **No. of Positive Detections/No. of Samples** | **Range of Positive Detections (mg/kg)** | **Range of Non-Detects (mg/kg)** | **Maximum Detected Concentration (mg/kg)** | **Arithmatic Mean (mg/kg)** |
| 19/19 | 35 - 270 | NA | 270 | 148 | 292/292 | 50 - 1,500 | NA | 1,500 | 393 |

NA = Not applicable (vanadium was detected in each sample)
mg/kg = milligrams per kilogram
USGS = United States Geological Survey
NAPR = Naval Activity Puerto Rico

**TABLE 2**
**SUMMARY STATISTICS AND RESULTS - VANADIUM IN NAPR BACKGROUND AND SWMU 68 SURFACE SOIL**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| Chemical | Population [1] | Descriptive Statistics [2] | | | | | | Test for Normality [4] | Test for Homogeneity of Variance [5] | Distributional Statistics | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Frequency of Detection | Range of Detections | Range of Non-Detections | Mean | SE | 95% UCL [3] | | | Mean/Median of the Distribution | Right Tail of the Distribution [6] | |
| | | | | | | | | | | | Quantile Test | Slippage Test |
| Vanadium | SWMU 68 | 13/13 | 65 - 170 | NA | 107 | 9.3 | 124 (Normal Distribution) | Normal at α = 0.05 (p = 0.1886) | Variances are not equal at α = 0.05 (p = 0.0254) | Satterthwaite's t-test [7]; Not elevated at α = 0.05 (p = 0.9870); Power = 0.000041) | Not elevated at α = 0.05 | Not elevated at α = 0.05 |
| | Background | 19/19 | 35 - 270 | NA | 148 | 14.7 | 174 (Normal Distribution) | Normal at α = 0.05 (p = 0.9679) | | | | |

Notes:

95% UCL = 95% Upper Confidence Limit of the mean
NA = Not applicable
SE = Standard error
SWMU = Solid Waste Management Unit
NAPR = Naval Activity Puerto Rico
α = Significance level (for the distributional statistics, α represents the probability criteria [0.05] for rejecting the null hypothesis that data sets were sampled from the same population)

(1) SWMU 68 surface soil data taken from Baker (2007) and LANTDIV (2004); background data taken from Baker (2006).
(2) Units in mg/kg.
(3) 95% Upper Conficence Limit was calculated using USEPA ProUCL Version 3.00.02 software.
(4) Normality verified by Shapiro-Wilks test. The test for normality was performed because each data set (SWMU 68 and background) has less than fifteen percent non-detected results.
(5) Homogeneity of variance verified by F test. The test for homogeneity of variance was performed because each data set (SWMU 68 and background) exhibits a normal distribution and has less than fifteen percent non-detected results.
(6) Quantile and slippage tests only determine whether or not a particular contaminant is likely present at equivalent or elevated concentrations relative to background.
(7) Satterthwaite's t-test was used because: (a) there are less than fifteen percent non-detected results in the combined data set (SWMU 68 and background); (b) each data set has a normal distribution; and (c) the SWMU 68 and background data set variances are not equal.

References:


Baker Environmental, Inc. (2007). Draft Phase I RCRA Facility Investigation Report for SWMU 68, Naval Activity Puerto Rico, Ceiba, Puerto Rico. March 26, 2007.
Baker. (2006). Revised Final Summary Report for Environmental Background Concentrations of Inorganic Compounds, Naval Activity Puerto Rico, Ceiba, Puerto Rico. October 17, 2006.
Naval Facilities Engineering Command, Atlantic Division (LANTDIV). 2004. Draft Phase II Environmental Condition of Property (ECP) Report, Naval Activity Puerto Rico, Ceiba, Puerto Rico. March 31, 2004.
Naval Facilities Engineering Command (NFESC). 2002. Guidance for Environmental Background Analysis. Volume 1: Soil. NFESC user's Guide UG-209-ENV. April 2002.

**TABLE 3**
**SUMMARY STATISTICS AND RESULTS - VANADIUM IN NAPR BACKGROUND AND SWMU 68 SUBSURFACE SOIL**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| Chemical | Population [1] | Descriptive Statistics [2] | | | | | | Test for Normality [4] | Test for Homogeneity of Variance [5] | Distributional Statistics | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Frequency of Detection | Range of Detections | Range of Non-Detections | Mean | SE | 95% UCL [3] | | | Mean/Median of the Distribution | Right Tail of the Distribution [6] | |
| | | | | | | | | | | | Quantile Test | Slippage Test |
| Vanadium | SWMU 68 | 23/23 | 48 - 440 | NA | 136 | 16.3 | 163 (Gamma Distribution) | Lognormal at α = 0.05 (p = 0.1920) | Variances are equal at α = 0.05 (p = 0.1193) | Two-sample t-test [7]; Not elevated at α = 0.05 (p = 0.9787; Power = 0.000106) | Not elevated at α = 0.05 | Not elevated at α = 0.05 |
| | Background [1] | 19/19 | 25 - 410 | NA | 209 | 25.9 | 253 (Normal Distribution) | Lognormal at α = 0.05 (p = 0.0531) | | | | |

Notes:

95% UCL = 95% Upper Confidence Limit of the mean
NA = Not applicable
SE = Standard error
SWMU = Solid Waste Management Unit
NAPR = Naval Activity Puerto Rico
α = Significance level (for the distributional statistics, α represents the probability criteria [0.05] for rejecting the null hypothesis that data sets were sampled from the same population)

(1) SWMU 68 subsurface soil data taken from Baker (2007) and LANTDIV (2004); background data (clay soil type) taken from Baker (2006).
(2) Units in mg/kg.
(3) 95% Upper Conficence Limit was calculated using USEPA ProUCL Version 3.00.02 software.
(4) Normality verified by Shapiro-Wilks test. The test for normality was performed because each data set (SWMU 68 and background) has less than fifteen percent non-detected results.
(5) Homogeneity of variance verified by F test. The test for homogeneity of variance was performed because each data set (SWMU 68 and background) exhibits a lognormal distribution and has less than fifteen percent non-detected results.
(6) Quantile and slippage tests only determine whether or not a particular contaminant is likely present at equivalent or elevated concentrations relative to background.
(7) Two sample t-test was used because: (a) there are less than fifteen percent non-detected results in the combined data sets (reference area and background); (b) each data set has a lognormal distribution; and (c) the SWMU 68 and background data set distributions have equal variances.

References:


Baker Environmental, Inc. (2007). Draft Phase I RCRA Facility Investigation Report for SWMU 68, Naval Activity Puerto Rico, Ceiba, Puerto Rico. March 26, 2007.
Baker. (2006). Revised Final Summary Report for Environmental Background Concentrations of Inorganic Compounds, Naval Activity Puerto Rico, Ceiba, Puerto Rico. October 17, 2006.
Naval Facilities Engineering Command, Atlantic Division (LANTDIV). 2004. Draft Phase II Environmental Condition of Property (ECP) Report, Naval Activity Puerto Rico, Ceiba, Puerto Rico. March 31, 2004.

**TABLE 4**
**SUMMARY STATISTICS AND RESULTS - VANADIUM IN NAPR BACKGROUND AND SWMU 68 GROUNDWATER**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| Chemical | Population [1] | Descriptive Statistics [2] | | | | | | Test for Normality [5] | Test for Homogeneity of Variance [6] | Distributional Statistics | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Frequency of Detection | Range of Detections | Range of Non-Detections | Mean [3] | SE | 95% UCL [4] | | | Mean/Median of the Distribution | Right Tail of the Distribution [7] | |
| | | | | | | | | | | | Quantile Test | Slippage Test |
| Vanadium | SWMU 68 | 7/7 | 17J - 210J | NA | 83 | 28.9 | 139 (Normal Distribution) | Lognormal at α = 0.05 (p = 0.3530) | Variances are equal at α = 0.05 (p = 0.1653) | Two-sample t-test [8]; Not elevated at α = 0.05 (p = 0.6185; Power = 0.0262) | Not elevated at α = 0.05 | Not elevated at α = 0.05 |
| | Background | 11/12 | 1.7J - 549 | 8.5U - 8.5U | 161 | 47.0 | 341 (Gamma Distribution) | Lognormal at α = 0.05 (p = 0.1595) | | | | |

Notes:

J = Estimated value
U = Not detected value
95% UCL = 95% Upper Confidence Limit of the mean
NA = Not applicable
SE = Standard error
NAPR = Naval Activity Puerto Rico
SWMU = Solid Waste Management Unit
α = Significance level (for the distributional statistics, α represents the probability criteria [0.05] for rejecting the null hypothesis that data sets were sampled from the same population)

(1) SWMU 68 subsurface soil data taken from Baker (2007); background data (clay soil type) taken from Baker (2006).
(2) Units in ug/L.
(3) Mean based on 1/2 non-detected values.
(4) 95% Upper Conficence Limit was calculated using USEPA ProUCL Version 3.00.02 software. The reporting limit for the non-detected value within the background data set was used in the derivation of the background groundwater 95% UCL.
(5) Normality verified by Shapiro-Wilks test. the test for normality was performed because each data set (SWMU 68 and background) has less than fifteen percent non-detected results.
(6) Homogeneity of variance verified by F test. The test for homogeneity of variance was performed because each data set (SWMU 68 and background) exhibits a lognormal distribution and has less than fifteen percent non-detected results.
(7) Quantile and slippage tests only determine whether or not a particular contaminant is likely present at equivalent or elevated concentrations relative to background. It is noted that the SWMU 68 and background groundwater data sets were evaluated using the quantile test even though the SWMU 68 data set data set has less than ten data points (Navy guidance [NFESC, 2002] recommends a minimum of ten data points for each data set).
(8) Two sample t-test was used because: (a) there are less than fifteen percent non-detected results in the combined data sets (SWMU 68 and background); (b) each data set has a lognormal distribution; and (c) the SWMU 68 and background data set distributions have equal variances.

References:

Baker Environmental, Inc. (2007). Draft Phase I RCRA Facility Investigation Report for SWMU 68, Naval Activity Puerto Rico, Ceiba, Puerto Rico. March 26, 2007.
Baker. (2006). Revised Final Summary Report for Environmental Background Concentrations of Inorganic Compounds, Naval Activity Puerto Rico, Ceiba, Puerto Rico. October 17, 2006.

**TABLE 5**
**SUMMARY STATISTICS AND RESULTS - ARSENIC IN NAPR BACKGROUND AND SWMU 68 SURFACE SOIL**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| Chemical | Population [1] | Descriptive Statistics [2] | | | | | | Test for Normality [5] | Test for Homogeneity of Variance [6] | Distributional Statistics | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Frequency of Detection | Range of Detections | Range of Non-Detections | Mean [3] | SE | 95% UCL [4] | | | Mean/Median of the Distribution | Right Tail of the Distribution [7] | |
| | | | | | | | | | | | Quantile Test | Slippage Test |
| Arsenic | SWMU 68 | 13/13 | 0.92J - 3.4 | NA | 1.69 | 0.18 | 2.03 (Gamma Distribution) | Test was not performed | Test was not performed | Gehan test [8], G(1.794)>Z(1.645), Elevated at $\alpha = 0.05$ | Not elevated at $\alpha = 0.05$ | Not elevated at $\alpha = 0.05$ |
| | Background | 14/20 | 0.21J - 2.5J | 0.69UJ - 1.8U | 1.18 | 0.17 | 1.47 (Normal Distribution) | Test was not performed | | | | |

**Notes:**

J = Estimated value
U = Not detected value
UJ = Not detected, estimated value
NA = Not applicable
SE = Standard error
SWMU = Solid Waste Management Unit
NAPR = Naval Activity Puerto Rico
95% UCL = 95% Upper Confidence Limit of the mean
$\alpha$ = Significance level (for the distributional statistics, $\alpha$ represents the probability criteria [0.05] for rejecting the null hypothesis that data sets were sampled from the same population)

[1] SWMU 68 subsurface soil data taken from Baker (2007) and LANTDIV (2004); background data taken from Baker (2006).
[2] Units in mg/kg.
[3] Mean based on 1/2 non-detected values.
[4] 95% Upper Conficence Limit was calculated using USEPA ProUCL Version 3.00.02 software.
[5] The test for normality was not performed because the NAPR background data set has greater than 15 percent non-detected results.
[6] The test for homogeneity of variance was not performed because the NAPR background data set has greater than 15 percent non-detected results.
[7] Quantile and slippage tests only determine whether or not a particular contaminant is likely present at equivalent or elevated concentrations relative to background.
[8] The Gehan test was used because: (a) the number of non-detected results in the combined data set (NAPR background and SWMU 68) is greater than fifteen percent but does not exceed fifty percent; and (b) there is more than one reporting limit for the non-detected values.

References:

Baker Environmental, Inc. (2007). Draft Phase I RCRA Facility Investigation Report for SWMU 68, Naval Activity Puerto Rico, Ceiba, Puerto Rico. March 26, 2007.
Baker. (2006). Revised Final Summary Report for Environmental Background Concentrations of Inorganic Compounds, Naval Activity Puerto Rico, Ceiba, Puerto Rico. October 17, 2006.
Naval Facilities Engineering Command, Atlantic Division (LANTDIV). 2004. Draft Phase II Environmental Condition of Property (ECP) Report, Naval Activity Puerto Rico, Ceiba, Puerto Rico. March 31, 2004.

**TABLE 6**
**SUMMARY STATISTICS AND RESULTS - ARSENIC IN NAPR BACKGROUND AND SWMU 68 SUBSURFACE SOIL**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| Chemical | Population [1] | Descriptive Statistics [2] | | | | | | Test for Normality [5] | Test for Homogeneity of Variance [6] | Distributional Statistics | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Frequency of Detection | Range of Detections | Range of Non-Detections | Mean [3] | SE | 95% UCL [4] | | | Mean/Median of the Distribution | Right Tail of the Distribution [7] | |
| | | | | | | | | | | | Quantile Test | Slippage Test |
| Arsenic | SWMU 68 | 20/23 | 0.35J - 3.6 | 1.1U - 1.2U | 1.31 | 0.17 | 1.648 (Lognormal) | Test was not performed | Test was not performed | Gehan Test [8], G(3.008)>Z(1.645), Elevated at α = 0.05 | Not elevated at α = 0.05 | Not elevated at α = 0.05 |
| | Background | 13/19 | 0.28J - 1.7 | 0.22UJ - 1.3U | 0.73 | 0.10 | 0.94 (Gamma Distribution) | Test was not performed | | | | |

**Notes:**

J = Estimated value
U = Not detected value
UJ = Not detected, estimated value
SE = Standard error
95% UCL = 95% Upper Confidence Limit of the mean
SWMU = Solid Waste Management Unit
NAPR = Naval Activity Puerto Rico
α = Significance level (for the distributional statistics, α represents the probability criteria [0.05] for rejecting the null hypothesis that data sets were sampled from the same population)

(1) SWMU 68 surface soil data taken from Baker (2007) and LANTDIV (2004); background data (clay soil type) taken from Baker (2006).
(2) Units in mg/kg.
(3) Mean based on 1/2 non-detected values.
(4) 95% Upper Confidence Limit was calculated using USEPA ProUCL Version 3.00.02 software.
(5) The test for normality was not performed because the NAPR background data set has greater than 15 percent non-detected results.
(6) The test for homogeneity of variance was not performed because the NAPR background data set has greater than 15 percent non-detected results.
(7) Quantile and slippage tests only determine whether or not a particular contaminant is likely present at equivalent or elevated concentrations relative to background.
(8) The Gehan test was used because: (a) the number of non-detected results in the combined data set (NAPR background and SWMU 68) is greater than fifteen percent but does not exceed fifty percent; and (b) there is more than one reporting limit for the non-detected values.

References:

Baker Environmental, Inc. (2007). Draft Phase I RCRA Facility Investigation Report for SWMU 68, Naval Activity Puerto Rico, Ceiba, Puerto Rico. March 26, 2007.
Baker. (2006). Revised Final Summary Report for Environmental Background Concentrations of Inorganic Compounds, Naval Activity Puerto Rico, Ceiba, Puerto Rico. October 17, 2006.
Naval Facilities Engineering Command, Atlantic Division (LANTDIV). 2004. Draft Phase II Environmental Condition of Property (ECP) Report, Naval Activity Puerto Rico, Ceiba, Puerto Rico. March 31, 2004.

**TABLE 7**
**TOTAL SOIL DATA AND COPC SELECTION SUMMARY - SWMU 68**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| Contaminant | Criteria [1] | Contaminant Frequency / Range / Location | | | COPC Selection | | Exposure Concentration Selection | | |
|---|---|---|---|---|---|---|---|---|---|
| | Region IX Residential Soil PRG Values | No. of Positive Detects / No. of Samples | Range of Positive Detections | Location of Maximum Detection | Selected as a COPC? | Rationale for Selection or Deletion | 95% UCL [3] (ProUCL) | Exposure Concentration | Rationale for Concentration Selection |
| **Inorganics (mg/kg)** | | | | | | | | | |
| Arsenic | 0.390 C | 22/25 | 0.8 J - 2.7 | 68SB01-01 | YES | ASL | 1.51 (N) | 1.51 | 95% Student's-t UCL |

Notes:

UCL - Upper Confidence Limit
PRG - Preliminary Remediation Goal
COPC - Chemical of Potential Concern

mg/kg - milligram per kilogram
C = Carcinogenic

J - Analyte present - Reported value is estimated

Rationale Codes:

(ASL) Above Screening Level

Shaded constituents were identified as COPCs for quantitative risk evaluation.

(1) All non-carcinogenic criteria were divided by 10 to account for potential additive effects of chemicals.
USEPA Region IX Residential Soil COC Screening Value (derived from USEPA Region IX PRG Table)

(2) ProUCL was used to calculate the 95% UCL and distribution (>4 samples):
(N) - Normal distribution

**TABLE 8**
**SUMMARY OF EXPOSURE PARAMETERS - SWMU 68**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| Parameter | Units | Future Adult Residents<br>RME | Future Young Child Residents<br>RME |
|---|---|---|---|
| **Soil** | | | |
| Ingestion Rate of Soil (IR-S) | mg/day | 100<br>USEPA, 1991 | 200<br>USEPA, 1991 |
| Fraction Ingested from Source (Fi) | NA | 1<br>Prof Judge | 1<br>Prof Judge |
| Exposure Frequency (EF) | days/year | 350<br>USEPA, 1991 | 350<br>USEPA, 1991 |
| Exposure Duration (ED) | years | 24<br>USEPA, 1997 | 6<br>USEPA, 1997 |
| Exposure Time (ET) | hours/day | 24<br>Prof Judge | 24<br>Prof Judge |
| Surface Area Available for Contact (SA) | cm2/day | 5,700<br>USEPA, 1997 | 2,800<br>USEPA, 1997 |
| Respiration Rate (RR) | m3/hour | 1.27<br>USEPA, 1997 | 0.69<br>USEPA, 1997 |
| Conversion Factor (CF) | kg/mg | 1.00E-06<br>USEPA, 1989 | 1.00E-06<br>USEPA, 1989 |
| Averaging Time (Non-Cancer) (AT-N) | days | 8,760<br>USEPA, 1989 | 2,190<br>USEPA, 1989 |
| **Other Parameters** | | | |
| Body Weight (BW) | kg | 70<br>USEPA, 1997 | 15<br>USEPA, 1997 |
| Soil to Skin Adherence Factor (AF) | mg/cm2 | 0.07<br>USEPA, 1997 | 0.2<br>USEPA, 1997 |
| Particulate Emission Factor (PEF) | m3/kg | 1.32E+09<br>Cowherd, et al., 1995 | 1.32E+09<br>Cowherd, et al., 1995 |
| Averaging Time (Cancer) (AT-C) | days | 25,550<br>USEPA, 1989 | 25,550<br>USEPA, 1989 |

Notes:

RME - Reasonalble Maximum Exposure

ABS - Absorption Factors
USEPA, 2004: Risk Assessment Guidance for Superfund Vol 1, Human Health Evaluation Manual
(Part E, Supplemental Guidance for Dermal Risk Assessment). EPA/540/R-99/005.
The following USEPA Region III default absorbance factors will be applied in the absence of reference values from
USEPA, 2001 to estimate dermal intake of COPCs in soil and sediment (USEPA, 1995):
0.05% and 3.0% - VOAs (chemical specific)
1.0% - Inorganics
3.0% - Dioxins / Furans

Prof Judge - Professional Judgment

Cowherd, et al., 1995: Rapid Assessment of Exposure to Particulate Emissions from Surface Contamination. OHEA. EPA/600/8-85/002.
USEPA, 1989. Risk Assessment Guidance for Superfund, Volume I - Human Health Evaluation Manual (Part A) Interim Final.
USEPA, 1991. Risk Assessment Guidance for Superfund, Volume I - Human Health Evaluation Manual Supplemental Gudiance. "Standard Default Exposure Factors."
USEPA, 1997. Exposure Factors Handbook. Vol. 1: General Factors. ORD. EPA/600/P-95/002Fa.

**TABLE 9**
**SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - SWMU 68**
**REASONABLE MAXIMUM EXPOSURE**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Adult

| Medium | Exposure Medium | Exposure Point | Chemical | Carcinogenic Risk | | | | | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal | External (Radiation) | Exposure Routes Total | Primary Target Organ | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Total Soil | Total Soil | Total Soil | Arsenic | 1.1E-06 | -- | 1.3E-07 | -- | 1.2E-06 | Skin / CVS | <0.01 | -- | <0.01 | <0.01 |
| | | | Chemical Total | 1.1E-06 | -- | 1.3E-07 | -- | 1.2E-06 | | <0.01 | -- | <0.01 | <0.01 |
| | | Exposure Point Total | | | | | | 1.2E-06 | | | | | <0.01 |
| | Exposure Medium Total | | | | | | | 1.2E-06 | | | | | <0.01 |
| | Air | Fugative Dust | Arsenic | -- | 2.5E-09 | -- | -- | 2.5E-09 | NA | -- | -- | -- | -- |
| | | | Chemical Total | -- | 2.5E-09 | -- | -- | 2.5E-09 | | -- | -- | -- | -- |
| | | Exposure Point Total | | | | | | 2.5E-09 | | | | | -- |
| | Exposure Medium Total | | | | | | | 2.5E-09 | | | | | -- |
| **Total Soil Total** | | | | | | | | **1.19E-06** | | | | | **<0.01** |
| **Adult Residents Total** | | | | | | | | **1.19E-06** | | | | | **<0.01** |

| | | | |
|---|---|---|---|
| Total Risk Across Total Soil | 1.2E-06 | Total Hazard Index Across Total Soil | <0.01 |
| Total Risk Across All Media and All Exposure Routes | 1.2E-06 | oss All Media and All Exposure Routes | 0.0 |

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System

**Oral and Dermal Exposure Routes:**

| | |
|---|---|
| Oral / Dermal Cardiovascular System HI = | <0.01 |
| Oral / Dermal Skin HI = | <0.01 |

**TABLE 10**
**SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - SWMU 68**
**REASONABLE MAXIMUM EXPOSURE**

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Young Child

| Medium | Exposure Medium | Exposure Point | Chemical | Carcinogenic Risk | | | | | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal | External (Radiation) | Exposure Routes Total | Primary Target Organ | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Total Soil | Total Soil | Total Soil | Arsenic | 2.5E-06 | -- | 2.1E-07 | -- | 2.7E-06 | Skin / CVS | 0.06 | -- | <0.01 | 0.07 |
| | | | Chemical Total | 2.5E-06 | -- | 2.1E-07 | -- | 2.7E-06 | | 0.06 | -- | <0.01 | 0.07 |
| | | Exposure Point Total | | | | | | 2.7E-06 | | | | | 0.07 |
| | Exposure Medium Total | | | | | | | 2.7E-06 | | | | | 0.07 |
| | Air | Fugative Dust | Arsenic | -- | 1.6E-09 | -- | -- | 1.6E-09 | NA | -- | -- | -- | -- |
| | | | Chemical Total | -- | 1.6E-09 | -- | -- | 1.6E-09 | | -- | -- | -- | -- |
| | | Exposure Point Total | | | | | | 1.6E-09 | | | | | -- |
| | Exposure Medium Total | | | | | | | 1.6E-09 | | | | | -- |
| **Total Soil Total** | | | | | | | | **2.69E-06** | | | | | **0.07** |
| **Young Child Residents Total** | | | | | | | | **2.69E-06** | | | | | **0.07** |

| | | | |
|---|---|---|---|
| Total Risk Across Total Soil | 2.7E-06 | Total Hazard Index Across Total Soil | 0.1 |
| Total Risk Across All Media and All Exposure Routes | 2.7E-06 | oss All Media and All Exposure Routes | 0.1 |

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System

**Oral and Dermal Exposure Routes:**

| | |
|---|---|
| Oral / Dermal Cardiovascular System HI = | 0.1 |
| Oral / Dermal Skin HI = | 0.1 |

**TABLE 11**
**SUMMARY STATISTICS AND RESULTS - VANADIUM IN NAPR BACKGROUND AND SWMU 14 SUBSURFACE SOIL**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| Chemical | Population [1] | Descriptive Statistics [2] | | | | | | Test for Normality [4] | Test for Homogeneity of Variance [5] | Distributional Statistics | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Frequency of Detection | Range of Detections | Range of Non-Detections | Mean | SE | 95% UCL [3] | | | Mean/Median of the Distribution | Right Tail of the Distribution [6] | |
| | | | | | | | | | | | Quantile Test | Slippage Test |
| Vanadium | SWMU 14 | 14/14 | 86.8J - 320J | NA | 182 | 17.9 | 214 (Normal Distribution) | Normal at α = 0.05 (p = 0.8045) | Variances are equal at α = 0.05 (p = 0.0603) | Two sample t-test [7]; Not elevated at α = 0.05 (p = 0.7778); Power = 0.008136) | Not elevated at α = 0.05 | Not elevated at α = 0.05 |
| | Background | 19/19 | 25 - 410 | NA | 209 | 25.9 | 253 (Normal Distribution) | Normal at α = 0.05 (p = 0.1847) | | | | |

Notes:

95% UCL = 95% Upper Confidence Limit of the mean
J = Estimated value
NA = Not applicable
SE = Standard error
SWMU = Solid Waste Management Unit
NAPR = Naval Activity Puerto Rico
α = Significance level (for the distributional statistics, α represents the probability criteria [0.05] for rejecting the null hypothesis that data sets were sampled from the same population)

(1) SWMU 14 subsurface soil data taken from Baker (2007); background data (clay soil type) taken from Baker (2006).
(2) Units in mg/kg.
(3) 95% Upper Conficence Limit was calculated using USEPA ProUCL Version 3.00.02 software.
(4) Normality verified by Shapiro-Wilks test. The test for normality was performed because each data set (SWMU 14 and background) has less than fifteen percent non-detected results.
(5) Homogeneity of variance verified by F test. The test for homogeneity of variance was performed because each data set (SWMU 14 and background) exhibits a normal distribution and has less than fifteen percent non-detected results.
(6) Quantile and slippage tests only determine whether or not a particular contaminant is likely present at equivalent or elevated concentrations relative to background.
(7) Two sample t-test was used because: (a) there are less than fifteen percent non-detected results in the combined data sets (SWMU 14 and background); (b) each data set has a normal distribution; and (c) the SWMU 14 and background data set distributions have equal variances.

References:

Baker Environmental, Inc. (2007). Final Phase II RCRA Facility Investigation Report for SWMU 14, Naval Activity Puerto Rico, Ceiba, Puerto Rico. March 23, 2007.
Baker. (2006). Revised Final Summary Report for Environmental Background Concentrations of Inorganic Compounds, Naval Activity Puerto Rico, Ceiba, Puerto Rico. October 17, 2006.

# FIGURES

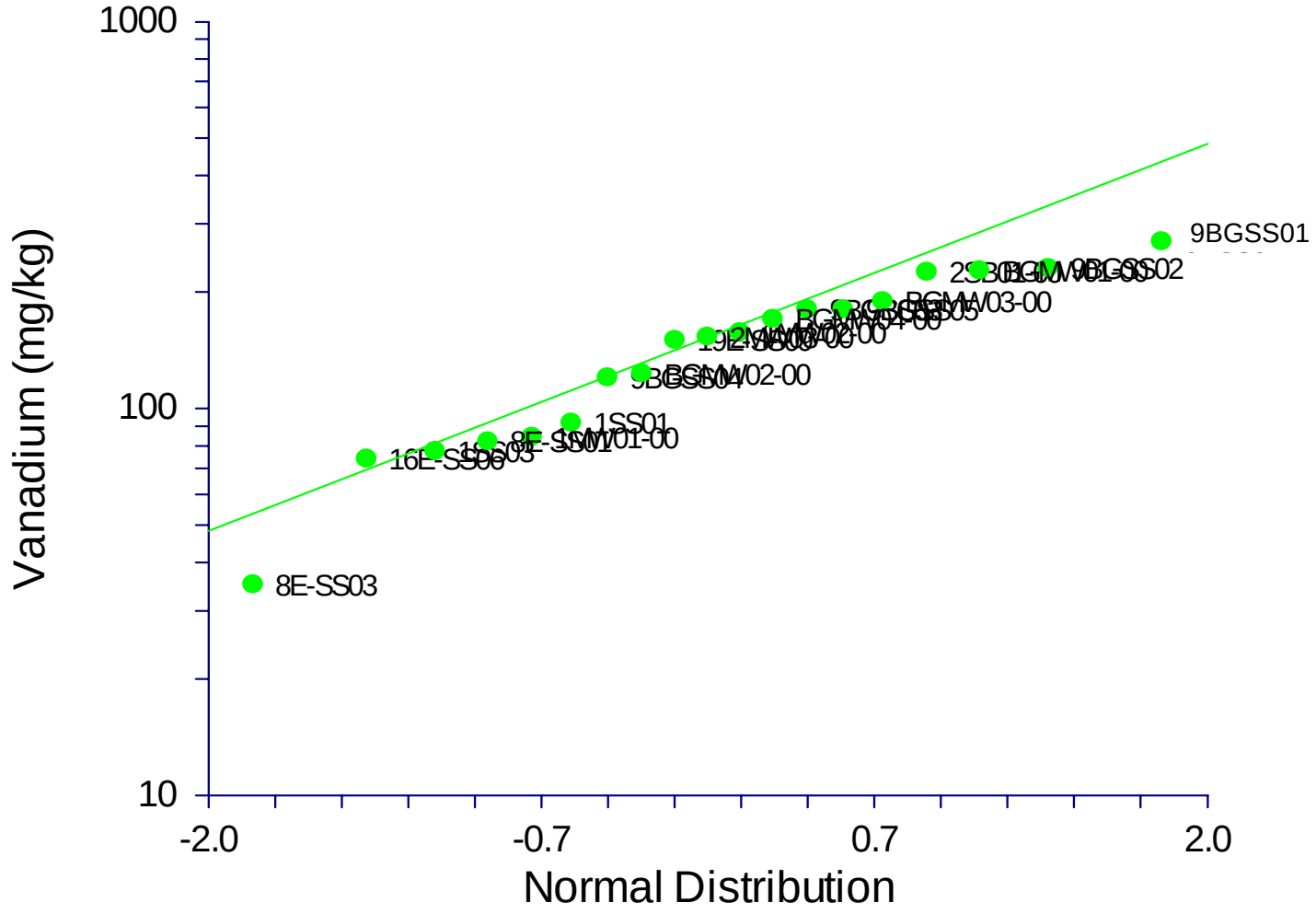


**FIGURE 1**
**PROBABILITY PLOT OF VANADIUM IN NAPR**
**BACKGROUND SURFACE SOIL**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

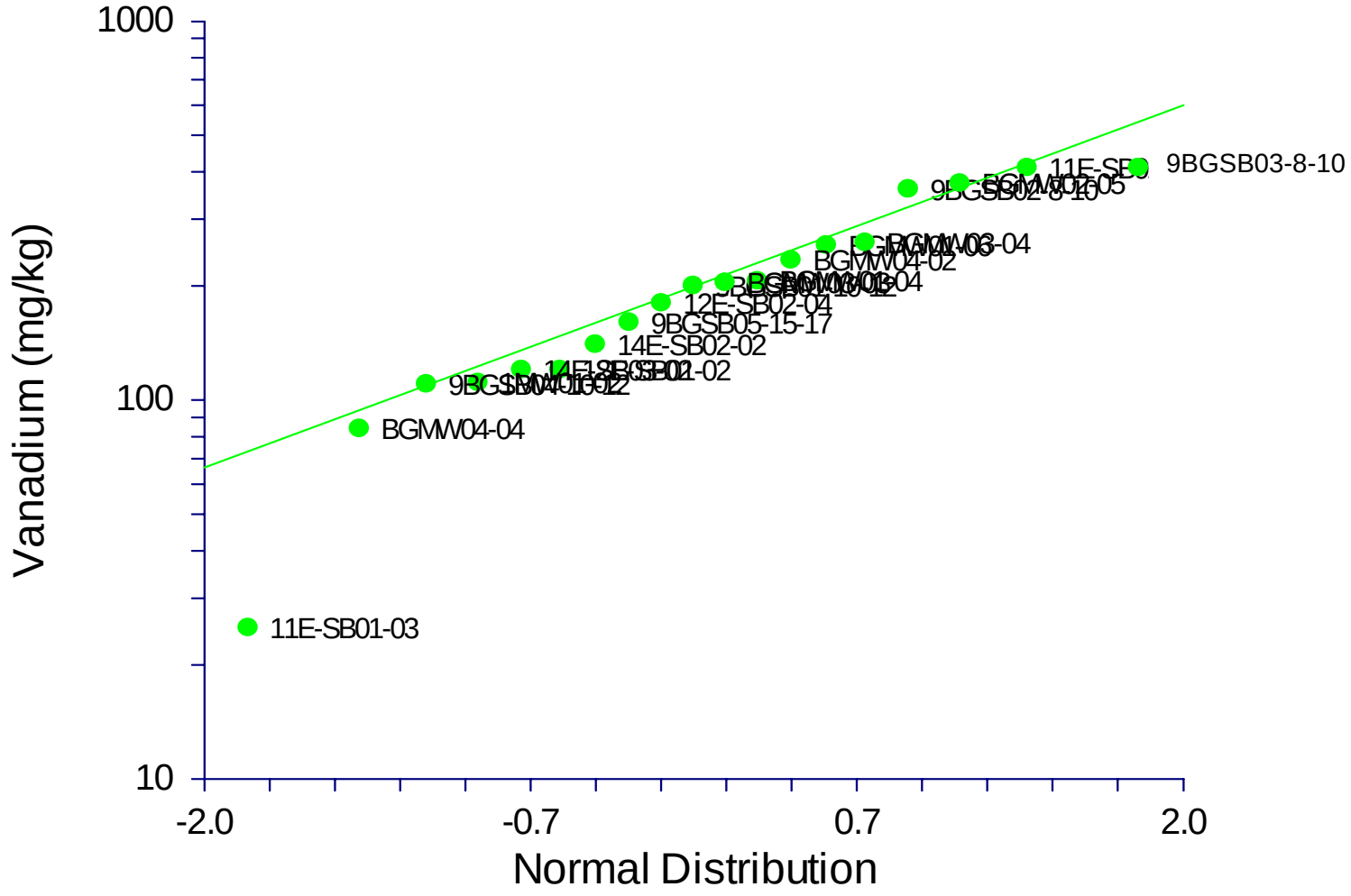


**FIGURE 2**
**PROBABILITY PLOT OF VANADIUM IN NAPR**
**BACKGROUND SUBSURFACE SOIL**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

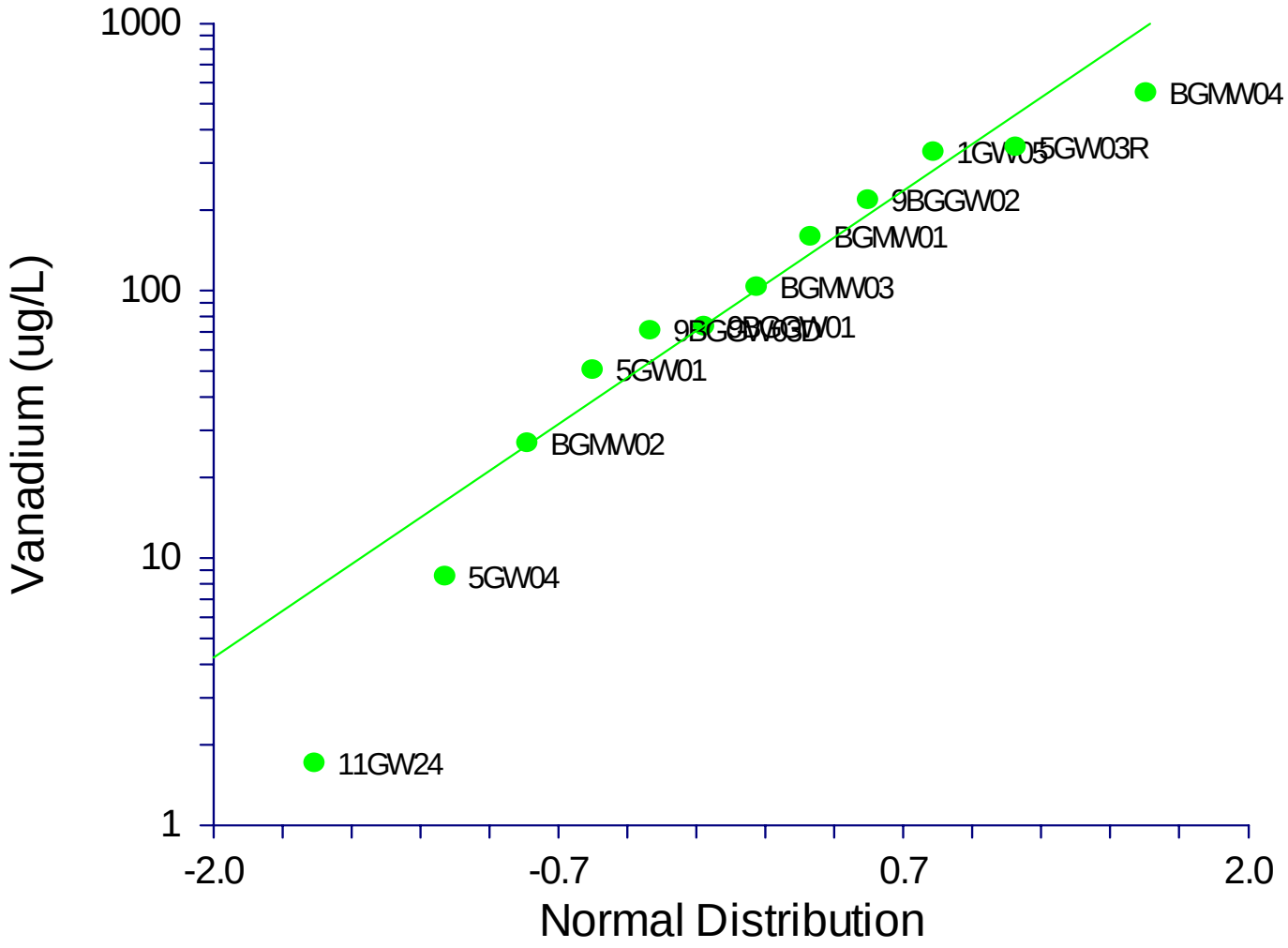


**FIGURE 3**
**PROBABILITY PLOT OF VANADIUM IN NAPR**
**BACKGROUND GROUNDWATER**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

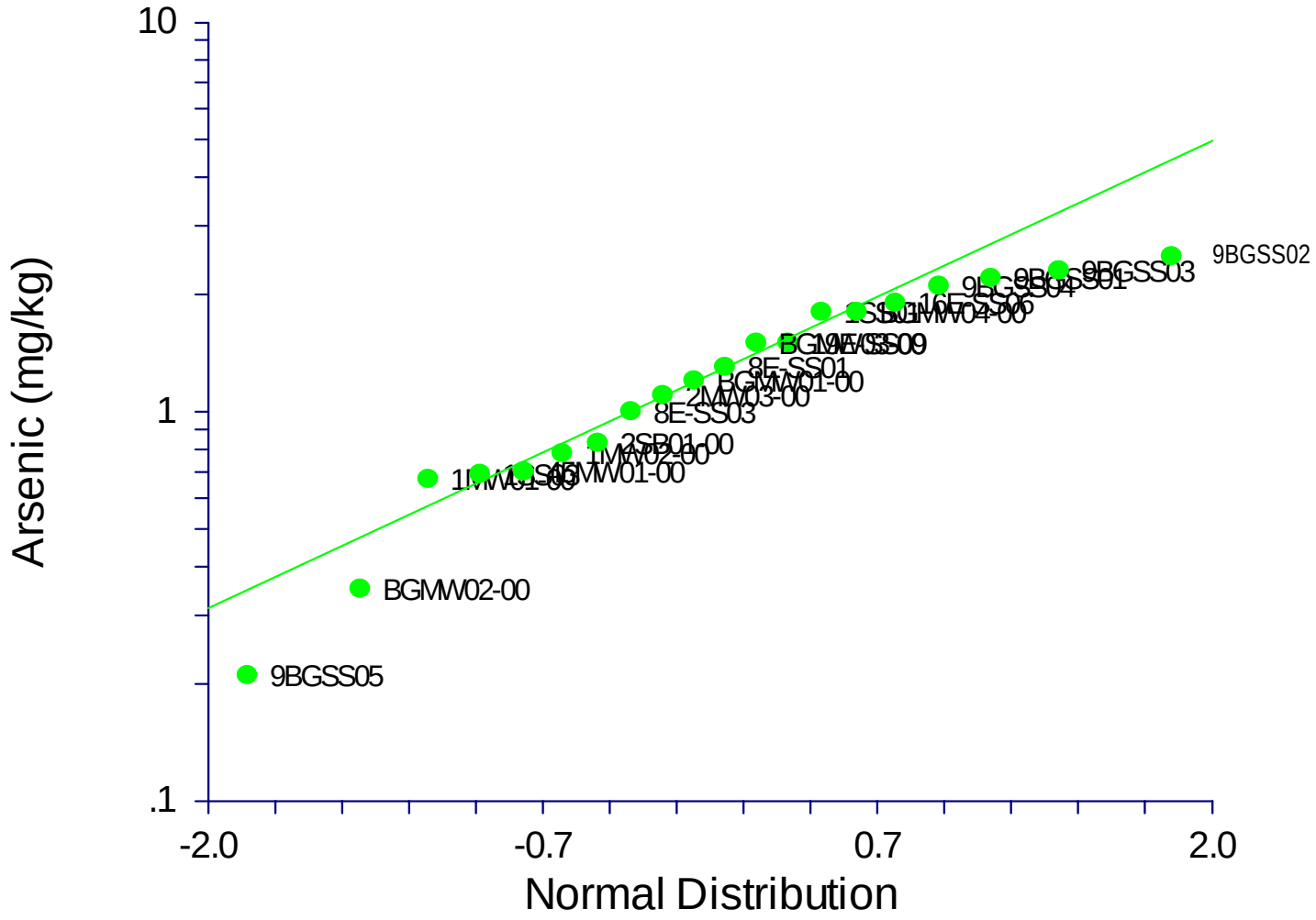


**FIGURE 4**
**PROBABILITY PLOT OF ARSENIC IN NAPR**
**BACKGROUND SURFACE SOIL**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

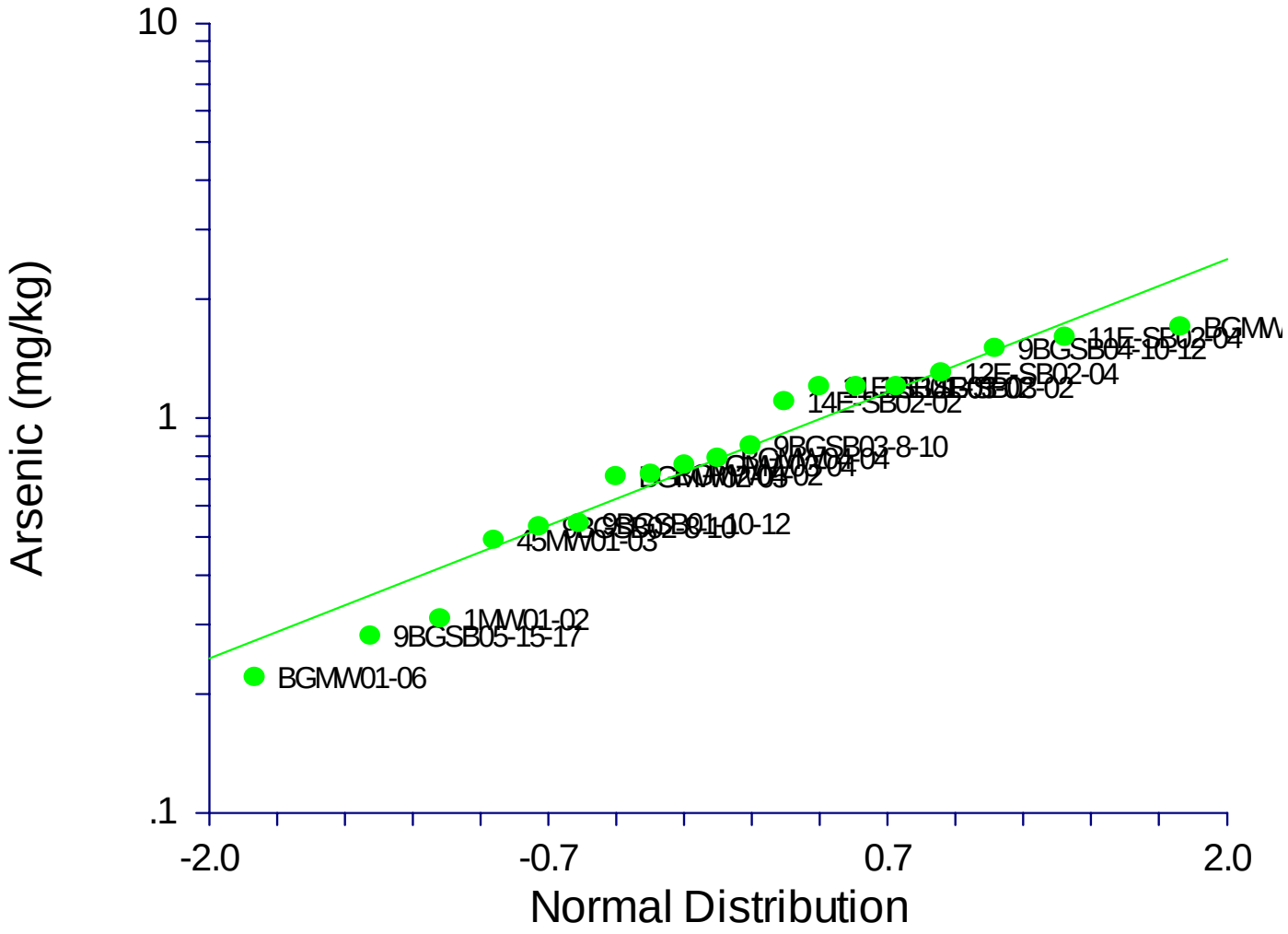


**FIGURE 5**
**PROBABILITY PLOT OF ARSENIC IN NAPR**
**BACKGROUND SUBSURFACE SOIL**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

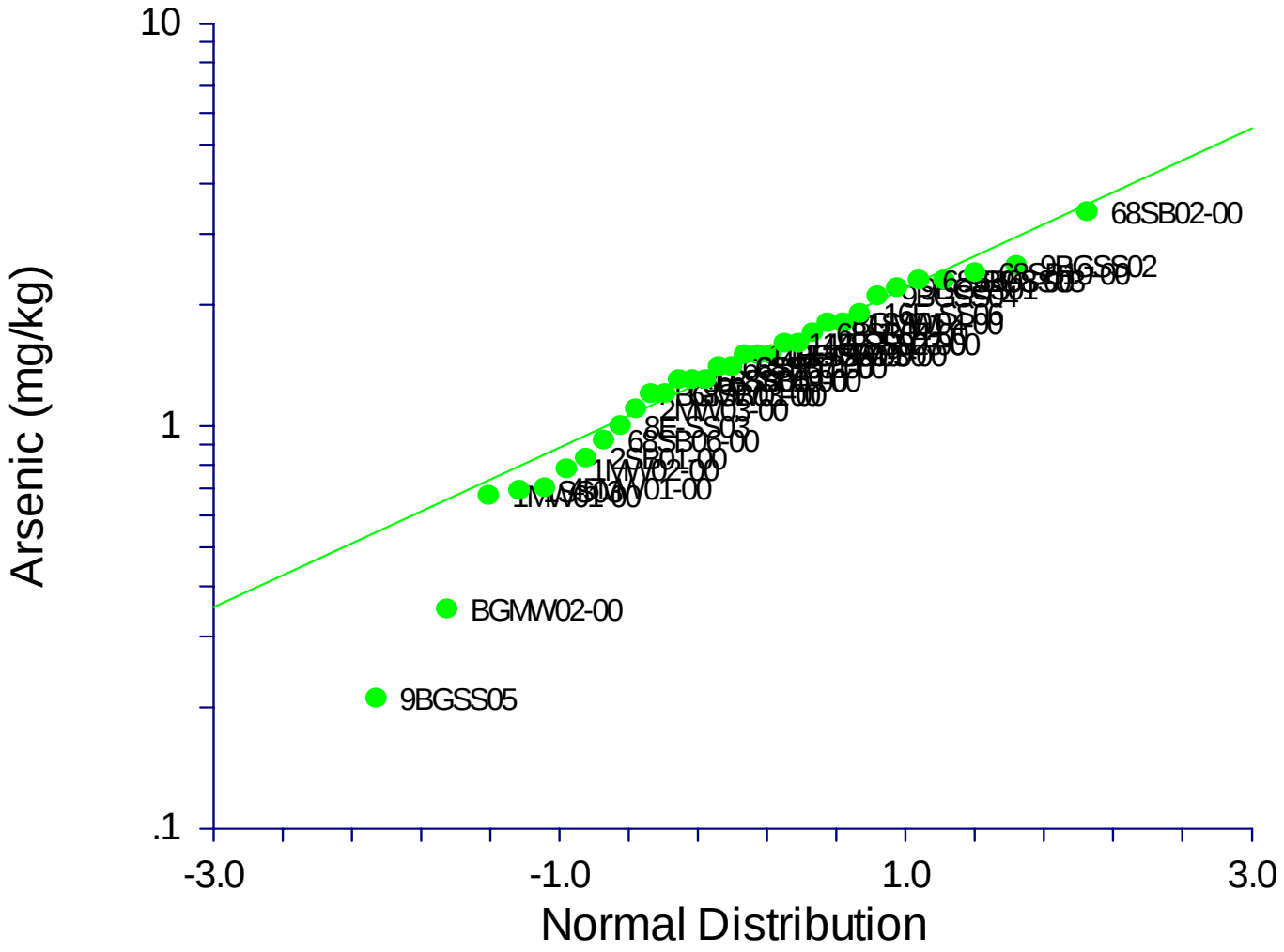


**FIGURE 6**
**PROBABILITY PLOT OF ARSENIC IN NAPR**
**BACKGROUND AND SWMU 68 SURFACE SOIL**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

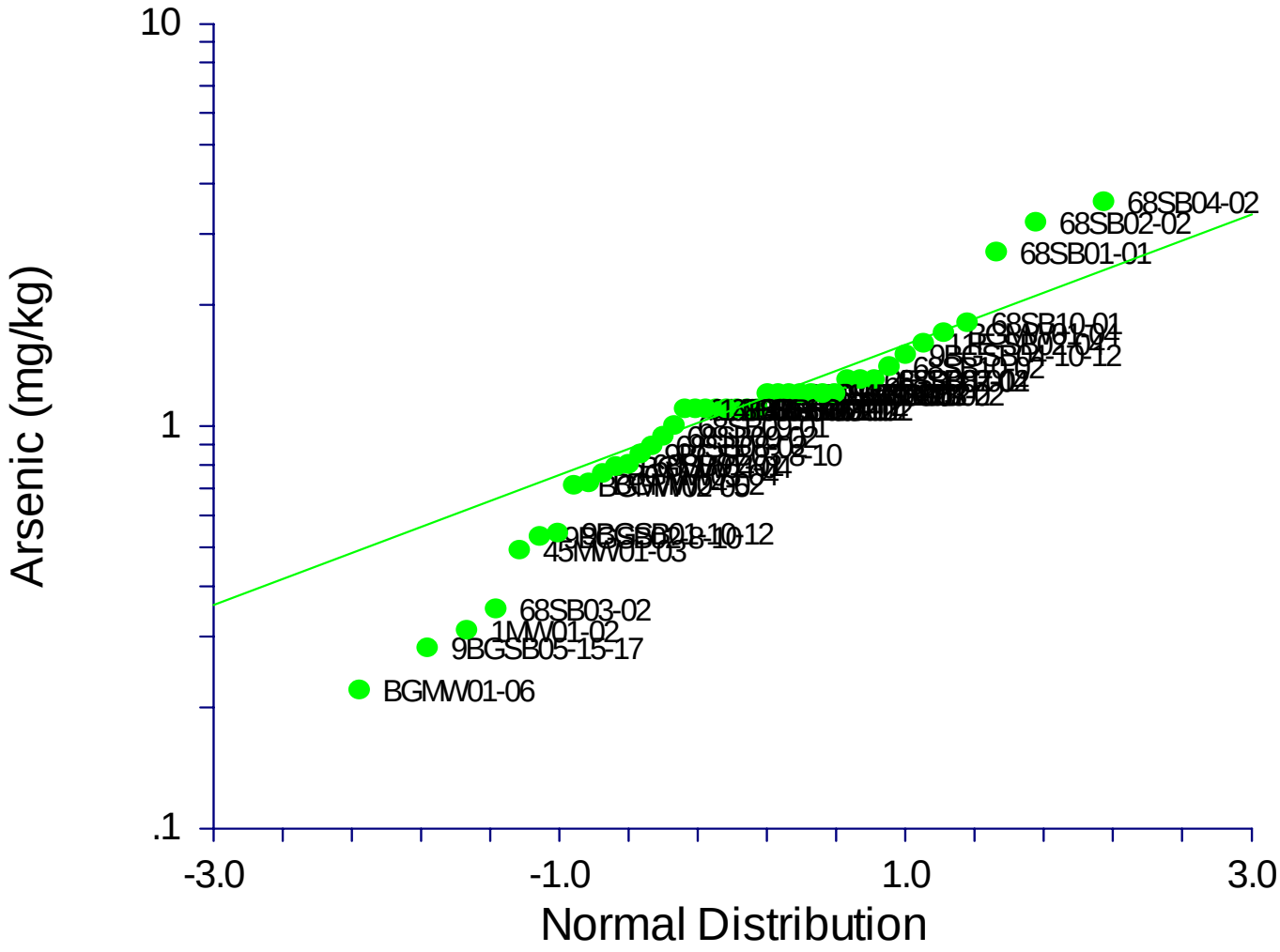


**FIGURE 7**
**PROBABILITY PLOT OF ARSENIC IN NAPR**
**BACKGROUND AND SWMU 68 SUBSURFACE SOIL**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

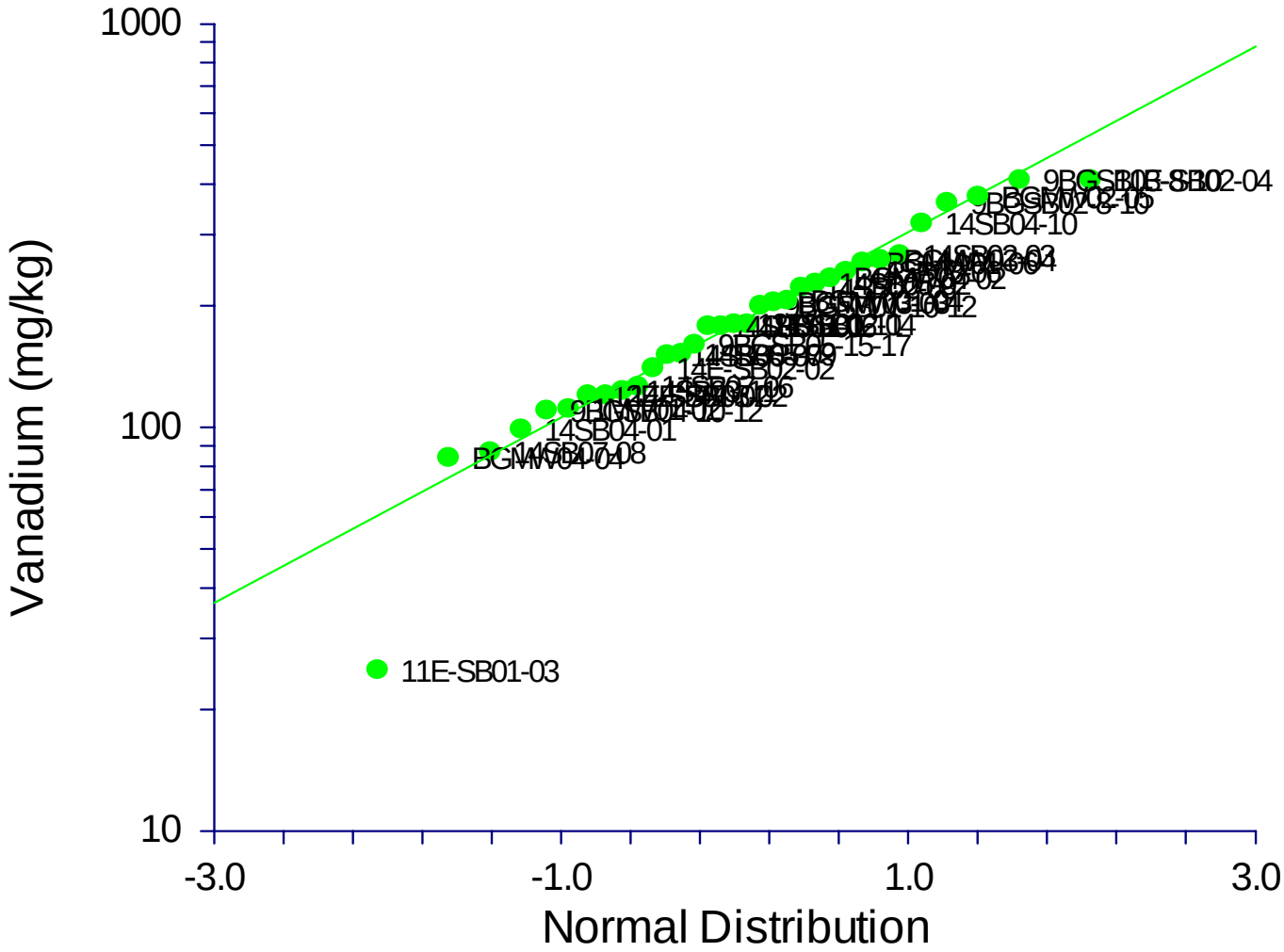


**FIGURE 8**
**PROBABILITY PLOT OF VANADIUM IN NAPR**
**BACKGROUND AND SWMU 14 SUBSURFACE SOIL**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

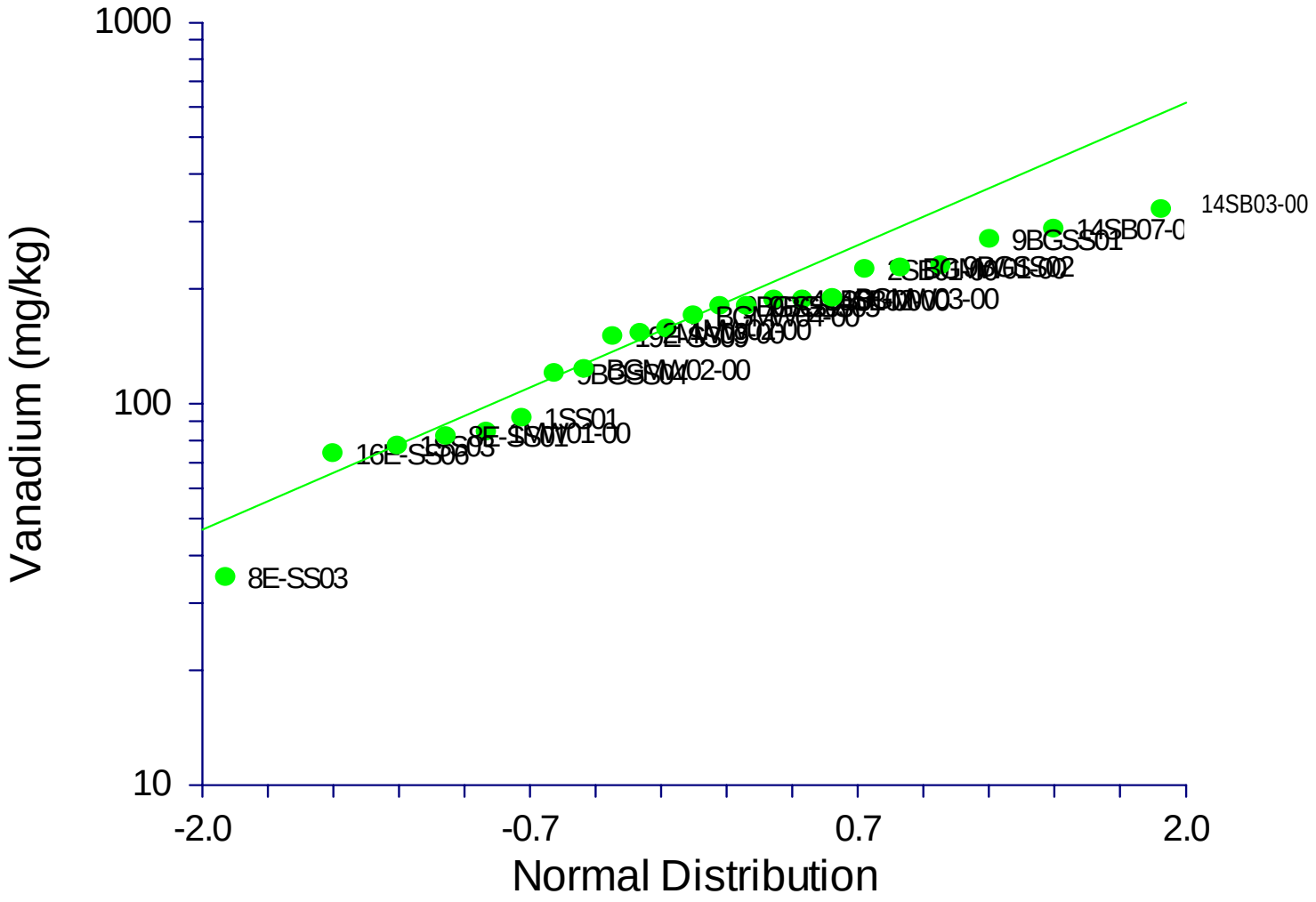


**FIGURE 9**
**PROBABILITY PLOT OF VANADIUM IN NAPR BACKGROUND AND SWMU 14 SURFACE SOIL**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

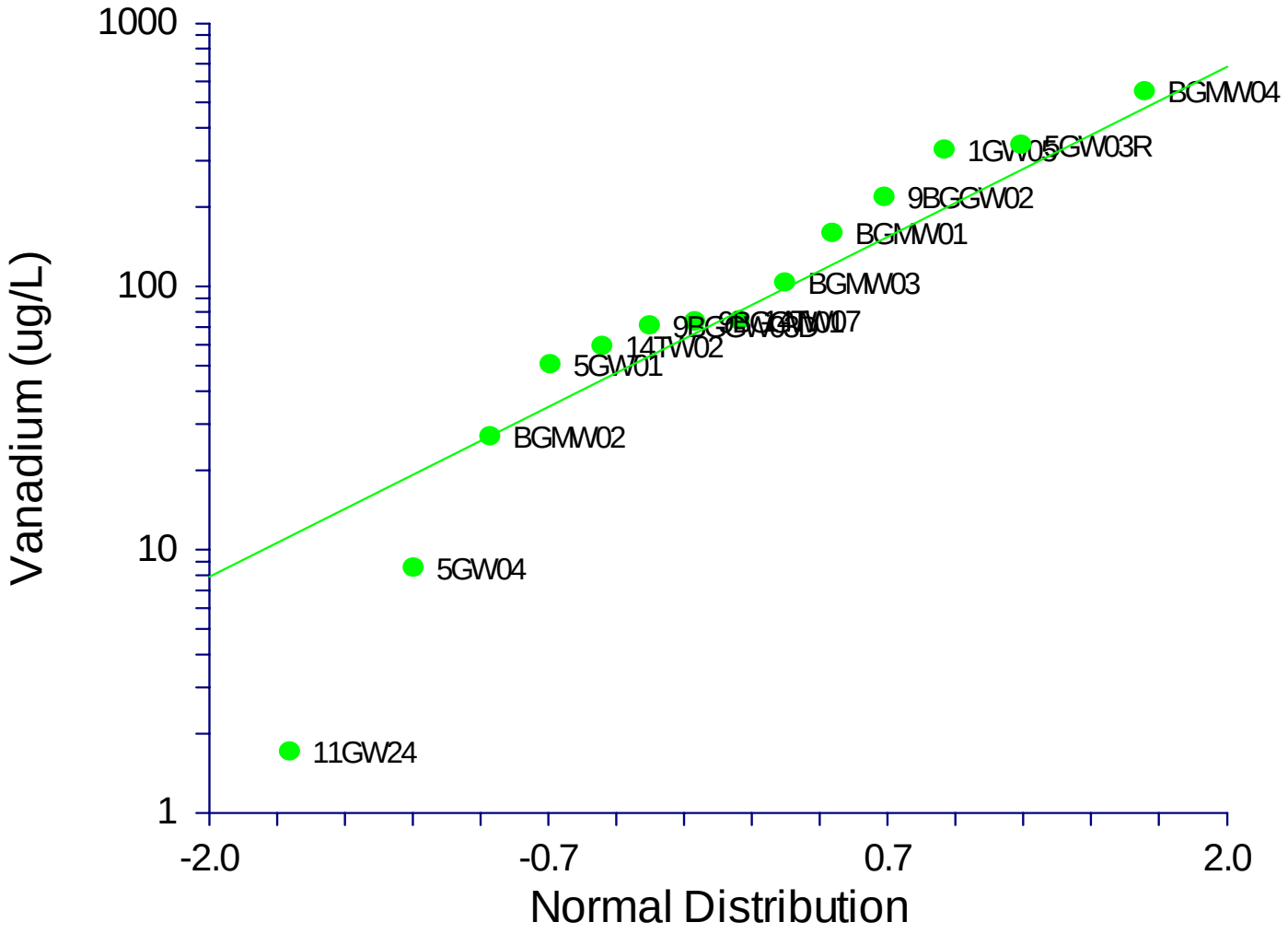


**FIGURE 10**
**PROBABILITY PLOT OF VANADIUM IN NAPR BACKGROUND AND SWMU 14 GROUNDWATER**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**