DEPARTMENT OF THE ARMY
NORTH PACIFIC DIVISION LABORATORY
CORPS OF ENGINEERS
1491 N.W. GRAHAM AVENUE
TROUTDALE, OREGON 97060-9503

October 3, 1995

Bill Richards
Ecology and Environment, Inc.
840 K Street, Suite 100
Anchorage, Alaska 99501

Dear Mr. Richards:

Enclosed, completing all analyses requested to date, are reports of analytical data for the Ft. Richardson OU-A POL Laboratory Dry Well project sampled by Ecology and Environment, Inc. from June 8 through 30, 1995. Included are:

a. Enclosure 1, Original Chemical Quality Assurance Report

b. Enclosure 2, Original report numbers 9014, 9019, 9022, 9024, and 9029 from ARDL, Inc. with facsimile addendum dated 05 Sep 95

c. Enclosure 3, Original CENPD-ET-EN-L sample cooler receipt forms and telephone records

Reference original report numbers 49334, 49403, 49481, 49512, 49606, 49848, and 50103 from Sound Analytical Services, Inc. previously submitted to your office by the laboratory.

Please contact Dr. Ajmal M. Ilias at (503) 669-0246 if you have any questions.

Sincerely,

Enclosures

For Ajmal M. Ilias
Timothy J. Seeman, Director
North Pacific Division Laboratory

CENPD-ET-EN-L (95-0273) 03 Oct 95

CHEMICAL QUALITY ASSURANCE REPORT

FT. RICHARDSON OU-A, POL LABORATORY DRY WELL

1. **SUMMARY:**

a. The following deficiencies and/or delinquencies were noted in the primary laboratory's data. Di-n-butylphthalate and gasoline range organics (GRO) was detected in selected soil laboratory method blanks in various Sound Analytical Services (SAS) reports. Where applicable, the associated data of these analytes should be considered due to laboratory contamination. Sample cooler temperatures ranging from 0 to 2 °C were recorded throughout five out of seven SAS reports, which is outside of the USACE required 4°+/-2.

I. Volatiles (VOC): Based on holding time expiration, the VOC data for seventeen selected soil samples and two sludge samples should be considered estimates. Surrogate recoveries for 43 VOC soil samples were outside of EPA quality control (QC) limits. Based on the out of control surrogate recoveries, the VOC data for these samples should be considered estimates. Due to out of control internal standard results during the initial analysis of VOC soil samples 95POLLDW-3017SB and -3028SB (SAS report 49403), the data should be considered unusable as the outlier internal standards directly affect the quantitation of selected VOC targeted analytes.

II. Polychlorinated Biphenyls (PCB) and Inorganics: Based on low surrogate and/or matrix spike recoveries, low levels of targeted PCB analytes, reactive cyanide and reactive sulfide would not have been detected if present in sludge samples 95POLLDW-3001SG and -3002SG of SAS report 49334.

III. GRO, DRO, and TRPH: Based on holding time expiration, the GRO data for three reanalyzed samples should be considered estimates. The surrogate recovery for two GRO samples and three DRO samples were diluted out due to the high concentration of fuel in the samples; data should be considered estimates. Based on low surrogate recoveries, low levels of GRO may not have been detected if present in three soil samples. Based on out of control QC data, low levels of GRO may not have been detected the soil samples of SAS report 49848, the soil DRO data of SAS report 49848 should be considered estimates and the soil TRPH data of SAS report 49848 should be considered high estimates.

IV. TCLP and Total Metals: Based on out of control QC data, the TCLP-mercury data of sludge samples -3001SG and -3002SG and the total chromium data of SAS report 49334 should be considered high estimates. low levels of total antimony may not have been detected in the associated soil samples of SAS reports 49334, 49403, 49521, 49606, and 49848 and low levels of total mercury may not have been detected in the soil samples of SAS report 49334. Based on out of control RPD results, the following soil data should be considered estimates: total calcium in

SAS reports 49403, 49481, and 49848; total magnesium and vanadium in SAS report 49848; and total potassium in SAS report49521.

b. The primary blind duplicate and QA data comparisons are presented in Tables I through IX. All data agree with each other and are comparable with the following exceptions: The primary blind duplicate data of GRO in Table III-2, total nickel and silver in Table IV-5, bis(2-ethylhexyl)phthalate in Table V-2, total mercury in Table V-6, and total thallium in Table VII-5. In these instances, the primary laboratory had acceptable internal QC data and the discrepancies could not be analytically resolved. One out of two primary data did not agree with the QA data for bis(2-ethylhexyl)phthalate in Table V-2, total nickel and silver in Table IV-5, total mercury in Table V-6, total thallium in Table VII-5 and DRO in Tables IV-3 and VII-3. The QA data of bunker C in Table I-4, TRPH in Table II-5, TCLP-chromium, mercury, and silver in Table I-5, total antimony in Tables VI-5, VII-5, and VIII-6, and reactive sulfide in Table I-6 did not agree with the primary blind duplicate results. In the majority of cases, both laboratories had acceptable internal QC data and the primary data was accepted based on blind duplicate or QA data agreements. See section 8 of this report and their respective comparison tables for details of the data discrepancies.

2. **BACKGROUND:** The samples were collected on June 8, 9, 12, 13, 15, 16, 19, and 30, 1995 and received by the analytical laboratories on June 10, 13 through 17, 20 through 22, and July 1, 3, 14, 1995.

3. **OBJECTIVES:**

a. Eighty soil, one sludge, two water, and nine blind duplicate samples were collected from various location to determine the extent of the chemical contamination on the site.

b. Seven QA soil and one sludge samples were submitted to evaluate the primary laboratory's data quality.

4. **PROJECT ORGANIZATION:**

a. The samples were collected by Ecology and Environment, Inc., Anchorage, Alaska.

b. The primary samples were analyzed by Sound Analytical Services (SAS), Inc., Tacoma, Washington.

c. The QA samples were analyzed by Applied Research & Development Laboratory (ARDL), Inc., Mt. Vernon, Illinois.

5. ANALYTICAL REFERENCES:

Number	Title	Date
SW-846, Third Edition	Test Methods for Evaluating Solid Waste - Final Update II	1/95
GRO and DRO	State of Alaska Interim TPH Methods	2/92

6. EVALUATION OF THE PRIMARY LABORATORY'S DATA:

a. Surrogate Recoveries: Three, six, two and two surrogates, similar to the analytes of interest, were used in the following analyses: volatile organic compounds (VOC) by EPA method 8260, semi-volatile organics (BNA) by EPA method 8270, polychlorinated biphenyls (PCB) by EPA method 8080, and U.S. Army Corps of Engineers Fuel Identification\Quantitation (COE/FIQ), respectively. One surrogate was used in the following analyses: gasoline range organics (GRO) by State of Alaska fuel hydrocarbon method 8015 modified, and diesel range organics (DRO) by State of Alaska fuel hydrocarbon method 8100 modified. All surrogate recoveries were within EPA, Alaska Department of Environmental Conservation (ADEC) or laboratory established (LE) quality control (QC) limits and are acceptable with the following exceptions and/or notations.

I. VOC: One out of three surrogate recoveries for VOC soil samples 95POLLDW-3001SB, -3008SB, -3017SB(RE), -3021SB, -3026SB, -3029SB, -3030SB, -3032SB, -3033SB, -3036SB, -3037SB, -3069SB, -3072SB, -3074SB, -3076SB, -3077SB, and -3092SB was above the EPA QC limit. Based on a high surrogate recovery, the VOC data for these samples should be considered high estimates. One out of three surrogate recoveries for VOC soil samples -3004SB, -3009SB, -3010SB, -3014SB, -3015SB, -3018SB, -3019SB, -3023SB, -3057SB, -3059SB, -3075SB(RE), -3093SB, -3094SB, and -3095SB was below the EPA QC limit. Two out of three surrogate recoveries for VOC soil sample -3022SB were below EPA QC limits. Based on the low surrogate recovery results, the VOC data for these samples should be considered low estimates and low levels of targeted volatiles may not have been detected if present. Two out of three surrogate recoveries for VOC soil samples -3011SB, -3013SB, -3016SB, -3025SB, -3028SB, -3028SB(RE), -3034SB, -3062SB, -3070SB, and -3075SB were outside EPA QC limits. Based on the out of control surrogate recoveries, the VOC data for these samples should be considered estimates. Three out of three surrogate recoveries for VOC soil sample -3012SB were outside EPA QC limits due to severe fuel hydrocarbon matrix interference.

Based on the out of control surrogate recoveries, the VOC data should be considered estimates. The laboratory indicated in the report case narratives that most of the VOC samples which exhibited out of control surrogate recoveries were reanalyzed usually past holding time requirements.

II. PCB: The surrogate recoveries for PCB sludge samples -3001SG and -3002SG were below LE QC limits due to severe matrix interference encountered during analysis. Based on the low surrogate recoveries, low levels of targeted PCB's would not have been detected if present in these samples.

III. GRO and DRO: The surrogate recovery for GRO samples -3012SB and -3021SB were diluted out due to the high concentration of GRO in the samples. As the extraction efficiency of these samples could not be determined, the GRO data for these samples should be considered estimates. The surrogate recovery for GRO samples -3092SB, -3093SB, and -3094SB was below the ADEC QC limit. Based on the low surrogate recoveries, low levels of GRO may not have been detected if present. The laboratory performed a reanalysis of these samples past holding time and achieved acceptable surrogate recoveries; these data should be considered estimates due to holding time expiration. The surrogate recovery for DRO samples -3012SB, -3013SB, and -3021SB were diluted out due to the high concentration of DRO in the samples. As the extraction efficiency of these samples could not be determined, the DRO data for these samples should be considered estimates.

b. Matrix Spike (MS), Matrix Spike Duplicate (MSD), Laboratory Control (LC) Recoveries and Relative Percent Difference (RPD) Results: All MS/MSD and LC recoveries and RPD results were within EPA, ADEC or LE QC limits and are acceptable with the following exceptions and/or notations.

I. VOC: Three out of 20 TCLP-VOC MS/MSD recoveries in SAS report 49334 were above EPA QC limits. Since VOC targeted analytes were not detected in the associated TCLP samples, the VOC data quality was not adversely affected by the high recoveries. Three out of five soil VOC RPD results in batch A407 in SAS report 49334 were marginally above EPA QC limits due to the matrix of the original sample (-3001SB). Two out of five medium level protocol soil VOC RPD results in batch A741 referenced in SAS reports 49334 and 49403 were above EPA QC limits. One out of five soil VOC RPD results in batches A928 and A959 referenced in SAS reports 49512 and 49848 were above EPA QC limits. The precision of the above mentioned associated data are accepted based on the remaining acceptable RPD results.

II. BNA: Three out of 22 BNA soil MS/MSD recoveries in SAS report 49481 were above EPA QC limits. Four out of 22 BNA water MS/MSD recoveries in SAS report 49848 were above EPA QC limits. The accuracy of the associated BNA data of these reports are accepted based on the remaining acceptable matrix spike recoveries.

III. PCB and COE/FIQ: The sludge PCB MS and MSD recoveries in SAS report 49334 were below the LE QC limit due to severe matrix interference encountered during analysis. Based on the low spike recoveries, low levels of targeted PCB analytes would not have been detected if present in samples -3001SG and -3002SG. The COE/FIQ MS and MSD recoveries of kerosene and the RPD result were outside of LE QC limits in SAS report 49334 due to the high level of fuel hydrocarbons in the original sample (-3002SG). For the purpose of data evaluation, the out of control results should not be considered significant as the original sample concentration was greater than four times the spike amount. The COE/FIQ blank spike (BS) sample was inadvertently spiked below the detection limit by the laboratory during extraction and therefore was not useful in evaluating the accuracy of the COE/FIQ data. The accuracy of the COE/FIQ data of this report (samples -3001SG and -3002SG) are acceptable based on the acceptable sample surrogate recoveries.

IV. GRO, DRO and TRPH: The soil GRO laboratory duplicate RPD result in SAS report 49334 was above the LE QC limit. The out of control RPD result should be considered significant as the data of the comparison are attributable to laboratory contamination. The soil GRO MS and MSD recoveries in SAS report 49848 were below the LE QC limit due to laboratory noted laboratory noted matrix interference. Based on the low spike recoveries, low levels of GRO may not have been detected if present in associated samples of this report (-3087SB through -3095SB). One out of two soil GRO MS/MSD recoveries in SAS report 50103 was below the LE QC limit. The accuracy of the GRO data are acceptable based on the remaining acceptable matrix spike and LC recoveries. The soil DRO laboratory duplicate RPD result in SAS report 49512 was not reported but was calculated as above the LE QC limit at 74. For the purpose of data evaluation, the out of control RPD result should not be considered significant as the data of the comparison was within a factor of five to the DRO detection limit. The soil DRO MS and MSD recoveries in SAS report 49848 were above the LE QC limit due to laboratory noted sample non-homogeneity. Review of the related internal QC data, substantiates this assumption. The accuracy of the DRO data in this report are accepted based on acceptable sample surrogate and acceptable LC sample recoveries. The soil DRO laboratory duplicate RPD result in SAS report 49848 was above the LE QC limit due to sample non-homogeneity as noted above. The DRO data of this report (samples -3087SB through -3095SB) should be considered estimates. The soil TRPH MS and MSD recoveries in SAS report 49848 were above the LE QC limit. Based on the high spike recoveries, the TRPH data of this report (samples -3087SB through -3095SB) should be considered high

estimates. It is possible that sample non-homogeneity may have attributed to the out of control results.

V. TCLP and Total Metals: The MS recovery of TCLP-mercury in SAS report 49334 was above the EPA QC limit. Based on the high spike recovery, the TCLP-mercury data of the associated samples (-3001SG and -3002SG) should be considered high estimates. Due to the high concentration of targeted metals in the original samples, the MS recoveries of aluminum, iron, and manganese in selected SAS reports were not calculable. The accuracy of the data are acceptable based on acceptable LC standard recoveries. The soil MS recovery of total chromium in SAS report 49334 was above the EPA QC limit. The total chromium data associated with this report (samples -3001SB through -3016SB) should be considered high estimates. The soil MS recovery of total antimony in SAS reports 49334, 49403, 49521, 49606, and 49848 was below the EPA QC limit. Based on the low spike recoveries, low levels of total antimony may not have been detected if present in the associated samples of these respective reports (-3001SB through -3016SB, -3017SB through -3037SB, -3058SB through -3077SB, -3078SB through -3086SB, and -3087SB through -3095SB). The soil MS recovery of total mercury in SAS report 49334 was below the EPA QC limit. Based on the low spike recovery, low levels of total mercury may not have been detected if present in the associated samples of this report (-3001SB through -3016SB). The soil MS recovery of total manganese in SAS report 49606 was above the EPA QC limit due to the presence of manganese in the original sample; data are accepted. The laboratory duplicate RPD of total calcium in SAS reports 49403, 49481, and 49848 was above the LE QC limit of 35. The soil calcium data of these respective reports (samples -3017SB through -3037SB, -3038SB through -3057SB, and -3087SB through -3095SB) should be considered estimates. The laboratory duplicate RPD of total magnesium and vanadium in SAS report 49848 was above the LE QC limit. The soil magnesium and vanadium data of this report (samples -3087SB through -3095SB) should be considered estimates. The laboratory duplicate RPD of total potassium in SAS report 49521 was above the LE QC limit. The soil potassium data of this report (samples -3058SB through -3077SB) should be considered estimates. The laboratory duplicate RPD of total cadmium in SAS report 49403 and total mercury in SAS report 49481 was above the LE QC limit. For the purpose of data evaluation, the out of control RPD results should not be considered significant as the data of the comparison was within a factor of five to the analytes detection limit.

VI. Inorganics: The MS recovery of reactive cyanide and reactive sulfide in SAS report 49334 were below the LE QC limit. Based on the low spike recoveries, low levels of reactive cyanide and reactive sulfide may not have been detected if present in samples -3001SG and -3002SG.

c. Field Blind Duplicate Results: The primary field blind duplicate results are presented in Tables I through IX. All data agree with each other with the following exceptions. The primary blind duplicate data of GRO in Table III-2, total nickel and silver in Table IV-5, bis(2-ethylhexyl)phthalate in Table V-2, total mercury in Table V-6, and total thallium in Table VII-5. As the primary laboratory had acceptable internal QC data, the discrepancies could not be analytically resolved.

d. Laboratory Method Blanks: All laboratory method blanks were free of targeted analytes with the following exceptions. Di-n-butylphthalate, at 2.4 ppm, was detected in the soil BNA method blank of SAS report 49403. The di-n-butylphthalate data for samples -3021SB and -3034SB should be considered due to laboratory contamination. Di-n-butylphthalate, at 0.47 ppm, was detected in the soil BNA method blank referenced in SAS reports 49512 and 49848. Since di-n-butylphthalate was not detected in any associated BNA samples, the BNA data quality was not adversely affected by the laboratory contamination. Di-n-butylphthalate, at 18 ppb, was detected in the water BNA method blank of SAS report 49848. The di-n-butylphthalate data for sample -3001WA should be considered due to laboratory contamination. GRO, at 1.1 ppm, was detected in the soil GRO method blank of SAS report 49334. The GRO data of the associated samples (-3001SB through -3016SB) should be considered due to laboratory contamination except for the data of sample -3012SB which had a GRO result greater than ten times the level of method blank contamination. GRO, at 0.83 ppm, was detected in the soil GRO method blank of SAS report 49512. The GRO data of the associated samples (-3058SB through -3077SB) should be considered due to laboratory contamination, where applicable. GRO, at 0.46 ppm, was detected in the soil GRO method blank of SAS report 49606. The GRO data of the associated samples (-3078SB through -3086SB) should be considered due to laboratory contamination, where applicable. GRO, at 0.72 ppm, was detected in the soil GRO method blank of SAS report 50103. The GRO data for sample 95POLLDW-001SP are acceptable as the GRO result (8.8 ppm) was greater than ten times the level of method blank contamination.

e. Sample Holding Times and Detection Limits: All sample holding times and detection/reporting limits met EPA and ADEC method criteria and are acceptable with the following exceptions.

I. VOC: Due to out of control continuing calibration recoveries, sludge samples -3001SG and -3002SG in SAS report 49334 were reanalyzed for TCLP-VOC's 13 days past the maximum holding time. The TCLP-VOC data for these samples should be considered estimates. VOC samples -3001SB, -3011SB, -3011SB(RE), -3012SB, -3017SB(RE), -3028SB(RE), -3059SB(RE), -3062SB(RE), -3069SB(RE), -3070SB(RE), -3075SB(RE), -3092SB(RE), -3093SB(RE), -3094SB(RE) and -3094SB(RE)-dilution were either initially analyzed past holding time or were

reanalyzed past holding time due to initial out of control internal QC data.. Based on holding time expiration, the VOC data for the affected samples should be considered estimates. VOC samples -3012SB and -3021SB were reanalyzed past holding time by the medium level protocol (methanolic extraction) due to the high concentration of 4-methyl-2-pentanone (MIBK) in the samples. Based on holding time expiration. the VOC data of these analyses should be considered estimates.

II. GRO and COE/FIQ: The reanalysis of GRO samples -3092SB, -3093SB and -3094SB was performed 8 days past holding time. Based on holding time expiration, the GRO data of these analyses should be considered estimates. The original analysis of soil sample -3092SB was reported as being performed on 22 Jul 95. This was a laboratory typographical error and the initial analysis (14 Jul 95) was not past holding time. The laboratory did not exceed the 28 day extraction/analysis holding time for COE/FIQ samples -3001SG and -3002SG. The SAS report 49334 case narrative stated that the samples were extracted 17 days after collection and were three days past holding time. The COE/FIQ samples were actually eleven days within holding time.

f. Internal Standard and Calibration Verification Results: Due to initial out of control TCLP-VOC continuing calibration percent difference (%D) results, sludge samples -3001SG and -3002SG in SAS report 49334 were reanalyzed past holding time. It was noted that the laboratory submitted the reanalyzed TCLP-VOC results for these samples. Due to out of control internal standard results during the initial analysis of VOC soil samples -3017SB and -3028SB in SAS report 49403 were reanalyzed past holding time. It was noted that the laboratory submitted the both the initial and reanalyzed VOC results for these samples. The initial VOC data should be considered unusable as the outlier internal standards directly affect the quantitation of selected VOC targeted analytes.

g. Chain of Custody (COC) Records and Sample Cooler Receipt (SCR) Forms: All COC records and SCR forms met U.S. Army Corps of Engineers (USACE) ER1110-1-263 regulations with the following exceptions and/or notations. Sample cooler temperatures ranging from 0 to 2 degrees Celsius ($^{\circ}$C) were recorded throughout five out of seven SAS reports (49334, 49403, 49481, 49512 and 49606), which is below the USACE requirement of 4 ± 2 $^{\circ}$C.

h. Overall Evaluation of the Primary Laboratory's Data: The following deficiencies and/or delinquencies were noted in the primary laboratory's data. Di-n-butylphthalate and GRO were detected in selected soil laboratory method blanks in various SAS reports. Where applicable, the associated data of these analytes should be considered due to laboratory contamination. Sample cooler temperatures ranging from 0 to 2 $^{\circ}$C were recorded throughout five out of seven SAS reports.

I. VOC: Based on holding time expiration, the VOC data for seventeen selected soil samples and two sludge samples should be considered estimates. Surrogate recoveries for 43 VOC soil samples were outside of EPA QC limits. Based on the out of control surrogate recoveries, the VOC data for these samples should be considered estimates. The laboratory indicated in the report case narratives that most of the VOC samples which exhibited out of control surrogate recoveries were reanalyzed, usually past holding time requirements. Due to out of control internal standard results during the initial analysis of VOC soil samples -3017SB and -3028SB (SAS report 49403), the data should be considered unusable as the outlier internal standards directly affect the quantitation of selected VOC targeted analytes.

II. PCB and Inorganics: Based on low surrogate and matrix spike recoveries, low levels of targeted PCB analytes would not have been detected if present in sludge samples -3001SG and -3002SG of SAS report 49334. Based on low matrix spike recoveries, low levels of reactive cyanide and reactive sulfide may not have been detected if present in sludge samples -3001SG and -3002SG.

III. GRO, DRO, and TRPH: Based on holding time expiration, the GRO data for reanalyzed samples -3092SB, -3093SB and -3094SB should be considered estimates. The surrogate recovery for GRO samples -3012SB and -3021SB and DRO samples -3012SB, -3013SB, and -3021SB were diluted out due to the high concentration of fuel in the samples. As the extraction efficiency of these samples could not be determined, the GRO and/or DRO data for these samples should be considered estimates. Based on low surrogate recoveries, low levels of GRO may not have been detected if present in samples -3092SB, -3093SB, and -3094SB. Based on low matrix spike recoveries, low levels of GRO may not have been detected the soil samples of SAS report 49848. Based on out of control RPD results, the soil DRO data of SAS report 49848 should be considered estimates. Based on high matrix spike recoveries, the soil TRPH data of SAS report 49848 should be considered high estimates.

IV. TCLP and Total Metals: Based on high matrix spike recoveries, the TCLP-mercury data of sludge samples -3001SG and -3002SG and the total chromium data of SAS report 49334 should be considered high estimates. Based on low matrix spike recoveries, low levels of total antimony may not have been detected in the associated soil samples of SAS reports 49334, 49403, 49521, 49606, and 49848 and low levels of total mercury may not have been detected in the soil samples of SAS report 49334. Based on out of control RPD results, the following soil data should be considered estimates: total calcium in SAS reports 49403, 49481, and 49848; total magnesium and vanadium in SAS report 49848; and total potassium in SAS report49521.

7. EVALUATION OF THE QA LABORATORY'S DATA:

a. Laboratory Method Blanks: All laboratory method blanks were free of targeted analytes with the following exceptions. Up to 5 ppb of methylene chloride was detected in the soil VOC method blanks referenced in ARDL reports 9022, 9024, and 9029. The associated VOC data of methylene chloride in samples 95POLLDW-3041SB, -3047SB, -3061SB, and -3080SB should be considered due to laboratory contamination. Chloroform and 5 ppb and 1,4-dichlorobenzene at 11 ppb were detected in the TCLP-VOC and TCLP-BNA method blanks of ARDL report 9014. The VOC data of chloroform in sample -3003SG should be considered due to laboratory contamination. Since 1,4-dichlorobenzene was not detected in any associated sample, the TCLP-BNA data quality was not adversely affected by the laboratory contamination. TOC, at 5.1 ppm, was detected in the soil method blank referenced in ARDL reports 9014, 9022, and, 9029. Since the associated TOC results for samples -3003SB, -3041SB, and -3080SB are greater than ten times the level of method blank contamination, the TOC data are acceptable and should not be considered due to laboratory contamination.

b. Sample Holding Times, Reporting Limits and Calibration Verifications: All sample holding times, reporting limits and calibration verifications (CCVs) met EPA and ADEC method criteria and are acceptable with the following exceptions. The PCB reporting limit for sludge sample -3003SG was elevated ten-fold due to the matrix of the sample. The laboratory noted in the case narrative of ARDL report 9014 that the sample extract could only be concentrated to 10 milliliters (ml) instead of the required 1 ml. The resulting PCB reporting limits ranged from 2.6 to 5.8 ppm. The FIQ reporting limit for sludge sample -3003SG was elevated one thousand-fold due to the matrix of the sample and the high concentration of fuel (kerosene) in the sample. The resulting fuel reporting limits ranged from 2100 to 11,000 ppm.

c. Surrogate Recoveries: All surrogate recoveries were within EPA, ADEC or LE QC limits with the following exceptions and/or notations. One out of three surrogate recoveries in the VOC MS sample of ARDL report 9014 was above the EPA QC limit. The accuracy of the associated VOC data are acceptable based on acceptable sample surrogate recoveries and acceptable MS and MSD analyte recoveries. One out of two surrogate recoveries in PCB sample -3003SG and in the PCB MS sample was above the LE QC limit. Per method, the PCB data are acceptable. The FIQ surrogate recovery for sludge sample -3003SG, and in the MS and MSD samples was diluted out due to the high concentration of fuels in the sample. As the extraction efficiency of the sample could not be determined, the kerosene and bunker C data for this sample should be considered estimates.

d. MS, MSD, and LC Recoveries and RPD Results: All MS, MSD, and LC recoveries and RPD results were within EPA, ADEC, or LE QC limits with the following exceptions and/or

notations. The PCB MS and MSD recoveries in ARDL report 9014 were above the LE QC limit. The LC recovery was within QC limits indicating matrix interference was encountered during the analysis. As PCB targeted analytes were not detected in the associated sample (-3003SG), the PCB data quality was not adversely affected by the high spike recoveries. The FIQ MS and MSD recoveries for sample -3003SG were diluted out due to the high concentration of fuels in the sample. The soil MS and MSD recoveries of aluminum, iron, and manganese in each ARDL report and the matrix spike recoveries of mercury as referenced in ARDL reports 9014 and 9019 of were outside of EPA QC limits. For the purpose of data evaluation, the spike recovery data should not be considered significant as the original sample results were greater than four times the spike amounts. One out of two soil MS/MSD recoveries of arsenic, chromium, and magnesium referenced in ARDL reports 9014 and 9019 and of selenium and zinc in ARDL report 9029 of were outside of EPA QC limits. The accuracy of the associated data are acceptable based on the remaining acceptable matrix spike and LC recoveries. The soil MS and MSD recoveries of calcium referenced in ARDL reports 9014 and 9019 were below the EPA QC limit. The calcium data for soil samples -3003SB, -3020SB, and -3027SB should be considered low estimates. he RPD of calcium in ARDL reports 9022 and 9024 was above the EPA QC limit. The calcium data for soil samples -3041SB, -3047SB, and -3061SB should be considered estimates. The MS and MSD recoveries of antimony in ARDL reports 9022, 9024, and 9029 were below the EPA QC limit. The LC recoveries were within QC limits indicating matrix interference was encountered during the analysis. Based on the low matrix spike recoveries, low levels of antimony may not have been detected if present in all of the QA soil samples. The RPD of sodium in ARDL report 9024 was above the EPA QC limit but should not be considered significant for the purpose of data evaluation, as the data of the comparison was within five times the reporting limit of sodium (45.2 ppm). The laboratory did not report MS and MSD recoveries for calcium, magnesium, potassium, and sodium in ARDL reports 9022, 9024, and 9029. The accuracy of the associated data are acceptable based on acceptable LC recoveries. The total cyanide MS and MSD recoveries in ARDL report 9014 were above the EPA QC limit of 125 percent. The LC recovery was within QC limits indicating matrix interference was encountered during the analysis. The total cyanide data for sludge sample -30o3SG should be considered a high estimate. The reactive sulfide RPD result in ARDL report 9014 was above the LE QC limit but should not be considered significant for the purpose of data evaluation, as the data of the comparison was less than five times the reporting limit of reactive sulfide (81.4 ppm).

e. COC Records and SCR Forms: All met EPA and/or USACE ER1110-1-263 requirements with the following exceptions and/or notations. The North Pacific Division Laboratory (NPDL) SCR form in ARDL report 9019 noted the following delinquencies. The sample containers for soil sample 95POLLDW-3047SB were not individually packaged (see SCR of ARDL report 9022). One out of two VOC sample containers for soil sample -3061SB had headspace (see SCR of ARDL

report 9024). VOC and GRO samples listed on NPDL SCR as containing headspace were not of this project. The NPDL SCR recorded a sample cooler temperature of 1.0 and 1.3 °C for the samples of ARDL report 9019 and 9024, respectively. This cooler temperature is below the USACE requirement of 4 ± 2 °C. .

f. Overall Evaluation of the QA Laboratory's Data: The data of analytes detected in the laboratory method blanks should be considered due to laboratory contamination in the associated samples with the exception of the soil TOC data. The PCB and FIQ reporting limits for sludge sample -3003SG were elevated due to the matrix of the sample and/or the high concentration of fuel (kerosene) in the sample. Based on a diluted out surrogate recovery, the extraction efficiency of the FIQ sludge sample -3003SG could not be determined. The kerosene and bunker C data for this sample should be considered estimates. The soil MS and MSD recoveries of calcium referenced in ARDL reports 9014 and 9019 were below the EPA QC limit. Based on out of control MS/MSD recoveries or RPD results, the calcium data for soil samples -3003SB, -3020SB, and -3027SB should be considered low estimates and the calcium data for soil samples -3041SB, -3047SB, and -3061SB should be considered estimates. Based on out of control matrix spike recoveries, low levels of antimony may not have been detected if present in all of the QA soil samples. Based on out of control matrix spike recoveries, the total cyanide data for sludge sample -3003SG should be considered a high estimate. Because of out of control cooler temperatures, QA samples 95POLLDW-3020SB, -3027SB, and -3061SB may have been compromised prior to analysis.

8. **COMPARISON OF THE PRIMARY AND QA LABORATORIES' DATA:** The primary and QA data comparisons are presented in Tables I through VIII. All data agree with each other and are comparable with the following exceptions.

I. BNA and COE/FIQ: The primary (-3039SB) data of bis(2-ethylhexyl)phthalate do not agree with either the blind duplicate or QA data in Table V-2. Since both laboratories had acceptable internal QC data, the discrepancy could not be analytically resolved. The primary (-3040SB) data of bis(2-ethylhexyl)phthalate are accepted based on QA data agreement. The QA data of bunker C does not agree with the primary blind duplicate data in Table I-4 A review of the QA laboratory's fuel chromatogram (ARDL report 9014) indicates that bunker C was erroneously quantified in the QA sample. The laboratory incorrectly integrated a portion of the kerosene fuel pattern during quantitation of bunker C. The primary data are acceptable based on blind duplicate agreement and consistent pattern recognition/integration procedures.

II. DRO and TRPH: The primary (-3026SB) and QA data comparison of DRO does not agree with each other in Table IV-3. Since both laboratories had acceptable internal QC data, the

discrepancy could not be analytically resolved. Review of the primary and QA fuel chromatograms indicate the presence of a fuel hydrocarbon pattern in the samples. The primary DRO data of sample -3025SB are accepted based on QA data agreement. The primary (-3059SB) and QA data comparison of DRO does not agree with each other in Table VII-3. Since both laboratories had acceptable internal QC data, the discrepancy could not be analytically resolved. A review of the primary and QA fuel chromatograms indicate the presence of diesel range fuel hydrocarbons in all samples. The level of fuel hydrocarbons detected in primary sample -3059SB was below the detection limit. The primary (-3060SB) DRO data are accepted based on QA agreement. The QA data of TRPH does not agree with the primary blind duplicate data in Table II-5. Since both laboratories had acceptable internal QC data, the discrepancy could not be analytically resolved. The primary and QA fuel chromatograms indicate diesel range and late eluting fuel hydrocarbons which probably should have been detectable as TRPH in the primary samples.

III. TCLP Metals, Total Metals and Inorganics: The QA data comparisons of TCLP-chromium, mercury, and silver do not agree with the primary blind duplicate data in Table I-5. Since both laboratories had acceptable internal QC data for TCLP-chromium and silver, the data discrepancies could not be analytically resolved. The primary data of TCLP-chromium, mercury, and silver are accepted based on blind duplicate agreement. The primary data of TCLP-mercury should be considered high estimates based on a high laboratory matrix spike recovery (see SAS report 49334). The primary (-3025SB) data of total nickel and silver do not agree with either the blind duplicate or QA data in Table IV-5. Since both laboratories had acceptable internal QC data, the discrepancy could not be analytically resolved. The primary (-3026SB) data of nickel and silver are accepted based on QA data agreement. The primary (-3039SB) data of total mercury do not agree with either the blind duplicate or QA data in Table V-6. Since both laboratories had acceptable internal QC data, the discrepancy could not be analytically resolved. The primary (-3040SB) data of mercury are accepted based on QA data agreement. The primary (-3060SB) data of total thallium does not agree with either the blind duplicate or QA data in Table VII-5. Since both laboratories had acceptable internal QC data, the discrepancy could not be analytically resolved. The primary (-3059SB) data of thallium are accepted based on QA agreement. The QA data of antimony does not agree with the primary blind duplicate data in Table VI-5. The primary laboratory had acceptable internal QC data while the QA data of antimony should be considered low estimates based on low matrix spike recoveries. The primary data of antimony are accepted based on acceptable internal QC and blind duplicate agreement. The QA data of antimony do not agree with the blind duplicate data in Tables VII-5 and VIII-6. The primary and QA data of antimony should be considered low estimates based on low matrix spike recoveries. The primary data of antimony are accepted based on blind duplicate agreement. The primary and QA data comparison of reactive sulfide

does not agree in Table I-6. Based on a low matrix spike recovery, low levels of reactive sulfide may not have been detected in the primary samples (see SAS report 49334). The QA data are acceptable based on acceptable internal QC data.

CENPD-ET-EN-L (95-0273)

COMPARISON OF PRIMARY BLIND DUPLICATE AND QA RESULTS

Table I

Project: Ft. Richardson OU-A POL Lab Dry Well Matrix: Sludge Prefix: 95POLLDW-
Primary Laboratory: SAS, Inc. QA Laboratory: ARDL, Inc.

1. Method: TCLP Volatile Organics Compounds (EPA 1311/5030, 8260) Units: ug/L (ppb)

Analytes Detected	Primary Lab 3001SG	Primary Lab 3002SG	Reporting Limits	QA Lab 3003SG	Reporting Limits
Vinyl Chloride	ND	ND	60	ND	10
1,1-Dichloroethene	ND	ND	52	ND	5
2-Butanone	ND	ND	38	ND	100
Chloroform	ND	ND	53	7 B	5
Carbon Tetrachloride	ND	ND	73	ND	5
1,2-Dichloroethane	ND	ND	60	ND	5
Benzene	ND	ND	44	ND	5
Trichloroethene	ND	ND	49	ND	5
Tetrachloroethene	ND	ND	34	ND	5
Chlorobenzene	ND	ND	64	ND	5

B = Found in method blank
ND = Not detected

SUMMARY: The primary blind duplicate and QA data agree with each other for all targeted volatiles and are comparable.

CENPD-ET-EN-L (95-0273)
Table I cont.

2. Method: TCLP Semi-Volatile Organics Compounds (EPA 1311/3510,8270) Units: ug/L (ppb)

Analytes Detected	Primary Lab 3001SG	Primary Lab 3002SG	Reporting Limits	QA Lab 3003SG	Reporting Limits
1,4-Dichlorobenzene	ND	ND	100	ND	10
2-Methylphenol	ND	ND	100	ND	10
4-Methylphenol	ND	ND	280	11	10
Hexachloroethane	ND	ND	200	ND	10
Nitrobenzene	ND	ND	300	ND	10
Hexachlorobutadiene	ND	ND	79	ND	10
2,4,6-Trichlorophenol	ND	ND	81	ND	10
2,4,5-Trichlorophenol	ND	ND	87	ND	50
2,4-Dinitrotoluene	ND	ND	130	ND	10
Hexachlorobenzene	ND	ND	74	ND	10
Pentachlorophenol	ND	ND	100	ND	50
Pyridine	ND	ND	500	ND	10

SUMMARY: The primary blind duplicate and QA data agree with each other for all targeted analytes and are comparable.

CENPD-ET-EN-L (95-0273)
Table I cont.

3. Method: Polychlorinated Biphenyls (EPA 3550/8080) Units: ug/Kg (ppb)

Analytes Detected	Primary Lab 3001SG	Primary Lab 3002SG	Reporting Limits	QA Lab 3003SG	Reporting Limits
Aroclor 1016	ND	ND	180/210	ND	2600
Aroclor 1221	ND	ND	220/260	ND	2600
Aroclor 1232	ND	ND	110/130	ND	2600
Aroclor 1242	ND	ND	130/150	ND	2600
Aroclor 1248	ND	ND	290/340	ND	2600
Aroclor 1254	ND	ND	110/130	ND	2600
Aroclor 1260	ND	ND	220/260	ND	2600
Percent Solids	17.2	14.4		30.7	

SUMMARY: The primary blind duplicate and QA data agree with each other for all targeted analytes and are comparable.

4. Method: Fuel Identification/Quantitation (EPA 3550/COE 8015 Mod.) Units: mg/Kg (ppm)

Analytes Detected	Primary Lab 3001SG	Primary Lab 3002SG	Reporting Limits	QA Lab 3003SG	Reporting Limits
Gasoline	ND	ND	1400/1600	ND	11,000
Kerosene	67,000	66,000	1400/1600	70,000	11,000
Jet Fuel	ND	ND	1400/1600	ND	11,000
Diesel Fuel #2	ND	ND	1100/1300	ND	11,000
Bunker C (D#6)	ND	ND	5600/6500	70,000	2100

SUMMARY: The primary blind duplicate and QA data agree within a factor of five with each other or their reporting limits except for the QA data of bunker C. A review of the QA laboratory's fuel chromatogram (ARDL report 9014) indicates that bunker C was erroneously quantified in the QA sample. The laboratory incorrectly integrated a portion of the kerosene fuel pattern during quantitation of bunker C. The primary data are acceptable based on blind duplicate agreement and consistent pattern recognition/integration procedures.

CENPD-ET-EN-L (95-0273)
Table I cont.

5. Primary Method: TCLP Metals (EPA 1311/EPA 3005, 6010, 7470) Units: mg/L (ppm)
QA Method: TCLP Metals (EPA 1311/EPA 3010, 6010, 7470)

Analytes Detected	Primary Lab 3001SG	3002SG	Reporting Limits	QA Lab 3003SG	Reporting Limits
Arsenic	ND	ND	0.15	0.035	0.030
Barium	4.5	5	0.0041	3.5	0.010
Cadmium	ND	0.015	0.01	ND	0.0030
Chromium	0.24	0.41	0.0077	0.020	0.0050
Lead	4.6	5.4	0.046	2.7	0.030
Mercury	0.087	0.033	0.017	0.0019	0.00020
Selenium	ND	ND	0.1	ND	0.040
Silver	0.24	0.43	0.0084	ND	0.0050

SUMMARY: The primary blind duplicate and QA data agree within a factor of five with each other or their reporting limits and are comparable except for the data comparisons of chromium, mercury, and silver. Since both laboratories had acceptable internal QC data for chromium and silver, the data discrepancies could not be analytically resolved. The primary data of chromium, mercury, and silver are accepted based on blind duplicate agreement. The primary data of mercury should be considered high estimates based on a high laboratory matrix spike recovery (see SAS report 49334).

CENPD-ET-EN-L (95-0273)
Table I cont.

6. Method: Inorganic Parameters (EPA SW-846 Series) Units: mg/Kg (ppm)

Analytes Detected	Primary Lab 3001SG	Primary Lab 3002SG	Reporting Limits	QA Lab 3003SG	Reporting Limits
Total Cyanide	6.8	11	0.5	22.7	1.6
Reactive Cyanide	ND	ND	20	ND	0.81
Reactive Sulfide	ND	ND	20	451	81.4
Flashpoint (°F)	>212	>212	20	>200	81.4
pH (SU)	6.22	6.13	NA	5.8	
Corrosivity(mm per year)	0.0007	0.0009	0.0002	NR	

NR = Not requested on chain of custody record
NA = Not applicable

SUMMARY: The primary blind duplicate and QA data agree within a factor of five with each other except for the data comparison of reactive sulfide. Based on a low matrix spike recovery, low levels of reactive sulfide may not have been detected in the primary samples (see SAS report 49334). The QA data are acceptable based on acceptable internal QC data.

CENPD-ET-EN-L (95-0273)

COMPARISON OF PRIMARY BLIND DUPLICATE AND QA RESULTS

Table II

Project: Ft. Richardson OU-A POL Lab Dry Well Matrix: Soil Prefix: 95POLLDW-
Primary Laboratory: SAS, Inc. QA Laboratory: ARDL, Inc.

1. Method: Volatile Organics Compounds (EPA 5030/8260) Units: ug/Kg (ppb)

Analytes Detected	Primary Lab 3001SB	3002SB	Reporting Limits	QA Lab 3003SB	Reporting Limits
Methylene Chloride	6	ND	4.1/4.4	9	6
Percent Solids	90.8	85.0		87.8	

ND = Not detected

SUMMARY: The primary blind duplicate and QA data agree within a factor of two with each other or their reporting limits for all targeted volatiles and are comparable.

2. Method: Semi-Volatile Organics Compounds (EPA 3550/8270) Units: ug/Kg (ppb)

Analytes Detected	Primary Lab 3001SB	3002SB	Reporting Limits	QA Lab 3003SB	Reporting Limits
	ND	ND	18-500	ND	380-1800

SUMMARY: The primary blind duplicate and QA data agree with each other for all targeted analytes and are comparable.

CENPD-ET-EN-L (95-0273)
Table II cont.

3. Method: Gasoline Range Organics (ADEC 8015 Mod.) Units: mg/Kg (ppm)

Analytes Detected	Primary Lab 3001SB	Primary Lab 3002SB	Reporting Limits*	QA Lab 3003SB	Reporting Limits
GRO	1.6 B	0.46 JB	0.2/0.22	ND	5.0

* = Method detection limit
B = Found in method blank
J = Estimated concentration

SUMMARY: The primary blind duplicate data agree within a factor of four with each other, agree with the QA data and are comparable.

4. Method: Diesel Range Organics (EPA 3550/ADEC 8100 Mod.) Units: mg/Kg (ppm)

Analytes Detected	Primary Lab 3001SB	Primary Lab 3002SB	Reporting Limits*	QA Lab 3003SB	Reporting Limits
DRO	29	24	3.3/3.6	17.0	4.5

SUMMARY: The primary blind duplicate and QA data agree within a factor of two with each other and are comparable.

5. Method: Total Recoverable Petroleum Hydrocarbons (EPA 9071/418.1) Units: mg/Kg (ppm)

Analytes Detected	Primary Lab 3001SB	Primary Lab 3002SB	Reporting Limits	QA Lab 3003SB	Reporting Limits
TRPH	ND	ND	7.4/8.4	96.0	11.4

SUMMARY: The primary blind duplicate data agree each other but do not agree within a factor of five with the QA data. Since both laboratories had acceptable internal QC data, the discrepancy could not be analytically resolved. The primary and QA fuel chromatograms indicate diesel range and late eluting fuel hydrocarbons which probably should have been detectable as TRPH in the primary samples.

CENPD-ET-EN-L (95-0273)
Table II cont.

6. Primary Method: Total Metals (EPA 3051/EPA 200.8, 6010, 7471) Units: mg/Kg (ppm)
QA Method: Total Metals (EPA 3050/6010, 7000 Series)

Analytes Detected	Primary Lab 3001SB	Primary Lab 3002SB	Reporting Limits	QA Lab 3003SB	Reporting Limits
Aluminum	17,000	15,000	15/18	18,500	5.7
Antimony	0.92	1.4	0.45/0.52	ND	2.3
Arsenic	3.8	4.9	0.088/0.1	8	0.57
Barium	79	78	0.41/0.47	85.1	1.1
Beryllium	ND	ND	0.32/0.37	0.41	0.11
Cadmium	0.15	0.096	0.024/0.028	ND	0.34
Calcium	3400	2800	34/40	8610	11.4
Chromium	24	23	0.77/0.89	39.4	0.57
Cobalt	12	11	4.6/5.3	14.2	0.57
Copper	25	20	0.82/0.95	22.1	0.57
Iron	25,000	23,000	9.5/11	28,900	5.7
Lead	20	23	0.045/0.052	26.4	3.4
Magnesium	6900	5500	8.2/9.5	7720	11.4
Manganese	500	470	0.89/1	606	0.57
Mercury	2.2	2.1	0.83/0.78	1.8	0.090
Nickel	34	28	3.6/4.2	32.1	2.3
Potassium	330	290	44/51	526	114
Selenium	ND	ND	0.15/0.18	0.23	0.057
Silver	ND	ND	0.84/0.97	ND	0.57
Sodium	110	90	49/56	125	45.6
Thallium	ND	ND	0.24/0.27	0.22	0.11
Vanadium	46	45	4.8/5.6	72.4	0.5
Zinc	53	50	1.4/1.7	58.8	0.5

SUMMARY: The primary blind duplicate and QA data agree within a factor of four with each other or their reporting limits and are comparable.

CENPD-ET-EN-L (95-0273)
Table II cont.

7. Method: Total Organic Carbon (EPA 9060) Units: mg/Kg (ppm)

Analytes Detected	Primary Lab 3001SB	Primary Lab 3002SB	Reporting Limits	QA Lab 3003SB	Reporting Limits
TOC	13,000	16,000	100	37,800	4.6

SUMMARY: The primary blind duplicate and QA data agree within a factor of three with each other and are comparable.

CENPD-ET-EN-L (95-0273)

COMPARISON OF PRIMARY BLIND DUPLICATE AND QA RESULTS

Table III

Project: Ft. Richardson OU-A POL Lab Dry Well Matrix: Soil Prefix: 95POLLDW-
Primary Laboratory: SAS, Inc. QA Laboratory: ARDL, Inc.

1. Method: Volatile Organics Compounds (EPA 5030/8260) Units: ug/Kg (ppb)

Analytes Detected	Primary Lab 3018SB	Primary Lab 3019SB	Reporting Limits	QA Lab 3020SB	Reporting Limits
Methylene Chloride	ND	ND	3.9/3.8	13	5
Percent Solids	96.1	95.6		96.7	

ND = Not detected

SUMMARY: The primary blind duplicate and QA data agree within a factor of four with each other or their reporting limits for all targeted volatiles and are comparable.

2. Method: Gasoline Range Organics (ADEC 8015 Mod.) Units: mg/Kg (ppm)

Analytes Detected	Primary Lab 3018SB	Primary Lab 3019SB	Reporting Limits*	QA Lab 3020SB	Reporting Limits
GRO	ND	1.1	0.19	ND	5.0

* = Method detection limit

SUMMARY: The primary blind duplicate data do not agree within a factor of five with each other or their detection limit. Since both laboratories had acceptable internal QC data, the discrepancy could not be analytically resolved. Due to the higher, but acceptable reporting limit used, the QA data was not useful in resolving the primary data discrepancy.

CENPD-ET-EN-L (95-0273)
Table III cont.

3. Method: Diesel Range Organics (EPA 3550/ADEC 8100 Mod.) Units: mg/Kg (ppm)

Analytes Detected	Primary Lab 3018SB	Primary Lab 3019SB	Reporting Limits*	QA Lab 3020SB	Reporting Limits
DRO	6	7.4	0.79/0.8	6.3	4.1

SUMMARY: The primary blind duplicate and QA data agree within a factor of two with each other and are comparable.

4. Method: Total Recoverable Petroleum Hydrocarbons (EPA 9071/418.1) Units: mg/Kg (ppm)

Analytes Detected	Primary Lab 3018SB	Primary Lab 3019SB	Reporting Limits	QA Lab 3020SB	Reporting Limits
TRPH	ND	13	7.4/6.9	26.6	10.3

SUMMARY: The primary blind duplicate and QA data agree within a factor of four with each other or their reporting limits and are comparable.

CENPD-ET-EN-L (95-0273)
Table III cont.

5. Primary Method: Total Metals (EPA 3051/EPA 200.8, 6010, 7471) Units: mg/Kg (ppm)
QA Method: Total Metals (EPA 3050/6010, 7000 Series)

Analytes Detected	Primary Lab 3018SB	Primary Lab 3019SB	Reporting Limits	QA Lab 3020SB	Reporting Limits
Aluminum	14,000	15,000	14/15	17,500	5.2
Antimony	0.57	0.57	0.4/0.46	ND	2.1
Arsenic	2.4	2.9	0.079/0.089	7.8	0.26
Barium	48	50	0.37/0.41	63.8	1.0
Beryllium	ND	ND	0.29/0.32	0.40	0.10
Cadmium	0.097	0.088	0.021/0.024	ND	0.31
Calcium	3800	4000	31/35	6410	10.3
Chromium	28	29	0.69/0.78	35.0	0.52
Cobalt	11	11	4.1/4.7	15.8	0.52
Copper	23	24	0.73/0.83	32.0	0.52
Iron	26,000	24,000	8.5/9.6	31,400	5.2
Lead	6.3	6.9	0.04/0.045	9.9	3.1
Magnesium	8200	8000	7.4/8.3	10,500	10.3
Manganese	570	510	0.8/0.9	670	0.52
Mercury	0.14	0.2	0.07/0.071	0.10	0.082
Nickel	33	31	3.2/3.7	37.5	2.1
Potassium	470	560	4.0/4.5	801	103
Selenium	ND	ND	0.14/0.16	0.082	0.052
Silver	ND	ND	0.75/0.85	ND	0.52
Sodium	110	160	44/49	180	41.4
Thallium	ND	ND	0.14/0.16	ND	0.41
Vanadium	41	42	4.3/4.9	74.3	0.52
Zinc	54	48	1.3/1.4	60.5	0.52

SUMMARY: The primary blind duplicate and QA data agree within a factor of four with each other or their reporting limits and are comparable.

CENPD-ET-EN-L (95-0273)

COMPARISON OF PRIMARY BLIND DUPLICATE AND QA RESULTS

Table IV

Project: Ft. Richardson OU-A POL Lab Dry Well Matrix: Soil Prefix: 95POLLDW-
Primary Laboratory: SAS, Inc. QA Laboratory: ARDL, Inc.

1. Method: Volatile Organics Compounds (EPA 5030/8260) Units: ug/Kg (ppb)

Analytes Detected	Primary Lab 3025SB	Primary Lab 3026SB	Reporting Limits	QA Lab 3027SB	Reporting Limits
Methylene Chloride	ND	ND	3.9/3.8	6	5
1,2-Dichloroethane	7	ND	3.1	ND	5
Percent Solids	95.7	96.2		95.3	

ND = Not detected

SUMMARY: The primary blind duplicate and QA data agree within a factor of two with each other or their reporting limits and are comparable.

2. Method: Gasoline Range Organics (ADEC 8015 Mod.) Units: mg/Kg (ppm)

Analytes Detected	Primary Lab 3025SB	Primary Lab 3026SB	Reporting Limits*	QA Lab 3027SB	Reporting Limits
GRO	ND	ND	0.19	ND	5

* = Method detection limit

SUMMARY: The primary blind duplicate and QA data agree with each other and are comparable.

CENPD-ET-EN-L (95-0273)
Table IV cont.

3. Method: Diesel Range Organics (ADEC 8100 Mod.) Units: mg/Kg (ppm)

Analytes Detected	Primary Lab 3025SB	Primary Lab 3026SB	Reporting Limits*	QA Lab 3027SB	Reporting Limits
DRO	2.8 J	ND	0.81/0.79	6.1	4.2

J = Estimated concentration

SUMMARY: The primary blind duplicate and QA data agree within a factor of five with each other or their reporting limits except for the primary (-3026SB) and QA data comparison. Since both laboratories had acceptable internal QC data, the discrepancy could not be analytically resolved. Review of the primary and QA fuel chromatograms indicate the presence of a fuel hydrocarbon pattern in the samples. The primary data of sample -3025SB are accepted based on QA data agreement.

4. Method: Total Recoverable Petroleum Hydrocarbons (EPA 9071/418.1) Units: mg/Kg (ppm)

Analytes Detected	Primary Lab 3025SB	Primary Lab 3026SB	Reporting Limits	QA Lab 3027SB	Reporting Limits
TRPH	ND	ND	7.2/6.9	11.9	10.5

SUMMARY: The primary blind duplicate and QA data agree within a factor of two with each other or their reporting limits and are comparable.

CENPD-ET-EN-L (95-0273)
Table IV cont.

5. Primary Method: Total Metals (EPA 3051/EPA 200.8, 6010, 7471) Units: mg/Kg (ppm)
QA Method: Total Metals (EPA 3050/6010, 7000 Series)

Analytes Detected	Primary Lab 3025SB	Primary Lab 3026SB	Reporting Limits	QA Lab 3027SB	Reporting Limits
Aluminum	5700	11,000	14/15	13,600	5.2
Antimony	ND	ND	0.42/0.43	ND	2.1
Arsenic	1.4	2.9	0.083/0.084	3.8	0.26
Barium	21	29	0.30	51	1.0
Beryllium	ND	ND	0.3/0.31	0.33	0.10
Cadmium	0.066	0.07	0.023	ND	0.31
Calcium	2500	5400	32/33	6730	10.5
Chromium	28	26	0.73	27.1	0.52
Cobalt	36	13	4.3/4.4	12.7	0.52
Copper	25	19	0.77/0.78	26.9	0.52
Iron	30,000	26,000	9/9.1	27,800	5.2
Lead	2.7	4.4	0.42/0.43	9.5	3.1
Magnesium	55,000	12,000	7.8	9020	10.5
Manganese	600	480	0.84/0.85	988	0.52
Mercury	0.17	0.14	0.069/0.076	ND	0.084
Nickel	280	55	3.4/3.5	34.2	2.1
Potassium	290	370	42	571	105
Selenium	ND	ND	0.15	ND	0.052
Silver	12	ND	0.79/0.8	ND	0.52
Sodium	52	ND	46	122	42.0
Thallium	ND	68	0.22	ND	0.42
Vanadium	25	42	4.6	62.2	0.52
Zinc	38	51	1.4	52.3	0.52

SUMMARY: The primary blind duplicate and QA data agree within a factor of five with each other or their reporting limits for all metals except for the primary (-3025SB) data of nickel and silver. Since both laboratories had acceptable internal QC data, the discrepancy could not be analytically resolved. The primary (-3026SB) data of nickel and silver are accepted based on QA data agreement.

CENPD-ET-EN-L (95-0273)

COMPARISON OF PRIMARY BLIND DUPLICATE AND QA RESULTS

Table V

Project: Ft. Richardson OU-A POL Lab Dry Well Matrix: Soil Prefix: 95POLLDW-
Primary Laboratory: SAS, Inc. QA Laboratory: ARDL, Inc.

1. Method: Volatile Organics Compounds (EPA 5030/8260) Units: ug/Kg (ppb)

Analytes Detected	Primary Lab 3039SB	Primary Lab 3040SB	Reporting Limits	QA Lab 3041SB	Reporting Limits
Methylene Chloride	ND	ND	3.9/4	8 B	5
Toluene	ND	ND	2.1/2.2	2 J	5
Percent Solids	92.9	93.1		93.6	

J = Estimated concentration
B = Found in method blank
ND = Not detected

SUMMARY: The primary blind duplicate and QA data agree within a factor of three with each other or their reporting limits and are comparable.

2. Method: Semi-Volatile Organics Compounds (EPA 3550/8270) Units: ug/Kg (ppb)

Analytes Detected	Primary Lab 3039SB	Primary Lab 3040SB	Reporting Limits	QA Lab 3041SB	Reporting Limits
Bis(2-ethylhexyl)phthalate	1100	ND	180	ND	350

SUMMARY: The primary blind duplicate and QA data agree within a factor of five with each other or their reporting limits for all targeted analytes except for the primary (-3039SB) data of bis(2-ethylhexyl)phthalate. Since both laboratories had acceptable internal QC data, the discrepancy could not be analytically resolved. The primary (-3040SB) data of bis(2-ethylhexyl)phthalate are accepted based on QA data agreement.

CENPD-ET-EN-L (95-0273)
Table V cont.

3. Method: Gasoline Range Organics (ADEC 8015 Mod.) Units: mg/Kg (ppm)

Analytes Detected	Primary Lab 3039SB	Primary Lab 3040SB	Reporting Limits*	QA Lab 3041SB	Reporting Limits
GRO	ND	ND	0.19/0.2	ND	5.0

* = Method detection limit

SUMMARY: The primary blind duplicate and QA data agree with each other and are comparable.

4. Method: Diesel Range Organics (EPA 3550/ADEC 8100 Mod.) Units: mg/Kg (ppm)

Analytes Detected	Primary Lab 3039SB	Primary Lab 3040SB	Reporting Limits*	QA Lab 3041SB	Reporting Limits
DRO	ND	ND	2.2/2.1	4.3	4.3

SUMMARY: The primary blind duplicate and QA data agree within a factor of three with each other and are comparable.

5. Method: Total Recoverable Petroleum Hydrocarbons (EPA 9071/418.1) Units: mg/Kg (ppm)

Analytes Detected	Primary Lab 3039SB	Primary Lab 3040SB	Reporting Limits	QA Lab 3041SB	Reporting Limits
TRPH	ND	ND	6.8/7.8	ND	10.7

SUMMARY: The primary blind duplicate and QA data agree with each other and are comparable.

CENPD-ET-EN-L (95-0273)
Table V cont.

6. Primary Method: Total Metals (EPA 3051/EPA 200.8, 6010, 7471) Units: mg/Kg (ppm)
QA Method: Total Metals (EPA 3050/6010, 7000 Series)

Analytes Detected	Primary Lab 3039SB	Primary Lab 3040SB	Reporting Limits	QA Lab 3041SB	Reporting Limits
Aluminum	7500	11,000	14/15	13,100	5.3
Antimony	ND	ND	0.42/0.44	ND	2.1
Arsenic	1.8	1.8	0.083/0.086	4.2	0.27
Barium	44	45	0.3/0.4	54.0	1.1
Beryllium	ND	ND	0.3/0.31	0.30	0.11
Cadmium	0.076	0.075	0.022/0.023	ND	0.32
Calcium	3300	6100	32/34	7110	10.7
Chromium	23	22	0.72/0.75	31.2	0.53
Cobalt	8.1	10	4.3/4.5	11.8	0.53
Copper	20	22	0.77/0.8	24.9	0.53
Iron	17,000	22,000	8.9/9.3	25,100	5.3
Lead	3.6	4.7	0.042/0.044	6.5	3.2
Magnesium	6100	7200	7.7/8	8960	10.7
Manganese	480	390	0.83/0.87	473	0.53
Mercury	0.61	0.1	0.076/0.065	ND	0.085
Nickel	31	31	3.4/3.5	32.0	2.1
Potassium	320	510	4.1/4.3	577	107
Selenium	ND	ND	0.15	0.058	0.053
Silver	ND	ND	0.79/0.82	ND	0.53
Sodium	87	130	46/48	107	42.7
Thallium	ND	ND	0.22/0.23	ND	0.11
Vanadium	23	35	4.5/4.7	56.2	0.53
Zinc	36	45	1.3/1.4	49.3	0.53

SUMMARY: The primary blind duplicate and QA data agree within a factor of five with each other or their reporting limits and are comparable except for the primary (-3039SB) data of mercury. Since both laboratories had acceptable internal QC data, the discrepancy could not be analytically resolved. The primary (-3040SB) data of mercury are accepted based on QA data agreement.

7. Method: Total Organic Carbon (EPA 9060) Units: mg/Kg (ppm)

Analytes Detected	Primary Lab 3039SB	Primary Lab 3040SB	Reporting Limits	QA Lab 3041SB	Reporting Limits
TOC	2600	3000	100	1120	4.3

SUMMARY: The primary blind duplicate and QA data agree within a factor of three with each other and are comparable.

CENPD-ET-EN-L (95-0273)

COMPARISON OF PRIMARY BLIND DUPLICATE AND QA RESULTS

Table VI

Project: Ft. Richardson OU-A POL Lab Dry Well Matrix: Soil Prefix: 95POLLDW-
Project Laboratory: SAS, Inc. QA Laboratory: ARDL, Inc.

1. Method: Volatile Organic Compounds (EPA 5030/8260) Units: ug/Kg (ppb)

Analytes Detected	Primary Lab 3045SB	Primary Lab 3046SB	Reporting Limits	QA Lab 3047SB	Reporting Limits
Methylene Chloride	ND	ND	3.9/3.7	9 B	5
Toluene	ND	ND	2.1/2	5	5
Percent Solids	96.8	97.6		97.1	

B = Found in method blank
ND = Not detected

SUMMARY: The primary blind duplicate and QA data agree within a factor of three with each other or their reporting limits for all targeted volatiles and are comparable.

2. Method: Gasoline Range Organics (ADEC 8015 Mod.) Units: mg/Kg (ppm)

Analytes Detected	Primary Lab 3045SB	Primary Lab 3046SB	Reporting Limits*	QA Lab 3047SB	Reporting Limits
GRO	ND	ND	0.18/0.19	ND	5.0

* = Method detection limit

SUMMARY: The primary blind duplicate and QA data agree with each other and are comparable.

3. Method: Diesel Range Organics (EPA 3550/ADEC 8100 Mod.) Units: mg/Kg (ppm)

Analytes Detected	Primary Lab 3045SB	Primary Lab 3046SB	Reporting Limits*	QA Lab 3047SB	Reporting Limits
DRO	2.2 J	2.3 J	2.1/2.2	4.8	4.1

J = Estimated concentration

SUMMARY: The primary blind duplicate and QA data agree within a factor of three with each other and are comparable.

4. Method: Total Recoverable Petroleum Hydrocarbons (EPA 9071/418.1) Units: mg/Kg (ppm)

Analytes Detected	Primary Lab 3045SB	Primary Lab 3046SB	Reporting Limits	QA Lab 3047SB	Reporting Limits
TRPH	ND	ND	6.8/6.4	14.1	10.3

SUMMARY: The primary blind duplicate and QA data agree within a factor of three with each other and are comparable.

CENPD-ET-EN-L (95-0273)
Table VI cont.

5. Primary Method: Total Metals (EPA 3051/EPA 200.8, 6010, 7471) Units: mg/Kg (ppm)
QA Method: Total Metals (EPA 3050/6010, 7000 Series)

Analytes Detected	Primary Lab 3045SB	Primary Lab 3046SB	Reporting Limits	QA Lab 3047SB	Reporting Limits
Aluminum	13,000	12,000	14	16,900	5.1
Antimony	ND	ND	0.4/0.43	2.3	2.1
Arsenic	2.6	3.5	0.078/0.084	5.6	0.26
Barium	48	48	0.36/0.39	56.7	1.0
Beryllium	ND	ND	0.28/0.3	0.38	0.10
Cadmium	0.1	0.096	0.021/0.023	ND	0.31
Calcium	3400	3100	30/33	6180	10.3
Chromium	27	40	0.68/0.73	34.7	0.51
Cobalt	12	11	4.1/4.4	15.2	0.51
Copper	23	26	0.73/0.78	31.1	0.51
Iron	26,000	24,000	8.4/9	30,200	5.1
Lead	6	6.3	0.04/0.062	8.2	3.1
Magnesium	9400	8500	7.3/7.8	12,500	10.3
Manganese	600	540	0.79/0.84	650	0.51
Mercury	0.087	0.072	0.075/0.072	ND	0.082
Nickel	38	42	3.2/3.4	54.1	2.1
Potassium	430	400	39/42	666	103
Selenium	ND	ND	0.14/0.15	0.075	0.051
Silver	ND	ND	0.74/0.8	ND	0.51
Sodium	110	100	43/46	147	41.2
Thallium	ND	ND	0.21/0.22	ND	0.10
Vanadium	40	37	4.3/4.6	69.3	0.51
Zinc	53	54	1.3/1.4	61.3	0.51

SUMMARY: The primary blind duplicate and QA data agree within a factor of five with each other or their reporting limits and are comparable except for the QA data of antimony. The primary laboratory had acceptable internal QC data. The QA data of antimony should be considered low estimates based on low matrix spike recoveries. The primary data of antimony are accepted based on acceptable internal QC and blind duplicate agreement.

CENPD-ET-EN-L (95-0273)

COMPARISON OF PRIMARY BLIND DUPLICATE AND QA RESULTS

Table VII

Project: Ft. Richardson OU-A POL Lab Dry Well Matrix: Soil Prefix: 95POLLDW-
Primary Laboratory: SAS, Inc. QA Laboratory: ARDL, Inc.

1. Method: Volatile Organic Compounds (EPA 5030/8260) Units: ug/Kg (ppb)

Analytes Detected	Primary Lab 3059SB	Primary Lab 3060SB	Reporting Limits	QA Lab 3061SB	Reporting Limits
Methylene Chloride	11	8.6	3.7/3.8	9 B	6
Percent Solids	93.3	91.6		88.4	

B = Found in method blank
ND = Not detected

SUMMARY: The primary blind duplicate and QA data agree within a factor of two with each other for all targeted volatiles and are comparable.

2. Method: Gasoline Range Organics (ADEC 8015 Mod.) Units: mg/Kg (ppm)

Analytes Detected	Primary Lab 3059SB	Primary Lab 3060SB	Reporting Limits*	QA Lab 3061SB	Reporting Limits
GRO	1 JB	0.75 JB	0.15	ND	5.0

J = Estimated concentration
* = Method detection limit

SUMMARY: The primary blind duplicate agree within a factor of two with each other, agree with the QA data and are comparable.

CENPD-ET-EN-L (95-0273)
Table VII cont.

3. Method: Diesel Range Organics (EPA 3550/ADEC 8100 Mod.) Units: mg/Kg (ppm)

Analytes Detected	Primary Lab 3059SB	Primary Lab 3060SB	Reporting Limits*	QA Lab 3061SB	Reporting Limits
DRO	ND	14	3.2/3.3	19	4.5

SUMMARY: The primary blind duplicate and QA data agree within a factor of five with each other or their detection limit except for the primary (-3059SB) and QA data comparison. Since both laboratories had acceptable internal QC data, the discrepancy could not be analytically resolved. A review of the primary and QA fuel chromatograms indicate the presence of diesel range fuel hydrocarbons in all samples. The level of fuel hydrocarbons detected in primary sample -3059SB was below the detection limit. The primary (-3060SB) DRO data are accepted based on QA agreement.

4. Method: Total Recoverable Petroleum Hydrocarbons (EPA 9071/418.1) Units: mg/Kg (ppm)

Analytes Detected	Primary Lab 3059SB	Primary Lab 3060SB	Reporting Limits	QA Lab 3061SB	Reporting Limits
TRPH	ND	ND	6.6/6.7	31.8	11.3

SUMMARY: The primary blind duplicate and QA data agree within a factor of five with each other or their reporting limits and are comparable.

CENPD-ET-EN-L (95-0273)
Table VII cont.

5. Primary Method: Total Metals (EPA 3051/EPA 200.8, 6010, 7471) Units: mg/Kg (ppm)
QA Method: Total Metals (EPA 3050/6010, 7000 Series)

Analytes Detected	Primary Lab 3059SB	Primary Lab 3060SB	Reporting Limits	QA Lab 3061SB	Reporting Limits
Aluminum	8300	10,000	15/16	13,200	5.7
Antimony	ND	ND	0.45/0.47	2.5	2.3
Arsenic	1.9	1.5	0.088/0.093	5.4	0.28
Barium	32	42	0.41/0.43	41.9	1.1
Beryllium	ND	ND	0.32/0.34	0.29	0.11
Cadmium	0.047	0.045	0.024/0.025	ND	0.34
Calcium	3100	4900	34/36	10,600	11.3
Chromium	16	17	0.76/0.81	29.2	0.57
Cobalt	7.2	9.4	4.6/4.8	11.9	0.57
Copper	16	17	0.81/0.86	22.3	0.57
Iron	17,000	20,000	9.5/10	25,400	5.7
Lead	3.1	4.1	0.044/0.047	6.1	3.4
Magnesium	5500	6700	8.2/8.6	8470	11.3
Manganese	350	390	0.88/0.94	515	0.57
Mercury	0.2	0.081	0.07/0.077	ND	0.090
Nickel	25	28	3.6/3.8	31.5	2.3
Potassium	360	360	44/47	482	113
Selenium	ND	ND	0.15/0.16	ND	0.057
Silver	ND	ND	0.83/0.88	ND	0.57
Sodium	98	89	48/51	98.0	45.2
Thallium	ND	2.3	0.23/0.25	0.13	0.11
Vanadium	26	31	4.8/5.1	61.8	0.57
Zinc	36	42	1.4/1.5	50.6	0.57

SUMMARY: The primary blind duplicate and QA data agree within a factor of five with each other or their reporting limits and are comparable except for the QA data of antimony and the primary (-3060SB) data of thallium. The primary and QA data of antimony should be considered low estimates based on low matrix spike recoveries. The primary data of antimony are accepted based on blind duplicate agreement. The primary and QA laboratories had acceptable internal QC data for thallium and the discrepancy could not be analytically resolved. The primary (-3059SB) data of thallium are accepted based on QA agreement.

CENPD-ET-EN-L (95-0273)

COMPARISON OF PRIMARY BLIND DUPLICATE AND QA RESULTS

Table VIII

Project: Ft. Richardson OU-A POL Lab Dry Well Matrix: Soil Prefix: 95POLLDW-
Primary Laboratory: SAS, Inc. QA Laboratory: ARDL, Inc.

1. Method: Volatile Organics Compounds (EPA 5030/8260) Units: ug/Kg (ppb)

Analytes Detected	Primary Lab 3078SB	Primary Lab 3079SB	Reporting Limits	QA Lab 3080SB	Reporting Limits
Methylene Chloride	ND	ND	3.7/3.8	6 B	5
Toluene	ND	ND	2	5 J	5
Percent Solids	97.6	97.6		97.9	

B = Found in method blank
J = Estimated concentration
ND = Not detected

SUMMARY: The primary blind duplicate and QA data agree within a factor of three with each other or their reporting limits for all targeted volatiles and are comparable.

2. Method: Semi-Volatile Organics Compounds (EPA 3550/8270) Units: ug/Kg (ppb)

Analytes Detected	Primary Lab 3078SB	Primary Lab 3079SB	Reporting Limits	QA Lab 3080SB	Reporting Limits
Bis(2-ethylhexyl)phthalate	210 J	ND	170	ND	340

SUMMARY: The primary blind duplicate and QA data agree within a factor of two with each other or their reporting limits for all targeted analytes and are comparable.

CENPD-ET-EN-L (95-0273)
Table VIII cont.

3. Method: Gasoline Range Organics (ADEC 8015 Mod.) Units: mg/Kg (ppm)

Analytes Detected	Primary Lab 3078SB	Primary Lab 3079SB	Reporting Limits*	QA Lab 3080SB	Reporting Limits
GRO	0.23 JB	1.1 B	0.18/0.19	ND	5.0

* = Method detection limit

SUMMARY: The primary blind duplicate and QA data agree within a factor of five with each other, agree with the QA data and are comparable.

4. Method: Diesel Range Organics (EPA 3550/ADEC 8100 Mod.) Units: mg/Kg (ppm)

Analytes Detected	Primary Lab 3078SB	Primary Lab 3079SB	Reporting Limits*	QA Lab 3080SB	Reporting Limits
DRO	3.8 J	3.5 J	3.1	4.3	4.1

SUMMARY: The primary blind duplicate and QA data agree within a factor of two with each other and are comparable.

5. Method: Total Recoverable Petroleum Hydrocarbons (EPA 9071/418.1) Units: mg/Kg (ppm)

Analytes Detected	Primary Lab 3078SB	Primary Lab 3079SB	Reporting Limits	QA Lab 3080SB	Reporting Limits
TRPH	9.5	ND	7/6.8	17.6	10.2

SUMMARY: The primary blind duplicate and QA data agree within a factor of three with each other or their reporting limits and are comparable.

CENPD-ET-EN-L (95-0273)
Table VIII cont.

6. Primary Method: Total Metals (EPA 3051/EPA 200.8, 6010, 7471) Units: mg/Kg (ppm)
QA Method: Total Metals (EPA 3050/6010, 7000 Series)

Analytes Detected	Primary Lab 3078SB	Primary Lab 3079SB	Reporting Limits	QA Lab 3080SB	Reporting Limits
Aluminum	16,000	12,000	14	21,100	5.1
Antimony	0.5	ND	0.41/0.42	3.5	2.0
Arsenic	3.5	3.5	0.08/0.082	7.0	0.26
Barium	45	38	0.37/0.38	53.7	1.0
Beryllium	ND	ND	0.29/0.3	0.50	0.10
Cadmium	0.2	0.45	0.022	0.33	0.31
Calcium	3500	2500	31/32	7790	10.2
Chromium	26	21	0.7/0.72	37.4	0.51
Cobalt	12	10	4.2/4.3	16.3	0.51
Copper	29	21	0.74/0.76	30.0	0.51
Iron	25,000	20,000	8.6/8.9	35,100	5.1
Lead	13	8.2	0.04/0.064	15.4	3.1
Magnesium	8700	6900	7.4/7.6	12,800	10.2
Manganese	610	410	0.8/0.83	731	0.51
Mercury	0.087	0.091	0.064/0.061	ND	0.081
Nickel	38	33	3.3/3.4	51.9	2.0
Potassium	390	340	41/41	713	102
Selenium	ND	ND	0.14	0.081	0.051
Silver	ND	ND	0.76/0.75	ND	0.51
Sodium	290	270	44/45	174	40.9
Thallium	ND	ND	0.21/0.22	ND	0.10
Vanadium	45	35	4.4/4.5	83.3	0.51
Zinc	69	83	1.3	83.0	0.51

SUMMARY: The primary blind duplicate and QA data agree within a factor of five with each other or their reporting limits and are comparable except for the QA data of antimony. The primary and QA data of antimony should be considered low estimates based on low matrix spike recoveries. The primary data of antimony are accepted based on blind duplicate agreement.

CENPD-ET-EN-L (95-0273)
Table VIII cont.

7. Method: Total Organic Carbon (EPA 9060) Units: mg/Kg (ppm)

Analytes Detected	Primary Lab 3078SB	Primary Lab 3079SB	Reporting Limits	QA Lab 3080SB	Reporting Limits
TOC	3000	3100	100	4330	4.1

SUMMARY: The primary blind duplicate and QA data agree within a factor of two with each other and are comparable.

CENPD-ET-EN-L (95-0273)

COMPARISON OF PRIMARY BLIND DUPLICATE RESULTS

Table IX

Project: Ft. Richardson OU-A POL Lab Dry Well Matrix: Soil Prefix: 95POLLDW-
Primary Laboratory: SAS, Inc.

1. Method: Volatile Organics Compounds (EPA 5030/8260) Units: ug/Kg (ppb)

Analytes Detected	Primary Lab 3088SB	Primary Lab 3089SB	Reporting Limits
Methylene Chloride	ND	ND	1.8-1.7
Percent Solids	96.1	95.5	

ND = Not detected

SUMMARY: The primary blind duplicate data agree with each other for all targeted volatiles.

2. Method: Semi-Volatile Organics Compounds (EPA 3550/8270) Units: ug/Kg (ppb)

Analytes Detected	Primary Lab 3088SB	Primary Lab 3089SB	Reporting Limits
	ND	ND	16-440

SUMMARY: The primary blind duplicate data agree with each other for all targeted analytes.

3. Method: Gasoline Range Organics (ADEC 8015 Mod.) Units: mg/Kg (ppm)

Analytes Detected	Primary Lab 3088SB	Primary Lab 3089SB	Reporting Limits*
GRO	ND	ND	0.46/0.45

* = Method detection limit

SUMMARY: The primary blind duplicate data agree with each other.

4. Method: Diesel Range Organics (EPA 3550/ADEC 8100 Mod.) Units: mg/Kg (ppm)

Analytes Detected	Primary Lab 3088SB	Primary Lab 3089SB	Reporting Limits*
DRO	32	59	0.8

SUMMARY: The primary blind duplicate data agree within a factor of two with each other.

5. Method: Total Recoverable Petroleum Hydrocarbons (EPA 9071/418.1) Units: mg/Kg (ppm)

Analytes Detected	Primary Lab 3088SB	Primary Lab 3089SB	Reporting Limits
TRPH	140	95	7.2/7.6

SUMMARY: The primary blind duplicate data agree within a factor of two with each other.

CENPD-ET-EN-L (95-0273)
Table IX cont.

6. Method: Total Metals (EPA 3050/6010,7000 Series) Units: mg/Kg (ppm)

Analytes Detected	Primary Lab 3088SB	Primary Lab 3089SB	Reporting Limits
Aluminum	12,000	13,000	15/14
Antimony	0.51	0.62	0.45/0.42
Arsenic	2.6	2.6	0.089/0.082
Barium	42	45	0.41/0.38
Beryllium	ND	ND	0.32/0.3
Cadmium	0.11	0.14	0.024/0.022
Calcium	3700	4300	35/32
Chromium	29	28	0.78/0.72
Cobalt	11	12	4.6/4.3
Copper	27	28	0.83/0.76
Iron	22,000	25,000	9.6/8.9
Lead	14	28	0.045/0.042
Magnesium	8300	9800	8.3/7.7
Manganese	600	600	0.9/0.83
Mercury	0.085	0.08	0.064/0.061
Nickel	40	41	3.7/3.4
Potassium	450	490	45/41
Selenium	ND	ND	0.16/0.14
Silver	ND	ND	0.85/0.78
Sodium	100	110	49/45
Thallium	ND	2	0.24/0.22
Vanadium	35	40	4.9/4.5
Zinc	54	55	1.4/1.3

SUMMARY: The primary blind duplicate data agree within a factor of two with each other or their reporting limits for all metals.

CENPD-ET-EN-L (95-0273)
Table IX cont.

7. Method: Total Organic Carbon (EPA 9060) Units: mg/Kg (ppm)

Analytes Detected	Primary Lab 3088SB	Primary Lab 3089SB	Reporting Limits
TOC	1900	2400	100

SUMMARY: The primary blind duplicate data agree within a factor of two with each other.

ecology and environment, inc.
International Specialists in the Environment

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October 25, 1996

Mr. Ted Bales
Project Manager
United States Army Engineer District,
Alaska
P.O. Box 898
Anchorage, Alaska 99506-0898

Re: Contract No. DACA85-93-D-0009, Delivery Order No. 0026; Resampling Groundwater Monitoring Wells for Dioxin/Furans at Ruff Road Fire Training Area (RRFTA); Operable Unit A (OU-A); Fort Richardson, Alaska

Dear Mr. Bales:

Ecology and Environment, Inc., (E & E) is submitting two copies of a data review summary and analytical results for the OU-A remedial investigation under United States Army Engineer District, Alaska, (Alaska District) Contract No. DACA85-93-D-0009 and Delivery Order No. 0026. The review summary addresses the data validation and usability of the polychlorinated dibenzo-p-dioxins/polychlorinated dibenzo-p-furans (dioxins/furans) data generated from the resampling of five monitoring wells at RRFTA on August 14 and 15, 1996.

E & E wrote the data review summary report to supplement the Alaska District's North Pacific Division Laboratory chemical quality assurance report (CQAR). However, the CQAR is not yet completed and therefore is unavailable. E & E will assess the usability of the laboratory data based on the data quality objectives specified in the OU-A management plan, the data review summary report, and the CQAR once the CQAR is completed.

If you have any questions or comments on this report, please contact Mr. William Richards or me at 257-5000.

Sincerely,

Paul Cooley
Project Chemist

PC/rph

Enclosures

QA/QC DATA REVIEW SUMMARY

I. Introduction:

Quanterra Environmental Services of West Sacramento, California, received seven groundwater samples intact from Ecology and Environment, Inc., (E & E) on August 20, 1996. The samples were collected by E & E using ultra-clean sampling protocol on August 14 and 15, 1996. Samples were analyzed for polychlorinated dibenzodioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) by high-resolution gas chromatography/high-resolution mass spectrometry SW-846 Method 8290. The sample identification numbers are:

96RRFTA001GW, 96RRFTA002GW, 96RRFTA004GW, 96RRFTA005GW, 96RRFTA006WA, 96RRFTA007GW, 96RRFTA008GW

For each sample, the laboratory submitted a data summary form containing PCDD/PCDF analysis results along with the percent recovery results for the internal standards. The reported analytical results were verified for identification and quantification by a review of the raw analytical data. Sample results were verified, and this review summary was prepared based on the quality assurance/quality control (QA/QC) protocols in SW-846 Method 8290 and *Quality Assurance/Quality Control Guidance for Removal Activities—Sampling QA/QC Plan and Data Validation Procedures* (United States Environmental Protection Agency 540-G-90-004).

II. Data Validation Comments:

The laboratory successfully analyzed the samples without any major problems. The raw data and supporting documents regarding QC parameters such as initial and daily calibrations, sample preparation, recoveries of internal and surrogate standards, PCDD/PCDF isomer peaks resolution, retention time and mass ion ratios for PCDD/PCDF identification, and method blank analyses were reviewed and found acceptable with the following exception. Surrogate recoveries of 13C-2,3,7,8-TCDF and 13C-2,3,7,8-TCDD in samples 96RRFTA-004GW, 96RRFTA005GW, and surrogate 13C-2,3,7,8-TCDF in sample 96RRFTA008GW were below the method recovery goal of 40%. Results associated with these surrogates are qualified *UJ* as nondetected estimated detection limit and are considered usable. The remainder of the data are considered valid with no qualification necessary.

Quanterra
Environmental Services

POLYCHLORINATED DIOXINS/FURANS
ISOMER SPECIFIC ANALYSIS
Method 8290

Client Name: Ecology & Environment, Inc.
Client ID: 96RRFTA001GW
Lab ID: 089126-0001-SA
Matrix: AQUEOUS
Authorized: 20 AUG 96

Sampled: 14 AUG 96
Prepared: 23 AUG 96

Received: 20 AUG 96
Analyzed: 27 AUG 96

Sample Amount 1.04 L
Column Type DB-5

Parameter	Result	Units	Detection Limit	Data Qualifiers
Furans				
TCDFs (total)	ND	pg/L	1.8	
2,3,7,8-TCDF	ND	pg/L	1.8	
PeCDFs (total)	ND	pg/L	1.7	
1,2,3,7,8-PeCDF	ND	pg/L	1.7	
2,3,4,7,8-PeCDF	ND	pg/L	1.4	
HxCDFs (total)	ND	pg/L	2.8	
1,2,3,4,7,8-HxCDF	ND	pg/L	0.90	
1,2,3,6,7,8-HxCDF	ND	pg/L	0.71	
2,3,4,6,7,8-HxCDF	ND	pg/L	2.8	
1,2,3,7,8,9-HxCDF	ND	pg/L	1.1	
HpCDFs (total)	ND	pg/L	2.1	
1,2,3,4,6,7,8-HpCDF	ND	pg/L	1.3	
1,2,3,4,7,8,9-HpCDF	ND	pg/L	2.1	
OCDF	ND	pg/L	15	
Dioxins				
TCDDs (total)	ND	pg/L	2.1	
2,3,7,8-TCDD	ND	pg/L	2.1	
PeCDDs (total)	ND	pg/L	1.8	
1,2,3,7,8-PeCDD	ND	pg/L	1.8	
HxCDDs (total)	ND	pg/L	3.0	
1,2,3,4,7,8-HxCDD	ND	pg/L	2.7	
1,2,3,6,7,8-HxCDD	ND	pg/L	2.7	
1,2,3,7,8,9-HxCDD	ND	pg/L	3.0	
HpCDDs (total)	ND	pg/L	2.5	
1,2,3,4,6,7,8-HpCDD	ND	pg/L	2.5	
OCDD	ND	pg/L	6.5	

(continued on following page)

ND = Not detected
NA = Not applicable

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Quanterra
Environmental Services

POLYCHLORINATED DIOXINS/FURANS
ISOMER SPECIFIC ANALYSIS (CONT.)
Method 8290

Client Name: Ecology & Environment, Inc.
Client ID: 96RRFTA001GW
Lab ID: 089126-0001-SA
Matrix: AQUEOUS
Authorized: 20 AUG 96

Sampled: 14 AUG 96
Prepared: 23 AUG 96

Received: 20 AUG 96
Analyzed: 27 AUG 96

Sample Amount 1.04 L
Column Type DB-5

	% Recovery
13C-2,3,7,8-TCDF	66
13C-2,3,7,8-TCDD	71
13C-1,2,3,7,8-PeCDF	71
13C-1,2,3,7,8-PeCDD	80
13C-1,2,3,4,7,8-HxCDF	74
13C-1,2,3,6,7,8-HxCDD	79
13C-1,2,3,4,6,7,8-HpCDF	82
13C-1,2,3,4,6,7,8-HpCDD	95
13C-OCDD	102

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Environmental Services

POLYCHLORINATED DIOXINS/FURANS
ISOMER SPECIFIC ANALYSIS
Method 8290

Client Name: Ecology & Environment, Inc.
Client ID: 96RRFTA002GW
Lab ID: 089126-0002-SA
Matrix: AQUEOUS Sampled: 14 AUG 96 Received: 20 AUG 96
Authorized: 20 AUG 96 Prepared: 23 AUG 96 Analyzed: 27 AUG 96

Sample Amount 1.02 L
Column Type DB-5

Parameter	Result	Units	Detection Limit	Data Qualifiers
Furans				
TCDFs (total)	ND	pg/L	0.97	
2,3,7,8-TCDF	ND	pg/L	0.97	
PeCDFs (total)	ND	pg/L	1.1	
1,2,3,7,8-PeCDF	ND	pg/L	1.1	
2,3,4,7,8-PeCDF	ND	pg/L	0.92	
HxCDFs (total)	ND	pg/L	2.8	
1,2,3,4,7,8-HxCDF	ND	pg/L	0.80	
1,2,3,6,7,8-HxCDF	ND	pg/L	0.63	
2,3,4,6,7,8-HxCDF	ND	pg/L	2.8	
1,2,3,7,8,9-HxCDF	ND	pg/L	0.99	
HpCDFs (total)	ND	pg/L	1.1	
1,2,3,4,6,7,8-HpCDF	ND	pg/L	0.67	
1,2,3,4,7,8,9-HpCDF	ND	pg/L	1.1	
OCDF	ND	pg/L	8.8	
Dioxins				
TCDDs (total)	ND	pg/L	1.1	
2,3,7,8-TCDD	ND	pg/L	1.1	
PeCDDs (total)	ND	pg/L	1.0	
1,2,3,7,8-PeCDD	ND	pg/L	1.0	
HxCDDs (total)	ND	pg/L	1.5	
1,2,3,4,7,8-HxCDD	ND	pg/L	1.4	
1,2,3,6,7,8-HxCDD	ND	pg/L	1.4	
1,2,3,7,8,9-HxCDD	ND	pg/L	1.5	
HpCDDs (total)	ND	pg/L	1.3	
1,2,3,4,6,7,8-HpCDD	ND	pg/L	1.3	
OCDD	ND	pg/L	4.7	

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POLYCHLORINATED DIOXINS/FURANS
ISOMER SPECIFIC ANALYSIS (CONT.)
Method 8290

Client Name: Ecology & Environment, Inc.
Client ID: 96RRFTA002GW
Lab ID: 089126-0002-SA
Matrix: AQUEOUS Sampled: 14 AUG 96 Received: 20 AUG 96
Authorized: 20 AUG 96 Prepared: 23 AUG 96 Analyzed: 27 AUG 96

Sample Amount 1.02 L
Column Type DB-5

	% Recovery
13C-2,3,7,8-TCDF	73
13C-2,3,7,8-TCDD	75
13C-1,2,3,7,8-PeCDF	78
13C-1,2,3,7,8-PeCDD	91
13C-1,2,3,4,7,8-HxCDF	78
13C-1,2,3,6,7,8-HxCDD	95
13C-1,2,3,4,6,7,8-HpCDF	83
13C-1,2,3,4,6,7,8-HpCDD	99
13C-OCDD	98

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POLYCHLORINATED DIOXINS/FURANS
ISOMER SPECIFIC ANALYSIS
Method 8290

Client Name: Ecology & Environment, Inc.
Client ID: 96RRFTA004GW
Lab ID: 089126-0003-SA
Matrix: AQUEOUS Sampled: 15 AUG 96 Received: 20 AUG 96
Authorized: 20 AUG 96 Prepared: 23 AUG 96 Analyzed: 27 AUG 96

Sample Amount 1.02 L
Column Type DB-5

Parameter	Result	Units	Detection Limit	Data Qualifiers
Furans				
TCDFs (total)	ND	pg/L	2.3	
2,3,7,8-TCDF	ND	pg/L	2.3	
PeCDFs (total)	ND	pg/L	1.6	
1,2,3,7,8-PeCDF	ND	pg/L	1.6	
2,3,4,7,8-PeCDF	ND	pg/L	1.3	
HxCDFs (total)	ND	pg/L	2.9	
1,2,3,4,7,8-HxCDF	ND	pg/L	0.58	
1,2,3,6,7,8-HxCDF	ND	pg/L	0.46	
2,3,4,6,7,8-HxCDF	ND	pg/L	2.9	
1,2,3,7,8,9-HxCDF	ND	pg/L	0.72	
HpCDFs (total)	ND	pg/L	1.2	
1,2,3,4,6,7,8-HpCDF	ND	pg/L	0.70	
1,2,3,4,7,8,9-HpCDF	ND	pg/L	1.2	
OCDF	ND	pg/L	7.8	
Dioxins				
TCDDs (total)	ND	pg/L	2.0	
2,3,7,8-TCDD	ND	pg/L	2.0	
PeCDDs (total)	ND	pg/L	1.5	
1,2,3,7,8-PeCDD	ND	pg/L	1.5	
HxCDDs (total)	ND	pg/L	1.6	
1,2,3,4,7,8-HxCDD	ND	pg/L	1.5	
1,2,3,6,7,8-HxCDD	ND	pg/L	1.5	
1,2,3,7,8,9-HxCDD	ND	pg/L	1.6	
HpCDDs (total)	ND	pg/L	1.4	
1,2,3,4,6,7,8-HpCDD	ND	pg/L	1.4	
OCDD	ND	pg/L	4.3	

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POLYCHLORINATED DIOXINS/FURANS
ISOMER SPECIFIC ANALYSIS (CONT.)
Method 8290

OUA 0021534

Client Name: Ecology & Environment, Inc.
Client ID: 96RRFTA004GW
Lab ID: 089126-0003-SA
Matrix: AQUEOUS Sampled: 15 AUG 96 Received: 20 AUG 96
Authorized: 20 AUG 96 Prepared: 23 AUG 96 Analyzed: 27 AUG 96

Sample Amount 1.02 L
Column Type DB-5

	% Recovery	
13C-2,3,7,8-TCDF	32	m
13C-2,3,7,8-TCDD	34	m
13C-1,2,3,7,8-PeCDF	52	
13C-1,2,3,7,8-PeCDD	69	
13C-1,2,3,4,7,8-HxCDF	66	
13C-1,2,3,6,7,8-HxCDD	85	
13C-1,2,3,4,6,7,8-HpCDF	81	
13C-1,2,3,4,6,7,8-HpCDD	97	
13C-OCDD	97	

Note m : Internal standard recovery is outside method recovery goal.

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POLYCHLORINATED DIOXINS/FURANS
ISOMER SPECIFIC ANALYSIS
Method 8290

OUA 0021535

Client Name: Ecology & Environment, Inc.
Client ID: 96RRFTA005GW
Lab ID: 089126-0004-SA
Matrix: AQUEOUS
Authorized: 20 AUG 96

Sampled: 15 AUG 96
Prepared: 23 AUG 96

Received: 20 AUG 96
Analyzed: 27 AUG 96

Sample Amount 1.04 L
Column Type DB-5

Parameter	Result	Units	Detection Limit	Data Qualifiers
Furans				
TCDFs (total)	ND	pg/L	3.0	U
2,3,7,8-TCDF	ND	pg/L	3.0	U
PeCDFs (total)	ND	pg/L	2.0	
1,2,3,7,8-PeCDF	ND	pg/L	2.0	
2,3,4,7,8-PeCDF	ND	pg/L	1.7	
HxCDFs (total)	ND	pg/L	2.3	
1,2,3,4,7,8-HxCDF	ND	pg/L	0.51	
1,2,3,6,7,8-HxCDF	ND	pg/L	0.40	
2,3,4,6,7,8-HxCDF	ND	pg/L	2.3	
1,2,3,7,8,9-HxCDF	ND	pg/L	0.63	
HpCDFs (total)	ND	pg/L	1.3	
1,2,3,4,6,7,8-HpCDF	ND	pg/L	0.79	
1,2,3,4,7,8,9-HpCDF	ND	pg/L	1.3	
OCDF	ND	pg/L	7.1	
Dioxins				
TCDDs (total)	ND	pg/L	3.2	U
2,3,7,8-TCDD	ND	pg/L	3.2	U
PeCDDs (total)	ND	pg/L	1.3	
1,2,3,7,8-PeCDD	ND	pg/L	1.3	
HxCDDs (total)	ND	pg/L	1.7	
1,2,3,4,7,8-HxCDD	ND	pg/L	1.5	
1,2,3,6,7,8-HxCDD	ND	pg/L	1.5	
1,2,3,7,8,9-HxCDD	ND	pg/L	1.7	
HpCDDs (total)	ND	pg/L	1.2	
1,2,3,4,6,7,8-HpCDD	ND	pg/L	1.2	
OCDD	ND	pg/L	5.8	

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POLYCHLORINATED DIOXINS/FURANS
ISOMER SPECIFIC ANALYSIS (CONT.)
Method 8290

OUA 0021536

Client Name: Ecology & Environment, Inc.
Client ID: 96RRFTA005GW
Lab ID: 089126-0004-SA
Matrix: AQUEOUS
Authorized: 20 AUG 96

Sampled: 15 AUG 96
Prepared: 23 AUG 96

Received: 20 AUG 96
Analyzed: 27 AUG 96

Sample Amount 1.04 L
Column Type DB-5

	% Recovery	
13C-2,3,7,8-TCDF	29	m
13C-2,3,7,8-TCDD	35	m
13C-1,2,3,7,8-PeCDF	48	
13C-1,2,3,7,8-PeCDD	64	
13C-1,2,3,4,7,8-HxCDF	62	
13C-1,2,3,6,7,8-HxCDD	80	
13C-1,2,3,4,6,7,8-HpCDF	77	
13C-1,2,3,4,6,7,8-HpCDD	95	
13C-OCDD	92	

Note m : Internal standard recovery is outside method recovery goal.

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POLYCHLORINATED DIOXINS/FURANS
ISOMER SPECIFIC ANALYSIS
Method 8290

OUA 0021537

Client Name: Ecology & Environment, Inc.
Client ID: 96RRFTA006GW
Lab ID: 089126-0005-SA
Matrix: AQUEOUS
Authorized: 20 AUG 96

Sampled: 15 AUG 96
Prepared: 23 AUG 96

Received: 20 AUG 96
Analyzed: 27 AUG 96

Sample Amount 1.02 L
Column Type DB-5

Parameter	Result	Units	Detection Limit	Data Qualifiers
Furans				
TCDFs (total)	ND	pg/L	1.6	
2,3,7,8-TCDF	ND	pg/L	1.6	
PeCDFs (total)	ND	pg/L	0.46	
1,2,3,7,8-PeCDF	ND	pg/L	0.46	
2,3,4,7,8-PeCDF	ND	pg/L	0.40	
HxCDFs (total)	ND	pg/L	3.0	
1,2,3,4,7,8-HxCDF	ND	pg/L	0.68	
1,2,3,6,7,8-HxCDF	ND	pg/L	0.54	
2,3,4,6,7,8-HxCDF	ND	pg/L	3.0	
1,2,3,7,8,9-HxCDF	ND	pg/L	0.84	
HpCDFs (total)	ND	pg/L	0.97	
1,2,3,4,6,7,8-HpCDF	ND	pg/L	0.59	
1,2,3,4,7,8,9-HpCDF	ND	pg/L	0.97	
OCDF	ND	pg/L	5.8	
Dioxins				
TCDDs (total)	ND	pg/L	2.6	
2,3,7,8-TCDD	ND	pg/L	2.6	
PeCDDs (total)	ND	pg/L	1.5	
1,2,3,7,8-PeCDD	ND	pg/L	1.5	
HxCDDs (total)	ND	pg/L	1.4	
1,2,3,4,7,8-HxCDD	ND	pg/L	1.3	
1,2,3,6,7,8-HxCDD	ND	pg/L	1.3	
1,2,3,7,8,9-HxCDD	ND	pg/L	1.4	
HpCDDs (total)	ND	pg/L	1.2	
1,2,3,4,6,7,8-HpCDD	ND	pg/L	1.2	
OCDD	ND	pg/L	4.3	

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POLYCHLORINATED DIOXINS/FURANS
ISOMER SPECIFIC ANALYSIS (CONT.)
Method 8290

OUA 0021538

Client Name: Ecology & Environment, Inc.
Client ID: 96RRFTA006GW
Lab ID: 089126-0005-SA
Matrix: AQUEOUS Sampled: 15 AUG 96 Received: 20 AUG 96
Authorized: 20 AUG 96 Prepared: 23 AUG 96 Analyzed: 27 AUG 96

Sample Amount 1.02 L
Column Type DB-5

	% Recovery
13C-2,3,7,8-TCDF	40
13C-2,3,7,8-TCDD	44
13C-1,2,3,7,8-PeCDF	56
13C-1,2,3,7,8-PeCDD	72
13C-1,2,3,4,7,8-HxCDF	65
13C-1,2,3,6,7,8-HxCDD	79
13C-1,2,3,4,6,7,8-HpCDF	78
13C-1,2,3,4,6,7,8-HpCDD	94
13C-OCDD	91

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POLYCHLORINATED DIOXINS/FURANS
ISOMER SPECIFIC ANALYSIS
Method 8290

OUA 0021539

Client Name: Ecology & Environment, Inc.
Client ID: 96RRFTA008GW
Lab ID: 089126-0006-SA
Matrix: AQUEOUS Sampled: 15 AUG 96 Received: 20 AUG 96
Authorized: 20 AUG 96 Prepared: 23 AUG 96 Analyzed: 27 AUG 96

Sample Amount 1.04 L
Column Type DB-5

Parameter	Result	Units	Detection Limit	Data Qualifiers
Furans				
TCDFs (total)	ND	pg/L	2.1	
2,3,7,8-TCDF	ND	pg/L	2.1	
PeCDFs (total)	ND	pg/L	0.46	
1,2,3,7,8-PeCDF	ND	pg/L	0.46	
2,3,4,7,8-PeCDF	ND	pg/L	0.40	
HxCDFs (total)	ND	pg/L	2.6	
1,2,3,4,7,8-HxCDF	ND	pg/L	0.60	
1,2,3,6,7,8-HxCDF	ND	pg/L	0.47	
2,3,4,6,7,8-HxCDF	ND	pg/L	2.6	
1,2,3,7,8,9-HxCDF	ND	pg/L	0.74	
HpCDFs (total)	ND	pg/L	1.1	
1,2,3,4,6,7,8-HpCDF	ND	pg/L	0.68	
1,2,3,4,7,8,9-HpCDF	ND	pg/L	1.1	
OCDF	ND	pg/L	5.5	
Dioxins				
TCDDs (total)	ND	pg/L	1.6	
2,3,7,8-TCDD	ND	pg/L	1.6	
PeCDDs (total)	ND	pg/L	1.6	
1,2,3,7,8-PeCDD	ND	pg/L	1.6	
HxCDDs (total)	ND	pg/L	1.2	
1,2,3,4,7,8-HxCDD	ND	pg/L	1.1	
1,2,3,6,7,8-HxCDD	ND	pg/L	1.1	
1,2,3,7,8,9-HxCDD	ND	pg/L	1.2	
HpCDDs (total)	ND	pg/L	1.0	
1,2,3,4,6,7,8-HpCDD	ND	pg/L	1.0	
OCDD	ND	pg/L	3.8	

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POLYCHLORINATED DIOXINS/FURANS
ISOMER SPECIFIC ANALYSIS (CONT.)
Method 8290

OUA 0021540

Client Name: Ecology & Environment, Inc.
Client ID: 96RRFTA008GW
Lab ID: 089126-0006-SA
Matrix: AQUEOUS Sampled: 15 AUG 96 Received: 20 AUG 96
Authorized: 20 AUG 96 Prepared: 23 AUG 96 Analyzed: 27 AUG 96

Sample Amount 1.04 L
Column Type DB-5

	% Recovery	
13C-2,3,7,8-TCDF	34	m
13C-2,3,7,8-TCDD	43	
13C-1,2,3,7,8-PeCDF	57	
13C-1,2,3,7,8-PeCDD	75	
13C-1,2,3,4,7,8-HxCDF	72	
13C-1,2,3,6,7,8-HxCDD	88	
13C-1,2,3,4,6,7,8-HpCDF	82	
13C-1,2,3,4,6,7,8-HpCDD	101	
13C-OCDD	92	

Note m : Internal standard recovery is outside method recovery goal.

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POLYCHLORINATED DIOXINS/FURANS
ISOMER SPECIFIC ANALYSIS
Method 8290

OUA 0021541

Client Name: Ecology & Environment, Inc.
Client ID: 96RRFTA007GW
Lab ID: 089126-0007-SA
Matrix: AQUEOUS Sampled: 15 AUG 96 Received: 20 AUG 96
Authorized: 20 AUG 96 Prepared: 23 AUG 96 Analyzed: 27 AUG 96

Sample Amount 1.02 L
Column Type DB-5

Parameter	Result	Units	Detection Limit	Data Qualifiers
Furans				
TCDFs (total)	ND	pg/L	2.1	
2,3,7,8-TCDF	ND	pg/L	2.1	
PeCDFs (total)	ND	pg/L	0.70	
1,2,3,7,8-PeCDF	ND	pg/L	0.70	
2,3,4,7,8-PeCDF	ND	pg/L	0.60	
HxCDFs (total)	ND	pg/L	2.8	
1,2,3,4,7,8-HxCDF	ND	pg/L	0.90	
1,2,3,6,7,8-HxCDF	ND	pg/L	0.71	
2,3,4,6,7,8-HxCDF	ND	pg/L	2.8	
1,2,3,7,8,9-HxCDF	ND	pg/L	1.1	
HpCDFs (total)	ND	pg/L	1.7	
1,2,3,4,6,7,8-HpCDF	ND	pg/L	1.0	
1,2,3,4,7,8,9-HpCDF	ND	pg/L	1.7	
OCDF	ND	pg/L	7.6	
Dioxins				
TCDDs (total)	ND	pg/L	2.1	
2,3,7,8-TCDD	ND	pg/L	2.1	
PeCDDs (total)	ND	pg/L	1.6	
1,2,3,7,8-PeCDD	ND	pg/L	1.6	
HxCDDs (total)	ND	pg/L	2.3	
1,2,3,4,7,8-HxCDD	ND	pg/L	2.1	
1,2,3,6,7,8-HxCDD	ND	pg/L	2.1	
1,2,3,7,8,9-HxCDD	ND	pg/L	2.3	
HpCDDs (total)	ND	pg/L	2.3	
1,2,3,4,6,7,8-HpCDD	ND	pg/L	2.3	
OCDD	ND	pg/L	10	

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Reported By: Clark Pickell Approved By: Saleh Arghestani

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Rev 230787

Quanterra
Environmental Services

POLYCHLORINATED DIOXINS/FURANS
ISOMER SPECIFIC ANALYSIS (CONT.)
Method 8290

OUA 0021542

Client Name: Ecology & Environment, Inc.
Client ID: 96RRFTA007GW
Lab ID: 089126-0007-SA
Matrix: AQUEOUS Sampled: 15 AUG 96 Received: 20 AUG 96
Authorized: 20 AUG 96 Prepared: 23 AUG 96 Analyzed: 27 AUG 96

Sample Amount 1.02 L
Column Type DB-5

	% Recovery
13C-2,3,7,8-TCDF	48
13C-2,3,7,8-TCDD	53
13C-1,2,3,7,8-PeCDF	63
13C-1,2,3,7,8-PeCDD	78
13C-1,2,3,4,7,8-HxCDF	76
13C-1,2,3,6,7,8-HxCDD	89
13C-1,2,3,4,6,7,8-HpCDF	86
13C-1,2,3,4,6,7,8-HpCDD	101
13C-OCDD	94

ND = Not detected
NA = Not applicable

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F

F Contaminant Characteristics

F Contaminant Characteristics

Appendix F presents chemical contaminants present at Operable Unit A (OU-A) that can be attributed to the site based on background information and available literature regarding the constituents of petroleum products. In addition, the physical-chemical characteristics affecting the environmental fate and transport of the identified contaminants are presented. Table F-1 summarizes the chemical contaminants of potential concern identified at OU-A.

Petroleum Hydrocarbons

Petroleum fuels are associated with each contaminant source identified at OU-A. Petroleum products are complex mixtures of more than 1,200 different hydrocarbons ranging from short-chain aliphatics to complex long-chain compounds. The physical properties of petroleum fuels vary according to refining processes, the origin of the crude oil, and the constituents and their percentages. Based on their molecular structure and solubility in water, most constituents of petroleum can be divided into one of the following groups:

- Those that preferentially adsorb to soil particles;
- Those that volatilize rapidly;
- Those that tend to migrate through soil to groundwater as a solute; and
- Those for which multiple pathways exist.

The major constituents and additives to regular unleaded gasoline, leaded gasoline, aviation fuel (jet A), and diesel fuel No. 2 are presented in Table F-2. Table F-3 presents the hazardous constituents of regular unleaded gasoline, leaded gasoline, JP-4, and DFA according to Material Safety Data Sheets (MSDSs) provided by MAPCO Alaska Petroleum, Inc. Table F-4 presents the estimated relative environmental partitioning of selected common petroleum constituents.

The transport of a petroleum product in the environment is largely determined by the physical and chemical properties of the individual constituents of the product. In general, soils with high organic content tend to adsorb petroleum hydrocarbons. Low-molecular weight constituents are not bound as strongly and will volatilize or leach out before the higher molecular weight constituents.

The aromatic constituents of petroleum products have densities of less than one. Consequently, a fresh petroleum spill that infiltrates soil to groundwater will accumulate at the water table. In this case, the most frequent migration mechanisms would be groundwater flow in the water table aquifer and vapor transport to vadose zone soils. As the petroleum mixes with groundwater, the aromatic petroleum constituents can become dissolved in the groundwater and natural degradation will begin to occur. At this point, vertical and horizontal groundwater gradients will influence the migration of the dissolved petroleum constituents. Long-chain hydrocarbons, such as bunker C-range organic compounds, will be the most prevalent form of the petroleum mixture as the residence time of the original product in the subsurface increases. These degraded petroleum fractions can be detected at locations far removed from the original spill location (Nyer 1992; Kostecki and Calabrese 1989).

Polynuclear Aromatic Hydrocarbons (PAHs)

Four PAHs were detected during the RI: benzo(a)anthracene, benzo(a)pyrene, benzo (b)fluoranthene, and indeno(1,2,3-c,d) pyrene. The chemical characteristics and behavior of these high molecular weight PAHs are expected to be similar in the environment. Table F-5 presents the physical and chemical properties of the organic channel of potential concern. They will volatilize from soil and water to a limited extent (Lyman et al. 1982) and have a strong tendency to adsorb to soil particles in soils with high organic content. These PAHs have low solubilities in water and are primarily found sorbed to suspended particles or settled in the bottom of the water column. PAHs will undergo biodegradation in soil and aquatic systems.

Dioxins/Furans (PCDDs/PCDFs)

PCDDs and PCDFs were detected during the OU-A RI investigation and are associated with the combustion of diesel, waste oils, and solvents. They are primarily associated with organic matter because of their high lipophilicity and low water solubility. PCDDs/PCDFs show little vertical migration in soil due to low water solubility and vapor pressure (Palarusky et al. 1986). Solvents such as waste oil or diesel fuel, and surfactants enhance their mobility in soils (Puri et al. 1989). PCDDs/PCDFs are extremely stable

compounds under most environmental conditions and have exhibited strong resistance to microbial degradation in soils (Freeman and Schory 1984). Several studies have reported that photolysis is a primary mechanism of degradation.

Inorganic Elements

Many inorganic elements were detected in various media at OU-A. Based on site-specific knowledge, however, chromium, mercury, and silver are the only elements suspected of being released to the environment from previous operations at OU-A. The mobility of inorganics is greatly affected by the oxidation-reduction potential, pH, particle-size distribution, and the concentration of other inorganics and organics in the surrounding environment.

Chromium

Chromium (Cr) occurs in two oxidation states in aqueous systems: Cr^{+3} and Cr^{+6}. Cr^{+6} is more toxic than Cr^{+3}. Trivalent chromium (Cr^{+3}) reacts with hydroxide ions in water to form insoluble chromium hydroxide, $Cr(OH)_3$, which is rapidly removed from water by precipitation and sorption to soils or sediments (EPA 1984). Hexavalent chromium (Cr^{+6}) forms soluble chromate and dichromate anions, which are not strongly sorbed to soils or sediments, and are mobile in the environment (EPA 1984). Cr^{+6} and Cr^{+3} can be converted in soils or surface water under conditions that change the redox potential of the system to solubilize or precipitate chromium (EPA 1979).

Chromium does not appear to undergo biological transformation reactions such as methylation, but Cr^{+6} can be chemically reduced to Cr^{+3} upon contact with plant or animal tissue (E & E 1994).

Mercury

Mercury (Hg) can be found in three oxidation states: Hg^0, Hg^{+1}, and Hg^{+2}. Hg^0 is a liquid at room temperature and forms amalgams with many metals. These amalgams are liquid when the concentration of the other metal is small, but they solidify as the other metal concentration increases. Mercury forms approximately 68 known inorganic compounds and 42 organic derivatives (CRC 1983). Organic mercury compounds tend to be more soluble and mobile than inorganic mercury compounds (Manahan 1994). Inorganic mercury can be converted in the environment to methylmercury by bacteria (Manahan 1994). Mercury may volatilize, however, the vapor pressure is somewhat irregular (Clayton et al. 1981).

Silver

Silver is a white, lustrous metal, which is very ductile and malleable, and it is the best conductor of heat and electricity. Silver can be found in three oxidation states: Ag^0, Ag^{+1}, and Ag^{+2}. The majority of silver is found as Ag^{+1}. Silver is insoluble in water and soluble in nitric acid. Silver tends to be immobilized in the presence of iron and manganese complexes, and organic matter (Boyle 1968). Silver may form complex ions with chlorides, and sulfates; forms soluble organic compounds; and adsorb onto humic complexes and suspended particles (Boyle 1968). Biotransformation is not a significant process because silver inhibits bacterial biodegrative enzymes (Domsch 1984).

Table F-1

CHEMICAL CONTAMINANTS[a]
OPERABLE UNIT A
FORT RICHARDSON, ALASKA

Fuel
Gasoline
Diesel
Base, Neutral, Acid Extractable Compounds (BNAs)
benzo (A) Anthracene
benzo (A) Pyrene
benzo (b) fluoranthene
indeno (1,2,3-cd) Pyrene
Inorganic Elements
Chromium
Mercury
Silver
Dioxins/Furans

[a] The list of contaminants presented in this table is referenced in the contaminants list provided in the Approach Document for the Baseline Human Health Risk Assessment (E & E 1995). The Approach Document list has been condensed on the basis of attributability to OU-A contaminant sources.

OUA 0021550

Table F-2

COMPOSITION OF FUELS
OPERABLE UNIT A
FORT RICHARDSON, ALASKA

Regular Unleaded Gasoline	Volume %
Normal/Iso Hydrocarbons (58%)	
Isopentane	9-11
n-Butane	4-5
n-Pentane	2.6-2.7
Isobutane	0.7-1
Propane	0.07-0.08
2-Methylpentane	—
Hexane	—
Methylhexanes	—
Heptane	—
Methylheptanes	—
Methyloctanes	—
Decane	—
Undecane	—
Aromatic Hydrocarbons (32%)	
Xylenes	6-7
Toluene	6-7
Ethylbenzene	5
Benzene	2-5
1,3,5-Trimethylbenzene	1.3
1,2,3-Trimethylbenzene	0.73
n-Propylbenzene	0.6
Naphthalene	0.2-0.5
n-Butylbenzene	0.08
Methylnaphthalenes	—
Benzo(b)fluoranthene	3.9 (mg/L)
Fluoranthene	1.84 (mg/L)
Anthracene	1.84 (mg/L)
Anthracene	1.55 (mg/L)
Benzo(e)pyrene	0.3 (mg)
Olefins (5%)	
3-Methyl 1-butene	0.06-0.08
2-Butene	0.16-0.17
Cyclic Hydrocarbons (5%)	
Cyclopentane	—
Cydohexane	—

Leaded Gasoline	Volume %
Normal/Iso Hydrocarbons (59%)	
Isopentane	9-11
n-Butane	4-5
n-Pentane	2.6-2.7
Isobutane	0.1
Propane	0.07-0.08
2-Methylpentane	—
Hexane	—
Methylhexanes	—
Heptane	—
Methylheptanes	—
Decane	—
Undecane	—
Aromatic Hydrocarbons (26%)	
Xylenes	6-7
Toluene	6-7
Ethylbenzene	5
Benzene	2-5
1,3,5-Trimethylbenzene	1.3
1,2,3-Trimethylbenzene	0.73
Naphthalene	0.08
n-Butylbenzene	0.2-0.5
Methylnaphthalenes	—
Benzo(b)fluoranthene	3.9 (mg/L)
Fluoranthene	1.84 (mg/L)
Anthracene	1.55 (mg/L)
Benzo(e)pyrene	0.3 (mg/L)
Olefins (5%)	
2-Butene	0.06-0.17
3-Methyl 1-butene	0.06-0.08
Cyclic Hydrocarbons (5%)	
Cyclopentane	—
Cydohexane	—
Methylcyclopentane	—
Methylcyclohexane	—
Additives	

Key at end of table.

OUA 0021551

Table F-2

COMPOSITION OF FUELS
OPERABLE UNIT A
FORT RICHARDSON, ALASKA

Regular Unleaded Gasoline	Volume %	Leaded Gasoline	Volume %
Methylcyclopentane	—	Tetraethyl lead	600 (mg/L)
Methylcyclohexane	—	Tetramethyl lead	5 (mg/L)
Additives		Dichloroethane	210 (mg/L)
Ethyl Alcohol (octane booster)	Up to 5	Dibromoethane (EDB)	190 (mg/L)
Methyl t-butyl ether (octane booster)	Up to 12	2,6-di-t-butyl-4-methylphenol (anti-oxidant)	—
Methyl alcohol (fuel line anti-icer)	0.2		
Tricresyl phosphate (combustion chamber deposit modifier)	Up to 0.2 (mg/L)		
2,6 Di-t-butyl-4-methylphenol (anti-oxidant)	—		

Key at end of table.

OUA 0021552

Table F-2

COMPOSITION OF FUELS
OPERABLE UNIT A
FORT WAINWRIGHT, ALASKA

Aviation Fuel (Jet A)	Volume %	Diesel Fuel No. 2	Volume %
Normal/Iso Hydrocarbons (59%)		**Cyclic Hydrocarbons (0.93%)**	
Undecane	36	Cyclopentane	0.59
Decane	16.5	Tetramethylcyclopentane	0.01
3-Methyloctane	2.5	Propylcyclohexane	0.07
Dodecane	0.7	Ethylcyclohexane	0.04
Tridecane	0.5	1,1,3-Trimethylcyclohexane	0.03
2,6,10-Trimethyldodecane	0.45	**Additives**	
2-Methylbutane	0.2	Dibromoethane (EDB)	0.05
2-Methylnonane	0.2	**Normal/Iso Hydrocarbons (75%)**	
2-Methylbutane	0.26	Predominantly C_{10} to C_{16}	
3-Methyldecane	0.14	**Aromatic Hydrocarbons (15%)**	
4-Methylnonane	0.22	Phenanthrene	0.26-0.3
Aromatic Hydrocarbons (35%)		Naphthalene	0.14-0.11
1,2,4,5-Tetramethylbenzene	9	Fluorene	0.07-0.1
1,2,3-Trimethylbenzene	6.6	Anthracene	0.013-0.02
1,2-Dimethyl-3-propylbenzene	5.4	1,2,3,4-Tetrahydroquinoline	—
Propylbenzene	3-5	2,6-Dimethylquinoline	—
1-Methyl-4-propylbenzene	3.3	1-Methylnaphthalene	—
Buytlbenzene	2	2,3,6-Trimethylnaphthalene	—
2-Methylnaphthalene	—	2,3,5-Trimethylnaphthalene	—
Methylindane	0.3	1,3,5-Trimethylbenzene	—
Naphthalene	0.14	n-Propylbenzene	Trace
2-Methylnaphthalene	0.34	Ethylbenzene	Trace
1,2-Diethylbenzene	0.24	Xylenes	Trace
1,4-Dimethyl-2-ethylbenzene	0.2	Toluene	Trace
1,3-Dimethylnaphthalene	0.15	Benzene	Trace
Xylenes	.07	**Additives**	
Ethylbenzene	0.02	N,N-Disalicylidene diamine (metal deactivator)	—
Benzene	0.02	Alkyl Nitrate (cetane improver)	0.2
Toluene	Trace	2,6-Di-t-butyl-4-methylphenol (anti-oxidant)	—
Olefins (0%)		Tetroethyl lead	600 (mg/L)
Aviation Fuel (JP-4)			
n-Butane	0.12	2,5-Dimethylheptane	0.52
Isobutane	0.66	Unidentified	0.98

Key at end of table.

Table F-2

OUA 0021553

COMPOSITION OF FUELS
OPERABLE UNIT A
FORT WAINWRIGHT, ALASKA

Aviation Fuel (Jet A)	Volume %	Diesel Fuel No. 2	Volume %
n-Pentane	1.06	Ethylbenzene	0.37
2,2-Dimethylbutane	0.10	m-Xylene	0.96
2-Methylpentane	1.28	p-Xylene	0.35
3-Methylpentane	0.89	3,4-Dimethylheptane	0.43
n-Hexane	2.21	4-Ethylheptane	0.18
Methylcyclopentane	1.16	4-Methyloctane	0.86
2,2-Dimethylpentane	0.25	2-Methyloctane	0.88
Benzene	0.50	3-Methyloctane	0.79
Cyclohexane	1.24	o-Xylene	1.01
2-Methylhexane	2.35	1-Methyl-4-ethylcyclohexane	0.48
3-Methylhexane	1.97	n-Nonane	2.25
trans-1,3-Dimethylcyclopentane	0.36	Isopropylbenzene	0.30
cis-1,3-Dimethylcyclopentane	0.34	n-Propylbenzene	0.71
cis-1,2-bimethylcyclopentane	0.54	1-Methyl-3-ethylbenzene	0.49
n-Heptane	3.67	1-Methyl-4-ethylbenzene	0.43
Methylcyclohexane	2.27	1,3,5-Trimethylbenzene	0.42
2,2,3,3-Tetramethylbutane	0.24	1-Methyl-2-ethylbenzene	0.23
Ethylcyclopentane	0.26	1,2,4-Trimethylbenzene	1.01
2,5-Dimethylhexane	0.37	n-Decane	2.16
2,4-Dimethylhexane	0.58	n-Butylcyclohexane	0.70
1,2,4-Trimethylcyclopentane	0.25	1,3-Diethylbenzene	0.46
3,3-Dimethylhexane	0.26	1-Methyl-4-propylbenzene	0.40
1,2,3-Trimethylcyclopentane	0.25	1,3-Dimethyl-5-ethylbenzene	0.61
Toluene	1.33	1-Methyl-2-i-propylbenzene	0.29
2,2-Dimethylhexane	0.71	1,4-Dimethyl-2-ethylbenzene	0.70
2-Methylheptane	2.70	1,2-Dimethyl-4-ethylbenzene	0.77
4-Methylheptane	0.92	n-Undecane	2.32
cis-1,3-Dimethylcyclohexane	0.42	1,2,3,4-Tetramethylbenzene	0.75
3-Methylheptane	3.04	Naphthalene	0.50
1-Methyl-3-ethylcyclohexane	0.17	2-Methylundecane	0.64
1-Methyl-2-ethylcyclohexane	0.39	n-Dodecane	2.00
Dimethylcyclohexane	0.43	2,6-Dimethylundecane	0.71
n-Octane	3.80	Unidentified	0.68
1,3,5-Trimethylcyclohexane	0.99	2-Methylnaphthalene	0.56

Key at end of table.

Table F-2

COMPOSITION OF FUELS
OPERABLE UNIT A
FORT WAINWRIGHT, ALASKA

Aviation Fuel (Jet A)	Volume %	Diesel Fuel No. 2	Volume %
1,1,3-Trimethylcyclohexane	0.48	1-Methylnaphthalene	0.78
		n-Tridecane	1.52
		2,6-Dimethylnaphthalene	0.25
		n-Tetradecane	

Key:

— = Hydrocarbon is not present.

Source: Watts 1989.

Table F-3

HAZARDOUS CONSTITUENTS OF MAPCO REFINERY FUEL BY AVERAGE WEIGHT (%) OPERABLE UNIT A FORT RICHARDSON, ALASKA

Constituent	Unleaded Gasoline (MUR)	Leaded Gasoline (MOGAS)	Jet Fuel (JP-4)	Arctic Grade Fuel Oil (DFA)
Benzene	3.63	3.63	0.78	0.24
Cumene (isopropylbenzene)	0.62	0.70	—	0.04
Cyclohexane	2.07	2.07	<4.0	—
Ethylbenzene	1.70	1.80	0.85	0.09
1,2,4-Trimethylbenzene	3.58	4.20	0.81	0.27
Toluene	6.95	6.95	3.33	0.50
Mixed xylenes	9.04	9.85	2.60	0.53
Tetra ethyl lead	—	0.007	—	—
Diethylene glycol monomethyl ether	—	—	0.17	—
Naphthalene	—	—	—	0.34

Source: Mapco 1993a.

Table F-4

ESTIMATED RELATIVE ENVIRONMENTAL PARTITIONING OF SELECTED PETROLEUM CONSTITUENTS OPERABLE UNIT A FORT RICHARDSON, ALASKA

Petroleum Constituents	Percent Adsorbed to Soil Particles	Percent Volatilized	Percent Solubilized in Groundwater and Soil Moisture
Alkanes			
(n)Heptane	0.1	99.8	0.1
(n)Hexane	0.1	99.8	0.1
(n)Pentane	0.1	99.8	0.1
Aromatics			
Benzene	3	62	35
Ethylbenzene	21	59	20
Naphthalene	61	8	31
Toluene	3	77	20
O-Xylene	15	54	31

Source: Adapted from Kostecki and Calabrese 1989.

Table F-5

PHYSICAL AND CHEMICAL PROPERTIES OF PRIMARY ORGANIC CHEMICALS OF POTENTIAL CONCERN OPERABLE UNIT A FORT RICHARDSON, ALASKA

Chemical Name	CAS Number	Mole Weight (g/mole)	Physical State at 20°C	Water Solubility (mg/L)	Source	Liquid Density (g/mL)	Source	Vapor Pressure (mm Hg)	Source	Henry's Law Constant (atm-m^3/mol)	Source	K_{oc} (mL/g)	Source	Log K_{oc}	Source	BCF	Source
Dioxins/Furans																	
2,3,7,8-TCDD	1746-02-6	322.0	Solid	2.00 E-04	A	1.83	B	1.70 E-06	A	3.60 E-03	A	B3.30 E+06	A	6.20	B	5.00 E+03	A
Polynuclear Aromatic Hydrocarbons																	
Benzo(a)anthracene	56-55-3	228.30	Solid	1.20 E-02	B	1.27	B	2.20 E-08	B	2.30 E-06	B	1.38 E+06	B	5.90	B	1.17 E+04	A
Benzo(a)pyrene	50-32-8	252.32	Solid	390 E-03	B	1.35	B	5.60 E-09	B	2.40 E-06	B	1.00 E-06	B	6.00	B	5.00 E+03	C
Benzo(b)fluoranthene	205-99-2	252.32	Solid	1.40 E-02	B	–	–	5.00 E-07	B	2.20 E-05	B	5.49 E+05	B	6.57	B	–	–
Indeno (1,2,3-cd)Pyrene	193-39-5	276.3	Solid	–	B	–	–	10^{-10}	B	6.95×10^{-8}	B	1.6× $E\text{-}0^6$	B	6.20	B	–	–

A Miscellaneous Physical Contract Handbook.
B Knox, R.C., 1993, *Subsurface Fate and Transport Processes*, Lewis Publishers, Inc., Ann Arbor, Michigan.
C Kitano, M., 1978, *Biodegradation and Bioaccumulation Tests on Chemical Substances*, OECD Tokyo Meeting, TSU-No. 3.

Key:

- = No available data.
atm -m^3/mol = Atmospheres in cubic meters per inch.
BCF = Bioconcentration Factor.
g/mL = Grams per liter.
K_{oc} = Organic carbon coefficient.
mg/L = Milligrams per liter.
mL/g = Milliliters per gram.
mmHg = Millimeters of mercury.
VOCs = Volatile organic compounds.

Key at end of table.

G

G Contaminant Transport Modeling

G Contaminant Transport Modeling

Objectives

The SESOIL contaminant transport model was used to calculate preliminary, conservative, order-of-magnitude estimates of the leachability of petroleum constituents in subsurface soil at each OU-A site. Each SESOIL model is based on a simplified conceptual system of the unsaturated soil horizon and uses the best available site information, appropriate published data, and professional estimates where necessary.

The effects of biodegradation, chemical transformation, and dispersion are not accounted for in the models for OU-A. Therefore, the chemical concentrations and estimates of the maximum depth of contaminant migration provided by the models are probably much greater than if degradation processes were included in the models. Contaminated media volumes assumed for each site were also estimated conservatively.

SESOIL Computer Model

SESOIL is a seasonal soil compartment model that estimates the rate of vertical chemical transport and transformation in the soil column in terms of mass and concentration distributions among the soil, water, and air phases in the unsaturated soil zone (Bonazountas and Wagner 1984). The model uses regional and site-specific input data for climate, soil characteristics, chemical parameters, contaminant application rates, and contaminant degradation rates to simulate chemical mobility and fate within a discrete soil column.

The soil column is defined in the model as a compartment that extends from the soil surface through the unsaturated zone to the groundwater table. The soil compartment can be divided into a maximum of four layers of varying thickness and specific soil properties, and contaminant data can be defined for each layer. Layers may then be further divided into a maximum of 10 sublayers. Sublayers share the same input properties as defined for the layer and are used for contaminant tracking and data reporting.

The SESOIL model output includes chemical concentrations, mass quantities, and partitioning (e.g., quantities adsorbed, volatilized, and dissolved in soil moisture) for each layer and sublayer of the model. Output from the models is produced monthly to create simulations up to a total simulation time of 99 years. A summary of the results generated by each model for the three OU-A sites is presented in Table G-1. Tables G-2 through G-4 present the results generated by each site-specific model for OU-A.

Model Input Data

Site-specific data used for the model design and input are provided in this appendix following Tables G-2 through G-4, and the sources of the data are included. In general, climatological and chemical property data were not specific to individual sites, but were available through published resources and applied uniformly to all three sites. (Climate data were available from Merrill Air Field station.) Soil characterization information was developed on a site-specific basis and was derived from either site sample data or published values for generalized soil types. Soil horizons and contaminant zone designs were derived from the soil borings and sample analytical data generated during the RI.

Analytical data for diesel-range organics (DRO) were the most consistently available data for subsurface soils at each OU-A site. However, only one chemical's properties (e.g., molecular weight, Henry's Law constant) can be input into the SESOIL model. Thus, DRO, a mixture of chemicals, cannot be used as a contaminant in SESOIL. Because the SESOIL model requires compound-specific information, naphthalene was chosen as a representative and persistent component of the arctic-grade diesel that is believed to be a likely source of the DRO contamination at OU-A. The concentrations of naphthalene used for the model were derived as a fraction of the average DRO concentration detected at each site. The fraction of naphthalene in DRO was determined from the average percent constituents of diesel fuels reported by Mapco Alaska (Mapco 1993b). The area, thickness, and average concentration of contamination were conservatively determined for each site based on the depths and locations of soil boring samples containing DRO at concentrations greater than 100 mg/kg.

Model Calibration

Calibration of the SESOIL model involves adjusting various input parameters (soil disconnectedness, intrinsic permeability, and porosity) so that output parameters, such as soil moisture and recharge, reflect actual (measured) or reasonable site-specific conditions. Each model was calibrated to a soil moisture reading from 5% to 7.5% according to the results of laboratory soil analyses. In addition, the total recharge estimates formulated by the models

averaged approximately 7.8 inches per year, or 57% of the total annual precipitation. These estimates are reasonable for this location based on the data presented in a 1989 groundwater model for the Anchorage area prepared by the United States Geological Survey (Patrick et al. 1989).

SESOIL Model Results

All SESOIL models were run for a total simulation time of 90 years. Model output data are summarized in Table G-1 for each site for years 1, 10, and 90 of the simulation. The model data presented in this table include: maximum depths of contaminant movement, concentrations of adsorbed naphthalene, and concentrations of naphthalene in soil moisture. Based on observed depth of groundwater at each site, the depth to groundwater from the contaminant front was determined based on the model results. Abbreviated model output reports for each site are also provided in this appendix.

As indicated in Table G-1, contaminant migration in the unsaturated soil column does not reach groundwater levels at any of the three OU-A sites during the 90-year model simulations. At the RRTSL site, contaminants originating at an observed maximum depth of 20-feet BGS migrate approximately 0.5 feet, 4.5 feet, and 37 feet over the 1-, 10-, and 90-year modeling periods, respectively. Without considering the effects of natural attenuation processes, such as biodegradation, the contaminant front would migrate to within 30 feet of groundwater levels. As a result of such degradation processes, it is unlikely that groundwater contamination would pose concern at the RRTSL site.

At the RRFTA and POLLDW sites, maximum estimated contaminant migration distances of 9.5 feet and 11 feet, respectively, were predicted for the 90-year simulation period. With observed maximum contaminants depths of 20 feet at the RRFTA site and 64 feet at the POLLDW site, the contaminant front in each case migrates to within 121 feet and 40 feet of groundwater, respectively. Based on the likelihood that biodegradation and other natural attenuation processes would reduce contaminant concentrations and migration distances, it is extremely unlikely that groundwater contamination would pose concern at either site.

Table G-1

SESOIL MODEL SUMMARY
OPERABLE UNIT A
FORT RICHARDSON, ALASKA

Site	Modeling Time	Modeled Maximum Contaminant Depth (ft. BGS)[a]	Vertical Contaminant Migration Distance from Time 0 (ft.)	Estimated Distance to Groundwater from Contaminants (ft.)	Model Estimated Naphthalene Concentrations	
					Soil (mg/kg)	Soil Moisture (mg/L)
Roosevelt Road Transmitter Site Leachfield	1 year	20	0.5	66	12	9.1
	10 year	24	4.5	62	0.11	0.08
	90 year	56	37	30	0.61	0.47
Ruff Road Fire Training Area	1 year	20	0.5	130	17	3.3
	10 year	21	1.5	129	1.1	0.21
	90 year	29	9.5	121	0.82	0.15
Petroleum, Oil, and Lubricant Laboratory Dry Well	1 year	65	0	51	120	30
	10 year	66	2	49	21	5.2
	90 year	75	11	40	0.7	0.17

[a] The maximum contaminant depths were originally calculated in metric units (see attached data).

Key:

BGS = below ground surface.
ft. = feet.
m = meters.
mg/kg = milligrams per kilogram.
mg/L = milligrams per liter.

Table G-2

SESOIL MODEL INPUT SUMMARY
ROOSEVELT ROAD TRANSMITTER SITE LEACHFIELD
OPERABLE UNIT A
FORT RICHARDSON, ALASKA

Parameter	Baseline Input Data	Source
Soil Data:		
Intrinsic Permeability (cm^2)	5.00E-09	Site Data, Literature
Effective Porosity	0.29	Literature
Soil Disconnectedness	4	Documentation
Total Organic Carbon (%)	0.1	Site Data
Soil pH	7	Documentation
Dry Bulk Density (g/cm^3)	1.7	Site Data / Documentation
CEC (meq/100g)	0	Documentation
Freudlich Exponent	1	Documentation
Chemical Data:		
Adsorption Coefficient, K_{oc} (µg/g)/(µg/mL)	1300	Literature
Biodegradation Rate, water (1/day)	0	--
Biodegradation Rate, soil (1/day)	0	--
Solubility (ug/mL @ 25°C)	31.7	Literature
Diffusion Coefficient in Air (cm^2/s)	0.001	Literature
Henry's Law Constant @ 25°C	0.00115	Literature
Soil Partition Coefficient, K_d (µg/g)/(µg/mL)	calculated	--
Molecular Weight (g/mol)	128	Literature
Neutral Hydrolysis (L/mol-day)	0	--
Base Hydrolysis (L/mol-day)	0	--
Acid Hydrolysis (L/mol-day)	0	--
Ligand Stability Constant	0	--
Ligand Ratio	0	--
Ligand Molecular Weight (g/mol)	0	--
Application and Climate Data:		
Site Latitude	61	Site Data
Surface Area (cm^2)	1.20E+07	Site Data
Spill Index (1-spill, 2-constant)	1	--
Residual Concentration (mg/kg of naphthalene)	0.83	Site Data
No. of Layers / Compartments	4	Documentation
Layer 1 thickness (cm)	580	Site Data
Layer 2 thickness (cm)	30	Site Data
Layer 3 thickness (cm)	1000	Site Data
Layer 4 thickness (cm)	1000	Site Data
All Interlayer Ratios	1	Documentation
Climate	Merrill Field	Literature

Notes: Documentation = refers to model recommended settings.
Literature = refers to available information of published data.
Site Data = refers to site specific data collected during the RI.

Key at end of table.

Key:

-- = not applicable or not required.
cm = centimeters.
cm^2 = square centimeters.
cm^2/s = square centimeters per second.
g/cm^3 = grams per cubic centimeter.
g/mol = grams per mole.
L/mol-day = liters per mole per day.
meq/100g = milliequivalents per 100 grams of dry soil.
µg/g = micrograms per gram.
mg/kg = milligrams per kilogram.
µg/mL = micrograms per milliliter.

RRTSL025_WPD

OUA 0021566

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*****************************************************************************************************
*****                                                                                               *****
***** SESOIL-84 :  SEASONAL CYCLES OF WATER, SEDIMENT, AND POLLUTANTS IN SOIL ENVIRONMENTS          *****
*****                                                                                               *****
***** DEVELOPERS:  M. BONAZOUNTAS,ARTHUR D. LITTLE INC.  ,(617)864-5770,X5871                      *****
*****              J. WAGNER     ,DIS/ADLPIPE, INC.      ,(617)492-1991,X5820                     *****
*****                                                                                               *****
***** MODIFIED EXTENSIVELY BY:                                                                     *****
***** D.M. HETRICK                                                                                 *****
***** OAK RIDGE NATIONAL LABORATORY                                                                *****
***** (615) 576-7556                                                                               *****
***** VERSION    :  SEPTEMBER 1986                                                                 *****
*****                                                                                               *****
*****************************************************************************************************
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****** MONTHLY SESOIL MODEL OPERATION ******
MONTHLY SITE SPECIFIC SIMULATION

REGION : Ft. Richardson: OU-A RRTSL
SOIL TYPE : Sand
COMPOUND : Naphthalene
WASHLOAD DATA :
APPLICATION AREA: AP3598, AP3603, AP3602; 5 to 20ft

GENERAL INPUT PARAMETERS

-- SOIL INPUT PARAMETERS --

SOIL DENSITY (G/CM**3):	1.70
INTRINSIC PERMEABILITY (CM**2):	.500E-08
DISCONNECTEDNESS INDEX (-):	4.00
POROSITY (-):	.290
ORGANIC CARBON CONTENT (%):	.100
CATION EXCHANGE CAPACITY (MILLI EQ./100G DRY SOIL):	.000
FREUNDLICH EXPONENT (-):	1.00

1

-- CHEMICAL INPUT PARAMETERS --

SOLUBILITY (UG/ML):	31.7
DIFFUSION COEFFICIENT IN AIR (CM**2/SEC):	.100E-02
HENRYS LAW CONSTANT (M**3-ATM/MOLE):	.115E-02
ADSORPTION COEFFICIENT ON ORGANIC CARBON(KOC):	.130E+04
ADSORPTION COEFFICIENT ON SOIL (K):	.000
MOLECULAR WEIGHT (G/MOL):	128.
VALENCE (-):	.000
NEUTRAL HYDROLYSIS CONSTANT (/DAY):	.000
BASE HYDROLYSIS CONSTANT (L/MOL-DAY):	.000
ACID HYDROLYSIS CONSTANT (L/MOL-DAY):	.000
DEGRADATION RATE IN MOISTURE (/DAY):	.000
DEGRADATION RATE ON SOIL (/DAY):	.000
LIGAND-POLLUTANT STABILITY CONSTANT (-):	.000
NO. MOLES LIGAND/MOLE POLLUTANT (-):	.000
LIGAND MOLECULAR WEIGHT (G/MOL):	.000

-- APPLICATION INPUT PARAMETERS --

NUMBER OF SOIL LAYERS:	4			
YEARS TO BE SIMULATED:	90			
AREA (CM**2):	0.120E+08			
APPLICATION AREA LATITUDE (DEG.):	61.1			
SPILL (1) OR STEADY APPLICATION (0):	1			
DEPTHS (CM):	0.58E+03	30.	0.10E+04	0.10E+04
NUMBER OF SUBLAYERS/LAYER	1	1	10	10
PH (CM):	7.0	7.0	7.0	7.0
INTRINSIC PERMEABILITIES (CM**2):	0.00	0.00	0.00	0.00
KDEL RATIOS (-):	1.0	1.0	1.0	
KDES RATIOS (-):	1.0	1.0	1.0	
OC RATIOS (-):	1.0	1.0	1.0	
CEC RATIOS (-):	1.0	1.0	1.0	
FRN RATIOS(-):	1.0	1.0	1.0	
ADS RATIOS(-):	1.0	1.0	1.0	

YEAR - 1 MONTHLY INPUT PARAMETERS

-- CLIMATIC INPUT PARAMETERS --

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
TEMP. (DEG C)	1.390	-5.000	-11.200	-14.900	-9.500	-6.050	2.170	7.390	12.390	14.720	13.560	8.780
CLOUD CVR (FRAC.)	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500
REL. HUM.(FRAC.)	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500
ALBEDO (-)	0.180	0.320	0.480	0.510	0.480	0.420	0.210	0.150	0.150	0.150	0.150	0.150
EVAPOT. (CM/DAY)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PRECIP. (CM)	3.690	1.350	3.150	2.030	1.170	0.990	0.660	0.790	3.450	4.060	7.210	6.530
M.TIME RAIN(DAYS)	0.430	0.500	0.430	0.480	0.370	0.310	0.310	0.320	0.380	0.470	0.590	0.420
M. STORM NO. (-)	2.170	2.170	1.520	1.410	1.040	0.910	1.180	1.520	3.320	4.240	4.180	2.000
M. SEASON (DAYS)	30.400	30.400	30.400	30.400	30.400	30.400	30.400	30.400	30.400	30.400	30.400	30.400

-- POLLUTANT INPUT PARAMETERS --

POL. INP-1 (UG/CM**2)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TRNSFORMD-1 (UG/CM**2)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SINKS-1 (UG/CM**2)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LIG.INPUT-1 (UG/CM**2)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
VOLATILIZATION MULT.-1	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
SURFACE RUNOFF MULT.	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
POL. IN RAIN (FRAC-SL)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

POL. INP-2 (UG/CM**2)	6.45E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TRNSFORMD-2 (UG/CM**2)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SINKS-2 (UG/CM**2)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LIG.INPUT-2 (UG/CM**2)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
VOLATILIZATION MULT.-2	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00

POL. INP-3 (UG/CM**2)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TRNSFORMD-3 (UG/CM**2)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SINKS-3 (UG/CM**2)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LIG.INPUT-3 (UG/CM**2)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
VOLATILIZATION MULT.-3	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00

POL. INP-L (UG/CM**2)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TRNSFORMD-L (UG/CM**2)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SINKS-L (UG/CM**2)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LIG.INPUT-L (UG/CM**2)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
VOLATILIZATION MULT.-L	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00

1

YEAR - 2 MONTHLY INPUT PARAMETERS

-- CLIMATIC INPUT PARAMETERS ARE SAME AS LAST YEAR

-- POLLUTANT INPUT PARAMETERS --

POL. INP-1 (UG/CM**2)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TRNSFORMD-1 (UG/CM**2)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SINKS-1 (UG/CM**2)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LIG.INPUT-1 (UG/CM**2)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
VOLATILIZATION MULT.-1	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
SURFACE RUNOFF MULT.	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
POL. IN RAIN (FRAC-SL)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

POL. INP-2 (UG/CM**2)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TRNSFORMD-2 (UG/CM**2)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SINKS-2 (UG/CM**2)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LIG.INPUT-2 (UG/CM**2)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
VOLATILIZATION MULT.-2	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00

POL. INP-3 (UG/CM**2)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TRNSFORMD-3 (UG/CM**2)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SINKS-3 (UG/CM**2)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LIG.INPUT-3 (UG/CM**2)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
VOLATILIZATION MULT.-3	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00

POL. INP-L (UG/CM**2)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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 TRNSFORMD-L (UG/CM**2) 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00
 SINKS-L (UG/CM**2)     0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00
 LIG.INPUT-L (UG/CM**2) 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00
 VOLATILIZATION MULT.-L 1.00E+00 1.00E+00 1.00E+00 1.00E+00 1.00E+00 1.00E+00 1.00E+00 1.00E+00 1.00E+00 1.00E+00 1.00E+00 1.00E+00
1
      YEAR - 3    MONTHLY INPUT PARAMETERS
      ========    ========================

      -- CLIMATIC INPUT PARAMETERS ARE SAME AS LAST YEAR

      -- POLLUTANT INPUT PARAMETERS ARE SAME AS LAST YEAR
1
.
.       (etc.......)
.
1
      YEAR -90    MONTHLY INPUT PARAMETERS
      ========    ========================

      -- CLIMATIC INPUT PARAMETERS ARE SAME AS LAST YEAR

      -- POLLUTANT INPUT PARAMETERS ARE SAME AS LAST YEAR
1



      YEAR - 1    MONTHLY RESULTS (OUTPUT)
      ========    ========================


      -- HYDROLOGIC CYCLE COMPONENTS --
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	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
MOIS. IN L1 (%)	6.424	6.395	6.946	6.975	6.714	6.279	5.525	4.945	5.061	5.177	5.989	6.627
MOIS. BELOW L1 (%)	6.424	6.395	6.946	6.975	6.714	6.279	5.525	4.945	5.061	5.177	5.989	6.627
PRECIPATION (CM)	3.712	1.401	3.158	2.012	1.170	1.038	0.692	0.822	3.426	4.079	7.188	6.511
NET INFILT. (CM)	3.708	1.401	3.123	2.009	1.169	1.037	0.692	0.822	3.426	4.079	7.188	6.438
EVAPOTRANS. (CM)	0.510	0.304	0.304	0.304	0.304	0.731	1.326	1.323	2.203	2.694	3.451	2.464
MOIS. RETEN (CM)	1.394	-0.063	1.204	0.063	-0.570	-0.950	-1.647	-1.267	0.253	0.254	1.774	1.394
SUR. RUNOFF (CM)	0.000	0.000	0.035	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.073
GRW. RUNOFF (CM)	1.805	1.160	1.615	1.642	1.435	1.257	1.013	0.767	0.970	1.132	1.963	2.580
YIELD (CM)	1.808	1.160	1.650	1.644	1.436	1.257	1.013	0.767	0.970	1.132	1.963	2.652
PAU/MPA (GZU)	1.006	1.038	1.003	0.991	1.000	1.049	1.048	1.041	0.993	1.005	0.997	0.997
PA/MPA (GZ)	1.006	1.038	1.003	0.991	1.000	1.049	1.048	1.041	0.993	1.005	0.997	0.997

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1                                   -- POLLUTANT MASS INPUT TO COLUMN (UG) --
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	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
PRECIP.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
LOAD UPPER	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
LOAD ZONE 2	7.740E+09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
LOAD ZONE 3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
LOAD LOWER	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
TOTAL INPUT	7.740E+09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

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0          -- POLLUTANT MASS DISTRIBUTION IN COLUMN (UG) -- NOTE: IF COMPONENT IS ZERO EACH MONTH, IT IS NOT PRINTED
           ---------------------------------------------------------------------------------------------------------


      UPPER SOIL ZONE:

           SUBLAYER  1
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VOLATILIZED	9.795E+01	6.123E+02	1.140E+03	1.653E+03	2.244E+03	2.977E+03	3.978E+03	5.052E+03	5.663E+03	6.197E+03	6.105E+03	6.099E+03
IN SOIL MOI	5.594E+05	1.736E+06	3.077E+06	4.264E+06	5.264E+06	6.071E+06	6.457E+06	6.837E+06	8.010E+06	9.181E+06	1.157E+07	1.376E+07
ADS ON SOIL	1.925E+07	6.001E+07	9.790E+07	1.351E+08	1.733E+08	2.137E+08	2.583E+08	3.056E+08	3.498E+08	3.919E+08	4.270E+08	4.589E+08
IN SOIL AIR	9.994E+04	3.196E+05	5.210E+05	7.104E+05	9.098E+05	1.134E+06	1.392E+06	1.654E+06	1.850E+06	2.028E+06	2.141E+06	2.269E+06

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      SOIL ZONE 2:

           SUBLAYER  1
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DIFFUSED UP	2.130E+07	4.224E+07	3.952E+07	3.872E+07	3.958E+07	4.170E+07	4.554E+07	4.824E+07	4.627E+07	4.446E+07	3.937E+07	3.608E+07
IN SOIL MOI	2.169E+08	2.148E+08	2.315E+08	2.313E+08	2.217E+08	2.066E+08	1.813E+08	1.616E+08	1.643E+08	1.670E+08	1.916E+08	2.104E+08
ADS ON SOIL	7.463E+09	7.422E+09	7.366E+09	7.328E+09	7.299E+09	7.272E+09	7.251E+09	7.223E+09	7.175E+09	7.130E+09	7.070E+09	7.017E+09
IN SOIL AIR	3.875E+07	3.953E+07	3.920E+07	3.854E+07	3.832E+07	3.860E+07	3.907E+07	3.910E+07	3.795E+07	3.689E+07	3.545E+07	3.470E+07

SOIL ZONE 3:

SUBLAYER 1

SUBLAYER 2

SUBLAYER 3

SUBLAYER 4

SUBLAYER 5

SUBLAYER 6

SUBLAYER 7

SUBLAYER 8

SUBLAYER 9

SUBLAYER 10

LOWER SOIL ZONE:

SUBLAYER 1

SUBLAYER 2

SUBLAYER 3

SUBLAYER 4

SUBLAYER 5

SUBLAYER 6

SUBLAYER 7

SUBLAYER 8

SUBLAYER 9

SUBLAYER 10

-- POLLUTANT CONCENTRATIONS (UG/ML) OR (UG/G) -- NOTE: IF CONCENTRATIONS ARE ZERO FOR EACH MONTH, THEY ARE NOT PRINTED --

UPPER SOIL ZONE:

SUBLAYER 1

MOISTURE	1.251E-03	3.901E-03	6.365E-03	8.783E-03	1.127E-02	1.389E-02	1.679E-02	1.987E-02	2.274E-02	2.548E-02	2.776E-02	2.984E-02
%SOLUBILITY	3.947E-03	1.231E-02	2.008E-02	2.771E-02	3.554E-02	4.382E-02	5.297E-02	6.267E-02	7.174E-02	8.038E-02	8.757E-02	9.412E-02
ADSORBED	1.627E-03	5.072E-03	8.274E-03	1.142E-02	1.465E-02	1.806E-02	2.183E-02	2.583E-02	2.956E-02	3.312E-02	3.609E-02	3.879E-02
SOIL AIR	6.361E-05	2.031E-04	3.394E-04	4.634E-04	5.866E-04	7.173E-04	8.517E-04	9.881E-04	1.110E-03	1.223E-03	1.337E-03	1.457E-03

SOIL ZONE 2:

SUBLAYER 1

MOISTURE	9.380E+00	9.329E+00	9.259E+00	9.211E+00	9.174E+00	9.140E+00	9.114E+00	9.078E+00	9.019E+00	8.962E+00	8.886E+00	8.82[illegible]E+00

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 SOLUBILITY 2.959E+01 2.943E+01 2.921E+01 2.906E+01 2.894E+01 2.883E+01 2.875E+01 2.864E+01 2.845E+01 2.827E+01 2.803E+01 2.782E+01
ADSORBED    1.219E+01 1.213E+01 1.204E+01 1.197E+01 1.193E+01 1.188E+01 1.185E+01 1.180E+01 1.172E+01 1.165E+01 1.155E+01 1.147E+01
SOIL AIR    4.768E-01 4.857E-01 4.937E-01 4.860E-01 4.777E-01 4.719E-01 4.623E-01 4.515E-01 4.403E-01 4.302E-01 4.280E-01 4.308E-01

     SOIL ZONE 3:

     LOWER SOIL ZONE:


POL DEP CM  5.964E+02 5.970E+02 5.982E+02 5.991E+02 5.996E+02 6.001E+02 6.004E+02 6.008E+02 6.020E+02 6.035E+02 6.062E+02 6.086E+02

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                           ==========================

       -- TOTAL INPUTS (UG) --
UPPER SOIL ZONE              0.000E+00
SOIL ZONE 2                  7.740E+09
SOIL ZONE 3                  0.000E+00
LOWER SOIL ZONE              0.000E+00

          -- HYDROLOGIC CYCLE COMPONENTS --
AVERAGE SOIL MOISTURE ZONE 1 (%)                 6.088
AVERAGE SOIL MOISTURE BELOW ZONE 1 (%)           6.088
TOTAL PRECIPITATION (CM)                        35.209
TOTAL INFILTRATION (CM)                         35.094
TOTAL EVAPOTRANSPIRATION (CM)                   15.917
TOTAL SURFACE RUNOFF (CM)                        0.108
TOTAL GRW RUNOFF (CM)                           17.338
TOTAL MOISTURE RETENTION (CM)                    1.838
TOTAL YIELD (CM)                                17.454
0          -- POLLUTANT MASS DISTRIBUTION IN COLUMN (UG) -- NOTE: IF COMPONENT IS ZERO EACH MONTH, IT IS NOT PRINTED
           ---------------------------------------------------------------------------------------------------------
FOR FINAL MASS IN SOIL MOI., ADS. ON SOIL, SOIL AIR, IMMOBIL CEC, COMPLEXED, AND PURE PHASE FOR EACH SUBLAYER, SEE ABOVE (MONTH SEP)
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     UPPER SOIL ZONE:

          SUBLAYER  1

               TOTAL VOLATILIZED                4.182E+04

     SOIL ZONE 2:

          SUBLAYER  1

               TOTAL DIFFUSED (UP)              4.830E+08

     SOIL ZONE 3:

          SUBLAYER  1

          SUBLAYER  2

          SUBLAYER  3

          SUBLAYER  4

          SUBLAYER  5

          SUBLAYER  6

          SUBLAYER  7

          SUBLAYER  8

          SUBLAYER  9

          SUBLAYER 10

     LOWER SOIL ZONE:

          SUBLAYER  1

          SUBLAYER  2

          SUBLAYER  3

          SUBLAYER  4

          SUBLAYER  5

          SUBLAYER  6
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SUBLAYER 7

SUBLAYER 8

SUBLAYER 9

SUBLAYER 10

1 -- AVERAGE POLLUTANT CONCENTRATIONS -- NOTE: ONLY NON-ZERO VALUES ARE PRINTED --

UPPER SOIL ZONE:

SUBLAYER 1

SOIL MOISTURE (UG/ML)	1.566E-02
ADSORBED SOIL (UG/G)	2.036E-02
SOIL AIR (UG/ML)	7.784E-04

SOIL ZONE 2:

SUBLAYER 1

SOIL MOISTURE (UG/ML)	9.114E+00
ADSORBED SOIL (UG/G)	1.185E+01
SOIL AIR (UG/ML)	4.612E-01

SOIL ZONE 3:

LOWER SOIL ZONE:

MAX. POLL. DEPTH (M) 6.086E+00

1

1

YEAR -10 MONTHLY RESULTS (OUTPUT)

-- HYDROLOGIC CYCLE COMPONENTS --

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
MOIS. IN L1 (%)	6.946	6.772	7.207	7.178	6.859	6.366	5.583	4.974	5.090	5.206	6.018	6.656
MOIS. BELOW L1 (%)	6.946	6.772	7.207	7.178	6.859	6.366	5.583	4.974	5.090	5.206	6.018	6.656
PRECIPATION (CM)	3.677	1.383	3.162	2.085	1.171	0.987	0.701	0.794	3.476	4.137	7.259	6.575
NET INFILT. (CM)	3.674	1.383	3.126	2.082	1.170	0.986	0.701	0.794	3.476	4.137	7.259	6.501
EVAPOTRANS. (CM)	0.510	0.304	0.304	0.304	0.304	0.735	1.355	1.339	2.230	2.725	3.483	2.482
MOIS. RETEN (CM)	0.697	-0.380	0.950	-0.063	-0.697	-1.077	-1.711	-1.331	0.253	0.254	1.774	1.394
SUR. RUNOFF (CM)	0.000	0.000	0.036	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.074
GRW. RUNOFF (CM)	2.467	1.459	1.871	1.841	1.563	1.328	1.056	0.785	0.992	1.158	2.001	2.625
YIELD (CM)	2.470	1.459	1.907	1.844	1.564	1.329	1.056	0.785	0.992	1.158	2.001	2.699
PAU/MPA (GZU)	0.996	1.024	1.004	1.027	1.001	0.997	1.061	1.005	1.007	1.019	1.007	1.007
PA/MPA (GZ)	0.996	1.024	1.004	1.027	1.001	0.997	1.061	1.005	1.007	1.019	1.007	1.007

1 -- POLLUTANT MASS INPUT TO COLUMN (UG) --

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
PRECIP.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
LOAD UPPER	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
LOAD ZONE 2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
LOAD ZONE 3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
LOAD LOWER	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
TOTAL INPUT	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

0 -- POLLUTANT MASS DISTRIBUTION IN COLUMN (UG) -- NOTE: IF COMPONENT IS ZERO EACH MONTH, IT IS NOT PRINTED

UPPER SOIL ZONE:

SUBLAYER 1

VOLATILIZED	1.613E+04	1.695E+04	1.621E+04	1.609E+04	1.668E+04	1.783E+04	1.968E+04	2.108E+04	2.034E+04	1.963E+04	1.743E+04	1.5[illegible]4
IN SOIL MOI	3.709E+07	3.616E+07	3.835E+07	3.817E+07	3.651E+07	3.395E+07	2.987E+07	2.669E+07	2.726E+07	2.781E+07	3.191E+07	3.5[illegible]7
ADS ON SOIL	1.180E+09	1.180E+09	1.176E+09	1.175E+09	1.176E+09	1.179E+09	1.183E+09	1.186E+09	1.184E+09	1.181E+09	1.172E+09	1.1[illegible]9

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 N SOIL AIR 5.986E+06 6.181E+06 6.184E+06 6.123E+06 6.136E+06 6.232E+06 6.356E+06 6.412E+06 6.252E+06 6.102E+06 5.870E+06 5.751E+06

     SOIL ZONE 2:

          SUBLAYER  1

DIFFUSED UP 7.630E+05 7.846E+05 7.367E+05 7.156E+05 7.336E+05 7.811E+05 8.623E+05 9.262E+05 8.833E+05 8.280E+05 6.988E+05 6.007E+05
IN SOIL MOI 6.531E+06 6.331E+06 6.586E+06 6.480E+06 6.173E+06 5.730E+06 5.051E+06 4.522E+06 4.538E+06 4.528E+06 4.962E+06 5.234E+06
ADS ON SOIL 2.078E+08 2.066E+08 2.020E+08 1.995E+08 1.989E+08 1.989E+08 2.000E+08 2.009E+08 1.971E+08 1.922E+08 1.822E+08 1.738E+08
IN SOIL AIR 1.054E+06 1.082E+06 1.062E+06 1.039E+06 1.038E+06 1.052E+06 1.075E+06 1.086E+06 1.041E+06 9.933E+05 9.126E+05 8.583E+05

     SOIL ZONE 3:

          SUBLAYER  1

DIFFUSED UP 2.416E+06 2.550E+06 2.437E+06 2.402E+06 2.475E+06 2.633E+06 2.894E+06 3.085E+06 2.957E+06 2.827E+06 2.479E+06 2.239E+06
IN SOIL MOI 1.896E+08 1.850E+08 1.950E+08 1.926E+08 1.833E+08 1.697E+08 1.488E+08 1.324E+08 1.339E+08 1.351E+08 1.521E+08 1.642E+08
ADS ON SOIL 6.032E+09 6.037E+09 5.978E+09 5.931E+09 5.907E+09 5.892E+09 5.890E+09 5.884E+09 5.815E+09 5.736E+09 5.586E+09 5.452E+09
IN SOIL AIR 3.060E+07 3.162E+07 3.144E+07 3.090E+07 3.081E+07 3.116E+07 3.166E+07 3.181E+07 3.072E+07 2.964E+07 2.798E+07 2.693E+07

          SUBLAYER  2

IN SOIL MOI 0.000E+00 0.000E+00 1.733E+06 3.417E+06 4.288E+06 4.786E+06 4.730E+06 4.684E+06 6.442E+06 8.565E+06 1.378E+07 1.912E+07
ADS ON SOIL 0.000E+00 0.000E+00 5.314E+07 1.052E+08 1.382E+08 1.661E+08 1.872E+08 2.081E+08 2.797E+08 3.636E+08 5.059E+08 6.350E+08
IN SOIL AIR 0.000E+00 0.000E+00 2.794E+05 5.481E+05 7.207E+05 8.786E+05 1.006E+06 1.125E+06 1.478E+06 1.879E+06 2.534E+06 3.136E+06

          SUBLAYER  3

          SUBLAYER  4

          SUBLAYER  5

          SUBLAYER  6

          SUBLAYER  7

          SUBLAYER  8

          SUBLAYER  9

          SUBLAYER 10

     LOWER SOIL ZONE:

          SUBLAYER  1

          SUBLAYER  2

          SUBLAYER  3

          SUBLAYER  4

          SUBLAYER  5

          SUBLAYER  6

          SUBLAYER  7

          SUBLAYER  8

          SUBLAYER  9

          SUBLAYER 10


     -- POLLUTANT CONCENTRATIONS (UG/ML) OR (UG/G) -- NOTE: IF CONCENTRATIONS ARE ZERO FOR EACH MONTH, THEY ARE NOT PRINTED --
     ---------------------------------------------------------------------------------------------------------------------------


     UPPER SOIL ZONE:

          SUBLAYER  1

MOISTURE    7.672E-02 7.673E-02 7.646E-02 7.640E-02 7.648E-02 7.662E-02 7.688E-02 7.710E-02 7.695E-02 7.677E-02 7.620E-02 7.570E-02
%SOLUBILITY 2.420E-01 2.420E-01 2.412E-01 2.410E-01 2.413E-01 2.417E-01 2.425E-01 2.432E-01 2.427E-01 2.422E-01 2.404E-01 2.388E-01
ADSORBED    9.973E-02 9.975E-02 9.940E-02 9.932E-02 9.942E-02 9.961E-02 9.995E-02 1.002E-01 1.000E-01 9.980E-02 9.905E-02 9.841E-02
SOIL AIR    3.900E-03 3.995E-03 4.077E-03 4.031E-03 3.982E-03 3.956E-03 3.900E-03 3.834E-03 3.757E-03 3.685E-03 3.670E-03 3.698E-03

     SOIL ZONE 2:

          SUBLAYER  1

MOISTURE    2.612E-01 2.597E-01 2.539E-01 2.508E-01 2.500E-01 2.500E-01 2.513E-01 2.526E-01 2.477E-01 2.416E-01 2.290E-01 2.184E-01
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 SOLUBILITY 8.239E-01 8.193E-01 8.008E-01 7.910E-01 7.886E-01 7.888E-01 7.928E-01 7.968E-01 7.813E-01 7.621E-01 7.225E-01 6.890E-01
ADSORBED    3.395E-01 3.376E-01 3.300E-01 3.260E-01 3.250E-01 3.251E-01 3.267E-01 3.283E-01 3.220E-01 3.141E-01 2.978E-01 2.84
SOIL AIR    1.328E-02 1.352E-02 1.354E-02 1.323E-02 1.302E-02 1.291E-02 1.275E-02 1.256E-02 1.209E-02 1.160E-02 1.103E-02 1.0

     SOIL ZONE 3:

          SUBLAYER  1

MOISTURE    2.261E+00 2.263E+00 2.241E+00 2.223E+00 2.214E+00 2.208E+00 2.208E+00 2.205E+00 2.180E+00 2.150E+00 2.094E+00 2.044E+00
%SOLUBILITY 7.133E+00 7.139E+00 7.069E+00 7.012E+00 6.984E+00 6.967E+00 6.964E+00 6.957E+00 6.876E+00 6.782E+00 6.605E+00 6.447E+00
ADSORBED    2.939E+00 2.942E+00 2.913E+00 2.890E+00 2.878E+00 2.871E+00 2.870E+00 2.867E+00 2.834E+00 2.795E+00 2.722E+00 2.657E+00
SOIL AIR    1.149E-01 1.178E-01 1.195E-01 1.173E-01 1.153E-01 1.140E-01 1.120E-01 1.097E-01 1.064E-01 1.032E-01 1.008E-01 9.983E-02

          SUBLAYER  2

MOISTURE    0.000E+00 0.000E+00 1.992E-02 3.943E-02 5.179E-02 6.228E-02 7.018E-02 7.801E-02 1.048E-01 1.363E-01 1.896E-01 2.380E-01
%SOLUBILITY 0.000E+00 0.000E+00 6.283E-02 1.244E-01 1.634E-01 1.965E-01 2.214E-01 2.461E-01 3.307E-01 4.299E-01 5.982E-01 7.508E-01
ADSORBED    0.000E+00 0.000E+00 2.589E-02 5.126E-02 6.732E-02 8.096E-02 9.123E-02 1.014E-01 1.363E-01 1.772E-01 2.465E-01 3.094E-01
SOIL AIR    0.000E+00 0.000E+00 1.062E-03 2.080E-03 2.696E-03 3.216E-03 3.559E-03 3.880E-03 5.119E-03 6.541E-03 9.133E-03 1.163E-02

     LOWER SOIL ZONE:

POL DEP CM  7.097E+02 7.103E+02 7.114E+02 7.123E+02 7.129E+02 7.134E+02 7.137E+02 7.141E+02 7.151E+02 7.164E+02 7.186E+02 7.207E+02


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                           ================================

       -- TOTAL INPUTS (UG) --
UPPER SOIL ZONE              0.000E+00
SOIL ZONE 2                  0.000E+00
SOIL ZONE 3                  0.000E+00
LOWER SOIL ZONE              0.000E+00

          -- HYDROLOGIC CYCLE COMPONENTS --
AVERAGE SOIL MOISTURE ZONE 1 (%)              6.238
AVERAGE SOIL MOISTURE BELOW ZONE 1 (%)        6.238
TOTAL PRECIPITATION (CM)                     35.405
TOTAL INFILTRATION (CM)                      35.287
TOTAL EVAPOTRANSPIRATION (CM)                16.076
TOTAL SURFACE RUNOFF (CM)                     0.109
TOTAL GRW RUNOFF (CM)                        19.148
TOTAL MOISTURE RETENTION (CM)                 0.064
TOTAL YIELD (CM)                             19.265
0         -- POLLUTANT MASS DISTRIBUTION IN COLUMN (UG) -- NOTE: IF COMPONENT IS ZERO EACH MONTH, IT IS NOT PRINTED
          ---------------------------------------------------------------------------------------------------------
FOR FINAL MASS IN SOIL MOI., ADS. ON SOIL, SOIL AIR, IMMOBIL CEC, COMPLEXED, AND PURE PHASE FOR EACH SUBLAYER, SEE ABOVE (MONTH SEP)
-------------------------------------------------------------------------------------------------------------------------------


     UPPER SOIL ZONE:

          SUBLAYER  1

               TOTAL VOLATILIZED                2.140E+05

     SOIL ZONE 2:

          SUBLAYER  1

               TOTAL DIFFUSED (UP)              9.314E+06

     SOIL ZONE 3:

          SUBLAYER  1

               TOTAL DIFFUSED (UP)              3.139E+07

          SUBLAYER  2

          SUBLAYER  3

          SUBLAYER  4

          SUBLAYER  5

          SUBLAYER  6

          SUBLAYER  7

          SUBLAYER  8

          SUBLAYER  9
```

SUBLAYER 10

LOWER SOIL ZONE:

SUBLAYER 1

SUBLAYER 2

SUBLAYER 3

SUBLAYER 4

SUBLAYER 5

SUBLAYER 6

SUBLAYER 7

SUBLAYER 8

SUBLAYER 9

SUBLAYER 10

1 -- AVERAGE POLLUTANT CONCENTRATIONS -- NOTE: ONLY NON-ZERO VALUES ARE PRINTED --

UPPER SOIL ZONE:

SUBLAYER 1

SOIL MOISTURE (UG/ML)	7.658E-02
ADSORBED SOIL (UG/G)	9.956E-02
SOIL AIR (UG/ML)	3.874E-03

SOIL ZONE 2:

SUBLAYER 1

SOIL MOISTURE (UG/ML)	2.472E-01
ADSORBED SOIL (UG/G)	3.213E-01
SOIL AIR (UG/ML)	1.252E-02

SOIL ZONE 3:

SUBLAYER 1

SOIL MOISTURE (UG/ML)	2.191E+00
ADSORBED SOIL (UG/G)	2.848E+00
SOIL AIR (UG/ML)	1.109E-01

SUBLAYER 2

SOIL MOISTURE (UG/ML)	8.253E-02
ADSORBED SOIL (UG/G)	1.073E-01
SOIL AIR (UG/ML)	4.076E-03

LOWER SOIL ZONE:

MAX. POLL. DEPTH (M)	7.207E+00

1

YEAR -90 MONTHLY RESULTS (OUTPUT)

-- HYDROLOGIC CYCLE COMPONENTS --

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
MOIS. IN L1 (%)	6.946	6.772	7.207	7.178	6.859	6.366	5.583	4.974	5.090	5.206	6.018	6.656
MOIS. BELOW L1 (%)	6.946	6.772	7.207	7.178	6.859	6.366	5.583	4.974	5.090	5.206	6.018	6.656
PRECIPATION (CM)	3.677	1.383	3.162	2.085	1.171	0.987	0.701	0.794	3.476	4.137	7.259	6.575
NET INFILT. (CM)	3.674	1.383	3.126	2.082	1.170	0.986	0.701	0.794	3.476	4.137	7.259	6.501
EVAPOTRANS. (CM)	0.510	0.304	0.304	0.304	0.304	0.735	1.355	1.339	2.230	2.725	3.483	2.482
MOIS. RETEN (CM)	0.697	-0.380	0.950	-0.063	-0.697	-1.077	-1.711	-1.331	0.253	0.254	1.774	1.394
SUR. RUNOFF (CM)	0.000	0.000	0.036	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.074
GRW. RUNOFF (CM)	2.467	1.459	1.871	1.841	1.563	1.328	1.056	0.785	0.992	1.158	2.001	2.625
YIELD (CM)	2.470	1.459	1.907	1.844	1.564	1.329	1.056	0.785	0.992	1.158	2.001	2.699

PAU/MPA (GZU)	0.996	1.024	1.004	1.027	1.001	0.997	1.061	1.005	1.007	1.019	1.007	1.007
PA/MPA (GZ)	0.996	1.024	1.004	1.027	1.001	0.997	1.061	1.005	1.007	1.019	1.007	1.007

1 -- POLLUTANT MASS INPUT TO COLUMN (UG) --

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
PRECIP.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
LOAD UPPER	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
LOAD ZONE 2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
LOAD ZONE 3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
LOAD LOWER	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
TOTAL INPUT	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

0 -- POLLUTANT MASS DISTRIBUTION IN COLUMN (UG) -- NOTE: IF COMPONENT IS ZERO EACH MONTH, IT IS NOT PRINTED

UPPER SOIL ZONE:

SUBLAYER 1

VOLATILIZED	2.374E+03	2.493E+03	2.382E+03	2.363E+03	2.448E+03	2.615E+03	2.885E+03	3.087E+03	2.976E+03	2.870E+03	2.547E+03	2.334E+03
IN SOIL MOI	5.456E+06	5.317E+06	5.634E+06	5.604E+06	5.356E+06	4.978E+06	4.377E+06	3.906E+06	3.986E+06	4.065E+06	4.660E+06	5.118E+06
ADS ON SOIL	1.736E+08	1.735E+08	1.728E+08	1.725E+08	1.726E+08	1.728E+08	1.733E+08	1.736E+08	1.731E+08	1.726E+08	1.711E+08	1.699E+08
IN SOIL AIR	8.806E+05	9.087E+05	9.086E+05	8.989E+05	9.003E+05	9.138E+05	9.311E+05	9.385E+05	9.143E+05	8.917E+05	8.571E+05	8.393E+05

SOIL ZONE 2:

SUBLAYER 1

DIFFUSED UP	2.978E+03	3.121E+03	2.979E+03	2.952E+03	3.049E+03	3.248E+03	3.579E+03	3.833E+03	3.701E+03	3.579E+03	3.187E+03	2.929E+03
IN SOIL MOI	3.005E+05	2.928E+05	3.103E+05	3.086E+05	2.949E+05	2.740E+05	2.409E+05	2.150E+05	2.195E+05	2.238E+05	2.567E+05	2.819E+05
ADS ON SOIL	9.561E+06	9.555E+06	9.515E+06	9.500E+06	9.502E+06	9.512E+06	9.537E+06	9.555E+06	9.530E+06	9.502E+06	9.427E+06	9.360E+06
IN SOIL AIR	4.850E+04	5.004E+04	5.003E+04	4.950E+04	4.956E+04	5.030E+04	5.125E+04	5.166E+04	5.034E+04	4.910E+04	4.721E+04	4.623E+04

SOIL ZONE 3:

SUBLAYER 1

DIFFUSED UP	3.872E+03	4.062E+03	3.878E+03	3.846E+03	3.983E+03	4.256E+03	4.694E+03	5.022E+03	4.842E+03	4.668E+03	4.140E+03	3.7
IN SOIL MOI	1.275E+06	1.242E+06	1.316E+06	1.309E+06	1.251E+06	1.162E+06	1.022E+06	9.123E+05	9.311E+05	9.493E+05	1.089E+06	1.1
ADS ON SOIL	4.058E+07	4.054E+07	4.037E+07	4.030E+07	4.031E+07	4.036E+07	4.046E+07	4.053E+07	4.043E+07	4.030E+07	3.998E+07	3.970E+07
IN SOIL AIR	2.058E+05	2.123E+05	2.123E+05	2.100E+05	2.103E+05	2.134E+05	2.175E+05	2.192E+05	2.136E+05	2.083E+05	2.002E+05	1.960E+05

SUBLAYER 2

DIFFUSED UP	6.217E+03	6.520E+03	6.221E+03	6.163E+03	6.375E+03	6.804E+03	7.500E+03	8.025E+03	7.731E+03	7.445E+03	6.591E+03	6.022E+03
IN SOIL MOI	1.705E+06	1.661E+06	1.759E+06	1.748E+06	1.671E+06	1.552E+06	1.364E+06	1.218E+06	1.242E+06	1.266E+06	1.451E+06	1.592E+06
ADS ON SOIL	5.424E+07	5.419E+07	5.394E+07	5.383E+07	5.383E+07	5.388E+07	5.401E+07	5.411E+07	5.395E+07	5.376E+07	5.329E+07	5.286E+07
IN SOIL AIR	2.751E+05	2.838E+05	2.836E+05	2.805E+05	2.808E+05	2.849E+05	2.903E+05	2.926E+05	2.850E+05	2.778E+05	2.669E+05	2.611E+05

SUBLAYER 3

DIFFUSED UP	1.226E+04	1.284E+04	1.224E+04	1.211E+04	1.252E+04	1.336E+04	1.472E+04	1.574E+04	1.515E+04	1.457E+04	1.287E+04	1.174E+04
IN SOIL MOI	2.550E+06	2.483E+06	2.628E+06	2.611E+06	2.494E+06	2.316E+06	2.036E+06	1.817E+06	1.852E+06	1.886E+06	2.158E+06	2.364E+06
ADS ON SOIL	8.115E+07	8.105E+07	8.060E+07	8.040E+07	8.037E+07	8.042E+07	8.060E+07	8.073E+07	8.043E+07	8.008E+07	7.925E+07	7.850E+07
IN SOIL AIR	4.116E+05	4.244E+05	4.238E+05	4.189E+05	4.192E+05	4.253E+05	4.332E+05	4.365E+05	4.248E+05	4.138E+05	3.969E+05	3.877E+05

SUBLAYER 4

DIFFUSED UP	2.612E+04	2.734E+04	2.605E+04	2.576E+04	2.662E+04	2.840E+04	3.129E+04	3.345E+04	3.219E+04	3.095E+04	2.733E+04	2.490E+04
IN SOIL MOI	4.352E+06	4.236E+06	4.479E+06	4.447E+06	4.246E+06	3.941E+06	3.463E+06	3.090E+06	3.148E+06	3.203E+06	3.658E+06	4.001E+06
ADS ON SOIL	1.385E+08	1.382E+08	1.374E+08	1.369E+08	1.368E+08	1.368E+08	1.371E+08	1.373E+08	1.367E+08	1.360E+08	1.343E+08	1.328E+08
IN SOIL AIR	7.025E+05	7.239E+05	7.223E+05	7.133E+05	7.136E+05	7.236E+05	7.369E+05	7.423E+05	7.220E+05	7.026E+05	6.728E+05	6.561E+05

SUBLAYER 5

DIFFUSED UP	5.182E+04	5.426E+04	5.171E+04	5.117E+04	5.289E+04	5.641E+04	6.215E+04	6.645E+04	6.396E+04	6.152E+04	5.437E+04	4.958E+04
IN SOIL MOI	7.928E+06	7.714E+06	8.154E+06	8.093E+06	7.725E+06	7.169E+06	6.299E+06	5.619E+06	5.723E+06	5.820E+06	6.644E+06	7.263E+06
ADS ON SOIL	2.523E+08	2.518E+08	2.501E+08	2.492E+08	2.489E+08	2.489E+08	2.493E+08	2.497E+08	2.485E+08	2.471E+08	2.440E+08	2.412E+08
IN SOIL AIR	1.280E+06	1.318E+06	1.315E+06	1.298E+06	1.298E+06	1.316E+06	1.340E+06	1.350E+06	1.313E+06	1.277E+06	1.222E+06	1.191E+06

SUBLAYER 6

DIFFUSED UP	9.154E+04	9.591E+04	9.144E+04	9.051E+04	9.357E+04	9.981E+04	1.100E+05	1.176E+05	1.132E+05	1.090E+05	9.641E+04	8.805E+04
IN SOIL MOI	1.425E+07	1.386E+07	1.465E+07	1.454E+07	1.388E+07	1.288E+07	1.132E+07	1.009E+07	1.028E+07	1.046E+07	1.194E+07	1.306E+07
ADS ON SOIL	4.534E+08	4.524E+08	4.494E+08	4.478E+08	4.472E+08	4.472E+08	4.480E+08	4.485E+08	4.464E+08	4.440E+08	4.386E+08	4.336E+08
IN SOIL AIR	2.300E+06	2.369E+06	2.363E+06	2.333E+06	2.333E+06	2.365E+06	2.408E+06	2.425E+06	2.358E+06	2.294E+06	2.197E+06	2.141E+06

SUBLAYER 7

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 IFFUSED UP 1.338E+05 1.403E+05 1.339E+05 1.327E+05 1.373E+05 1.466E+05 1.615E+05 1.727E+05 1.665E+05 1.605E+05 1.424E+05 1.304E+05
 N SOIL MOI 2.349E+07 2.286E+07 2.418E+07 2.401E+07 2.292E+07 2.127E+07 1.869E+07 1.667E+07 1.699E+07 1.730E+07 1.978E+07 2.165E+07
ADS ON SOIL 7.474E+08 7.460E+08 7.415E+08 7.391E+08 7.384E+08 7.384E+08 7.397E+08 7.407E+08 7.377E+08 7.343E+08 7.263E+08 7.190E+08
IN SOIL AIR 3.791E+06 3.907E+06 3.899E+06 3.851E+06 3.852E+06 3.905E+06 3.976E+06 4.005E+06 3.897E+06 3.795E+06 3.638E+06 3.551E+06

          SUBLAYER  8

DIFFUSED UP 1.552E+05 1.630E+05 1.559E+05 1.547E+05 1.603E+05 1.712E+05 1.889E+05 2.021E+05 1.950E+05 1.884E+05 1.676E+05 1.541E+05
IN SOIL MOI 3.422E+07 3.332E+07 3.528E+07 3.505E+07 3.347E+07 3.107E+07 2.731E+07 2.436E+07 2.485E+07 2.533E+07 2.902E+07 3.182E+07
ADS ON SOIL 1.089E+09 1.087E+09 1.082E+09 1.079E+09 1.078E+09 1.079E+09 1.081E+09 1.083E+09 1.079E+09 1.075E+09 1.066E+09 1.057E+09
IN SOIL AIR 5.524E+06 5.695E+06 5.688E+06 5.622E+06 5.626E+06 5.705E+06 5.810E+06 5.853E+06 5.701E+06 5.557E+06 5.337E+06 5.219E+06

          SUBLAYER  9

DIFFUSED UP 1.307E+05 1.378E+05 1.321E+05 1.315E+05 1.366E+05 1.461E+05 1.614E+05 1.729E+05 1.672E+05 1.621E+05 1.449E+05 1.340E+05
IN SOIL MOI 4.329E+07 4.217E+07 4.470E+07 4.444E+07 4.247E+07 3.945E+07 3.468E+07 3.095E+07 3.161E+07 3.225E+07 3.703E+07 4.070E+07
ADS ON SOIL 1.377E+09 1.376E+09 1.371E+09 1.368E+09 1.368E+09 1.370E+09 1.373E+09 1.375E+09 1.372E+09 1.369E+09 1.360E+09 1.351E+09
IN SOIL AIR 6.987E+06 7.207E+06 7.207E+06 7.129E+06 7.138E+06 7.242E+06 7.378E+06 7.436E+06 7.249E+06 7.075E+06 6.811E+06 6.674E+06

          SUBLAYER 10

DIFFUSED UP 4.884E+04 5.222E+04 5.068E+04 5.115E+04 5.366E+04 5.787E+04 6.433E+04 6.929E+04 6.761E+04 6.643E+04 6.057E+04 5.736E+04
IN SOIL MOI 4.670E+07 4.554E+07 4.834E+07 4.812E+07 4.602E+07 4.278E+07 3.762E+07 3.360E+07 3.436E+07 3.511E+07 4.042E+07 4.454E+07
ADS ON SOIL 1.486E+09 1.486E+09 1.482E+09 1.482E+09 1.483E+09 1.485E+09 1.489E+09 1.493E+09 1.492E+09 1.491E+09 1.484E+09 1.479E+09
IN SOIL AIR 7.538E+06 7.783E+06 7.794E+06 7.719E+06 7.735E+06 7.853E+06 8.005E+06 8.072E+06 7.880E+06 7.702E+06 7.434E+06 7.304E+06

     LOWER SOIL ZONE:

          SUBLAYER  1

IN SOIL MOI 3.721E+07 3.658E+07 3.935E+07 3.960E+07 3.817E+07 3.572E+07 3.158E+07 2.833E+07 2.927E+07 3.028E+07 3.559E+07 4.005E+07
ADS ON SOIL 1.184E+09 1.194E+09 1.207E+09 1.219E+09 1.230E+09 1.240E+09 1.250E+09 1.259E+09 1.271E+09 1.285E+09 1.307E+09 1.330E+09
IN SOIL AIR 6.006E+06 6.252E+06 6.345E+06 6.352E+06 6.416E+06 6.559E+06 6.720E+06 6.806E+06 6.713E+06 6.642E+06 6.546E+06 6.568E+06

          SUBLAYER  2

          SUBLAYER  3

          SUBLAYER  4

          SUBLAYER  5

          SUBLAYER  6

          SUBLAYER  7

          SUBLAYER  8

          SUBLAYER  9

          SUBLAYER 10

     -- POLLUTANT CONCENTRATIONS (UG/ML) OR (UG/G) -- NOTE: IF CONCENTRATIONS ARE ZERO FOR EACH MONTH, THEY ARE NOT PRINTED --
     ---------------------------------------------------------------------------------------------------------------------------

     UPPER SOIL ZONE:

          SUBLAYER  1

MOISTURE    1.129E-02 1.128E-02 1.123E-02 1.122E-02 1.122E-02 1.123E-02 1.126E-02 1.128E-02 1.125E-02 1.122E-02 1.113E-02 1.105E-02
%SOLUBILITY 3.560E-02 3.559E-02 3.544E-02 3.539E-02 3.540E-02 3.544E-02 3.553E-02 3.560E-02 3.550E-02 3.539E-02 3.510E-02 3.485E-02
ADSORBED    1.467E-02 1.466E-02 1.460E-02 1.458E-02 1.459E-02 1.461E-02 1.464E-02 1.467E-02 1.463E-02 1.458E-02 1.446E-02 1.436E-02
SOIL AIR    5.737E-04 5.873E-04 5.990E-04 5.918E-04 5.842E-04 5.801E-04 5.713E-04 5.612E-04 5.494E-04 5.385E-04 5.359E-04 5.397E-04

     SOIL ZONE 2:

          SUBLAYER  1

MOISTURE    1.202E-02 1.201E-02 1.196E-02 1.194E-02 1.194E-02 1.196E-02 1.199E-02 1.201E-02 1.198E-02 1.194E-02 1.185E-02 1.176E-02
%SOLUBILITY 3.791E-02 3.789E-02 3.773E-02 3.767E-02 3.767E-02 3.771E-02 3.781E-02 3.788E-02 3.778E-02 3.768E-02 3.738E-02 3.711E-02
ADSORBED    1.562E-02 1.561E-02 1.555E-02 1.552E-02 1.553E-02 1.554E-02 1.558E-02 1.561E-02 1.557E-02 1.553E-02 1.540E-02 1.529E-02
SOIL AIR    6.109E-04 6.253E-04 6.377E-04 6.300E-04 6.218E-04 6.173E-04 6.080E-04 5.973E-04 5.848E-04 5.732E-04 5.706E-04 5.747E-04

     SOIL ZONE 3:

          SUBLAYER  1

MOISTURE    1.521E-02 1.520E-02 1.513E-02 1.511E-02 1.511E-02 1.513E-02 1.517E-02 1.519E-02 1.515E-02 1.511E-02 1.499E-02 1.488E-02
%SOLUBILITY 4.798E-02 4.794E-02 4.773E-02 4.766E-02 4.767E-02 4.772E-02 4.784E-02 4.793E-02 4.781E-02 4.765E-02 4.727E-02 4.694E-02
ADSORBED    1.977E-02 1.976E-02 1.967E-02 1.964E-02 1.964E-02 1.966E-02 1.971E-02 1.975E-02 1.970E-02 1.964E-02 1.948E-02 1.934E-02
SOIL AIR    7.731E-04 7.912E-04 8.069E-04 7.971E-04 7.868E-04 7.810E-04 7.692E-04 7.556E-04 7.399E-04 7.251E-04 7.217E-04 7.268E-04

          SUBLAYER  2
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MOISTURE	2.033E-02	2.031E-02	2.022E-02	2.018E-02	2.018E-02	2.019E-02	2.024E-02	2.028E-02	2.022E-02	2.015E-02	1.997E-02	1.981E-02
%SOLUBILITY	6.413E-02	6.408E-02	6.377E-02	6.365E-02	6.365E-02	6.370E-02	6.386E-02	6.398E-02	6.379E-02	6.356E-02	6.301E-02	6.2[illegible]
ADSORBED	2.643E-02	2.641E-02	2.628E-02	2.623E-02	2.623E-02	2.625E-02	2.632E-02	2.637E-02	2.629E-02	2.620E-02	2.597E-02	2.5[illegible]
SOIL AIR	1.033E-03	1.058E-03	1.078E-03	1.065E-03	1.051E-03	1.043E-03	1.027E-03	1.009E-03	9.872E-04	9.671E-04	9.619E-04	9.679E-04

SUBLAYER 3

MOISTURE	3.042E-02	3.038E-02	3.021E-02	3.014E-02	3.012E-02	3.014E-02	3.021E-02	3.026E-02	3.015E-02	3.002E-02	2.970E-02	2.942E-02
%SOLUBILITY	9.595E-02	9.583E-02	9.531E-02	9.507E-02	9.503E-02	9.508E-02	9.530E-02	9.546E-02	9.510E-02	9.469E-02	9.370E-02	9.281E-02
ADSORBED	3.954E-02	3.949E-02	3.928E-02	3.918E-02	3.916E-02	3.918E-02	3.927E-02	3.934E-02	3.919E-02	3.902E-02	3.861E-02	3.825E-02
SOIL AIR	1.546E-03	1.582E-03	1.611E-03	1.590E-03	1.568E-03	1.556E-03	1.532E-03	1.505E-03	1.472E-03	1.441E-03	1.431E-03	1.437E-03

SUBLAYER 4

MOISTURE	5.191E-02	5.182E-02	5.149E-02	5.132E-02	5.128E-02	5.129E-02	5.139E-02	5.146E-02	5.123E-02	5.096E-02	5.035E-02	4.980E-02
%SOLUBILITY	1.637E-01	1.635E-01	1.624E-01	1.619E-01	1.618E-01	1.618E-01	1.621E-01	1.623E-01	1.616E-01	1.608E-01	1.588E-01	1.571E-01
ADSORBED	6.748E-02	6.736E-02	6.693E-02	6.672E-02	6.666E-02	6.667E-02	6.681E-02	6.690E-02	6.660E-02	6.625E-02	6.546E-02	6.473E-02
SOIL AIR	2.639E-03	2.698E-03	2.745E-03	2.708E-03	2.670E-03	2.648E-03	2.607E-03	2.559E-03	2.501E-03	2.446E-03	2.425E-03	2.432E-03

SUBLAYER 5

MOISTURE	9.455E-02	9.436E-02	9.373E-02	9.340E-02	9.329E-02	9.329E-02	9.346E-02	9.358E-02	9.314E-02	9.262E-02	9.146E-02	9.039E-02
%SOLUBILITY	2.983E-01	2.977E-01	2.957E-01	2.946E-01	2.943E-01	2.943E-01	2.948E-01	2.952E-01	2.938E-01	2.922E-01	2.885E-01	2.851E-01
ADSORBED	1.229E-01	1.227E-01	1.218E-01	1.214E-01	1.213E-01	1.213E-01	1.215E-01	1.217E-01	1.211E-01	1.204E-01	1.189E-01	1.175E-01
SOIL AIR	4.806E-03	4.913E-03	4.998E-03	4.928E-03	4.858E-03	4.817E-03	4.741E-03	4.654E-03	4.547E-03	4.445E-03	4.405E-03	4.415E-03

SUBLAYER 6

MOISTURE	1.699E-01	1.696E-01	1.684E-01	1.678E-01	1.676E-01	1.676E-01	1.679E-01	1.681E-01	1.673E-01	1.664E-01	1.644E-01	1.625E-01
%SOLUBILITY	5.361E-01	5.350E-01	5.314E-01	5.295E-01	5.288E-01	5.288E-01	5.297E-01	5.303E-01	5.278E-01	5.250E-01	5.186E-01	5.127E-01
ADSORBED	2.209E-01	2.205E-01	2.190E-01	2.182E-01	2.179E-01	2.179E-01	2.183E-01	2.185E-01	2.175E-01	2.163E-01	2.137E-01	2.113E-01
SOIL AIR	8.638E-03	8.829E-03	8.982E-03	8.856E-03	8.728E-03	8.655E-03	8.517E-03	8.361E-03	8.169E-03	7.988E-03	7.917E-03	7.939E-03

SUBLAYER 7

MOISTURE	2.802E-01	2.796E-01	2.779E-01	2.770E-01	2.768E-01	2.768E-01	2.773E-01	2.776E-01	2.765E-01	2.752E-01	2.723E-01	2.695E-01
%SOLUBILITY	8.838E-01	8.821E-01	8.767E-01	8.740E-01	8.731E-01	8.731E-01	8.747E-01	8.758E-01	8.723E-01	8.682E-01	8.588E-01	8.501E-01
ADSORBED	3.642E-01	3.635E-01	3.613E-01	3.602E-01	3.598E-01	3.598E-01	3.605E-01	3.609E-01	3.595E-01	3.578E-01	3.539E-01	3.503E-01
SOIL AIR	1.424E-02	1.456E-02	1.482E-02	1.462E-02	1.441E-02	1.429E-02	1.406E-02	1.381E-02	1.350E-02	1.321E-02	1.311E-02	1.316E-02

SUBLAYER 8

MOISTURE	4.082E-01	4.076E-01	4.055E-01	4.045E-01	4.042E-01	4.044E-01	4.052E-01	4.058E-01	4.045E-01	4.031E-01	3.994E-01	3.9[illegible]1
%SOLUBILITY	1.288E+00	1.286E+00	1.279E+00	1.276E+00	1.275E+00	1.276E+00	1.278E+00	1.280E+00	1.276E+00	1.271E+00	1.260E+00	1.249E+00
ADSORBED	5.306E-01	5.299E-01	5.271E-01	5.258E-01	5.255E-01	5.257E-01	5.267E-01	5.275E-01	5.259E-01	5.240E-01	5.193E-01	5.149E-01
SOIL AIR	2.075E-02	2.122E-02	2.162E-02	2.134E-02	2.105E-02	2.088E-02	2.055E-02	2.018E-02	1.975E-02	1.935E-02	1.924E-02	1.935E-02

SUBLAYER 9

MOISTURE	5.162E-01	5.158E-01	5.138E-01	5.129E-01	5.129E-01	5.133E-01	5.146E-01	5.155E-01	5.144E-01	5.132E-01	5.097E-01	5.065E-01
%SOLUBILITY	1.629E+00	1.627E+00	1.621E+00	1.618E+00	1.618E+00	1.619E+00	1.623E+00	1.626E+00	1.623E+00	1.619E+00	1.608E+00	1.598E+00
ADSORBED	6.711E-01	6.706E-01	6.679E-01	6.668E-01	6.668E-01	6.673E-01	6.689E-01	6.701E-01	6.688E-01	6.672E-01	6.627E-01	6.585E-01
SOIL AIR	2.624E-02	2.686E-02	2.740E-02	2.706E-02	2.671E-02	2.651E-02	2.610E-02	2.564E-02	2.512E-02	2.463E-02	2.455E-02	2.474E-02

SUBLAYER 10

MOISTURE	5.570E-01	5.570E-01	5.556E-01	5.553E-01	5.558E-01	5.566E-01	5.583E-01	5.596E-01	5.591E-01	5.587E-01	5.564E-01	5.543E-01
%SOLUBILITY	1.757E+00	1.757E+00	1.753E+00	1.752E+00	1.753E+00	1.756E+00	1.761E+00	1.765E+00	1.764E+00	1.762E+00	1.755E+00	1.749E+00
ADSORBED	7.241E-01	7.241E-01	7.223E-01	7.219E-01	7.225E-01	7.236E-01	7.258E-01	7.274E-01	7.269E-01	7.263E-01	7.233E-01	7.206E-01
SOIL AIR	2.831E-02	2.900E-02	2.963E-02	2.930E-02	2.894E-02	2.874E-02	2.832E-02	2.783E-02	2.730E-02	2.682E-02	2.680E-02	2.708E-02

LOWER SOIL ZONE:

SUBLAYER 1

MOISTURE	4.438E-01	4.475E-01	4.523E-01	4.570E-01	4.610E-01	4.649E-01	4.687E-01	4.718E-01	4.764E-01	4.818E-01	4.899E-01	4.984E-01
%SOLUBILITY	1.400E+00	1.412E+00	1.427E+00	1.442E+00	1.454E+00	1.466E+00	1.478E+00	1.488E+00	1.503E+00	1.520E+00	1.545E+00	1.572E+00
ADSORBED	5.769E-01	5.817E-01	5.880E-01	5.941E-01	5.993E-01	6.043E-01	6.093E-01	6.134E-01	6.193E-01	6.263E-01	6.368E-01	6.480E-01
SOIL AIR	2.256E-02	2.330E-02	2.412E-02	2.411E-02	2.400E-02	2.400E-02	2.377E-02	2.347E-02	2.326E-02	2.312E-02	2.359E-02	2.435E-02

POL DEP CM	1.686E+03	1.687E+03	1.688E+03	1.688E+03	1.689E+03	1.690E+03	1.690E+03	1.690E+03	1.691E+03	1.692E+03	1.693E+03	1.695E+03

1 YEAR - 90 ANNUAL SUMMARY REPORT

-- TOTAL INPUTS (UG) --

UPPER SOIL ZONE	0.000E+00
SOIL ZONE 2	0.000E+00
SOIL ZONE 3	0.000E+00
LOWER SOIL ZONE	0.000E+00

-- HYDROLOGIC CYCLE COMPONENTS --

AVERAGE SOIL MOISTURE ZONE 1 (%)	6.238
AVERAGE SOIL MOISTURE BELOW ZONE 1 (%)	6.238
TOTAL PRECIPITATION (CM)	35.405
TOTAL INFILTRATION (CM)	35.287
TOTAL EVAPOTRANSPIRATION (CM)	16.076
TOTAL SURFACE RUNOFF (CM)	0.109
TOTAL GRW RUNOFF (CM)	19.148
TOTAL MOISTURE RETENTION (CM)	0.064
TOTAL YIELD (CM)	19.265

0 -- POLLUTANT MASS DISTRIBUTION IN COLUMN (UG) -- NOTE: IF COMPONENT IS ZERO EACH MONTH, IT IS NOT PRINTED

FOR FINAL MASS IN SOIL MOI., ADS. ON SOIL, SOIL AIR, IMMOBIL CEC, COMPLEXED, AND PURE PHASE FOR EACH SUBLAYER, SEE ABOVE (MONTH SEP)

UPPER SOIL ZONE:

SUBLAYER 1

TOTAL VOLATILIZED 3.137E+04

SOIL ZONE 2:

SUBLAYER 1

TOTAL DIFFUSED (UP) 3.913E+04

SOIL ZONE 3:

SUBLAYER 1

TOTAL DIFFUSED (UP) 5.106E+04

SUBLAYER 2

TOTAL DIFFUSED (UP) 8.161E+04

SUBLAYER 3

TOTAL DIFFUSED (UP) 1.601E+05

SUBLAYER 4

TOTAL DIFFUSED (UP) 3.404E+05

SUBLAYER 5

TOTAL DIFFUSED (UP) 6.763E+05

SUBLAYER 6

TOTAL DIFFUSED (UP) 1.197E+06

SUBLAYER 7

TOTAL DIFFUSED (UP) 1.759E+06

SUBLAYER 8

TOTAL DIFFUSED (UP) 2.056E+06

SUBLAYER 9

TOTAL DIFFUSED (UP) 1.757E+06

SUBLAYER 10

TOTAL DIFFUSED (UP) 7.000E+05

LOWER SOIL ZONE:

SUBLAYER 1

SUBLAYER 2

SUBLAYER 3

SUBLAYER 4

SUBLAYER 5

SUBLAYER 6