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ICF KAISER ENGINEERS

ICF KAISER ENGINEERS, INC.
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703/934-3300

TO: Claudia Brand

FROM: Davida Parker Trumbo

DATE: July 20, 1990

SUBJECT: Arrowhead Plating Site, Data Validation, 7 Water Samples for Inorganic Analysis, Versar Inc., Control No. 2885

A data validation was performed on the inorganic analytical data from 7 water samples collected at the Arrowhead Plating Site as part of the remedial investigation/feasibility study. The samples were analyzed in accordance with EPA Contract Laboratory Program protocols for cyanide and in accordance with SW-846 protocols for the following metals:

Aluminum	Chromium	Mercury	Sodium
Barium	Copper	Potassium	Zinc
Calcium	Iron	Nickel	
Cadmium	Lead	Silver	

The data was validated in accordance with quality control criteria established in the noted analytical methods. A copy of the checklist used to record the specific observances has been provided for your information as an attachment to this report.

The following samples were included in this data package:

MW3-GW2 T	MW11-GW1 T
MW3-GW2 D	MW11-GW1 D
MW4-GW1 T	
MW4-GW1 T	
MW4-GW1 D	

(It should be noted that MW4 and MW11 were mislabelled and should have been designated first round samples. The correct designation appears in the audit report.)

Overall Data Assessment: The overall laboratory performance met quality control criteria with the following exceptions:

1. Assessment of quality control blank sample indicated that several analytes were determined in the blank at concentration greater than the instrument detection limit (IDL). Sample results less than five time the largest amount of contamination found in any blank associated with the sample should be treated as though the material was not detected above the sample detection limit. The analytes and the associated impacted samples are provided below.

Analyte	Samples		
Copper	MW3-GW2 T MW3-GW2 D	MW4-GW1 T MW4-GW1 D	MW11-GW1 T MW11-GW1 D
Iron	MW3-GW2 D		
Potassium	MW3-GW2 D	MW11-GW1 T	MW11-GW1 D

2. The quality control samples which would normally be used to assess laboratory performance was not provided for this package, due to the fact that the method dictates the recommended frequency. The laboratory is compliant with respect to the quality control protocols, but it is suggested that at a minimum a specified number of quality control samples be specified for each batch.

3. The value for potassium in MW3 is questionable since the concentration in the total sample is less than the concentration in the dissolved sample. A review of the raw data indicates problems associated with the analysis. The potassium result should be rejected for MW3-GW2 T and estimated for MW3-GW2 D.

The following criteria were reviewed during the data validation:

1. **Holding Times:** All criteria were met.

2. **Initial and Continuing Calibration Verification:** All criteria were met.

3. **Blank Analysis:** Copper (26.4 ug/L) and potassium (1091 ug/L) were detected in the continuing calibration blank at a concentration. Calcium (15.3 ug/L) and iron (19.2 ug/L) were detected in in the preparation blank. Aluminum (21.2 ug/L), calcium (19.8 ug/L), iron (14.6 ug/L), and sodium (62.7 ug/L) were detected in the field blank. The analytes and the associated impacted samples are provided below.

Analyte	Samples		
Copper	MW3-GW2	MW4-GW1	MW11-GW1
	MW3-GW2 F	MW4-GW1 F	MW11-GW1 F
Iron	MW3-GW2 F		
Potassium	MW3-GW2	MW4-GW1 F	MW11-GW1
	MW3-GW2 F	MW11-GW1 F	

4. **ICP Interference Check Sample:** All criteria were met.

5. **Matrix Spike Sample Analysis:** Not performed.

6. **Laboratory Precision Evaluation:** Not performed.

7. **Field Precision Evaluation:** Duplicate samples were not collected during this sampling event.

8. **Laboratory Control Sample:** Metals were analyzed by SW-846 methods which do not specify the evaluation of laboratory control samples. Since cyanide was processed using contract laboratory program (CLP) protocols the results were evaluated and all criteria were met.

9. **Standard Additions/Furnace Atomic Absorption Analysis:** All criteria were met.

10. **Serial Dilution Results:** Not performed.

ICF KAISER ENGINEERS

ICF KAISER ENGINEERS, INC.
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703/934-3300

TO: Claudia Brand

FROM: Davida Parker Trumbo

DATE: July 10, 1990

SUBJECT: Arrowhead Plating Site, Data Validation, 17 Water Samples for Inorganic Analysis, Versar Inc., Control No. 2769

A data validation was performed on the inorganic analytical data from 17 water samples collected at the Arrowhead Plating Site as part of the remedial investigation/feasibility study. The samples were analyzed in accordance with EPA Contract Laboratory Program protocols for cyanide and in accordance with SW-846 protocols for the following metals:

Aluminum	Chromium	Mercury	Sodium
Barium	Copper	Potassium	Zinc
Calcium	Iron	Nickel	
Cadmium	Lead	Silver	

The data was validated in accordance with quality control criteria established in the noted analytical methods. A copy of the checklist used to record the specific observances has been provided for your information as an attachment to this report.

The following samples were included in this data package:

MW5 GW2	MW8 GW2	MW12 GW2
MW5 GW2 F	MW8 GW2 F	MW12 GW2 F
MW6 GW2	MW9 GW2	MW13 GW2
MW6 GW2 F	MW9 GW2 F	MW13 GW2 F
MW7 GW2	MW10 GW2	Field Blank #5
MW7 GW2 F	MW10 GW2 F	

Overall Data Assessment: The overall laboratory performance met quality control criteria with the following exceptions:

1. The cyanide holding times exceeded the recommended time of 14 days. Samples appeared to have been analyzed and extracted approximately 26 days after collection. Sample results should be rejected for this analyte in the unfiltered water samples.

2. Zinc results should be considered estimated due to precision problems associated with the laboratory duplicate.

The following criteria were reviewed during the data validation:

1. **Holding Times:** All criteria were met with the exception of cyanide which was analyzed in excess of 14 days. All cyanide data should be rejected.

2. **Initial and Continuing Calibration Verification:** All criteria were met.

3. **Blank Analysis:** Calcium was detected in the continuing calibration blank at a concentration of 7.3 ppb. Since calcium was detected in all samples at percentage concentrations, the concentration in the blank has no impact on the samples and therefore no action is required.

   Equipment blank #5 had contamination above the instrument detection limit (IDL) for the following analytes: aluminum (25.6 ppb), calcium (79.2 ppb), sodium (320 ppb), and zinc (15.4 ppb). The effect of sodium and calcium are negligible in all samples with the exception of MW5-GW2 F (calcium). Aluminum contamination is negligible for all unfiltered sample, but may impact the filtered samples by potentially introducing false positives. All of the zinc results have the potential for being introduced to the sample through inadequate decontamination protocols.

4. **ICP Interference Check Sample:** All criteria were met.

5. **Matrix Spike Sample Analysis:** All criteria were met.

6. **Laboratory Precision Evaluation:** Duplicate analysis was performed on sample MW12 GW2. The percent recovery for aqueous duplicate samples were in control with the exception of zinc which had a percent relative difference of 55.9% indicating a laboratory precision problem.

7. **Field Precision Evaluation:** Duplicate samples were not collected during this sampling event.

8. **Laboratory Control Sample:** Metals were analyzed by SW-846 methods which do not specify the evaluation of laboratory control samples. Since cyanide was processed using contract laboratory program (CLP) protocols the results should have been evaluated, but the necessary information was not included in the data package.

9. **Standard Additions/Furnace Atomic Absorption Analysis:** All criteria were met.

10. **Serial Dilution Results:** Although the serial dilutions did not agree within 10% for analyte concentrations greater than ten times the IDL for barium and zinc, no action is warranted.

ICF KAISER ENGINEERS

ICF KAISER ENGINEERS, INC.
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703/934-3300

TO: Claudia Brand

FROM: Jay Kuhn

DATE: August 28, 1990

SUBJECT: Arrowhead Plating Site, Data Validation, 3 Water Samples, Semivolatile and Volatile Organic Analysis, Versar Inc., Virginia.

REFERENCE: Validation 16, Versar Control Number 3065, Groundwater

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A level I validation was performed on the organic analytical data from 3 water samples collected at the Arrowhead Plating Site as part of the Remedial Investigation/Feasibility Study. The samples were analyzed for EPA Target Compound List (TCL) semivolatile and volatile organics by Versar Inc., Springfield, Virginia. Validation was performed in accordance with the EPA Functional Guidelines for Evaluating Organics Analyses (February 1, 1988). A copy of the checklist has been provided as an attachment for your information.

The samples included in the data package are the following.

AR3-GW1 MW4-GW2 MW11-GW2

Overall Assessment of Data for Samples Evaluated:

1. The detected value of tetrachloroethene in AR3-GW1 should be considered estimated.

2. For the semivolatile analysis, all nondetect data for the acid fraction of sample MW11-GW2 should be rejected.

3. The following target compound is tentatively identified for sample MW4-GW2: methylene chloride. The following target compounds are tentatively identified for sample MW11-GW2: 1,1-dichloroethene, methylene chloride, trichloroethene, and tetrachloroethene.

4. In order to quantitate target compounds the following dilutions were done: AR3-GW1 (1/50) and MW11-GW2 (1/50). As a result, the method detection limits were increased by a factor of 50 for both samples.

The following criteria were reviewed in validating the data:

1. **Holding Time**: All criteria met

2. **GC/MS Tune**: All criteria met.

3. **Calibration**:

Volatile: Instruments U and Y were used to perform the volatile analysis. Calibration results for the instruments are as follows.

Instrument U

Initial: 7/10/90, 1 compound, bromoform, has a relative standard deviation (%RSD) > 30%.

Impact on data: No samples were quantitated from this initial calibration.

Continuing: 7/13/90, 5 compounds: bromomethane, vinyl acetate, trans-1,3-dichloropropene, 2-hexanone, and tetrachloroethene have a percent deviation (%D) > 25%. The sample potentially impacted is AR3-GW1.

Impact on data: The detected value of tetrachloroethene in AR3-GW1 should be considered estimated.

Instrument Y

Initial: 7/12/90, 1 compound, acetone, has a relative standard deviation (%RSD) > 30%.

Impact on data: No samples were quantitated from this initial calibration.

Continuing: 7/19/90, 2 compounds: bromomethane and vinyl acetate have a %RSD > 30%.

Impact on data: The samples potentially impacted are MW4-GW2, MW11-GW2, MW11-GW2MS, and MW11-GW2MSD. Results for compounds which are quantitated on continuing calibrations with percent deviation (%D) > 25% should be qualified as follows: detected compound values for bromomethane and vinyl acetate should be estimated. These compounds were not detected in these samples.

Semivolatile: Instrument Z was used to perform the semivolatile analysis. Calibration results for the instrument is as follows.

Instrument Z

Initial: 7/23/90, 3 compounds, 4-chloroaniline, 3-nitroaniline, and 4-nitroaniline have a %RSD > 30%.

Impact on data: No samples were quantitated from this initial calibration.

Continuing: 7/24/90, 4 compounds, benzoic acid, 4-chloroaniline, 3-nitroaniline and 4-nitroaniline have a %D > 25%.

Impact on data: Results for compounds which are quantitated on continuing calibrations with percent deviation (%D) > 25% should be qualified as follows: detected compound values for benzoic acid, 4-chloroaniline, 3-nitroaniline, and 4-nitroaniline should be estimated. The samples potentially impacted are AR3-GW1, AR3-GW1MS, AR3-GW1MSD, MW4-GW2, and MW11-GW2. These compounds were not detected in these samples.

4. **Blanks:**

The intent of blank analysis results are to evaluate the potential of contamination contribution by the sampling and/or analytical process. Both field blanks and laboratory blanks are included in this data package. Acetone was detected in the laboratory blank VBLK43 at a concentration of 10 ug/L. This results in a "considered nondetect" value of 100 ug/L for samples associated with this blank.

Impact on data: The sample potentially impacted is AR3-GW1. Acetone was not detected in this sample.

5. **Surrogate Spike:**

All surrogates for the Volatile Organic Analysis (VOA) were compliant. The following compounds have noncompliant semivolatile surrogate recoveries: MW11-GW2 (2-fluorophenol, 4%); MW4-GW2 (phenol-d5, 96%); and AR3-GW1MSD (phenol-d5, 98%).

Impact on data: For the semivolatile analysis, all nondetect data for the acid fraction of sample MW11-GW2 should be rejected.

6. **Matrix Spike/Matrix Spike Duplicate:**

For the matrix spike sample, AR3-GW1MS, the following recoveries were noncompliant: 4-nitrophenol (103%) and pentachlorophenol (110%). For the matrix spike duplicate sample, AR3-GW1MSD, the following recoveries were noncompliant: phenol (101%), 4-nitrophenol (116%), 2,4-dinitrotoluene (106%), and pentachlorophenol (117%).

Impact on data: It is in the reviewers judgement that no qualification of the data is warranted.

7. **Field Duplicates:** No duplicates were done with this analytical sequence.

8. **Internal Standard (IS) Performance:** All criteria met.

9. **TCL Compound Identification:**

The following compound is tentatively identified for sample MW4-GW2: methylene chloride. The following samples are tentatively identified for sample MW11-GW2: 1,1-dichloroethene, methylene chloride, trichloroethene, and tetrachloroethene.

10. **Compound Quantitation and Reported Detection Limits:**

In order to quantitate target compounds the following dilutions were done: AR3-GW1 (1/50) and MW11-GW2 (1/50). As a result, the method detection limits were increased by a factor of 50 for both samples. Instrument detection limits were not submitted.

11. **Tentatively Identified Compounds:** All criteria met.

12. **System Performance:** All criteria met.

ICF KAISER ENGINEERS

ICF KAISER ENGINEERS, INC.
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703/934-3300

TO: Claudia Brand

FROM: Jay Kuhn

DATE: August 28, 1990

SUBJECT: Arrowhead Plating Site, Data Validation, 3 Water Samples, Semivolatile and Volatile Organic Analysis, Versar Inc., Virginia.

REFERENCE: Validation 15, Versar Control Number 3082, Groundwater

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A level I validation was performed on the organic analytical data from 3 water samples collected at the Arrowhead Plating Site as part of the Remedial Investigation/Feasibility Study. The samples were analyzed for EPA Target Compound List (TCL) semivolatile volatile organics organics by Versar Inc., Springfield, Virginia. Validation was performed in accordance with the EPA Functional Guidelines for Evaluating Organics Analyses (February 1, 1988). A copy of the checklist has been provided as an attachment for your information.

The samples included in the data package are the following.

AR1-GW1 AR2-GW1 AR2-GW1A

Overall Assessment of Data for Samples Evaluated:

1. The following compounds are tentatively identified for sample AR2-GW1: 1,1-dichloroethene, trichloroethene, and tetrachloroethene. The following compounds are tentatively identified for sample AR2-GW1A: 1,1-dichloroethene, trichloroethene, and tetrachloroethene. The following compounds are tentatively identified for sample AR1-GW1: trichloroethene and tetrachloroethene.

2. In order to quantitate target compounds the following dilutions were done: AR2-GW1 (1/20) and AR2-GW1A (1/20). As a result, the method detection limits were increased by a factor of 20 for both samples.

The following criteria were reviewed in validating the data:

1. **Holding Time**: All criteria met

2. **GC/MS Tune**: All criteria met.

3. **Calibration**:

Volatile: Instrument Y was used to perform the volatile analysis. Calibration results for the instrument is as follows.

Instrument Y

Initial: 7/12/90, 1 compound, acetone, has a relative standard deviation (%RSD) > 30%.

Impact on data: No samples were quantitated from this initial calibration.

Continuing: 7/16/90, Meets criteria.

Semivolatile: Instrument Z was used to perform the semivolatile analysis. Calibration results for the instrument is as follows.

Instrument Z

Initial: 7/23/90, 3 compounds: 4-chloroaniline, 3-nitroaniline, and 4-nitroaniline have a %RSD > 30%.

Impact on data: No samples were quantitated from this initial calibration.

Continuing: 7/24/90, 4 compounds: benzoic acid, 4-chloroaniline, 3-nitroaniline and 4-nitroaniline have a %D > 25%.

Impact on data: Results for compounds which are quantitated on continuing calibrations with percent deviation (%D) > 25% should be qualified as follows: detected compound values for benzoic acid, 4-chloroaniline, 3-nitroaniline, and 4-nitroaniline should be estimated. The samples potentially impacted are AR1-GW1, AR1-GW1MS, AR1-GW1MSD, AR2-GW1, and AR2-GW1A. These compounds were not detected in these samples.

4. **Blanks:**

The intent of blank analysis results are to evaluate the potential of contamination contribution by the sampling and/or analytical process. Both field blanks and laboratory blanks are included in this data package. There were no volatile or semivolatile compounds were detected in any of the laboratory or field blanks.

5. **Surrogate Spike:**

Sample AR1-GW1MS had one surrogate outlier, phenol-d5, with a recovery of 95%

Impact on data: No qualification of data is warranted for one surrogate outlier.

6. **Matrix Spike/Matrix Spike Duplicate:**

For the matrix spike sample, AR1-GW1MS, the following recoveries were noncompliant: phenol (96%), 4-nitrophenol (95%), and 2,4-dinitrotoluene (99%). For the matrix spike duplicate sample, AR1-GW1MSD, the following recoveries were noncompliant: phenol (93%), 4-nitrophenol (102%), 2,4-dinitrotoluene (104%), and pentachlorophenol (112%).

Impact on data: It is in the reviewers judgement that no qualification of the data is warranted.

7. **Field Duplicates:**

The following compounds were detected in the volatile fraction of AR2-GW1 and AR2-GW1A respectively:

Compound:	AR2-GW1:	AR2-GW1A:	RPD:
1,1-Dichloroethane	200 ug/L	280 ug/L	33%
1,1,1-Trichloroethane	260 ug/L	350 ug/L	30%
Trichloroethene	990 ug/L	1300 ug/L	27%
Tetrachloroethene	880 ug/L	1200 ug/L	31%

Impact on data: It is in the reviewers judgement that no qualification of the data is warranted.

8. **Internal Standard (IS) Performance:** All criteria met.

9. **TCL Compound Identification:**

The following compounds are tentatively identified for sample AR2-GW1: 1,1-dichloroethene, trichloroethene, and tetrachloroethene. The following samples are tentatively identified for sample AR2-AR1A: 1,1-dichloroethene, trichloroethene, and tetrachloroethene. The following compounds are tentatively identified for sample AR1-GW1: trichloroethene and tetrachloroethene.

10. **Compound Quantitation and Reported Detection Limits:**

In order to quantitate target compounds the following dilutions were done: AR2-GW1 (1/20) and AR2-GW1A (1/20). As a result, the method detection limits were increased by a factor of 20 for both samples. Instrument detection limits were not submitted.

11. **Tentatively Identified Compounds:** All criteria met.

12. **System Performance:** All criteria met.

ICF KAISER ENGINEERS

ICF KAISER ENGINEERS, INC.
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703/934-3300

TO: Claudia Brand

FROM: Jay Kuhn

DATE: August 28, 1990

SUBJECT: Arrowhead Plating Site, Data Validation, 1 Water Sample, Reextraction, Semivolatile Organic Analysis, Versar Inc., Virginia.

REFERENCE: Validation 18, Versar Control Number 3065, Groundwater

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A level I validation was performed on the organic analytical data from 3 water samples collected at the Arrowhead Plating Site as part of the Remedial Investigation/Feasibility Study. The samples were analyzed for EPA Target Compound List (TCL) semivolatile organics by Versar Inc., Springfield, Virginia. Validation was performed in accordance with the EPA Functional Guidelines for Evaluating Organics Analyses (February 1, 1988). A copy of the checklist has been provided as an attachment for your information.

The sample included in this data package is MW11-GW2. Note that this sample is a reextraction and therefore is designated MW11-GW2RE in the data package.

Overall Assessment of Data for Samples Evaluated:

1. Due to exceeding holding time, method detection limits should be considered estimated.

The following criteria were reviewed in validating the data:

1. **Holding Time:**

   Holding time exceeded by 14 days.

   Impact on data: Method detection limits should be considered estimated.

2. GC/MS Tune: All criteria met.

3. **Calibration:**

   Semivolatile: Instrument T was used to perform the semivolatile analysis. Calibration results for the instrument is as follows.

   Instrument T

   Initial: 8/1/90, Meets criteria.

   Continuing: 8/13/90, 2 compounds, benzoic acid and 4,6-dinitro-2-methylphenol have a %D > 25%.

   Impact on data: Results for compounds which are quantitated on continuing calibrations with percent deviation (%D) > 25% should be qualified as follows: detected compound values for benzoic acid and 4,6-dinitro-2-methylphenol should be estimated. The sample potentially impacted is MW11-GW2. These compounds were not detected in this sample.

4. **Blanks:**

   The intent of blank analysis results are to evaluate the potential of contamination contribution by the sampling and/or analytical process. Both field blanks and laboratory blanks are included in this data package. No compounds were detected in the associated blanks.

5. **Surrogate Spike:**

   The following compounds have noncompliant semivolatile surrogate recoveries: MW11-GW2RE (2-fluorophenol, 15%); and SBLK12 (phenol-d5, 101%; 2-fluorophenol, 115%).

   Impact on data: With respect to surrogate recovery, it is in the reviewers judgement that there is no impact on the data.

6. **Matrix Spike/Matrix Spike Duplicate:** No MS/MSD was done with this analytical sequence.

7. **Field Duplicates:** No duplicates were done with this analytical sequence.

8. **Internal Standard (IS) Performance:** All criteria met.

9. **TCL Compound Identification:** No target compounds were detected.

10. **Compound Quantitation and Reported Detection Limits:**

Method detection limits were met. Instrument detection limits were not submitted.

11. **Tentatively Identified Compounds:** All criteria met.

12. **System Performance:** All criteria met.

ICF KAISER ENGINEERS

ICF KAISER ENGINEERS, INC.
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703/934-3300

TO: Claudia Brand

FROM: Jay Kuhn

DATE: March 17, 1990

SUBJECT: Arrowhead Plating Site, Data Validation, 6 Water Samples, Volatile Organic Analysis, General Physics Laboratory, Gaithersburg, Maryland.

A level I validation was performed on the organic analytical data from 6 water samples collected at the Arrowhead Plating Site as part of the Remedial Investigation/Feasibility Study. The samples were analyzed for EPA Target Compound List (TCL) volatile organics by General Physics Laboratory, Gaithersburg, Maryland. A volatile organic trip blank was also included in this data package. Validation was performed in accordance with the EPA Functional Guidelines for Evaluating Organics Analyses (February 1, 1988). A copy of the checklist has been provided as an attachment for your information.

The samples included in the data package are the following.

Water Samples:

MW21-GW3
MW22-GW3
MW23-GW3
MW24-GW3
MW25-GW3
MW26-GW3
Trip Blank

Overall Assessment of the Data for the Samples Evaluated:

1. The holding time was exceeded for the analysis of the dilution MW21-GW3DL1. The quantitated value for trichloroethene should be considered estimated.

2. Due to a noncompliant surrogate recovery for MW21-GW3DL, the quantitated values for 1,1-dichloroethene, 1,1,1-trichloroethane, and tetrachloroethene should be considered estimated.

3. The detection of toluene in the Trip BlankRE results in the detected value of toluene to be considered non-detect in the samples MW21-GW3, MW23-GW3, AND MW26-GW3. In addition, the detection of acetone in the Trip BlankRE results in the detected value of acetone to be considered

nondetected in the samples MW21-GW3 and MW23-GW3.

4. Due to the substantial deviation in the continuing calibration response of acetone, the method detection limit for acetone should be considered estimated for Trip BlankRE.

9. Due to the substantial deviation in the continuing calibration response of 2-butanone, the method detection limit for 2-butanone should be considered estimated for Trip BlankRE.

10. Due to a low response of 2-butanone in the continuing calibration, the method detection limit for 2-butanone should be rejected for the following associated samples: MW21-GW3, MW22-GW3, MW23-GW3, MW24-GW3, MW25-GW3 and MW26-GW3.

ICF KAISER ENGINEERS

ICF KAISER ENGINEERS, INC.
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703/934-3300

TO: Claudia Brand

FROM: Jay Kuhn

DATE: March 17, 1990

SUBJECT: Arrowhead Plating Site, Data Validation, 6 Water Samples, Volatile Organic Analysis, General Physics Laboratory, Gaithersburg, Maryland.

A level I validation was performed on the organic analytical data from 6 water samples collected at the Arrowhead Plating Site as part of the Remedial Investigation/Feasibility Study. The samples were analyzed for EPA Target Compound List (TCL) volatile organics by General Physics Laboratory, Gaithersburg, Maryland. A volatile organic trip blank was also included in this data package. Validation was performed in accordance with the EPA Functional Guidelines for Evaluating Organics Analyses (February 1, 1988). A copy of the checklist has been provided as an attachment for your information.

The samples included in the data package are the following.

Water Samples:

MW21-GW3
MW22-GW3
MW23-GW3
MW24-GW3
MW25-GW3
MW26-GW3
Trip Blank

Overall Assessment of the Data for the Samples Evaluated:

1. The holding time was exceeded for the analysis of the dilution MW21-GW3DL1. The quantitated value for trichloroethene should be considered estimated.

2. Due to a noncompliant surrogate recovery for MW21-GW3DL, the quantitated values for 1,1-dichloroethene, 1,1,1-trichloroethane, and tetrachloroethene should be considered estimated.

3. The detection of toluene in the Trip BlankRE results in the detected value of toluene to be considered non-detect in the samples MW21-GW3, MW23-GW3, AND MW26-GW3. In addition, the detection of acetone in the Trip BlankRE results in the detected value of acetone to be considered

nondetected in the samples MW21-GW3 and MW23-GW3.

4. Due to the substantial deviation in the continuing calibration response of acetone, the method detection limit for acetone should be considered estimated for Trip BlankRE.

9. Due to the substantial deviation in the continuing calibration response of 2-butanone, the method detection limit for 2-butanone should be considered estimated for Trip BlankRE.

10. Due to a low response of 2-butanone in the continuing calibration, the method detection limit for 2-butanone should be rejected for the following associated samples: MW21-GW3, MW22-GW3, MW23-GW3, MW24-GW3, MW25-GW3 and MW26-GW3.

ICF KAISER ENGINEERS

ICF KAISER ENGINEERS, INC.
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703/934-3300

TO: Claudia Brand

FROM: Davida Parker Trumbo DPT

DATE: April 9, 1991

SUBJECT: Arrowhead Plating Site, Data Validation, 1 Soil and 18 Water Samples for Inorganic Analysis, General Physics, Case No. KAISR1

A data validation was performed on the inorganic analytical data from 1 soil and 18 water samples collected at the Arrowhead Plating Site as part of the remedial investigation/feasibility study. The samples were analyzed in accordance with EPA Contract Laboratory Program protocols for cyanide and the following metals:

Aluminum	Chromium	Mercury	Sodium
Barium	Copper	Potassium	Zinc
Calcium	Iron	Nickel	
Cadmium	Lead	Silver	

The data was validated in accordance with quality control criteria established in the noted analytical methods. A copy of the checklist used to record the specific observances has been provided for your information as an attachment to this report.

The following samples were included in this data package:

M11GWD	M12GWD	M13GWD	M1GWD
M2GW3D	M3GW3D	M4GW3D	M5GW3F
M6GW3F	MW11GW	MW12GW	MW13GW
MW1GW3	MW2GW3	MW3GW3	MW4GW3
MW5GW3	MW6GW3	SB23S1	

Overall Data Assessment: The overall laboratory performance met quality control criteria with the following exception:

1. Assessment of quality control blank samples indicated that several analytes were determined in blanks at concentrations greater than the instrument detection limit (IDL). Sample results less than five time the largest amount of contamination found in any blank associated with the sample should be treated as though the analyte was not detected above the sample detection limit. The analytes and the associated impacted samples are provided below.

Aluminum:	M12GWD			
Calcium:	M4GW3D	M5GW3F	MW5GW3	
Copper:	M11GWD	M12GWD	M13GWD	M1GW3D
	M2GW3D	M3GW3D	M4GW3D	M5GW3F
	M6GW3F	MW11GW	MW12GW	MW13GW
	MW1GW3	MW2GW3	MW3GW3	MW5GW3
	MW6GW3			

DATA VALIDATION
KAISR1
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1. Assessment of Quality Control Blanks (continued)

Mercury:	M1GW3D	M2GW3D	M3GW3D	M4GW3D
	M5GW3F	M6GW3F	MW1GW3	MW2GW3
	MW3GW3	MW4GW3	MW5GW3	MW6GW3
Potassium:	M12GWD	M13GWD	M1GW3D	M2GW3D
	M3GW3D	M4GW3D	M5GW3F	M6GW3F
	MW11GW	MW12GW	MW13GW	MW1GW3
	MW2GW3	MW3GW3	MW4GW3	MW5GW3
	MW6GW3			
Sodium:	SB23S1			

2. The results for copper, lead, mercury, and silver should be estimated for all aqueous samples. Barium, copper, and lead results should be estimated in the soil sample. Silver results should be rejected due to poor recoveries.

3. Iron results should be qualified as estimated in water samples to due to poor recoveries associated with laboratory precision.

4. Copper results have been qualified in M5GW3F due to a low correlation associated with the method of standard additions.

5. The aluminum result should be qualified in the soil sample due to potential chemical or spectral interference.

DATA VALIDATION
KAISR1
PAGE 3 OF 5

The following criteria were reviewed during the data validation:

1. **Holding Times:** All criteria were met.

2. **Initial and Continuing Calibration Verification:** All criteria were met.

3. **Blank Analysis:** The following blank contamination and potentially impacted samples are summarized below:

Blank	Contaminant	Concentration	Samples
[1]ICV	Copper	1.0 ug/L	Water
		1.7 mg/kg	Soil
	Potassium		
		480 ug/L	Water
	Sodium		
		255 ug/L	Water
[2]CCV1	Copper	2.7 ug/L	Water
	Potassium	2320 ug/L	
	Sodium	285 ug/L	
CCV2	Potassium	3080 ug/L	Water
	Sodium	210 ug/L	
CCV3	Copper	2.7 mg/kg	Soil
	Iron	-39.6 mg/kg	
	Mercury	0.2 mg/kg	
	Potassium	4630 mg/kg	
	Sodium	450 mg/kg	
CCV4	Copper	1.4 mg/kg	Soil
	Sodium	500 mg/kg	
[3]PBW	Copper	0.7 ug/L	Water
	Mercury	0.2 ug/L	
	Potassium	144 ug/L	
Rinse	Calcium	125 ug/L	Water
	Copper	5.0 ug/L	
	Potassium	3520 ug/L	
	Sodium	395 ug/L	

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[1] Initial Calibration Verification
[2] Continuing Calibration Blank
[3] Preparation Blank Water

3. **Blank Analysis: (continued)**

Action:

The following sample results for the noted analytes may be attributable to blank contamination encountered during either the sampling or analysis event due to the fact that the constituent was detected at a concentration less than five times the blank contamination:

Aluminum:	M12GWD			
Calcium:	M4GW3D	M5GW3F	MW5GW3	
Copper:	M11GWD	M12GWD	M13GWD	M1GW3D
	M2GW3D	M3GW3D	M4GW3D	M5GW3F
	M6GW3F	MW11GW	MW12GW	MW13GW
	MW1GW3	MW2GW3	MW3GW3	MW5GW3
	MW6GW3			
Mercury:	M1GW3D	M2GW3D	M3GW3D	M4GW3D
	M5GW3F	M6GW3F	MW1GW3	MW2GW3
	MW3GW3	MW4GW3	MW5GW3	MW6GW3
Potassium:	M12GWD	M13GWD	M1GW3D	M2GW3D
	M3GW3D	M4GW3D	M5GW3F	M6GW3F
	MW11GW	MW12GW	MW13GW	MW1GW3
	MW2GW3	MW3GW3	MW4GW3	MW5GW3
	MW6GW3			
Sodium:	SB23S1			

4. **ICP Interference Check Sample:** All criteria were met.

5. **Matrix Spike Sample Analysis:** The following spike samples had analytes out-of-control either less than 75% and greater than 125%:

Sample	Analyte	% Recovery
MW1GW3D	Copper	49.8
	Lead	74
	Mercury	65.7
	Silver	51.5
MW1GW3S	Copper	48.4
	Lead	74
	Mercury	45.5
	Silver	51.2

5. **Matrix Spike Sample Analysis:(continued)**

SB2341	Barium	402
	Copper	43.3
	Lead	55.6
	Silver	0

Action: The results for copper, lead, mercury, and silver should be estimated for all aqueous samples. Barium, copper, and lead results should be estimated in the soil sample. Silver results should be rejected due to poor recoveries.

6. **Laboratory Precision Evaluation:** Duplicate analysis was performed on samples MW1GW3 and SB23S1. The percent recovery for aqueous duplicate samples were in control with the exception of iron. Iron results should be qualified as estimated for water samples. The soil duplicate sample results were in control.

7. **Field Precision Evaluation:** Duplicate samples were not collected during this sampling event.

8. **Laboratory Control Sample:** All criteria were met.

9. **Standard Additions/Furnace Atomic Absorption Analysis:** All criteria were met with the exception of M5GW3F, which had a correlation of 0.9896 for copper. The copper result for this sample has been qualified as estimate.

10. **Serial Dilution Results:** Chemical or physical interferences were encountered for the analyses of aluminum in soil. The aluminum soil sample result should be considered estimated.

ICF KAISER ENGINEERS

ICF KAISER ENGINEERS, INC.
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703/934-3300

TO: Claudia Brand

FROM: Davida Parker Trumbo DPT

DATE: April 9, 1991

SUBJECT: Arrowhead Plating Site, Data Validation, 16 Water Samples for Inorganic Analysis, General Physics, Case No. KAISR2

A data validation was performed on the inorganic analytical data from 16 water samples collected at the Arrowhead Plating Site as part of the remedial investigation/feasibility study. The samples were analyzed in accordance with EPA Contract Laboratory Program protocols for cyanide and the following metals:

Aluminum	Chromium	Mercury	Sodium
Barium	Copper	Potassium	Zinc
Calcium	Iron	Nickel	
Cadmium	Lead	Silver	

The data was validated in accordance with quality control criteria established in the noted analytical methods. A copy of the checklist used to record the specific observances has been provided for your information as an attachment to this report.

The following samples were included in this data package:

A1GW3D	A2GW3D	A3GW3D	AR1GW3
AR2GW3	AR3GW3	AR3AGW	M10GWD
M7GW3D	M8GW3D	M9GW3D	MW10GW
A3AGWD	MW7GW3	MW8GW3	MW9GW3

Overall Data Assessment: The overall laboratory performance met quality control criteria with the following exception:

1. Assessment of quality control blank samples indicated that several analytes were determined in blanks at concentrations greater than the instrument detection limit (IDL). Sample results less than five time the largest amount of contamination found in any blank associated with the sample should be treated as though the analyte was not detected above the sample detection limit. The analytes and the associated impacted samples are provided below.

Barium:	A2GW3D	AR1GW3	AR2GW3	AR3AGW
	M10GWD	M8GW3D	M10GW	MW8GW3
Copper:	A1GW3D	AR2GW3	AR3GW3	M7GW3D
	M8GW3D	M9GW3D	MW8GW3	MW9GW3

1. Assessment of Quality Control Blanks (continued)

Nickel:	AR3AGW	MW9GW3		
Sodium:	SB23S1			
Zinc:	A1GW3D	A2GW3D	AR1GW3	AR2GW3
	AR3GW3	M7GW3D	M8GW3D	M9GW3D
	MW8GW3	MW9GW3		

2. The results for copper, lead, and silver should be estimated for all samples due to poor recoveries associated with the matrix spike.

3. Aluminum, iron, and zinc results should be qualified as estimated in all samples to due to poor laboratory precision.

4. Copper has been qualified as estimated in AR2GW2 due to a low correlation associated with the method of standard additions.

5. The aluminum results for all samples should be qualified as estimated due to potential chemical or spectral interference.

The following criteria were reviewed during the data validation:

1. **Holding Times:** All criteria were met.

2. **Initial and Continuing Calibration Verification:** All criteria were met.

3. **Blank Analysis:** The following blank contamination and potentially impacted samples are summarized below:

Blank	Contaminant	Concentration (ug/L)	Samples
[1]ICV	Barium	-9.4	Water
	Copper	1.7	
	Mercury	0.2	
	Nickel	-19.7	
	Sodium	490	
[2]CCV1	Barium	-14.5	Water
	Copper	-1.4	
	Nickel	-20.3	
	Sodium	-195	
	Zinc	-8.5	
CCV2	Barium	-13.8	Water
	Copper	-1.4	
	Sodium	-430	
CCV3	Barium	-18.9	Water
	Copper	2.0	
	Sodium	-510	
[3]PBW	Sodium	-485 ug/L	Water

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[1] Initial Calibration Verification
[2] Continuing Calibration Blank
[3] Preparation Blank Water

3. **Blank Analysis: (continued)**

Action:

The following sample results for the noted analytes may be attributable to blank contamination encountered during either the sampling or analysis event due to the fact that the constituent was detected at a concentration less than five times the blank contamination:

Barium:	A2GW3D	AR1GW3	AR2GW3	AR3AGW
	M10GWD	M8GW3D	M10GW	MW8GW3
Copper:	A1GW3D	AR2GW3	AR3GW3	M7GW3D
	M8GW3D	M9GW3D	MW8GW3	MW9GW3
Nickel:	AR3AGW	MW9GW3		
Sodium:	SB23S1			
Zinc:	A1GW3D	A2GW3D	AR1GW3	AR2GW3
	AR3GW3	M7GW3D	M8GW3D	M9GW3D
	MW8GW3	MW9GW3		

4. **ICP Interference Check Sample:** All criteria were met.

5. **Matrix Spike Sample Analysis:** The following spike samples had analytes out-of-control either less than 75% and greater than 125%:

Sample	Analyte	% Recovery
A3GW3D	Copper	1.6
	Lead	64.2
	Silver	70.6
AR3AGW	Copper	5.0
	Lead	60.5

Action: The results for copper, lead, and silver should be estimated for all samples.

6. **Laboratory Precision Evaluation:** Duplicate analysis was performed on samples AR3GW3D and A3GW3. The percent recovery were in control with the exception of aluminum, iron, and zinc. Aluminum, iron, and zinc results should be qualified as estimated for all samples.

7. **Field Precision Evaluation:** Duplicate samples were not collected during this sampling event.

8. **Laboratory Control Sample:** All criteria were met.

9. **Standard Additions/Furnace Atomic Absorption Analysis:** All criteria were met with the exception of AR2GW3, which had a correlation of 0.9896 for copper. The copper result for this sample has been qualified as estimate.

10. **Serial Dilution Results:** Chemical or physical interferences were encountered for the analyses of aluminum, and sample results should be considered estimated.

ICF KAISER ENGINEERS

ICF KAISER ENGINEERS, INC.
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703/934-3300

TO: Claudia Brand

FROM: Davida Parker Trumbo DPT

DATE: April 9, 1991

SUBJECT: Arrowhead Plating Site, Data Validation, 4 Soil and 12 Water Samples for Inorganic Analysis, General Physics, Case No. KAISR3

A data validation was performed on the inorganic analytical data from 4 soil and 12 water samples collected at the Arrowhead Plating Site as part of the remedial investigation/feasibility study. The samples were analyzed in accordance with EPA Contract Laboratory Program protocols for cyanide and the following metals:

Aluminum	Chromium	Mercury	Sodium
Barium	Copper	Potassium	Zinc
Calcium	Iron	Nickel	
Cadmium	Lead	Silver	

The data was validated in accordance with quality control criteria established in the noted analytical methods. A copy of the checklist used to record the specific observances has been provided for your information as an attachment to this report.

The following samples were included in this data package:

M21GWD	M22GWD	M23GWD	M24GWD
M25GWD	M26GWD	MW21GW	MW22GW
MW23GW	MW24GW	MW25GW	MW26GW
SB21S3	SB21S5	SB21S6	SB22S3

Overall Data Assessment: The overall laboratory performance met quality control criteria with the following exception:

1. Assessment of quality control blank samples indicated that several analytes were determined in blanks at concentrations greater than the instrument detection limit (IDL). Sample results less than five time the largest amount of contamination found in any blank associated with the sample should be treated as though the analyte was not detected above the sample detection limit. The analytes and the associated impacted samples are provided below.

Aluminum:	M22GWD	M23GWD	M25GWD	
Chromium:	M21GWD	M22GWD	M23GWD	M24GWD
	M25GWD	M26GWD	MW21GW	MW22GW
	MW23GW	MW24GW	MW25GW	
Copper:	M22GWD	M23GWD	M24GWD	M25GWD
	M26GWD	MW25GW	SB22S3	

1. Assessment of Quality Control Blanks (continued)

Potassium:	M22GWD	M25GWD	M26GWD	MW22GW
	MW25GW	SB21S3	SB21S5	SB21S6
	SB22S3			
Sodium:	SB22S3			

2. The results for lead, mercury, and silver should be estimated for all aqueous samples. Barium, chromium, copper, lead, silver, and zinc results should be estimated in the soil samples. Cadmium and nickel results should be rejected due to poor recoveries.

3. Chromium, iron, mercury, and sodium results in unfiltered aqueous samples and aluminum in the filtered aqueous samples should be qualified as estimated due to poor laboratory precision. In addition, chromium and copper results should be qualified as estimated for soil samples.

The following criteria were reviewed during the data validation:

1. **Holding Times:** All criteria were met.

2. **Initial and Continuing Calibration Verification:** All criteria were met.

3. **Blank Analysis:** The following blank contamination and potentially impacted samples are summarized below:

Blank	Contaminant	Concentration	Samples
[1]ICV	Copper	2.2 ug/L	Water
	Potassium	-715 ug/L	
	Iron	40.4 mg/kg	Soil
	Sodium	280 mg/kg	
[2]CCV1	Aluminum	122 ug/L	Water
	Chromium	9.5 ug/L	
	Copper	1.1 ug/L	
	Potassium	945 ug/L	
	Sodium	470 ug/L	
CCV2	Aluminum	134 ug/L	Water
	Chromium	9.3 ug/L	
	Potassium	580 ug/L	
	Sodium	660	
CCV3	Copper	1.6 mg/kg	Soil
	Iron	64.2 mg/kg	
	Sodium	610 mg/kg	
CCV4	Copper	2.0 mg/kg	Soil
	Iron	1.4 mg/kg	
[3]PBW	Copper	2.2 ug/L	Water
	Sodium	250 ug/L	

3. **Blank Analysis: (continued)**

PBS	Copper	0.42 mg/kg	Soil
	Potassium	107 mg/kg	

[1] Initial Calibration Verification
[2] Continuing Calibration Blank
[3] Preparation Blank Water

Action:

The following sample results for the noted analytes may be attributable to blank contamination encountered during either the sampling or analysis event due to the fact that the constituent was detected at a concentration less than five times the blank contamination:

Aluminum:	M22GWD	M23GWD	M25GWD	
Chromium:	M21GWD	M22GWD	M23GWD	M24GWD
	M25GWD	M26GWD	MW21GW	MW22GW
	MW23GW	MW24GW	MW25GW	
Copper:	M22GWD	M23GWD	M24GWD	M25GWD
	M26GWD	MW25GW	SB22S3	
Potassium:	M22GWD	M25GWD	M26GWD	MW22GW
	MW25GW	SB21S3	SB21S5	SB21S6
	SB22S3			
Sodium:	SB22S3			

4. **ICP Interference Check Sample:** All criteria were met.

5. **Matrix Spike Sample Analysis:** The following spike samples had analytes out-of-control either less than 75% and greater than 125%:

Sample	Analyte	% Recovery
MW21GW	Lead	52.2
	Mercury	175
	Silver	53.8

5. **Matrix Spike Sample Analysis: (continued)**

MW21GWD	Lead	58.5
	Silver	60.8
SB21S3	Barium	18.4
	Cadmium	22.8
	Chromium	10.5
	Copper	234
	Lead	65.4
	Nickel	21.6
	Silver	47.5
	Zinc	18.0

Action: The results for lead, mercury, and silver should be estimated for all aqueous samples. Barium, chromium, copper, lead, silver, and zinc results should be estimated in the soil samples. Cadmium and nickel results should be rejected due to poor recoveries. It should be noted that the post digestion spike for cadmium and nickel were in control.

6. **Laboratory Precision Evaluation:** Duplicate analysis was performed on samples MW21GW, M21GWD, and SB21S3. The relative percent difference for aqueous duplicate samples were in control with the following exceptions: (1) chromium, iron, mercury, and sodium in the unfiltered sample; and (2) aluminum in the filtered sample. Soil variances were in control for the duplicate sample with the exception of chromium and copper. Chromium and copper results should be qualified as estimated for soil samples.

7. **Field Precision Evaluation:** Duplicate samples were not collected during this sampling event.

8. **Laboratory Control Sample:** All criteria were met.

9. **Standard Additions/Furnace Atomic Absorption Analysis:** All criteria were met.

10. **Serial Dilution Results:** All criteria were met.

SOIL BORINGS

ARROWHEAD PLATING
VOLATILE ORGANICS DATA FOR SOIL BORINGS
in units of ug/kg

Sample ID	Depth	Tetrachloroethene	Acetone	2-Butanone	Toluene	1,2-Dichloroethene (total)	Total Xylenes	Methylene Chloride
SB1-S4	15-17	6 U	11 U	11 U	6 U	6 U	6 U	6 U
SB2-S7	12-14	5 U	11 U	11 U	5 U	5 U	5 U	5 U
SB3-S4	15-17	7 U	14 U	14 U	7 U	7 U	7 U	7 U
SB4-SS3	10-12	6 U	13 U	13 U	6 U	6 U	6 U	12
SB4-SS3A	10-12	6 U	13 U	13 U	6 U	6 U	6 U	9
SB5-S1	0-2	6 U	13 U	13 U	6 U	6 U	6 U	6 U
SB5-S4	15-17	6 U	17 (e)	12 U	6 U	6 U	6 U	6 U
SB6-S1	0-2	22	120 (e)	12 U	6 U	6 U	6 U	6 U
SB6-S2	5-7	5 U	11 U	11 U	5 U	6 U	6 U	5 U
SB6-S4	15-17	6 U	11 U	11 U	6 U	6 U	6 U	6 U
SB7-S3	10-12	6 U	11 U	11 U	6 U	6 U	6 U	6 U
SB7-S4	15-17	6 U	13 U	13 U	6 U	6 U	6 U	6 U
SB8-S2	6-7	140,000	11,000 (d)	14,000 U	7,100 U	7,100 U	7,100 U	7,100 U
SB8-S3 RE	10-12	7	200	17	4 (c)	6 U	6 U	[5] (c)
SB8-S3A (Dup) RE	15-17	26	100	9 (c)	2 (c)	1 (c)	6 U	6 U
SB9-S1 RE	0-2	6 U	12 U	12 U	6 U	6 U	6 U	6 U
SB9-S3	10-12	6 U	11 U	11 U	6 U	6 U	6 U	6 U
SB9-S3A (Dup) RE	10-12	5 U	10 U	10 U	5 U	5 U	5 U	5 U
SB9-S4	15-17	6 U	11 U	11 U	6 U	6 U	6 U	6 U
SB10-S3	10-12	11 U	11 U	11 U	6 U	6 U	6 U	(5)
SB11-S2	5-7	6 U	13 U	13 U	6 U	6 U	6 U	6 U
SB12-S2	5-7	7 (c)	16 U	16 U	8 U	8 U	8 U	8 U
SB12-S2A (Dup)	5-7	9	16 U	16 U	8 U	8 U	8 U	8 U
SB13-S1	0-2	6 U	11 U	11 U	6 U	6 U	6 U	6 U
SB20-SS7	12-14	6 U	[16] (e)	11 U	6 U	6 U	4 (c)	6 U

U indicates compound was not detected above limit indicated.
RE=Reextraction
(c)=The compound is tentatively identified, and quantitated at less than the method detection limit.
(d)=Mass spectral data suggests the presence of this compound, but due to the dilution the compound cannot be confirmed.
(e)=Due to a substantial deviation in the response for the daily calibration, this value is considered estimated.
[ ]=This detected concentration is considered non-detected because it is within ten times the concentration detected in the trip blank.
( )=This detected concentration is considered non-detected because it is within ten times the concentration detected in the reagent blank.

01/25/91

ARROWHEAD PLATING SITE
VOLATILE ORGANICS DATA FOR SOIL BORINGS (Round 3,
in units of ug/Kg

Sample ID	Acetone	2-Butanone	1,1-Dichloro-ethene	1,2-Dichloro-ethene	1,1,1-Trichloro-ethane	Trichloro-ethene	Tetrachloro-ethene	Methylene Chloride	1,1-Dichloro-ethane	Benzene	Comment
Federal Standards ug/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
SB21-S3	30	12U	7	5(c)	15	150	86	(7)	2(c)	(2)	Note A
SB21-S5	49(c)	63U	470	26(c)	460	1,300(a)	1,300(a)	(19)	24(c)	8(c)	Note A
SB21-S6	130	62U	56	31U	100	160	190	(17)	31U	8(c)	Note A
SB22-S3	20	11U	5U	5U	5U	5U	5U	(5)	5U	(2)	Note A

NA=Not Available
DL=Dilution
RE=Reextraction
U=Indicates the compound was not detected above the limit indicated.
( )=This detected concentration is considered non-detected because it is within ten times the concentration detected in the reagent blank.
[ ]=This detected concentration is considered non-detected because it is within ten times the concentration detected in the field blank.
(a)=The quantitated value exceeds the range of calibration; therefore, this value should be considered estimated.
(b)=The compound is tentatively identified.
(c)=The compound is tentatively identified and quantitated at less than the method detection limit.
(d)=Mass spectral data suggests the presence of this compound, but due to the dilution the compound cannot be confirmed.
(e)=Due to a substantial deviation in the response for the daily calibration, this value is considered estimated.
(f)=40 CFR, Part 141-National Primary Drinking Water Regulation. pp526-533, 585-587
(g)=Proposed
(h)=Suggested No Adverse Response Levels (SNARLS)
(j)=Analysis of sample outside holding time; this value should be considered estimated.
(k)=Due to a noncompliant surrogate, this value should be considered estimated.

Note A: Due to a substantial deviation in the chloromethane response, the method detection limit for chloromethane should be considered estimated.

ARROWHEAD PLATING SITE
SEMIVOLATILE ORGANICS DATA FOR SOIL BORINGS
in units of ug/kg

Sample ID	Depth	4-Chloro-Aniline	Bis(2-ethylhexyl)phthalate	Number of Tentatively Identified Compounds	Tentative Identification	Comments
SB1-S4	15-17	380 U	380 U	0		
SB2-S7	12-14	360 U	360 U	0		
SB3-S4	15-17	470 U	470 U	0		
SB4-SS3	10-12	420 U	420 U	4	Unknowns	
SB4-SS3A	10-12	420 U	420 U	5	Unknowns	
SB5-S1	0-2	840 U	840 U	3	Unknowns	
SB5-S4	15-17	780 U	780 U	0		
SB6-S1	0-2	820 U	820 U	3	2,4-Dimethyl-3-heptanone, Unknown Alcohol, and Unknown	
SB6-S2	5-7	720 U	720 U	0		
SB6-S4 RE	15-17	740 U	740 U	0		See Note A,B
SB7-S3	10-12	490 U	490 U	0		
SB7-S4	15-17	830 U	830 U	0		
SB8-S2	6-7	740 U	740 U	1	Unknown	
SB8-S3	10-12	740 U	740 U	5	Ketones and Unknowns	
SB8-S3A (Dup)	10-12	290(c)	770 U	2	Unknowns	
SB9-S1	0-2	750 U	750 U	4	2,4-Dimethyl-3-Heptanone and Unknowns	
SB10-S3	10-12	380 U	380 U	0		
SB11-S2	5-7	400 U	210(c)	0		
SB12-S2	5-7	510 U	510 U	8	Unknowns	
SB12-S2A (Dup)	5-7	520 U	520 U	9	Unknowns	
SB13-S1	0-2	370 U	370 U	10	Unknowns, Unknown Hydrocarbon, and Molecular Sulfur	

U indicates compound was not detected above limit indicated.
c: The compound is tentatively identified, and quantitated at less than the method detection limit.
Note A: Due to a recovery of an acid surrogate at less than 10% for this sample, method detection limits for acid compounds should be rejected.
Note B: Due to the low response of 3,3-Dichlorobenzidene the method detection limit should be rejected.

01/25/91

ARROWHEAD PLATING SITE
INORGANIC DATA FOR SOIL BORING SAMPLES

Sample ID	Aluminum %	Barium mg/kg	Cadmium mg/kg	Calcium mg/kg	Chromium mg/kg	Copper mg/kg	Iron mg/kg	Lead mg/kg	Mercury mg/kg	Nickel mg/kg	Potassium mg/kg	Silver mg/kg	Sodium mg/kg	Zinc mg/kg	Cyanide mg/kg
SB1-S4	0.23(b)	8.4(e)	<.54	15.3(b)	3.9	3.7	20600	<4.5	<.11	3.1	198(b)	<.33	16.5(c,d)	7.2(b,c)	<.40
SB2-S7	0.36(b)	12.2(e)	<.54	23.5(b)	5.5	2.7	12400	<4.5	<.11	2.3	274(b)	<.33	14.8(c,d)	5.2(b,c)	<.36
SB3-S4	0.45(b)	8.5(e)	<.54	25.2(b)	7.0	4.5	26800	4.8	<.11	3.2	ND(b)	<.33	13.6(c,d)	9.7(b,c)	<.36
SB4-SS3	0.35	12.1	<.54	0.02(b)	33.3(b)	1.5	103000	<4.5	<.11	6.7(b)	232	<.33(d)	76.1(b,c)	21.2(b,c)	<.36
SB4-SS3A	0.51	11.7	<.45	0.03(b)	13.5(b)	1.2	43000	<1.7	<.12	3.8(b)	185	<.23(d)	164(b,c)	8.3(b,c)	<.29
SB5-S1	1.23(b)	51.0(e)	<.52	5.86(b)	14.4	6.0	12400	9.1	<.10	6.6	490(b,c)	<.31	26.1(c,d)	17.1(b,c)	<.39
SB5-S4	0.42(b)	14.1(e)	<.59	30.7(b)	10.1	3.2	49200	<4.8	<.11	4.3	191(b)	<.35	220(c)	12.7(b,c)	<.45
SB6-S1	0.74(b)	31.2(e)	<.57	29600(b)	11.4	30.4	7160	13.4	<.11	6.1	927(b)	<.34	194(c)	24.6(b,c)	0.83
SB6-S2	1.04(b)	26.9(e)	<.53	225(b)	8.7	4.0	8320	6.3	<.10	3.7	317(b)	<.32	45.1(c)	10.4(b,c)	<.48
SB6-S4	0.36(b)	10.2(e)	<.56	134(b)	4.8	1.8	14200	<4.6	<.11	3.0	137(b)	<.34	11.1(c,d)	6.0(b,c)	<.55
SB7-S3	0.45(b)	11.9(e)	<.53	18.4(b)	9.5	50.1	30100	<4.3	<.11	3.0	172(b)	<.32	42.8(c)	11.1(b,c)	<.52
SB7-S4	0.56(b)	12.1(e)	<.60	131(b)	10.5	7.3	12100	6.2	<.11	3.5	990(b)	<.36	952(c)	22.6(b,c)	<.61
SB8-S2	0.83(a)	47.1(d)	<.56	0.06(d)	11.5(d)	4.3(b,c)	11000(d)	6.3(b,d)	<.11	3.3	191	<.33	169(c,d)	9.8	<.55
SB8-S3A	0.56(a)	49.7(d)	<.57	0.03(d)	5.7(d)	2.5(b,c)	5420(d)	<4.7(d)	<.11	2.3	205	<.34	40.0(c,d)	8.9	<.56
SB8-S3	0.75(a)	32.3(d)	<.55	0.03(d)	9.2(d)	3.2(b,c)	11400(d)	5.1(d)	<.095	3.3	236	<.33	40.3(c,d)	9.5	<.55

LEGEND:

< - Not detected above the limit indicated.
NR - Not Required
(a) - Estimate value due to low bias associated with extended holding time.
(b) - Estimate value due to low bias associated with matrix spike assessment.
(c) - Estimate value due to potential chemical or physical interferences associated with ICP analysis.
(d) - Value is less than five times the concentration in the associated blank.
(e) - Estimate value due to poor laboratory precision.

ARROWHEAD PLATING SITE
INORGANIC DATA FOR SOIL BORING SAMPLES
(continued)

Sample ID	Aluminum	Barium	Cadmium	Calcium	Chromium	Copper	Iron	Lead	Mercury	Nickel	Potassium	Silver	Sodium	Zinc	Cyanide
	%	mg/kg	mg/kg	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
SB9-S1	0.73(a)	22.0(d)	<.55	0.03(d)	10.0(d)	5.3(b,c)	10900(d)	5.7(b)	<.11	2.1	202	<.33	21.8(c,d)	7.7	<.54
SB10-S3	0.40(a)	19.2(d)	<.56	0.01(d)	6.5(d)	5.8(b,c)	54100(d)	<4.6(d)	<.11	2.4	157	<.34	495(c,d)	13.6	<.52
SB11-S2	0.62(a)	9.5(d)	<.62	0.01(d)	18.4(d)	5.9(b,c)	18100(d)	<5.1(d)	<.12	1.4	499	<.37	575(c,d)	6.2	<.58
SB12-S2	0.50(a)	13.2(d)	<.77	0.00(b,d)	13.8(d)	6.4(b,c)	8680(d)	6.4(d)	<.16	2.1	1020	<.46	98.3(c,d)	13.6	<.69
SB12-S2A	0.72(a)	21.5(d)	<.78	0.01(d)	14.4(d)	8.5(b,c)	10700(d)	13.0(d)	<.14	2.6	1210	<.47	177(c,d)	19.5	<.76
SB13-S1	0.45(a)	18.7(d)	<.63	0.04(d)	6.2(d)	3.5(b,c)	13500(d)	<5.2(d)	<.13	2.3	156	<.38	97.5(c,d)	7.7	<.60
SB15-SS1	NR	NR	NR	NR	NR	3.7	NR	NR	NR	NR	NR	NR	NR	3.6	<.45(d)
SB15-SS2	NR	NR	NR	NR	NR	3.6	NR	NR	NR	NR	NR	NR	NR	7.7	<.56(d)
SB15-SS3	NR	NR	NR	NR	NR	2.3	NR	NR	NR	NR	NR	NR	NR	8.2	<.60(d)
SB15-SS4	NR	NR	NR	NR	NR	2.5	NR	NR	NR	NR	NR	NR	NR	7.0	<.65(d)
SB16-SS1	NR	NR	NR	NR	NR	6.9(b)	NR	NR	NR	NR	NR	NR	NR	15.2(c)	<.55(d)
SB16-SS10	NR	NR	NR	NR	NR	4.7(b)	NR	NR	NR	NR	NR	NR	NR	13.1(c)	<.56(d)
SB16-SS2	NR	NR	NR	NR	NR	6.5(b)	NR	NR	NR	NR	NR	NR	NR	17.1(c)	<.46(d)
SB16-SS3	NR	NR	NR	NR	NR	117(b)	NR	NR	NR	NR	NR	NR	NR	45.0(c)	0.71(a)
SB16-SS4	NR	NR	NR	NR	NR	9.9(b)	NR	NR	NR	NR	NR	NR	NR	15.6(c)	<.44(d)
SB16-SS5	NR	NR	NR	NR	NR	1.9(b)	NR	NR	NR	NR	NR	NR	NR	8.1(c)	<.47(d)
SB16-SS6	NR	NR	NR	NR	NR	4.1(b)	NR	NR	NR	NR	NR	NR	NR	6.2(c)	<.56(d)
SB16-SS7	NR	NR	NR	NR	NR	11.7(b)	NR	NR	NR	NR	NR	NR	NR	14.5(c)	<.52(d)

LEGEND:

< - Not detected above the limit indicated.
NR - Not Requested
(a) - Estimate value due to low bias associated with extended holding time.
(b) - Estimate value due to low bias associated with the matrix spike and matrix spike duplicate.
(c) - Estimate value due to potential chemical or physical interferences associated with ICP analysis.
(d) - Estimate detection limit due to elevated level associated with extended holding time.

ARROWHEAD PLATING SITE
INORGANIC DATA FOR SOIL BORING SAMPLES
(continued)

Sample ID	Aluminum %	Barium mg/kg	Cadmium mg/kg	Calcium %	Chromium mg/kg	Copper mg/kg	Iron mg/kg	Lead mg/kg	Mercury mg/kg	Nickel mg/kg	Potassium mg/kg	Silver mg/kg	Sodium %	Zinc mg/kg	Cyanide mg/kg
SB16-SS8	NR	NR	NR	NR	NR	4.5(b)	NR	NR	NR	NR	NR	NR	NR	7.2(c)	<.49(d)
SB16-SS9	NR	NR	NR	NR	NR	3.9(b)	NR	NR	NR	NR	NR	NR	NR	8.2(c)	<.54(d)
SB17-SS1	NR	NR	NR	NR	NR	9.6	NR	NR	NR	NR	NR	NR	NR	14.8	<.56(d)
SB17-SS2	NR	NR	NR	NR	NR	6.9	NR	NR	NR	NR	NR	NR	NR	9.4	<.56(d)
SB17-SS3	NR	NR	NR	NR	NR	5.3	NR	NR	NR	NR	NR	NR	NR	15.8	<.52(d)
SB17-SS4	NR	NR	NR	NR	NR	15.3	NR	NR	NR	NR	NR	NR	NR	15.3	<.48(d)
SB17-SS5	NR	NR	NR	NR	NR	1060	NR	NR	NR	NR	NR	NR	NR	226	1.5(a)
SB17-SS6	NR	NR	NR	NR	NR	860	NR	NR	NR	NR	NR	NR	NR	267	2.6(a)
SB18-SS1	NR	NR	NR	NR	NR	54.2	NR	NR	NR	NR	NR	NR	NR	51.5	<.53(d)
SB18-SS2	NR	NR	NR	NR	NR	10.4	NR	NR	NR	NR	NR	NR	NR	12.6	<.52(d)
SB18-SS3	NR	NR	NR	NR	NR	51.9	NR	NR	NR	NR	NR	NR	NR	28.9	0.46(a)
SB18-SS4	NR	NR	NR	NR	NR	71.0	NR	NR	NR	NR	NR	NR	NR	30.7	<.51(d)
SB18-SS5	NR	NR	NR	NR	NR	5.5	NR	NR	NR	NR	NR	NR	NR	9.8	<.53(d)
SB18-SS6	NR	NR	NR	NR	NR	7.0	NR	NR	NR	NR	NR	NR	NR	9.1	<.55(d)

LEGEND:

< - Not detected above the limit indicated.
NR - Not Requested
(a) - Estimate value due to low bias associated with extended holding time.
(b) - Estimate value due to low bias associated with the matrix spike and matrix spike duplicate.
(c) - Estimate value due to potential chemical or physical interferences associated with ICP analysis.
(d) - Estimate detection limit due to elevated level associated with extended holding time.

ARROWHEAD PLATING SITE
INORGANIC DATA FOR SOIL BORING SAMPLES
(continued)

Sample ID	Aluminum %	Barium mg/kg	Cadmium mg/kg	Calcium %	Chromium mg/kg	Copper mg/kg	Iron mg/kg	Lead mg/kg	Mercury mg/kg	Nickel mg/kg	Potassium mg/kg	Silver mg/kg	Sodium %	Zinc mg/kg	Cyanide mg/kg
SB19-SS1	NR	NR	NR	NR	NR	5.4(b)	NR	NR	NR	NR	NR	NR	NR	15.4(c)	<.27(d)
SB19-SS2	NR	NR	NR	NR	NR	1.9(b)	NR	NR	NR	NR	NR	NR	NR	12.8(c)	<.26(d)
SB19-SS3	NR	NR	NR	NR	NR	4.2(b)	NR	NR	NR	NR	NR	NR	NR	14.3(c)	<.28(d)
SB19-SS4	NR	NR	NR	NR	NR	5.2(b)	NR	NR	NR	NR	NR	NR	NR	16.5(c)	<.28(d)
SB19-SS5	NR	NR	NR	NR	NR	57.8	NR	NR	NR	NR	NR	NR	NR	25.3(c)	0.45(a)
SB19-SS6	NR	NR	NR	NR	NR	12.4	NR	NR	NR	NR	NR	NR	NR	18.3(c)	<.27(d)
SB19-SS7	NR	NR	NR	NR	NR	5.0(b)	NR	NR	NR	NR	NR	NR	NR	17.9(c)	<.29(d)
SB20-SS1	NR	NR	NR	NR	NR	5.6(b)	NR	NR	NR	NR	NR	NR	NR	12.3(c)	.28(d)
SB20-SS2	NR	NR	NR	NR	NR	4.0(b)	NR	NR	NR	NR	NR	NR	NR	12.4(c)	<.27(d)
SB20-SS3	NR	NR	NR	NR	NR	9.9(b)	NR	NR	NR	NR	NR	NR	NR	15.6(c)	<.20(d)
SB20-SS4	NR	NR	NR	NR	NR	192.0	NR	NR	NR	NR	NR	NR	NR	53.7(c)	2.6(a)
SB20-SS5	NR	NR	NR	NR	NR	82.2	NR	NR	NR	NR	NR	NR	NR	36.1(c)	1.6(a)
SB20-SS5A	NR	NR	NR	NR	NR	81.1	NR	NR	NR	NR	NR	NR	NR	39.5(c)	2.0(a)
SB20-SS6	NR	NR	NR	NR	NR	8.6(b)	NR	NR	NR	NR	NR	NR	NR	11.6(c)	1.6(a)
SB20-SS7	NR	NR	NR	NR	NR	25.2	NR	NR	NR	NR	NR	NR	NR	39.0(c)	0.72(a)
SB21-S3	.57	12.9 (b)	1.2 U(e)	1,380	8.8 (b,f)	84.8 (b,f)	13,100	3.4 (b)	0.13	6.6 U(e)	75.9 (a)	0.59 (b)	1,318.63 (a)	33.5 (b)	11.4
SB21-S5	.287	11.3 (b)	1.3 U(e)	209 U	2.3 U(b,f)	14.8 (b,f)	9,900	1.0 (b)	0.13	7.0 U(e)	189.0	0.26 U(b)	144.33 (a)	3.4 (b)	1.29 U
SB21-S6	.414	11.0 U(b)	1.3 U(e)	204 U	3.6 (b,f)	42.3 (b,f)	21,200	2.3 (b)	0.19	6.8 U(e)	582.0	0.25 U	155.58 (a,b)	8.7 (b)	1.25 U
SB22-S3	.416	9.6 U(b)	1.1 U(e)	178 U	6.5 (b,f)	3.7 (a,b,f)	11,000	3.1 (b)	0.11	5.9 U(e)	253.0 (a)	0.22 U(b)	83.24 (a)	4.0 (b)	1.10 U
SB23-S1	.886(c)	23.98 (b)	1.19 U	5,090	10.22	4.0 (b)	10,900	7.2 (b)	0.04	6.02 U	69.27	0.22 U(e)	51.50 (a)	9.55	1.12

LEGEND:

U - Not detected above limit indicated.
NR - Not Requested
(a) - Estimate value due to low bias associated with extended holding time.
(b) - Estimate value due to low bias associated with the matrix spike and matrix spike duplicate.
(c) - Estimate value due to potential chemical or physical interferences associated with ICP analysis.
(d) - Estimate detection limit due to elevated level associated with extended holding time.
(e) - Reject value due to poor recovery due to poor recovery associated with matrix spike.
(f) - Estimate value due to poor laboratory precision.

ICF KAISER ENGINEERS

ICF KAISER ENGINEERS, INC.
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703/934-3300

TO: Claudia Brand

FROM: Jay Kuhn

DATE: July 17, 1990

SUBJECT: Arrowhead Plating Site, Data Validation, 3 Soil Boring Samples, Semivolatile and Volatile Organic Analysis, Versar Inc., Virginia.

REFERENCE: Validation 1, Versar Control Number 2289 and 2309, Soil Boring

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A level I validation was performed on the organic analytical data from 3 soil boring samples collected at the Arrowhead Plating Site as part of the Remedial Investigation/Feasibility Study. The samples were analyzed for EPA Target Compound List (TCL) volatile organics and semivolatile organics by Versar Inc., Springfield, Virginia. A volatile organic compounds trip blank was also included in the sample package. Validation was performed in accordance with the EPA Functional Guidelines for Evaluating Organics Analyses (February 1, 1988). A copy of the checklist has been provided as an attachment for your information.

The samples included in the data package are the following.

SB1-S4 (15-17')	SB3-S4 (15-17')
SB2-S7 (12-14')	Trip Blank

Overall Assessment of Data for Samples Evaluated:

There are no qualifiers placed on this data with respect to this validation.

The following criteria were reviewed in validating the data:

1. **Holding Time:** All criteria met

2. **GC/MS Tune:** All criteria met.

3. **Calibration:**

Volatile Analysis Calibration:

Instruments U was used to perform the volatile analysis. Calibration results for this instrument is as follows:

Instrument U

Initial: 3/20/90, Meets criteria.

Continuing: 3/23/90, Meets criteria.

Semivolatile Analysis Calibration:

Instrument T was used to perform the semivolatile analysis. Calibration results for this instrument is as follows:

Instrument T

Initial: 3/27/90,Meets criteria.

Continuing: 4/2/90, 1 compound, Chrysene, has a percent deviation (%D) > 25%.

Impact on data: Results for compounds which are quantitated on continuing calibrations with %D > 25% should be qualified as follows: detected compound values should be estimated for Chrysene. The samples potentially impacted are SB1-S4, SB2-S7, and SB3-S4. Chrysene was not detected in any of these samples; therfore, no qualification of the data is warranted.

4. **Blanks:**

The intent of blank analysis results are to evaluate the potential of contamination contribution by the sampling and/or analytical process. Both field blanks and laboratory blanks are included in this data package. No contamination was found in laboratory or trip blanks.

5. **Surrogate Spike:**

Surrogate recovery windows created from EPA Contract Laboratory Program data base. Sample SB2-S7MSD (matrix spike duplicate) has a recovery of 1,2-Dichloroethane at 54%.

Impact on data: Since this outlier is a matrix spike duplicate, it is in the reviewers judgement that there is no impact on the results reported

for the sample SB2-S7 which is compliant.

6. **Matrix Spike/Matrix Spike Duplicate:**

A matrix spike/matrix spike duplicate was done for the volatile fraction only. The following are recovery outliers:

Sample ID:	Compound:	Recovery:
SB2-S7MS	1,1-Dichloroethene	58%
SB2-S7MSD	1,1-Dichloroethene	48%
SB2-S7MSD	Benzene	62%

The relative percent deviation for Benzene was an outlier at 24%.

Impact on data: The results of SB2-S7 are not impacted by these variances nor are the individual samples associated with the case.

7. **Field Duplicates:**

No field duplicates were done with this analytical sequence.

8. **Internal Standard (IS) Performance:** All criteria met.

9. **TCL Compound Identification:** All criteria met.

10. **Compound Quantitation and Reported Detection Limits:**

Instrument detection limits were not submitted. Quantitation limits were met.

11. **Tentatively Identified Compounds:** All criteria met.

12. **System Performance:** All criteria met.

ICF KAISER ENGINEERS

ICF KAISER ENGINEERS, INC.
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703/934-3300

TO: Claudia Brand

FROM: Jay Kuhn

DATE: July 16, 1990

SUBJECT: Arrowhead Plating Site, Data Validation, Semivolatile [11 Soil Samples, 1 Water Sample] and Volatile [14 Soil Samples, 3 Water Samples] Organic Analysis, Versar Inc., Virginia.

REFERENCE: Validation 2, Versar Control Number 2309 and 2327, Soil Borings

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A level I validation was performed on the organic analytical data from 14 soil samples collected at the Arrowhead Plating Site as part of the Remedial Investigation/Feasibility Study. The samples were analyzed for EPA Target Compound List (TCL) semivolatile and volatile organics by Versar Inc., Springfield, Virginia. A volatile organic compounds trip blanks were also included in the sample package. Validation was performed in accordance with the EPA Functional Guidelines for Evaluating Organics Analyses (February 1,1988). A copy of the checklist has been provided as attachment for your information.

The samples included in the data package are the following.

SB5-S1 (0'-2')
SB5-S4 (15'-17')
SB6-S1 (0'-2')
SB6-S2 (5'-7')
SB6-S4 (15'-17')
SB7-S3 (10'-12')
SB7-S4 (15'-17')
Equipment Blank
Trip Blank (3/23/90) *
SB8-S2 (6'-7')
SB8-S3 (10'-12')
SB8-S3A
SB9-S1 (0'-2')
SB9-S3 (10'-12') *
SB9-S3A *
SB9-S4 (15'-17') *
Trip Blank (3/28/90) *

* Volatile Organics Analysis Only

Overall Assessment of Data for Samples Evaluated:

1. The integrity of the semivolatile acid fraction analysis for sample SB6-S4 is questionable due to low surrogate recoveries. The initial analysis of the sample contained surrogate recoveries less than 10% for 2 of the acid surrogate standards and one of the base/neutral surrogate standards. These standards are added to the samples to assess the

methods accuracy and precision. In accordance with contractual requirements, the laboratory reextracted and reanalyzed the sample and associated method blank. Although the initial problem associated with the base/neutral fraction was remediated, one acid fraction surrogate recovery was less than 10%. Results associated with the acid fraction for this sample should therefore be rejected.

2. With respect to initial and continuing calibrations, the impact on data is as follows: the detected value of acetone should be considered estimated for samples SB5-S4 and SB6-S1; the non-detect data for 3,3'-dichlorobenzidene should be rejected for SB6-S4.

3. In the field duplicates there is a substantial deviation in the detected value of tetrachloroethene. This value should be considered estimated in field duplicates SB8-S3 and SB8-S3A.

4. The following samples had noncompliant internal standard areas: SB8-S3, SB8-S3A, SB9-S1, and SB9-S3A. The reextractions were compliant; therefore, the data from reextractions was used.

The following criteria were reviewed in validating the data:

1. **Holding Time**: All criteria met except for SB6-S4 semivolatile analysis. The initial extraction was within holding times but was not compliant with respect to surrogate recovery. The reextraction did not meet holding time criteria and also was not compliant with respect to surrogate recovery. Impact on data: no impact with respect to holding time (see surrogate evaluation).

2. GC/MS Tune: All criteria met.

3. Calibration:

   Volatile TCL:

   Instruments U, W, and Y were used to perform the volatile analysis. Calibration results for each instrument are as follows:

   Instrument U

   Initial: 3/28/90, meets criteria.
   Continuing: 4/2/90, 8 compounds have a %D > 25%.
   Continuing: 4/6/90, 3 compounds have a %D > 25%.
   Continuing: 4/7/90, 4 compounds have a %D > 25%.

   Impact on data: Results for compounds which are quantitated on continuing calibrations with percent deviation (%D) > 25% should be qualified as follows: detected compound values should be estimated. The detected value for acetone should be considered estimated for samples SB5-S4 and SB6-S1.

   Initial: 4/9/90, meets criteria.
   Continuing: 4/11/90, 9 compounds have a %D > 25%.

   Impact on data: Results for compounds which are quantitated on continuing calibrations with percent deviation (%D) > 25% should be qualified as follows: detected compound values should be estimated. None of these compounds were detected for the samples associated with this calibration.

   Instrument W

   Initial: 4/9/90, 35 compounds have a %RSD > 30%. Notified the laboratory that this standard was not compliant. The laboratory stated that an error in data transfer resulted in the values. The corrected initial calibration form has been resubmitted and is to replace page 100267. The resubmission meets criteria.
   Continuing: 4/10/90, 35 compounds have a %D > 25%. Notified the laboratory of the noncompliant standard. The laboratory stated that an error in data transfer resulted in the values. The corrected initial calibration form has been resubmitted and is to

replace page 100275. The resubmission has 1 compound, 2-butanone with a %D > 25%

Impact on data: Results for 2-butanone which are quantitated on the continuing calibration with percent deviation (%D) > 25% should be qualified as follows: detected compound values should be estimated. The samples potentially impacted are SB8-S3RE (reextraction) and SB8-S3ARE (reextraction). 2-Butanone was not detected in any of these samples.

Initial: 4/11/90, meets criteria.
Continuing: 4/11/90, meets criteria.

Instrument Y

Initial: 4/2/90, meets criteria.
Initial: 4/3/90, meets criteria.
Continuing: 4/4/90, meets criteria.

Semivolatile TCL:

Instrument T was used to perform semivolatile analysis. Calibration results for the instrument are as follows:

Instrument T

Initial: 3/27/90, meets criteria.
Continuing: 4/4/90, 2 compounds have a %D > 25%.
Continuing: 4/6/90, 3 compounds have a %D > 25%.
Continuing: 4/9/90, 2 compounds have a %D > 25%.
Continuing: 4/10/90, 3 compounds have a %D > 25%.
Continuing: 4/11/90, 6 compounds have a %D > 25%

Impact on data: Results for compounds which are quantitated on continuing calibrations with percent deviation (%D) > 25% should be qualified as follows: detected compound values should be estimated. The potentially impacted samples are SB5-S4, SB6-S1, SB6-S2, SB6-S4, SB7-S3, SB7-S4, SB7-S3MS, SB7-S3MSD, SB8-S2, SB9-S1, and SB5-S1. No compounds with a %D > 25% were detected in these samples.

Initial: 4/17/90, meets criteria.

Initial: 4/19/90, meets criteria.
Continuing: 4/23/90, 6 compounds have a %D > 25%. 1 compound, 3,3'-dichlorobenzidene, has a response factor (RF) < 0.05.

Impact on data: Results for compounds which are quantitated on continuing calibrations with percent deviation (%D) > 25% should be qualified as follows: detected compound values should be

estimated and reject all non-detected data for the compound 4-chloroaniline. The low response for 3,3'-dichlorobenzidene qualifies the data as follows: detected compound values should be estimated and reject the data of those compounds which are non-detected. The impact on data is as follows: the non-detection of 3,3'-dichlorobenzidene in sample SB6-S4 should be rejected.

4. Blanks:

Blank analysis results are assessed to evaluate the potential of contamination contribution by the sampling and/or analytical process. Field blanks, trip blanks, and laboratory blanks are included in this data package. The maximum concentration of contamination found in any of the field, trip, or laboratory blanks is as follows:

Contamination	Detected Concentration of Contamination	Contamination Considered Non-detect up to Concentration	Blank I.D.
Acetone	8 ug/L	80 ug/L	Equip Blank
Methylene Chloride	3 ug/L	30 ug/L	VBLK07
Acetone	9 ug/L	80 ug/L	VBLK07
2-Butanone	880 ug/L	8800 ug/L	VBLK35(MED)

Impact on data: No data was qualified based on this contamination.

5. Surrogate Spike: Surrogate recovery windows created from EPA Contract Laboratory Program data base.

Volatile: SB5-S4 had 1 surrogate out of the required range. SB5-S4 RE (reextraction) had 1 surrogate out (same surrogate). SB8-S3 had 1 surrogate out. Impact on data: It is in the reviewers judgement that there is no significant impact.

Semivolatile: The equipment blank had 1 acid surrogate out. SB6-S4 had 2 acid surrogate recoveries less than 10%. In addition, SB6-S4 had 1 base/neutral surrogate recovery less than 10%. SB6-S4 (reextraction) had 1 acid surrogate recovery less than 10%. SBLK62 (Laboratory Blank) had 1 acid surrogate recovery less than 10%. SB8-S3A had 1 acid surrogate out and 1 base/neutral surrogate out. SB8-S3 had 1 acid surrogate out and 1 base/neutral surrogate out. Impact on data: All positive results for sample SB6-S4 associated with the acid fraction are estimated and non-detected results should be rejected for use.

6. Matrix Spike/Matrix Spike Duplicate:

Volatile: SB7-S3 had the same surrogate out in the MS and MSD. Since this information can not be used to assess the accuracy and precision of the individual samples no action is required.

Semivolatile: All recoveries and Relative Percent Deviations (RPD's) meet criteria.

7. Field Duplicates:

Volatile: The field duplicates are SB9-S3 and SB9-S3A. In addition, SB9-S3A was reextracted and designated SB9-S3ARE. There are also field duplicates SB8-S3 and SB8-S3A with a reextraction SB8-S3ARE. No compounds were detected for all three analyses of SB9-S3. The results of the analyses of SB8-S3A are as follows:

Compound Quantitated	SB8-S3 (ug/kg)	SB8-S3A (ug/kg)	SB8-S3RE (ug/kg)
Methylene Chloride	6	6	5
Acetone	160	170	200
2-Butanone	25	25	17
Tetrachloroethene	10	100	7
Toluene	7	6	4

The Relative Percent Deviations (RPD's) for SB8-S3 and SB8-S3A are as follows:

Compound Quanitated	RPD
Methylene Chloride	0%
Acetone	6%
2-Butanone	0%
Tetrachloroethene	164%
Toluene	15%

Impact on data: The field duplicates reflect good precision with the exception of tetrachloroethene. The substantial difference in values between the duplicates could reflect failure to homogenize the sample prior to analysis. The detected value of terachloroethene should be considered estimated for SB8-S3 and SB8-S3A.

Semivolatile: The field duplicates are SB8-S3 and SB8-S3A for semivolatile analysis. In both samples all target compounds were less than the method detection limit. In sample SB8-S3A, 4-Chloroaniline was tentatively identified and quantitated at 290 ug/Kg, which was less than the method detection limit. The method detection limit value for 4-Chloroaniline in SB8-S3 is 740 ug/Kg.

The Relative Percent Standard Deviation (RPD) for two values is 87%.

Impact on data: It is in the reviewers judgement that there is no significant impact.

8. **Internal Standard (IS) Performance**:

   Volatile: The following samples had non-compliant internal standard areas: SB8-S3, SB8-S3A, SB9-S1, and SB9-S3A. The reextractions were compliant.

   Semivolatile: All submitted samples meet IS criteria.

9. **TCL Compound Identification**: All qualitative analysis acceptable.

10. **Compound Quantitation and Reported Detection Limits**: All method detection limits were acceptable. Instrument detection limits were not submitted.

11. **Tentatively Identified Compounds**: All criteria met

12. **System Performance**: System performance acceptable.

ICF KAISER ENGINEERS

ICF KAISER ENGINEERS, INC.
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703/934-3300

TO: Claudia Brand

FROM: Jay Kuhn

DATE: July 16, 1990

SUBJECT: Arrowhead Plating Site, Data Validation, 21 Soil Samples, 2 Water Samples, Semivolatile and Volatile Organic Analysis, Versar Inc., Virginia.

REFERENCE: Validation 3, Versar Control Number 2338 and 2349, Surface Soil and Soil Boring

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A level I validation was performed on the organic analytical data from 21 soil samples collected at the Arrowhead Plating Site as part of the Remedial Investigation/Feasibility Study. The samples were analyzed for EPA Target Compound List (TCL) semivolatile and volatile organics by Versar Inc., Springfield, Virginia. A volatile organic compounds trip blank was also included in the sample package. Validation was performed in accordance with the EPA Functional Guidelines for Evaluating Organics Analyses (February 1,1988). A copy of the checklist has been provided as an attachment for your information.

The samples included in the data package are the following.

SB10-S3	SS21	SS32
SB11-S2	SS22	SS33
SB12-S2 (5'-7')	SS23	SS34
SB12-S2A	SS24	SS35
SB13-S1 (0'-2')	SS25	SS36
Trip Blank	SS26	SS37
	SS27	SS38
	SS28	SS39
	Trip Blank	

Overall Assessment of Data for Samples Evaluated:

1. The integrity of the semivolatile TCL analysis of SB12-S2A is questionable with respect to holding time. Although technical requirements for holding times have not been established, the reextraction data has not been delivered and the laboratory did not commit to a date in the narrative.

2. Contamination contribution by the sampling and analytical process is

present. The samples potentially impacted are SB10-S3, SS34, SS35, SS37 for blank VBLK07 and SS36 for blank VBLK35. The sample results which are qualified are as follows: for sample SS34 the detection of methylene chloride and acetone should be considered non-detect, for sample SS35 the detection of methylene chloride should be considered non-detect, and for sample SS36 the detection of 2-butanone should be considered non-detect.

3. For sample SS35 the quantitated value of acetone should be considered estimated.

4. For the following samples the method detection limit for compounds quantitated by perylene-D12 should be rejected: SB10-S3, SB11-S2, SB12-S2A, SB12-S2ARI, SB12-S2, SB12-S2RI, SS33, SS33RI, SB10-S3RI, and SB11-S2RI.

The following criteria were reviewed in validating the data:

1. **Holding Time:** All criteria were met except for samples SB12-S2A and SS24. SS24, semivolatile TCL, was incorrectly extracted at a medium level and was reextracted outside holding time as a low level. A compliant analysis of SB12-S2A has not been submitted at this time. Technical requirements for holding times have not been established for soil samples. Impact on data: It is in the reviewers judgement that there is no significant impact.

2. **GC/MS Tune:** All criteria met.

3. **Calibration:**

   Volatile TCL: Instruments U, W, and Y were used to perform the volatile analysis. Calibration results for each instrument are as follows:

   Instrument U

   Initial: 4/9/90, 35 compounds %RSD > 30%. Notified the laboratory of the noncompliant standards. The laboratory stated that an error in data transfer resulted in the values. The corrected initial calibration form has been resubmitted and is to replace page 100273. The resubmission meets criteria.

   Continuing: 4/10/90, 4 compounds have a %D > 25%. Notified the laboratory that the continuing calibration form does not reflect the calibration check of response values for instrument U on 4/10/90. The laboratory submitted the correct continuing calibration form which is to replace page 100277. The resubmitted form has 2 compounds, acetone and bromoform, with a %D > 25%.

   Impact on data: Results for the compounds Acetone and Bromoform which are quantitated on continuing calibrations with percent deviations (%D) > 25% should be qualified as follows: detected compound values should be estimated. The samples potentially impacted are Tripblank (3/30/90), SS28, SS32, SS33, SS38, SS39, SS38MS, SS38MSD, SS25, and SB11-S2. Acetone and bromoform were not detected in these samples.

   Continuing: 4/11/90, 9 compounds have a %D > 25%. Notified the laboratory that the continuing calibration form does not reflect the calibration check of response values for instrument U on 4/11/90. The laboratory submitted the correct continuing calibration form which is to replace page 100278. The resubmitted form has 8 compounds with a %D > 25%.

   Impact on data: Results for compounds which are quantitated on continuing calibrations with percent deviations (%D) > 25% should be qualified as follows: detected compound values should be estimated. The compounds are chloroethane, acetone, 1,2-dichloroethane, 2-butanone, dibromochloromethane, bromoform,

4-methyl-2-pentanone, and 2-hexanone. The sample potentially impacted is SS27. None of these compounds were detected in SS27.

Continuing: 4/12/90, 8 compounds have a %D > 25%. Notified the laboratory that the continuing calibration form does not reflect the calibration check of response values for instrument U on 4/12/90. The laboratory submitted the correct continuing calibration form which is to replace page 100278. The resubmitted form has 8 compounds with a %D > 25%.

Impact on data: Results for compounds which are quantitated on continuing calibrations with percent deviations (%D) > 25% should be qualified as follows: detected compound values should be estimated. The compounds are acetone, 2-butanone, carbon tetrachloride, trichloroethene, dibromochloromethane, bromoform, tetrachloroethene, and ethylbenzene. The potentially impacted sample is SS26. None of these compounds were detected in SS26.

Instrument W

Initial: 4/9/90, 35 compounds have a %RSD > 30%. Notified the laboratory of the noncompliant standards. The laboratory stated that an error in data transfer resulted in the values. The corrected initial calibration form has been submitted and is to replace page 100274. The resubmission meets criteria.

Continuing: 4/10/90, 35 compounds have a %D > 25%. Notified the laboratory of the noncompliant standard. The laboratory stated that an error in data transfer resulted in the values. The corrected continuing calibration form has been submitted and is to replace page 100279. The resubmission has 1 compound, 2-butanone, with a %D > 25%.

Impact on data: The result for 2-butanone which are quanitated on continuing calibrations with percent deviations (%D) > 25% should be qualified as follows: the detected compound value should be considered estimated. The samples potentially impacted are SS34, SS35, SB10-S3, and SS37. The sample impacted is SS35 whose detected value for acetone is considered estimated.

Initial: 4/11/90, meets criteria.

Continuing: 4/11/90, 35 compounds have a %D > 25%. Notified the laboratory of the noncompliant standard. The laboratory stated that an error in data transfer resulted in the values. The corrected continuing calibration form has been submitted and is to replace page 100280. The resubmission meets criteria.

Instrument Y

Initial: 4/2/90, 1 compound has a %RSD > 30%.

Continuing: 4/5/90, 4 compounds have a %D > 25%.

Impact on data: No results for compounds were quantitated from the initial calibration. Results for compounds which are quanitated on continuing calibrations with percent deviations (%D) > 25% should be qualified as follows: detected compound values should be estimated. The compounds are total xylenes, chloromethane, carbon tetrachloride, bromodichloromethane, and 2-hexanone. The sample potentially impacted is the Trip_Blank received 3/29/80. None of these compounds were detected in this blank.

Semivolatile TCL: Instrument T was used to perform semivolatile analysis. Calibration results for each instrument are as follows:

Instrument T

Initial: 4/19/90, meets criteria.

Continuing: 4/20/90, 5 compounds have a %D > 25%.

Impact on data: Results for compounds which are quanitated on continuing calibrations with percent deviations (%D) > 25% should be qualified as follows: detected compound values for benzyl alcohol, bis(2-chloroisopropyl)ether, 4-chloroaniline, 2-methylnaphthalene, and 3-nitroaniline should be estimated and reject the data of the compounds, benzyl alcohol and 4-chloroaniline, when non-detected. The samples impacted are SB12-S2RI (reinjection), SB12-S2ARI (reinjection), SB13-S1, SS26, SS27, SS28, SS35, SS37, SS38, SB10-S3, SB11-S2, and SS39.

Continuing: 4/23/90, 6 compounds have a %D > 25%. 1 compound has a RF < 0.05.

Impact on data: Results for compounds which are quanitated on continuing calibrations with percent deviations (%D) > 25% should be qualified as follows: detected compound values for benzyl alcohol, bis(2-chloroisopropyl)ether, 4-chloroaniline, 2-methylnaphthalene, and 3-nitroaniline should be estimated and reject the data of the compound 4-chloroaniline when non-detected. Result for the compound quanitated on continuing calibrations with response factors less than 0.05 should be qualified as follows: the non-detection of this compound, 3,3'-dichlorobenzidene, should be rejected. The samples impacted are SS23, SS32, SS33, SS34, SS36, SB10-S3RI (reinjection), and SB11-S2RI (reinjection).

Continuing: 4/24/90, 6 compounds have a %D > 25%.

Impact on data: Results for compounds which are quanitated on continuing calibrations with percent deviations (%D) > 25% should be qualified as follows: detected compound values for phenol, bis(2-Chloroethyl)ether, benzyl alcohol, bis(2-

chloroisopropyl)ether, 4-chloroaniline, and 2-methylnaphthalene should be estimated and reject the data of the compound 4-chloroaniline when non-detected. The impacted sample is SS33RI (reinjection).

Initial: 4/30/90, meets criteria.

4. Blanks:

The intent of blanks are to review the potential of contamination contribution by the sampling and/or analytical process. Those compounds present in the blanks should be flagged as non-detect for the specified concentration range within the sample. Both field blanks and trip blanks are included in this data package. The maximum concentration of contamination found in any of the field, trip, or laboratory blanks is as follows:

Contamination	Detected Concentration of Contamination	Contamination Considered Non-detect up to Concentration	Blank I.D.
Methylene Chloride	3 ug/Kg	30 ug/Kg	VBLK07
Acetone	9 ug/Kg	80 ug/Kg	VBLK07
2-Butanone	880 ug/Kg	8800 ug/Kg	VBLK35(MED)

Note: values need to be adjusted by a factor of 5 for SS37.

Impact on data: the detection of acetone and methylene chloride in sample SS34 should be considered non-detect. The detection of methylene chloride in SS35 should be considered non-detect.

5. **Surrogate Spike**: Surrogate recovery windows created from EPA Contract Laboratory Program data base.

Volatile: meets criteria.

Semivolatile: SB12-S2A had 2 base/neutral and 1 acid surrogate out . SB12-S2ARI(reinjection) had 2 base/neutral and 1 acid surrogate out. SB10-S3 had 1 acid surrogate out. SB12-S2 had 1 base/neutral and 1 acid surrogate out. SB12-S2RI(reinjection) had 2 base/neutral and 1 acid surrogate out. SB33 had 1 acid surrogate out. SB33RI(reinjection) had 1 acid surrogate out. Impact on data: For sample SB12-S2A positive results should be considered estimates.

6. **Matrix Spike/Matrix Spike Duplicate:**

Volatile: meets criteria.

Semivolatile: 1 base/neutral matrix spike and one acid matrix spike recovery are high in the MS and MSD. All RPD's meet criteria.

Impact on data: The results for SS21 are not impacted by these variances nor are the individual samples associated with this case.

7. **Field Duplicates:**

Volatile: The field duplicates are SB12-S2 and SB12-S2A. tetrachloroethene was quantitated at 7 ug/kg and 9 ug/kg respectively. The relative percent deviation (RPD) is 25%.

Semivolatile: The field duplicates are SS33 and SS33A. bis(ethylhexyl)phthalate was quantitated at 190 ug/kg and 350 ug/kg respectively. The RPD is 59%.

Impact on data: It is in the reviewers judgement that there is no significant impact.

8. **Internal Standard Performance:**

Volatile: 1 internal standard outlier for sample SB13-S1 0'-2'. 1 internal standard outlier for SB13-S1RI. Impact on data: Positive results quantitated off the internal standards should be considered estimates and for non-detect results the quantitation limit should be considered estimated.

Semivolatile: The recovery of the sixth internal standard, perylene-D12, was less than 50% of the reference internal standard for SB10-S3 and its reinjection. The same is true for SB11-S2 and its reinjection. The fifth internal standard, chrysene-D12, as well as the sixth internal standard were less than 50% of the reference internal standard for SB12-S2A. The same is true for the reinjection of SB12-S2A with the third internal standard, acenaphthene-D10, also less than 50% The recovery of the sixth internal standard, perylene-D12, was less than 50% of the reference internal standard for SB12-S2 and the fifth and sixth internal standards are low for its reinjection. The sixth internal standard is also noncompliant for SB33 as well as its reinjection. Impact on data: Positive results quantitated off the internal standards should be considered estimates and for non-detect results as follows:

Sample:	Acenaphthene-D10	Chrysene-D12	Perylene-D12
SB10-S3		-	R
SB10-S3RI	-	-	R
SB11-S2	-	-	R
SB11-S2RI	-	-	R
SB12-S2A	-	UJ	R
SB12-S2ARI	-	UJ	R
SB12-S2 5'-7'	UJ	-	R
SB12-S2 5'-7'RI	-	UJ	R
SS33	-	-	R
SS33RI	-	-	R
	-		

Legend:
UJ-quantitation limit should be estimated for non-detect compounds
R-substantial drop off of internal standard recovered; non-detects should be flagged as unusable.

The following are the compounds quantitated off of the internal standards in question.

Acenaphthene-D10	(continued) Acenaphthene-D10	Chrysene-D12
Hexachlorocyclopentadiene	Diethylphthalate	Pyrene
2,4,6-Trichlorophenol	4-Nitroaniline	Butylbenzylphthalate
2,4,5-Trichlorophenol	4,6-Dinitro-2-methylphenol	Benz(a)anthracene
2-Chloronaphthalene	N-Nitrosodiphenylamine	Chrysene
2-Nitroaniline	4-Bromophenyl-phenylether	3,3'-Dichlorobenzidene
Acenaphthylene	Hexachlorobenzene	Bis(2ethylhexyl) phthalate
Dimethylphthalate		
2,6-Dinitrotoluene		Perylene-D12
Acenaphthene		
3-Nitroanailine		Di-n-octylphthalate
2,4-Dinitrophenol		Benzo(b)fluoranthene
Dibenzofuran		Benzo(k)fluoranthene
4-Nitrophenol		Benzo(a)pyrene
2,4-Dinitrotoluene		Indeno(1,2,3-cd) pyrene
Fluorene		Dibenzo(a,h)anthracene
4-Chlorophenyl-phenylether		Benzo(g,h,i)perylene

9. **TCL Compound Identification:** All qualitative analysis acceptable.

10. **Compound Quantitation and Reported Detection Limits:** All quantitation and reported detection limits acceptable.

11. **Tentatively Identified Compounds:** Meets criteria.

12. System Performance: System performance acceptable.

ICF KAISER ENGINEERS

ICF KAISER ENGINEERS, INC.
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703/934-3300

TO: Claudia Brand

FROM: Jay Kuhn

DATE: July 17, 1990

SUBJECT: Arrowhead Plating Site, Data Validation, 2 Soil Boring Samples, 4 Water Samples, Semivolatile Organic Analysis, Versar Inc., Virginia.

REFERENCE: Validation 8, Versar Control Number 2753 and 2763, Soil Boring, Groundwater

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A level I validation was performed on the organic analytical data from 2 soil boring samples, 2 groundwater samples, and field blanks collected at the Arrowhead Plating Site as part of the Remedial Investigation/Feasibility Study. The samples were analyzed for EPA Target Compound List (TCL) semivolatile organics by Versar Inc., Springfield, Virginia. Validation was performed in accordance with the EPA Functional Guidelines for Evaluating Organics Analyses (February 1, 1988). A copy of the checklist has been provided as an attachment for your information.

The samples included in the data package are the following.

Water Sample:	Soil Sample:
Equipment Blank 3	SB4-SS3 (10-12')
Equipment Blank 4	SB4-SS3A (10-12')
MW1-GW2	
MW2-GW2	

Note: Samples Trip Blank 13 and Trip Blank (received 5/18/90) were listed in the narrative, but no data for these samples were submitted in this data package.

Overall Assessment of Data for Samples Evaluated:

The reagent **blank** SBLK74 is noncompliant with respect to surrogate recoveries. **The laboratory** submitted another reagent blank, SBLK71, which was extracted on the same day as the soil samples SB4-SS3 and SB4-SS3A; however, this blank was not associated with the extraction sequence of these soil samples. Although the use of SBLK71 is questionable with respect to determining contamination contribution from the extraction process, it is in the reviewers judgement that the noncompliant surrogate recoveries is an isolated occurrence and does not reflect a fundamental problem with the extraction process; therefore, no qualification of the data is warranted.

The following criteria were reviewed in validating the data:

1. **Holding Time:** All criteria met

2. **GC/MS Tune:** All criteria met.

3. **Calibration:**

Semivolatile Analysis Calibration:

Instrument T was used to perform the semivolatile analysis. Calibration results for this instrument is as follows:

Instrument T

Initial: 6/11/90, 1 compound, benzoic acid, has a percent relative standard deviation (%RSD) > 30%.

Impact on data: No samples were quantitated on this initial calibration.

Continuing: 6/12/90, 1 compound, benzoic acid, has a percent deviation (%D) > 25%.

Impact on data: Results for compounds which are quantitated on continuing calibrations with %D > 25% should be qualified as follows: detected compound values should be estimated for benzoic acid. The samples potentially impacted are SB4-SS3, SB4-SS3A, SB4-SS3MS, and SB4-SS3MSD. Benzoic acid was not detected in any of these samples.

Instrument Z

Initial: 6/7/90, Meets criteria.

Continuing: 6/7/90, 1 compound, 4-chloroaniline, has a percent deviation (%D) > 25%.

Impact on data: Results for compounds which are quantitated on continuing calibrations with %D > 25% should be qualified as follows: detected compound values should be estimated for 4-chloroanilne. The samples potentially impacted are MW1-GW2 and MW2-GW2. 4-Chloroaniline was not detected in any of these samples.

4. **Blanks:**

The intent of blank analysis results are to evaluate the potential of contamination contribution by the sampling and/or analytical process. Both field blanks and laboratory blanks are included in this data package. The compound bis(2-ethylhexyl)phthalate was detected at 53

ug/Kg in laboratory blank SBLK71. This would result in a 'considered nondetect' value of 530 ug/Kg for associated samples. It should be noted that, although this blank was extracted on the same day as the samples, this reagent blank is not the associated blank for the semivolatile extraction sequence.

5. **Surrogate Spike:**

Water Matrix:

Surrogate recovery windows created from EPA Contract Laboratory Program data base. All samples and field blanks for the water matrix had high acid surrogate recoveries. Due to lack of sample, reextractions were not done.

Impact on data: All positive results for the acid fraction should be considered estimated for the following samples: MW1-GW2 and MW2-GW2. No compounds from the acid fraction were detected.

Soil Matrix:

All surrogates for the reagent blank SBLK74 were less than 10%.

Impact on data: The laboratory submitted another reagent blank, SBLK71, which was extracted on the same day as the soil samples SB4-SS3 and SB4-SS3A; however, this blank was not associated with the extraction sequence of these soil samples. Although the use of SBLK71 is questionable with respect to determining contamination contribution from the extraction process, it is in the reviewers judgement that this represents an isolated occurrence and does not reflect a fundamental problem with the extraction process.

6. **Matrix Spike/Matrix Spike Duplicate:**

The matrix spike SB4-SS3MS had a low recovery for n-nitroso-di-propylamine. In addition, the relative percent deviations (RPDs) were noncompliant for both acid and base neutral matrix spike compounds.

Impact on data: Although this could reflect poor precision for the analytical process. It is in the reviewers judgement that there is no impact on the data.

7. **Field Duplicates:**

The field duplicates for the soil matrix are SB4-SS3 and SB4-SS3A. No target compounds were detected in ether sample.

8. **Internal Standard (IS) Performance:** All criteria met.

9. **TCL Compound Identification:** All criteria met.

10. **Compound Quantitation and Reported Detection Limits:**

Instrument detection limits were not submitted. Quantitation limits were met except for reagent blank SBLK71. This reagent blank's quantitation limit should be increased by 1.053.

11. **Tentatively Identified Compounds:** All criteria met.

12. **System Performance:** All criteria met.

NUS Corporation
Data Review Worksheets

Project Name Arrowhead Plating
TDD No. 4205 B# 13,14
Reference No. Control # 2753/2763

REGIONAL REVIEW OF ORGANIC CONTRACT LABORATORY DATA PACKAGE

The hardcopied (laboratory name) Versar data package received at Region I has been reviewed and the quality assurance and performance data summarized. The data reviewed included:

Case No. control # 2753/2763 SAS No. _____ Sampling Date:
No. of Sample 4 Matrix Groundwater, Shipping Date:
+ Field Blanks Soil borings Date Received by Lab: See Comments

Traffic Report Nos: SB4-553 (10-13') SB4-553A (10-12')
Equipment Blank 3, Equipment Blank 4, Trip Blank 13, MW1-GW2, MW2-GW2, Trip Blank,
Blank No.:
Duplicate Nos SB4-553, SB4-553A

Contract No. _____ requires that specific analytical work be done and that associated reports be provided by the contractor to the Regions, EMSL-LV, and SMO. The general criteria used to determine the performance were based on an examination of:

- Holding times
- DFTPP and BFB performance results
- Surrogate spike results
- Matrix spike results
- Field/Lab Precision Evaluation
- Blank analysis results
- Detection limit results
- Initial and Continuing Calibration

Overall comments:

Date Received by Laboratory
5/17/90 — 5/13/90
Equipment Blank 3 — MW1-GW2
Equipment Blank 4 — MW2-GW2
Trip Blank 13 — TRIP BLANK
SB4-553 (10-12')
SB4-553A (10-12')

Definitions of Qualifiers

A - Acceptable data.
J - Approximate data due to quality control criteria.
* - Reject data due to other quality control criteria.
** - Reject data due to blank contamination.
ND - Not detected.
+ - Positive compound identification.
NJ - Tentatively identified compound.

Trip Blank Data Not in this Package

Reviewer: Cindy C. Kuhl Date: 6/27/90

ICF KAISER ENGINEERS

ICF KAISER ENGINEERS, INC.
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703/934-3300

TO: Claudia Brand

FROM: Jay Kuhn

SUBJECT: Arrowhead Plating Site, Data Validation, 1 Soil Boring Sample, 4 Water Samples, Volatile Organic Analysis, Versar Inc., Virginia.

Reference: Validation 11, Versar Control Number 2749 and 2753, Soil Boring

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A level I validation was performed on the organic analytical data from 1 soil boring sample and field blanks collected at the Arrowhead Plating Site as part of the Remedial Investigation/Feasibility Study. The samples were analyzed for EPA Target Compound List (TCL) volatile organics by Versar Inc., Springfield, Virginia. Validation was performed in accordance with the EPA Functional Guidelines for Evaluating Organics Analyses (February 1, 1988). A copy of the checklist has been provided as an attachment for your information.

The samples included in the data package are the following.

SB20-SS7 (12-14')
Trip Blank
Equipment Blank 3
Equipment Blank 4
Trip Blank 13

Overall Assessment of Data for Samples Evaluated:

1. The quantitation of acetone should be qualified as estimated for sample SB20-SS7.

2. The detected concentration of acetone in sample SB20-SS7 should be considered non-detected.

The following criteria were reviewed in validating the data:

1. **Holding Time:** All criteria met

2. **GC/MS Tune:** All criteria met.

3. **Calibration:**

Instruments U and Y were used to perform the volatile analysis. Calibration results for each instrument are as follows.

Instrument U

Initial: 5/21/90, 1 compound, bromomethane, has a relative standard deviation (%RSD) > 30%.

Impact on data: None

Continuing: 5/23/90, 2 compounds, acetone and bromoform, have a %D > 25%.

Impact on data: Results for compounds which are quantitated on continuing calibrations with percent deviation (%D) > 25% should be qualified as follows: detected compound values for acetone and bromoform should be estimated. The sample potentially impacted is SB20-SS7. The result for acetone in SB20-SS7 should be qualified as estimated.

Instrument Y

Initial: 5/22/90, meets criteria.

4. **Blanks:**

The intent of blank analysis results are to evaluate the potential of contamination contribution by the sampling and/or analytical process. Both field blanks and laboratory blanks are included in this data package. No contamination was found in laboratory blanks. Acetone at a concentration of 9 ug/L was detected in the Trip Blank received into the laboratory on 5/16/90. In the associated samples any detected values of acetone would be considered non-detect at a concentration up to 90 ug/L.

Impact on data: The detected concentration of acetone in sample SB20-SS7 should be considered non-detected.

5. **Surrogate Spike:**

Surrogate recovery windows created from EPA Contract Laboratory Program data base. All surrogate recoveries are compliant.

6. **Matrix Spike/Matrix Spike Duplicate:**

No matrix spike/matrix spike duplicate was done with this analytical sequence.

7. **Field Duplicates:**

   No field duplicates were done with this analytical sequence.

8. **Internal Standard (IS) Performance:** All criteria met.

9. **TCL Compound Identification:** All criteria met.

10. **Compound Quantitation and Reported Detection Limits:**

    Instrument detection limits were not submitted. Quantitation limits were met.

11. **Tentatively Identified Compounds:** All criteria met.

12. **System Performance:** All criteria met.

ICF KAISER ENGINEERS

ICF KAISER ENGINEERS, INC.
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703/934-3300

TO: Claudia Brand

FROM: Davida Parker Trumbo

DATE: July 11, 1990

SUBJECT: Arrowhead Plating Site, Data Validation, 25 Soil Samples for Inorganic Analysis, Versar Inc., Control Nos. 2327, 2338, 2349

A data validation was performed on the inorganic analytical data from 25 soil samples collected at the Arrowhead Plating Site as part of the remedial investigation/feasibility study. The samples were analyzed in accordance with EPA Contract Laboratory Program protocols for cyanide and in accordance with SW-846 protocols for the following metals:

Aluminum	Chromium	Mercury	Sodium
Barium	Copper	Potassium	Zinc
Calcium	Iron	Nickel	
Cadmium	Lead	Silver	

The data was validated in accordance with quality control criteria established in the noted analytical methods. A copy of the checklist used to record the specific observances has been provided for your information as an attachment to this report.

The following samples were included in this data package:

SB8-S2	SB12-S2	SS27	SS38
SB8-S3	SB3-S1	SS28	SS39
SB8-S3	SS21	SS32	
SB8-S3A	SS22	SS33	
SB10-S3	SS23	SS34	
SB11-S2	SS24	SS35	
SB11-S2	SS25	SS36	
MW4 GW1	SS26	SS37	

Overall Data Assessment: The overall laboratory performance met quality control criteria with the following exceptions:

1. Cyanide detection limits should be considered estimated due to extended holding times above the CLP recommended holding period of 12 days.

2. Aluminum results should be considered approximate in all soil boring samples due to the elevated percent recoveries associated with the matrix spike samples.

3. Assessment of quality control blank sample indicated that several analytes were determined in the blank at concentration greater than the instrument detection limit (IDL). Sample results less than five time the largest amount of contamination found in any blank associated with the sample should be treated as highly suspect due to the possibility of false positives. The analytes and associated samples which are impacted by this condition have been provided below.

Analyte	Samples			
Calcium	SB12-S2			
Copper	SB10-S3	SB11-S2	SB12-S2	SB12-2A
	SB13-S1	SB8-S2	SB8-S3A	SB8-S3
	SB9-S1	SS24	SS28	
	SS33	SS35	SS39	
Lead	SB8-S2	SB9-S1	SS21	
	SS22		SS23	

4. Sample results which require qualification based upon laboratory precision performance are listed below.

Sample Type	Analyte
Soil Boring	Sodium
Surface Soil	Aluminum
	Chromium
	Iron
	Potassium
	Sodium

5. Field sampling precision was assessed through the evaluation of duplicate samples collected in the field. Barium, calcium, chromium, iron, lead, and sodium results should be considered estimated in the soil boring samples due to poor recoveries associated with duplicate data.

6. Copper and sodium results should be estimated in soil boring samples due to serial dilution variances which indicate chemical or physical interferences associated with ICP matrix effects.

The following criteria were reviewed during the data validation:

1. **Holding Times:** All criteria were met with the exception of cyanide which was extracted within 14 days and analyzed 14 days later. The cyanide results should be considered estimates and biased on the low side.

2. **Initial and Continuing Calibration Verification:** All criteria were met.

3. **Blank Analysis:** The following blank contamination and potentially affected samples are summarized below. The actual impacted samples have been identified in the action section and in the overall data assessment.

Blank	Contaminant	Concentration (ug/l)	Samples
[1]CCB1	Lead	18.1	SB8-S3A SB9-S1 SS21 SS22 SS23
[2]CCB2	Aluminum	58.1	2224 SS32
	Calcium	46.7	SS25 SS33
	Copper	52.6	SS26 SS34
	Sodium	26.1	SS27 SS35 SS28
[3]PBS1	Aluminum	55.3	All Samples
	Calcium	36.6	
	Copper	13.8	
PBS2	Aluminum	43.7	All Samples
	Calcium	43.2	
	Copper	8.06	
	Sodium	71.8	

[1] Continuing Calibration Blank
[2] Preparation Blank Soil

Action: The following analytes were detected in the noted samples at concentration less than five times the contamination level detected in the highest associated blank:

Analyte	Samples		
Calcium	SB12-S2		
Copper	SB8-S2	SB11-S2	SS28
	SB8-S3	SB12-S2	SS33
	SB8-S3A	SB12-2A	SS35
	SB9-S1	SB13-S1	SS39
	SB10-S1	SS24	

Action:(cont). The following analyte was detected in the noted samples at concentration less than five times the contamination level detected in the highest associated blank:

Analyte	Samples
Lead	SB8-S2
	SB9-S1
	SS21
	SS22
	SS23

4. **ICP Interference Check Sample:** All criteria were met.

5. **Matrix Spike Sample Analysis:** Samples SB8-S3 and SS-23 were evaluated to determine laboratory performance on spiked samples. The analytes and recommended action for all samples are indicated below.

Sample	Analyte	Recovery	Action
SB8-S3	Aluminum	136	Estimate Soil Boring Results
	Silver	47.7	Accept
SS-23	Calcium	NC	None required
	Silver	46.9	Accept

6. **Laboratory Precision Evaluation:** Duplicate analysis was performed on sample SB8-S3 and SS-23. The percent recovery for SB8-S3 duplicate samples were in control with the exception of sodium which had a percent relative difference (RPD) of 89.4% indication poor laboratory precision. Sodium results should be qualified as estimated. Several RPDs were out-of-control for sample SS-23 including aluminum, chromium, iron, potassium, and sodium. Sample results for these analytes should be estimated.

7. **Field Precision Evaluation:** SB8-S3 and SB12-S2 were the duplicate samples collected for this sampling event. Several analytes exhibited elevated RPDs including barium, calcium, lead, and sodium for SB12-S3 and barium, chromium, and iron for SB8-S3.

8. **Laboratory Control Sample:** Metals were analyzed by SW-846 methods which do not specify the evaluation of laboratory control samples. Since cyanide was processed using contract laboratory program (CLP) protocols the results should have been evaluated, but the necessary information was not included in the data package.

9. **Standard Additions/Furnace Atomic Absorption Analysis (GFAA):** GFAA analysis not required for soil samples.

10. **Serial Dilution Results:** The serial dilution results did not agree within 10% of each other for copper and sodium in the soil boring samples indicating chemical or physical interferences associated with matrix effects. The resultant sample concentrations should be considered estimated for soil boring samples.

ICF KAISER ENGINEERS

ICF KAISER ENGINEERS, INC.
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703/934-3300

TO: Claudia Brand

FROM: Davida Parker Trumbo

DATE: July 10, 1990

SUBJECT: Arrowhead Plating Site, Data Validation, 26 Soil and 2 Water Samples for Inorganic Analysis, Versar Inc., Control No. 2753

A data validation was performed on the inorganic analytical data from 26 soil and 2 water samples collected at the Arrowhead Plating Site as part of the remedial investigation/feasibility study. The samples were analyzed in accordance with EPA Contract Laboratory Program protocols for cyanide and in accordance with SW-846 protocols for copper and zinc.

The data was validated in accordance with quality control criteria established in the noted analytical methods. A copy of the checklist used to record the specific observances has been provided for your information as an attachment to this report.

The following samples were included in this data package:

SB15-SS1	SB16-SS4	SB17-SS1	SB18-SS1
SB15-SS2	SB16-SS5	SB17-SS2	SB18-SS2
SB15-SS3	SB16-SS6	SB17-SS3	SB18-SS3
SB15-SS4	SB16-SS7	SB17-SS4	SB18-SS4
SB16-SS1	SB16-SS8	SB17-SS5	SB18-SS5
SB16-SS2	SB16-SS9	SB17-SS6	SB18-SS6
SB16-SS3	SB16-SS10		

Equipment Blank #3
Equipment Blank #4

Overall Data Assessment: The overall laboratory performance met quality control criteria with the following exceptions:

1. The cyanide holding times exceeded the recommended time of 12 days. Due to the fact that soil cyanide holding times are based upon water criterion, it is recommended that the detection limits be considered estimates and that the potential for false negatives is high.

2. Copper results for the SB16 samples should be considered estimated due to accuracy problems associated with the matrix spike and precision problems associated with the duplicate recovery. Sample results may have the tendency to be biased low as a result of the matrix spike assessment.

3. Zinc values for the SB16 series samples should be approximated due to to chemical or physical interferences associated with the method.

The following criteria were reviewed during the data validation:

1. **Holding Times:** All criteria were met with the exception of the cyanide analysis, which exceeded the recommended water 14 day holding time. The resultant values should be considered estimates.

2. **Initial and Continuing Calibration Verification:** All criteria were met.

3. **Blank Analysis:** The following blank contamination and potentially affected samples are summarized below:

Blank	Contaminant	Concentration (ug/L)	Impacts
[1]ICB	Potassium	963	Water Samples
[2]CCB1	Calcium	7.4	Water Samples
	Chromium	6.4	
	Potassium	1192	
CCB2	Chromium	6.6	Water Samples
	Potassium	1281	
	Sodium	33.8	
[3]PBW	Calcium	8.4	Water Samples
	Sodium	32.0	
[4]PBS	Copper	0.3	Soil Samples
Equipment Blank #3	Iron	26.7	Soil Samples
	Sodium	153	
Equipment Blank #~~3~~	Aluminum	142	Soil Samples
	Calcium	51.4	
	Chromium	6.9	
	Sodium	101	

[1] Initial Calibration Blank
[2] Continuing Calibration Blank
[3] Preparation Blank Water
[4] Preparation Blank Soil

Action: Since the only analysis performed on samples was for cooper and zinc, the additional analytes detected do not affect sample results.

4. **ICP Interference Check Sample:** All criteria were met.

5. **Matrix Spike Sample Analysis:** Samples SB16-SS3 and SB18-SS3 were evaluated to determine laboratory performance on spiked samples. All criteria were met with the exception

of copper for SB16-SS3. All of the SB16 samples were processed during the time the precision problems occurred.

6. **Laboratory Precision Evaluation:** Duplicate analysis was performed on samples SB15-SS4, SB16-SS3, and SB18-SS3. All criteria were met for samples SB15 and SB18. The criteria were not met for cooper and zinc analysis performed on SB16-SS3. All of the SB16 samples were processed during the time the precision problems occurred.

7. **Field Precision Evaluation:** Field duplicate samples were not included in this package.

8. **Laboratory Control Sample:** Metals were analyzed by SW-846 methods which do not specify the evaluation of laboratory control samples. Since cyanide was processed using contract laboratory program (CLP) protocols the results should have been evaluated, but the necessary information was not included in the data package.

9. **Standard Additions/Furnace Atomic Absorption Analysis:** Equipment blanks were analyzed using this the GFAA method and all criteria were met.

10. **Serial Dilution Results:** All criteria were met with the exception of zinc. The sample concentration should be estimated for zinc based upon this assessment.

ICF KAISER ENGINEERS

ICF KAISER ENGINEERS, INC.
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703/934-3300

TO: Claudia Brand

FROM: Davida Parker Trumbo

DATE: July 10, 1990

SUBJECT: Arrowhead Plating Site, Data Validation, 1 Water and 10 Soil Samples for Inorganic Analysis, Versar Inc., Control Nos. 2289 and 2309

A data validation was performed on the inorganic analytical data from 1 water and 10 soil samples collected at the Arrowhead Plating Site as part of the remedial investigation/feasibility study. The samples were analyzed in accordance with SW-846 protocols for cyanide and the following metals:

Aluminum	Chromium	Mercury	Sodium
Barium	Copper	Potassium	Zinc
Calcium	Iron	Nickel	
Cadmium	Lead	Silver	

The data was validated in accordance with quality control criteria established in the noted analytical methods. A copy of the checklist used to record the specific observances has been provided for your information as an attachment to this report.

The following samples were included in this data package:

SB1-S4	SB6-S2
SB2-S7	SB6-S4
SB3-S4	SB7-S3
SB5-S1	SB7-S4
SB5-S4	Equipment Blank
SB6-S1	

Overall Assessment of Data: The overall laboratory performance met quality control criteria with the following exception:

1. Sample results for aluminum, calcium, potassium, and zinc may have the tendency to be biased low due to percent recoveries associated with the matrix spike.

2. Barium results in all samples should be considered estimated due to poor laboratory precision associated with this analyte.

3. The potential for physical or chemical interferences exists for sodium and zinc analyses and sample results should be considered estimated.

4. Sodium results for SB1-S4, SB2-S7, SB3-S4, SB5-S1, and SB6-S4 have the potential for being false postives due to contamination associated with the preparation blank.

The following criteria were reviewed during the data validation:

1. **Holding Times:** All criteria were met.

2. **Initial and Continuing Calibration Verification:** All criteria were met.

3. **Blank Analysis:** The following blank contamination and potentially affected samples are summarized below:

Blank	Contaminant	Concentration (ug/L)	Impact
[1]ICB	Calcium	19.5	All Samples
	Copper	4.1	
	Silver	3.2	
[2]CCB1	Calcium	11.3	SB6-S2
	Copper	6.8	SB6-S4
	Iron	9.6	SB7-S3
			SB7-S4
CCB2	Copper	4.6	All Samples
	Iron	25.8	
[3]PBS1	Aluminum	120	All Samples
	Calcium	95.9	
	Iron	50.8	
	Sodium	37.9	
Equipment Blank	Aluminum	8.5	All Samples
	Sodium	8.0	

[1] Initial Calibration Blank
[2] Continuing Calibration Blank
[3] Preparation Blank Soil

Action: Although the contaminants identified in the initial and calibration blanks are above the instrument detection limit (IDL) the sample concentrations for calcium, copper, and iron are highly elevated and sample results would not be impacted from these constituents. Silver was detected below the IDL in all samples, therefore no action is warranted.

Contamination in the preparation blank is negligible with the exception of sodium in the following samples: SB1-S4, SB2-S7, SB3-S4, SB5-S1, SB5-S4, SB6-S4. The sodium results in these samples may potentially be false positive results.

The efficiency of the decontamination procedures was evidence through the evaluation of the equipment blank sample results. The noted contamination did not adversely impact samples and indicated good decontamination procedures.

4. **ICP Interference Check Sample:** All criteria were met.

5. **Matrix Spike Sample Analysis:** The spike recoveries for SB7-S3 had the following analytes out-of-control either less than 75% and greater than 125%:

Analyte	% Recovery
Aluminum	71.6
Calcium	72.7
Iron	168
Potassium	71.7
Zinc	64.6

Action: The recovery results indicate that the accuracy for the noted constituents were not in control and results for these analytes may have the tendency to be biased low. The assessment does not apply to the iron results due to the fact that the sample concentration was greater than 4 times the spike result. It should also be noted that the SW-846 criterion for matrix spikes does not require spiking for sample concentrations greater than 0.1%, which would be the case for aluminum and potassium (with the exception of sample SB3-S4).

6. **Laboratory Precision Evaluation:** Duplicate analysis was performed on sample SB7-S3. The relative percent difference was greater than 35% for barium indicating that the laboratory precision for this analyte was not within control. All sample results should be estimated for this analyte.

7. **Field Precision Evaluation:** Not applicable. Duplicate samples were not collected during this sampling event.

8. **Laboratory Control Sample:** Metals were analyzed by SW-846 methods which do not specify the evaluation of laboratory control samples, but the laboratory submitted the appropriate form and all analytes were in control. Since cyanide was processed using contract laboratory program (CLP) protocols the results were evaluated and determined to be in control.

9. **Standard Additions/Furnace Atomic Absorption Analysis (GFAA):** Samples were not analyzed using GFAA.

10. **Serial Dilution Results:** All criteria were met with the exception of sodium and zinc. The sample results should be approximated for these analytes in the samples.

ICF KAISER ENGINEERS

ICF KAISER ENGINEERS, INC.
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703/934-3300

TO: Claudia Brand

FROM: Davida Parker Trumbo

DATE: July 11, 1990

SUBJECT: Arrowhead Plating Site, Data Validation, 15 Soil Samples for Inorganic Analysis, Versar Inc., Control No. 2749

A data validation was performed on the inorganic analytical data from 15 soil samples collected at the Arrowhead Plating Site as part of the remedial investigation/feasibility study. The samples were analyzed in accordance with EPA Contract Laboratory Program protocols for cyanide and in accordance with SW-846 protocols for copper and zinc.

The data was validated in accordance with quality control criteria established in the noted analytical methods. A copy of the checklist used to record the specific observances has been provided for your information as an attachment to this report.

The following samples were included in this data package:

SB19-SS1	SB20-SS1	SB20-SS7
SB19-SS2	SB20-SS2	
SB19-SS3	SB20-SS3	
SB19-SS4	SB20-SS4	
SB19-SS5	SB20-SS5	
SB19-SS6	SB20-SS5A	
SB19-SS7	SB20-SS6	

Overall Data Assessment: The overall laboratory performance met quality control criteria with the following exceptions:

1. Cyanide detection limits should be considered approximate due to the extended holding time.

2. Copper was detected in the quality control blanks. Samples with copper concentrations less than five time the amount detected in the sample should be considered highly suspect the data should be qualified with the statement that the value was not detected above the sample quantitation limit. Affected samples include:

SB19-SS1	SB19-SS2	SB19-SS3	SB19-SS4
SB19-SS7	SB20-SS1	SB20-SS2	SB20-SS3
SB20-SS6			

3. Zinc results should be considered estimated due to chemical or physical interferences associated with method matrix effects.

The following criteria were reviewed during the data validation:

1. **Holding Times:** All criteria was met with the exception of cyanide, which was analyzed approximately 26 days after sample collection. All cyanide results should be considered estimated.

2. **Initial and Continuing Calibration Verification:** All criteria met.

3. **Blank Analysis:** Copper was detected in the continuing calibration blank at 1.5 ug/L and the preparation blank at 15.9 ug/L. Samples with copper concentration reported less than five times the preparation blank concentration include:

SB19-SS1	SB19-SS2	SB19-SS3	SB19-SS4
SB19-SS7	SB20-SS1	SB20-SS2	SB20-SS3
SB20-SS6			

4. **ICP Interference Check Sample:** All criteria met.

5. **Matrix Spike Sample Analysis:** Sample SB20-SS5 was evaluated to determine laboratory performance on spiked samples and all criteria was met.

6. **Laboratory Precision Evaluation:** Duplicate analysis was performed on sample SB20-SS5. All criteria was met.

7. **Field Precision Evaluation:** Duplicate samples were not included in this package.

8. **Laboratory Control Sample:** Metals were analyzed by SW-846 methods which do not specify the evaluation of laboratory control samples. Since cyanide was processed using contract laboratory program (CLP) protocols the results should have been evaluated, but the necessary information was not included in the data package.

9. **Standard Additions/Furnace Atomic Absorption Analysis:** All analyses were performed by ICP, therefore this method was not applicable.

10. **Serial Dilution Results:** Zinc results in all samples should be considered estimated due to chemical or physical interferences associated with the sample matrix.

ICF KAISER ENGINEERS

ICF KAISER ENGINEERS, INC.
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703/934-3300

TO: Claudia Brand

FROM: Davida Parker Trumbo

DATE: July 12, 1990

SUBJECT: Arrowhead Plating Site, Data Validation, 2 Soil and 4 Water Samples for Inorganic Analysis, Versar Inc., Control No. 2763

A data validation was performed on the inorganic analytical data from 2 soil and 4 water samples collected at the Arrowhead Plating Site as part of the remedial investigation/feasibility study. The samples were analyzed in accordance with EPA Contract Laboratory Program protocols for cyanide and in accordance with SW-846 protocols for the following metals:

Aluminum	Chromium	Mercury	Sodium
Barium	Copper	Potassium	Zinc
Calcium	Iron	Nickel	
Cadmium	Lead	Silver	

The data was validated in accordance with quality control criteria established in the noted analytical methods. A copy of the checklist used to record the specific observances has been provided for your information as an attachment to this report.

samples in this data package included:

MW1-GW2	MW2-GW2	SB4-SS3
MW1-GW2 F	MW2-GW2 F	SB4-SS3A

Overall Data Assessment: The overall laboratory performance met quality control criteria with the following exceptions:

1. Cyanide samples were analyzed approximately 25 days after sample collection. The detection limits for this analyte should be considered elevated, indicating the potential for false negatives. Results for MW1-GW2 and MW2-GW2 should be rejected, and soil boring sample results should be considered approximate.

2. Silver results are rejected for all monitoring well samples due to poor recoveries associated with the matrix spike. The potential for false negatives exists due to elevated detection limits.

4. Nickel and potassium results in the water samples and copper results in soil samples should be approximated due to variances associated with the laboratory duplicate analysis.

5. Calcium, chromium, nickel, sodium, and zinc duplicate results in samples SB4-SS3 and SB4-SS3A exhibited significant variances. This could be attributable to several factors including the non-homogeneity of the sample. Results for the analytes in theses samples may therefore be viewed as approximate.

6. Sodium and zinc results are approximated in soil boring samples SB4-SS3 and SB4-SS3A due to chemical or physical interferences associated with the ICP analysis.

The following criteria were reviewed during the data validation:

1. **Holding Times:** All criteria were met with the exception of cyanide which was analyzed after the recommending holding period of 14 days. Cyanide results for water samples should be rejected and soil boring results should be considered approximate.

2. **Initial and Continuing Calibration Verification:** All criteria met.

3. **Blank Analysis:** All criteria were met.

4. **ICP Interference Check Sample:** All criteria were met.

5. **Matrix Spike Sample Analysis:** The spike recovery for MW1-GW1 was 9% and suggests accuracy problems. The results for silver in all water samples should be rejected due to the potential for false negatives. All criteria were met for soil boring samples.

6. **Laboratory Precision Evaluation:** All criteria were met for water samples with the exception of nickel and potassium. The results for these analytes should be approximated in all samples. All criteria were met for soil samples with the exception of copper suggesting that all soil samples be approximated for that analyte.

7. **Field Precision Evaluation:** Duplicate samples were collected for soil boring samples and large variances between sample results were obtained for the following analyte: calcium, chromium, nickel, sodium, and zinc. The results for these analytes may be considered approximate.

8. **Laboratory Control Sample:** Metals were analyzed by SW-846 methods which do not specify the evaluation of laboratory control samples, but the laboratory submitted the appropriate form and all analytes were in control. Since cyanide was processed using contract laboratory program (CLP) protocols the results were evaluated and determined to be in control.

9. **Standard Additions/Furnace Atomic Absorption Analysis (GFAA):** All criteria were met.

10. **Serial Dilution Results:** All criteria were met for the water samples. Sample results should be approximated for sodium and zinc results in the soil boring samples due to chemical or physical interferences encountered during ICP analysis. approximated for these analytes in the samples.

ICF KAISER ENGINEERS

ICF KAISER ENGINEERS, INC.
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703/934-3300

TO: Claudia Brand

FROM: Jay Kuhn

DATE: August 29, 1990

SUBJECT: Arrowhead Plating Site, Data Validation, 2 Soil Boring Samples, Reextractions, Semivolatile Organic Analysis, Versar Inc., Virginia.

REFERENCE: Validation 17, Versar Control Number 2309 and 2338, Soil Boring

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A level I validation was performed on the organic analytical data from 3 soil boring samples collected at the Arrowhead Plating Site as part of the Remedial Investigation/Feasibility Study. The samples were analyzed for EPA Target Compound List (TCL) semivolatile organics by Versar Inc., Springfield, Virginia. Validation was performed in accordance with the EPA Functional Guidelines for Evaluating Organics Analyses (February 1, 1988). A copy of the checklist has been provided as an attachment for your information.

The samples included in the data package are the following.

SB6-S4 (15-17') SB12-S2A

Note: These samples are designated SB6-S4RE and SB12-S2ARE within the data package as a result of being reextractions.

Overall Assessment of Data for Samples Evaluated:

1. All nondetect data for SB6-S4 and SB12-S2A should be considered estimated.

2. As a result of Gel Permeation Chromatography (GPC) procedure on sample SB6-S4 the method detection limits are increased by a factor of two.

The following criteria were reviewed in validating the data:

1. **Holding Time:**

These are reextracted samples which exceed the holding time by more than thirty days.

Impact on data: All nondetect data for SB6-S4RE and SB12-S2ARE should be considered estimated.

2. GC/MS Tune: All criteria met.

3. Calibration:

Semivolatile Analysis Calibration:

Instrument Z was used to perform the semivolatile analysis. Calibration results for this instrument are as follows:

Instrument Z

Initial: 6/7/90, Meets criteria.

Continuing: 6/13/90, 1 compound, 3-nitroaniline, has a percent deviation (%D) > 25%.

Impact on data: Results for compounds which are quantitated on continuing calibrations with %D > 25% should be qualified as follows: detected compound values should be estimated. The sample potentially impacted is SB12-S2ARE. No compounds were detected in this sample therefore, no qualification of the data is warranted.

Continuing: 6/14/90, 1 compound, 3-nitroaniline, has a %D > 25%.

Impact on data: Results for compounds which are quantitated on continuing calibrations with %D > 25% should be qualified as follows: detected compound values should be estimated. The sample potentially impacted is SB6-S4RE. No compounds were detected in this sample therefore, no qualification of the data is warranted.

4. **Blanks:**

The intent of blank analysis results are to evaluate the potential of contamination contribution by the sampling and/or analytical process. Both field blanks and laboratory blanks are included in this data package. No contamination was found in laboratory or trip blanks.

5. **Surrogate Spike:**

Surrogate recovery windows created from EPA Contract Laboratory Program data base. Sample SB6-S4RE has the following compounds with noncompliant recoveries: nitrobenzene-d5 (12%), 2-fluorobiphenyl (13%), phenol-d5 (12%), 2-fluorophenol (12%), and 2,4,6-tribromophenol (12%).

Impact on data: All detected values would be considered estimated. No target compounds were detected; therefore, no qualification of the data with respect to surrogate recovery is warranted.

6. **Matrix Spike/Matrix Spike Duplicate:**

   No MS/MSD was done with this analytical sequence.

7. **Field Duplicates:**

   No field duplicates were done with this analytical sequence.

8. **Internal Standard (IS) Performance:** All criteria met.

9. **TCL Compound Identification:** All criteria met.

10. **Compound Quantitation and Reported Detection Limits:**

    Instrument detection limits were not submitted. As a result of a Gel Permeation Chromatography (GPC) procedure on sample SB6-S4RE the method detection limits are increased by a factor of two.

11. **Tentatively Identified Compounds:** All criteria met.

12. **System Performance:** All criteria met.

ICF KAISER ENGINEERS

ICF KAISER ENGINEERS, INC.
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703/934-3300

TO: Claudia Brand

FROM: Jay Kuhn

DATE: March 17, 1990

SUBJECT: Arrowhead Plating Site, Data Validation, 2 Sediment Samples, 4 Soil Samples, Volatile Organic Analysis, General Physics Laboratory, Gaithersburg, Maryland.

A level I validation was performed on the organic analytical data from 2 sediment samples and 4 soil samples collected at the Arrowhead Plating Site as part of the Remedial Investigation/Feasibility Study. The samples were analyzed for EPA Target Compound List (TCL) volatile organics by General Physics Laboratory, Gaithersburg, Maryland. Validation was performed in accordance with the EPA Functional Guidelines for Evaluating Organics Analyses (February 1, 1988). A copy of the checklist has been provided as an attachment for your information.

The samples included in the data package are the following.

Sediment Samples:	Soil Samples:
MF-SD1	SB21-S3
SF-SD1	SB21-S5
	SB21-S6
	SB22-S3

Overall Assessment of the Data for the Samples Evaluated:

1. The detection of methylene chloride and acetone in the laboratory blank, VBLKL, results in the detected values of methylene chloride and acetone to be considered non-detect in the samples MF-SD1 and SF-SD1.

2. The detection of methylene chloride in the laboratory blank, VBLKD, results in the detected values of methylene chloride to be considered non-detect in the following samples: SB21-S3, SB21-S5, SB21-S6, and SB22-S3.

3. The detection of benzene in the laboratory blank, VBLKD, results in the detected values of benzene to be to be considered nondetect in the samples SB21-S3 and SB22-S3.

4. Due to the substantial deviation in the continuing calibration response

of chloromethane, the method detection limit for chloromethane should be considered estimated for the following samples: SB21-S3, SB21-S5, SB21-S6, and SB22-S3.

ICF KAISER ENGINEERS

ICF KAISER ENGINEERS, INC.
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703/934-3300

TO: Claudia Brand

FROM: Davida Parker Trumbo DPT

DATE: April 9, 1991

SUBJECT: Arrowhead Plating Site, Data Validation, 1 Soil and 18 Water Samples for Inorganic Analysis, General Physics, Case No. KAISR1

A data validation was performed on the inorganic analytical data from 1 soil and 18 water samples collected at the Arrowhead Plating Site as part of the remedial investigation/feasibility study. The samples were analyzed in accordance with EPA Contract Laboratory Program protocols for cyanide and the following metals:

Aluminum	Chromium	Mercury	Sodium
Barium	Copper	Potassium	Zinc
Calcium	Iron	Nickel	
Cadmium	Lead	Silver	

The data was validated in accordance with quality control criteria established in the noted analytical methods. A copy of the checklist used to record the specific observances has been provided for your information as an attachment to this report.

The following samples were included in this data package:

M11GWD	M12GWD	M13GWD	M1GWD
M2GW3D	M3GW3D	M4GW3D	M5GW3F
M6GW3F	MW11GW	MW12GW	MW13GW
MW1GW3	MW2GW3	MW3GW3	MW4GW3
MW5GW3	MW6GW3	SB23S1	

Overall Data Assessment: The overall laboratory performance met quality control criteria with the following exception:

1. Assessment of quality control blank samples indicated that several analytes were determined in blanks at concentrations greater than the instrument detection limit (IDL). Sample results less than five time the largest amount of contamination found in any blank associated with the sample should be treated as though the analyte was not detected above the sample detection limit. The analytes and the associated impacted samples are provided below.

Aluminum:	M12GWD			
Calcium:	M4GW3D	M5GW3F	MW5GW3	
Copper:	M11GWD	M12GWD	M13GWD	M1GW3D
	M2GW3D	M3GW3D	M4GW3D	M5GW3F
	M6GW3F	MW11GW	MW12GW	MW13GW
	MW1GW3	MW2GW3	MW3GW3	MW5GW3
	MW6GW3			

1. Assessment of Quality Control Blanks (continued)

Mercury:	M1GW3D	M2GW3D	M3GW3D	M4GW3D
	M5GW3F	M6GW3F	MW1GW3	MW2GW3
	MW3GW3	MW4GW3	MW5GW3	MW6GW3
Potassium:	M12GWD	M13GWD	M1GW3D	M2GW3D
	M3GW3D	M4GW3D	M5GW3F	M6GW3F
	MW11GW	MW12GW	MW13GW	MW1GW3
	MW2GW3	MW3GW3	MW4GW3	MW5GW3
	MW6GW3			
Sodium:	SB23S1			

2. The results for copper, lead, mercury, and silver should be estimated for all aqueous samples. Barium, copper, and lead results should be estimated in the soil sample. Silver results should be rejected due to poor recoveries.

3. Iron results should be qualified as estimated in water samples to due to poor recoveries associated with laboratory precision.

4. Copper results have been qualified in M5GW3F due to a low correlation associated with the method of standard additions.

5. The aluminum result should be qualified in the soil sample due to potential chemical or spectral interference.

The following criteria were reviewed during the data validation:

1. **Holding Times:** All criteria were met.

2. **Initial and Continuing Calibration Verification:** All criteria were met.

3. **Blank Analysis:** The following blank contamination and potentially impacted samples are summarized below:

Blank	Contaminant	Concentration	Samples
[1]ICV	Copper	1.0 ug/L	Water
		1.7 mg/kg	Soil
	Potassium	480 ug/L	Water
	Sodium	255 ug/L	Water
[2]CCV1	Copper	2.7 ug/L	Water
	Potassium	2320 ug/L	
	Sodium	285 ug/L	
CCV2	Potassium	3080 ug/L	Water
	Sodium	210 ug/L	
CCV3	Copper	2.7 mg/kg	Soil
	Iron	-39.6 mg/kg	
	Mercury	0.2 mg/kg	
	Potassium	4630 mg/kg	
	Sodium	450 mg/kg	
CCV4	Copper	1.4 mg/kg	Soil
	Sodium	500 mg/kg	
[3]PBW	Copper	0.7 ug/L	Water
	Mercury	0.2 ug/L	
	Potassium	144 ug/L	
Rinse	Calcium	125 ug/L	Water
	Copper	5.0 ug/L	
	Potassium	3520 ug/L	
	Sodium	395 ug/L	

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1 Initial Calibration Verification
2 Continuing Calibration Blank
3 Preparation Blank Water

3. **Blank Analysis: (continued)**

Action:

The following sample results for the noted analytes may be attributable to blank contamination encountered during either the sampling or analysis event due to the fact that the constituent was detected at a concentration less than five times the blank contamination:

Aluminum:	M12GWD			
Calcium:	M4GW3D	M5GW3F	MW5GW3	
Copper:	M11GWD	M12GWD	M13GWD	M1GW3D
	M2GW3D	M3GW3D	M4GW3D	M5GW3F
	M6GW3F	MW11GW	MW12GW	MW13GW
	MW1GW3	MW2GW3	MW3GW3	MW5GW3
	MW6GW3			
Mercury:	M1GW3D	M2GW3D	M3GW3D	M4GW3D
	M5GW3F	M6GW3F	MW1GW3	MW2GW3
	MW3GW3	MW4GW3	MW5GW3	MW6GW3
Potassium:	M12GWD	M13GWD	M1GW3D	M2GW3D
	M3GW3D	M4GW3D	M5GW3F	M6GW3F
	MW11GW	MW12GW	MW13GW	MW1GW3
	MW2GW3	MW3GW3	MW4GW3	MW5GW3
	MW6GW3			
Sodium:	SB23S1			

4. **ICP Interference Check Sample:** All criteria were met.

5. **Matrix Spike Sample Analysis:** The following spike samples had analytes out-of-control either less than 75% and greater than 125%:

Sample	Analyte	% Recovery
MW1GW3D	Copper	49.8
	Lead	74
	Mercury	65.7
	Silver	51.5
MW1GW3S	Copper	48.4
	Lead	74
	Mercury	45.5
	Silver	51.2

5. **Matrix Spike Sample Analysis:(continued)**

SB2341	Barium	402
	Copper	43.3
	Lead	55.6
	Silver	0

Action: The results for copper, lead, mercury, and silver should be estimated for all aqueous samples. Barium, copper, and lead results should be estimated in the soil sample. Silver results should be rejected due to poor recoveries.

6. **Laboratory Precision Evaluation:** Duplicate analysis was performed on samples MW1GW3 and SB23S1. The percent recovery for aqueous duplicate samples were in control with the exception of iron. Iron results should be qualified as estimated for water samples. The soil duplicate sample results were in control.

7. **Field Precision Evaluation:** Duplicate samples were not collected during this sampling event.

8. **Laboratory Control Sample:** All criteria were met.

9. **Standard Additions/Furnace Atomic Absorption Analysis:** All criteria were met with the exception of M5GW3F, which had a correlation of 0.9896 for copper. The copper result for this sample has been qualified as estimate.

10. **Serial Dilution Results:** Chemical or physical interferences were encountered for the analyses of aluminum in soil. The aluminum soil sample result should be considered estimated.

ICF KAISER ENGINEERS

ICF KAISER ENGINEERS, INC.
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703/934-3300

TO: Claudia Brand

FROM: Davida Parker Trumbo DPT

DATE: April 9, 1991

SUBJECT: Arrowhead Plating Site, Data Validation, 4 Soil and 12 Water Samples for Inorganic Analysis, General Physics, Case No. KAISR3

A data validation was performed on the inorganic analytical data from 4 soil and 12 water samples collected at the Arrowhead Plating Site as part of the remedial investigation/feasibility study. The samples were analyzed in accordance with EPA Contract Laboratory Program protocols for cyanide and the following metals:

Aluminum	Chromium	Mercury	Sodium
Barium	Copper	Potassium	Zinc
Calcium	Iron	Nickel	
Cadmium	Lead	Silver	

The data was validated in accordance with quality control criteria established in the noted analytical methods. A copy of the checklist used to record the specific observances has been provided for your information as an attachment to this report.

The following samples were included in this data package:

M21GWD	M22GWD	M23GWD	M24GWD
M25GWD	M26GWD	MW21GW	MW22GW
MW23GW	MW24GW	MW25GW	MW26GW
SB21S3	SB21S5	SB21S6	SB22S3

Overall Data Assessment: The overall laboratory performance met quality control criteria with the following exception:

1. Assessment of quality control blank samples indicated that several analytes were determined in blanks at concentrations greater than the instrument detection limit (IDL). Sample results less than five time the largest amount of contamination found in any blank associated with the sample should be treated as though the analyte was not detected above the sample detection limit. The analytes and the associated impacted samples are provided below.

Aluminum:	M22GWD	M23GWD	M25GWD	
Chromium:	M21GWD	M22GWD	M23GWD	M24GWD
	M25GWD	M26GWD	MW21GW	MW22GW
	MW23GW	MW24GW	MW25GW	
Copper:	M22GWD	M23GWD	M24GWD	M25GWD
	M26GWD	MW25GW	SB22S3	

1. Assessment of Quality Control Blanks (continued)

Potassium:	M22GWD	M25GWD	M26GWD	MW22GW
	MW25GW	SB21S3	SB21S5	SB21S6
	SB22S3			
Sodium:	SB22S3			

2. The results for lead, mercury, and silver should be estimated for all aqueous samples. Barium, chromium, copper, lead, silver, and zinc results should be estimated in the soil samples. Cadmium and nickel results should be rejected due to poor recoveries.

3. Chromium, iron, mercury, and sodium results in unfiltered aqueous samples and aluminum in the filtered aqueous samples should be qualified as estimated due to poor laboratory precision. In addition, chromium and copper results should be qualified as estimated for soil samples.

The following criteria were reviewed during the data validation:

1. **Holding Times:** All criteria were met.

2. **Initial and Continuing Calibration Verification:** All criteria were met.

3. **Blank Analysis:** The following blank contamination and potentially impacted samples are summarized below:

Blank	Contaminant	Concentration	Samples
[1]ICV	Copper	2.2 ug/L	Water
	Potassium	-715 ug/L	
	Iron	40.4 mg/kg	Soil
	Sodium	280 mg/kg	
[2]CCV1	Aluminum	122 ug/L	Water
	Chromium	9.5 ug/L	
	Copper	1.1 ug/L	
	Potassium	945 ug/L	
	Sodium	470 ug/L	
CCV2	Aluminum	134 ug/L	Water
	Chromium	9.3 ug/L	
	Potassium	580 ug/L	
	Sodium	660	
CCV3	Copper	1.6 mg/kg	Soil
	Iron	64.2 mg/kg	
	Sodium	610 mg/kg	
CCV4	Copper	2.0 mg/kg	Soil
	Iron	1.4 mg/kg	
[3]PBW	Copper	2.2 ug/L	Water
	Sodium	250 ug/L	

3. **Blank Analysis: (continued)**

PBS	Copper	0.42 mg/kg	Soil
	Potassium	107 mg/kg	

[1] Initial Calibration Verification
[2] Continuing Calibration Blank
[3] Preparation Blank Water

Action:

The following sample results for the noted analytes may be attributable to blank contamination encountered during either the sampling or analysis event due to the fact that the constituent was detected at a concentration less than five times the blank contamination:

Aluminum:	M22GWD	M23GWD	M25GWD	
Chromium:	M21GWD	M22GWD	M23GWD	M24GWD
	M25GWD	M26GWD	MW21GW	MW22GW
	MW23GW	MW24GW	MW25GW	
Copper:	M22GWD	M23GWD	M24GWD	M25GWD
	M26GWD	MW25GW	SB22S3	
Potassium:	M22GWD	M25GWD	M26GWD	MW22GW
	MW25GW	SB21S3	SB21S5	SB21S6
	SB22S3			
Sodium:	SB22S3			

4. **ICP Interference Check Sample:** All criteria were met.

5. **Matrix Spike Sample Analysis:** The following spike samples had analytes out-of-control either less than 75% and greater than 125%:

Sample	Analyte	% Recovery
MW21GW	Lead	52.2
	Mercury	175
	Silver	53.8

5. **Matrix Spike Sample Analysis: (continued)**

MW21GWD	Lead	58.5
	Silver	60.8
SB21S3	Barium	18.4
	Cadmium	22.8
	Chromium	10.5
	Copper	234
	Lead	65.4
	Nickel	21.6
	Silver	47.5
	Zinc	18.0

Action: The results for lead, mercury, and silver should be estimated for all aqueous samples. Barium, chromium, copper, lead, silver, and zinc results should be estimated in the soil samples. Cadmium and nickel results should be rejected due to poor recoveries. It should be noted that the post digestion spike for cadmium and nickel were in control.

6. **Laboratory Precision Evaluation:** Duplicate analysis was performed on samples MW21GW, M21GWD, and SB21S3. The relative percent difference for aqueous duplicate samples were in control with the following exceptions: (1) chromium, iron, mercury, and sodium in the unfiltered sample; and (2) aluminum in the filtered sample. Soil variances were in control for the duplicate sample with the exception of chromium and copper. Chromium and copper results should be qualified as estimated for soil samples.

7. **Field Precision Evaluation:** Duplicate samples were not collected during this sampling event.

8. **Laboratory Control Sample:** All criteria were met.

9. **Standard Additions/Furnace Atomic Absorption Analysis:** All criteria were met.

10. **Serial Dilution Results:** All criteria were met.

SURFACE SOILS

ARROWHEAD PLATING SITE
VOLATILE ORGANICS DATA FOR SURFACE SOILS
in units of ug/kg

Sample ID	Depth	Tetrachloroethene	Acetone	2-Butanone	1,2-Dichloroethene	Methylene Chloride	1,1,1-Trichloroethane	Carbon Tetrachloride	Trichloroethene	Tentatively Identified Compounds	Comments
SS21	0-6	6.0 U	11	11.0 U	6.0 U	6.0 U	6.0 U	6.0 U	6.0 U		
SS22	0-6	6.0 U	11.0 U	11.0 U	6.0 U	6.0 U	6.0 U	6.0 U	6.0 U		
SS23	0-6	6.0 U	13	11.0 U	6.0 U	6.0 U	6.0 U	6.0 U	6.0 U		
SS24	0-6	97	50	21	6.0 U	4(c)	32	6	29		
SS25	0-6	6.0 U	12.0 U	12.0 U	6.0 U	6.0 U	6.0 U	6.0 U	6.0 U		
SS26	0-6	6.0 U	12.0 U	12.0 U	6.0 U	6.0 U	6.0 U	6.0 U	6.0 U		
SS27	0-6	6.0 U	11.0 U	11.0 U	6.0 U	6.0 U	6.0 U	6.0 U	6.0 U		
SS28	0-6	6.0 U	12.0 U	12.0 U	6.0 U	6.0 U	6.0 U	6.0 U	6.0 U	Beta-Pinene	
SS29	0-6	6.0 U	11.0 U	11.0 U	6.0 U	6.0 U	6.0 U	6.0 U	6.0 U		
SS30	0-6	6.0 U	12.0 U	12.0 U	6.0 U	6.0 U	6.0 U	6.0 U	6.0 U	3-Carene	
SS31	0-6	6.0 U	12.0 U	12.0 U	6.0 U	6.0 U	6.0 U	6.0 U	6.0 U	3-Carene	
SS32	0-6	6.0 U	12.0 U	12.0 U	6.0 U	6.0 U	6.0 U	6.0 U	6.0 U		
SS33	0-6	6.0 U	11.0 U	11.0 U	6.0 U	6.0 U	6.0 U	6.0 U	6.0 U		
SS34	0-6	6.0 U	(8)	11.0 U	6.0 U	(5)	6.0 U	6.0 U	6.0 U		
SS35	0-6	6.0 U	98	16(e)	6.0 U	(12)	6.0 U	6.0 U	6.0 U	Ethanol	
SS36	0-6	3,300	3,200	(1,600)	930.0 U	930.0 U	930.0 U	930.0 U	930.0 U		Note A
SS37	0-6	600	60.0 U	60.0 U	30.0 U	30.0 U	20(d)	30.0 U	30.0 U		Note B
SS38	0-6	27	11.0 U	11.0 U	6.0 U	6.0 U	6.0 U	6.0 U	6.0 U		
SS39	0-6	19	12.0 U	12.0 U	6.0 U	6.0 U	6.0 U	6.0 U	6.0 U		
SP1	0-6	150(h)	62.0 U	62.0 U	580(h)	31.0 U	31.0 U	31.0 U	31.0 U		

U indicates the compound was not detected above limit indicated.
( )=This detected concentration is considered non-detected because it is within ten times the concentration detected in the reagent blank.
(c)=The compound is tentatively identified and quantitated at less than the method detection limit.
(d)=Mass spectral data suggests the presence of this compound, but due to the dilution the compound cannot be confirmed.
(e)=Due to a substantial deviation in the response for the daily calibration, this value is considered estimated.
(h)=Due to a substantial deviation in the internal standard area, this value is considered estimated.

Note A: Sample analyzed using medium level protocol which results in higher method detection limits.
Note B: Dilution of the sample in order to quantitate target compounds results in a increase in the method detection limit by a factor of five.

01/25/91

ARROWHEAD PLATING SITE
SEMIVOLATILE ORGANICS DATA FOR SURFACE SOILS
in units of ug/kg

Sample ID	Depth	Di-n-butylphthalate	Bis(2-ethylhexyl)phthalate	Phenanthrene	Number of Tentatively Identified Compounds	Tentative Identification	Comments
SS21	0-6	380 U	380 U	380 U	12	Unknown Hydrocarbons; Unknowns	
SS22	0-6	370 U	370 U	370 U	12	Unknown Hydrocarbons; Unknowns	
SS23	0-6	490	270 U	370 U	14	Unknown Hydrocarbons; Unknowns	Note B
SS24	0-6	770 U	770 U	770 U	20	Unknown Hydrocarbons; Unknown Ketone; Unknowns	
SS25	0-6	380 U	380 U	380 U	10	Unknown Hydrocarbons; Unknown Ketone; Unknowns	
SS26	0-6	390 U	310 (c)	390 U	18	Molecular Sulfur; Unknown Hydrocarbons	Note C
SS27	0-6	380 U	380 U	380 U	7	2,4-Dimethyl-3-heptanone; Unknowns	Note C
SS28	0-6	390 U	390 U	390 U	9	Unknown Hydrocarbons; Unknowns; Unknown Ketone	Note C
SS29	0-6	390 U	390 U	390 U	3	Unknown Ketone; Unknowns	Note E
SS30	0-6	400 U	400 U	400 U	5	Substituted Benzene; Unknowns; Unknown Ketone	Note E
SS31	0-6	400 U	400 U	400 U	5	Caryophyllene; Substituted Benzene; Unknowns	Note E
SS32	0-6	400 U	200 (c)	400 U	13	Unknowns	Note B
SS33	0-6	350 U	190 (c)	350 U	4	Unknown Hydrocarbons; Unknowns	Note A,B
SS34	0-6	370 U	370 U	370 U	19	Unknown Hydrocarbons; Unknowns; Aldehydes	Note B
SS35	0-6	390 U	390 U	390 U	5	Unknown Hydrocarbons; Unknowns	Note C
SS36	0-6	460 U	460 U	140 (c)	15	Hexadecanoic Acid; Organic Acids; Unknowns	Note B
SS37	0-6	390 U	390 U	390 U	10	Unknown Hydrocarbons; Unknowns	Note C
SS38	0-6	370 U	370 U	370 U	1	Unknown Ketone	Note C
SS39	0-6	370 U	370 U	370 U	7	Unknown Hydrocarbons; Unknowns	Note C
SP1	0-6	820 U	1,200	820 U	15	Benzenesulfonamide; Substituted Phenols; Unknowns	Note D

U indicates the compound was not detected above limit indicated.
(c) The compound is tentatively identified and quantitated at less than the method detection limit.
Note A: Non-detect data for Di-n-octylphthalate, Benzo(b)flouranthene, Benzo(k)flouranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenzo(a,h)anthracene,and Benzo(g,h,i)perylene should be rejected.
Note B: Non-detect data for 3,3'-Dichlorobenzidene should be rejected.
Note C: Non-detect data for Benzyl Alcohol and 4-Chloroaniline should be rejected.
Note D: Due to a substantial deviation of the first internal standard area, the method detection limit is considered estimated for the following compounds: 2-Chlorophenol, Phenol, Bis(2-chloroethyl)ether, 1,3-Dichlorobenzene, 1,4-Dichlorobenzene, 1,2-Dichlorobenzene, Benzyl Alcohol, Bis(2-chloroisopropyl)ether, 2-Methylphenol, Hexachloroethane, 4-Methylphenol, and n-Nitroso-di-n-propylamine.
Note E: Sample extract was incorrectly diluted prior to analysis. This results in the method detection limit being increased by a factor of 1.1.

01/25/91

ARROWHEAD PLATING SITE
INORGANIC DATA FOR SURFACE SOIL SAMPLES

Sample ID	Aluminum %	Barium mg/kg	Cadmium mg/kg	Calcium mg/kg	Chromium mg/kg	Copper mg/kg	Iron mg/kg	Lead mg/kg	Mercury mg/kg	Nickel mg/kg	Potassium mg/kg	Silver mg/kg	Sodium mg/kg	Zinc mg/kg	Cyanide mg/kg
SS21	0.63(c)	50.6	0.57 U	511	8.6(c)	88.0	7,010(c)	6.5(b)	0.11 U	5.2	237(c)	0.34 U	335(c)	23.8	0.54 U
SS22	0.64(c)	30.9	0.55 U	9,390	9.4(c)	116.0	7,610(c)	4.9(b)	0.11 U	4.4	494(c)	0.33 U	114(c)	31.4	0.62
SS23	0.67(c)	40.9	0.57 U	19,300	10.6(c)	156.0	8,480(c)	8.6(b)	0.10 U	5.9	860(c)	0.34 U	180(c)	48.4	4.40
SS24	0.54(c)	47.7	0.58 U	524	7.2(c)	12.8(b)	6,430(c)	7.2	0.12 U	3.2	173(c)	0.35 U	223(c)	19.6	2.20
SS25	0.98(c)	40.8	0.56 U	7,670	12.3(c)	181.0	10,500(c)	8.3	0.098 U	6.3	750(c)	0.67	339(c)	45.6	8.70
SS26	0.85(c)	35.7	0.57 U	15,900	10.4(c)	160.0	8,670(c)	7.9	0.095 U	3.7	456(c)	0.34 U	258(c)	76.7	1.30
SS27	0.57(c)	18.5	0.57 U	4,040	7.7(c)	31.8	4,970(c)	5.2	0.11 U	2.4	428(c)	0.34 U	53.3(c)	17.2	1.20
SS28	0.43(c)	42.1	0.60 U	1,010	6.8(c)	10.1(b)	6,910(c)	9.0	0.12 U	2.4	212(c)	0.36 U	107(c)	14.9	0.79
SS29	0.95	34.6	0.22 U	259	10.5	4.3	8,350	8.2	0.10 U	4.8	319	0.33 U(f)	43.6	14.4(e)	0.52 U
SS30	1.07	34.3	0.22 U	154	12.5	5.1	9,600	6.0	0.098 U	4.5	400	0.33 U(f)	15.7	14.9(e)	0.44 U
SS31	0.87	29.7	0.23 U	237	10.1	4.3	13,500	6.0	0.10 U	5.6	342	0.35 U(f)	34.7	12.9(e)	0.57 U
SS32	1.46(c)	67.5	0.58 U	671	19.0(c)	35.0	NR(c)	10.4	0.15	9.5	524(c)	0.35 U	37.3(c)	33.0	0.55 U
SS33	0.69(c)	17.6	0.56 U	316	7.1(c)	10.9(b)	6,510(c)	4.6 U	0.11 U	2.5	257(c)	0.33 U	29.9(c)	51.3	0.54 U
SS34	0.67(c)	35.2	0.56 U	1,930	11.6(c)	36.8	15,900(c)	8.6	0.099 U	5.2	461(c)	0.34 U	94.5(c)	20.7	0.74
SS35	0.10(c)	52.0	0.59 U	114	3.0(c)	2.7(b)	564(c)	6.6	0.10 U	1.3 U	150(c)	0.36 U	56.4(c)	1.9	0.53 U
SS36	0.85(c)	137.0	1.0	4,240	13.3(c)	7,800.0	12,300(c)	18.6	6.4	14.6	312(c)	0.49	138(c)	862.0	0.73 U
SS37	0.71(c)	56.7	0.57 U	667	9.7(c)	36.4	8,360(c)	9.7	0.11 U	3.9	222(c)	0.34 U	39.3(c)	20.4	0.55 U
SS38	0.58(c)	48.8	0.56 U	594	7.7(c)	31.4	6,920(c)	10.7	0.11 U	3.7	221(c)	0.34 U	60.2(c)	19.2	0.55 U
SS39	0.68(c)	36.5	0.58 U	742	8.7(c)	8.3(b)	8,720(c)	6.9	0.11 U	2.5	195(c)	0.35 U	81.5(c)	11.7	0.56 U

LEGEND:

U - Not detected above limit indicated.
NR - Not Requested
(b) - Sample results were less than five times the contaminant concentration found in the blanks and should be considered artifacts contributed by the blank.
(c) - Estimate due to precision problems associated with the matrix spike.
(e) - Potential chemical or physical interferences associated with ICP analysis.
(f) - Reject data based upon high potential for false negatives.

01/25/91

ICF KAISER ENGINEERS

ICF KAISER ENGINEERS, INC.
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703/934-3300

TO: Claudia Brand

FROM: Jay Kuhn

DATE: July 16, 1990

SUBJECT: Arrowhead Plating Site, Data Validation, 21 Soil Samples, 2 Water Samples, Semivolatile and Volatile Organic Analysis, Versar Inc., Virginia.

REFERENCE: Validation 3, Versar Control Number 2338 and 2349, Surface Soil and Soil Boring

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A level I validation was performed on the organic analytical data from 21 soil samples collected at the Arrowhead Plating Site as part of the Remedial Investigation/Feasibility Study. The samples were analyzed for EPA Target Compound List (TCL) semivolatile and volatile organics by Versar Inc., Springfield, Virginia. A volatile organic compounds trip blank was also included in the sample package. Validation was performed in accordance with the EPA Functional Guidelines for Evaluating Organics Analyses (February 1,1988). A copy of the checklist has been provided as an attachment for your information.

The samples included in the data package are the following.

SB10-S3	SS21	SS32
SB11-S2	SS22	SS33
SB12-S2 (5'-7')	SS23	SS34
SB12-S2A	SS24	SS35
SB13-S1 (0'-2')	SS25	SS36
Trip Blank	SS26	SS37
	SS27	SS38
	SS28	SS39
	Trip Blank	

Overall Assessment of Data for Samples Evaluated:

1. The integrity of the semivolatile TCL analysis of SB12-S2A is questionable with respect to holding time. Although technical requirements for holding times have not been established, the reextraction data has not been delivered and the laboratory did not commit to a date in the narrative.

2. Contamination contribution by the sampling and analytical process is

present. The samples potentially impacted are SB10-S3, SS34, SS35, SS37 for blank VBLK07 and SS36 for blank VBLK35. The sample results which are qualified are as follows: for sample SS34 the detection of methylene chloride and acetone should be considered non-detect, for sample SS35 the detection of methylene chloride should be considered non-detect, and for sample SS36 the detection of 2-butanone should be considered non-detect.

3. For sample SS35 the quantitated value of acetone should be considered estimated.

4. For the following samples the method detection limit for compounds quantitated by perylene-D12 should be rejected: SB10-S3, SB11-S2, SB12-S2A, SB12-S2ARI, SB12-S2, SB12-S2RI, SS33, SS33RI, SB10-S3RI, and SB11-S2RI.

The following criteria were reviewed in validating the data:

1. **Holding Time:** All criteria were met except for samples SB12-S2A and SS24. SS24, semivolatile TCL, was incorrectly extracted at a medium level and was reextracted outside holding time as a low level. A compliant analysis of SB12-S2A has not been submitted at this time. Technical requirements for holding times have not been established for soil samples. Impact on data: It is in the reviewers judgement that there is no significant impact.

2. **GC/MS Tune:** All criteria met.

3. **Calibration:**

   Volatile TCL: Instruments U, W, and Y were used to perform the volatile analysis. Calibration results for each instrument are as follows:

   Instrument U

   Initial: 4/9/90, 35 compounds %RSD > 30%. Notified the laboratory of the noncompliant standards. The laboratory stated that an error in data transfer resulted in the values. The corrected initial calibration form has been resubmitted and is to replace page 100273. The resubmission meets criteria.

   Continuing: 4/10/90, 4 compounds have a %D > 25%. Notified the laboratory that the continuing calibration form does not reflect the calibration check of response values for instrument U on 4/10/90. The laboratory submitted the correct continuing calibration form which is to replace page 100277. The resubmitted form has 2 compounds, acetone and bromoform, with a %D > 25%.

   Impact on data: Results for the compounds Acetone and Bromoform which are quantitated on continuing calibrations with percent deviations (%D) > 25% should be qualified as follows: detected compound values should be estimated. The samples potentially impacted are Tripblank (3/30/90), SS28, SS32, SS33, SS38, SS39, SS38MS, SS38MSD, SS25, and SB11-S2. Acetone and bromoform were not detected in these samples.

   Continuing: 4/11/90, 9 compounds have a %D > 25%. Notified the laboratory that the continuing calibration form does not reflect the calibration check of response values for instrument U on 4/11/90. The laboratory submitted the correct continuing calibration form which is to replace page 100278. The resubmitted form has 8 compounds with a %D > 25%.

   Impact on data: Results for compounds which are quantitated on continuing calibrations with percent deviations (%D) > 25% should be qualified as follows: detected compound values should be estimated. The compounds are chloroethane, acetone, 1,2-dichloroethane, 2-butanone, dibromochloromethane, bromoform,

4-methyl-2-pentanone, and 2-hexanone. The sample potentially impacted is SS27. None of these compounds were detected in SS27.

Continuing: 4/12/90, 8 compounds have a %D > 25%. Notified the laboratory that the continuing calibration form does not reflect the calibration check of response values for instrument U on 4/12/90. The laboratory submitted the correct continuing calibration form which is to replace page 100278. The resubmitted form has 8 compounds with a %D > 25%.

Impact on data: Results for compounds which are quantitated on continuing calibrations with percent deviations (%D) > 25% should be qualified as follows: detected compound values should be estimated. The compounds are acetone, 2-butanone, carbon tetrachloride, trichloroethene, dibromochloromethane, bromoform, tetrachloroethene, and ethylbenzene. The potentially impacted sample is SS26. None of these compounds were detected in SS26.

Instrument W

Initial: 4/9/90, 35 compounds have a %RSD > 30%. Notified the laboratory of the noncompliant standards. The laboratory stated that an error in data transfer resulted in the values. The corrected initial calibration form has been submitted and is to replace page 100274. The resubmission meets criteria.

Continuing: 4/10/90, 35 compounds have a %D > 25%. Notified the laboratory of the noncompliant standard. The laboratory stated that an error in data transfer resulted in the values. The corrected continuing calibration form has been submitted and is to replace page 100279. The resubmission has 1 compound, 2-butanone, with a %D > 25%.

Impact on data: The result for 2-butanone which are quanitated on continuing calibrations with percent deviations (%D) > 25% should be qualified as follows: the detected compound value should be considered estimated. The samples potentially impacted are SS34, SS35, SB10-S3, and SS37. The sample impacted is SS35 whose detected value for acetone is considered estimated.

Initial: 4/11/90, meets criteria.

Continuing: 4/11/90, 35 compounds have a %D > 25%. Notified the laboratory of the noncompliant standard. The laboratory stated that an error in data transfer resulted in the values. The corrected continuing calibration form has been submitted and is to replace page 100280. The resubmission meets criteria.

Instrument Y

Initial: 4/2/90, 1 compound has a %RSD > 30%.

Continuing: 4/5/90, 4 compounds have a %D > 25%.

Impact on data: No results for compounds were quantitated from the initial calibration. Results for compounds which are quanitated on continuing calibrations with percent deviations (%D) > 25% should be qualified as follows: detected compound values should be estimated. The compounds are total xylenes, chloromethane, carbon tetrachloride, bromodichloromethane, and 2-hexanone. The sample potentially impacted is the Trip_Blank received 3/29/80. None of these compounds were detected in this blank.

Semivolatile TCL: Instrument T was used to perform semivolatile analysis. Calibration results for each instrument are as follows:

Instrument T

Initial: 4/19/90, meets criteria.

Continuing: 4/20/90, 5 compounds have a %D > 25%.

Impact on data: Results for compounds which are quanitated on continuing calibrations with percent deviations (%D) > 25% should be qualified as follows: detected compound values for benzyl alcohol, bis(2-chloroisopropyl)ether, 4-chloroaniline, 2-methylnaphthalene, and 3-nitroaniline should be estimated and reject the data of the compounds, benzyl alcohol and 4-chloroaniline, when non-detected. The samples impacted are SB12-S2RI (reinjection), SB12-S2ARI (reinjection), SB13-S1, SS26, SS27, SS28, SS35, SS37, SS38, SB10-S3, SB11-S2, and SS39.

Continuing: 4/23/90, 6 compounds have a %D > 25%. 1 compound has a RF < 0.05.

Impact on data: Results for compounds which are quanitated on continuing calibrations with percent deviations (%D) > 25% should be qualified as follows: detected compound values for benzyl alcohol, bis(2-chloroisopropyl)ether, 4-chloroaniline, 2-methylnaphthalene, and 3-nitroaniline should be estimated and reject the data of the compound 4-chloroaniline when non-detected. Result for the compound quanitated on continuing calibrations with response factors less than 0.05 should be qualified as follows: the non-detection of this compound, 3,3'-dichlorobenzidene, should be rejected. The samples impacted are SS23, SS32, SS33, SS34, SS36, SB10-S3RI (reinjection), and SB11-S2RI (reinjection).

Continuing: 4/24/90, 6 compounds have a %D > 25%.

Impact on data: Results for compounds which are quanitated on continuing calibrations with percent deviations (%D) > 25% should be qualified as follows: detected compound values for phenol, bis(2-Chloroethyl)ether, benzyl alcohol, bis(2-

chloroisopropyl)ether, 4-chloroaniline, and 2-methylnaphthalene should be estimated and reject the data of the compound 4-chloroaniline when non-detected. The impacted sample is SS33RI (reinjection).

Initial: 4/30/90, meets criteria.

4. **Blanks**:

The intent of blanks are to review the potential of contamination contribution by the sampling and/or analytical process. Those compounds present in the blanks should be flagged as non-detect for the specified concentration range within the sample. Both field blanks and trip blanks are included in this data package. The maximum concentration of contamination found in any of the field, trip, or laboratory blanks is as follows:

Contamination	Detected Concentration of Contamination	Contamination Considered Non-detect up to Concentration	Blank I.D.
Methylene Chloride	3 ug/Kg	30 ug/Kg	VBLK07
Acetone	9 ug/Kg	80 ug/Kg	VBLK07
2-Butanone	880 ug/Kg	8800 ug/Kg	VBLK35(MED)

Note: values need to be adjusted by a factor of 5 for SS37.

Impact on data: the detection of acetone and methylene chloride in sample SS34 should be considered non-detect. The detection of methylene chloride in SS35 should be considered non-detect.

5. **Surrogate Spike**: Surrogate recovery windows created from EPA Contract Laboratory Program data base.

Volatile: meets criteria.

Semivolatile: SB12-S2A had 2 base/neutral and 1 acid surrogate out . SB12-S2ARI(reinjection) had 2 base/neutral and 1 acid surrogate out. SB10-S3 had 1 acid surrogate out. SB12-S2 had 1 base/neutral and 1 acid surrogate out. SB12-S2RI(reinjection) had 2 base/neutral and 1 acid surrogate out. SB33 had 1 acid surrogate out. SB33RI(reinjection) had 1 acid surrogate out. Impact on data: For sample SB12-S2A positive results should be considered estimates.

6. **Matrix Spike/Matrix Spike Duplicate:**

Volatile: meets criteria.

Semivolatile: 1 base/neutral matrix spike and one acid matrix spike recovery are high in the MS and MSD. All RPD's meet criteria.

Impact on data: The results for SS21 are not impacted by these variances nor are the individual samples associated with this case.

7. **Field Duplicates:**

Volatile: The field duplicates are SB12-S2 and SB12-S2A. tetrachloroethene was quantitated at 7 ug/kg and 9 ug/kg respectively. The relative percent deviation (RPD) is 25%.

Semivolatile: The field duplicates are SS33 and SS33A. bis(ethylhexyl)phthalate was quantitated at 190 ug/kg and 350 ug/kg respectively. The RPD is 59%.

Impact on data: It is in the reviewers judgement that there is no significant impact.

8. **Internal Standard Performance:**

Volatile: 1 internal standard outlier for sample SB13-S1 0'-2'. 1 internal standard outlier for SB13-S1RI. Impact on data: Positive results quantitated off the internal standards should be considered estimates and for non-detect results the quantitation limit should be considered estimated.

Semivolatile: The recovery of the sixth internal standard, perylene-D12, was less than 50% of the reference internal standard for SB10-S3 and its reinjection. The same is true for SB11-S2 and its reinjection. The fifth internal standard, chrysene-D12, as well as the sixth internal standard were less than 50% of the reference internal standard for SB12-S2A. The same is true for the reinjection of SB12-S2A with the third internal standard, acenaphthene-D10, also less than 50% The recovery of the sixth internal standard, perylene-D12, was less than 50% of the reference internal standard for SB12-S2 and the fifth and sixth internal standards are low for its reinjection. The sixth internal standard is also noncompliant for SB33 as well as its reinjection. Impact on data: Positive results quantitated off the internal standards should be considered estimates and for non-detect results as follows:

Sample:	Acenaphthene-D10	Chrysene-D12	Perylene-D12
SB10-S3		-	R
SB10-S3RI	-	-	R
SB11-S2	-	-	R
SB11-S2RI	-	-	R
SB12-S2A	-	UJ	R
SB12-S2ARI	-	UJ	R
SB12-S2 5'-7'	UJ	-	R
SB12-S2 5'-7'RI	-	UJ	R
SS33	-	-	R
SS33RI	-	-	R
	-		

Legend:
UJ-quantitation limit should be estimated for non-detect compounds
R-substantial drop off of internal standard recovered; non-detects should be flagged as unusable.

The following are the compounds quantitated off of the internal standards in question.

(continued)

Acenaphthene-D10

Hexachlorocyclopentadiene
2,4,6-Trichlorophenol
2,4,5-Trichlorophenol
2-Chloronaphthalene
2-Nitroaniline
Acenaphthylene
Dimethylphthalate
2,6-Dinitrotoluene
Acenaphthene
3-Nitroanailine
2,4-Dinitrophenol
Dibenzofuran
4-Nitrophenol
2,4-Dinitrotoluene
Fluorene
4-Chlorophenyl-phenylether

Acenaphthene-D10

Diethylphthalate
4-Nitroaniline
4,6-Dinitro-2-methylphenol
N-Nitrosodiphenylamine
4-Bromophenyl-phenylether
Hexachlorobenzene

Chrysene-D12

Pyrene
Butylbenzylphthalate
Benz(a)anthracene
Chrysene
3,3'-Dichlorobenzidene
Bis(2ethylhexyl) phthalate

Perylene-D12

Di-n-octylphthalate
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Benzo(a)pyrene
Indeno(1,2,3-cd) pyrene
Dibenzo(a,h)anthracene
Benzo(g,h,i)perylene

9. **TCL Compound Identification:** All qualitative analysis acceptable.

10. **Compound Quantitation and Reported Detection Limits:** All quantitation and reported detection limits acceptable.

11. **Tentatively Identified Compounds:** Meets criteria.

12. **System Performance:** System performance acceptable.

ICF KAISER ENGINEERS

ICF KAISER ENGINEERS, INC.
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703/934-3300

TO: Claudia Brand

FROM: Jay Kuhn

DATE: July 16, 1990

SUBJECT: Arrowhead Plating Site, Data Validation, 3 Soil Samples and 2 Water Samples, Semivolatile and Volatile Organic Analysis, Versar Inc., Virginia.

REFERENCE: Validation 5, Versar Control Number 2549 and 2502, Surface Soil, Groundwater

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A level I validation was performed on the organic analytical data from 3 soil samples and 1 water sample collected at the Arrowhead Plating Site as part of the Remedial Investigation/Feasibility Study. The samples were analyzed for EPA Target Compound List (TCL) semivolatile and volatile organics by Versar Inc., Springfield, Virginia. A volatile organic compounds trip blank was also included in the sample package. Validation was performed in accordance with the EPA Functional Guidelines for Evaluating Organics Analyses (February 1,1988). A copy of the checklist has been provided as attachment for your information.

The samples included in the data package are the following.

Water	Soil
MW1-GW1	SS29
Trip Blank 10	SS30
	SS31

Overall Data Assessment: The overall laboratory performance met quality control criteria with the following exceptions:

1. Data for the non-detected compounds carbon disulfide, vinyl acetate, 4-methyl-2-pentanone, and 2-hexanone in sample MW-1 GW-1 should be rejected due to the non-compliance of the continuing calibration standard. In addition, the detected value for acetone should be considered estimated.

2. Sample MW-1 GW-1 the identification of 2-butanone does not meet criteria for SW846 Method 8240 or EPA Contract Laboratory Program. The result is qualified as tentatively identified.

3. The method detection limits for semivolatile analysis of SS29, SS30, and SS31 are elevated by a factor of 1.1.

The following criteria were reviewed in validating the data:

1. **Holding Time**: All criteria met.

2. **GC/MS Tune**: All criteria met.

3. **Calibration**:

Volatile TCL:

Instruments Y and U were used to perform the volatile analysis. Calibration results for each instrument are as follows:

Instrument Y

Initial: 4/25/90, meets criteria.
Continuing: 4/30/90, 7 compounds have a percent Deviation (%D) > 25%.

Impact on data: Results for compounds in MW1-GW1 which are quantitated on continuing calibrations with percent deviation (%D) > 25% should be qualified as follows: detected compound values should be estimated for acetone and all non-detected data should be rejected for carbon disulfide, vinyl acetate, 4-methyl-2-pentanone, and 2-hexanone.

Instrument U

Initial: 4/23/90, meets criteria.
Continuing: 4/27/90, 4 compounds have a %D > 25%.

Impact on data: The percent deviation was greater than 25% for bromomethane, chloroethane, acetone, and carbon disulfide. The samples potentially impacted were SS29, SS30, and SS31. Since the noted analytes were not quantitated in these samples, no action is warranted.

Semivolatile TCL:

Instrument Z was used to perform semivolatile analysis. Calibration results for the instrument are as follows:

Instrument Z

Initial: 5/15/90, 1 compound has a percent relative standard deviation (%RSD) > 30%.

Impact on data: The percent deviation was greater than 30% for 3-nitroaniline. The samples potentially impacted were SS29, SS30, and SS31. Since the noted analyte was not quantitated in these samples, no action is warranted.

Continuing: 5/16/90, 1 compound has a %D > 25%.

Impact on data: The percent deviation was greater than 25% for 3-nitroaniline. Although sample results were not impacted, the matrix spike and matrix spike duplicate for SS29 could potentially be impacted. However, this is not within the scope of a Level I validation, and no action is warranted.

4. Blanks:

Blank analysis results were assessed to evaluate the potential of contamination contribution by the sampling and/or analytical process. Field blanks, trip blanks, and laboratory blanks were included in this data package. The maximum concentration of contamination found in any of the field, trip, or laboratory blanks and the impact on data were as follows:

Contamination	Detected Concentration of Contamination	Contamination Considered Non-detect up to Concentration	Blank I.D.
Acetone	15 ug/L	150 ug/L	Trip Blank 10
Methylene Chloride	1 ug/L	10 ug/L	VBLK17

Impact on data: Acetone and methylene chloride were not detected in any of the associated samples; therefore, no action is warranted.

5. Surrogate Spike: All criteria were met for volatile and semivolatile analyses.

6. Matrix Spike/Matrix Spike Duplicate:

Volatile: Meets criteria.

Semivolatile: The matrix spike, SS29MS, had three matrix spikes out and the matrix spike duplicate, SS29MSD, had two matrix spikes out. In addition, the relative percent deviation (RPD) for acenapthene was out at 21%. SS29 is not impacted by these variances nor are the individual samples associated with this case.

7. Field Duplicates: No field duplicates submitted for this analytical sequence.

8. Internal Standard (IS) Performance: All submitted samples meet IS criteria.

9. **TCL Compound Identification:**

Sample MW-1 GW-1 the identification of 2-Butanone does not meet criteria for SW846 Method 8240 or EPA Contract Laboratory Program. The mass ion 39 in the sample spectrum is not within 20% of the standard spectrum. The compound was not qualified as tentatively identified on the data summary sheet.

10. **Compound Quantitation and Reported Detection Limits:**

A dilution factor of 1.1 resulted for the semivolatile TCL analysis of SS29, SS30 and SS31. This occurred as a result of the final extract being spilt for pesticide analysis. It should be noted that the field chain of custody did not designate these samples for pesticide analysis. As a result of this dilution, the minimum method detection limits were elevated by a factor of 1.1.

11. **Tentatively Identified Compounds:** All criteria met

12. **System Performance:** System performance acceptable.

ICF KAISER ENGINEERS

ICF KAISER ENGINEERS, INC.
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703/934-3300

TO: Claudia Brand

FROM: Davida Parker Trumbo

DATE: July 12, 1990

SUBJECT: Arrowhead Plating Site, Data Validation, 3 Soil and 1 Water sample for Inorganic Analysis, Versar Inc., Control No. 2549

A data validation was performed on the inorganic analytical data from 3 soil and 1 water sample collected at the Arrowhead Plating Site as part of the remedial investigation/feasibility study. The samples were analyzed in accordance with EPA Contract Laboratory Program protocols for cyanide and in accordance with SW-846 protocols for the following metals:

Aluminum	Chromium	Mercury	Sodium
Barium	Copper	Potassium	Zinc
Calcium	Iron	Nickel	
Cadmium	Lead	Silver	

The data was validated in accordance with quality control criteria established in the noted analytical methods. A copy of the checklist used to record the specific observances has been provided for your information as an attachment to this report.

Samples in this data package included: SS29, SS30, SS31, and TW1.

Overall Data Assessment: The overall laboratory performance met quality control criteria with the following exceptions:

1. Samples requiring cyanide analysis were extracted 14 days after collection and analyzed nine days later. The detection limits for this analysis have the potential to be elevated, thereby increasing the possibility of false negatives due to exceedance of the CLP holding time of 12 days. The cyanide results for TW1 should be rejected and surface soil sample results should be considered approximate.

2. The concentration of zinc in TW1 may be an artifact of the blank because it has been detected at a concentration less than five times the concentration in the quality control sample.

3. Silver results should be rejected due to problems associated with the matrix spike recoveries. The Elevated detection limits increase the potential for the existence of false negatives.

4. Zinc results should be approximated due to chemical or physical interferences associated with matrix effects during ICP analysis.

The following criteria were reviewed during the data validation:

1. **Holding Times:** All criteria were met with the exception of cyanide which was analyzed after the recommending holding preriod of 14 days. Cyanide results for all samples should be considered approximate.

2. **Initial and Continuing Calibration Verification:** All criteria were met.

3. **Blank Analysis:** All criteria were met for the soil samples. Zinc was detected in the calibration blank sample for the water sample. The amount of zinc in the sample qas equivalent to a concentration less than five times the blank concentration, thereby elevating the possibility of false positive results.

4. **ICP Interference Check Sample:** All criteria were met.

5. **Matrix Spike Sample Analysis:** The spike recovery for SS29 had silver recovery at 3%. The results for this element should be treated as a non-detect analyte.

6. **Laboratory Precision Evaluation:** All critera met.

7. **Field Precision Evaluation:** Not applicable. Duplicate samples were not collected during this sampling event.

8. **Laboratory Control Sample:** Metals were analyzed by SW-846 methods which do not specify the evaluation of laboratory control samples, but the laboratory submitted the appropriate form and all analytes were in control. Since cyanide was processed using contract laboratory program (CLP) protocols the results were evaluated and determined to be in control.

9. **Standard Additions/Furnace Atomic Absorption Analysis (GFAA):** Samples were not analyzed using GFAA.

10. **Serial Dilution Results:** All criteria were met with the exception of zinc. The sample results should be approximated for these analytes in the samples.

ICF KAISER ENGINEERS

ICF KAISER ENGINEERS, INC.
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703/934-3300

TO: Claudia Brand

FROM: Davida Parker Trumbo

DATE: July 11, 1990

SUBJECT: Arrowhead Plating Site, Data Validation, 26 Soil Samples for Inorganic Analysis, Versar Inc., Control Nos. 2327, 2338, 2349

A data validation was performed on the inorganic analytical data from 26 soil samples collected at the Arrowhead Plating Site as part of the remedial investigation/feasibility study. The samples were analyzed in accordance with EPA Contract Laboratory Program protocols for cyanide and in accordance with SW-846 protocols for the following metals:

Aluminum	Chromium	Mercury	Sodium
Barium	Copper	Potassium	Zinc
Calcium	Iron	Nickel	
Cadmium	Lead	Silver	

The data was validated in accordance with quality control criteria established in the noted analytical methods. A copy of the checklist used to record the specific observances has been provided for your information as an attachment to this report.

The following samples were included in this data package:

SB8-S2	SB12-S2	SS27	SS38
SB8-S3	SB3-S1	SS28	SS39
SB8-S3	SS21	SS32	
SB8-S3A	SS22	SS33	
SB10-S3	SS23	SS34	
SB11-S2	SS24	SS35	
SB11-S2	SS25	SS36	
MW4 GW1	SS26	SS37	

Overall Data Assessment: The overall laboratory performance met quality control criteria with the following exceptions:

1. Cyanide results should be considered estimated concentration values due to extended holding times above the CLP recommended holding period.

2. Aluminum results should be considered approximate in all soil boring samples due to the elevated percent recoveries associated with the matrix spike samples.

3. Assessment of quality control blank sample indicated that several analytes were determined in the blank at concentration greater than the instrument detection limit (IDL). Sample results less than five time the largest amount of contamination found in any blank associated with the sample should be treated as highly suspect due to the possibility of false positives. The analytes and associated samples which are impacted by this condition have been provided below.

Analyte	Samples			
Calcium	SB12-S2			
Copper	SB10-S3	SB11-S2	SB12-S2	SB12-2A
	SB13-S1	SB8-S2	SB8-S3A	SB8-S3
	SB9-S1	SS24	SS28	
	SS33	SS35	SS39	
Lead	SB8-S2	SB9-S1	SS21	
	SS22	SS23		

4. Sample results which require qualification based upon laboratory performance are listed below.

Sample Type	Analyte
Soil Boring	Sodium
Surface Soil	Aluminum
	Chromium
	Iron
	Potassium
	Sodium

5. Field sampling precision was assessed through the evaluation of the precision associated with duplicate samples collected in the field. Barium, calcium, chromium, iron, lead, and sodium results should be considered estimated in the soil boring samples due to poor recoveries associated with duplicate data.

6. Copper and sodium results should be estimated in soil boring samples due to serial dilution variances which indicate chemical or physical interferences associated with ICP matrix effects.

The following criteria were reviewed during the data validation:

1. **Holding Times:** All criteria were met with the exception of cyanide which was extracted within 14 days and analyzed 14 days later. The cyanide results should be considered estimates and biased on the low side.

2. **Initial and Continuing Calibration Verification:** All criteria were met.

3. **Blank Analysis:** The following blank contamination and potentially affected samples are summarized below. The actual impacted samples have been identified in the action section and in the overall data assessment.

Blank	Contaminant	Concentration (ug/l)	Samples
[1]CCB1	Lead	18.1	SB8-S3A SB9-S1 SS21 SS22 SS23
[2]CCB2	Aluminum	58.1	2224 SS32
	Calcium	46.7	SS25 SS33
	Copper	52.6	SS26 SS34
	Sodium	26.1	SS27 SS35 SS28
[3]PBS1	Aluminum	55.3	All Samples
	Calcium	36.6	
	Copper	13.8	
PBS2	Aluminum	43.7	All Samples
	Calcium	43.2	
	Copper	8.06	
	Sodium	71.8	

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[1] Initial Calibration Blank
[2] Continuing Calibration Blank
[3] Preparation Blank Soil

Action: The following analytes were detected in the noted samples at concentration less than five times the contamination level detected in the highest associated blank:

Analyte	Samples
Calcium	SB12-S2
Copper	SB8-S2 SB11-S2 SS28 SB8-S3 SB12-S2 SS33 SB8-S3A SB12-2A SS35 SB9-S1 SB13-S1 SS39 SB10-S1 SS24
Lead	SB8-S2 SB9-S1 SS21 SS22 SS23

4. **ICP Interference Check Sample:** All criteria were met.

5. **Matrix Spike Sample Analysis:** Samples SB8-S3 and SS-23 were evaluated to determine laboratory performance on spiked samples. The analytes and recommended action for all samples are indicated below.

Sample	Analyte	Recovery	Action
SB8-S3	Aluminum	136	Estimate Results
	Silver	47.7	Accept
SS-23	Calcium	NC	None required
	Silver	46.9	Accept

6. **Laboratory Precision Evaluation:** Duplicate analysis was performed on sample SB8-S3 and SS-23. The percent recovery for SB8-S3 duplicate samples were in control with the exception of sodium which had a percent relative difference (RPD) of 89.4% indication poor laboratory precision. Sodium results should be qualified as estimated. Several RPDs were out-of-control for sample SS-23 including aluminum, chromium, iron, potassium, and sodium. Sample results for these analytes should be estimated.

7. **Field Precision Evaluation:** SB8-S3 and SB12-S2 were the duplicate samples collected for this sampling event. Several analytes exhibited elevated RPDs including barium, calcium, lead, and sodium for SB12-S3 and barium, chromium, and iron for SB8-S3.

8. **Laboratory Control Sample:** Metals were analyzed by SW-846 methods which do not specify the evaluation of laboratory control samples. Since cyanide was processed using contract laboratory program (CLP) protocols the results should have been evaluated, but the necessary information was not included in the data package.

9. **Standard Additions/Furnace Atomic Absorption Analysis (GFAA):** GFAA analysis not required for soil samples.

10. **Serial Dilution Results:** The serial dilution results did not agree within 10% of each other for copper and sodium in the soil boring samples indicating chemical or physical interferences associated with matrix effects. The resultant sample concentrations should be considered estimated for soil boring samples.

ICF KAISER ENGINEERS

ICF KAISER ENGINEERS, INC.
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703/934-3300

TO: Claudia Brand

FROM: Davida Parker Trumbo

DATE: January 3, 1991

SUBJECT: Arrowhead Plating Site, Data Validation, twenty-three (23) Soil Samples and four (4) Water Samples for Volatile Organic Analysis, Versar Laboratories Inc., Control Number 3913.

A data validation was performed on the volatile organic data acquired for (23) soil and (4) water samples collected at the Arrowhead Plating Site as part of the remedial investigation/feasibility study. The samples were analyzed in accordance with the EPA Office of Solid Waste, *Test Methods for Evaluating Solid Waste*, Method 8240 for volatile organic compounds.

The data was validated in accordance with appropriate modifications to the *Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses*, February 1988, and quality control criteria established in the noted analytical method. A copy of the checklist used to record the specific observances has been provided for your information as an attachment to this report.

The following samples were included in this data package:

SS-1	SS-8	SS-15	SEW2-SD1
SS-2	SS-9	SS-16	SEW3-SD1
SS-3	SS-10	SS-17	SEW1-SW1
SS-4	SS-11	SS-18	SEW2-SW1
SS-5	SS-12	SS-19	TRIPBLANK
SS-6	SS-13	SS-20	TRIPBLANK2
SS-7	SS-14	SEW-SD1	

Overall Data Assessment: The overall laboratory performance met quality control criteria with the following exceptions:

1. The holding time of 14 days was exceeded for the following samples: SS-14, SS-15, SS-16, SS-17, SS-18, SS-19, SS-20, SEW1-SD1, SEW2-SD1, and SEW3-SD1. It should be noted that the samples in question are soil samples. Currently, the Agency has not adopted holding time criteria for soil samples but has left it up to the discretion of the data reviewer to apply water holding time criteria to soil samples. Since the samples in question exceeded the holding time by at most two days it is felt that the impact of the situation may not be highly critical to the data quality. The data will however be deemed estimated for these samples, and it will be left to the discretion of the project manager to have the samples reanalyzed.

2. The detection limits should be estimated for the noted analytes in the associated samples due to the variability of the response factors associated with the continuing calibration

ANALYTE	SAMPLE(S)
Chloromethane Bromomethane 1,1,1-Trichloroethane Carbon Tetrachloride Dibromochloromethane	SS-1 SS-6 SS-11 SS-2 SS-7 SS-12 SS-3 SS-8 SS-13 SS-4 SS-9 SS-5 SS-10
1,1,2,2-Tetrachloroethane	SS-19 SEW-SD2 SS-20 SEW-SD3 SEW-SD1
Bromomethane Chloroethane 4-Methyl-2-Pentanone 2-Hexanone	SEW1-SW1 SEW2-SW1 TRIPBLANK TRIPBLANK2

3. The concentration of methylene chloride reported in samples SS-11, SS-12, SS-13, SS-16, and SEW2-SW1 will be qualified as artifacts because the reported concentrations are below the acceptance criteria.

The following criteria were reviewed during the data validation:

1. **Holding Times:** All criteria were met with the exception of the following samples: SS-14, SS-15, SS-16, SS-17, SS-18, SS-19, SS-20, SEW1-SD1, SEW2-SD1, and SEW3-SD1. Information pertaining to the characterization of these samples is not available to the data reviewer, therefore the results will be considered estimated.

2. **GC/MS Tuning:** The tuning and performance criteria were evaluated to ensure mass resolution identification and the sensitivity of the instrumentation. The raw data was verified against the mass calibration and found to be compliant. GC/MS tuning information was available for all samples analyzed in this batch. All ion abundance criteria were met.

3. **Initial and Continuing Calibration Verification:** All criteria were met for initial calibration. Several continuing calibration results were non-compliant with respect to the percent difference between initial and continuing calibration. The criterion for conformance is a variance no greater than 25% from the initial calibration result. Analytes and affected samples include:

ANALYTE	SAMPLE(S)	ACTION
Chloromethane Bromomethane 1,1,1-Trichloroethane Carbon Tetrachloride Dibromochloromethane	SS-1 SS-6 SS-11 SS-2 SS-7 SS-12 SS-3 SS-8 SS-13 SS-4 SS-9 SS-5 SS-10	The detection limits for the noted analytes should be estimated in the associated samples due to the variability in the response factors associated with the continuing calibration.
1,1,2,2-Tetrachloroethane	SS-19 SEW-SD2 SS-20 SEW-SD3 SEW-SD1	
Bromomethane Chloroethane 4-Methyl-2-pentanone 2-Hexanone	SEW1-SW1 SEW2-SW1 TRIPBLANK TRIPBLANK2	

3. **Blank Assessment:** The function of this criterion was to determine the existence and magnitude of contamination problems. The results associated with each blank (i.e., method and trip) were reviewed and evaluated. One method blank was processed for each matrix type. Methylene chloride and acetone were both detected at a concentration of 5 ppb in the associated blank sample. Acetone was not detected in any of the samples associated with this case, and therefore does not contribute contamination. Methylene chloride was detected in several samples below the quantitation limit but above the instrument detection limit (i.e., SS-12, SS-13, SS-16, and SEW2-SW1) and in sample SS-11 just above the detection limit. The data will be qualified to indicate that the concentration of methylene chloride in the noted samples are to be considered artifacts.

4. **Surrogate Recovery:** Laboratory performance criteria was established by means of spiking activities. All samples requiring volatile organic analysis were spiked with three surrogate compounds prior to analysis. All surrogate recoveries were compliant with the requisite control criteria.

5. **Matrix Spike/Matrix Spike Duplicate:** The raw data was checked and all calculations agreed within 10% of the reported values. It was noted that the matrix spike Form I did not contain the actual concentration of spiked analyte. The laboratory was consulted for clarification.

6. **Field Precision Evaluation:** Field duplicates were not included in this sample set.

7. **Internal Standard Performance:** The internal standard performance criteria was evaluated to discern the GC/MS sensitivity and the stabilization of the response during the sample run. The raw data was evaluated and the retention times and internal standard areas were verified. All criteria were determined to be compliant with quality control protocols.

8. **TCL Compound Identification:** The objective of this assessment was to minimize the number of erroneous identifications of compounds. The criteria is applied more easily in the detection of false positive results due to the fact that false negatives would imply missing data, and therefore would be more difficult to assess. It is my opinion that the information provided by Versar Laboratories Inc. concerning positive identifications is correct.

9. **Compound Quantitation and Reported Detection Limits:** This criteria was assessed to determine whether reported results and quantitation limits were accurate. Detection limit information was not provided in this data package. All calculated results were compliant.

10. **Tentatively Identified Compounds:** The objective of this assessment was to ensure that the laboratory performed library searched for non-TCL constituents that had area/height greater than 10% of the size of the nearest internal standard. The raw data was checked and it was determined that the laboratory performed library searched for all required peaks in the sample and blank chromatograms as applicable.

ICF KAISER ENGINEERS

ICF KAISER ENGINEERS, INC
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703 934-3300

TO: Claudia Brand

FROM: Davida Parker Trumbo

DATE: January 3, 1991

SUBJECT: Arrowhead Plating Site, Data Validation, Twenty-nine (29) Soil and Eight (8) Water Samples for Cyanide Analysis, Versar Laboratories Inc., Control Number 3913.

A data validation was performed on the analytical data acquired for cyanide from (8) water and (29) soil samples collected at the Arrowhead Plating Site as part of the remedial investigation/feasibility study. The samples were analyzed for total cyanide in accordance with the modified CLP version of method 335.2 from *Methods for the Chemical Analysis of Water and Waste*, 1983.

The data was validated in accordance with quality control criteria established in the noted analytical method. A copy of the checklist used to record the specific observances has been provided for your information as an attachment to this report.

The following samples were included in this data package:

SS-1	SS-8	SS-15	SEW2-SD1	ST5-SD3	SEW1-SW1
SS-2	SS-9	SS-16	SEW3-SD1	ST1-SW3	SEW2-SW1
SS-3	SS-10	SS-17	ST1-SD3	ST1-SW3A	
SS-4	SS-11	SS-18	ST1-SD3A	ST2-SW3	
SS-5	SS-12	SS-19	ST2-SD3	ST3-SW3	
SS-6	SS-13	SS-20	ST3-SD3	ST4-SW3	
SS-7	SS-14	SEW1-SD1	ST4-SD3	ST5-SW3	

Overall Assessment of Data: The overall laboratory performance met quality control criteria and were compliant with the requisite specifications with the exception of the distilled matrix spike for sample SEW1-SD1. The detection limits for sediment samples should be qualified as being low biased.

The following criteria were reviewed during the data validation:

1. **Holding Times:** All criteria were met.

2. **Initial and Continuing Calibration Verification:** All criteria were met.

3. **Blank Analysis:** The following blank contamination and potentially affected samples are summarized below:

Blank	Contaminant	Concentration	Impact
[1]PBW	Aluminum	57.9 ug/L	SEW1-SW1
	Calcium	28.4	SEW2-SW1
	Iron	34.2	
	Sodium	117	
	Zinc	5.6	
[2]PBS1	Aluminum	7.51 mg/kg	Soils and
	Barium	0.20	Sediments
	Iron	1.18	
	Sodium	7.21	
PBS3	Aluminum	8.02	Soils and
	Iron	0.55	Sediments
	Sodium	8.18	

[1] Preparation Blank Water
[2] Preparation Blank Soil

Action: The concentration reported for aluminum (137 ug/L) in sample SEW1-SW1 and the zinc concentration (17.0 ug/L) for SEW2-SW1 should be qualified since the concentrations are less than five times the concentration determined in the associated blank. A review of the soil data indicated that the level of constituents reported in the samples are above the five times criterion reported in the associated blank and therefore do not require qualification.

4. **ICP Interference Check Sample:** All criteria were met.

5. **Matrix Spike Sample Analysis:** The spike recovery for silver in SEW1-SW1 was 71.1%. The low recovery indicates that the accuracy for the noted constituents were not in control and results for these analytes may have the tendency to be biased low. The water samples should be qualified accordingly.

6. **Laboratory Precision Evaluation:** Duplicate analysis was performed on samples SEW1-SD1, SEW1-SW1, and SS-19. The relative percent difference was greater than 20% for aluminum in SEW1-SW1 and greater than 35% for calcium in SEW1-SD1. These results indicate that the laboratory precision for the noted analytes was not within control. Aluminum results should be considered estimated in water sample and calcium results should be considered estimated for sediment samples.

7. **Field Precision Evaluation:** Not applicable. Duplicate samples were not collected during this sampling event.

8. **Laboratory Control Sample:** Metals were analyzed by SW-846 methods which do not specify the evaluation of laboratory control samples.

9. **Standard Additions/Furnace Atomic Absorption Analysis (GFAA):** Water samples were analyzed using GFAA and all criteria were in control.

10. **Serial Dilution Results:** All criteria were met with the exception of sodium and zinc in sample SEW1-SD1 and zinc in SS-19. The associated sample results should be approximated for these analytes.

ICF KAISER ENGINEERS

ICF KAISER ENGINEERS, INC.
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703/934-3300

TO: Claudia Brand

FROM: Davida Parker Trumbo

DATE: January 3, 1991

SUBJECT: Arrowhead Plating Site, Data Validation, Twenty-nine (29) Soil and Eight (8) Water Samples for Cyanide Analysis, Versar Laboratories Inc., Control Number 3913.

A data validation was performed on the analytical data acquired for cyanide from (8) water and (29) soil samples collected at the Arrowhead Plating Site as part of the remedial investigation/feasibility study. The samples were analyzed for total cyanide in accordance with the modified CLP version of method 335.2 from *Methods for the Chemical Analysis of Water and Waste*, 1983.

The data was validated in accordance with quality control criteria established in the noted analytical method. A copy of the checklist used to record the specific observances has been provided for your information as an attachment to this report.

The following samples were included in this data package:

SS-1	SS-8	SS-15	SEW2-SD1	ST5-SD3	SEW1-SW1
SS-2	SS-9	SS-16	SEW3-SD1	ST1-SW3	SEW2-SW1
SS-3	SS-10	SS-17	ST1-SD3	ST1-SW3A	
SS-4	SS-11	SS-18	ST1-SD3A	ST2-SW1	
SS-5	SS-12	SS-19	ST2-SD3	ST3-SW1	
SS-6	SS-13	SS-20	ST3-SD3	ST4-SW1	
SS-7	SS-14	SEW1-SD1	ST4-SD3	ST5-SW1	

Overall Assessment of Data: The overall laboratory performance met quality control criteria and were compliant with the requisite specifications with the exception of the distilled matrix spike for sample SEW1-SD1. The detection limits for sediment samples should be qualified as being low biased.

The following criteria were reviewed during the data validation:

1. **Holding Times:** All criteria were met.

2. **Initial and Continuing Calibration Verification:** All criteria were met.

3. **Blank Analysis:** All criteria were met.

4. **Matrix Spike Sample Analysis:** All criteria were met with the exception of SEW1-SD1, which had a recovery of 65%. The detection limit has the potential for being biased low in the sediment samples.

5. **Laboratory Precision Evaluation:** Duplicate analysis was performed on samples ST4-SW3, SEW1-SD1, and SS-19. All sample results were reported below the detection limit.

6. **Field Precision Evaluation:** Duplicate samples were collected for samples ST1-SD3 and ST1-SW3. The sample results were reported below the detection limit.

7. **Laboratory Control Sample:** All criteria were met.

ICF KAISER ENGINEERS

ICF KAISER ENGINEERS, INC.
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703/934-3300

TO: Claudia Brand

FROM: Jay Kuhn

DATE: March 17, 1990

SUBJECT: Arrowhead Plating Site, Data Validation, 2 Sediment Samples, 4 Soil Samples, Volatile Organic Analysis, General Physics Laboratory, Gaithersburg, Maryland.

A level I validation was performed on the organic analytical data from 2 sediment samples and 4 soil samples collected at the Arrowhead Plating Site as part of the Remedial Investigation/Feasibility Study. The samples were analyzed for EPA Target Compound List (TCL) volatile organics by General Physics Laboratory, Gaithersburg, Maryland. Validation was performed in accordance with the EPA Functional Guidelines for Evaluating Organics Analyses (February 1, 1988). A copy of the checklist has been provided as an attachment for your information.

The samples included in the data package are the following.

Sediment Samples:	Soil Samples:
MF-SD1	SB21-S3
SF-SD1	SB21-S5
	SB21-S6
	SB22-S3

Overall Assessment of the Data for the Samples Evaluated:

1. The detection of methylene chloride and acetone in the laboratory blank, VBLKL, results in the detected values of methylene chloride and acetone to be considered non-detect in the samples MF-SD1 and SF-SD1.

2. The detection of methylene chloride in the laboratory blank, VBLKD, results in the detected values of methylene chloride to be considered non-detect in the following samples: SB21-S3, SB21-S5, SB21-S6, and SB22-S3.

3. The detection of benzene in the laboratory blank, VBLKD, results in the detected values of benzene to be to be considered nondetect in the samples SB21-S3 and SB22-S3.

4. Due to the substantial deviation in the continuing calibration response

of chloromethane, the method detection limit for chloromethane should be considered estimated for the following samples: SB21-S3, SB21-S5, SB21-S6, and SB22-S3.

SURFACE WATER

ARROWHEAD PLATING SITE
VOLATILE ORGANICS DATA FOR SURFACE WATER (Round 1)
in units of ug/L

Sample ID	Acetone	1,2-Dichloroethene	Trichloroethene	Methylene Chloride	Tetrachloroethene
Background Federal ug/L	ND	0.033(f)	2.8(f)	ND	0.88(f)
ST1-SW1	10.0 U	23	34	5.0 U	39
ST2-SW1	(7)(c)	5	6	[5]	7
ST2-SW1A	(8)(c,e)	6	8	[5]	9
ST3-SW1	10.0 U	5.0 U	5.0 U	[5]	5.0 U
ST4-SW1	10.0 U	5.0 U	5.0 U	5.0 U	5.0 U
ST5-SW1	[7](c)	5.0 U	5.0 U	[4](c)	5.0 U
ST6-SW1	[7](c)	5.0 U	5.0 U	5.0 U	5.0 U
ST7-SW1	[9](c)	5.0 U	5.0 U	5.0 U	5.0 U

U indicates the compound was not detected above the limit indicated.
ND=Not Developed
( )=This detected concentration is considered non-detected because it is within ten times the concentration detected in the reagent blank.
[ ]=This detected concentration is considered non-detected because it is within ten times the concentration detected in the trip blank.
(c)=The compound is tentatively identified and quantitated at less than the method detection limit.
(e)=Due to substantial deviation in the response for the daily calibration, this value is considered estimated.
(f)=45 FR 79,318-79,379; November 28, 1980.

01/25/91

ARROWHEAD PLATING SITE
VOLATILE ORGANICS DATA FOR SURFACE WATER (Round 2)
in units of ug/L

Sample ID	Acetone	1,2-Dichloroethene	Trichloroethene	Methylene Chloride	Tetrachloroethene	Tentatively Identified Compounds
Background Federal ug/L	ND	0.033(g)	2.8(g)	ND	0.88(g)	
ST1-SW2	[8](c)	30	38	5.0 U	41	Unknown Hydrocarbon
ST1-SW2A	[10]	24	30	5.0 U	32(f)	
ST2-SW2	[8](c)	5	6	5.0 U	7(f)	
ST3-SW2	10.0 U	5.0 U	5.0 U	[2]	5.0 U	
ST4-SW2	10.0 U	5.0 U	5.0 U	[3]	5.0 U	
ST5-SW2	10.0 U	5.0 U	5.0 U	[2]	5.0 U	
ST6-SW2	10.0 U	5.0 U	5.0 U	[3]	5.0 U	
ST7-SW2	10.0 U	5.0 U	5.0 U	[2]	5.0 U	

U indicates the compound was not detected above the limit indicated.
ND=Not Developed
[ ]=This detected concentration is considered non-detected because it is within ten times the concentration detected in the trip blank.
(c)=The compound is tentatively identified and quantitated at less than the method detection limit.
(f)=Mass spectral criteria was not met for the identification of this compound; therefore, the compound is tentatively identified.
(g)=45 FR 79,318-79,379; November 28, 1980.

01/25/91

ARROWHEAD PLATING SITE
VOLATILE ORGANICS DATA FOR SURFACE WA[illegible] (Round 3)
in units of ug/L

Sample ID	Acetone	1,1-Dichloro-ethene	1,2-Dichloro-ethene	1,1,1-Trichloro-ethane	Trichloro-ethene	Tetrachloro-ethene	Methylene Chloride	1,1-Dichloro-ethane	Chloro-form	1,2-Dichloro-ethane	1,1,2-Tri-chloroethane	Carbon Disulfide	Comment
Federal Standards	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
MF-SW1, DL	10U	44	980(a)	170	1,600	300	1(c)	30(e)	6	5U	3(c)	5U	Note A
MF2-SW1	10	3(c)	4(c)	(3)	140	(6)	5U	5U	5U	5U	5U	5U	Note A
SF-SW1,DL	10U	44	8	28	1,800	30	5U	1(c,e)	2(c)	2(c)	4(c)	(2)	Note A

NA=Not Available
DL=Dilution
RE=Reextraction
U=Indicates the compound was not detected above the limit indicated.
( )=This detected concentration is considered non-detected because it is within ten times the concentration detected in the reagent blank.
[ ]=This detected concentration is considered non-detected because it is within ten times the concentration detected in the field blank.
(a)=The quantitated value exceeds the range of calibration; therefore, this value should be considered estimated.
(b)=The compound is tentatively identified.
(c)=The compound is tentatively identified and quantitated at less than the method detection limit.
(d)=Mass spectral data suggests the presence of this compound, but due to the dilution the compound cannot be confirmed.
(e)=Due to a substantial deviation in the response for the daily calibration, this value is considered estimated.
(f)=40 CFR, Part 141-National Primary Drinking Water Regulation. pp526-533, 585-587
(g)=Proposed
(h)=Suggested No Adverse Response Levels (SNARLS)
(j)=Analysis of sample outside holding time; this value should be considered estimated.
(k)=Due to a noncompliant surrogate, this value should be considered estimated.

Note A: Due to a substantial deviation in the 2-butanone response, the method detection limit for 2-butanone should be considered estimated.

ARROWHEAD PLATING SITE
SEMIVOLATILE ORGANICS DATA FOR SURFACE WATER (Round 1)
in units of ug/L

Sample ID	Bis(2-ethylhexyl)phthalate	Number of Tentatively Identified Compounds	Tentatively Identified Compounds	Comments
Background Federal ug/L	NA			Note A
ST1-SW1	18	1	1H-Benzotriazole	
ST2-SW1	10.0 U	0		
ST2-SW1A	10.0 U	0		
ST3-SW1	10.0 U	0		
ST4-SW1	10.0 U	0		
ST5-SW1	10.0 U	0		
ST6-SW1	10.0 U	0		
ST7-SW1	10.0 U	0		

U indicates the compound was not detected above the limit indicated.
Note A: No Federal Background Criteria Developed

01/25/91

ARROWHEAD PLATING SITE
SEMIVOLATILE ORGANICS DATA FOR SURFACE WATER (Round 2)
in units of ug/L

Sample ID	Bis(2-ethylhexyl)phthalate	Number of Tentatively Identified Compounds	Tentatively Identified Compounds	Comments
Background Federal ug/L	NA			Note A
ST1-SW2	10.0 U	4	Substituted Propanol; Substituted Benzene; Unknown	
ST1-SW2A	10.0 U	2	Substituted Propanol; Unknown	
ST2-SW2	10.0 U	4	Substituted Propanol; Unknown	
ST3-SW2	10.0 U	0		
ST4-SW2	(9)(c)	0		
ST5-SW2	(18)	0		
ST6-SW2	(18)	0		
ST7-SW2	(15)	0		

U indicates the compound was not detected above the limit indicated.
( )=This detected concentration is considered non-detected because it is within ten times the concentration detected in the reagent blank.
(c)=The compound is tentatively identified and quantitated at less than the method detection limit.
Note A: No Federal Background Criteria Developed 01/25/91
NA - Not Applicable.

ARROWHEAD PLATING SITE
INORGANIC DATA FOR SURFACE WATER SAMPLES
ROUND I

mple ID	Aluminum ug/L	Barium ug/L	Cadmium ug/L	Calcium ug/L	Chromium ug/L	Copper ug/L	Iron ug/L	Lead ug/L	Mercury ug/L	Nickel ug/L	Potassium ug/L	Silver ug/L	Sodium ug/L	Zinc ug/L	Cyanide ug/L
1-SW1	157(a)	17.6	2.0 U	5,240	9.0 U	3.4	788	1.0 U	0.2 U	18.0 U	2,510 U(a)	1.0 U	94,300	21.0(a,c)	NR
1-SW1	1,190	21.2	2.0 U	5,750	9.0 U	6.3	2,640	1.0 U	0.2 U	18.0 U	2,780(a)	1.0 U	99,100	20.6(a,c)	10 U(d)
2-SW1	696	91.8	2.0 U	22,800	9.0 U	3.2	5,570	1.0 U	0.2 U	18.0 U	11,000(a)	1.0 U	46,800	20.1(a,c)	10 U(d)
2-SW1 F	44.0(a)	132.0	2.0 U	34,000	9.0 U	1.7	4,520	1.0 U	0.2 U	18.0 U	14,500(a)	1.0 U	17,300	9.6(a,c)	NR
2-SW1A	643(a)	91.8	2.0 U	21,100	9.0 U	3.0	5,230	1.0 U	0.2 U	18.0 U	8,920(a)	1.0 U	42,200	9.6(a,c)	10 U(d)
2-SW1A	161(a)	63.6	2.0 U	16,300	9.0 U	2.9	2,060	1.0 U	0.2 U	18.0 U	7,260(a)	1.0 U	58,400	10.1(a,c)	NR
3-SW1	547(a)	67.1	2.0 U	10,900	9.0 U	2.7	2,350	1.1	0.2 U	18.0 U	6,460(a)	1.0 U	20,200	10.1(a,c)	16.2(e)
3-SW1 F	76.5(a)	56.5	2.0 U	10,800	9.0 U	2.8	728	1.0 U	0.2 U	18.0 U	6,120(a)	1.0 U	21,000	10.4(a,c)	NR
4-SW1	440(a)	56.5	6.9	3,550	9.0 U	1.5	1,360	1.1	0.2 U	18.0 U	2,680(a)	1.0 U	9,000	18.2(a,c)	10 U(d)
4-SW1 F	76.3(a)	49.4	4.0	3,440	9.0 U	3.1	305	1.0 U	0.2 U	18.0 U	2,570(a)	1.0 U	9,120	60.8(a,c)	NR
5-SW1	533(a)	49.4	8.0	5,120	9.0 U	4.1	1,780	1.0 U	0.2 U	18.0 U	3,660(a)	1.0 U	11,800	15.5(a,c)	10 U(d)
5-SW1 F	23.6(a)	44.1	8.0	5,300	9.0 U	4.2	418	1.0 U	0.2 U	18.0 U	3,670(a)	1.0 U	12,800	15.7(a,c)	NR
6-SW1	305(a)	25.2	7.9	3,910	9.0 U	3.4	1,410	1.0 U	0.2 U	18.0 U	3,970(a)	1.0 U	8,300	10.3(a,c)	10 U(d)
6-SW1 F	16.7(a)	23.8	4.0	3,600	9.0 U	7.4	365	2.4	0.2 U	18.0 U	2,510 U(a)	1.0 U	8,720	10.4(a,c)	NR
7-SW1	350(a)	28.2	2.0 U	3,140	9.0 U	1.3	1,750	1.0 U	0.2 U	18.0 U	3,900(a)	1.0 U	4,490	20.9(a,c)	10 U(d)
7-SW1 F	14.5(a)	24.7	4.0	2,840	9.0 U	3.3	302	1.0 U	0.2 U	18.0 U	2,510 U(b)	1.0 U	4,760	10.5(a,c)	NR

U - Not detected above limit indicated.
NR - Not Required
(a) - Estimate value due to low bias associated with precision problems.
(b) - Estimate value due to low bias associated with matrix spike assessment.
(c) - Field duplicate results deviated by greater than 20% indicating precision problems.
(d) - Detection limits should be estimated due to extended holding times.
(e) - Estimate value due to extended holding time.

01/25/91

ARROWHEAD PLATING SITE
INORGANIC DATA FOR SURFACE WATER SAMPLES
ROUND 11

mple ID	Aluminum ug/L	Barium ug/L	Cadmium ug/L	Calcium ug/L	Chromium ug/L	Copper ug/L	Iron ug/L	Lead ug/L	Mercury ug/L	Nickel ug/L	Potassium ug/L	Silver ug/L	Sodium ug/L	Zinc ug/L	Cyanide ug/L
1-SW2	3,570	26.8(d)	5.0 U	6,100	5.0 U	16.8	5,190	3.5(a)	0.20 U	10.0 U	1,140(c)	1.0 U	113,000	14.8(a,c)	4.7 U(f)
1-SW2 F	126(a)	12.1(d)	5.0 U	6,270	5.0 U	5.3	495	3.5 U	0.20 U	10.0 U	2,230(c)	1.0 U	115,000	5.3(a,c)	NR
1-SW2A	3,630	26.5(d)	5.0 U	6,640	6.7	13.7	5,750	2.9(a)	0.20 U	10.0 U	2,320(c)	1.0 U	116,000	25.1(a,c)	5.0 U(f)
1-SW2A F	55.7(a)	15.4(d)	5.0 U	6,690	5.0 U	3.8	343	1.0 U	0.20 U	10.0 U	3,190(c)	1.0 U	117,000	5.2(a,c)	NR
2-SW2	2,400	81.6(d)	5.0 U	17,300	5.0 U	9.9	6,960	3.1	0.20 U	10.0 U	5,830(c)	1.0 U	67,900	19.6(a,c)	4.6 U(f)
2-SW2 F	159	35.3(d)	5.0 U	11,200	5.0 U	2.9	1,060	1.0 U	0.20 U	10.0 U	3,820(c)	1.0 U	95,700	10.3(a,c)	NR
3-SW2	1,370	75.8(d)	5.0 U	12,100	7.3	4.7	3,670	1.0 U	0.20 U	10.0 U	5,410	1.0 U	26,100	9.8(a,c)	10.5(g)
3-SW2 F	50.9(a)	64.0(d)	5.0 U	12,500	5.0 U	3.1	738	1.0 U	0.20 U	10.0 U	6,190	1.0 U	27,200	10.3(a,c)	NR
4-SW2	319	61.4(d)	5.0 U	3,720	5.2	1.0	1,340	2.1(a)	0.20 U	10.0 U	3,040	1.0 U	10,500	23.4(a,c)	2.5 U(f)
4-SW2 F	37.7(a)	53.0(d)	5.0 U	3,450	5.0 U	1.6	369	1.0 U	0.20 U	10.0 U	871	1.0 U	10,700	12.5(a,c)	NR
5-SW2	1,060	64.7(d)	5.0 U	6,940	5.0 U	5.9	3,490	1.6(a)	0.20 U	10.0 U	3,440	1.0 U	16,500	20.3(a,c)	2.5 U(f)
5-SW2 F	53.8(a)	50.8(d)	5.0 U	6,340	5.0 U	3.4	676	1.0 U	0.20 U	10.0 U	3,360	1.0 U	16,300	12.4(a,c)	NR
6-SW2	638	38.2(d)	5.0 U	5,060	5.0 U	3.4	6,070	1.0 U	0.20 U	10.0 U	1,000	1.0 U	11,100	9.4(a,c)	2.5 U(f)
6-SW2 F	24.4(a)	28.0(d)	5.0 U	5,230	5.0 U	3.7	1,620	1.0 U	0.20 U	10.0 U	2,050	1.0 U	12,200	9.8(a,c)	NR
7-SW2	211	32.4(d)	5.0 U	3,590	5.0 U	1.0	4,480	2.1(a)	0.20 U	10.0 U	2,190	1.0 U	4,320	9.7(a,c)	3.4 U(f)
7-SW2 F	26.6(a)	25.8(d)	5.0 U	3,560	5.0 U	1.8	1,620	1.0 U	0.20 U	10.0 U	1,700	1.0 U	4,730	7.3(a,c)	NR

EGEND:

- U - Not detected above limit indicated.
- NR - Not Required
- a - Sample result is less than five times the concentration of the associated blank and should not be considered real.
- c - Estimate value due to laboratory precision problems.
- d - Estimate value due to potential chemical or physical interferences.
- f - Reject value due to extended holding time.
- g - Estimate value due to extended holding times.

01/25/91

ICF KAISER ENGINEERS

ICF KAISER ENGINEERS, INC.
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703/934-3300

TO: Claudia Brand

FROM: Jay Kuhn

DATE: July 17, 1990

SUBJECT: Arrowhead Plating Site, Data Validation, 1 Surface Soil, 8 Sediment, 12 Water Samples Semivolatile and Volatile Organic Analysis, Versar Inc., Virginia.

REFERENCE: Validation 4, Versar Control Number 2440 and 2452, Surface Soil, Sediment and Water

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A level I validation was performed on the organic analytical data from 8 sediment samples, 9 water samples, and 1 surface soil collected at the Arrowhead Plating Site as part of the Remedial Investigation/Feasibility Study. The samples were analyzed for EPA Target Compound List (TCL) semivolatile and volatile organics by Versar Inc., Springfield, Virginia. Volatile organic compound trip blanks were also included in the sample package. Validation was performed in accordance with the EPA Functional Guidelines for Evaluating Organics Analyses (February 1,1988). A copy of the checklist has been provided as an attachment for your information.

The samples included in the data package are the following.

Sediment/Surface Soil Samples	Water Samples
SP1	ST1-SW1
ST1-SD1	ST2-SW1A
ST2-SD1	ST2-SW1
ST2-SD1A	ST3-SW1
ST3-SD1	ST4-SW1
ST4-SD1	ST5-SW1
ST5-SD1	ST6-SW1
ST6-SD1	ST7-SW1
ST7-SD1	Tank-1
	Trip Blank 7
	Trip Blank 9 (4/10/90)
	Trip Blank 9 (4/11/90)

Overall Assessment of Data for Samples Evaluated:

1. Due to a substantial deviation in the continuing calibration response of acetone, the detected value is considered estimated in the following

compounds: ST2-SD1, ST4-SD1, ST5-SD1, ST6-SD1, and ST2-SW1A.

2. Because of the detection of acetone in the associated reagent blank the values for acetone are considered non-detected in the following samples: ST2-SW1, ST2-SW1A, ST5-SW1, ST6-SW1, and ST7-SW1.

3. The detection of methylene chloride and acetone in the associated Trip Blank 9 (received 4/10/90) results in the values of methylene chloride to be considered non-detected in samples ST2-SW1, ST2-SW1A, ST3-SW1, and ST5-SW1. In addition the values of acetone are considered non-detected in ST5-SW1, ST6-SW1, and ST7-SW1. It should be noted that the contamination detected in the trip blank could be caused by the reagent blank, VBLK69, associated with the analysis of Trip Blank 9 (received 4/10/90).

4. Deviation of all internal standard areas for sample ST5-SD1 results in the detected value of Acetone to be considered estimated and the method detection limit for all other target compounds should be considered estimated.

5. Method detection limits for SP-1 were not met by a factor of 2 as a result of a dilution. In addition, a dilution factor of 10 was used in the analysis of SP-1MS and SP-1MSD.

The following criteria were reviewed in validating the data:

1. **Holding Time**: All criteria were met.

2. **GC/MS Tune**: All criteria met.

3. **Calibration**:

Volatile TCL: Instruments U and W were used to perform the volatile analysis. Calibration results for each instrument are as follows:

Instrument U

Initial: 4/19/90, 1 compound has a %RSD > 30%.

Impact on data: No compounds were quantitated from the initial calibration.

Continuing: 4/20/90, 1 compound, acetone, has a %D > 25%.

Impact on data: The result for the compound, acetone, which is quantitated on a continuing calibration with a percent deviation (%D) > 25% should be qualified as follows: the detected value of acetone should be estimated. The samples potentially impacted are ST1-SD1, ST2-SD1, ST2-SD1A, ST3-SD1, ST4-SD1, ST6-SD1, ST7-SD1, ST1-SD1MS (matrix spike), ST1-SD1MSD (matrix spike duplicate), ST5-SD1, ST1-SD1MSDRE (reextraction), and ST5-SD1RE (reextraction). The impacted samples are ST2-SD1, ST4-SD1, ST5-SD1, and ST6-SD1.

Initial: 4/21/90, meets criteria.

Instrument W

Initial: 4/16/90, 2 compounds have a %RSD > 30%.

Impact on data: No compounds were quantitated from the initial calibration.

Continuing: 4/19/90, 5 compounds have a %D > 25%.

Impact on data: The results for chloromethane, acetone, carbon disulfide, vinyl acetate, and 2-hexanone, which are quantitated on the continuing calibration with percent deviations (%D) > 25% should be qualified as follows: the detected compound values should be considered estimated, and reject the data of the compound chloromethane when nondetected. The samples potentially impacted are Trip Blank 7 and Trip Blank 9. The sample impacted is Trip Blank 7.

Continuing: 4/20/90, 3 compounds have a %D > 25%.

Impact on data: The results for acetone, carbon disulfide, and vinyl acetate, which are quantitated on the continuing calibration with percent deviations (%D) > 25% should be qualified as follows: the detected compound values should be considered estimated. The samples potentially impacted are ST1-SW1, ST2-SW1, ST2-SW1A, and ST3-SW1. The actual impacted is the detected value of acetone ST2-SW1A.

Continuing: 4/20/90, 3 compounds have a %D > 25%.

Impact on data: The results for carbon disulfide, vinyl acetate, and 2-hexanone, which are quantitated on the continuing calibration with percent deviations (%D) > 25% should be qualified as follows: the detected compound values should be considered estimated. The samples potentially impacted are ST4-SW1, ST5-SW1, ST6-SW1, and ST7-SW1. None of these compounds were detected in these samples.

Continuing: 4/21/90, 2 compounds have a %D > 25%.

Impact on data: The results for carbon disulfide and bromoform, which are quantitated on the continuing calibration with percent deviations (%D) > 25% should be qualified as follows: the detected compound values should be considered estimated. The samples potentially impacted are Trip Blank 9 and Tank-1. None of these compounds were detected in these samples.

Semivolatile TCL: Instrument T and Z were used to perform the semivolatile analysis. Calibration results for each instrument are as follows:

Instrument T

Initial: 5/5/90, 6 compounds have a %RSD > 30%. As is, this initial calibration does not meet SW-846, method 8270 criteria and is therefore noncompliant. Notified the laboratory that the initial calibration form does not reflect the response values for the initial calibration of instrument T on 5/5/90. The laboratory submitted the correct continuing calibration form which is to replace pages 400099 and 400100. The submitted form has 1 compound, benzoic acid, with a %RSD > 30%.

Impact on data: No samples were quantitated from the initial calibration.

Continuing: 5/8/90, 4 compounds have a %D > 25%. As is, this continuing calibration does not meet SW-846, method 8270 criteria and is therefore noncompliant. Notified the laboratory that the continuing calibration form does not reflect the response values

for the continuing calibration of instrument T on 5/5/90. The laboratory submitted the correct continuing calibration form which is to replace pages 400107 and 400108. The submitted form has the following compounds with a %D > 25%: benzoic acid, 4-nitroaniline, and butylbenzylphthalate.

Impact on data: The results for benzoic acid, 4-nitroaniline, and butylbenzylphthalate which are quantitated on the continuing calibration with percent deviations (%D) > 25% should be qualified as follows: the detected compound values should be considered estimated. The samples potentially impacted are ST1-SD1 and ST2-SD1. These compounds were not detected in these samples.

Continuing: 5/9/90, 7 compounds have a %D > 25%. As is, this continuing calibration does not meet SW-846, method 8270 criteria and is therefore noncompliant. Notified the laboratory that the continuing calibration form does not reflect the response values for the continuing calibration of instrument T on 5/8/90. The laboratory submitted the correct continuing calibration form which is to replace pages 400109 and 400110. The submitted form has the following compounds with a %D > 25%: n-nitroso-di-n-propylamine, benzoic acid, 4-nitroaniline, flourene, 4-chlorophenyl-phenylether, anthracene, butylbenzylphthalate, and chrysene.

Impact on data: The results for these compounds which are quantitated on the continuing calibration with percent deviations (%D) > 25% should be qualified as follows: the detected compound values should be considered estimated. The samples potentially impacted are ST2-SD1A, ST3-SD1, and ST4-SD1. These compounds were not detected in these samples.

Continuing: 5/10/90, 3 compounds have a %D > 25%. As is, this continuing calibration does not meet SW-846, method 8270 criteria and is therefore noncompliant. Notified the laboratory that the continuing calibration form does not reflect the response values for the continuing calibration of instrument T on 5/10/90. The laboratory submitted the correct continuing calibration form which is to replace 400111 and 400112. The continuing calibration has 1 compound, anthracene, with a %D > 25%.

Impact on data: The results for anthracene which are quantitated on the continuing calibration with percent deviations (%D) > 25% should be qualified as follows: the detected compound values should be considered estimated. The samples potentially impacted are ST5-SD1, ST6-SD1, and SP-1. Anthracene was not detected in any of these samples.

Instrument Z

Initial: 4/13/90, 2 compounds have a %RSD > 30%.

Impact on data: No compounds were quantitated form this initial calibration.

Continuing: 5/1/90, 2 compounds have a %D > 25%.

Impact on data: The results for 4-chloroaniline and 3-nitroaniline, which are quantitated on the continuing calibration with percent deviations (%D) > 25% should be qualified as follows: the detected compound values should be considered estimated. The samples potentially impacted are ST1-SW1, ST1-SW1MS, ST1-SW1MSD, ST2-SW1, ST2-SW1A, ST3-SW1, ST4-SW1, ST5-SW1, and ST6-SW1. These compounds were not detected in these samples.

Continuing: 5/2/90, 2 compounds have a %D > 25%.

Impact on data: The results for 4-chloroaniline and 3-nitroaniline, which are quantitated on the continuing calibration with percent deviations (%D) > 25% should be qualified as follows: the detected compound values should be considered estimated. The samples potentially impacted are Tank-1 and ST7-SW1. These compounds were not detected in these samples.

4. **Blanks:**

The intent of blanks are to review the potential of contamination contribution by the sampling and/or analytical process. Those compounds present in the blanks should be flagged as non-detect for the specified concentration range within the sample. Both field blanks and trip blanks are included in this data package. The maximum concentration of contamination found in any of the field, trip, or laboratory blanks is as follows:

Contamination	Detected Concentration of Contamination	Contamination Considered Non-detect up to Concentration	Blank I.D.
Methylene Chloride	4 ug/L	40 ug/L	VBLK69
Acetone	8 ug/L	80 ug/L	VBLK69
Acetone	8 ug/L	80 ug/L	VBLK96
Methylene Chloride	4 ug/L	40 ug/l	VBLK97
Acetone	9 ug/L	90 ug/L	VBLK23
Methylene Chloride	3 ug/L	30 ug/L	Trip Blank 9
Acetone	6 ug/L	60 ug/L	Trip Blank 9

Impact on data: The detection of methylene chloride and acetone in the associated Trip Blank 9 (received 4/10/90) results in the values of methylene chloride to be considered non-detected in samples ST2-SW1, ST2-SW1A, ST3-SW1, and ST5-SW1. In addition the values of acetone are considered non-detected in ST5-SW1, ST6-SW1,

and ST7-SW1. It should be noted that the contamination detected in the trip blank could be caused by the reagent blank, VBLK69, associated with the analysis of Trip Blank 9 (received 4/10/90).

5. **Surrogate Spike**: Surrogate recovery windows created from EPA Contract Laboratory Program data base.

Volatile: meets criteria.

Semivolatile: ST1-SW1 had 1 acid surrogate out. ST3-SW1 had 1 acid surrogate out. ST2-SD1 had one acid surrogate out.

Impact on data: The results are not considered impacted when there is only one surrogate outlier.

6. **Matrix Spike/Matrix Spike Duplicate:**

Volatile: meets criteria.

Semivolatile:

Water Matrix: The following recoveries were out of the recovery windows created from EPA Contract Laboratory Program data base.

ST1-SW1MS: 4-nitrophenol recovery high (94%)
ST1-SW1MSD: 4-nitrophenol recovery high (94%)

All RPDs meet criteria.

Impact on data: It is in the reviewers judgement that there is no impact on the data.

Sediment Matrix: The following recoveries were out of the recovery windows created from EPA Contract Laboratory Program data base.

SP-1MS: 1,4-dichlorobenzene recovery low (22%)
ST2-SD1MS: 4-chloro-3-methylphenol recovery high (119%), 4-nitrophenol recovery high (129%), 2,4-dinitrotoluene recovery high (100%)
ST2-SD1MSD: 4-nitrophenol recovery high (115%) , and 2,4-dinitrotoluene recovery high (95%).

The RPDs for the matrix spike and matrix spike duplicate of sample SP-1 were out for 1,4-dichlorobenzene, n-nitroso-di-n-propylamine, and 1,2,4-trichlorobenzene.

Impact on data: It is in the reviewers judgement that there is no impact on the data.

7. Field Duplicates:

Water Matrix: The field duplicates are ST2-SW1 and ST2-SW1A. No compounds were detected in ether of the samples for the TCL semivolatile analysis. The following compounds were detected for the TCL volatile analysis:

Compound Quantitated	ST2-SW1	ST2-SW1A	RPD
Methylene Chloride	5 ug/L	5 ug/L	0%
Acetone	7 ug/L	8 ug/L	13%
1,2-Dichloroethene	5 ug/L	6 ug/L	18%
Trichloroethene	6 ug/L	8 ug/L	29%
Tetrachloroethene	7 ug/L	9 ug/L	13%

Impact on data: It is in the reviewers judgement that there is no significant impact.

Sediment Matrix: The field duplicates are ST2-SD1 and ST2-SD1A. No samples were detected in ether of the samples for TCL semivolatile analysis. For TCL volatile analysis acetone was detected in ST2-SD1 and ST2-SD1A at 9 ug/Kg and 14 ug/Kg respectively. The RPD is 43%.

Impact on data: It is in the reviewers judgement that there is no significant impact.

8. Internal Standard Performance:

Volatile: For sample ST1-SD1MSD and its reextraction ST1-SD1MSDRE both the first internal standard, bromochloromethane, and the second internal standard, 1,4-difluorobenzene, were outliers. For sample ST5-SD1 and its reextraction ST5-SD1RE all internal standards were outliers. For SP-1 all internal standards were outliers. **Note**: No reextraction of SP-1 was done.

Impact on data: Positive results quantitated off the internal standards should be considered estimated and for non-detect results, the quantitation limit should be considered estimated.

Semivolatile: For sample SP-1 the first internal standard, 1,4-dichlorobenzene-D4, was an outlier. **Note**: No reextraction of SP-1 was done. For sample ST6-SD1 the first internal standard, 1,4-dichlorobenzene-D4, and the second internal standard, naphthalene-

D8, were outliers. **Note**: No reextraction of ST6-SD1 was done.

Impact on data: Positive results quantitated off the internal standards should be considered estimates and for non-detect results the quantitation limit should be considered estimated.

9. **TCL Compound Identification**: All qualitative analysis acceptable.

10. **Compound Quantitation and Reported Detection Limits**: Method detection limits for SP-1 were not met by a factor of 2. The analysis of SP-1MS and SP-1MSD were not met by a factor of 10. **Note**: SP-1, SP-1MS and SP-1MSD were not analyzed at the same dilution.

    Impact on data: The TCL semivolatile, bis(2-ethylhexyl)phthalate, was confirmed in SP-1 and tentatively identified in SP-1MS, and SP-1MSD.

11. **Tentatively Identified Compounds**: Meets criteria.

12. **System Performance**: The laboratory summary sheet incorrectly designated sample Trip Blank 7 as Trip Blank/ST7. The sample number ST2-SW1A was incorrectly designated ST2-SD2A. Sample ST2-SW1 was incorrectly entered into the instrument W logbook as ST2-SW2. This error was carried over into the generation of forms associated with this analysis.

    Impact on data: The laboratory was notified of these errors and resubmitted the following information:

Incorrect Sample Number	Correct Sample Number	Pages Resubmitted
Trip Blank/ST7	Trip Blank 7	Narrative 100005 100009 100016 100152 100153 100154 100155 200089 200202 200195 through 199 000031
ST2-SD2A	ST2-SW1A	Narrative 200195 through 199
ST2-SW2	ST2-SW1	Narrative 100005 100010 100017 100041 100042

100043
100044
200090
200203

It should be noted that the above pages represent the basic documentation for tracking the sample and form generation for the analytical process. In some instances, the raw data still has the incorrect sample designation.

ICF KAISER ENGINEERS

ICF KAISER ENGINEERS, INC.
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703/934-3300

TO: Claudia Brand

FROM: Jay Kuhn

DATE: July 18, 1990

SUBJECT: Arrowhead Plating Site, Data Validation, 12 Water Samples and 8 Sediment Samples, Volatile Organic Analysis, Versar Inc., Virginia.

REFERENCE: Validation 12, Versar Control Number 2763 and 2769, Surface Water, Sediment

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A level I validation was performed on the organic analytical data from 8 water samples and 8 sediment samples collected at the Arrowhead Plating Site as part of the Remedial Investigation/Feasibility Study. The samples were analyzed for EPA Target Compound List (TCL) volatile organics by Versar Inc., Springfield, Virginia. Validation was performed in accordance with the EPA Functional Guidelines for Evaluating Organics Analyses (February 1, 1988). A copy of the checklist has been provided as an attachment for your information.

The samples included in the data package are the following.

ST1-SW2	ST5-SW2	ST2-SD2	ST7-SD2
ST1-SW2A	ST6-SW2	ST3-SD2	Field Blank 5
ST2-SW2	ST7-SW2	ST4-SD2	Trip Blank 15
ST3-SW2	ST1-SD2	ST5-SD2	Trip Blank 16
ST4-SW2	ST1-SD2A	ST6-SD2	Trip Blank 17

Overall Assessment of Data for Samples Evaluated:

The following is a summary of this data evaluation:

1. Tetrachloroethene should be qualified as tentatively identified in samples ST1-SW2A and ST2-SW2.

2. The detected values of acetone in ST4-SD2, ST5-SD2, ST6-SD2, and ST7-SD2 should be considered non-detected. The detected value of methylene chloride in ST3-SW2, ST4-SW2, ST5-SW2, ST6-SW2, and ST7-SW2 should be considered non-detected.

The following criteria were reviewed in validating the data:

1. **Holding Time**: All criteria met

2. **GC/MS Tune**: All criteria met.

3. **Calibration**:

Instruments W and U were used to perform the volatile analysis. Calibration results for each instrument are as follows.

Instrument W

Initial: 5/29/90, 1 compound, acetone, has a relative standard deviation (%RSD) > 30%.

Impact on data: No compounds were quantitated from the initial calibration.

Continuing: 5/31/90, 1 compound, acetone, has a %D > 25%.

Impact on data: Results for compounds which are quantitated on continuing calibrations with percent deviation (%D) > 25% should be qualified as follows: detected compound values for acetone should be estimated. The samples potentially impacted are ST3-SW2, ST4-SW2, ST5-SW2, ST6-SW2, and ST7-SW2. Acetone was not detected in any of these samples.

Continuing: 5/31/90, 4 compounds, bromomethane, methylene chloride, 1,1,2-trichloroethane, and 2-hexanone, have a %D > 25%.

Impact on data: Results for compounds which are quantitated on continuing calibrations with percent deviation (%D) > 25% should be qualified as follows: detected compound values for bromomethane, methylene chloride, 1,1,2-trichloroethane, and 2-hexanone should be considered estimated. The samples potentially impacted are ST1-SW2, ST1-SW2A, and ST2-SW2. These compounds were not detected in the samples.

Instrument U

Initial: 5/31/90, meets criteria.

Continuing: 5/31/90, meets criteria.

Continuing: 6/1/90, meets criteria.

4. **Blanks**:

The intent of blank analysis results are to evaluate the potential of contamination contribution by the sampling and/or analytical process. Both field blanks and laboratory blanks are included in this data package. The maximum concentration of contamination found in any of the

field, trip, or laboratory blanks is as follows:

Contamination	Detected Concentration of Contamination	Contamination Considered Non-detect up to Concentration	Blank I.D.
2-Butanone	5 ug/L	50 ug/L	VBLK52
Methylene Chloride	3 ug/L	30 ug/L	Field Blank 5
Acetone	7 ug/L	70 ug/L	Field Blank 5
Methylene Chloride	3 ug/L	30 ug/L	Trip Blank 15
Methylene Chloride	3 ug/L	30 ug/L	Trip Blank 16
Acetone	10 ug/L	100 ug/L	Trip Blank 16
Acetone	10 ug/L	100 ug/L	Trip Blank 17

Impact on data: The detected values of acetone in ST4-SD2, ST5-SD2, ST6-SD2, and ST7-SD2 should be considered non-detected. The detected value of methylene chloride in ST3-SW2, ST4-SW2, ST5-SW2, ST6-SW2, and ST7-SW2 should be considered non-detected.

5. **Surrogate Spike:**

Surrogate recovery windows created from EPA Contract Laboratory Program data base. All surrogate recoveries are compliant.

6. **Matrix Spike/Matrix Spike Duplicate:**

Matrix Spike recovery windows created from EPA Contract Laboratory Program data base. All matrix spike recoveries are compliant. All relative percent deviations (RPDs) are compliant

7. **Field Duplicates:**

The field duplicates are ST1-SW2 and ST1-SW2A for surface water and ST1-SD2 and ST1-SD2A for sediments. The results for surface water duplicates and Relative Percent Deviations (RPDs) are as follows:

Compound Quantitated	ST1-SW2	ST1-SW2A	RPDs
Acetone	8 ug/L	10 ug/L	22%
1,2-Dichloroethene	30 ug/l	24 ug/L	22%
Trichloroethene	38 ug/L	30 ug/L	24%
Tetrachloroethene	41 ug/L	32 ug/L	25%

No compounds were detected for sediment duplicates ST1-SD2 and ST1-SD2A.

Impact on data: The field duplicates reflect good precision. It is in the reviewers judgement that there is no significant impact on the data.

8. **Internal Standard (IS) Performance**: All criteria met.

9. **TCL Compound Identification:**

The criteria that mass ions of the sample spectrum be within 20% of the corresponding standard spectrum was not met for the following detected compounds.

Sample ID:	Target Compound:
ST1-SW2A	Tetrachloroethene
ST2-SW2	Tetrachloroethene

Impact on data: These results will be qualified as tentatively identified.

10. **Compound Quantitation and Reported Detection Limits:**

Instrument detection limits were not submitted. Quantitation limits were met.

11. **Tentatively Identified Compounds**: All criteria met.

12. **System Performance**: All criteria met.

ICF KAISER ENGINEERS

ICF KAISER ENGINEERS, INC.
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703/934-3300

TO: Claudia Brand

FROM: Davida Parker Trumbo

DATE: July 11, 1990

SUBJECT: Arrowhead Plating Site, Data Validation, 8 Sediment and 17 Water Samples for Inorganic Analysis, Versar Inc., Control No. 2800

A data validation was performed on the inorganic analytical data from 16 water and 8 soil samples collected at the Arrowhead Plating Site as part of the remedial investigation/feasibility study. The samples were analyzed in accordance with EPA Contract Laboratory Program protocols for cyanide and in accordance with SW-846 protocols for the following metals:

Aluminum	Chromium	Mercury	Sodium
Barium	Copper	Potassium	Zinc
Calcium	Iron	Nickel	
Cadmium	Lead	Silver	

The data was validated in accordance with quality control criteria established in the noted analytical methods. A copy of the checklist used to record the specific observances has been provided for your information as an attachment to this report.

The following samples were included in this data package:

ST1-SD2	ST2-SD2	ST4-SD2	ST6-SD2	Equipment
ST1-SD2A	ST2-SW2	ST4-SW2	ST6-SW2	Blank #5
ST1-SW2	ST2-SW2 F	ST4-SW2 F	ST6-SW2 F	
ST1-SW2 F	ST3-SD2	ST5-SD2	ST7-SD2	
ST1-SW2A	ST3-SW2	ST5-SW2	ST7-SW2	
ST1-SW2A F	ST3-SW2 F	ST5-SW2 F	ST7-SW2 F	

Overall Data Assessment: The overall laboratory performance met quality control criteria with the following exceptions:

1. Cyanide detection limits should be considered estimated in sediment samples and the potential for false negatives should be noted. Results for unfiltered surface water samples should be rejected due to the extended holding time.

2. Assessment of quality control blank sample indicated that several analytes were determined in the blank at concentration greater than the instrument detection limit (IDL). Sample results less than five time the largest amount of contamination found in any blank associated with the sample should be treated as though the material was not detected above the sample detection limit. The analytes and the associated samples are provided below.

Analyte	Samples		
Aluminum	ST1-SW2 F	ST2-SW1 F	ST7-SW2 F
	ST3-SW2 F	ST5-SW2 F	
	ST4-SW2 F	ST6-SW2 F	
Lead	ST1-SW2	ST4-SW2	
	ST1-SW2A	ST5-SW2	
	ST2-SW2	ST7-SW2	
Zinc	ST1-SW2	ST1-SW2 F	ST3-SW2
	ST1-SW2A	ST3-SW2 F	ST6-SW2
	ST1-SW2A F	ST4-SW2	ST6-SW2 F
	ST2-SW2	ST4-SW2 F	ST7-SW2
	ST2-SW2 F	ST5-SW2	ST7-SW2 F
	ST5-SW2 F		
Sodium	ST3-SD2		
	ST7-SD2		
Potassium	ST1-SD2A		
	ST3-SD2		
	ST5-SD2		

3. Results for aluminum and iron should be approximated in all sediment samples due to low bias associated with the matrix spike.

4. The assessment of laboratory precision indicated problems with the reproducibility of sample results associated with aluminum, barium, chromium, potassium, sodium, and zinc in sediment sample and potassium and zinc results in surface water samples. Results should be approximated in the respective matrix.

5. Zinc results in sediment samples and barium results in surface water samples potential chemical or physical interferences associated with ICP analysis.

The following criteria were reviewed during the data validation:

1. **Holding Times:** All criteria were met with the exception of cyanide which was analyzed after the recommended holding time. Detection limits for cyanide in sediment samples should be considered estimated and results in surface water samples should be rejected.

2. **Initial and Continuing Calibration Verification:** All criteria were met.

3. **Blank Analysis:** The following blank contamination and potentially affected samples are summarized below:

Blank	Contaminant	Concentration (ug/l)	Samples
[1]CCB1	Calcium	7.4	ST1-SD2
	Chromium	6.4	ST1-SD2A
	Potassium	1192	ST2-SD2
			ST3-SD2
			ST4-SD2
			ST5-SD2
			ST6-SD2
CCB3	Chromium	6.6	Sediment Potassium 1281
	Sodium	33.8	
[2]PBW	Aluminum	12.1	Surface Water
	Barium	2.9	
	Calcium	15.1	
	Iron	12.6	
	Lead	4.4	
	Zinc	31.6	
[3]PBS	Calcium	29.0	Sediment
	Iron	9.6	
	Sodium	61.3	
	Zinc	10.6	
[4]RB5	Barium	2.9	All Samples
	Calcium	22.6	
	Iron	9.9	

[1] Continuing Calibration Blank
[2] Preparation Blank Water
[3] Preparation Blank Soil
[4] Field Blank #5

Action:

Surface Water: The following analytes were detected in the noted samples at concentration less than five times the contamination level detected in the highest associated blank:

Analyte	Samples
Aluminum	ST1-SW2 F ST2-SW1 FST7-SW2 F ST3-SW2 FST5-SW2 F ST4-SW2 FST6-SW2 F
Lead	ST1-SW2ST4-SW2 ST1-SW2AST5-SW2 ST2-SW2ST7-SW2
Zinc	ST1-SW2AST3-SW2 FST6-SW2 ST1-SW2A FST4-SW2 ST6-SW2 F ST2-SW2ST4-SW2 FST7-SW2 ST2-SW2 FST5-SW2ST7-SW2 F ST3-SW2ST5-SW2 F

Sediment Samples: The following samples and analytes were detected at concentration less than five times the contamination level in the blank sample:

Analyte	Samples
Sodium	ST3-SD2 ST7-SD2
Potassium	ST1-SD2A ST3-SD2 ST5-SD2

4. **ICP Interference Check Sample:** All criteria were met.

5. **Matrix Spike Sample Analysis:** All criteria were met for the surface water samples. Aluminum and iron should be approximated in all sediment samples due low bias.

6. **Laboratory Precision Evaluation:** Duplicate analysis was performed on samples ST1-SD2A, ST4-SD2, and ST1-SW2A. The criteria were met for ST1-SD2A with the exception of aluminum, barium, chromium, potassium, sodium, and zinc. The reported values for these analytes will be considered estimates in all sediment samples. All criteria were met for ST1-SW2A with the exception of potassium, which should be estimated in all surface water samples. Cyanide was the only matrix spike analyzed in sample ST4-SD2 and all criteria were met.

7. **Field Precision Evaluation:** ST1-SD2/ST1-SD2A and ST1-SW2/ST1-SW2A were the duplicate samples collected for this sampling event. Due to the high variance in sample result concentration, the following analyte results should be considered estimates in all sediment samples: aluminum, calcium, chromium, iron, potassium, sodium, and zinc. All criteria were met

for ST2-SD1. All criteria were met for the surface water samples with the exception of potassium and zinc. Results for these analytes should be estimated for all surface water samples.

8. **Laboratory Control Sample:** Metals were analyzed by SW-846 methods which do not specify the evaluation of laboratory control samples. Since cyanide was processed using contract laboratory program (CLP) protocols the results should have been evaluated, but the necessary information was not included in the data package.

9. **Standard Additions/Furnace Atomic Absorption Analysis:** All criteria were met.

10. **Serial Dilution Results:** All criteria were met with the exception of zinc in sediment samples and barium in surface water samples. Results for these analytes will be estimated in the respective matrix.

ICF KAISER ENGINEERS

ICF KAISER ENGINEERS, INC.
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703/934-3300

TO: Claudia Brand

FROM: Davida Parker Trumbo

DATE: July 10, 1990

SUBJECT: Arrowhead Plating Site, Data Validation, 16 Water and 8 Soil Samples for Inorganic Analysis, Versar Inc., Control No. 2440

A data validation was performed on the inorganic analytical data from 16 water and 8 soil samples collected at the Arrowhead Plating Site as part of the remedial investigation/feasibility study. The samples were analyzed in accordance with EPA Contract Laboratory Program protocols for cyanide and in accordance with SW-846 protocols for the following metals:

Aluminum	Chromium	Mercury	Sodium
Barium	Copper	Potassium	Zinc
Calcium	Iron	Nickel	
Cadmium	Lead	Silver	

Surface water samples were analyzed for dissolved and total metals.

The data was validated in accordance with quality control criteria established in the noted analytical methods. A copy of the checklist used to record the specific observances has been provided for your information as an attachment to this report.

The following samples were included in this data package:

ST1-SD1	ST2-SW1A	ST4-SW1	ST6-SW1
ST1-SW1	ST2-SW1A F	ST4-SW1 F	ST6-SW1 F
ST2-SD1	ST3-SD1	ST5-SD1	ST7-SD1
ST2-SD1A	ST3-SW1	ST5-SW1	ST7-SW1
ST2-SW1	ST3-SW1 F	ST5-SW1 F	ST7-SW1 F
ST2-SW1 F	ST4-SD1	ST6-SD1	Equipment Blank 2

Overall Data Assessment: The overall laboratory performance met quality control criteria with the following exceptions:

1. Detection limits for cyanide in unfiltered surface water and sediment samples should be estimated due to the extended holding times associated with the samples.

2. Assessment of quality control blank samples indicated that several analytes were determined in blanks at concentrations greater than the instrument detection limit (IDL). Sample results less than five time the largest amount of contamination found in any blank associated with the sample should be treated as though the analyte was not detected above the sample detection limit. The analytes and the associated impacted samples are provided below.

Analyte	Samples		
Aluminum	ST1-SW1	ST2-SW1 F	ST2-SW1 F
	ST3-SW1 F	ST4-SW1 F	ST1-SW5 F
	ST6-SW1 F	ST7-SW1 F	
Barium	ST1-SW1		
Calcium	ST3-SD1		
Sodium	ST3-SD1		
Zinc	ST1-SW1	ST2-SW1	ST2-SW1 F
	ST2-SW1A	ST2-SW1 F	ST3-SW1
	ST3-SW1 F	ST4-SW1	ST5-SW1
	ST5-SW1 F	ST6-SW1	ST6-SW1 F
	ST7-SW1	ST7-SW1 F	ST2-SD1A
	ST3-SD1	ST5-SD1	

3. Sediment sample results for potassium have the tendency to be biased low and should be considered the minimum concentration present due to low percent recoveries associated with the matrix spike.

4. The assessment of laboratory precision indicated problems with the reproducibility of sample results associated with aluminum, potassium, and zinc in surface water and copper and iron in sediment samples. Sample results for these analytes in the associated matrices should be treated as estimated values.

5. Surface water sample results for zinc have the potential for being biased and should be considered estimated due to poor precision associated with the field duplicate.

6. Potential chemical or physical intereference could not be evaluated for this data set.

The following criteria were reviewed during the data validation:

1. **Holding Times:** All criteria were met with the exception of cyanide which was analyzed after the recommended holding time. Results for cyanide should be considered estimated.

2. **Initial and Continuing Calibration Verification:** All criteria were met.

3. **Blank Analysis:** The following blank contamination and potentially affected samples are summarized below:

Blank	Contaminant	Concentration (ug/l)	Samples	
[1]ICB1	Sodium	67.4	All	
[2]CCB2	Barium	3.5	ST1-SW1	ST5-SW1
	Sodium	77.4	ST2-SW1 F	ST5-SW1 F
			ST2-SW1A F	ST6-SW1
			ST3-SW1 F	ST7-SW1
			ST4-SW1	
[3]PBW	Aluminum	46.2	Surface Water	
	Barium	3.5		
	Calcium	119		
	Sodium	311		
	Zinc	21.3		
[4]PBS	Aluminum	45.0	Sediment	
	Calcium	198		
	Sodium	45.3		
	Zinc	10.6		

[1] Initial Calibration Blank
[2] Continuing Calibration Blank
[3] Preparation Blank Water
[4] Preparation Blank Soil

Action:

Surface Water: The following analytes were detected in the noted samples at concentration less than five times the contamination level detected in the highest associated blank:

Analyte	Samples		
Aluminum	ST1-SW1	ST2-SW1 F	ST2-SW1 F
	ST3-SW1 F	ST4-SW1 F	ST1-SW5 F
	ST6-SW1 F	ST7-SW1 F	

Barium	ST1-SW1		
Zinc	ST1-SW1	ST2-SW1	ST2-SW1 F
	ST2-SW1A	ST2-SW1 F	ST3-SW1
	ST3-SW1 F	ST4-SW1	ST5-SW1
	ST5-SW1 F	ST6-SW1	ST6-SW1 F
	ST7-SW1	ST7-SW1 F	

Sediment Samples: The following samples and analytes were detected at concentration less than five times the contamination level in the blank sample:

Analyte	Samples		
Calcium	ST3-SD1		
Sodium	ST3-SD1		
Zinc	ST2-SD1A	ST3-SD1	ST5-SD1

4. **ICP Interference Check Sample:** All criteria were met.

5. **Matrix Spike Sample Analysis:** Samples ST4-SW1 and ST1-SD1 were evaluated to determine laboratory performance on spiked samples. All criteria were met for sample ST4-SW1. All criteria were met for ST1-SD1 with the exception of potassium which had a percent recovery of 65%. Results for this analyte may be biased low.

6. **Laboratory Precision Evaluation:** Duplicate analysis was performed on samples ST1-SD1, ST1-SW1D, and ST1-SW1. All criteria were met for ST1-SW1D. All criteria were met for ST1-SD1 with the exception of copper and iron. These analytes will be considered estimated values. All criteria were met for sample ST1-SW1 with the exception of aluminum, potassium, and zinc. These analytes values should be treated as estimated concentrations in all surface water samples.

7. **Field Precision Evaluation:** ST2-SD1/ST2-SD1A and ST2-SW1/ST2-SW1A were the duplicate samples collected for this sampling event. All criteria were met for ST2-SD1. ST1-SW1 results were in control with the exception of zinc. Zinc results should be considered estimated for surface water samples.

8. **Laboratory Control Sample:** Metals were analyzed by SW-846 methods which do not specify the evaluation of laboratory control samples. Since cyanide was processed using contract laboratory program (CLP) protocols the results should have been evaluated, but the necessary information was not included in the data package.

9. **Standard Additions/Furnace Atomic Absorption Analysis:** All criteria were met.

10. **Serial Dilution Results:** Although this information would normally be evaluated, the necessary information was not included in this package.

ICF KAISER ENGINEERS

ICF KAISER ENGINEERS INC
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703.934-3300

TO: Claudia Brand

FROM: Davida Parker Trumbo

DATE: January 3, 1991

SUBJECT: Arrowhead Plating Site, Data Validation, Twenty-nine (29) Soil and Eight (8) Water Samples for Cyanide Analysis, Versar Laboratories Inc., Control Number 3913.

A data validation was performed on the analytical data acquired for cyanide from (8) water and (29) soil samples collected at the Arrowhead Plating Site as part of the remedial investigation/feasibility study. The samples were analyzed for total cyanide in accordance with the modified CLP version of method 335.2 from *Methods for the Chemical Analysis of Water and Waste*, 1983.

The data was validated in accordance with quality control criteria established in the noted analytical method. A copy of the checklist used to record the specific observances has been provided for your information as an attachment to this report.

The following samples were included in this data package:

SS-1	SS-8	SS-15	SEW2-SD1	ST5-SD3	SEW1-SW1
SS-2	SS-9	SS-16	SEW3-SD1	ST1-SW3	SEW2-SW1
SS-3	SS-10	SS-17	ST1-SD3	ST1-SW3A	
SS-4	SS-11	SS-18	ST1-SD3A	ST2-SW3	
SS-5	SS-12	SS-19	ST2-SD3	ST3-SW3	
SS-6	SS-13	SS-20	ST3-SD3	ST4-SW3	
SS-7	SS-14	SEW1-SD1	ST4-SD3	ST5-SW3	

Overall Assessment of Data: The overall laboratory performance met quality control criteria and were compliant with the requisite specifications with the exception of the distilled matrix spike for sample SEW1-SD1. The detection limits for sediment samples should be qualified as being low biased.

The following criteria were reviewed during the data validation:

1. **Holding Times:** All criteria were met.

2. **Initial and Continuing Calibration Verification:** All criteria were met.

3. **Blank Analysis:** All criteria were met.

4. **Matrix Spike Sample Analysis:** All criteria were met with the exception of SEW1-SD1, which had a recovery of 65%. The detection limit has the potential for being biased low in the sediment samples.

5. **Laboratory Precision Evaluation:** Duplicate analysis was performed on samples ST4-SW3, SEW1-SD1, and SS-19. All sample results were reported below the detection limit.

6. **Field Precision Evaluation:** Duplicate samples were collected for samples ST1-SD3 and ST1-SW3. The sample results were reported below the detection limit.

7. **Laboratory Control Sample:** All criteria were met.

SEDIMENTS

ARROWHEAD PLATING SITE
VOLATILE ORGANICS ANALYSIS DATA FOR SEDIMENTS (Round 1)
in units of ug/kg

Sample ID	1,2-Dichloroethene	Trichloroethene	Tetrachloroethene	Acetone	2-Butanone	Comments
	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	
ST1-SD1	6 (c)	7 (b)	18	15.0 U	15.0 U	
ST2-SD1	7.0 U	7.0 U	7.0 U	9 (c,e)	14.0 U	
ST2-SD1A	7.0 U	7.0 U	7.0 U	14.0 U	14.0 U	
ST3-SD1	7.0 U	7.0 U	7.0 U	13.0 U	13.0 U	
ST4-SD1	8.0 U	8.0 U	8.0 U	20 (e)	16.0 U	
ST5-SD1	7.0 U	7.0 U	7.0 U	56 (e,h)	14.0 U	Note A
ST6-SD1	9.0 U	9.0 U	9.0 U	120 (e)	21	
ST7-SD1	7.0 U	7.0 U	7.0 U	15.0 U	15.0 U	

U indicates the compound was not detected above the limit indicated.
(b)=The compound is tentatively identified.
(c)=The compound is tentatively identified and quantitated at less than the method detection limit.
(e)=Due to the substantial deviation in the response for the daily calibration, this value is considered estimated.
(h)=Due to a substantial deviation in the internal standard area, this value is considered estimated.

Note A: Due to a substantial deviation for all internal standard areas, the method detection limit is considered estimated for all target compounds.

01/25/91

ARROWHEAD PLATING SITE
VOLATILE ORGANICS DATA FOR SEDIMENTS (Round 2)
in units of ug/kg.

Sample ID	Acetone
ST1-SD2	13.0 U
ST1-SD2A	12.0 U
ST2-SD2	14.0 U
ST3-SD2	13.0 U
ST4-SD2	[18]
ST5-SD2	[7](c)
ST6-SD2	[32]
ST7-SD2	[13]

U indicates the compound was not detected above the limit indicated.
[ ]=This detected concentration is considered non-detected because it is within ten times the concentration detected in the trip blank.
(c)=The compound is tentatively identified and quantitated at less than the method detection limit.

01/25/91

ARROWHEAD PLATING SIT
VOLATILE ORGANICS DATA FOR SEDIMENTS (Round 3)
in units of ug/Kg

Sample ID	Acetone	1,1-Dichloro-ethene	1,2-Dichloro-ethene	1,1,1-Trichloro-ethane	Trichloro-ethene	Tetrachloro-ethene	Methylene Chloride	Benzene	Styrene	Comment
Federal Standards ug/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	
MF-SD1	(7)	2(c)	37	20	160	120	(23)	3(c)	3(c)	Note A
SF-SD1	(6)	13	7U	14	1,400	48	(40)	4(c)	7U	Note A

NA=Not Available
DL=Dilution
RE=Reextraction
U=Indicates the compound was not detected above the limit indicated.
( )=This detected concentration is considered non-detected because it is within ten times the concentration detected in the reagent blank.
[ ]=This detected concentration is considered non-detected because it is within ten times the concentration detected in the field blank.
(a)=The quantitated value exceeds the range of calibration; therefore, this value should be considered estimated.
(b)=The compound is tentatively identified.
(c)=The compound is tentatively identified and quantitated at less than the method detection limit.
(d)=Mass spectral data suggests the presence of this compound, but due to the dilution the compound cannot be confirmed.
(e)=Due to a substantial deviation in the response for the daily calibration, this value is considered estimated.
(f)=40 CFR, Part 141-National Primary Drinking Water Regulation. pp526-533, 585-587
(g)=Proposed
(h)=Suggested No Adverse Response Levels (SNARLS)
(j)=Analysis of sample outside holding time; this value should be considered estimated.
(k)=Due to a noncompliant surrogate, this value should be considered estimated.

Note A: Quantitated values are from both low-level and mid-level analyses.

ARROWHEAD PLATING SITE
SEMIVOLATILE ORGANICS DATA FOR SEDIMENTS (Round 1)
in units of ug/kg

Sample ID	Benzoic Acid	Bis(2-ethylhexyl)phthalate	Number of Tentatively Idenified Compounds	Tentative Identification	Comments
ST1-SD1	2,400 U	500 U	6	Unknown Ketones; Unknown Organic Acid; Unknowns	
ST2-SD1	2,300 U	470 U	12	Unknown Ketones, Hydrocarbons, and Alcohols; Unknowns	
ST2-SD1A	2,300 U	470 U	8	Unknown Ketones, Hydrocarbons, and Alcohols; Hexanedioic Acid	
ST3-SD1	2,100 U	440 U	3	Ketones and Unknowns	
ST4-SD1	2,500 U	520 U	13	Ketones and Unknown Hydrocarbons	
ST5-SD1	730(c)	640	23	Ketones; Tetrahydronapththalene; Substituted Napthalenes; Unknowns	
ST6-SD1	2,800 U	590 U	17	Hexadecanoic Acid; Unknown Hydrocarbon; Unknowns	Note A
ST7-SD1	500(c)	190(c)	23	Ketones; Organic Acids; Hydrocarbons; Unknowns	

U indicates the compound was not detected above the limit indicated.
(c)=The compound is tentatively identified and quantitated at less than the method detection limit.

Note A: Due to a sustantial deviation for the first and second internal standards areas, the method detection limit is considered estimated for the following compounds: 2-Chlorophenol, Phenol, Bis(2-chloroethyl)ether, 1,3-Dichlorobenzene, 1,4-Dichlorobenzene, 1,2-Dichlorobenzene, Benzyl Alcohol, Bis(2-chloroisopropylether), 2-Methylphenol, Hexachloroethane, 4-Methylphenol, n-Nitroso-di-n-propylamine, Nitrobenzene, Isophorone, 2-Nitrophenol, 2,4-Dimethylphenol, Bis(2-chloroethoxy)methane, 2,4-Dichlorophenol, 1,2,4-Trichlorobenzene, Naphthalene, Benzoic Acid, 4-Chloroaniline, Hexachlorobutadiene, 4-Chloro-3-methylphenol, and 2-Methylnaphthalene

01/25/91

ARROWHEAD PLATING SITE
SEMIVOLATILE ORGANICS DATA FOR SEDIMENTS (Round 2)
in units of ug/kg

Sample ID	Target Compound List Detected	Number of Tentatively Idenified Compounds	Tentative Identification
ST1-SD2	ND	8	Unknown Ketones; Unknown Hydrocarbons
ST1-SD2A	ND	7	Unknown Ketones; Unknown Hydrocarbons
ST2-SD2	ND	4	Unknown Ketones; Unknowns
ST3-SD2	ND	6	Molecular Sulfur; Unknown Ketones; Unknowns
ST4-SD2	ND	3	Molecular Sulfur; Unknown Ketones; Unknowns
ST5-SD2	ND	10	Molecular Sulfur; Unknown Hydrocarbons; Unknowns
ST6-SD2	ND	11	Molecular Sulfur; Unknown Hydrocarbons; Unknowns
ST7-SD2	ND	9	Molecular Sulfur; Tetrahydronaphthalene; Unknown Hydrocarbons; Unknowns

ND=No target compounds were detected.

01/25/91

ARROWHEAD PLATING SITE
INORGANIC DATA FOR SEDIMENT SAMPLES
ROUND I

Sample ID	Aluminum %	Barium mg/kg	Cadmium mg/kg	Calcium mg/kg	Chromium mg/kg	Copper mg/kg	Iron %	Lead mg/kg	Mercury mg/kg	Nickel mg/kg	Potassium mg/kg	Silver mg/kg	Sodium mg/kg	Zinc mg/kg	Cyanide mg/kg
ST1-SD1	0.21	14.1	0.59	909	7.5	4.4(a)	0.94(a)	3.0 U	0.11 U	6.4	1,090(b)	0.79	193	23.1(c)	0.63 U(d)
ST2-SD1	0.16	23.0	0.63	583	5.2	2.5(a)	1.29(a)	3.2 U	0.13 U	2.5 U	716(b)	0.87	91.4	15.6(c)	0.63 U(d)
ST2-SD1A	0.16	17.8	0.51	690	7.0	2.5(a)	0.35(a)	2.9 U	0.12 U	2.3 U	948(b)	0.50	109	10.7(c)	0.56 U
ST3-SD1	0.05	4.5	0.53	98.0	3.4	1.8(a)	0.29(a)	2.9 U	0.10 U	2.3 U	320(b)	0.38 U	26.4	6.2(c)	0.52 U(d)
ST4-SD1	0.72	37.5	0.52	274	16.3	4.4(a)	0.13(a)	5.5	0.13 U	2.6 U	1,010(b)	0.71	68.4	18.6(c)	0.64 U(d)
ST5-SD1	0.44	32.0	0.26 U	267	7.4	2.5(a)	0.78(a)	3.0 U	0.12 U	2.3 U	366(b)	0.44	51.9	11.3(c)	0.64 U(d)
ST6-SD1	1.21	92.2	0.98	622	14.5	7.2(a)	3.98(a)	8.5	0.17 U	6.5	711(b)	1.5	69.9	31.3(c)	0.70 U(d)
ST7-SD1	0.55	48.4	0.25 U	360	8.9	2.4(a)	0.63(a)	3.3	0.12 U	3.6	412(b)	0.42	31.7	14.9(c)	0.43 U(d)

U - Not detected above the limit indicated.
(a) - Estimate value due to low bias associated with precision problems.
(b) - Estimate value due to low bias associated with matrix spike assessment.
(c) - Field duplicate result deviated by greater than 20% indicating precision problems.
(d) - Detection limit should be estimated due to extended holding time.

01/25/91

ARROWHEAD PLATING SITE
INORGANIC DATA FOR SEDIMENT SAMPLES
ROUND II

Sample ID	Aluminum mg/kg	Barium mg/kg	Cadmium mg/kg	Calcium mg/kg	Chromium mg/kg	Copper mg/kg	Iron mg/kg	Lead mg/kg	Mercury mg/kg	Nickel mg/kg	Potassium mg/kg	Silver mg/kg	Sodium mg/kg	Zinc mg/kg	Cyanide mg/kg
ST1-SD2	0.26(b,c)	13.2(c)	0.65 U	693	9.1(c)	2.4	10,200(b)	3.7	0.11 U	5.2	854(c)	0.26 U	140	20.4(c,d)	0.30 U(e)
ST1-SD2A	0.34(b,c)	10.9(c)	0.60 U	222	5.7(c)	2.1	7,710(b)	3.2	0.12 U	1.8	303(c)	0.24 U	77.2	9.7(c,d)	0.30 U(e)
ST2-SD2	0.19(b,c)	38.0(c)	0.71 U	638	7.0(c)	1.9	4,920(b)	5.4	0.12 U	1.4 U	1,030(c)	0.28 U	129	6.8(c,d)	0.33 U(e)
ST3-SD2	0.10(b,c)	7.0(c)	0.62 U	103	4.1(c)	1.3	3,770(b)	2.0	0.12 U	1.2 U	213(c)	0.25 U	18.7	6.3(c,d)	0.30 U(e)
ST4-SD2	1.32(b,c)	78.6(c)	0.68 U	194	30.9(c)	6.2	22,800(b)	9.2	0.14 U	3.8	2,120(c)	0.27 U	61.9	21.4(c,d)	0.32 U(e)
ST5-SD2	0.57(b,c)	37.0(c)	0.59 U	225	8.2(c)	2.0	9,240(b)	4.1	0.12 U	4.0	432(c)	0.24 U	42.4	11.6(c,d)	0.32 U(e)
ST6-SD2	1.97(b,c)	118(c)	0.58 U	325	19.9(c)	6.9	19,200(b)	6.6	0.14 U	11.9	1,040(c)	0.23 U	71.2	37.7(c,d)	0.35 U(e)
ST7-SD2	0.53(b,c)	63.5(c)	0.57 U	346	14.0(c)	2.2	6,520(b)	4.6	0.12 U	3.2	731(c)	0.23 U	29.9	20.3(c,d)	0.29 U(e)

LEGEND:

U - Not detected above limit indicated.
(b) - Estimate value due to low bias associated with matrix spike assessment.
(c) - Estimate value due to laboratory precision problems.
(d) - Estimate value due to potential chemical or physical interferences.
(e) - Estimate detection limits due to extended holding times.

01/25/91

ICF KAISER ENGINEERS

TO: Claudia Brand

FROM: Davida Parker Trumbo

DATE: January 3, 1991

ICF KAISER ENGINEERS, INC
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703/934-3300

SUBJECT: Arrowhead Plating Site, Data Validation, Twenty-nine (29) Soil and Eight (8) Water Samples for Cyanide Analysis, Versar Laboratories Inc., Control Number 3913.

A data validation was performed on the analytical data acquired for cyanide from (8) water and (29) soil samples collected at the Arrowhead Plating Site as part of the remedial investigation/feasibility study. The samples were analyzed for total cyanide in accordance with the modified CLP version of method 335.2 from *Methods for the Chemical Analysis of Water and Waste*, 1983.

The data was validated in accordance with quality control criteria established in the noted analytical method. A copy of the checklist used to record the specific observances has been provided for your information as an attachment to this report.

The following samples were included in this data package:

SS-1	SS-8	SS-15	SEW2-SD1	ST5-SD3	SEW1-SW1
SS-2	SS-9	SS-16	SEW3-SD1	ST1-SW3	SEW2-SW1
SS-3	SS-10	SS-17	ST1-SD3	ST1-SW3A	
SS-4	SS-11	SS-18	ST1-SD3A	ST2-SW3	
SS-5	SS-12	SS-19	ST2-SD3	ST3-SW3	
SS-6	SS-13	SS-20	ST3-SD3	ST4-SW3	
SS-7	SS-14	SEW1-SD1	ST4-SD3	ST5-SW3	

Overall Assessment of Data: The overall laboratory performance met quality control criteria and were compliant with the requisite specifications with the exception of the distilled matrix spike for sample SEW1-SD1. The detection limits for sediment samples should be qualified as being low biased.

The following criteria were reviewed during the data validation:

1. **Holding Times:** All criteria were met.

2. **Initial and Continuing Calibration Verification:** All criteria were met.

3. **Blank Analysis:** All criteria were met.

4. **Matrix Spike Sample Analysis:** All criteria were met with the exception of SEW1-SD1, which had a recovery of 65%. The detection limit has the potential for being biased low in the sediment samples.

5. **Laboratory Precision Evaluation:** Duplicate analysis was performed on samples ST4-SW3, SEW1-SD1, and SS-19. All sample results were reported below the detection limit.

6. **Field Precision Evaluation:** Duplicate samples were collected for samples ST1-SD3 and ST1-SW3. The sample results were reported below the detection limit.

7. **Laboratory Control Sample:** All criteria were met.

ICF KAISER ENGINEERS

ICF KAISER ENGINEERS, INC.
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703/934-3300

TO: Claudia Brand

FROM: Davida Parker Trumbo

DATE: July 11, 1990

SUBJECT: Arrowhead Plating Site, Data Validation, 8 Sediment and 17 Water Samples for Inorganic Analysis, Versar Inc., Control No. 2800

A data validation was performed on the inorganic analytical data from 16 water and 8 soil samples collected at the Arrowhead Plating Site as part of the remedial investigation/feasibility study. The samples were analyzed in accordance with EPA Contract Laboratory Program protocols for cyanide and in accordance with SW-846 protocols for the following metals:

Aluminum	Chromium	Mercury	Sodium
Barium	Copper	Potassium	Zinc
Calcium	Iron	Nickel	
Cadmium	Lead	Silver	

The data was validated in accordance with quality control criteria established in the noted analytical methods. A copy of the checklist used to record the specific observances has been provided for your information as an attachment to this report.

The following samples were included in this data package:

ST1-SD2	ST2-SD2	ST4-SD2	ST6-SD2	Equipment
ST1-SD2A	ST2-SW2	ST4-SW2	ST6-SW2	Blank #5
ST1-SW2	ST2-SW2 F	ST4-SW2 F	ST6-SW2 F	
ST1-SW2 F	ST3-SD2	ST5-SD2	ST7-SD2	
ST1-SW2A	ST3-SW2	ST5-SW2	ST7-SW2	
ST1-SW2A F	ST3-SW2 F	ST5-SW2 F	ST7-SW2 F	

Overall Data Assessment: The overall laboratory performance met quality control criteria with the following exceptions:

1. Cyanide detection limits should be considered estimated in sediment samples and the potential for false negatives should be noted. Results for unfiltered surface water samples should be rejected due to the extended holding time.

2. Assessment of quality control blank sample indicated that several analytes were determined in the blank at concentration greater than the instrument detection limit (IDL). Sample results less than five time the largest amount of contamination found in any blank associated with the sample should be treated as though the material was not detected above the sample detection limit. The analytes and the associated samples are provided below.

Analyte	Samples		
Aluminum	ST1-SW2 F	ST2-SW1 F	ST7-SW2 F
	ST3-SW2 F	ST5-SW2 F	
	ST4-SW2 F	ST6-SW2 F	
Lead	ST1-SW2	ST4-SW2	
	ST1-SW2A	ST5-SW2	
	ST2-SW2	ST7-SW2	
Zinc	ST1-SW2	ST1-SW2 F	ST3-SW2
	ST1-SW2A	ST3-SW2 F	ST6-SW2
	ST1-SW2A F	ST4-SW2	ST6-SW2 F
	ST2-SW2	ST4-SW2 F	ST7-SW2
	ST2-SW2 F	ST5-SW2	ST7-SW2 F
	ST5-SW2 F		
Sodium	ST3-SD2		
	ST7-SD2		
Potassium	ST1-SD2A		
	ST3-SD2		
	ST5-SD2		

3. Results for aluminum and iron should be approximated in all sediment samples due to low bias associated with the matrix spike.

4. The assessment of laboratory precision indicated problems with the reproducibility of sample results associated with aluminum, barium, chromium, potassium, sodium, and zinc in sediment sample and potassium and zinc results in surface water samples. Results should be approximated in the respective matrix.

5. Zinc results in sediment samples and barium results in surface water samples potential chemical or physical interferences associated with ICP analysis.

The following criteria were reviewed during the data validation:

1. **Holding Times:** All criteria were met with the exception of cyanide which was analyzed after the recommended holding time. Detection limits for cyanide in sediment samples should be considered estimated and results in surface water samples should be rejected.

2. **Initial and Continuing Calibration Verification:** All criteria were met.

3. **Blank Analysis:** The following blank contamination and potentially affected samples are summarized below:

Blank	Contaminant	Concentration (ug/l)	Samples
[1]CCB1	Calcium	7.4	ST1-SD2
	Chromium	6.4	ST1-SD2A
	Potassium	1192	ST2-SD2
			ST3-SD2
			ST4-SD2
			ST5-SD2
			ST6-SD2
CCB3	Chromium	6.6	Sediment Potassium 1281
	Sodium	33.8	
[2]PBW	Aluminum	12.1	Surface Water
	Barium	2.9	
	Calcium	15.1	
	Iron	12.6	
	Lead	4.4	
	Zinc	31.6	
[3]PBS	Calcium	29.0	Sediment
	Iron	9.6	
	Sodium	61.3	
	Zinc	10.6	
[4]RB5	Barium	2.9	All Samples
	Calcium	22.6	
	Iron	9.9	

[1] Continuing Calibration Blank
[2] Preparation Blank Water
[3] Preparation Blank Soil
[4] Field Blank #5

Action:

Surface Water: The following analytes were detected in the noted samples at concentration less than five times the contamination level detected in the highest associated blank:

Analyte	Samples	
Aluminum	ST1-SW2 F	ST2-SW1 FST7-SW2 F ST3-SW2 FST5-SW2 F ST4-SW2 FST6-SW2 F
Lead		ST1-SW2ST4-SW2 ST1-SW2AST5-SW2 ST2-SW2ST7-SW2
Zinc		ST1-SW2AST3-SW2 FST6-SW2 ST1-SW2A FST4-SW2 ST6-SW2 F ST2-SW2ST4-SW2 FST7-SW2 ST2-SW2 FST5-SW2ST7-SW2 F ST3-SW2ST5-SW2 F

Sediment Samples: The following samples and analytes were detected at concentration less than five times the contamination level in the blank sample:

Analyte	Samples	
Sodium	ST3-SD2	ST7-SD2
Potassium	ST1-SD2A	ST3-SD2 ST5-SD2

4. **ICP Interference Check Sample:** All criteria were met.

5. **Matrix Spike Sample Analysis:** All criteria were met for the surface water samples. Aluminum and iron should be approximated in all sediment samples due low bias.

6. **Laboratory Precision Evaluation:** Duplicate analysis was performed on samples ST1-SD2A, ST4-SD2, and ST1-SW2A. The criteria were met for ST1-SD2A with the exception of aluminum, barium, chromium, potassium, sodium, and zinc. The reported values for these analytes will be considered estimates in all sediment samples. All criteria were met for ST1-SW2A with the exception of potassium, which should be estimated in all surface water samples. Cyanide was the only matrix spike analyzed in sample ST4-SD2 and all criteria were met.

7. **Field Precision Evaluation:** ST1-SD2/ST1-SD2A and ST1-SW2/ST1-SW2A were the duplicate samples collected for this sampling event. Due to the high variance in sample result concentration, the following analyte results should be considered estimates in all sediment samples: aluminum, calcium, chromium, iron, potassium, sodium, and zinc. All criteria were met

for ST2-SD1. All criteria were met for the surface water samples with the exception of potassium and zinc. Results for these analytes should be estimated for all surface water samples.

8. **Laboratory Control Sample:** Metals were analyzed by SW-846 methods which do not specify the evaluation of laboratory control samples. Since cyanide was processed using contract laboratory program (CLP) protocols the results should have been evaluated, but the necessary information was not included in the data package.

9. **Standard Additions/Furnace Atomic Absorption Analysis:** All criteria were met.

10. **Serial Dilution Results:** All criteria were met with the exception of zinc in sediment samples and barium in surface water samples. Results for these analytes will be estimated in the respective matrix.

ICF KAISER ENGINEERS

ICF KAISER ENGINEERS, INC.
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703/934-3300

TO: Claudia Brand

FROM: Davida Parker Trumbo

DATE: July 10, 1990

SUBJECT: Arrowhead Plating Site, Data Validation, 16 Water and 8 Soil Samples for Inorganic Analysis, Versar Inc., Control No. 2440

A data validation was performed on the inorganic analytical data from 16 water and 8 soil samples collected at the Arrowhead Plating Site as part of the remedial investigation/feasibility study. The samples were analyzed in accordance with EPA Contract Laboratory Program protocols for cyanide and in accordance with SW-846 protocols for the following metals:

Aluminum	Chromium	Mercury	Sodium
Barium	Copper	Potassium	Zinc
Calcium	Iron	Nickel	
Cadmium	Lead	Silver	

Surface water samples were analyzed for dissolved and total metals.

The data was validated in accordance with quality control criteria established in the noted analytical methods. A copy of the checklist used to record the specific observances has been provided for your information as an attachment to this report.

The following samples were included in this data package:

ST1-SD1	ST2-SW1A	ST4-SW1	ST6-SW1
ST1-SW1	ST2-SW1A F	ST4-SW1 F	ST6-SW1 F
ST2-SD1	ST3-SD1	ST5-SD1	ST7-SD1
ST2-SD1A	ST3-SW1	ST5-SW1	ST7-SW1
ST2-SW1	ST3-SW1 F	ST5-SW1 F	ST7-SW1 F
ST2-SW1 F	ST4-SD1	ST6-SD1	Equipment Blank 2

Overall Data Assessment: The overall laboratory performance met quality control criteria with the following exceptions:

1. Detection limits for cyanide in unfiltered surface water and sediment samples should be estimated due to the extended holding times associated with the samples.

2. Assessment of quality control blank samples indicated that several analytes were determined in blanks at concentrations greater than the instrument detection limit (IDL). Sample results less than five time the largest amount of contamination found in any blank associated with the sample should be treated as though the analyte was not detected above the sample detection limit. The analytes and the associated impacted samples are provided below.

Analyte	Samples		
Aluminum	ST1-SW1	ST2-SW1 F	ST2-SW1 F
	ST3-SW1 F	ST4-SW1 F	ST1-SW5 F
	ST6-SW1 F	ST7-SW1 F	
Barium	ST1-SW1		
Calcium	ST3-SD1		
Sodium	ST3-SD1		
Zinc	ST1-SW1	ST2-SW1	ST2-SW1 F
	ST2-SW1A	ST2-SW1 F	ST3-SW1
	ST3-SW1 F	ST4-SW1	ST5-SW1
	ST5-SW1 F	ST6-SW1	ST6-SW1 F
	ST7-SW1	ST7-SW1 F	ST2-SD1A
	ST3-SD1	ST5-SD1	

3. Sediment sample results for potassium have the tendency to be biased low and should be considered the minimum concentration present due to low percent recoveries associated with the matrix spike.

4. The assessment of laboratory precision indicated problems with the reproducibility of sample results associated with aluminum, potassium, and zinc in surface water and copper and iron in sediment samples. Sample results for these analytes in the associated matrices should be treated as estimated values.

5. Surface water sample results for zinc have the potential for being biased and should be considered estimated due to poor precision associated with the field duplicate.

6. Potential chemical or physical intereference could not be evaluated for this data set.

The following criteria were reviewed during the data validation:

1. **Holding Times:** All criteria were met with the exception of cyanide which was analyzed after the recommended holding time. Results for cyanide should be considered estimated.

2. **Initial and Continuing Calibration Verification:** All criteria were met.

3. **Blank Analysis:** The following blank contamination and potentially affected samples are summarized below:

Blank	Contaminant	Concentration (ug/l)	Samples	
[1]ICB1	Sodium	67.4	All	
[2]CCB2	Barium	3.5	ST1-SW1	ST5-SW1
	Sodium	77.4	ST2-SW1 F	ST5-SW1 F
			ST2-SW1A F	ST6-SW1
			ST3-SW1 F	ST7-SW1
			ST4-SW1	
[3]PBW	Aluminum	46.2	Surface Water	
	Barium	3.5		
	Calcium	119		
	Sodium	311		
	Zinc	21.3		
[4]PBS	Aluminum	45.0	Sediment	
	Calcium	198		
	Sodium	45.3		
	Zinc	10.6		

[1] Initial Calibration Blank
[2] Continuing Calibration Blank
[3] Preparation Blank Water
[4] Preparation Blank Soil

Action:

Surface Water: **The following analytes were detected in the noted samples at concentration less than five times the contamination level detected in the highest associated blank:**

Analyte	Samples		
Aluminum	ST1-SW1	ST2-SW1 F	ST2-SW1 F
	ST3-SW1 F	ST4-SW1 F	ST1-SW5 F
	ST6-SW1 F	ST7-SW1 F	

Barium	ST1-SW1		
Zinc	ST1-SW1	ST2-SW1	ST2-SW1 F
	ST2-SW1A	ST2-SW1 F	ST3-SW1
	ST3-SW1 F	ST4-SW1	ST5-SW1
	ST5-SW1 F	ST6-SW1	ST6-SW1 F
	ST7-SW1	ST7-SW1 F	

Sediment Samples: The following samples and analytes were detected at concentration less than five times the contamination level in the blank sample:

Analyte	Samples		
Calcium	ST3-SD1		
Sodium	ST3-SD1		
Zinc	ST2-SD1A	ST3-SD1	ST5-SD1

4. **ICP Interference Check Sample:** All criteria were met.

5. **Matrix Spike Sample Analysis:** Samples ST4-SW1 and ST1-SD1 were evaluated to determine laboratory performance on spiked samples. All criteria were met for sample ST4-SW1. All criteria were met for ST1-SD1 with the exception of potassium which had a percent recovery of 65%. Results for this analyte may be biased low.

6. **Laboratory Precision Evaluation:** Duplicate analysis was performed on samples ST1-SD1, ST1-SW1D, and ST1-SW1. All criteria were met for ST1-SW1D. All criteria were met for ST1-SD1 with the exception of copper and iron. These analytes will be considered estimated values. All criteria were met for sample ST1-SW1 with the exception of aluminum, potassium, and zinc. These analytes values should be treated as estimated concentrations in all surface water samples.

7. **Field Precision Evaluation:** ST2-SD1/ST2-SD1A and ST2-SW1/ST2-SW1A were the duplicate samples collected for this sampling event. All criteria were met for ST2-SD1. ST1-SW1 results were in control with the exception of zinc. Zinc results should be considered estimated for surface water samples.

8. **Laboratory Control Sample:** Metals were analyzed by SW-846 methods which do not specify the evaluation of laboratory control samples. Since cyanide was processed using contract laboratory program (CLP) protocols the results should have been evaluated, but the necessary information was not included in the data package.

9. **Standard Additions/Furnace Atomic Absorption Analysis:** All criteria were met.

10. **Serial Dilution Results:** Although this information would normally be evaluated, the necessary information was not included in this package.

ICF KAISER ENGINEERS

ICF KAISER ENGINEERS, INC.
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703/934-3300

TO: Claudia Brand

FROM: Jay Kuhn

DATE: July 18, 1990

SUBJECT: Arrowhead Plating Site, Data Validation, 9 Water Samples and 8 Sediment Samples, Semivolatile Organic Analysis, Versar Inc., Virginia.

REFERENCE: Validation 13, Versar Control Number 2763 and 2769, Surface Water, Sediment

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A level I validation was performed on the organic analytical data from 8 water samples and 8 sediment samples collected at the Arrowhead Plating Site as part of the Remedial Investigation/Feasibility Study. The samples were analyzed for EPA Target Compound List (TCL) semivolatile organics by Versar Inc., Springfield, Virginia. Validation was performed in accordance with the EPA Functional Guidelines for Evaluating Organics Analyses (February 1, 1988). A copy of the checklist has been provided as an attachment for your information.

The samples included in the data package are the following.

ST1-SW2	ST5-SW2	ST2-SD2	ST7-SD2
ST1-SW2A	ST6-SW2	ST3-SD2	Field Blank 5
ST2-SW2	ST7-SW2	ST4-SD2	
ST3-SW2	ST1-SD2	ST5-SD2	
ST4-SW2	ST1-SD2A	ST6-SD2	

Overall Assessment of Data for Samples Evaluated:

The detected value of bis(2-ethylhexyl)phthalate should be considered non-detect for the following samples: ST4-SW2, ST5-SW2, ST6-SW2, and ST7-SW2.

The following criteria were reviewed in validating the data:

1. **Holding Time**: All criteria met

2. **GC/MS Tune**: All criteria met.

3. **Calibration**:

Instrument T was used to perform the semivolatile analysis. Calibration results for the instrument is as follows.

Instrument T

Initial: 6/11/90, 1 compound, benzoic acid, has a relative standard deviation (%RSD) > 30%.

Impact on data: No compounds were quantitated from the initial calibration.

Continuing: 6/18/90, 2 compounds, benzoic acid and hexachlorobenzene, have a %D > 25%.

Impact on data: Results for compounds which are quantitated on continuing calibrations with percent deviation (%D) > 25% should be qualified as follows: detected compound values for benzoic acid and hexachlorobenzene should be estimated. The samples potentially impacted are ST1-SW2, ST1-SW2A, ST2-SW2, ST3-SW2, ST4-SW2, and ST5-SW2. These compounds were not detected in any of these samples; therefore, no qualification of the data is warranted.

Continuing: 6/19/90, 6 compounds: benzoic acid, 2-nitroaniline, 4-nitrophenol, 4-bromophenyl-phenylether, hexachlorobenzene, butylbenzylphthalate have a %D > 25%.

Impact on data: Results for compounds which are quantitated on continuing calibrations with percent deviation (%D) > 25% should be qualified as follows: detected compound values should be considered estimated. The samples potentially impacted are ST7-SW2, ST6-SW2, ST1-SD2, ST1-SD2A, ST2-SD2, and ST3-SD2. These compounds were not detected in the samples; therefore, no qualification of the data is warranted.

Continuing: 6/20/90, 9 compounds: n-nitroso-di-n-propylamine, benzoic acid, **2-nitroaniline**, 2,4-dinitrophenol, 4-nitrophenol, 4-bromophenyl-phenyl**ether**, hexachlorobenzene, butyl benzylphthalate, and bis(2-ethyl**hexyl**)phthalate have %D > 25%.

Impact on data: Results for compounds which are quantitated on continuing calibrations with percent deviation (%D) > 25% should be qualified as follows: detected compound values should be considered estimated. The samples potentially impacted are ST4-SD2, ST5-SD2, ST6-SD2, and ST7-SD2. These compounds were not detected in the samples; therefore, no qualification of the data is warranted.

4. **Blanks:**

The intent of blank analysis results are to evaluate the potential of contamination contribution by the sampling and/or analytical process. Both field blanks and laboratory blanks are included in this data package. Bis(2-ethylhexyl)phthalate was detected at 17ug/L in the laboratory blank SBLK86. This results in a 'considered non-detect value' of 170ug/L. The samples potentially impacted are ST1-SW2, ST1-SW2A, ST2-SW2, ST3-SW2, ST4-SW2, ST5-SW2, ST6-SW2, and ST7-SW2

Impact on data: The detected value of bis(2-ethylhexyl)phthalate should be considered non-detect for the following samples: ST4-SW2, ST5-SW2, ST6-SW2, and ST7-SW2.

5. **Surrogate Spike:**

Surrogate recovery windows created from EPA Contract Laboratory Program data base. Sample ST2-SW2 had one surrogate outlier, 2-fluorobiphenyl, with a recovery of 38%.

Impact on data: No qualification of data is warranted with one surrogate outlier.

6. **Matrix Spike/Matrix Spike Duplicate:**

Matrix Spike recovery windows created from EPA Contract Laboratory Program data base. All matrix spike recoveries are compliant. The following Relative Percent Deviations (RPDs) were outliers:

Compound:	RPD:
Phenol	42%
1,4-Dichlorobenzene	47%
n-Nitroso-di-n-propylamine	41%
1,2,4-Trichlorobenzene	41%
4-Chloro-3-methylphenol	50%
Acenaphthene	47%

Impact on data: The sample used for the matrix spike was ST3-SD2. These compounds were not detected in this sample; therefore, no qualification of the data is warranted.

7. **Field Duplicates:** The field duplicate used in the sediment sample is ST1-SD2 and ST1-SD2A. The field duplicate for surface water sample is ST1-SW2 and ST1-SW2A. No target compounds were detected in ether field duplicates.

8. **Internal Standard (IS) Performance:** All criteria met.

9. **TCL Compound Identification:** All criteria met.

10. **Compound Quantitation and Reported Detection Limits:**

Instrument detection limits were not submitted. Quantitation limits were met.

11. **Tentatively Identified Compounds:** All criteria met.

12. **System Performance:** All criteria met.

ICF KAISER ENGINEERS

ICF KAISER ENGINEERS, INC
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031-1207
703/934-3300

TO: Claudia Brand

FROM: Jay Kuhn

DATE: July 18, 1990

SUBJECT: Arrowhead Plating Site, Data Validation, 12 Water Samples and 8 Sediment Samples, Volatile Organic Analysis, Versar Inc., Virginia.

REFERENCE: Validation 12, Versar Control Number 2763 and 2769, Surface Water, Sediment

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A level I validation was performed on the organic analytical data from 8 water samples and 8 sediment samples collected at the Arrowhead Plating Site as part of the Remedial Investigation/Feasibility Study. The samples were analyzed for EPA Target Compound List (TCL) volatile organics by Versar Inc., Springfield, Virginia. Validation was performed in accordance with the EPA Functional Guidelines for Evaluating Organics Analyses (February 1, 1988). A copy of the checklist has been provided as an attachment for your information.

The samples included in the data package are the following.

ST1-SW2	ST5-SW2	ST2-SD2	ST7-SD2
ST1-SW2A	ST6-SW2	ST3-SD2	Field Blank 5
ST2-SW2	ST7-SW2	ST4-SD2	Trip Blank 15
ST3-SW2	ST1-SD2	ST5-SD2	Trip Blank 16
ST4-SW2	ST1-SD2A	ST6-SD2	Trip Blank 17

Overall Assessment of Data for Samples Evaluated:

The following is a summary of this data evaluation:

1. Tetrachloroethene should be qualified as tentatively identified in samples ST1-SW2A and ST2-SW2.

2. The detected values of acetone in ST4-SD2, ST5-SD2, ST6-SD2, and ST7-SD2 should be considered non-detected. The detected value of methylene chloride in ST3-SW2, ST4-SW2, ST5-SW2, ST6-SW2, and ST7-SW2 should be considered non-detected.

The following criteria were reviewed in validating the data:

1. **Holding Time**: All criteria met

2. **GC/MS Tune**: All criteria met.

3. **Calibration**:

Instruments W and U were used to perform the volatile analysis. Calibration results for each instrument are as follows.

Instrument W

Initial: 5/29/90, 1 compound, acetone, has a relative standard deviation (%RSD) > 30%.

Impact on data: No compounds were quantitated from the initial calibration.

Continuing: 5/31/90, 1 compound, acetone, has a %D > 25%.

Impact on data: Results for compounds which are quantitated on continuing calibrations with percent deviation (%D) > 25% should be qualified as follows: detected compound values for acetone should be estimated. The samples potentially impacted are ST3-SW2, ST4-SW2, ST5-SW2, ST6-SW2, and ST7-SW2. Acetone was not detected in any of these samples.

Continuing: 5/31/90, 4 compounds, bromomethane, methylene chloride, 1,1,2-trichloroethane, and 2-hexanone, have a %D > 25%.

Impact on data: Results for compounds which are quantitated on continuing calibrations with percent deviation (%D) > 25% should be qualified as follows: detected compound values for bromomethane, methylene chloride, 1,1,2-trichloroethane, and 2-hexanone should be considered estimated. The samples potentially impacted are ST1-SW2, ST1-SW2A, and ST2-SW2. These compounds were not detected in the samples.

Instrument U

Initial: 5/31/90, meets criteria.

Continuing: 5/31/90, meets criteria.

Continuing: 6/1/90, meets criteria.

4. **Blanks**:

The intent of blank analysis results are to evaluate the potential of contamination contribution by the sampling and/or analytical process. Both field blanks and laboratory blanks are included in this data package. The maximum concentration of contamination found in any of the

field, trip, or laboratory blanks is as follows:

Contamination	Detected Concentration of Contamination	Contamination Considered Non-detect up to Concentration	Blank I.D.
2-Butanone	5 ug/L	50 ug/L	VBLK52
Methylene Chloride	3 ug/L	30 ug/L	Field Blank 5
Acetone	7 ug/L	70 ug/L	Field Blank 5
Methylene Chloride	3 ug/L	30 ug/L	Trip Blank 15
Methylene Chloride	3 ug/L	30 ug/L	Trip Blank 16
Acetone	10 ug/L	100 ug/L	Trip Blank 16
Acetone	10 ug/L	100 ug/L	Trip Blank 17

Impact on data: The detected values of acetone in ST4-SD2, ST5-SD2, ST6-SD2, and ST7-SD2 should be considered non-detected. The detected value of methylene chloride in ST3-SW2, ST4-SW2, ST5-SW2, ST6-SW2, and ST7-SW2 should be considered non-detected.

5. **Surrogate Spike:**

Surrogate recovery windows created from EPA Contract Laboratory Program data base. All surrogate recoveries are compliant.

6. **Matrix Spike/Matrix Spike Duplicate:**

Matrix Spike recovery windows created from EPA Contract Laboratory Program data base. All matrix spike recoveries are compliant. All relative percent deviations (RPDs) are compliant

7. **Field Duplicates:**

The field duplicates are ST1-SW2 and ST1-SW2A for surface water and ST1-SD2 and ST1-SD2A for sediments. The results for surface water duplicates and Relative Percent Deviations (RPDs) are as follows:

Compound Quantitated	ST1-SW2	ST1-SW2A	RPDs
Acetone	8 ug/L	10 ug/L	22%
1,2-Dichloroethene	30 ug/l	24 ug/L	22%
Trichloroethene	38 ug/L	30 ug/L	24%
Tetrachloroethene	41 ug/L	32 ug/L	25%

No compounds were detected for sediment duplicates ST1-SD2 and ST1-SD2A.

Impact on data: The field duplicates reflect good precision. It is in the reviewers judgement that there is no significant impact on the data.

8. **Internal Standard (IS) Performance**: All criteria met.

9. **TCL Compound Identification**:

The criteria that mass ions of the sample spectrum be within 20% of the corresponding standard spectrum was not met for the following detected compounds.

Sample ID:	Target Compound:
ST1-SW2A	Tetrachloroethene
ST2-SW2	Tetrachloroethene

Impact on data: These results will be qualified as tentatively identified.

10. **Compound Quantitation and Reported Detection Limits**:

Instrument detection limits were not submitted. Quantitation limits were met.

11. **Tentatively Identified Compounds**: All criteria met.

12. **System Performance**: All criteria met.