

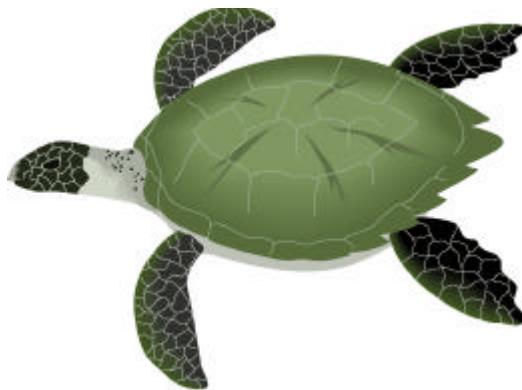


United States Air Force
15th Air Base Wing
Environmental Restoration Program

Waimanalo Stream ITIR

EE/CA for OU1

Bellows Air Force Station Oahu, Hawaii



Attachment A

Analytical Methods and QA/QC Results

Attachment A

Analytical Methods and Quality Assurance/Quality Control Results: Waimanalo Stream

This attachment contains the analytical methods and associated quality assurance/quality control (QA/QC) results for environmental samples collected from Waimanalo Stream as part of the Engineering Evaluation/Cost Analysis (EE/CA) of Operable Unit 1 (OU1) and Waimanalo Stream at Bellows Air Force Station, Hawaii. The table of contents on the following pages includes the contents of the entire set of available material. The text in this attachment contains Sections I through IV. Sections V through VIII are available in hardcopy form upon request. Access to this report and the underlying data project database is provided on the CH2M HILL Web Site, including Sections IV through VI. Please contact Vito D'Aurora at 1-530-243-5886, ext. 3365, or vdaurora@ch2m.com, for access instructions.

Attachment A

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Acronyms and Abbreviations

%D	Percent difference
%R	Percent recovery
%RSD	Percent relative standard deviation
AFB	Air Force Base
AFCEE	Air Force Center for Environmental Excellence
AFCEE QAPP	Air Force Center for Environmental Excellence Quality Assurance Project Plan
AFS	Air Force Station
ASCII	American Standard Code for Information Interchange
Battelle MSL	Battelle Marine Sciences Laboratory
Bellows EE/CA OU1	Bellows Air Force Station Engineering Evaluation/Cost Analysis for Operable Unit 1
Bellows EE/CA QAPP	Bellows Air Force Station EE/CA Site Specific Quality Assurance Project Plan
CCB	Continuing calibration blank
CCV	Continuing calibration verification
CoC	Chain-of-Custody
CVO	CH2M HILL Applied Sciences Laboratory
DQOs	Data quality objectives
EE/CA	Engineering Evaluation/Cost Analysis
EPA	U.S. Environmental Protection Agency
ICVS	Initial calibration verification standard
ICP	Inductively coupled plasma
ERPIMS	Environmental Resources Program Information Management System

IS	Internal standard
Katalyst	Katalyst Analytical Technologies
LCL	Lower control limit
LCS	Laboratory control sample
MDL	Method detection limit
MS/MSD	Matrix spike/Matrix spike duplicate
NFG	National Functional Guidelines
PAHs	Polynuclear aromatic hydrocarbons
PARCC	Precision, accuracy, representativeness, completeness and comparability
PE	Performance evaluation
QA	Quality Assurance
QAL	Quality Analytical Laboratories
QAPP	Quality Assurance Project Plan
QB	Quarterly Blind
QC	Quality control
RL	Reporting limit
RPD	Relative percent difference
RSD	Relative standard deviation
SAP	Sampling and Analysis Plan
SDGs	Sample delivery groups
UCL	Upper control limit
WP/WS	Water Pollution/Water Study

Data Flags:

J = Analyte is present but the reported value may not be accurate or precise (estimated).

R = Analyte is rejected for use.

U = Analyte was not detected at the specified detection limit.

M = A matrix effect was identified in the MS/MSD samples. Recovery of the analyte detected in the native sample is considered to have been affected by the nature of the matrix.

UM = A matrix effect was identified in the MS/MSD samples. The recovery of analytes not detected in the native sample is considered to have been affected by the nature of the matrix.

B = Analyte was detected in the native sample above the reporting limit and the associated lab or field blanks.

UB = Analyte was not detected in the native sample but was identified above the reporting limit in associated lab or field blanks.

F = Analyte was detected at a concentration less than the adjusted reporting limit but greater than the adjusted method detection limit.

exclude = Data not used in risk assessment. More appropriate data exist for this analyte.

none = A final flag is not applied when this flag is present. This placeholder is for calculating QC criteria issues without flagging.

I Laboratory Analysis

1.0 Analytical Program

1.1 Laboratories and Methods

This report covers the laboratory analytical scope of work for the field investigation of Waimanalo Stream conducted as part of the Engineering Evaluation/Cost Analysis of Operable Unit 1 (OU1) and Waimanalo Stream at Bellows Air Force Station, Hawaii. OU1 comprises four Air Force Installation Restoration Program (IRP) Sites: LF01, DP17, SD22, and DP06. The Bellows OU1 EE/CA field investigation also included investigation of Waimanalo Stream in order to assess the potential impact of the OU1 sites on the stream.

The analytical work was conducted in accordance with the Air Force Center for Environmental Excellence (AFCEE) Quality Assurance Project Plan (QAPP) Version 3.0 and the Bellows EE/CA QAPP as defined in Appendix F of the *Work Plan: Engineering Evaluation/Cost Analysis for Operable Unit 1, Bellows AFS, Oahu, Hawaii*, (CH2M HILL, October 1998). The Bellows EE/CA QAPP comprises the *Installation-Wide QAPP for Multiple Projects at 15ABW Installations in Hawaii, Version 1.0* (CH2M HILL, October 1998) as supplemented by site-specific information presented in Appendix F of the Bellows OU1 *Work Plan*.

Twenty-one environmental samples and two field duplicates were collected with additional field quality control (QC) samples. Table 14 in Section IV is a summary of the samples taken. Twenty-seven methods were used to analyze the soil, water, and fish tissue environmental samples. Analyses were performed by CH2M HILL Quality Analytical Laboratories (QAL) (Redding, CA), CH2M HILL Applied Sciences Laboratory (CVO) (Corvallis, OR), Katalyst Analytical Technologies, (Katalyst) (Peoria, IL) and Battelle Marine Sciences Laboratory (Battelle MSL) (Sequim, WA). The laboratories reported all soil results on a dry weight basis.

The samples were divided into twelve sample delivery groups (SDGs). QAL provided five SDGs (RF948, RF954, RF961, RF966 and RF980) covering the majority of the methods. Katalyst, CVO and Battelle MSL acted in a support capacity. Katalyst provided five SDGs (27513, 27530, 27534, 27539 and 27553) for methods SW8081, SW8082, SW8151A and SW9060. CVO provided one SDG, numbered 8509 for AVS/SEM. Battelle MSL provided one SDG B1301A for tissue analyses for metals, pesticides and PCBs by NOAA methods. The SDGs were evaluated for data quality. A listing of sample identifications, methods and number of samples associated with each SDG is provided in Section IV, Table 15. Data summary reports are provided in Section V and the data quality evaluation reports are provided in Section VI.

1.2 Reference to Analytical Methods and Quality Control

The Bellows EE/CA QAPP was written to reflect as much of the AFCEE QAPP as possible. The Bellows EE/CA QAPP was written so that the laboratories would follow the AFCEE QAPP with the limited variances outlined in the Bellows EE/CA QAPP. The Bellows EE/CA QAPP reflects the desire of 15 CES/CEVR, the regulators, and the prime contractor to perform this work in as close an alignment with the 1998 AFCEE guidance documents and subsequent addenda and clarifications as possible.

The Bellows EE/CA QAPP identifies the following method-specific QC requirements for each analytical parameter and matrix: (1) frequency of QC data collection for each type of QC procedure, (2) the quantitative acceptance limits for these QC data, and (3) the corrective action required when these QC data are outside defined acceptance limits. The Bellows EE/CA QAPP clearly presents these requirements as the project goals used for the Bellows OU1 EE/CA.

The Bellows EE/CA QAPP defines a plan to test that the correct sampling, analytical, and data reduction procedures are followed by using audits and data validation. The requirement for 100 percent of the data to undergo a defined data evaluation check results in a complete usability assessment. Final qualifier flags for matrix effects were not applied globally based on matrix/location/analyte combinations. Instead, the risk assessors have requested that only the associated native sample be flagged. Qualifier flags for field quality control samples are applied following the protocol defined in the project-specific QAPP regarding field blanks, ambient blanks, equipment blanks and field duplicates.

Completeness calculations and interpretation are designed to ascertain whether sufficient data were produced to satisfy the assumptions in the Sampling and Analysis Plan (SAP) upon which the site assessment protocols have been established.

2.0 Chronology of Laboratory Analyses

This field effort was conducted and the resulting samples analyzed from November 1998 through January 1999. Samples were collected and shipped by overnight carrier to the laboratories for analysis. Section IV, Table 15, lists all samples collected and the analyses performed by date.

3.0 Quality Assurance/Quality Control Program

3.1 Types of QC Samples by Method

All analytical data from Bellows AFS EE/CA OU1 were evaluated as described in the Bellows EE/CA QAPP. Analytical performance was initially assessed on an SDG basis or analytical batch basis. Section VI and the CH2M HILL Web Site contain the data quality evaluation reports by SDG and method. Several SDGs may be associated with the same laboratory QC samples. The association of laboratory QC samples and environmental samples from the same

analytical batches is determined by the laboratory lot control number. The assessment of data includes a review of laboratory summary forms as defined in the AFCEE QAPP; (1) the Chain-of-Custody (COC) documentation; (2) holding time compliance; (3) the required QC samples at the specified frequencies; (4) flagging for method blanks; (5) laboratory control spiking samples; (6) surrogate spike recoveries for organic analyses; (7) analytical spike data; (8) matrix spike/matrix spike duplicate (MS/MSD) samples on a site/location basis; and (9) initial and continuing calibration information and other method-specific criteria as defined by the project-specific QAPP. Review of raw data and laboratory bench sheets is performed by a third-party validator, The Environmental Company (TEC).

Field samples were also reviewed to ascertain field compliance and data quality issues. This included the review of ambient blanks, trip blanks, equipment blanks and field duplicates as specified and defined in the *Installation-Wide Field Sampling Plan for Multiple Projects at 15 ABW Installations in Hawaii, Version 2.0* (IWfsp; CH2M HILL, October 1998).

Data flags were assigned according to the Bellows EE/CA QAPP using the QC acceptance limits as defined therein. Any parameters not addressed specifically by the Bellows EE/CA QAPP were evaluated using professional judgement with The National Functional Guidelines (NFG) as a reference and are described in the individual data quality evaluation reports. In addition, some validation criteria and flagging reflect guidance given to us by our AFCEE consulting chemist during the validation process and are described in Section 3.3.

The data validation flags for each SDG are summarized in each data quality evaluation report (Section VI). These flags, as well as the reason for each flag, are entered into the electronic database and are available to the data users. Multiple flags can routinely be applied to a specific sample method/matrix/analyte combination, but there will only be one final flag. As discussed below, a final flag is applied to the data on the basis of the flags entered into the database and is the most conservative of the applied validation flags using the AFCEE QAPP protocol. The final flags also include matrix and blank sample impacts.

Data flags can be separated into two categories to be used in estimating both contractor and analytical completeness: (1) flags caused by laboratory deviation from requirements in the project-specific QAPP; and (2) flags applied because of the nature of the sample matrix or method limitations. The database keeps track of the type of protocol violation. As such, contractual and analytical completeness during data validation is accomplished.

The data flags are those listed in the Bellows EE/CA QAPP and are defined below:

J = Analyte is present but the reported value may not be accurate or precise (estimated).

R = Analyte is rejected for use.

U = Analyte was not detected at the specified detection limit.

M = A matrix effect was identified in the MS/MSD samples. Recovery of the analyte detected in the native sample is considered to have been affected by the nature of the matrix.

UM = A matrix effect was identified in the MS/MSD samples. The recovery of analytes not detected in the native sample are considered to have been affected by the nature of the matrix.

B = Analyte was detected in the native sample and the associated lab or field blanks.

UB = Analyte was not detected in the native sample but was identified above the reporting limit in associated lab or field blanks.

F = Analyte was detected at a concentration less than the reporting limit but greater than the method detection limit.

Exclude = Data not used in risk assessment. More appropriate data exist for this analyte.

None = A flag is not applied. This is a placeholder for calculating QC criteria issues without flagging.

Overall summaries of data validation findings are presented in Section 3.3 below.

3.2 Frequency of QC samples and the Acceptance Criteria by Method

The frequency of field and laboratory quality control samples and the associated control criteria are specified in the Bellows EE/CA QAPP. These control criteria were used to evaluate the laboratory data.

3.3 Problems Detected During Data Validation

- In the following method-specific discussions, only the criteria exceedances that impact data qualification are discussed.
- In the case where internal standard (IS) recoveries were outside control limits and a matrix effect on a recovery was confirmed by reanalysis, we have chosen to remove the R flag and replace it with the U flag for non-detects. The basis for this flagging strategy and the viability of this data is as follows: (a) There is no guidance in the AFCEE QAPP to direct the course of data qualification when corrective action implementation yields the same result as did the original analysis; (b) Confirmation of a matrix effect on internal standard recoveries in independent analyses of the same sample must have been done by the laboratory; (c) All associated quality control samples meet criteria, indicating that an analytical system problem does not exist; (d) In the current AFCEE flagging system, matrix effects on target analyte recoveries in the MS/MSDs do not result in R flags for non-detects. Therefore, to be consistent with the spirit of the AFCEE QAPP, a matrix effect on internal standards will follow the same severity of data qualification.
- Surrogate exceptions are represented by applying flags to all target analytes in a method except in the case where it is applicable to flag analytes by analytical fraction, as in SW8270 semivolatiles.

- As directed by our risk assessment team, matrix effects were represented by flagging analytes only on the native and field duplicate sample results. This is due to the nature of the geology of the Hawaiian Islands.
- The following discussion describing the evaluation of data by method refers to qualification of native and field duplicate sample results only. Other field and laboratory samples are not included since they are not directly used in risk assessment calculations.
- In discussions with the EPA, the method detection limits (MDLs) and control limits values published in SW846 for MCPA and MCPP in method SW8151 are derived from statistical evaluation of data generated from a different method and a different detector than those described in SW8151 and may not be appropriate when strictly following this method. Since the method values are in question and information gathered from laboratories around the country indicate that several of these MDL and control criteria values are unobtainable by this method, the AFCEE consulting chemist on this project has agreed to allow the use of laboratory MDLs and reporting limits (RLs) and historically generated control limits for second party data validation. The laboratories flag the data as prescribed in the AFCEE QAPP; however, some laboratory flags were changed during data validation. Notation is made in the affected data quality evaluation reports.
- In cases where sample dilution and confirmation analyses result in two measured values for an analyte, only the appropriate value is included in the risk assessment data set while the other analytical results are flagged “exclude” and omitted. All data, however, remain in the project database.
- Due to the matrix effects demonstrated by Katalyst, Section 3.6.2 describes in detail the approach CH2M HILL took during the analytical portion of this project to get the best data possible from the affected samples to be used in the site assessment. The matrix affected column stability for pesticides and PCB analysis, as reflected in closing continuing calibration failures. This required extensive reworking of the samples, including several re-extractions and re-analyses.

Tables 1-13 in Section IV are generated directly from the database that is populated during electronic data loading and data quality evaluation, and are expanded on in the text below for each method. Please refer to the tables for specific samples affected by each occurrence. The distinction between protocol violations that affect contractor compliance and other QC issues (see the discussion of flag categories in Section I, 3.1) that affect data usability but have no effect on contractor compliance is summarized in Table 1 and used in calculations of completeness in Table 13. The other tables in that section, as well as the text below, do not address the distinction between contractor and overall compliance but only address the frequency and type of QC criteria exceedances.

Acid Volatile-Acid Sulfide and Simultaneously Extracted Metals (AVS/SEM)

Reporting Limits

Soil sample results contain analyte concentrations for which the reported values fall between the MDL and the RL. These concentrations have been flagged F and are represented in Section IV, Table 3. The qualified results represent values determined at levels where the true value of the measured chemical cannot be quantified with a high degree of confidence. The data user may consider these qualified results as estimates when making project decisions.

Field Duplicate

The elements detected in field duplicates that exceeded the relative percent difference (RPD) criteria outlined in the QAPP have been identified in the data quality evaluation reports and are summarized in Section IV, Table 8. One soil sample AVS result and the associated field duplicate were J flagged and should be considered estimated when making project decisions.

Holding Times

Holding time exceptions have been noted in the data quality evaluation reports and are summarized in Section IV, Table 2. The holding time for one soil AVS sample result was exceeded. One soil sample detect was J flagged to note the exceedance.

Method E350 (Ammonia-Nitrogen)

Field Duplicate

The elements detected in field duplicates that exceeded the relative percent difference (RPD) criteria outlined in the QAPP have been identified in the data quality evaluation reports and are summarized in Section IV, Table 8. One soil sample result and the associated field duplicate were J flagged and should be considered estimated when making project decisions.

Method E354.1 (Nitrite-N)

Reporting Limits

Water sample results contain analyte concentrations for which the reported values fall between the MDL and the RL. These concentrations have been flagged F and are represented in Section IV, Table 3. The qualified results represent values determined at levels where the true value of the measured chemical cannot be quantified with a high degree of confidence. The data user may consider these qualified results as estimates when making project decisions.

NOAA Metals-Tissue

Blanks

Laboratory blanks evidencing contamination have been identified and flagged in the data quality evaluation reports and a summary of the samples affected is presented in Section IV, Table 6.

Blank detections reported above the RLs were evaluated for their effect on the sample data. Thirty tissue sample results were qualified due to target concentrations detected above the reporting limit in associated laboratory blanks. Nine non-detected results for the elements in the associated blank have been qualified with a UB flag. Twenty-one detected sample results for the elements detected in the associated blanks have been qualified with B flags. Blank detections reported less than the RLs were evaluated for their effect on the sample data. One hundred and eighty tissue sample results were qualified due to target concentrations detected less than the reporting limit in associated laboratory blanks. Four non-detected results for the elements in the associated blank have been qualified with a UB flag. One hundred and seventy-six detected sample results for the elements detected in the associated blanks have been qualified with B flags. The overall impact on data usability is minimal due to blank contamination.

Calibration

Calibration criteria were compared against the Bellows EE/CA QAPP requirements and the exceptions have been indicated in the data quality evaluation reports and summarized in Section IV, Table 5. Six beryllium sample results were qualified for continuing calibration (CCV) exceedance and J flagged as estimated detects.

Laboratory Control Samples

LCS exceptions have been identified in the data quality evaluation reports and are indicated in Section IV, Table 9. Sixty tissue samples associated with LCSs that exceeded %R criteria for specific elements are qualified as indicated. Fifty-one detected sample results associated with LCSs exceeding the UCL and LCL were J flagged as estimated detects. Nine non-detected sample results associated with LCSs exceeding the LCL have been R flagged and rejected for use as definitive data for project decisionmaking.

Matrix Spike / Matrix Spike Duplicate

Matrix effects have been identified in the data quality evaluation reports and the affected samples summarized in Section IV, Table 11. Thirty-four tissue sample results have been qualified to reflect the effect of the matrix on the precision and accuracy of the results. The imprecision and inaccuracy reflected in the MS/MSD results suggest that the detection limit may be somewhat unreliable when dealing with this matrix. Consequent to the noted matrix effect, three sample results associated with the affected MS/MSDs were qualified as estimated non-detects and flagged UM. Thirty-one detected sample results are affected to an unknown degree by the matrix and are flagged M. Data users should consider the potential matrix impact on affected sample analytes when evaluating the data for project decisionmaking.

Re-extraction and/or Reanalysis

Reanalysis is performed to verify surrogate recoveries, internal standard recoveries, analyze dilutions, analyze re-extracted samples and perform confirmation analyses. The confirmatory results are then marked “exclude”. For samples that are diluted and reanalyzed, the best representative result is selected and the other results are flagged “exclude”, but are shown in the

database. Nineteen sample results were excluded from the risk assessment database due to reanalysis or confirmation.

NOAA Pesticide/PCBs -Tissue

Calibration

Calibration criteria were compared against the Bellows EE/CA QAPP requirements and the exceptions have been indicated in the data quality evaluation reports and summarized in Section IV, Table 5. Eighty tissue sample results were qualified for initial calibration verification standard (ICVS) exceedances. One hundred and twenty tissue sample results were qualified for continuing calibration verification (CCV) exceedances. Ninety tissue sample results were qualified for calibration verification ending standard (CVES) exceedances. Sixty-two detected results associated with these exceedances were J flagged as estimated detects. Thirty non-detected results associated with recoveries less than the LCL were R flagged and rejected for use as definitive data for project decision making. One hundred and ninety-eight non-detected results associated with recoveries greater than the UCL were none flagged to note the exceedances.

Confirmation Analysis

Confirmation analysis of forty-three tissue sample results exceeded the RPD criteria outlined in the Bellows EE/CA QAPP. These sample results have been flagged J and the data users should consider these values as estimates when making project decisions. Section IV, Table 12, summarizes the data that have been qualified due to confirmation analysis RPD exceedance.

Matrix Spike / Matrix Spike Duplicate

Matrix effects have been identified in the data quality evaluation reports and the affected samples summarized in Section IV, Table 11. Two tissue sample results have been qualified to reflect the effect of the matrix on the precision and accuracy of the results. The imprecision and inaccuracy reflected in the MS/MSD results suggest that the detection limit may be somewhat unreliable when dealing with this matrix. Consequent to the noted matrix effect, two sample results associated with the affected MS/MSDs were qualified as estimated non-detects and flagged UM. Data users should consider the potential matrix impact on affected sample analytes when evaluating the data for project decisionmaking.

Re-extraction and/or Reanalysis

Reanalysis is performed to verify surrogate recoveries, internal standard recoveries, analyze dilutions, analyze re-extracted samples and perform confirmation analyses. The confirmatory results are then excluded. For samples that are diluted and reanalyzed, the best representative result is selected and the other results are flagged exclude, but are shown in the database. Nineteen sample results were excluded from the risk assessment database due to reanalysis or confirmation.

Surrogates

Surrogate recoveries that exceed the criteria defined in the Bellows EE/CA QAPP are identified in the data quality evaluation reports and are listed in Section IV, Table 7. The surrogate recoveries on forty-one tissue samples exceeded the LCL. Twenty-five associated non-detected results were flagged R and rejected for use as definitive data for project decisionmaking. Sixteen detected results were J flagged as estimated detects.

Method SW6010A (Metals by Inductively Coupled Plasma - ICP)

Reporting Limits

Soil and water sample results contain analyte concentrations where the reported values fall between the MDL and the RL. These concentrations have been flagged F and are represented in Section IV, Table 3. The qualified results represent values determined at levels where the true value of the measured chemical cannot be quantified with a high degree of confidence. The data user may consider these qualified results as estimates when making project decisions.

Blanks

Laboratory and field blanks evidencing contamination have been identified and flagged in the data quality evaluation reports and a summary of the samples affected is presented in Section IV, Table 6. Sixteen water sample results were qualified due to target concentrations detected above the reporting limit in associated equipment blanks. The analytes were found in the equipment blanks as well as the samples and have been qualified with B flags.

Matrix Spike / Matrix Spike Duplicate

Matrix effects have been identified in the data quality evaluation reports and the affected samples summarized in Section IV, Table 11. Fifteen soil and nine water sample results have been qualified to reflect the effect of the matrix on the precision and accuracy of the results. The imprecision and inaccuracy reflected in the MS/MSD results suggest that the detection limit may be somewhat unreliable when dealing with this matrix. Consequent to the noted matrix effect, the sample results associated with the affected MS/MSDs are affected to an unknown degree by the matrix and are flagged M. Data users should consider the potential matrix impact on affected sample analytes when evaluating the data for project decisionmaking.

Serial Dilution

Chemical or physical interference effects have been identified in the data quality evaluation reports and the affected samples summarized in Section IV, Table 11. Eight iron results derived from the soil matrix have been qualified to reflect the effect of the interference on the precision and accuracy of the results. The sample results associated with the affected serial dilution were flagged J.

Method SW7041 (Antimony by Atomic Absorption - Furnace)

Reporting Limits

Water sample results contain analyte concentrations for which the reported values fall between the MDL and the RL. These concentrations have been flagged F and are represented in Section IV, Table 3. The qualified results represent values determined at levels where the true value of the measured chemical cannot be quantified with a high degree of confidence. The data user may consider these qualified results as estimates when making project decisions.

Matrix Spike / Matrix Spike Duplicate

Matrix effects have been identified in the data quality evaluation reports and the affected samples summarized in Section IV, Table 11. Three soil and two water sample results have been qualified to reflect the effect of the matrix on the precision and accuracy of the results. The imprecision and inaccuracy reflected in the MS/MSD results suggest that the detection limit may be somewhat unreliable when dealing with this matrix. Consequent to the noted matrix effect, the five sample results associated with the affected MS/MSDs were qualified as estimated non-detects and flagged UM. Data users should consider the potential matrix impact on affected sample analytes when evaluating the data for project decisionmaking.

Method SW7060 (Arsenic by Atomic Absorption - Furnace)

Reporting Limits

Soil and water sample results contain analyte concentrations where the reported values fall between the MDL and the RL. These concentrations have been flagged F and are represented in Section IV, Table 3. The qualified results represent values determined at levels where the true value of the measured chemical cannot be quantified with a high degree of confidence. The data user may consider these qualified results as estimates when making project decisions.

Matrix Spike / Matrix Spike Duplicate

Matrix effects have been identified in the data quality evaluation reports and the affected samples summarized in Section IV, Table 11. One water and two soil sample results have been qualified to reflect the effect of the matrix on the precision and accuracy of the results. The imprecision and inaccuracy reflected in the MS/MSD results suggest that the detection limit may be somewhat unreliable when dealing with this matrix. Consequent to the noted matrix effect, one water sample result associated with the affected MS/MSDs was qualified as an estimated non-detect and flagged UM. Two detected soil sample results are affected to an unknown degree by the matrix and are flagged M. Data users should consider the potential matrix impact on affected sample analytes when evaluating the data for project decisionmaking.

Method SW7421 (Lead by Atomic Absorption - Furnace)

Reporting Limits

Soil and water sample results contain analyte concentrations for which the reported values fall between the MDL and the RL. These concentrations have been flagged F and are represented in

Section IV, Table 3. The qualified results represent values determined at levels where the true value of the measured chemical cannot be quantified with a high degree of confidence. The data user may consider these qualified results as estimates when making project decisions.

Matrix Spike / Matrix Spike Duplicate

Matrix effects have been identified in the data quality evaluation reports and the affected samples summarized in Section IV, Table 11. One soil and a single water sample result have been qualified to reflect the effect of the matrix on the precision and accuracy of the results. The imprecision and inaccuracy reflected in the MS/MSD results suggest that the detection limit may be somewhat unreliable when dealing with this matrix. Consequent to the noted matrix effect, the water sample result associated with the affected MS/MSDs was qualified as an estimated non-detect and flagged UM. One detected soil sample result was affected to an unknown degree by the matrix and was flagged M. Data users should consider the potential matrix impact on affected sample analytes when evaluating the data for project decisionmaking.

Method SW7841 (Thallium by Atomic Absorption - Furnace)

Matrix Spike / Matrix Spike Duplicate

Matrix effects have been identified in the data quality evaluation reports and the affected samples summarized in Section IV, Table 11. Two sample results derived from the soil matrix have been qualified to reflect the effect of the matrix on the precision and accuracy of the result. Both non-detected results were flagged UM as estimated. Data users should consider the potential matrix impact on affected sample analytes when evaluating the data for project decision making.

Method SW8015-E (TPH-Diesel)

Reporting Limits

Soil sample results contain analyte concentrations for which the reported values fall between the MDL and the RL. These concentrations have been flagged F and are represented in Section IV, Table 3. The qualified results represent values determined at levels where the true value of the measured chemical cannot be quantified with a high degree of confidence. The data user may consider these qualified results as estimates when making project decisions.

Method SW8015-P (TPH-Gasoline)

Reporting Limits

Soil and water sample results contain analyte concentrations for which the reported values fall between the MDL and the RL. These concentrations have been flagged F and are represented in Section IV, Table 3. The qualified results represent values determined at levels where the true value of the measured chemical cannot be quantified with a high degree of confidence. The data user may consider these qualified results as estimates when making project decisions.

Method SW8081 (Chlorinated Pesticides)

Reporting Limits

Soil and water sample results contain analyte concentrations for which the reported values fall between the MDL and the RL. These concentrations have been flagged F and are represented in Section IV, Table 3. The qualified results represent values determined at levels where the true value of the measured chemical cannot be quantified with a high degree of confidence. The data user may consider these qualified results as estimates when making project decisions.

Calibration

Calibration criteria were compared against the Bellows EE/CA QAPP requirements and the exceptions have been indicated in the data quality evaluation reports and summarized in Section IV, Table 5. The exceptions encountered during the initial calibration included soil analyses' relative standard deviation (RSD) and the first order regression (R²). Twenty-eight results have been R flagged and rejected for use as definitive data for project decisionmaking. Two hundred and thirty-two soil and twelve water sample results were qualified for continuing calibration verification (CCV) exceedance. In most cases, the exceedance results from closing CCV imprecision and is a result of decomposition of the analytical column due to matrix effects. Detected results associated with these recovery exceedances were J flagged as estimated. Non-detected results associated with recoveries greater than the UCL were none flagged to note the exceedance and uncertainty in the database. Non-detected results associated with recoveries less than the LCL were R flagged and rejected for use as definitive data for project decisionmaking.

Confirmation Analysis

Confirmation analysis of fourteen soil sample results exceeded the RPD criteria outlined in the Bellows EE/CA QAPP. These sample results have been flagged J and the data users should consider these values as estimates when making project decisions. Section IV, Table 12, summarizes the data that has been qualified due to confirmation analysis RPD exceedance. One soil sample result was R flagged because the confirmation analysis did not confirm. This is a protocol violation and consequently, there is no viable confirmation result. The soil result was rejected for use as definitive data for project decisionmaking.

Field Duplicate

The analytes detected in field duplicates that exceeded the relative percent difference (RPD) criteria outlined in the QAPP have been identified in the data quality evaluation reports and are summarized in Section IV, Table 8. Two soil sample results and the associated field duplicate were J flagged and should be considered estimated when making project decisions.

Holding Times

Holding time exceptions have been noted in the data quality evaluation reports and are summarized in Section IV, Table 2. The samples were reanalyzed outside of holding time to provide: (1) a demonstration of the data set within technical analytical control, (2) dilutions within the calibration range, and (3) confirmation of detects. This is a protocol violation and the results have been R flagged and rejected for use as definitive data for project decisionmaking. These samples were initially analyzed within holding time, but due to matrix effects, dilutions and confirmation of detects, reanalysis was necessary.

Laboratory Control Samples

LCS exceptions have been identified in the data quality evaluation reports and are indicated in Section IV, Table 9. Toxaphene was not spiked into the LCS sample. Fourteen soil and eight water sample results associated with this missing LCS compound were R flagged and rejected for use as definitive data for project decisionmaking. Analytically, there were not any samples with detects for Toxaphene.

Matrix Spike / Matrix Spike Duplicate

Matrix effects have been identified in the data quality evaluation reports and the affected samples summarized in Section IV, Table 11. Thirty-eight soil and thirty-eight water sample results have been qualified to reflect the effect of the matrix on the precision and accuracy of the result. Consequent to the noted matrix effect, six soil and sixteen water sample results associated with the affected MS/MSDs were qualified as estimated non-detects and flagged UM. Thirty-two soil and twenty-two water detected results were affected to an unknown degree by the matrix and were flagged M. Data users should consider the potential matrix impact on affected sample analytes when evaluating the data for project decisionmaking.

In addition to the above issue, the laboratory qualified one hundred and eighty-eight soil sample results with M flags inappropriately by grouping samples by SDG instead of using site/location information. One hundred and twenty-two M flags were removed during data validation and replaced with U flags. Sixty-six M flags were removed and replaced with F flags.

Re-extraction and/or Reanalysis

Reanalysis is performed to verify surrogates recoveries, internal standard recoveries, analyze dilutions, analyze re-extracted samples and perform confirmation analyses. The confirmatory results are then excluded for use. For samples that are diluted and reanalyzed, the best representative result is selected and the other results are flagged “exclude”, but are shown in the database. Five hundred and thirty-three soil and four water sample results were excluded from the risk assessment database due to either reanalysis or confirmation. Additionally, two rejected results were excluded because a more appropriate result was available. However, these results are maintained in the project database.

Method SW8082 (Polychlorinated Biphenyls-PCBs)

Calibration

The laboratory qualified seven soil sample results with R flags inappropriately. The R flags were removed during data validation and replaced with U flags.

Matrix Spike / Matrix Spike Duplicate

Matrix effects have been identified in the data quality evaluation reports and the affected samples summarized in Section IV, Table 11. Forty-two soil sample results have been qualified to reflect the effect of the matrix on the precision and accuracy of the result. Consequent to the noted matrix effect, sample results associated with the affected MS/MSDs were qualified as estimated

non-detects and flagged UM. Data users should consider the potential matrix impact on affected sample analytes when evaluating the data for project decisionmaking.

In addition to the above issue, the laboratory qualified twenty-eight soil sample results with M flags inappropriately by grouping samples by SDG instead of using site/location information. The M flags were removed during data validation and replaced with U flags.

Re-extraction and/or Reanalysis

Reanalysis is performed to verify surrogates recoveries, internal standard recoveries, analyze dilutions, analyze re-extracted samples and perform confirmation analyses. The confirmatory results are then excluded. For samples that are diluted and reanalyzed, the best representative result is selected and the other results are flagged “exclude”, but are shown in the database. Sixty-three soil sample results were excluded from the risk assessment database due to either reanalysis or confirmation.

Surrogates

Surrogate recoveries that exceed the criteria defined in the Bellows EE/CA QAPP are identified in the data quality evaluation reports and are listed in Section IV, Table 7. The surrogate recoveries on seven soil samples exceeded the UCL and the non-detected results were none flagged to note the exceedance and maintain the lab flag.

Method SW8151A (Herbicides)

Reporting Limits

Soil and water sample results contain analyte concentrations for which the reported values fall between the MDL and the RL. These concentrations have been flagged F and are represented in Section IV, Table 3. The qualified results represent values determined at levels where the true value of the measured chemical cannot be quantified with a high degree of confidence. The data user may consider these qualified results as estimates when making project decisions.

Calibration

Calibration criteria were compared against the Bellows EE/CA QAPP requirements and the exceptions have been indicated in the data quality evaluation reports and summarized in Section IV, Table 5. Fourteen soil sample results were qualified for continuing calibration verification (CCV) exceedance. One detected result associated with these recovery exceedances was J flagged as estimated. Thirteen non-detected results associated with recoveries greater than the UCL were none flagged to note the exceedance.

One soil result was greater than the instrument calibration range and was J flagged as an estimated detect.

In addition to the above issue, the laboratory qualified eight soil sample results with R flags inappropriately. Five R flags were removed during data validation and replaced with U flags. Three R flags were removed and replaced with F flags.

Confirmation Analysis

Confirmation analysis of one water and two soil sample results exceeded the RPD criteria outlined in the Bellows EE/CA QAPP. These sample results have been flagged J and the data users should consider these values as estimates when making project decisions. Section IV, Table 12, summarizes the data that has been qualified due to confirmation analysis RPD exceedance.

Laboratory Control Samples

LCS exceptions have been identified in the data quality evaluation reports and are indicated in Section IV, Table 9. Thirty-six water sample results associated with LCSs that exceeded %R criteria for specific compounds are qualified as indicated. Four non-detected water sample results associated with LCSs exceeding the UCL have been none flagged to note the exceedance and maintain the lab flag. Thirty-two water non-detected sample results associated with LCSs exceeding the LCL have been R flagged and rejected for use as definitive data for project decisionmaking.

Matrix Spike / Matrix Spike Duplicate

Matrix effects have been identified in the data quality evaluation reports and the affected samples summarized in Section IV, Table 11. Thirty soil and six water sample results have been qualified to reflect the effect of the matrix on the precision and accuracy of the result. Consequent to the noted matrix effect, twenty-five soil and six water sample results associated with the affected MS/MSDs were qualified as estimated non-detects and flagged UM. Five soil detected results were affected to an unknown degree by the matrix and were flagged M. Data users should consider the potential matrix impact on affected sample analytes when evaluating the data for project decisionmaking.

In addition to the above issue, the laboratory qualified eighty-six soil sample results with M flags inappropriately by grouping samples by SDG instead of using site/ location information. The M flags were removed during data validation and replaced with U flags for seventy-one results and F flags for fifteen results.

Re-extraction and/or Reanalysis

Reanalysis is performed to verify surrogates recoveries, internal standard recoveries, analyze dilutions, analyze re-extracted samples and perform confirmation analyses. The confirmatory results are then excluded. For samples that are diluted and reanalyzed, the best representative result is selected and the other results are flagged "exclude", but are shown in the database. One hundred and four soil and two water sample results were excluded from the risk assessment database due to either reanalysis or confirmation. However, these results are maintained in the project database.

Surrogates

Surrogate recoveries that exceed the criteria defined in the Bellows EE/CA QAPP are identified in the data quality evaluation reports and are listed in Section IV, Table 7. The surrogate

recoveries on four soil samples exceeded the UCL. The non-detected results were none flagged to note the exceedance and maintain the lab flag. The detected result was J flagged as estimated.

Method SW8260A (Volatiles)

Reporting Limits

Water sample results contain analyte concentrations for which the reported values fall between the MDL and the RL. These concentrations have been flagged F and are represented in Section IV, Table 3. The qualified results represent values determined at levels where the true value of the measured chemical cannot be quantified with a high degree of confidence. The data user may consider these qualified results as estimates when making project decisions.

Calibration

Calibration criteria were compared against the Bellows EE/CA QAPP requirements and the exceptions have been indicated in the data quality evaluation reports and summarized in Section IV, Table 5. Four water sample results were qualified for continuing calibration verification (CCV) recoveries less than the LCL. Four non-detected results associated with these recovery exceedances were R flagged and rejected for use as definitive data for project decisionmaking.

Matrix Spike / Matrix Spike Duplicate

Matrix effects have been identified in the data quality evaluation reports and the affected samples summarized in Section IV, Table 11. Nine soil and three water sample results have been qualified to reflect the effect of the matrix on the precision and accuracy of the results. The imprecision and inaccuracy reflected in the MS/MSD results suggest that the detection limit may be somewhat unreliable when dealing with this matrix. Consequent to the noted matrix effect, the sample results associated with the affected MS/MSDs were qualified as estimated non-detects and flagged UM. Data users should consider the potential matrix impact on affected sample analytes when evaluating the data for project decisionmaking.

Method SW8270B (Semivolatiles)

Reporting Limits

Water and soil sample results contain analyte concentrations for which the reported values fall between the MDL and the RL. These concentrations have been flagged F and are represented in Section IV, Table 3. The qualified results represent values determined at levels where the true value of the measured chemical cannot be quantified with a high degree of confidence. The data user may consider these qualified results as estimates when making project decisions.

Blanks

Laboratory blanks evidencing contamination have been identified and flagged in the data quality evaluation reports and a summary of the samples affected is presented in Section IV, Table 6. Blank detections were evaluated for their effect on the sample data. One water sample result was qualified and flagged UB due to target concentrations detected above the reporting limit in the

associated laboratory blank. The overall impact on data usability is minimal due to blank contamination.

Calibration

Calibration criteria were compared against the Bellows EE/CA QAPP requirements and the exceptions have been indicated in the data quality evaluation reports and summarized in Section IV, Table 5. Four water sample results were qualified for continuing calibration (CCV) recoveries less than the LCL. These non-detected results were R flagged and rejected for use as definitive data for project decisionmaking.

Laboratory Control Samples

LCS exceptions have been identified in the data quality evaluation reports and are indicated in Section IV, Table 9. Two water samples associated with LCSs that exceeded %R criteria for specific compounds are qualified as indicated. The sample results associated with LCSs with a %R that exceeded the LCL have been flagged R and rejected for use as definitive data for project decisionmaking.

Matrix Spike / Matrix Spike Duplicate

Matrix effects have been identified in the data quality evaluation reports and the affected samples summarized in Section IV, Table 11. Fifteen soil and seven water sample results have been qualified to reflect the effect of the matrix on the precision and accuracy of the results. The imprecision and inaccuracy reflected in the MS/MSD results suggest that the detection limit may be somewhat unreliable when dealing with this matrix. Consequent to the noted matrix effect, the sample results associated with the affected MS/MSDs were qualified as estimated non-detects and flagged UM. Data users should consider the potential matrix impact on affected sample analytes when evaluating the data for project decisionmaking.

Method SW8310 (Polynuclear Aromatic Hydrocarbons - PAHs)

Reporting Limits

Soil sample results contain analyte concentrations where the reported values fall between the MDL and the RL. These concentrations have been flagged F and are represented in Section IV, Table 3. The qualified results represent values determined at levels where the true value of the measured chemical cannot be quantified with a high degree of confidence. The data user may consider these qualified results as estimates when making project decisions.

Confirmation Analysis

Confirmation analysis of five soil sample results exceeded the RPD criteria outlined in the Bellows EE/CA QAPP. These sample results have been flagged J and the data users should consider these values as estimates when making project decisions. Section IV, Table 12, summarizes the data that has been qualified due to confirmation analysis RPD exceedance.

Holding Times

Holding time exceptions have been noted in the data quality evaluation reports and are summarized in Section IV, Table 2. Holding times were exceeded for the analyses of sixteen soil sample results. This is

a QAPP protocol violation and the results have been R flagged and rejected for use as definitive data for project decisionmaking.

Re-extraction and/or Reanalysis

Reanalysis is performed to verify surrogates recoveries, internal standard recoveries, analyze dilutions, analyze re-extracted samples and perform confirmation analyses. The confirmatory results are then excluded. For samples that are diluted and reanalyzed, the best representative result is selected and the other results are flagged “exclude”, but are shown in the database. Nineteen soil sample results were excluded from the risk assessment database due to either reanalysis or confirmation. However these results are maintained in the project database.

Method SW9012 (Cyanide)

Reporting Limits

Soil and water sample results contain analyte concentrations for which the reported values fall between the MDL and the RL. These concentrations have been flagged F and are represented in Section IV, Table 3. The qualified results represent values determined at levels where the true value of the measured chemical cannot be quantified with a high degree of confidence. The data user may consider these qualified results as estimates when making project decisions.

Field Duplicate

The analyte detected in the field duplicate that exceeded the relative percent difference (RPD) criteria outlined in the QAPP have been identified in the data quality evaluation reports and are summarized in Section IV, Table 8. One soil sample result and the associated field duplicate were J flagged and should be considered estimated when making project decisions.

Method SW9056 (Anions)

Reporting Limits

Water sample results contain analyte concentrations for which the reported values fall between the MDL and the RL. These concentrations have been flagged F and are represented in Section IV, Table 3. The qualified results represent values determined at levels where the true value of the measured chemical cannot be quantified with a high degree of confidence. The data user may consider these qualified results as estimates when making project decisions.

Method SW9060 (Total Organic Carbon - TOC)

Matrix Spike / Matrix Spike Duplicate

Matrix effects have been identified in the data quality evaluation reports and the affected samples summarized in Section IV, Table 11. One water sample result has been qualified to reflect the effect of the matrix on the precision and accuracy of the result. This detected result was affected to an unknown degree by the matrix and was flagged M. Data users should consider the potential matrix impact on affected sample analytes when evaluating the data for project decisionmaking.

Calibration

Calibration criteria were compared against the Bellows EE/CA QAPP requirements and the exceptions have been indicated in the data quality evaluation reports and summarized in Section IV, Table 5. Daily calibration was not performed as per the QAPP. All other QC criteria were met. Six detected soil sample results associated with this calibration exceedance were J flagged as estimated detects. Two soil non-detected results were none flagged to note the exceedance and maintain the laboratory flag.

3.4 Corrective Actions

The required corrective actions for criteria exceedance are defined by method in the Bellows EE/CA QAPP. Copies of the laboratory corrective action reports are included in Section VIII of this Appendix. In general, the laboratories followed the corrective actions as outlined in the Bellows EE/CA QAPP.

3.5 Completeness

Section IV, Table 13, provides a completeness summary that lists the analytes, numbers of samples collected and completeness calculations for the site inspection. The Bellows EE/CA QAPP defines the completeness goals by analyte, method and matrix. Overall completeness is the number of valid results (not R flagged) divided by the number of possible results from all normal and field duplicate samples collected during the sampling event, independent of the reason for any rejected data. Contractor completeness, however, is influenced by those analytical results that are rejected as a result of non-compliance with the Bellows EE/CA QAPP because of error or omission. Contractor percent completeness is not influenced by field duplicate precision, confirmed matrix effects, field issues such as insufficient volumes for corrective action or results qualified because of low-level blank concentrations. The goal for completeness is 95% for water samples and 90% for soil samples.

Table 13 provides a completeness summary of the project data quality and shows whether matrix/method/analyte combinations met the Bellows EE/CA QAPP completeness criteria. The completeness goals specified in the Bellows EE/CA QAPP were not met for the NOAA methods. Tissue samples results not meeting the completeness goals include: beryllium (86%), chromium (57%) and 4,4-DDD (0%). The completeness goals for soils and waters specified in the Bellows EE/CA QAPP were not met for method SW8081. Soil sample results not meeting completeness goals include: 4,4-DDT (75%), alpha-chlordane (75%), endosulfan II (88%), endrin aldehyde (63%), gamma-chlordane (88%), methoxychlor (75%) and toxaphene (0%). Water sample results not meeting completeness goals include: toxaphene (0%). The completeness goals for waters specified in the Bellows EE/CA QAPP were not met for method SW8151A. Water sample results not meeting completeness goals include: 2,4,5-TP (0%), 2,4-D (50%), 2,4-DB (0%), dichloroprop (0%) and dinoseb (50%). The completeness goals for waters specified in the Bellows EE/CA QAPP were not met for method SW8260B. The water sample results not meeting completeness goals include: bromomethane (50%). The completeness goals for waters specified in the Bellows EE/CA QAPP were not met for method SW8270C. Water sample results not meeting completeness goals include: 3,3-dichlorobenzidine (75%) and benzoic acid (50%). The completeness goals for soils specified in the Bellows EE/CA QAPP were not met for method SW8310. Soil sample results not meeting completeness goals include: acenaphthene (88%), acenaphthylene (88%), anthracene (88%), benzo(a)anthracene (88%), benzo(a)pyrene (88%), benzo(b)fluoranthene (88%), benzo(g,h,i)perylene (88%), benzo(k)fluoranthene (88%), chrysene (88%), dibenz(a,h)anthracene (88%), fluoranthene(88%), fluorene (88%), indeno(1,2,3-cd)pyrene (88%), naphthalene (88%), phenanthrene(88%) and pyrene (88%). The Bellows EE/CA OU1 completeness objectives were met for all other matrix/method/analyte combinations.

3.6 Quality Assurance Activities, Audits, and Performance Evaluation Samples

The QAL and laboratories running analytical methods for this project are AFCEE-approved laboratories that have recently undergone AFCEE comprehensive audits. In addition, both laboratories participate in the U. S. Environmental Protection Agency (EPA), Water Pollution (WP), Water Study (WS) and Quarterly Blind (QB) performance monitoring programs. Internal evaluation of 100 percent of the chemical data was performed by using the Bellows EE/CA QAPP as a guide for data quality evaluation. Ten percent of the data is in third-party review and will be reported directly to AFCEE. No systematic protocol errors were identified on the basis of the QA program set up or during the monitoring of the field or laboratory efforts, with exception of the issues concerning Katalyst laboratory, discussed in Section 3.6.2 below.

3.6.1 Performance Evaluation Samples

Performance evaluation (PE) samples were analyzed for most analytical methods. These samples were provided by the third-party oversight group, The Environmental Company, Honolulu, HI, to the field crew, who labeled the containers as blind samples to the laboratories. Overall, the PE sample results were favorable except for the correlation for pesticides/PCBs. Where SVOCs (except hexachlorocyclopentadiene) are outside the 95th percentile, the spiking concentration in the PE sample is below the AFCEE reporting limit and reflects the uncertainty of the method at those levels. In the case of hexachlorocyclopentadiene the laboratory adhered to the AFCEE QAPP and R-flagged and rejected the result due to LCS recovery below the LCL. Consequently the result was recognized as being potentially low-biased. The indication in the PE report (below) that the laboratory reported the compound as not detected is incorrect; it is essentially not reported. The surrogate chlorobenzene associated with gasoline-range organics result recovered greater than the UCL. The sample was analyzed again with similar results. This suggests that the PE sample was exhibiting a matrix effect, potentially high-biasing the results. For PAHs, two compounds recovered below the 95th percentile. Not all compounds were spiked close to the AFCEE RL for this method and required a 50-fold dilution for analysis. Some furnace metals did not recover well. The review of the ICP analysis for the PE sample for these analytes had recoveries within the 95th percentile. All QC parameters for the furnace metals are within criteria, suggesting a possible matrix effect on the furnace results. The fact that at least one furnace metal recovered well also suggests a possible matrix effect on the furnace results. Since the laboratory did not know that the PE sample was a different matrix than the other samples for the project, no serial dilutions were performed to assess matrix interference as required by the method. Other samples for which ICP and furnace results are available show acceptable correlation. The analytical runs for pesticides/PCBs indicate analytical control as demonstrated by LCS, surrogate, calibration parameters and other QC measurements. In addition, CH2M HILL, upon reviewing the results for the PE samples, asked Katalyst to thoroughly review the SDG that contained the PE to look for errors in method performance or sample identification. No systematic errors were found, which suggests that the identity, shipping, labeling or manufacture of the PE sample may be responsible for the poor correlation. Katalyst has routinely passed other PE samples tests prior to those supplied for this project. CH2M HILL took the pesticide/PCB PE results into consideration when performing the data validation by carefully examining all performance criteria for indications of systematic errors.

PE SAMPLE EVALUATION TABLE						
CH2MHILL OU1 EE/CA AT BELLOWS AFS						
DO 0018, THIRD PARTY DATA REVIEW, HICKAM AFB						
Compounds	Certified Values (C_v) (? g/L)	Consensus Values (M_v) (? g/L)	95% Confidence Limit (95% CL) (? g/L)	Reported Value (R_v) (? g/L)	Within 95% Confidence Limit (95% CL)	Within 99% Confidence Limit (99% CL)
VOCs						
Benzene	80.09	77.20	57.3-97.2	74.7	Yes	Yes
Chlorobenzene	65.38	62.90	48.1-77.7	66.1	Yes	Yes
Ethylbenzene	79.72	78.30	59.2-97.5	70.1	Yes	Yes
Toluene	76.66	74.50	56.1-93.0	80.5	Yes	Yes
Bromoform	129.00	124.00	94.8-153	108.4	Yes	Yes
Carbon Tetrachloride	122.60	122.00	100-144	135.1	Yes	Yes
Chloroform	114.90	115.00	90.3-141	107.0	Yes	Yes
Methylene Chloride	76.47	80.80	67.9-93.7	79.3	Yes	Yes
1,2-Dichloropropane	98.75	97.20	90.4-104	91.8	Yes	Yes
trans-1,2-Dichloroethene	89.08	94.40	66.7-122	105.5	Yes	Yes
1,1,2,2-Tetrachloroethane	136.10	135.00	92.5-177	150.2	Yes	Yes
1,1,1-Trichloroethane	107.00	109.00	77.7-141	112.3	Yes	Yes
1,1,2-Trichloroethane	120.80	122.00	90.9-152	122.2	Yes	Yes
Trichloroethene	122.70	126.00	96.9-155	120.5	Yes	Yes
Tetrachloroethene	135.20	127.00	96.8-158	144.4	Yes	Yes
Other VOC Results						

Dibromochloromethane					2.2			
SVOCs								
Anthracene	4.50			3.5-5.6	3.3	F	No	NA
Diethylphthalate	16.00			1.7-20.1	13.5		Yes	NA
Fluorene	4.10			2.8-5.8	3.2	F	Yes	NA
Hexachlorocyclopentadiene	24.50			3.1-22.5	ND	R	No	NA
Pentachlorophenol	5.00			1.9-5.7	ND		No	NA
Phenanthrene	6.00			3.7-6.7	4.8	F	Yes	NA
Other SVOC Results								
Di-n-butylphthalate			NS	NA	1.2	F	NA	NA
Pesticides								
Aldrin	10.23		8.60	6.3-11.0	ND		No	No
Beta-BHC	10.70		9.70	7.4-12.0	ND		No	No
Endosulfan I	10.61		10.10	7.2-13.1	0.07	F	No	No
Endosulfan Sulfate	10.14		10.30	6.1-14.6	0.4	F	No	No
Heptachlor	10.93		9.10	5.7-12.5	ND		No	No
Methoxychlor	10.15		9.90	6.8-12.9	ND		No	No
Other Pesticide Results								
4,4'-DDT			NS	NA	0.8	F	NA	NA
Toxaphene			NS	NA	0.4	R	NA	NA
PCB								
Aroclor 1254			5.90	3.1-8.6	ND		NA	NA
TPH								
Gasoline Range	0.32		0.33	0.2-0.5	0.8	J	No	NA
Diesel Range			1.10	0.7-1.5	0.8	F	Yes	NA

Metals								
Aluminum	646.25		647.00		541-753		630.0	Yes Yes
Antimony	499.64		511.00		424-598		598.0	Yes Yes
Arsenic	714.75		765.00		671-860		15.0	No No
Barium	682.90		695.00		635-754		703.0	Yes Yes
Beryllium	386.65		392.00		362-422		386.0	Yes Yes
Cadmium	415.79		399.00		369-429		363.0	Yes Yes
Chromium	561.90		557.00		508-606		545.0	Yes Yes
Cobalt	653.50		644.00		585-703		638.0	Yes Yes
Copper	660.90		647.00		607-686		622.0	Yes Yes
Iron	891.15		875.00		791-960		900.0	Yes Yes
Lead	825.90		850.00		769-930		16.0	No No
Manganese	720.30		720.00		665-776		670.0	Yes Yes
Mercury	19.04		18.40		15.7-21.0		20.2	Yes Yes
Nickel	953.65		974.00		897-1051		1010.0	Yes Yes
Selenium	171.16		188.00		158-217		76.2	No No
Silver	176.49		191.00		170-213		183.0	Yes Yes
Thallium	387.49		367.00		293-440		294.0	Yes Yes
Vanadium	726.10		752.00		696-806		719.0	Yes Yes
Zinc	396.93		400.00		355-445		382.0	Yes Yes
PAHs								
Acenaphthene	70.34		69.10		20.7-98.0		46.4 F	Yes Yes
Anthracene	99.65		81.90		56.1-108		51.6 F	No Yes
Benzo(a)Anthracene	57.00		50.00		46.3-53.8		37.2	No No
Fluoranthene	87.07		73.00		59.0-87.1		65.9 F	Yes Yes
Fluorene	116.90		95.00		56.2-134		76.2 F	Yes Yes
Naphthalene	118.30		91.50		34.6-148		73.4 F	Yes Yes
Other PAH Results								
Phenanthrene			NS		NA		0.9 F	NA NA
Pyrene			NS		NA		0.1 F	NA NA

Herbicides									
2,4-D			0.50		0.3 - 0.8	0.4	R	Yes	NA
2,4,5-T			3.00		2.1 - 3.9	3.2		Yes	NA
2,4,5-TP			5.00		2.5 - 7.5	3.7		Yes	NA
Other Herbicide Results									
Dichloroprop	NS		NS		NA	0.3	F	NA	NA
*Key									
NA	Not Applicable								
ND	Not Detected								
NR	No Result								
NS	Not Spiked								
J	Estimated Value								
F	Estimated Value								
R	Rejected								
VOCs	Volatile Organic Compounds								
SVOCs	Semi Volatile Organic Compounds								
PCBs	Poly-chlorinated Biphenyls								
PAH	Poly-nuclear Aromatic Hydrocarbon								

3.6.2 Critical Quality Control Issues

CH2M HILL audited Katalyst once during the procurement process and again prior to sending samples. The initial audit was through a thorough request for qualifications, and review of the laboratory quality assurance plans and method detection limits. In addition, the laboratory was interviewed during and after the procurement process. The interviews suggested that the laboratory had read and understood the AFCEE and Bellows EE/CA QAPP.

We performed a physical audit of the laboratory prior to sending samples to the laboratory. The audit findings suggested the laboratory was prepared to provide AFCEE quality data and deliverables. The laboratory instructions on the AFCEE protocols were in each laboratory section and the personnel were familiar with the key elements of the program.

Data were not delivered when promised. After numerous conference calls with key personnel, it was discovered that Katalyst was having difficulties meeting the QAPP continuing calibration verification (CCV) protocol due to the sample matrix. Katalyst chose to analyze these samples four to five times, trying to get all the compounds to pass CCV. Katalyst demonstrated that it was a matrix effect by analyzing other client samples prior to analyzing CCVs. These CCVs were in control. They would immediately analyze a Bellows EE/CA OU1 sample followed by a CCV and the CCV would fail. The only way to complete the analyses was to have Katalyst stop analyzing the samples multiple times and provide the best analytical results from these multiple analytical runs. Katalyst could not provide these results in a timely manner and was having great difficulty producing the AFCEE forms. A CH2M HILL senior chemist/database manager went to Katalyst's Peoria, Illinois laboratory and assessed the situation. The assessment revealed that Katalyst could not produce the AFCEE forms in any reasonable timeframe. CH2M HILL would have to adjust the required deliverables to more closely align with Katalyst's more routine deliverables; we would then have a deliverable that could be validated and the project could continue to move forward. These packages were produced within one week with the assistance of the CH2M HILL senior chemist/database manager. Katalyst was instructed that they were still required to produce the AFCEE forms.

The validation of these data packages began and after several weeks of many calls for missing data and documentation, we again determined that a CH2M HILL chemist should go to Katalyst's laboratory to assist in the completion of these deliverables. Our chemist spent two weeks at the laboratory reviewing deliverables and pointing out missing components. At the end of these two weeks the packages were complete enough to have a reasonable chance of being validated. Some missing information could only be discovered during the validation process. After several weeks of continued review and requests for information, the validation process was complete. The outcome was usable data for the project for most herbicide, pesticide and PCB analytes. To this point, AFCEE forms have not been delivered. No review of raw data was performed, except by TEC.

II Data Evaluation

1.0 Methodology for Data Quality Assessment

The data assessment process, as outlined in the Bellows EE/CA QAPP, determines the usability of each individual analytical result. All normal and field duplicate samples are flagged in a comprehensive database from which data are extracted and summarized for the data users.

The QC tables in Section 7.0 of the AFCEE QAPP, along with the exceptions denoted in the Bellows EE/CA QAPP, comprise the QC acceptance limits. Those limits were used during the data validation process, which was based on the procedures outlined in these QAPPs.

Data are often qualified as estimated (J flagged) because of associated QC samples, such as laboratory control samples and laboratory duplicates. In addition, results can be qualified as estimated because of additional method performance indicators. As described in the Bellows EE/CA QAPP, these data points can be used for risk assessment if the data users determine that the limitations imposed by the quality flags do not impact the intended use of the data.

The final activity in the data quality evaluation is an assessment of whether the data meets the data quality objectives (DQOs). The goal of this assessment is to demonstrate that a sufficient number of representative samples were collected and the resulting analytical data can be used to support the decisionmaking process. The precision, accuracy, representativeness, completeness and comparability (PARCC) are addressed in the AFCEE QAPP. The following summary highlights our findings.

1. The Bellows EE/CA OU1 completeness objectives were not met for all matrix/method/analyte combinations.
2. Less than 1 percent of the data is qualified because of low-level lab or field blank contamination. The majority of blank contamination observed was for results at or below the Bellows EE/CA QAPP RLs and therefore not used to qualify data. The degree to which blank contamination was observed is within reasonable method expectations.
3. Confirmed matrix effects, including field duplicates, MS/MSD recoveries, and internal standard recoveries, resulted in data flagging. Global matrix flagging was not applied based on matrix/location/analyte combinations. Instead, the risk assessors have requested that only the associated native sample be flagged. This was done during the data validation process.

III Data Management

1.0 Review of Field and Laboratory Data

The Bellows EE/CA OU1 field sampling activities and laboratory analytical data are maintained in a project database or in project files where appropriate. Data were collected and stored in a manner consistent with the requirements of the Environmental Resources Program Information Management System (ERPIMS) data loading requirements, Version 3.0 of the Data Loading Handbook (AFCEE, 1995). The data collected are sufficient but not limited to those required for the ERPIMS submittal and include the field and laboratory data listed below:

Field Data

- Daily field progress reports
- Field worksheets
- Health and safety data sheets
- Daily field notebooks
- Lithologic logs
- Well completion diagram forms
- Hydropunch sampling data sheet
- Groundwater sample collection log
- Survey coordinates
- Chain-of-custody reports
- Health and safety audit reports
- Corrective action reports

Laboratory Data

- Laboratory data packages grouped by SDG
- Corrective action reports
- Laboratory MDL studies
- Internal data evaluation reports for all data

Field data destined for electronic storage and for ERPIMS are translated from the well completion diagrams and the soil boring logs to the database and reviewed by a professional second party for accuracy and completeness. Survey coordinates are reviewed for accuracy and completeness.

Laboratory data were received in both hardcopy (an original and one copy) and in electronic comma-delimited American Standard Code for Information Interchange (ASCII) format. The receipt of both data types were logged into the sample tracking program to determine completeness and contractor turnaround time compliance. The hardcopy of the laboratory data was split into sections by method for data quality evaluation. Summary information, such as COC and corrective action reports, are copied for each data evaluator. Each evaluator is given validation instructions derived from the Bellows EE/CA QAPP.

All data quality evaluation is done using a semi-automated data validation program that utilizes laboratory hardcopy and electronic data simultaneously. All validation flags and discoveries are entered into the project database and are linked directly to each individual data point. This process both validates hardcopy data and electronic data simultaneously. All ERPIMS submittals are made from this validated database.

All data quality evaluation reports are generated from the electronic database, thus reflecting the data used by the risk assessors.

The data management system was designed to maintain the usability and integrity of the data through a series of procedures and quality control checks that began at the field site and carried through to the generation of user data. These data included both the chemical data and field operation and performance information. Both the chemical data and the field data were handled in the relational database according to the guidelines established in the Bellows EE/CA QAPP and in "Environmental Data Management Procedures and Guidelines" (CH2M HILL, December, 1992 [CVOR307/05.51]). The salient features of these documents include guidance for the following:

- **Data Mapping.** The process in which collected chemical and field data were selected, marked and named for entry into the database. Each piece of information or data was identified (or "mapped") so that the data management process entered each piece of data into the proper location within the database structure.
- **Data Usability.** The process used to supply the data users with timely data sets that have been verified and that were complete and internally consistent.

The laboratory hardcopy report original and electronic data are stored in the project files and project local area network hard drive areas in the CH2M HILL office in Redding, California. Copies of the field data and the portions of laboratory reports are stored in the CH2M HILL office in Honolulu, Hawaii.

Laboratories were required to archive the analytical data as outlined in the Bellows EE/CA QAPP.

2.0 Data Summary

Sections IV through VIII include a comprehensive list of summary tables for all validation flags, data quality evaluation reports, chains of custody, laboratory corrective action reports, method control criteria and all sample data. Access to these sections is provided on the CH2M HILL Web Site to save on paper consumption and for reader ease of use. For access instructions contact Dr. Vito D'Aurora at 530-243-5886, extension 3365 or vdaurora@ch2m.com for access instructions.

References

HQ Air Force Center for Environmental Excellence, Quality Assurance Project Plan, v 3.0, March 1998

USEPA Contract Laboratory Program National Functional Guidelines for Data Review, 1994

Environmental Data Management Procedures and Guidelines (CH2M HILL, December, 1992 [CVOR307/05.51])

Work Plan for Engineering Evaluation/Cost Analysis for Operable Unit 1, Bellows AFS, Oahu Hawaii, October 1998

Basewide Field Sampling Plan for Multiple Projects at 15 ABW Installations in Hawaii, Version 2.0, October 1998