APPENDIX C

ANALYTICAL DATA QA/QC SUMMARY

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ANALYTICAL DATA QA/QC SUMMARY

Tetra Tech implemented a quality assurance/quality control (QA/QC) program to ensure that the data quality objectives of the marine resources study were met. This QA/QC program required that all analytical results be evaluated in accordance with precision, accuracy, representativeness, comparability, and completeness (PARCC) to ensure the attainment of project-specific data quality objectives. These PARCC parameters were evaluated according to the procedures described in the sampling and analysis plan for this project, entitled, *Marine Resources Sampling and Analysis Plan: Mākua Military Reservation* (Tetra Tech, 2006).

C.1 QA/QC SUMMARY

Selected field samples were analyzed by four laboratories (Columbia Analytical Services, Kelso, WA; Battelle Marine Sciences Laboratory, Sequim, WA; Severn Trent Laboratory (STL), Sacramento, CA; and APPL Laboratory, Fresno, CA) (Table 2-3).

All four laboratories generated data that were valid and usable for the stated purpose of this project. Many of the QC exceptions that were noted are the result of either matrix interferences or caused by the heterogeneous nature of the tissue being analyzed. These minor exceptions did not result in disqualifying any data.

Major QC exceptions were primarily isolated to the organochlorine pesticide analyses and were caused by confirmation column errors that precluded the accurate quantification of specific analytes. In these cases, the data were determined to be not valid and were excluded from use in any project analyses.

The specific results of this QA/QC assessment are discussed in the following sections.

C.2 PRECISION

Precision is the degree of mutual agreement between individual measurements of the same property under similar conditions. Precision is expressed quantitatively as the measure of variability of a group of measurements compared to their average value.

Field precision was evaluated by collecting and analyzing field replicates, comparing the results, and then calculating the relative percent difference (RPD). The RPD could not be calculated on samples where the parameter was "non-detected." Laboratory precision was evaluated by each laboratory as required by the analytical method being used.

C.2.1 Field Precision

Field precision was approximated by collecting and analyzing replicate samples of fish and limu. Discrete samples of fish and limu (of identical species and similar size/age class) were collected and sent to separate laboratories for analysis; thus providing an estimate of the relative variability of contaminants within species of the same size/age cohort. Precision was evaluated for both fish tissue and limu samples.

Dioxins/Furans and Gasoline (Purgeable Organics) - RPDs could not be calculated in either fish or limu samples for these classes of contaminants since at least one of the replicates contained "non-detected" concentrations of the analyte.

VOCs/SVOCs - RPDs ranging from 174 – 196% were calculated for Di-n-butyl phthalate levels in fish tissue replicate samples 6 & 2fd; 10 & Comp 9afd/10a; NW4 & NW1fd; and NW8 & NW2fd. Limu replicate samples NW1SW1-1 & NW1SW1-1fd had a calculated RPD value of 184% for Di-n-butyl phthalate.

Metals - RPDs ranging from 0.7 – 129% were calculated for all metals in every fish tissue sample, except for antimony. RPDs ranged from 1.6 – 121% for all metals in limu tissue, except for mercury, methyl mercury, and selenium.

Explosives - Fish tissue replicate samples 6 & 2fd had a calculated RPD of 49% for perchlorate. RPDs could not be calculated for the other explosives parameters since at least one of the replicates contained "non-detected" concentrations of the analyte.

RPDs could not be calculated for limu tissue samples since at least one of the replicates contained "non-detected" concentrations of the analyte.

Organochlorine Pesticides - Fish tissue replicate samples NW4 & NW1fd had a calculated RPD of 98% for heptachlor epoxide. RPDs could not be calculated for the other explosives parameters since at least one of the replicates contained "non-detected" concentrations of the analyte.

RPDs could not be calculated for limu tissue samples since at least one of the replicates contained "non-detected" concentrations of the analyte.

C.2.2 Laboratory Precision

Laboratory precision was assessed by the analysis of laboratory duplicates (a split of the sample carried through the entire sample preparation and analysis process) and duplicate matrix spikes. Precision was expressed as the RPD of replicate results. Precision was evaluated for both fish tissue and limu samples.

Dioxins/Furans - All RPDs from the duplicate analyses were within control limits.

Gasoline (Purgeable Organics)/VOCs/SVOCs - All RPDs from the duplicate analyses were within control limits.

Metals - All RPDs from the duplicate analyses were within control limits, with the following exceptions:

Battelle reported that RPD values were within the QC criterion of ≤25% for all detected metals except one fish tissue replicate (NW1fd) for aluminum (RPD = 61%). However, acceptable precision was demonstrated on the alternate measure of precision for Al.

Columbia Analytical Services reported that the RPD for the replicate analysis of aluminum and iron in sample NW1SW1-1 was outside the normal control limits.

Since the RPDs for the laboratory control sample (LCS) and laboratory control sample duplicate (LCSD) were within the QC criterion of ≤25%, the variability of the results was attributed to the heterogeneous nature of the samples.

Explosives - All RPDs from the duplicate analyses were within control limits, with the following exceptions:

APPL reported that RPD values were within the QC criterion of ≤25% for all detected explosives except one limu sample replicate (NW1SW3-1) for nitroglycerine (RPD = 33%).

STL reported no exceptions to the QC precision criteria.

Since the RPDs for the laboratory control sample (LCS) and laboratory control sample duplicate (LCSD) were within the QC criterion of ≤25%, the variability of the results was attributed to the heterogeneous nature of the samples.

Organochlorine Pesticides - All RPDs from the duplicate analyses were within control limits, with the following exceptions:

APPL reported that laboratory control sample RPD values were within the QC criterion of ≤30%, however, the RPDs for fish tissue sample NW1fd were outside control limits for the for all detected analytes (RPD range = 30.2 – 41.7%).

Columbia Analytical Services reported no exceptions to the QC precision criteria.

Since the RPDs for the laboratory control sample (LCS) and laboratory control sample duplicate (LCSD) were within the QC criterion of ≤30%, the variability of the results was attributed to the heterogeneous nature of the samples and matrix interference.

C.2.3 Precision Summary

Replicate analysis for both fish tissue and limu indicates that there is a significant level of intraspecies variability. The noted QA/QC exceptions to precision do not disqualify the data for use in this project.

C.3 ACCURACY

Accuracy is the degree of agreement between an analytical measurement and a reference accepted as a true value. The accuracy of a measurement system can be affected by errors introduced by cross-contamination in the field sampling process, sample preservation, sample handling, matrix sample preparation, analytical techniques, and cross-contamination in the laboratory. A program of sample spiking was used to evaluate laboratory accuracy. This program included analysis of the matrix spike (MS)/matrix spike duplicate (MSD) samples, LCS/LCSD samples, and method blanks.

Accuracy is expressed as the percent recovery of an analyte that has been added (spiked) to either a laboratory or environmental sample in a known concentration before extraction and subsequent analysis.

For the purposes of this project, accuracy was assessed using laboratory QC analyses only. The results of this assessment are discussed in the following sections.

C.3.1 Dioxins/Furans

All analyses were within control limits, with the following exception:

CAS reported that the LCS percent recovery (133.8%) for OCDF exceeded the QC limits of 70-130%. This did not affect the quality of the data since all MS/MSD percent recoveries were within QC limits.

STL reported no exceptions to the QC accuracy criteria.

C.3.2 Gasoline (Purgeable Organics)/VOCs/SVOCs

Columbia Analytical Services reported the following exceptions:

VOCs

Surrogate Exceptions - The control criteria were exceeded for one or more of the following surrogates (Dibromofloromethane, Toluene-d8,and 4-Bromofluorobenzene) in samples 1; 4; 10; NW4; NW5; NW6; NW7; NW9; NW10; NW1SW2-1; Comp 8, 8a; 3; 1b; 6; 7; 9; 12; 13; 14; NW2; NW3; and NW8 due to matrix interferences.

SVOCs

Matrix Spike Recovery - The matrix spike recoveries of Di-n-butyl phthalate, Pyrene, and Bis (2-ethylhexyl) Phthalate for sample 4 were outside control criteria because of matrix interference. All recoveries in the associated LCS were within control criteria limits, indicating that the analytical batch was in control.

APPL laboratory reported the following exceptions:

VOCs

Matrix Spike Recoveries – MS/MSD analysis was performed on sample NW1fd. Most target compounds recovered outside the control limits because of matrix interference. All recoveries in the associated LCS/LCSD were within control criteria limits, indicating that the analytical batch was in control.

Metals

Columbia Analytical Services reported the following exceptions:

Methyl Mercury

Matrix Spike Recovery Exceptions – The MS/MSD recoveries of Methyl mercury for samples 4 and NW1SW1-1 were outside control criteria. Recovery in the standard reference materials (SRM) as well as all other associated QA/QC results (method blanks, ongoing precision and recovery (OPR), and quality control samples (QCS)) was acceptable, which indicates that the analyses were in control. These MS/MSD outliers suggest the presence of matrix interference(s) that could cause the results to be biased low.

Total Metals

Matrix Spike Recovery Exceptions – The MS recovery of antimony for samples 4 and NW1SW1-1 and silver for samples NW2 and NW1SW1-1 were below the lower control limit established by the laboratory. The recoveries suggest a potential low bias to these samples for antimony and silver. The laboratory reported that the samples contained a relatively high amount of insoluble material which may have contributed to the low recoveries. The recoveries for silver in the SRM were within control limits indicating that the analytical batches were in control. The laboratory noted that the SRMs analyzed do not have certified values for antimony.

The control criteria for MS recoveries of aluminum, iron, and manganese for samples 4 and of aluminum and iron for sample NW1SW1-1 are not applicable since the analyte concentrations in the samples were significantly higher than the added spike concentrations, preventing accurate evaluation of the spike recoveries. Additionally, the MS recovery of manganese for sample NW1SW1-1 was outside laboratory control criteria as a result of the heterogeneous character of the sample. The RPD for the replicate analysis supports this. Variability between replicates was sufficient to bias the percent recoveries. The associated laboratory QA/QC results indicate that the analysis was in control.

Battelle reported that all accuracy criteria were within control limits.

Explosives

All accuracy QA/QC measures were within control limits, with the following exceptions:

APPL reported that samples 4 and NW1SW3-1 were selected by Tetra Tech for MS/MSD analysis. The MS/MSD results for sample 4 indicate that the percent recovery of RDX exceeded control limits with a high bias (152% and 194%). The MS/MSD results for sample

NW1SW3-1 indicate that the percent recovery for 2,4-DNT recovered below control limits, at 77.3% and 68.4%. Additionally, the laboratory reported that nitroglycerine recovered below the control limits, at 63.9%.

STL reported that nitroglycerine was positively identified in sample 2fd on the primary column. However, accurate quantification of the analyte could not be made since a large interference peak eluted at the retention time of the analyte on the confirmation column. Additionally, the nitroglycerine result for sample 9afd/10a Comp was flagged because the analyte was below the reporting limit on the confirmation column. Since this analyte could not be accurately quantified, the nitroglycerine result for these two samples should be excluded from use and not included in any project analyses.

STL flagged the RDX result for sample NW1SW1-1fd because the RPD between the primary and confirmation column exceeded the control criteria of 40%, which precluded accurate quantification of this analyte in the sample. Since this analyte could not be accurately quantified, the RDX result for this sample should be excluded from use and not included in any project analyses.

Organochlorine Pesticides

All accuracy QA/QC measures were within control limits, with the following exceptions:

Columbia Analytical Services reported that the confirmation comparison criteria of 40% difference between the primary and confirmation columns was exceeded for a few analytes in most of the field samples. Since these analytes could not be accurately quantified in these samples, they should be excluded from use and not included in any project analyses.

Accuracy Summary – The noted QA/QC exceptions do not disqualify the data for use in this project, with the following exceptions:

- Sample 2fd (Nitroglycerine)
- Sample 9afd/10a Comp (Nitroglycerine)
- Sample NW1SW1-1fd (RDX)
- Sample 1 (beta BHC, delta BHC, Heptachlor)
- Sample 1b (beta BHC, gamma BHC, Heptachlor epoxide)
- Sample 3 (Aldrin, 4,4'-DDT, Heptachlor epoxide)
- Sample 5 (Heptachlor epoxide)
- Sample 6 (Aldrin)
- Sample 7 (Aldrin)
- Sample Comp 8, 8a (gamma BHC, Heptachlor epoxide)
- Sample 10 (delta BHC, Heptachlor epoxide)
- Sample 12 (Heptachlor epoxide)

- Sample 13 (beta BHC, delta BHC)
- Sample 14 (beta BHC)
- Sample NW1fd (Heptachlor)
- Sample NW2 (beta BHC, Heptachlor epoxide)
- Sample NW5 (gamma BHC, Heptachlor epoxide)
- Sample NW6 (gamma BHC)
- Sample NW10 (Heptachlor epoxide)
- Sample NW1SW2-1 (Aldrin, beta BHC, Heptachlor epoxide)

C.4 REPRESENTATIVENESS

Representativeness expresses the degree to which sample data accurately and precisely represent the characteristics of a population, variations in a parameter at a sampling point, or an environmental condition. For this project, representative data were obtained by selecting sampling locations and by collecting multiple specimens. The following questions were used to assess representativeness:

- Were the appropriate species used?
- Were samples handled correctly?
- Were samples collected from appropriate locations?
- Were an appropriate number of samples collected and analyzed?
- Did other factors bias the results?

C.4.1 Representativeness Summary

All assessment parameters were in compliance with the project goals as described in the project document entitled, *Marine Resources Sampling and Analysis Plan: Mākua Military Reservation* (Tetra Tech, 2006), with the following exception:

A significant number of organochlorine data were disqualified because they could not be accurately quantified. Additionally, nitroglycerine and RDX data from three samples were disqualified. This resulted in a reduced number of valid data with which to use in the project assessment.

C.5 COMPARABILITY

Comparability is a qualitative parameter that expresses the degree of confidence with which one data set can be compared to another. Comparability of data was achieved by consistently following procedures for sampling and field activities, by using the same types of sampling equipment at each location, and by using standard measurement units in reporting analytical data.

C.5.1 Comparability Summary

All assessment parameters were in compliance with the project goals as described in the project document entitled, *Marine Resources Sampling and Analysis Plan: Mākua Military Reservation* (Tetra Tech, 2006).

C.6 COMPLETENESS

Completeness is a measure of the percentage of project-specific data that are valid. Valid data are obtained when samples are collected and analyzed in accordance with QC procedures outlined in the SAP and when none of the QC criteria that affect data usability are exceeded. Data that were validated and qualified as estimated will not be counted against the completeness goal because they are considered usable. Only rejected data or data not collected will be counted against the completeness goal.

As a guideline, data completeness should be approximately 90% for each analyte for all samples.

C.6.1 Comparability Summary

All analytes met or exceeded the 90% completeness guideline, with the following exception:

A significant number of organochlorine data were disqualified because they could not be accurately quantified. This resulted in a reduced number of valid data with which to use in the project assessment.

TETRA TECH
LABORATORY REPORT EVALUATION CHECKLIST

Project Name: Makua Shellfish Study Laboratory Used: APPL Sample Matrix: biological tissue
Project Number: 100-SFO-T95M78 Lab Project Number: ARF 57114 Checked By/On: YKP

	N/A	YES	NO
Is a Quality Assurance Project Plan (QAPP), Work Plan or a Sampling and Analysis (SAP) available?		✓	
Was the frequency stated in the QAPP, Work Plan or SAP for field duplicates, rinsate blanks and trip blanks met? one field duplicate missing due to limited sample availability			✓
Chain-of-Custody and Request for Analysis (CC/RA) Records:			
Is the CC/RA present and the original copy? (electronic report, no ~~original~~ original copy)			✓
Is the CC/RA complete and signed off as appropriate? no receiving APPL signature YKP			✓
Was the temperature received recorded by the laboratory and was it 4°C, ±2°? if not what _____. 2.5°C		✓	
Were any problems noted by the laboratory on the CC/RA? What? _____			✓
CC/RA - Laboratory Report Agreement:			
Were all the samples on the CC/RA analyzed as requested and instructions followed?		✓	
Is the Field Sample Identification and the Laboratory Number relationship consistent between the CC/RA and the laboratory report?		✓	
Do the Sampled and Received dates on the CC/RA match those on the laboratory report for each sample?		no	signature
Was the report signed and each report page stamped with the TETRA TECH "Date Received..." stamp? (1st page only)		✓	
Was a project narrative available and read?		✓	
Were any problems noted in the narrative? Describe see page 2		✓	
Were method numbers, matrices, units and reporting limits indicated and appropriate?		✓	
Was all other report heading information accurate?		✓	
Were all field duplicates within relative percent difference (RPD) control limits?	✓		
Were all results for field, rinsate and trip blanks ND?	✓		

TETRA TECH
LABORATORY REPORT EVALUATION CHECKLIST

Project Name: Makua Shellfish Study Laboratory Used: APPL
Project Number: 100-SFO-795M78 Lab Project Number: ARF57114

Sample Matrix: biological tissue
Checked By/On: YKP 11/9/2008

Analysis	Laboratory QC Batch Number	Number of TETRA TECH Samples in Batch	Holding Times Met	Surrogates	Method Blank (MB)	Matrix Spike/Matrix Spike Duplicate (MS/MSD)	Laboratory Control Spike (LCS)
8330B	$83TTS-081013A		✓	LCS (1/1 low)	✓	limited sample vol	low surrogate
8270C	$8270S-08193A		✓	✓	✓		✓
6020	$6020S-081016A/1		✓	NA	small blank hit		✓
7471	$HGS-081003A		✓	NA	✓		✓
8081A	$8SS-081013A		✓	✓	✓		✓
8290	$829ET27S-081010		✓	Blank 1/9 low	blank hit 1/9 surrogate low		✓
8260B	$8260S-081003BC		✓	✓	✓		✓
314.0	$314S-081006A		✓	NA	✓		✓

Date	Issues and Actions Taken
11/9/2008 YKP	8330B – low LCS surrogate, spike recovery within limits → data accepted → NFA
11/9/2008	6020 – Zn + AL → small blank hit → below PQL → NFA
11/9/2008	8290 – small blank hits → sample ND → NFA
11/9/2008	8290 – 1 of 9 blank surrogates low → NFA
11/9/2008	8260 – use 8260 soil data, both runs pass but MeOH would have higher RL
11/9/2008	missing signature on COC → revised by laboratory

TETRA TECH
LABORATORY REPORT EVALUATION CHECKLIST

Project Name: Nakua Shellfish Study
Project Number: 100-SF0795M78

Laboratory Used: APPL
Lab Project Number: ARF 57121

Sample Matrix: biological tissue
Checked By/On: YKP, 11/8/2008

	N/A	YES	NO
Is a Quality Assurance Project Plan (QAPP), Work Plan or a Sampling and Analysis (SAP) available?		✓	
Was the frequency stated in the QAPP, Work Plan or SAP for field duplicates, rinsate blanks and trip blanks met? (one field dup missing due to limited sample availability)			✓
Chain-of-Custody and Request for Analysis (CC/RA) Records:			
Is the CC/RA present and the original copy? (electronic copy of report, no original COC)		YKP ✓	✓
Is the CC/RA complete and signed off as appropriate?		✓	
Was the temperature received recorded by the laboratory and was it 4°C, ±2°? if not what _____. 2°C		✓	
Were any problems noted by the laboratory on the CC/RA? What? _____			✓
CC/RA - Laboratory Report Agreement:			
Were all the samples on the CC/RA analyzed as requested and instructions followed?		✓	
Is the Field Sample Identification and the Laboratory Number relationship consistent between the CC/RA and the laboratory report?		✓	
Do the Sampled and Received dates on the CC/RA match those on the laboratory report for each sample?		✓	
Was the report signed and each report page stamped with the TETRA TECH "Date Received..." stamp?		✓	
Was a project narrative available and read?		✓	
Were any problems noted in the narrative? Describe see 2nd page		✓	
Were method numbers, matrices, units and reporting limits indicated and appropriate?		✓	
Was all other report heading information accurate?		✓	
Were all field duplicates within relative percent difference (RPD) control limits?	✓		
Were all results for field, rinsate and trip blanks ND?	✓		

TETRA TECH
LABORATORY REPORT EVALUATION CHECKLIST

Project Name: Makua Shellfish Study
Project Number: 100-SFO-T95M78

Laboratory Used: APPL
Lab Project Number: ARF 57121

Sample Matrix: biological tissue
Checked By/On: YKP 11/8/2008

Analysis	Laboratory QC Batch Number	Number of TETRA TECH Samples in Batch	Holding Times Met	Surrogates	Method Blank (MB)	Matrix Spike/Matrix Spike Duplicate (MS/MSD)	Laboratory Control Spike (LCS)
8330B	$83TTS-081013A		✓	LCS (1/1 low)	✓	limited sample vol.	low surrogate ✓
8270 C	$8270S-081013A		✓	sample 1/6 high	✓		✓
6020	$6020-081016A (1)		✓	NA	small blank hit		✓
7471	$HG-S-081003A1		✓	NA	✓		✓
8081A	$88SS-081013A		✓	✓	✓		✓
8290	$829ET2TS-081010		✓	Blank 1/9 low	small blank hit 1/9 surr. low		✓
8260B	$8260S-081003AC		✓	✓	✓		✓
314.0	$3145-081006A		✓	NA	✓		✓

Date	Issues and Actions Taken
11/8/2008	8330B - low LCS surrogate, spike recovery within limits -> data accepted -> no further action
11/8/2008	8270C - 1 of 6 surrogates high in sample -> sample ND -> no further action
11/8/2008	6020 - Zn + Al -> small blank hit -> below PQL -> no further action
11/8/2008	8290 - small blank hits -> sample ND -> NFA
11/8/2008	8290 - 1 of 9 surrogates low in blank -> NFA

TETRA TECH
LABORATORY REPORT EVALUATION CHECKLIST

Project Name: Makua Shellfish Study
Project Number: 100-SFO-T95M78
Laboratory Used: APPL
Lab Project Number: ARF 57149
Sample Matrix: Biological tissue
Checked By/On: YKP 11/8/2008

	N/A	YES	NO
Is a Quality Assurance Project Plan (QAPP), Work Plan or a Sampling and Analysis (SAP) available?		✓	
Was the frequency stated in the QAPP, Work Plan or SAP for field duplicates, rinsate blanks and trip blanks met? one field dup missing due to limited sample availability			✓
Chain-of-Custody and Request for Analysis (CC/RA) Records:			
Is the CC/RA present and the original copy? electronic copy of report, no original COC)			✓
Is the CC/RA complete and signed off as appropriate?		✓	
Was the temperature received recorded by the laboratory and was it 4°C, ±2°? if not what _____. 2.5/3.0°C		✓	
Were any problems noted by the laboratory on the CC/RA? What? _____			✓
CC/RA - Laboratory Report Agreement:			
Were all the samples on the CC/RA analyzed as requested and instructions followed?		✓	
Is the Field Sample Identification and the Laboratory Number relationship consistent between the CC/RA and the laboratory report?		✓	
Do the Sampled and Received dates on the CC/RA match those on the laboratory report for each sample? receipt time is off by 5min between login sheet and COC		~~✓~~ YKP	✓
Was the report signed and each report page stamped with the TETRA TECH "Date Received..." stamp?		✓	
Was a project narrative available and read?		✓	
Were any problems noted in the narrative? Describe see page 2		✓	
Were method numbers, matrices, units and reporting limits indicated and appropriate?		✓	
Was all other report heading information accurate?		✓	
Were all field duplicates within relative percent difference (RPD) control limits?	✓		
Were all results for field, rinsate and trip blanks ND?	✓		

TETRA TECH
LABORATORY REPORT EVALUATION CHECKLIST

Project Name: Makua Shellfish Study
Project Number: 100-SFO-T95M78

Laboratory Used: APPL
Lab Project Number: ARF57149

Sample Matrix: Biological tissue
Checked By/On: YKP 11/8/2008

Analysis	Laboratory QC Batch Number	Number of TETRA TECH Samples in Batch	Holding Times Met	Surrogates	Method Blank (MB)	Matrix Spike/Matrix Spike Duplicate (MS/MSD)	Laboratory Control Spike (LCS)
8330	$83TTS-081013A		✓	LCS (1/1 low)	✓	limited sample vol	low surrogate
8270C	$8270S-081013A		✓	✓	✓		✓
6020	$6020S-081016A(1)		✓	NA	small blank hit		✓
7471	$HG-S-081013A		✓	NA	✓		✓
8081 A	$8SSS-081013A		✓	✓	✓		✓
8290	$8290ET27S081010		✓	Blank 1/9 low	small blank hit surrogate low		✓
8260 B	$8260S-081008BAM $8260S-081009AC	$8260S-081008AM1	✓	SBNS-01A surrogates 3/4 fail – MeOH passes	✓		✓
314.0	$314S-081014A		✓	NA			✓

Date	Issues and Actions Taken
11/8/2008	8330B – low LCS surrogate, spike recovery within limits -> data accepted -> NFA
11/8/2008	~~8270C~~ YKP – 6020 – Zn + Al -> small blank hit -> below PQL -> NFA
11/8/2008	8290 – small blank hits -> samples ND -> NFA
11/8/2008	8290 – 1 of 9 surrogates low in blank -> NFA
11/8/2008	8260 – SBNS-01-A surrogates (3/4) fail, methanol dilution passes -> use MeOH data

TETRA TECH
LABORATORY REPORT EVALUATION CHECKLIST

Project Name: Makua Shellfish Study
Project Number: 100-SFO-795M78
Laboratory Used: APPL
Lab Project Number: ARF 57162
Sample Matrix: biological tissue
Checked By/On: YKP 11/7/2008

	N/A	YES	NO
Is a Quality Assurance Project Plan (QAPP), Work Plan or a Sampling and Analysis (SAP) available?		✓	
Was the frequency stated in the QAPP, Work Plan or SAP for field duplicates, rinsate blanks and trip blanks met? one field dup missing due to limited sample availability			✓
Chain-of-Custody and Request for Analysis (CC/RA) Records:			
Is the CC/RA present and the original copy? no original copy -> electronic report			✓
Is the CC/RA complete and signed off as appropriate?		✓	
Was the temperature received recorded by the laboratory and was it 4°C, ±2°? if not what _____. 3°C		✓	
Were any problems noted by the laboratory on the CC/RA? What? _____			✓
CC/RA - Laboratory Report Agreement:			
Were all the samples on the CC/RA analyzed as requested and instructions followed?		✓	
Is the Field Sample Identification and the Laboratory Number relationship consistent between the CC/RA and the laboratory report?		✓	
Do the Sampled and Received dates on the CC/RA match those on the laboratory report for each sample?		✓	
Was the report signed and each report page stamped with the TETRA TECH "Date Received..." stamp? (1st page only)		✓	
Was a project narrative available and read?		✓	
Were any problems noted in the narrative? Describe see page 2		✓	
Were method numbers, matrices, units and reporting limits indicated and appropriate?		✓	
Was all other report heading information accurate?		✓	
Were all field duplicates within relative percent difference (RPD) control limits?	✓		
Were all results for field, rinsate and trip blanks ND?	✓		

TETRA TECH
LABORATORY REPORT EVALUATION CHECKLIST

Project Name: Makua Shellfish Study Laboratory Used: APPL
Project Number: 100-SFO-795178 Lab Project Number: ARF 57162

Sample Matrix: biological tissue
Checked By/On: YWP 11/7/2008

Analysis	Laboratory QC Batch Number	Number of TETRA TECH Samples in Batch	Holding Times Met	Surrogates	Method Blank (MB)	Matrix Spike/Matrix Spike Duplicate (MS/MSD)	Laboratory Control Spike (LCS)
8330B	$83TTS-081013A		✓	LCS (1/1 low)	✓	limited sample vol.	surrogate low
8270C	$8270S-081013A		✓	✓	✓		✓
6020	$6020S-081096A/1		✓	NA	small blank hit		✓
7471A	$HG-S-081013A1		✓	NA	✓		✓
8081A	$8885-081013A		✓	✓	✓		✓
8290	$829ET27S-081010		✓	9/9 low – sample 1/9 low – blank	1/9 low surrogate small blank OK hit		✓
8260B	$8260S-081008AC		✓	2/4 fail sample MeOH dilution passes	✓		✓
314.0	$314S-081014A		✓	NA	✓		✓

Date	Issues and Actions Taken
11/7/2008	8330B low LCS surrogate, spike recovery within limits -> data accepted -> NFA
11/7/2008	6020 - Zn + Al -> small blank hit -> below PQL -> NFA
11/7/2008	8290 - all sample surrogates fail low -> sample run at 1x dilution -> lab contacted
	on 11/9/2008 -> sample was rerun with similar results -> results rejected
11/7/2008	8290 - 1 of 9 blank LCS low & small blank hit -> NFA (atm)
11/7/2008	8260 - 2 of 4 sample LCS fail -> use MeOH dilution results

TETRA TECH
LABORATORY REPORT EVALUATION CHECKLIST

Project Name: Makua Shellfish Study Laboratory Used: APPL Sample Matrix: biological tissue
Project Number: 100-SFO-T95M78 Lab Project Number: ARF 57201 Checked By/On: XP 11/9/2005

	N/A	YES	NO
Is a Quality Assurance Project Plan (QAPP), Work Plan or a Sampling and Analysis (SAP) available?		✓	
Was the frequency stated in the QAPP, Work Plan or SAP for field duplicates, rinsate blanks and trip blanks met? one field dup missing due to limited sample availability			✓
Chain-of-Custody and Request for Analysis (CC/RA) Records:			
Is the CC/RA present and the original copy? no original COC -> electronic copy			✓
Is the CC/RA complete and signed off as appropriate?		✓	
Was the temperature received recorded by the laboratory and was it 4°C, ±2°? if not what _____. 3°C		✓	
Were any problems noted by the laboratory on the CC/RA? What? _____			✓
CC/RA - Laboratory Report Agreement:			
Were all the samples on the CC/RA analyzed as requested and instructions followed?		✓	
Is the Field Sample Identification and the Laboratory Number relationship consistent between the CC/RA and the laboratory report?		✓	
Do the Sampled and Received dates on the CC/RA match those on the laboratory report for each sample?		✓	
Was the report signed and each report page stamped with the TETRA TECH "Date Received..." stamp? 1st page only		✓	
Was a project narrative available and read?		✓	
Were any problems noted in the narrative? Describe see page 2		✓	
Were method numbers, matrices, units and reporting limits indicated and appropriate?		✓	
Was all other report heading information accurate?		✓	
Were all field duplicates within relative percent difference (RPD) control limits?	✓		
Were all results for field, rinsate and trip blanks ND?	✓		

TETRA TECH
LABORATORY REPORT EVALUATION CHECKLIST

Project Name: Hakua Shellfish Study
Project Number: 100-SFO-T95M78
Laboratory Used: APPL
Lab Project Number: ARF 57201
Sample Matrix: biological tissue
Checked By/On: YKP

Analysis	Laboratory QC Batch Number	Number of TETRA TECH Samples in Batch	Holding Times Met	Surrogates	Method Blank (MB)	Matrix Spike/Matrix Spike Duplicate (MS/MSD)	Laboratory Control Spike (LCS)
8330 B	$85TTS-081020A		✓	✓	✓	limited sample vol	✓
8270C	$8270S-081013A		✓	2 of 6 sample surrogates fail	✓		✓
6020	$6020S-081016A/1		✓	NA	small blank hit		✓
7471	$HG-S-081013A2		✓	NA	✓		✓
8081 A	$88SS-081013A		✓	✓	✓		✓
8290	$829ET2TS-081010		✓	1/9 in Blank low	small blank hit surr. low		✓
8260 B	$8260S-081013A2	MeOH data	✓	✓	✓		✓
314.0	$314S-081014A		✓	NA	✓		✓

Date	Issues and Actions Taken
11/9/2008	8270C - surrogates -> Terphenyl-d14 is high -> sample ND - NFA
	-> Phenol (S) - is low -> ~~PCP might have low bias~~ data accepted -> NFA
11/9/2008	6020 - Zn & Al -> small blank hit, below PQL -> NFA
11/9/2008	8290 - comment RE sample surr. incorrect -> emailed lab -> revised
11/9/2008	8290 - small blank hits -> below PQL & sample ND -> NFA
	8290 - 1 of 9 surrogates low in blank -> NFA
11/9/2008	8260 - use methanol dilution data -> NFA

TETRA TECH

LABORATORY REPORT EVALUATION CHECKLIST

Project Name: Nakua Shellfish Study
Project Number: 100-SFO-T95M78

Laboratory Used: APPL
Lab Project Number: ~~ARF 5221~~ 57221 MS

Sample Matrix: biological tissue
Checked By/On: YKP 11/9/2008

	N/A	YES	NO
Is a Quality Assurance Project Plan (QAPP), Work Plan or a Sampling and Analysis (SAP) available?		✓	
Was the frequency stated in the QAPP, Work Plan or SAP for field duplicates, rinsate blanks and trip blanks met? (one field duplicate missing due to limited sample availability)			✓
Chain-of-Custody and Request for Analysis (CC/RA) Records:			
Is the CC/RA present and the original copy? (no original copy → electronic report)			✓
Is the CC/RA complete and signed off as appropriate?		✓	
Was the temperature received recorded by the laboratory and was it 4°C, ±2°? if not what _____. 2°C		✓	
Were any problems noted by the laboratory on the CC/RA? What? _____			✓
CC/RA - Laboratory Report Agreement:			
Were all the samples on the CC/RA analyzed as requested and instructions followed?		✓	
Is the Field Sample Identification and the Laboratory Number relationship consistent between the CC/RA and the laboratory report?		✓	
Do the Sampled and Received dates on the CC/RA match those on the laboratory report for each sample?		✓	
Was the report signed and each report page stamped with the TETRA TECH "Date Received..." stamp?		✓	(coverpage only)
Was a project narrative available and read?		✓	
Were any problems noted in the narrative? Describe insufficient sample volume for % moisture analysis		✓	
Were method numbers, matrices, units and reporting limits indicated and appropriate?		✓	
Was all other report heading information accurate?		✓	
Were all field duplicates within relative percent difference (RPD) control limits?	✓		
Were all results for field, rinsate and trip blanks ND?	✓		

TETRA TECH
LABORATORY REPORT EVALUATION CHECKLIST

Project Name: Makua Shellfish Study
Project Number: 100-SFO-T95478

Laboratory Used: APPL
Lab Project Number: ARF 57221

Sample Matrix: biological tissue
Checked By/On: VKP 11/9/2008

Analysis	Laboratory QC Batch Number	Number of TETRA TECH Samples in Batch	Holding Times Met	Surrogates	Method Blank (MB)	Matrix Spike/Matrix Spike Duplicate (MS/MSD)	Laboratory Control Spike (LCS)
8330B	$83TTS-081020A ~~081021A~~	✓	✓	✓	✓	limited sampleval	✓
8270C	$8270S-081013A		✓	Sample (3 of 6)	✓		✓
6020	$6020S-081016A/1		✓	NA	small blank hit		✓
7471A	$HG-S-081022A		✓	NA	✓		✓
8081A	$8SS-081013A		✓	✓	✓		spike recovery high
8290	$829ETZTS-081010		✓	✓	small blank hit		✓
8260B	$8260S-081016AH		✓	sample 4/4 fail	sample blank hit in MeOH dil.		
314.0	$314S-081021A		✓	NA	✓		✓

Date	Issues and Actions Taken
11/9/2008 8270	3 of 6 surrogates of the sample did not pass, LCS & Blank passed, ~~PCP might have a low bias -> laboratory conducted 11/9/2008~~ VKP NFA - data accepted - PCP may have low bias
11/9/2008	Zn + Al -> small blank hit -> below PQL -> NFA -
11/9/2008	8081 - 1 LCS spike recovery high -> sample ND -> NFA
11/9/2008	8290 - small blank hit -> sample results below PQL -> NFA | TCDD, total results assumed ND -> blank > sx result
11/9/2008	8260 - all 4 surrogates fail for sample, 2 blank hits on MeOH-dil sample

↳ use undiluted data, 3 of 4 surrogates fail high
-> high bias assumed
-> samples ND

~~↳ sample ND @ PQL~~
~~↳ use MeOH data @ PQL~~
~~-> blank hits are above PQL~~
~~-> check in with lab if other data available~~ VKP

TETRA TECH

LABORATORY REPORT EVALUATION CHECKLIST

Project Name: Makua Shellfish Study Laboratory Used: TestAmerica West Sacramento Sample Matrix: biological tissue
Project Number: 100-SFO-T95M78 Lab Project Number: 68J70331 Checked By/On: YKP, 11/8/2008

	N/A	YES	NO
Is a Quality Assurance Project Plan (QAPP), Work Plan or a Sampling and Analysis (SAP) available?		✓	
Was the frequency stated in the QAPP, Work Plan or SAP for field duplicates, rinsate blanks and trip blanks met? (one field dup missing due to limited sample availability)			✓
Chain-of-Custody and Request for Analysis (CC/RA) Records:			
Is the CC/RA present and the original copy? (electronic report, no original COC available)			✓
Is the CC/RA complete and signed off as appropriate? COC receipt date time does not match report			✓
Was the temperature received recorded by the laboratory and was it 4°C, ±2°? if not what _____. 2°C		✓	
Were any problems noted by the laboratory on the CC/RA? What? _____			✓
CC/RA - Laboratory Report Agreement:			
Were all the samples on the CC/RA analyzed as requested and instructions followed? Perchlorate run by 8321			✓
Is the Field Sample Identification and the Laboratory Number relationship consistent between the CC/RA and the laboratory report?		✓	
Do the Sampled and Received dates on the CC/RA match those on the laboratory report for each sample?			✓ (time off see above)
Was the report signed and each report page stamped with the TETRA TECH "Date Received..." stamp?		✓	
Was a project narrative available and read?		✓	
Were any problems noted in the narrative? Describe insufficient volume for MS/MSD except for 6020. 6020 - raised RLs due to matrix interference		✓	
Were method numbers, matrices, units and reporting limits indicated and appropriate?		✓	
Was all other report heading information accurate?		✓	
Were all field duplicates within relative percent difference (RPD) control limits?	✓		
Were all results for field, rinsate and trip blanks ND?	✓		

TETRA TECH
LABORATORY REPORT EVALUATION CHECKLIST

Project Name: Makua Shellfish Study
Project Number: 100-SFO-T9SM78

Laboratory Used: TestAmerica Sacramento
Lab Project Number: G8J170331

Sample Matrix: biological tissue
Checked By/On: YKP, 11/8/2008

Analysis	Laboratory QC Batch Number	Number of TETRA TECH Samples in Batch	Holding Times Met	Surrogates	Method Blank (MB)	Matrix Spike/Matrix Spike Duplicate (MS/MSD)	Laboratory Control Spike (LCS)
8260B	8298695	2	✓	✓	✓	limited sample vol.	✓
8081A	8297336	2	✓	✓	✓		✓
8270C	8297344	2	✓	✓	✓		✓
8330	8297430	2	✓	✓	✓		✓
8321	8298336	1	✓	NA	✓		✓
8290	8295609	2	✓	✓	✓		✓
6020	8296157	2	✓	NA	blank contamination	some recoveries low -> RPD good	✓
7471A	8295364	1	✓	NA	✓	limited sample vol	✓

Date	Issues and Actions Taken
11/7/2008	call to lab re: Blank hits -> all blank hits below respective RLS
	sample results between 6x - 18x larger than blank values, some results
	right around RLS, -> data accepted -> no further action
	Blank hits for Ag, Cr, Cu, Fe, Se and Zn
	Ag - sample result ND
11/9/2008	laboratory contacted re: coc receipt time -> lab responds: one time is receipt time the other when cooler was unpacked -> No further action

TETRA TECH
LABORATORY REPORT EVALUATION CHECKLIST

Project Name: Mekua Shellfish Study
Project Number: 100-SFO-T95M78

Laboratory Used: Test America - West Sacramento
Lab Project Number: 6B7210326

Sample Matrix: biological tissue
Checked By/On: YKP, 11/8/2008

	N/A	YES	NO
Is a Quality Assurance Project Plan (QAPP), Work Plan or a Sampling and Analysis (SAP) available?	YKP ✓	✓	
Was the frequency stated in the QAPP, Work Plan or SAP for field duplicates, rinsate blanks and trip blanks met? (one field dup. missing due to limited sample availability.	✓		✓
Chain-of-Custody and Request for Analysis (CC/RA) Records:			
Is the CC/RA present and the original copy? (electronic copy, no original COC available)			✓
Is the CC/RA complete and signed off as appropriate?		✓	
Was the temperature received recorded by the laboratory and was it 4°C, ±2°? if not what -5°C. (accepted)			✓
Were any problems noted by the laboratory on the CC/RA? What? one jar was not labeled, this was clarified and resolved with cynthia @ APPL.		✓	
CC/RA - Laboratory Report Agreement:			
Were all the samples on the CC/RA analyzed as requested and instructions followed? Perchlorate data missing			✓
Is the Field Sample Identification and the Laboratory Number relationship consistent between the CC/RA and the laboratory report?		✓	
Do the Sampled and Received dates on the CC/RA match those on the laboratory report for each sample?		✓	
Was the report signed and each report page stamped with the TETRA TECH "Date Received..." stamp?		✓	
Was a project narrative available and read?		✓	
Were any problems noted in the narrative? Describe no MS/MSD due to limited sample volume (MS/MSD done only on 6020), 6020 diluted due to matrix interference		✓	
Were method numbers, matrices, units and reporting limits indicated and appropriate?		✓	
Was all other report heading information accurate?		✓	
Were all field duplicates within relative percent difference (RPD) control limits?	✓		
Were all results for field, rinsate and trip blanks ND?	✓		

TETRA TECH
LABORATORY REPORT EVALUATION CHECKLIST

Project Name: Makua Shellfish Study
Project Number: 100-SFO-T95M78

Laboratory Used: TestAmerica West Sacramento
Lab Project Number: G8J210326

Sample Matrix: biological tissue
Checked By/On: YKP, 11/8/2008

Analysis	Laboratory QC Batch Number	Number of TETRA TECH Samples in Batch	Holding Times Met	Surrogates	Method Blank (MB)	Matrix Spike/Matrix Spike Duplicate (MS/MSD)	Laboratory Control Spike (LCS)
8260B	8298695	2	✓	✓	✓	limited sample vol.	✓
8081A	8297336	2	✓	✓	✓	↓	✓
8270C	8297344	2	✓	✓	✓	↓	✓
8330	8297430	2	✓	✓	✓	↓	✓
8290	8295609	2	✓	✓	✓	↓	✓
6020	8296157	2	✓	NA	Blank contamination	some recoveries low, RPD good	✓
7471A	8301239	1	✓	NA	✓	limited sample vol.	✓
8321A	8316300	1	✓	NA	✓	↓	✓

Date	Issues and Actions Taken
11/8/2008	Blank hits for Ag, Cr, Cu, Fe, Se and Zn ; Ag sample result -> ND - no further action
11/7/2008	call to lab RE: Blank hits
	-> All blank hits were below the respective RLs, sample results between 5x-15x larger
	than blank values -> data accepted -> no further action (Cu + Cr right around RL)
11/8/2008	8321 -> results missing -> contact lab via email -> sample run and reported on 11/17/2008
11/7/2008	6020 -> MS/MSD -> some recoveries low, but close to limits -> data accepted