appendix C

QUALITY ASSURANCE/ QUALITY CONTROL

QUALITY ASSURANCE/QUALITY CONTROL

This appendix details quality assurance/quality control information for the water quality analyses, sediment geochemistry analyses, tissue chemistry analyses, invertebrate taxonomy, and otter trawl sample collection conducted for the District's 2007-08 ocean monitoring program.

INTRODUCTION

The Core monitoring program was designed to measure compliance with permit conditions and for temporal and spatial trend analysis. The program includes measurements of:

- Water quality;
- Sediment quality;
- Benthic infaunal community health;
- Fish and macroinvertebrate community health;
- Fish tissue contaminant concentrations (chemical body burden); and
- Fish health (including external parasites and diseases).

The Core monitoring program complies with the Orange County Sanitation District (OCSD) Quality Assurance/Quality Control (QA/QC) Program requirements and applicable federal, state, local, and contract requirements. The objectives of the quality assurance program are as follows:

- Scientific data generated will be of sufficient quality to stand up to scientific and legal scrutiny.

- Data will be gathered or developed in accordance with procedures appropriate for the intended use of the data.

- Data will be of known and acceptable precision, accuracy, representativeness, completeness, and comparability as required by the program.

The various aspects of the program are conducted on a schedule that varies weekly, monthly, quarterly, semi-annually, and annually. Table C-1 shows that sampling goals were achieved for >99.5 percent of the required samples. Sampling and data analysis is characterized by quarters one through four, which are representative of summer (July–September), fall (October–December), winter (January–March), and spring (April–June) seasons, respectively.

Table C-1. Ocean monitoring program sample collection - percent completion, July 2007–June 2008.

Orange County Sanitation District, California.

Quarter	Program Type	Parameter	Nominal # of Samples	# of Samples Collected	# of QA Duplicates (≤10%)	%Samples Collected
1	Water Quality	CTD Drops	105	105	11	100
		Ammonium	470	470	81	100
		Bacteria	260	260	25	100
	Sediment Chemistry	Grain size	49	49	7	100
		TOC	49	49	7	100
		Dissolved Sulfides	49	49	7	100
		Metals	49	49	7	100
		PCB/Pesticides	49	49	8	100
		PAH	49	49	8	100
		LAB	49	49	8	100
	Fish Community	Trawls	22	22	NA	100
	Fish Tissue	Hornyhead turbot	20 x 2 *	20 x 2 *	5	100
		English sole	20 x 2 *	20 x 2 *	5	100
		Sanddab Guild	18	18	0	100
2	Water Quality	CTD Drops	105	105	13	100
		Ammonium	470	469	81	99.8
		Bacteria	260	259	25	99.6
	Sediment Chemistry	Grain size	10	10	1	100
		TOC	10	10	1	100
		Dissolved Sulfides	10	10	1	100
		Metals	10	10	1	100
		PCB/Pesticides	10	10	1	100
		PAH	10	10	1	100
3	Water Quality	CTD Drops	105	105	15	100
		Ammonium	470	469	81	99.8
		Bacteria	260	259	25	99.6
	Sediment Chemistry	Grain size	10	10	1	100
		TOC	10	10	1	100
		Dissolved Sulfides	10	10	1	100
		Metals	10	10	1	100
		PCB/Pesticides	10	10	1	100
		PAH	10	10	1	100
	Fish Community	Trawls	22	22	NA	100
4	Water Quality	CTD Drops	136	136	16	100
		Ammonium	470	470	57	100
		Bacteria	260	260	25	100
	Sediment Chemistry	Grain size	10	10	1	100
		TOC	10	10	1	100
		Dissolved Sulfides	10	10	1	100
		Metals	10	10	1	100
		PCB/Pesticides	10	10	1	100
		PAH	10	10	1	100

* English sole and hornyhead turbot are analyzed for both muscle and liver tissue.
NA = not applicable

WATER QUALITY NARRATIVE

Introduction

OCSD's Environmental Laboratory and Ocean Monitoring (ELOM) staff collected 551, 550, 550, and 551 discrete ammonia samples respectively during the four quarters beginning July 1, 2007 and ending June 30, 2008. All samples were iced upon collection, preserved with 1:1 sulfuric acid upon receipt by the ELOM laboratory, and stored at 4 ± 2 °C until analysis according to ESL Standard Operating Procedures (SOPs), which are found in the Laboratory Operating Procedures Manual (LOPM).

Analytical Method - Ammonia

The samples were analyzed for ammonia on a segmented flow analyzer using Standard Method 4500-NH_3 G. In the analysis, sodium phenolate and sodium hypochlorite react with ammonia to form indophenol blue in a concentration proportional to the ammonia concentration in the sample. The blue color is intensified with sodium nitroprusside and is measured at 660 nm.

Analytical Method - Bacteriology

The bacteria samples were analyzed using Standard Method 9223 B. This method utilizes chromogenic substrate technology to detect the enzymes specific to the total coliform group, including *Escherichia coli,* and the enterococci group of bacteria. The laboratory utilized the Colilert-18® and Enterolert® test systems. Colilert-18® simultaneously detects total coliforms and *E. coli* using specific enzymes, ß-galactosidase and ß-glucuronidase, respectively. The Enterolert® system detects enterococci bacteria utilizing the enzyme ß-glucosidase.

QA/QC - Ammonia

A typical sample batch includes three blanks, an external reference standard, a spike, and a spike replicate in seawater collected from a control site. One spike and spike replicate is added to the batch every ten samples. The method detection limit (MDL) for low-level ammonia samples using the segmented flow instrument is 0.02 mg/L. QA/QC summary data are presented in Table C-2. All samples were analyzed within the required holding time. All analyses met the QA/QC criteria for blanks and the external reference sample. Five of 57 matrix spike recoveries, three of 58 matrix spike replicate recoveries, and one of 57 precision measurements for the matrix spike and matrix spike replicate samples was out of control for first quarter samples. Four of 58 matrix spike recoveries, two of 58 matrix spike replicate recoveries and six of 58 precision measurements for the matrix spike and matrix spike replicates were out of control for second quarter samples. One of 55 matrix spike replicate samples and three of 55 precision measurements for matrix spike and matrix spike replicates were out of control for third quarter samples. Four of 54 matrix spike recoveries and one of 54 matrix spike replicate recoveries and seven of 54 precision measurements for matrix spike and matrix spike replicates were out of control for fourth quarter samples. In all cases, it was determined that recovery and precision criteria were exceeded due to rounding of numbers in the data sets in question. Additionally, the set of results following those in question were within the control limits and therefore all results are considered valid.

QA/QC - Bacteriology

Microbiology samples were received by the Ocean Monitoring staff. Prior to February 2008, samples were received by microbiology staff. Forty-five meter depth samples at stations 2103, 2104, C2, 2205, WQ-1, WQ-9 and bottom depth samples at stations 2183, 2403, and

2203 were analyzed in duplicate in every batch. Precision of duplicate counts as described in Standard Method 9020 B was calculated on all data for 2007-08. Percent of samples meeting the precision criteria was 94.3% for total coliform, 90.2% for fecal coliform and 89.4% for enterococci. In all cases where precision failed, it was when one result was less than detection limit and its duplicate result was above the detection limit. This level of precision is not uncommon when bacteria levels are as low as they are in the ocean following the district's decision to disinfect its effluent. The MDL was 10 organisms/100 mL. All samples were analyzed within the required holding time. Temperature of the 35 °C and 41 °C incubators was monitored and recorded twice daily. Colilert-18® and Enterolert® lots received into the lab passed all QA/QC protocols designed to ensure proper product performance including testing new lots with known bacteria strains and confirmed to be within the manufacturer's expiration dates. Tray sealers were tested monthly to ensure proper operation. In general, QA/QC measures were in control, and all reported results are considered valid.

Table C-2. Water quality ammonia QA/QC summary, July 2007–June 2008.

Orange County Sanitation District, California.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Summer	NH3WQ070905-1	Ammonium	Blank	3	3	<2X MDL	N/A
			Matrix Spike	6	5*	80-120	
			Matrix Spike Dup	6	6	80-120	
			Matrix Spike Precision	6	6		< 11%
			ERA Check Standard	1	1	87 - 114	
Summer	NH3WQ070906-1	Ammonium	Blank	3	3	<2X MDL	N/A
			Matrix Spike	8	8	80-120	
			Matrix Spike Dup	9	9	80-120	
			Matrix Spike Precision	8	7**		< 11%
			ERA Check Standard	1	1	87 - 114	
Summer	NH3WQ070911-1	Ammonium	Blank	3	3	<2X MDL	N/A
			Matrix Spike	10	9*	80-120	
			Matrix Spike Dup	10	9*	80-120	
			Matrix Spike Precision	10	10		< 11%
			ERA Check Standard	1	1	87 - 114	
Summer	NH3WQ070912-1	Ammonium	Blank	3	3	<2X MDL	N/A
			Matrix Spike	10	8*	80-120	
			Matrix Spike Dup	10	8*	80-120	
			Matrix Spike Precision	10	10		< 11%
			ERA Check Standard	1	1	87 - 114	
Summer	NH3WQ070919-1	Ammonium	Blank	3	3	<2X MDL	N/A
			Matrix Spike	9	9	80-120	
			Matrix Spike Dup	9	9	80-120	
			Matrix Spike Precision	9	9		< 11%
			ERA Check Standard	1	1	87 - 114	

Table C-2 Continues.

Table C-2 Continued.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Summer	NH3WQ070925-1	Ammonium	Blank	3	3	<2X MDL	N/A
			Matrix Spike	7	6*	80-120	
			Matrix Spike Dup	7	5*	80-120	
			Matrix Spike Precision	7	7		< 11%
			ERA Check Standard	1	1	87 - 114	
Summer	NH3WQ070927-1	Ammonium	Blank	3	3	<2X MDL	N/A
			Matrix Spike	7	7	80-120	
			Matrix Spike Dup	7	7	80-120	
			Matrix Spike Precision	7	7		< 11%
			ERA Check Standard	1	1	87 - 114	
Fall	NH3WQ071031-1	Ammonium	Blank	3	3	<2X MDL	N/A
			Matrix Spike	7	6*	80-120	
			Matrix Spike Dup	7	6*	80-120	
			Matrix Spike Precision	7	7		< 11%
			ERA Check Standard	1	1	87 - 114	
Fall	NH3WQ071101-1	Ammonium	Blank	3	3	<2X MDL	N/A
			Matrix Spike	7	7	80-120	
			Matrix Spike Dup	7	7	80-120	
			Matrix Spike Precision	7	6**		< 11%
			ERA Check Standard	1	1	87 - 114	
Fall	NH3WQ071108-2	Ammonium	Blank	3	3	<2X MDL	N/A
			Matrix Spike	8	8	80-120	
			Matrix Spike Dup	8	8	80-120	
			Matrix Spike Precision	8	7**		< 11%
			ERA Check Standard	1	1	87 - 114	
Fall	NH3WQ071113-1	Ammonium	Blank	3	3	<2X MDL	N/A
			Matrix Spike	11	11	80-120	
			Matrix Spike Dup	11	11	80-120	
			Matrix Spike Precision	11	7**		< 11%
			ERA Check Standard	1	1	87 - 114	

Table C-2 Continues.

Table C-2 Continued.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Fall	NH3WQ071121-1	Ammonium	Blank	3	3	<2X MDL	N/A
			Matrix Spike	10	10	80-120	
			Matrix Spike Dup	10	10	80-120	
			Matrix Spike Precision	13	9*		< 11%
			ERA Check Standard	1	1	87 - 114	
Fall	NH3WQ071127-1	Ammonium	Blank	3	3	<2X MDL	N/A
			Matrix Spike	15	12*	80-120	
			Matrix Spike Dup	15	14*	80-120	
			Matrix Spike Precision	15	15		< 11%
			ERA Check Standard	1	1	87 - 114	
Winter	NH3WQ080219-1	Ammonium	Blank	3	3	<2X MDL	N/A
			Matrix Spike	10	10	80-120	
			Matrix Spike Dup	10	10	80-120	
			Matrix Spike Precision	10	9**		< 11%
			ERA Check Standard	1	1	87 - 114	
Winter	NH3WQ080221-1	Ammonium	Blank	3	3	<2X MDL	N/A
			Matrix Spike	10	10	80-120	
			Matrix Spike Dup	10	9*	80-120	
			Matrix Spike Precision	10	9**		< 11%
			ERA Check Standard	1	1	87 - 114	
Winter	NH3WQ080225-1	Ammonium	Blank	3	3	<2X MDL	N/A
			Matrix Spike	10	10	80-120	
			Matrix Spike Dup	10	10	80-120	
			Matrix Spike Precision	10	10		< 11%
			ERA Check Standard	1	1	87 - 114	
Winter	NH3WQ080227-1	Ammonium	Blank	3	3	<2X MDL	N/A
			Matrix Spike	10	10	80-120	
			Matrix Spike Dup	10	10	80-120	
			Matrix Spike Precision	10	9**		< 11%
			ERA Check Standard	1	1	87 - 114	

Table C-2 Continues.

Table C-2 Continued.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Winter	NH3WQ080228-1	Ammonium	Blank	3	3	<2X MDL	N/A
			Matrix Spike	10	10	80-120	
			Matrix Spike Dup	10	10	80-120	
			Matrix Spike Precision	10	10		< 11%
			ERA Check Standard	1	1	87 - 114	
Winter	NH3WQ080303-1	Ammonium	Blank	3	3	<2X MDL	N/A
			Matrix Spike	5	5	80-120	
			Matrix Spike Dup	5	5	80-120	
			Matrix Spike Precision	5	5		< 11%
			ERA Check Standard	1	1	87 - 114	
Spring	NH3WQ080515-1	Ammonium	Blank	3	3	<2X MDL	N/A
			Matrix Spike	9	7*	80-120	
			Matrix Spike Dup	9	9	80-120	
			Matrix Spike Precision	9	8**		< 11%
			ERA Check Standard	1	1	87 - 114	
Spring	NH3WQ080519-1	Ammonium	Blank	3	3	<2X MDL	N/A
			Matrix Spike	15	14*	80-120	
			Matrix Spike Dup	15	15	80-120	
			Matrix Spike Precision	15	14**		< 11%
			ERA Check Standard	1	1	87 - 114	
Spring	NH3WQ080520-1	Ammonium	Blank	3	3	<2X MDL	N/A
			Matrix Spike	18	18	80-120	
			Matrix Spike Dup	17	17	80-120	
			Matrix Spike Precision	17	14**		< 11%
			ERA Check Standard	1	1	87 - 114	
Spring	NH3WQ080611-1	Ammonium	Blank	3	3	<2X MDL	N/A
			Matrix Spike	12	11*	80-120	
			Matrix Spike Dup	13	12*	80-120	
			Matrix Spike Precision	12	10**		< 11%
			ERA Check Standard	1	1	87 - 114	

*Recovery (70% or 130%) was out of control due to rounding. ** Matrix spike precision (11.8%) was out of control due to rounding. The associated method blank and check standard were in control and therefore the data were reported.

SEDIMENT CHEMISTRY NARRATIVE

FIRST QUARTER (JULY 2007)

Introduction

OCSD's ELOM laboratory received 69 sediment samples from ELOM's ocean monitoring staff during the month of July 2007. All samples were stored according to ELOM LOPM. The samples were analyzed for organochlorine pesticides, polychlorinated biphenyl congeners (PCBs), polycyclic aromatic hydrocarbons (PAHs), linear alkyl benzenes (LABs), trace metals, mercury, dissolved sulfides (DS), total organic carbon (TOC), and grain size.

Analytical Methods - PAHs and LABs

The analytical methods used to detect PAHs and LABs in the samples are described in the OCSD ELOM LOPM. All sediment samples were extracted using an accelerated solvent extractor (ASE) during July through October 2007. Approximately 10 g (dry weight) of sample were used for each analysis. A separatory funnel extraction was performed using 100 mL of sample when field and rinse blanks were included in the batch.

A typical sample batch included 18 field samples with required QC samples. Sample batches that were analyzed for PAHs and LABs included the following QC samples: one sand blank, one reporting level spike, two standard reference materials (SRM), one matrix spike set, and two sample extraction duplicates. There were four batches extracted and analyzed for PAHs and LABs. In addition, one batch contained one rinse sample and one field blank. MDLs for PAHs and LABs are presented in Table C-3. Acceptance criteria for PAH SRMs are presented in Table C-4.

Sediment PAH and LAB QA/QC summary data are presented in Table C-5. All analyses were performed within holding times and with appropriate quality control measures, as stated in the program's Quality Assurance Project Plan (QAPP). Any variances are noted in the Comments/Notes section of each batch summary.

Analytical Methods - Organochlorine Pesticides and PCB Congeners

The analytical methods used to process the organochlorine pesticides and PCB congeners samples are described in the ELOM LOPM. An ASE was used to extract the sediment samples during the months of July through September 2007. All sediment extracts were analyzed by Ion Trap GC/MS/MS. Approximately 10 g (dry weight) of sample were used for each analysis. If a field blank and rinse were included in the batch, a separatory funnel extraction was performed using 100 mL of sample.

A typical sample batch consisted of 18 field samples with required QC samples, which included one sand blank, two SRM, one PCB/pesticide reporting level spike, one PCB/pesticide matrix spike set, and two duplicate sample extractions. There were four batches extracted. In addition, one batch contained a rinse sample and a field blank. MDLs for PCBs/pesticides are presented in Table C-6. Acceptance Criteria for PCB/pesticide SRMs are presented in Table C-7.

Sediment PCB/pesticide QA/QC summary data are presented in Table C-8. All analyses were performed within QAPP stated holding times and with appropriate quality control

measures. When constituent concentrations exceeded the calibration range of the instrument, dilutions were performed and the samples reanalyzed. Any variances are noted in the Comments/Notes section of each batch summary.

Analytical Methods - Trace Metals

Dried sediment samples were analyzed for trace metals in accordance with methods in the ELOM LOPM. A typical sample batch for aluminum, arsenic, beryllium, cadmium, chromium, copper, iron, nickel, lead, selenium, silver, and zinc analyses included three blanks, a blank spike, and one SRM. Additionally, duplicate samples, spiked samples and duplicate spiked samples were analyzed a minimum of once every ten sediment samples.

The analysis of the blank spike and SRM provided a measure of the accuracy of the analysis. The analysis of the sample, its duplicate, and the two spiked samples were evaluated for precision. The samples that were spiked with aluminum and iron were not evaluated for spike recoveries because the spike levels were extremely low compared to the concentrations of aluminum and iron in the native samples. The samples were spiked at 20 mg/kg dry weight whereas the native concentrations ranged between 5,000 and 35,000 mg/kg dry weight.

All samples were analyzed within their 6-month holding times. If any analyte exceeded the appropriate calibration curve, and Linear Dynamic Range, the sample was diluted and reanalyzed. MDLs for metals are presented in Table C-9. Acceptance criteria for trace metal SRMs are presented in Table C-10.

Approximately 1 g of dried sediment was combined with 5 mL concentrated ultrapure hydrochloric acid and 10 mL concentrated ultrapure nitric acid. The samples were digested in a microwave, which was programmed to ramp the temperature and pressure to 175 °C/70 psi within four minutes, dwell for four minutes and then allowed to cool. The final sample volumes were brought to 100 mL with deionized water of 18-megohm purity or better. The digested samples were analyzed for aluminum, arsenic, beryllium, cadmium, chromium, copper, iron, nickel, lead, selenium, silver, and zinc by inductively coupled mass spectroscopy (ICPMS).

Sediment trace metal QA/QC summary data are presented in Tables C-11. The relative percent difference (RPD) between the sample and its duplicate analysis are from 14.2% to 10.4%. Three selenium RPDs were -39.8%, -26.3%, and -29.1%, but their results were less than 10X MDL. The RPD for the spike and spike duplicate analysis are less than or equal to 11.6%. All spike recoveries were between 87% and 124%.

Analytical Methods - Mercury

Dried sediment samples were analyzed for mercury in accordance with methods described in the ELOM LOPM. QC for a typical batch included a blank, a blank spike, and a SRM. Sediment samples with duplicates, spiked samples and duplicate spiked samples were run approximately once every ten sediment samples. All samples were analyzed within their 6-month holding time. When sample mercury concentration exceeded the appropriate calibration curve, the sample was diluted with the reagent blank and reanalyzed. Approximately 0.5 g of dried sediment was digested in aqua regia using a 95 °C hot block. Once the samples were cooled, ultrapure water and potassium permanganate were added to each sample and the samples were redigested. Once the samples cooled again, sodium

chloride-hydroxylamine hydrochloride solution was added to each sample and the samples were brought to 50 mL volume. The same procedure was used to prepare the calibration standards. The samples were analyzed for mercury on a Perkin Elmer FIMS 400 system.

Note: A study was done using 5 g of sediment prior to fourth quarter sample analysis. The study results indicated that it was beneficial to use 5 g of sediment instead of 0.5 g because of a reduction in the variability of the replicate results. Therefore, beginning with the fourth quarter, the LOPM was changed to require 5 g instead of 0.5 g sample. The sample volume was also increased to 100 mL to accommodate the 5 g sample weight, beginning with the fourth quarter.

The MDL for sediment mercury is presented in Table C-9. Acceptance criteria for mercury SRM is presented in Table C-9. All QA/QC summary data are presented in Table C-11. All samples met the QA/QC criteria guidelines for accuracy and precision.

Analytical Methods - Dissolved Sulfides

Dissolved sulfides samples were analyzed in accordance with methods described in the ELOM LOPM. The MDL for dissolved sulfides is presented in Table C-12. Sediment dissolved sulfides QA/QC summary data are presented in Table C-13. All samples were analyzed within their required holding times. All analyses met the QA/QC criteria for blanks, blank spikes, matrix spikes, matrix spike replicates, and matrix spike precisions.

Analytical Methods - Total Organic Carbon

Total Organic Carbon (TOC) samples were analyzed by a contract laboratory: Columbia Analytical Services, Kelso, WA. The MDL for TOC is presented in Table C-12. Sediment TOC QA/QC summary data are presented in Table C-14. The samples were analyzed within their required holding times. Four samples were analyzed in duplicate. The samples and their duplicate analyses had an RPD of less than 10%.

Analytical Methods - Grain Size

Grain size samples were analyzed by a contract laboratory, Weston Solutions, Carlsbad, CA. The MDL for sediment grain size is presented in Table C-12. Sediment grain size QA/QC summary data are presented in Table C-15. Eleven reference samples were analyzed. All analyses were within three standard deviations of the reference standard for the statistical parameters (median, phi, and dispersion), percent gravel, percent sand, percent clay, and percent silt.

SECOND QUARTER (OCTOBER 2007)

OCSD's ELOM laboratory received ten sediment samples from the ocean monitoring staff during the month of October 2007. All samples were stored according to methods described in the ELOM LOPM. All samples were analyzed for organochlorine pesticides, PCB congeners, PAHs, trace metals, mercury, dissolved sulfides, grain size, and TOC.

All sediment samples that were analyzed for organochlorine pesticides and PCB congeners were extracted on October 24, 2007. All sediment samples that were analyzed for PAHs were extracted on December 30, 2007. Any variances that occurred during sample processing or analysis are noted in the Comments/Notes section of each batch summary.

All sediment samples were extracted using an ASE. All sediment extracts for PCB congeners and pesticides were analyzed by Ion Trap GC/MS/MS.

All samples were analyzed for metals within their holding times. All of the metals analyses met the QA criteria guidelines. Sediment metals QA/QC summary data are presented in Table C-11. All spike recoveries were between 87.0% and 103%. The RPD of the sample and its duplicate were less than or equal to 16.5%. Selenium's RPD was -25.3%, but its results were less than 10X the MDL. The RPD of the spike and spike duplicate were less than or equal to 3.3%

Sediment Mercury QA/QC summary data are presented in Table C-11. All samples met the QA criteria guidelines.

The analyses for dissolved sulfides, TOC, and grain size met criteria guidelines as specified in the project QAPP. MDL, SRM, and QA/QC summary data are presented in Tables C-12 through C-15.

THIRD QUARTER (JANUARY 2008)

OCSD's ELOM laboratory received ten sediment samples from the ocean monitoring staff during the month of January 2008. All samples were stored according to methods described in the ELOM LOPM. All samples were analyzed for organochlorine pesticides, PCB congeners, PAHs, trace metals, mercury, dissolved sulfides, grain size, and TOC.

All sediment samples that were analyzed for organochlorine pesticides and PCB congeners were extracted on February 20, 2008. All sediment samples that were analyzed for PAHs were extracted on February 27, 2008. Any variances are noted in the Comments/Notes section of each batch summary. All sediment samples were extracted using an ASE. All sediment extracts for PCB congeners and pesticides were analyzed by Ion Trap GC/MS/MS.

All samples were analyzed for metals within their holding times. A RPD (Ag results) of the batch (HMSED080225-1) was 28.7% and the acceptable limit is 20%. The SOP was evaluated. All other QA/QC of this batch was within acceptable ranges. After evaluation, it was concluded that the one high RPD of the Ag results was due to a nonhomogenous sample. All other analyses met the QA objectives. Sediment metals QA/QC summary data are presented in Table C-11. All spike recoveries were between 91.8% and 109%. The RPD of the sample and its duplicate were less than or equal to -6.1%. The RPD of the spike and spike duplicate were less than or equal to 2.5%.

Sediment mercury QA/QC summary data are presented in Table C-11. All samples met the QA criteria guidelines.

The analyses for dissolved sulfides and grain size met the QA criteria guidelines as specified in the project QAPP. The RPD (12.5%) for TOC was out of control due to sample homogeneity. The associated method blank, matrix spike recovery, and laboratory control sample were in control and therefore the TOC sample data were reported. MDL, SRM, and QA/QC summary data are presented in Tables C-12 through C-15.

FOURTH QUARTER (APRIL 2008)

OCSD's ELOM laboratory received ten sediment samples from the ocean monitoring staff during the month of April 2008. All samples were stored according to ELOM's LOPM. All samples were analyzed for organochlorine pesticides, PCB congeners, PAHs, trace metals, mercury, dissolved sulfides, grain size, and TOC.

All sediment samples being analyzed for organochlorine pesticides and PCB congeners were extracted on May 14, 2008. All sediment samples being analyzed for PAHs were extracted on May 22, 2008. Any variances, which may have occurred during sample processing or analysis, are noted in the Comments/Notes section of each batch summary. All sediment samples were extracted using an ASE. All sediment extracts for PCB congeners and pesticides were analyzed by Ion Trap GC/MS/MS.

All samples were analyzed for metals within their holding times. All metal analyses met the QA objectives. Sediment metals QA/QC summary data are presented in Table C-11. All spike recoveries were between 92.0% and 111.5%. The RPD of the sample and its duplicate were less than or equal to -4.4%. The RPD of the spike and spike duplicate were less than or equal to -3.3%.

Sediment mercury QA/QC summary data are presented in Table C-11. All samples met the QA criteria guidelines.

The analyses for dissolved sulfide, TOC, and grain size met the QA criteria guidelines specified in the QAPP. MDL, SRM, and QA/QC summary data are presented in Tables C-12 through C-15.

Table C-3. Method detection levels for PAH and LAB compounds in sediments, July 2007–June 2008.

Orange County Sanitation District, California.

PAH Compounds			
Parameter	**Accelerated Solvent Extraction SIM Detection Limit, (ng/g dry weight)**	**Parameter**	**Accelerated Solvent Extraction SIM Detection Limit, (ng/g dry weight)**
1,6,7-Trimethylnaphthalene	0.26	Benzo[k]fluoranthene	0.33
1-Methylnaphthalene	0.54	Biphenyl	0.37
1-Methylphenanthrene	0.42	Chrysene	0.28
2,6-Dimethylnaphthalene	0.43	Dibenz[a,h]anthracene	0.41
2-Methylnaphthalene	0.44	Dibenzothiophene	0.27
Acenaphthene	0.21	Fluoranthene	0.13
Acenaphthylene	0.31	Fluorene	0.29
Anthracene	0.22	Indeno[1,2,3-c,d]pyrene	0.31
Benz[a]anthracene	0.34	Naphthalene	0.50
Benzo[a]pyrene	0.24	Perylene	0.38
Benzo[b]fluoranthene	0.33	Phenanthrene	0.47
Benzo[e]pyrene	0.38	Pyrene	0.45
Benzo[g,h,I]perylene	0.36		

PAH Alkylated Homologues			
Parameter	**Accelerated Solvent Extraction SIM Detection Limit, (ng/g dry weight)**	**Parameter**	**Accelerated Solvent Extraction SIM Detection Limit, (ng/g dry weight)**
C1-Chrysenes	2	C1-Fluoranthenes/Pyrenes	2
C2-Chrysenes	2	C1-Naphthalenes	2
C3-Chrysenes	2	C2-Naphthalenes	2
C4-Chrysenes	2	C3-Naphthalenes	2
C1-Dibenzothiophenes	2	C4-Naphthalenes	2
C2-Dibenzothiophenes	2	C1-Phenanthrenes/Anthracenes	2
C3-Dibenzothiophenes	2	C2-Phenanthrenes/Anthracenes	2
C1-Fluorenes	2	C3-Phenanthrenes/Anthracenes	2
C2-Fluorenes	2	C4-Phenanthrenes/Anthracenes	2
C3-Fluorenes	2		

LAB Compounds			
Parameter	**Accelerated Solvent Extraction SIM Detection Limit, (ng/g dry weight)**	**Parameter**	**Accelerated Solvent Extraction SIM Detection Limit, (ng/g dry weight)**
2-Phenyldecane	0.21	6-Phenyltetradecane	0.55
3-Phenyldecane	0.27	7-Phenyltetradecane	0.69
4-Phenyldecane	0.26	2-Phenylundecane	0.29
5-Phenyldecane	0.27	3-Phenylundecane	0.27
2-Phenyltridecane	0.95	4-Phenylundecane	0.23
3-Phenyltridecane	1.2	5-Phenylundecane	0.35
4-Phenyltridecane	0.82	6-Phenylundecane	0.31
5-Phenyltridecane	1.3	2-Phenyldodecane	0.53
7+6-Phenyltridecane	2.6	3-Phenyldodecane	0.44
2-Phenyltetradecane	0.29	4-Phenyldodecane	0.90
3-Phenyltetradecane	1.2	5-Phenyldodecane	1.3
4-Phenyltetradecane	0.60	6-Phenyldodecane	1.0
5-Phenyltetradecane	0.70		

Table C-4. Acceptance criteria for standard reference materials of PAHs in sediments, July 2007–June 2008.

Orange County Sanitation District, California.

Compound Name	True Value µg/g	Certified Acceptance Criteria µg/g	
		Min.	Max.
SRM 1944A - Organics in Marine Sediment National Institute of Standards and Technology.			
Anthracene	1.77	0.44	2.21
Benz[a]anthracene	4.72	1.18	5.90
Benzo[a]pyrene	4.30	1.08	5.38
Benzo[b]fluoranthene	3.87	0.97	4.84
Benzo[e]pyrene	3.28	0.82	4.10
Benzo[g,h,i]perylene	2.84	0.71	3.55
Benzo[k]fluoranthene	2.30	0.58	2.88
Chrysene	4.86	1.22	6.08
Dibenz[a,h]anthracene	0.42	0.11	0.53
Fluoranthene	8.92	2.23	11.15
Indeno(1,2,3-c,d)pyrene	2.78	0.70	3.48
Naphthalene	1.65	0.41	2.06
Perylene	1.17	0.29	1.46
Phenanthrene	5.27	1.32	6.59
Pyrene	9.70	2.43	12.13
SRM 1941B - Organics in Marine Sediment National Institute of Standards and Technology			
Anthracene	184	110	258
Benz[a]anthracene	335	201	469
Benzo[a]pyrene	358	215	501
Benzo[b]fluoranthene	453	272	634
Benzo[e]pyrene	325	195	455
Benzo[g,h,i]perylene	307	184	430
Benzo[k]fluoranthene	225	135	315
Chrysene	291	175	407
Dibenz[a,h]anthracene	53	32	74
Fluoranthene	651	391	911
Indeno(1,2,3-c,d)pyrene	341	205	477
Naphthalene	848	509	1,187
Perylene	397	238	556
Phenanthrene	406	244	568
Pyrene	581	349	813

Table C-5. Sediment PAH/LAB QA/QC summary, July 2007–June 2008.

Orange County Sanitation District, California.

Quarter	Sample Set	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD	Comments
1	Sedcore_Jul07_CN	PAH SRM 1944	15	15	25% of the certified or published acceptance limits[1]	NA	100% Pass
1	Sedcore_Jul07_CN	PAH SRM 1941b	15	14			93% Pass
1	Sedcore_Jul07_CN	PAH Reporting Level Spike	25	0	60 -120		0% Pass
1	Sedcore_Jul07_CN	LAB Reporting Level Spike	25	24			96% Pass
1	Sedcore_Jul07_CN	PAH Matrix Spike					
1	Sedcore_Jul07_CN	Based on Mean of MS and MSD	25	25	40 - 120	NA	100% Pass
1	Sedcore_Jul07_CN	LAB Matrix Spike					
1	Sedcore_Jul07_CN	Based on Mean of MS and MSD	25	25	40 - 120	NA	100% Pass
1	Sedcore_Jul07_CN	PAH Duplicate Analysis - #1	12	9	NA	< 20% @ 3 x MDL of Sample Mean	75% Pass
1	Sedcore_Jul07_CN	PAH Duplicate Analysis - #2	4	9			64% Pass
1	Sedcore_Jul07_CN	LAB Duplicate Analysis - #1	19	18			95% Pass
1	Sedcore_Jul07_CN	PAH Duplicate Analysis - #2	20	18			90% Pass
1	Sedcore_Jul07_CO	PAH SRM 1944	15	12	25% of the certified or published acceptance limits[1]	NA	80% Pass
1	Sedcore_Jul07_CO	PAH SRM 1941b	15	15			100% Pass
1	Sedcore_Jul07_CO	PAH Reporting Level Spike	25	25	60 -120		100% Pass
1	Sedcore_Jul07_CO	LAB Reporting Level Spike	25	23			92% Pass
1	Sedcore_Jul07_CO	PAH Matrix Spike					
1	Sedcore_Jul07_CO	Based on Mean of MS and MSD	25	25	40 - 120	NA	100% Pass
1	Sedcore_Jul07_CO	LAB Matrix Spike					
1	Sedcore_Jul07_CO	Based on Mean of MS and MSD	25	24	40 – 120	NA	96% Pass
1	Sedcore_Jul07_CO	PAH Duplicate Analysis - #1	6	4	NA	< 20% @ 3 x MDL of Sample Mean	67% Pass
1	Sedcore_Jul07_CO	PAH Duplicate Analysis - #2	6	4			67% Pass
1	Sedcore_Jul07_CO	LAB Duplicate Analysis - #1	15	15			100% Pass
1	Sedcore_Jul07_CO	PAH Duplicate Analysis - #2	15	12			80% Pass

Notes: [1] SRM certified values are based on the addition of selected compounds prior to extraction for use as internal standards for quantification purposes. (NIST, Certificate of Analysis, SRM 1941b, SRM 1944, Organics in Marine Sediment).

OCSD laboratory results are not corrected for surrogate recoveries. The percent recoveries of all surrogate and PAH spike compounds of PAH Reporting Level Spike sample were lower than the acceptance limits. The recoveries of matrix spike samples were within the acceptance limits. Surrogate recoveries of all samples within Batch CN were within acceptance limits. The results from Reporting Level spike sample were rejected. The results from all the samples within batch CN were reported.

N/A=not applicable

Table C-5 Continues.

Table C-5 Continued.

Quarter	Sample Set	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD	Comments
1	Sedcore_Jul07_CP	PAH SRM 1944	15	0	25% of the certified or published acceptance limits[1]	NA	0% Pass
1	Sedcore_Jul07_CP	PAH SRM 1941b	15	13			87% Pass
1	Sedcore_Jul07_CP	PAH Reporting Level Spike	25	25	60 -120		100% Pass
1	Sedcore_Jul07_CP	LAB Reporting Level Spike	25	25			100% Pass
1	Sedcore_Jul07_CP	PAH Matrix Spike					
1	Sedcore_Jul06_CP	Based on Mean of MS and MSD	25	22	40 - 120	NA	88% Pass
1	Sedcore_Jul07_CP	LAB Matrix Spike					
1	Sedcore_Jul07_CP	Based on Mean of MS and MSD	25	23	40 - 120	NA	92% Pass
1	Sedcore_Jul07_CP	PAH Duplicate Analysis - #1	24	19	NA	< 20% @ 3 x MDL of Sample Mean	79% Pass
1	Sedcore_Jul07_CP	PAH Duplicate Analysis - #2	14	12			86% Pass
1	Sedcore_Jul07_CP	LAB Duplicate Analysis - #1	25	25			89% Pass
1	Sedcore_Jul07_CP	LAB Duplicate Analysis - #2	23	10			43% Pass
1	Sedcore_Jul07_CQ	PAH SRM 1944	15	14	25% of the certified or published acceptance limits[1]	NA	93% Pass
1	Sedcore_Jul07_CQ	PAH SRM 1941b	15	15			100% Pass
1	Sedcore_Jul07_CQ	PAH Reporting Level Spike	25	25	60 -120		100% Pass
1	Sedcore_Jul07_CQ	LAB Reporting Level Spike	25	25			100% Pass
1	Sedcore_Jul07_CQ	PAH Matrix Spike					
1	Sedcore_Jul07_CQ	Based on Mean of MS and MSD	25	25	40 - 120	NA	100% Pass
1	Sedcore_Jul07_CQ	LAB Matrix Spike					
1	Sedcore_Jul07_CQ	Based on Mean of MS and MSD	25	25	40 - 120	NA	100% Pass
1	Sedcore_Jul07_CQ	PAH Duplicate Analysis - #1	11	9	NA	< 20% @ 3 x MDL of Sample Mean	82% Pass
1	Sedcore_Jul07_CQ	PAH Duplicate Analysis - #2	4	2			50% Pass
1	Sedcore_Jul07_CQ	LAB Duplicate Analysis - #1	23	19			83% Pass
1	Sedcore_Jul07_CQ	LAB Duplicate Analysis - #2	19	19			100% Pass

Notes:

[1] SRM certified values are based on the addition of selected compounds prior to extraction for use as internal standards for quantification purposes. (NIST, Certificate of Analysis, SRM 1941b, SRM 1944, Organics in Marine Sediment).

OCSD laboratory results are not corrected for surrogate recoveries. Low surrogate recoveries may be due to error in sample preparation process. Color of sample extract appeared to be lighter than normal. No corrective action was taken.

N/A=not applicable.

Table C-5 Continues.

Table C-5 Continued.

Quarter	Sample Set	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD	Comments
2	Sedcore_Oct07_CR	PAH SRM 1944	15	9	25% of the certified or published acceptance limits[1]	NA	60% Pass
2	Sedcore_Oct07_CR	PAH SRM 1941b	15	13			87% Pass
2	Sedcore_Oct07_CR	PAH Reporting Level Spike	25	25	60 -120		100% Pass
2	Sedcore_Oct07_CR	PAH Matrix Spike					
2	Sedcore_Oct07_CR	Based on Mean of MS and MSD	25	25	40 - 120	NA	100% Pass
2	Sedcore_Oct07_CR	PAH Duplicate Analysis - #1	20	13	NA	< 20% @ 3 x MDL of Sample Mean	65% Pass
2	Sedcore_Oct07_CR	PAH Duplicate Analysis - #2	N/A	N/A			N/A
3	Sedcore_Jan08_CT	PAH SRM 1944	15	14	25% of the certified or published acceptance limits[1]	NA	93% Pass
3	Sedcore_Jan08_CT	PAH SRM 1941b	15	15			100% Pass
3	Sedcore_Jan08_CT	PAH Reporting Level Spike	25	25	60 -120		100% Pass
3	Sedcore_Jan08_CT	PAH Matrix Spike					
3	Sedcore_Jan08_CT	Based on Mean of MS and MSD	25	24	40 - 120	NA	96% Pass
3	Sedcore_Jan08_CT	PAH Duplicate Analysis - #1	18	13	NA	< 20% @ 3 x MDL of Sample Mean	68% Pass
3	Sedcore_Jan08_CT	PAH Duplicate Analysis - #2	N/A	N/A			N/A
4	Sedcore_Apr08_CU	PAH SRM 1944	15	13	25% of the certified or published acceptance limits[1]	NA	87% Pass
4	Sedcore_Apr08_CU	PAH SRM 1941b	15	13			87% Pass
4	Sedcore_Apr08_CU	PAH Reporting Level Spike	25	25	60 -120		100% Pass
`	Sedcore_Apr08_CU	PAH Matrix Spike					
4	Sedcore_Apr08_CU	Based on Mean of MS and MSD	25	25	40 - 120	NA	100% Pass
4	Sedcore_Apr08_CU	PAH Duplicate Analysis - #1	16	6	NA	< 20% @ 3 x MDL of Sample Mean	62% Pass
4	Sedcore_Apr08_CU	PAH Duplicate Analysis - #2	N/A	N/A			N/A

Notes:
[1]SRM certified values are based on the addition of selected compounds prior to extraction for use as internal standards for quantification purposes. (NIST, Certificate of Analysis, SRM 1944, SRM 1941b, Organics in Marine Sediment).
OCSD laboratory results are not corrected for surrogate recoveries.
N/A=not applicable

Table C-6. Method detection levels for PCB congeners and pesticides in sediments, July 2007–June 2008.

Orange County Sanitation District, California.

Parameter	ASE & GC/MS/MS Method Detection Limit (ng/g dry weight)	Parameter	ASE & GC/MS/MS Method Detection Limit (ng/g dry weight)
Aldrin	0.12	PCB 101	0.08
alpha-Chlordane	0.17	PCB 105	0.19
cis-NoNAchlor	0.20	PCB 110	0.16
Dieldrin	0.32	PCB 114	0.22
Endrin	0.53	PCB 118	0.18
gamma-BHC	0.12	PCB 119	0.09
gamma-Chlordane	0.15	PCB 123	0.18
Heptachlor	0.11	PCB 126	0.31
Heptachlor epoxide	0.19	PCB 128	0.22
Hexachlorobenzene	0.21	PCB 138	0.14
Mirex	0.14	PCB 149	0.12
trans-NoNAchlor	0.16	PCB 151	0.11
2,4'-DDD (o,p'-DDD)	0.15	PCB 153	NA
2,4'-DDE (o,p'-DDE)	0.13	PCB 153/168	0.28
2,4'-DDT (o,p'-DDT)	0.16	PCB 156	0.21
4,4'-DDD (p,p'-DDD)	0.17	PCB 157	0.22
4,4'-DDE (p,p'-DDE)	0.15	PCB 158	0.17
4,4'-DDT (p,p'-DDT)	0.18	PCB 167	0.28
4,4'-DDMU	0.50 [1]	PCB 168	NA
PCB 8	0.14	PCB 169	0.30
PCB 18	0.14	PCB 170	0.17
PCB 28	0.09	PCB 177	0.11
PCB 37	0.24	PCB 180	0.16
PCB 44	0.11	PCB 183	0.19
PCB 49	0.09	PCB 187	0.18
PCB 52	0.08	PCB 189	0.22
PCB 66	0.20	PCB 194	0.14
PCB 70	0.20	PCB 195	0.14
PCB 74	0.28	PCB 200	0.21
PCB 77	0.21	PCB 201	0.20
PCB 81	0.24	PCB 206	0.16
PCB 87	0.13	PCB 209	0.10
PCB 99	0.11		

[1] Value is the reporting limit (RL).
NA = Not analyzed.

Table C-7. Acceptance criteria for standard reference materials of pesticides/PCBs in sediments, July 2007–June 2008.

Orange County Sanitation District, California.

Parameter	True Value (ng/g)	Acceptance Range (ng/g)		Parameter	True Value (ng/g)	Acceptance Range (ng/g)	
		min.	max.			min.	max.
SRM 1944a - Organics in Marine Sediment, National Institute of Standards and Technology, New York/New Jersey Waterway Sediment							
alpha-Chlordane	16.51	15.7	17.3	PCB 99	37.5	35.1	39.9
cis-Nonachlor *	3.70	3.00	4.40	PCB 101	73.4	70.9	75.9
gamma-Chlordane *	8.00	6.00	10.0	PCB 105	24.5	23.4	25.6
Hexachlorobenzene	6.0	5.68	6.38	PCB 110	63.5	58.8	68.2
trans-Nonachlor	8.20	7.69	8.71	PCB 118	58.0	53.7	62.3
2,4'-DDD *	38.0	30.0	46.0	PCB 128	8.47	8.19	8.75
2,4'-DDE *	19.0	16.0	22.0	PCB 138	62.1	59.1	65.1
4,4'-DDD *	108	92.0	124	PCB 149	49.7	48.5	50.9
4,4'-DDE *	86.0	74.0	98.0	PCB 151	16.93	16.57	17.3
4,4'-DDT	119	108	130	PCB 153	74.0	71.1	76.9
2,4'-DDD *	38.0	30.0	46.0	PCB 156	6.52	5.86	7.18
PCB 8	22.3	20.0	24.6	PCB 170	22.6	21.2	24.0
PCB 18	51.0	48.4	53.6	PCB 180	44.3	43.1	45.5
PCB 28	80.8	78.1	83.5	PCB 183	12.19	11.6	12.8
PCB 44	60.2	58.2	62.2	PCB 187	25.1	24.1	26.1
PCB 49	53.0	51.3	54.7	PCB 194	11.2	9.80	12.6
PCB 52	79.4	77.4	81.4	PCB 195	3.75	3.36	4.14
PCB 66	71.9	67.6	76.2	PCB 206	9.21	8.70	9.72
PCB 87	29.9	25.6	34.2				
SRM 1941B - Organics in Marine Sediment, National Institute of Standards and Technology, New York/New Jersey Waterway Sediment							
alpha-Chlordane	0.850	0.740	0.960	PCB 99	2.90	2.54	3.26
cis-Nonachlor	0.378	0.325	0.431	PCB 101	5.11	4.77	5.45
gamma-Chlordane	0.566	0.473	0.659	PCB 105	1.43	1.33	1.53
Hexachlorobenzene	5.83	5.45	6.21	PCB 110	4.62	4.26	4.98
trans-Nonachlor	0.438	0.365	0.511	PCB 118	4.23	4.04	4.42
2.4'-DDE *	0.380	0.260	0.500	PCB 128	0.696	0.652	0.740
4,4'-DDE	3.22	2.94	3.50	PCB 138	3.60	3.32	3.88
4,4'-DDD	4.66	4.20	5.12	PCB 149	4.35	4.09	4.61
4,4'-DDT *	1.12	0.700	1.54	PCB 153/168	5.47	5.15	5.79
PCB 8	1.65	1.46	1.84	PCB 156	0.507	0.417	0.597
PCB 18	2.39	2.10	2.68	PCB 158 *	0.650	0.500	0.800
PCB 28	4.52	3.95	5.09	PCB 170	1.35	1.26	1.44
PCB 44	3.85	3.65	4.05	PCB 180	3.24	2.73	3.75
PCB 49	4.34	4.06	4.62	PCB 183	0.979	0.892	1.07
PCB 52	5.24	4.96	5.52	PCB 187	2.17	1.95	2.39
PCB 66	4.96	4.43	5.49	PCB 194	1.04	0.980	1.10
PCB 70 *	4.99	4.70	5.28	PCB 195	0.645	0.585	0.705
PCB 74 *	2.04	1.89	2.19	PCB 201	0.770	0.736	0.804
PCB 77 *	0.310	0.280	0.340	PCB 206	2.42	2.23	2.61
PCB 87	1.14	0.980	1.30	PCB 209	4.86	4.41	5.31
PCB 8	1.65	1.46	1.84	PCB 99	2.90	2.54	3.26
PCB 18	2.39	2.10	2.68	PCB 101	5.11	4.77	5.45

* non-certified

Table C-8. Sediment PCB/pesticide QA/QC summary, July 2007–June 2008.

Orange County Sanitation District, California.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
1	DP	PCB	SRM 1944a	27	25	25% of the certified ranges or published acceptance limits	NA
1	DP	PCB	SRM 1941b	27	25		
1	DP	PCB	Reporting Level Spike	44	42	60 -120	NA
1	DP	PCB	Matrix Spike	44	44	40 - 120	NA
1	DP	PCB	Matrix Spike Dup	44	44	40 - 120	NA
1	DP	PCB	Matrix Spike Precision	44	44	NA	< 20%
1	DP	Pesticide	SRM 1944a	4	3	25% of the certified ranges or published acceptance limits	NA
1	DP	Pesticide	SRM 1941b	7	4		
1	DP	Pesticide	Reporting Level Spike	19	18	60 -120	NA
1	DP	Pesticide	Matrix Spike	19	19	40 - 120	NA
1	DP	Pesticide	Matrix Spike Dup	19	19	40 - 120	NA
1	DP	Pesticide	Matrix Spike Precision	19	19	NA	< 20%
1	DP	PCB	Duplicate 1	0	0	NA	< 20% @ 3 x MDL of Sample Mean.
1	DP	Pesticides	Duplicate 1	0	0	NA	
1	DP	PCBs and Pesticides	Duplicate 1 Sum	1	1	NA	NA
1	DP	PCB	Duplicate 2	1	1	NA	< 20% @ 3 x MDL of Sample Mean.
1	DP	Pesticides	Duplicate 2	0	0	NA	
1	DP	PCBs and Pesticides	Duplicate 2 Sum	1	1	NA	NA
Comments: **Review of calibration check standards injected after sample injections, extraction notes, and instrument conditions did not indicate any atypical circumstances.**							
1	DQ	PCB	SRM 1944a	27	18	25% of the certified ranges or published acceptance limits	NA
1	DQ	PCB	SRM 1941b	27	21		
1	DQ	PCB	Reporting Level Spike	44	44	60 -120	NA
1	DQ	PCB	Matrix Spike	44	44	40 - 120	NA
1	DQ	PCB	Matrix Spike Dup	44	44	40 - 120	NA
1	DQ	PCB	Matrix Spike Precision	44	44	NA	< 20%
1	DQ	Pesticide	SRM 1944a	4	3	25% of the certified ranges or published acceptance limits	NA
1	DQ	Pesticide	SRM 1941b	7	3		
1	DQ	Pesticide	Reporting Level Spike	19	17	60 -120	NA
1	DQ	Pesticide	Matrix Spike	19	19	40 - 120	NA
1	DQ	Pesticide	Matrix Spike Dup	19	19	40 - 120	NA
1	DQ	Pesticide	Matrix Spike Precision	19	19	NA	< 20%
1	DQ	PCB	Duplicate 1	0	0	NA	< 20% @ 3 x MDL of Sample Mean.
1	DQ	Pesticide	Duplicate 1	1	0	NA	
1	DQ	PCBs and Pesticides	Duplicate 1 Sum	1	0	NA	NA
1	DQ	PCB	Duplicate 2	0	0	NA	< 20% @ 3 x MDL of Sample Mean.
1	DQ	Pesticide	Duplicate 2	1	1	NA	
1	DQ	PCBs and Pesticides	Duplicate 2 Sum	1	1	NA	NA

Comments:

Review of calibration check standards injected after sample injections, extraction notes, and instrument conditions did not indicate any atypical circumstances.

NA = Not Applicable

Table C-8 Continues.

Table C-8 Continued.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
1	DR	PCB	SRM 1944a	27	24	25% of the certified ranges or published acceptance limits	NA
1	DR	PCB	SRM 1941b	27	25		
1	DR	PCB	Reporting Level Spike	44	42	60 -120	NA
1	DR	PCB	Matrix Spike	44	44	40 - 120	NA
1	DR	PCB	Matrix Spike Dup	44	44	40 - 120	NA
1	DR	PCB	Matrix Spike Precision	44	44	NA	< 20%
1	DR	Pesticide	SRM 1944a	4	3	25% of the certified ranges or published acceptance limits	NA
1	DR	Pesticide	SRM 1941b	7	5		
1	DR	Pesticide	Reporting Level Spike	19	18	60 -120	NA
1	DR	Pesticide	Matrix Spike	19	19	40 - 120	NA
1	DR	Pesticide	Matrix Spike Dup	19	19	40 - 120	NA
1	DR	Pesticide	Matrix Spike Precision	19	19	NA	< 20%
1	DR	PCB	Duplicate 1	20	1	NA	< 20% @ 3 x MDL of Sample Mean.
1	DR	Pesticide	Duplicate 1	1	1	NA	
1	DR	PCBs and Pesticides	Duplicate 1 Sum	1	0	NA	NA
1	DR	PCB	Duplicate 2	0	0	NA	< 20% @ 3 x MDL of Sample Mean.
1	DR	Pesticide	Duplicate 2	1	1	NA	
1	DR	PCBs and Pesticides	Duplicate 2 Sum	1	1	NA	NA

Comments:

Dissimilar results (duplicate sample #1) due to a nonhomogeneous sample. As a part of set DR, a pair of spiked samples was analyzed. These samples were spiked with 64 constituents and every one of them yielded acceptable results for RPD as well as for percent recoveries. Because the RPD for the other QA samples passed the acceptance criteria, and because the suspect samples' surrogates' percent recoveries were acceptable, it was decided to accept their results, but to reject the RPD test. Extraction staff was advised to mix samples more thoroughly to ensure homogenous aliquots.

NA = Not applicable

1	DS	PCB	SRM 1944a	27	20	25% of the certified ranges or published acceptance limits	NA
1	DS	PCB	SRM 1941b	27	25		
1	DS	PCB	Reporting Level Spike	44	0	60 -120	NA
1	DS	PCB	Matrix Spike	44	31	40 - 120	NA
1	DS	PCB	Matrix Spike Dup	44	30	40 - 120	NA
1	DS	PCB	Matrix Spike Precision	44	41	NA	< 20%
1	DS	Pesticide	SRM 1944a	4	4	25% of the certified ranges or published acceptance limits	NA
1	DS	Pesticide	SRM 1941b	7	6		
1	DS	Pesticide	Reporting Level Spike	19	0	60 -120	NA
1	DS	Pesticide	Matrix Spike	19	19	40 - 120	NA
1	DS	Pesticide	Matrix Spike Dup	19	19	40 - 120	NA
1	DS	Pesticide	Matrix Spike Precision	19	19	NA	< 20%
1	DS	PCB	Duplicate 1	12	1	NA	< 20% @ 3 x MDL of Sample Mean.
1	DS	Pesticide	Duplicate 1	1	1	NA	
1	DS	PCBs and Pesticides	Duplicate 1 Sum	1	0	NA	NA
1	DS	PCB	Duplicate 2	0	0	NA	< 20% @ 3 x MDL of Sample Mean.
1	DS	Pesticide	Duplicate 2	1	1	NA	
1	DS	PCBs and Pesticides	Duplicate 2 Sum	1	1	NA	NA

Comments:

The Reporting Limit sample failed. Percent recovery values for all compounds were approximately 10% of the expected values. Because the same low recovery was obtained for the surrogate standards, it strongly suggests this was an extraction process issue. All instrument performance parameters were acceptable. Extraction analysts were advised to report all mishaps and unusual events related to the extraction.

Dissimilar results (duplicate sample #1) due to nonhomogeneous sample. Analysts were advised on the importance of thoroughly mixing the sediment sample before taking aliquots.

NA = Not applicable

Table C-8 Continues.

Table C-8 Continued.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
2	DT	PCB	SRM 1944a	27	24	25% of the certified ranges or published acceptance limits	NA
2	DT	PCB	SRM 1941b	27	27		
2	DT	PCB	Reporting Level Spike	44	41	60 -120	NA
2	DT	PCB	Matrix Spike	44	44	40 - 120	NA
2	DT	PCB	Matrix Spike Dup	44	44	40 - 120	NA
2	DT	PCB	Matrix Spike Precision	44	44	NA	< 20%
2	DT	Pesticide	SRM 1944a	4	4	25% of the certified ranges or published acceptance limits	NA
2	DT	Pesticide	SRM 1941b	7	6		
2	DT	Pesticide	Reporting Level Spike	19	17	60 -120	NA
2	DT	Pesticide	Matrix Spike	19	19	40 - 120	NA
2	DT	Pesticide	Matrix Spike Dup	19	19	40 - 120	NA
2	DT	Pesticide	Matrix Spike Precision	19	19	NA	< 20%
2	DT	PCB	Duplicate 1	6	6	NA	< 20% @ 3 x MDL of Sample Mean.
2	DT	Pesticide	Duplicate 1	1	1	NA	
2	DT	PCBs and Pesticides	Duplicate 1 Sum	1	1	NA	NA
Comments: **Review of calibration check standards injected after sample injections, extraction notes, and instrument conditions did not indicate any atypical circumstances.** **NA = Not applicable**							
3	DU	PCB	SRM 1944a	27	27	25% of the certified ranges or published acceptance limits	NA
3	DU	PCB	SRM 1941b	27	24		
3	DU	PCB	Reporting Level Spike	44	43	60 -120	NA
3	DU	PCB	Matrix Spike	44	44	40 - 120	NA
3	DU	PCB	Matrix Spike Dup	44	44	40 - 120	NA
3	DU	PCB	Matrix Spike Precision	44	7	NA	< 20%
3	DU	Pesticide	SRM 1944a	4	4	25% of the certified ranges or published acceptance limits	NA
3	DU	Pesticide	SRM 1941b	7	6		
3	DU	Pesticide	Reporting Level Spike	19	18	60 -120	NA
3	DU	Pesticide	Matrix Spike	19	19	40 - 120	NA
3	DU	Pesticide	Matrix Spike Dup	19	19	40 - 120	NA
3	DU	Pesticide	Matrix Spike Precision	19	7	NA	< 20%
3	DU	PCB	Duplicate 1	5	5	NA	< 20% @ 3 x MDL of Sample Mean.
3	DU	Pesticide	Duplicate 1	1	1	NA	
3	DU	PCBs and Pesticides	Duplicate 1 Sum	1	1	NA	NA
Comments: **Review of calibration check standards injected after sample injections, extraction notes, and instrument conditions did not indicate any atypical circumstances. As a part of set DU, a pair of spiked samples was analyzed. Both the spike and spike duplicate yielded passing % recoveries, however results for RPD for many of the analytes were greater than the acceptable limit of 20%. Because the RPD for the other QA samples passed the acceptance criteria, and because the suspect samples' surrogates' percent recoveries were acceptable, it was decided to accept their results.** **NA = Not applicable**							

Table C-8 Continues.

Table C-8 Continued.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
4	DW	PCB	SRM 1944a	27	26	25% of the certified ranges or published acceptance limits	NA
4	DW	PCB	SRM 1941b	27	26		
4	DW	PCB	Reporting Level Spike	44	42	60 -120	NA
4	DW	PCB	Matrix Spike	44	44	40 - 120	NA
4	DW	PCB	Matrix Spike Dup	44	44	40 - 120	NA
4	DW	PCB	Matrix Spike Precision	44	44	NA	< 20%
4	DW	Pesticide	SRM 1944a	4	4	25% of the certified ranges or published acceptance limits	NA
4	DW	Pesticide	SRM 1941b	7	3		
4	DW	Pesticide	Reporting Level Spike	19	16	60 -120	NA
4	DW	Pesticide	Matrix Spike	19	19	40 - 120	NA
4	DW	Pesticide	Matrix Spike Dup	19	19	40 - 120	NA
4	DW	Pesticide	Matrix Spike Precision	19	19	NA	< 20%
4	DW	PCB	Duplicate 1	3	3	NA	< 20% @ 3 x MDL of Sample Mean.
4	DW	Pesticide	Duplicate 1	1	1	NA	
4	DW	PCBs and Pesticides	Duplicate 1 Sum	1	1	NA	NA

Comments:

Review of calibration check standards injected after sample injections, extraction notes, and instrument conditions did not indicate any atypical circumstances.

NA = Not applicable

Table C-9. Method detection limits for trace metals in sediments, July 2007–June 2008.

Orange County Sanitation District, California.

Parameter	Detection Limits (mg/kg dry weight)
Aluminum	500
Arsenic	0.17
Beryllium	0.01
Cadmium	0.01
Chromium	0.13
Copper	0.15
Iron	500
Lead	0.1
Nickel	0.02
Mercury	0.002
Selenium	0.15
Silver	0.01
Zinc	0.12

Table C-10. Acceptance criteria for standard reference materials of metals in sediments, July 2007–June 2008.

Orange County Sanitation District, California.

Parameter	True Value (mg/kg)	Certified Acceptance Criteria (mg/kg)	
		Min.	Max.
Environmental Resource Associates 248 Priority PollutnT™/CLP Inorganic Soils – Microwave Digestion Environmental Resource Associates			
Aluminum	10300	2190	18400
Arsenic	48.3	28.6	68.0
Beryllium	54.0	39.4	68.6
Cadmium	155	118	194
Chromium	53.1	35.0	71.1
Copper	70.7	54.9	88.5
Iron	15200	6540	24000
Lead	184	137	230
Nickel	115	84.7	144
Selenium	106	60.4	152
Silver	83.8	48.8	121
Zinc	299	207	391
Resource Technology Corporation CRM016-050 Natural Matrix Certified Reference Material Lot L516			
Mercury	0.11	0.02	0.21

Table C-11. Sediment metals QA/QC summary, July 2007–June 2008.

Orange County Sanitation District, California.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Summer	HMSED070910-1	Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Nickel, Selenium, Silver, Zinc	Blank	10	10	<2X MDL	N/A
			Blank Spike	10	10	90-110	N/A
			Matrix Spike	10	10	75-125	
			Matrix Spike Dup	10	10	75-125	
			Matrix Spike Precision	10	10		< 20%
			Duplicate Analysis	10	9 *	NA	@ ≥ 10 X MDL < 20%
			CRM Analysis	10	10	80-120% or certified value, whichever is greater.	
Summer	HMSED071001-1	Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Nickel, Selenium, Silver, Zinc	Blank	10	10	<2X MDL	N/A
			Blank Spike	10	10	90-110	N/A
			Matrix Spike	10	10	75-125	
			Matrix Spike Dup	10	10	75-125	
			Matrix Spike Precision	10	10		< 20%
			Duplicate Analysis	10	10	NA	@ ≥ 10 X MDL < 20%
			CRM Analysis	10	10	80-120% or certified value, whichever is greater.	
Summer	ALFESED070912-1	Aluminum, Iron	Blank	2	2	<2X MDL	N/A
			Duplicate Analysis	2	2	NA	@ ≥ 10 X MDL < 20%
			CRM Analysis	2	2	80-120[A]	
Summer	ALFESED071015-1	Aluminum, Iron	Blank	2	2	<2X MDL	N/A
			Duplicate Analysis	2	2	NA	@ ≥ 10 X MDL < 20%
			CRM Analysis	2	2	80-120% or certified value, whichever is greater.	

* A RPD of sample and sample duplicate (Ag results) of the set was 28.7%. The acceptable limit is 20%. The method procedure was evaluated. All other QA/QC was within acceptable ranges. The QAQC included Blank Spike, Matrix Spikes and Matrix Spikes RPD. After evaluation, it was concluded that the high RPD of the Ag result was due to a nonhomogenous sample.
NA = Not applicable.

Table C-11 Continues.

Table C-11 Continued.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Summer	HGSED071106-1	Mercury	Blank	1	1	<2X MDL	N/A
			Blank Spike	1	1	90-110	N/A
			Matrix Spike	1	1	70-130	
			Matrix Spike Dup	1	1	70-130	
			Matrix Spike Precision	1	1		< 25%
			Duplicate Analysis	1	1	NA	@ ≥ 10 X MDL < 20%
			CRM Analysis	1	1	80-120% or certified value, whichever is greater.	
Summer	HGSED071107-1	Mercury	Blank	1	1	<2X MDL	N/A
			Matrix Spike Precision	1	1	90-110	N/A
			Duplicate Analysis	1	1	70-130	
			CRM Analysis	1	1	70-130	
			Matrix Spike Precision	1	1		< 25%
			Duplicate Analysis	1	1	NA	@ ≥ 10 X MDL < 20%
			CRM Analysis	1	1	80-120% or certified value, whichever is greater.	
Summer	HGSED071120-1	Mercury	Blank	1	1	<2X MDL	N/A
			Blank Spike	1	1	90-110	N/A
			Matrix Spike	1	1	70-130	
			Matrix Spike Dup	1	1	70-130	
			Matrix Spike Precision	1	1		< 25%
			Duplicate Analysis	1	1	NA	@ ≥ 10 X MDL < 20%
			CRM Analysis	1	1	80-120% or certified value, whichever is greater.	
Summer And Fall*	HGSED071120-2	Mercury	Blank	1	1	<2X MDL	N/A
			Blank Spike	1	1	90-110	N/A
			Matrix Spike	1	1	70-130	
			Matrix Spike Dup	1	1	70-130	
			Matrix Spike Precision	1	1		< 25%
			Duplicate Analysis	1	1	NA	@ ≥ 10 X MDL < 20%
			CRM Analysis	1	1	80-120% or certified value, whichever is greater.	

*Some Summer sediment samples were batched and analyzed with Fall sediment samples.
NA = Not applicable.

Table C-11 Continues.

Table C-11 Continued.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Fall	HMSED071130-1	Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Nickel, Selenium, Silver, Zinc	Blank	10	10	<2X MDL	N/A
			Blank Spike	10	10	90-110	N/A
			Matrix Spike	10	10	75-125	
			Matrix Spike Dup	10	10	75-125	
			Matrix Spike Precision	10	10		< 20%
			Duplicate Analysis	10	10	NA	@ $\geq$ 10 X MDL < 20%
			CRM Analysis	10	10	80-120% or certified value, whichever is greater.	
Fall	ALFESED071204-1	Aluminum, Iron	Blank	2	2	<2X MDL	N/A
			Duplicate Analysis	2	2	NA	@ $\geq$ 10 X MDL < 20%
			CRM Analysis	2	2	80-120% or certified value, whichever is greater.	

NA = Not applicable.

Table C-11 Continues.

Table C-11 Continued.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Winter	HMSED080225-1	Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Nickel, Selenium, Silver, Zinc	Blank	10	10	<2X MDL	N/A
			Blank Spike	10	10	90-110	N/A
			Matrix Spike	10	10	75-125	
			Matrix Spike Dup	10	10	75-125	
			Matrix Spike Precision	10	10		< 20%
			Duplicate Analysis	10	10	NA	@ $\geq$ 10 X MDL < 20%
			CRM Analysis	10	10	80-120% or certified value, whichever is greater.	
Winter	ALFESED070307-1	Aluminum, Iron	Blank	2	2	<2X MDL	N/A
			Duplicate Analysis	2	2	NA	@ $\geq$ 10 X MDL < 20%
			CRM Analysis	2	2	80-120% or certified value, whichever is greater.	
Winter	HGSED080213-1	Mercury	Blank	1	1	<2X MDL	N/A
			Matrix Spike Precision	1	1	90-110	N/A
			Duplicate Analysis	1	1	70-130	
			CRM Analysis	1	1	70-130	
			Matrix Spike Precision	1	1		< 25%
			Duplicate Analysis	1	1	NA	@ $\geq$ 10 X MDL < 20%
			CRM Analysis	1	1	80-120% or certified value, whichever is greater.	

NA = Not applicable.

Table C-11 Continues.

Table C-11 Continued.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Spring	HMSED080602-1	Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Nickel, Selenium, Silver, Zinc	Blank	10	10	<2X MDL	N/A
			Blank Spike	10	10	90-110	N/A
			Matrix Spike	10	10	75-125	
			Matrix Spike Dup	10	10	75-125	
			Matrix Spike Precision	10	10		< 20%
			Duplicate Analysis	10	10	NA	@ $\geq$ 10 X MDL < 20%
			CRM Analysis	10	10	80-120% or certified value, whichever is greater.	
Spring	ALFESED080604-1	Aluminum, Iron	Blank	2	2	<2X MDL	N/A
			Duplicate Analysis	2	2	NA	@ $\geq$ 10 X MDL < 20%
			CRM Analysis	2	2	80-120% or certified value, whichever is greater.	
Spring	HGSED080605-1	Mercury	Blank	1	1	<2X MDL	N/A
			Blank Spike	1	1	90-110	N/A
			Matrix Spike	1	1	70-130	
			Matrix Spike Dup	1	1	70-130	
			Matrix Spike Precision	1	1		< 25%
			Duplicate Analysis	1	1	NA	@ $\geq$ 10 X MDL < 20%
			CRM Analysis	1	1	80-120% or certified value, whichever is greater.	

NA = Not applicable.

Table C-12. Method detection limits for dissolved sulfides, total organic carbon, and grain size in sediments, July 2007–June 2008.

Orange County Sanitation District, California.

Parameter	Detection Limits
Dissolved Sulfides (OCSD)	1.03 mg/kg dry weight
Total Organic Carbon (Columbia Analytical Services)	0.05%
Grain Size (Weston Solutions, Inc.)	0.001 %

Table C-13. Sediment dissolved sulfides QA/QC summary, July 2007–June 2008.

Orange County Sanitation District, California.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Summer	SULFIDE070725-1 SULFIDE070726-1 SULFIDE070730-1 SULFIDE070731-1 SULFIDE070802-1 SULFIDE070814-1 SULFIDE070815-1	Dissolved Sulfides	Method Blank	8	8	<2X MDL	N/A
			Blank Spike	8	8	80 -120	N/A
			Matrix Spike	8	8	70 - 130	
			Matrix Spike Dup	8	8	70 - 130	
			Matrix Spike Precision	8	8		<30%
Fall	SULFIDE071018-1	Dissolved Sulfides	Method Blank	1	1	<2X MDL	N/A
			Blank Spike	1	1	80 -120	N/A
			Matrix Spike	1	1	70 - 130	
			Matrix Spike Dup	1	1	70 - 130	
			Matrix Spike Precision	1	1		<30%
Winter	SULFIDE080115-1	Dissolved Sulfides	Method Blank	1	1	<2X MDL	N/A
			Blank Spike	1	1	80 -120	N/A
			Matrix Spike	1	1	70 - 130	
			Matrix Spike Dup	1	1	70 - 130	
			Matrix Spike Precision	1	1		<30%
Spring	SULFIDE080430-1	Dissolved Sulfides	Method Blank	1	1	<2X MDL	N/A
			Blank Spike	1	1	80 -120	N/A
			Matrix Spike	1	1	70 - 130	
			Matrix Spike Dup	1	1	70 - 130	
			Matrix Spike Precision	1	1		<30%

NA = Not applicable

Table C-14. Sediment total organic carbon QA/QC summary, July 2007–June 2008.

Orange County Sanitation District, California.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Summer	TOC-071026-1	Total Organic Carbon	Duplicate Analysis:	4	4	NA	10%[1]
Fall	TOC-080118-1	Total Organic Carbon	Duplicate Analysis:	1	1	NA	10%[1]
Winter	K0800784	Total Organic Carbon	Duplicate Analysis:	1	0*	NA	10%[1]
Spring	K0803966	Total Organic Carbon	Duplicate Analysis:	1	1	NA	10%[1]

[1] TOC Target Precision of QC Criteria is not described in the Core Monitoring Quality Assurance Project Plan. Except for winter quarter, the RPDs for all compounds tested were <10%.
*RPD = 12.5%
NA = Not applicable

Table C-15. Sediment grain size QA/QC summary, July 2007–June 2008.

Orange County Sanitation District, California.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Summer	PSIZ-070913-1	Grain Size	Reference Standard	11	11	NA	Mean ± 3 σ of the reference standard for median phi, skewness, % dispersion, % gravel, % sand, % clay, and % silt
Fall	PSIZ-071121-1	Grain Size	Reference Standard	2	2	NA	Mean ± 3 σ of the reference standard for median phi, skewness, % dispersion, % gravel, % sand, % clay, and % silt
Winter	PSIZ-080219-1	Grain Size	Reference Standard	2	2	NA	Mean ± 3 σ of the reference standard for median phi, skewness, % dispersion, % gravel, % sand, % clay, and % silt
Spring	PSIZ-080609-1	Grain Size	Reference Standard	2	2	NA	Mean ± 3 σ of the reference standard for median phi, skewness, % dispersion, % gravel, % sand, % clay, and % silt

FISH TISSUE CHEMISTRY NARRATIVE

FIRST QUARTER (JULY 2007)

Introduction

OCSD's ELOM laboratory received 40 individual fish samples and 20 composite samples (containing six fish per bag), from ocean monitoring staff during the month of July 2007. The individual samples were stored, dissected, and homogenized according to methods described in the OCSD ELOM LOPM. A 1:1 muscle to water ratio was used. No water was used during liver homogenization. After the individual samples were homogenized, equal aliquots of muscle and liver from each sample were frozen and distributed to the inorganic and organic chemistry sections of the laboratory for analyses. Each of the 20 composites were weighed and homogenized using a 1:1 whole body fish to water ratio, according to methods described in the ELOM LOPM. After the composites were homogenized, equal aliquots were frozen and distributed to the inorganic and organic chemistry sections of the laboratory for analyses.

The Organic Chemistry Section extracted 40 fish muscle samples, 40 fish liver samples, and 20 whole body composite samples and analyzed them for PCB congeners and organochlorine pesticides. Percent lipid content was also determined for each sample.

A typical organic tissue sample batch included 15 field samples with required QC samples. The QC samples included one hydromatrix blank, two duplicate sample extractions, one matrix spike, one matrix duplicate spike, two SRMs, and one reporting level spike (matrix of choice was orange roughy).

For mercury analysis, one sample batch consisted of 28–30 fish tissue samples and the required QC samples, which included a blank, blank spike, fish muscle and liver SRMs, duplicates, and matrix spikes.

Analytical Methods - Organochlorine Pesticides and PCB Congeners

The analytical methods used for organochlorine pesticides and PCB congeners were according to methods described in the ELOM LOPM. All fish tissue was extracted using an ASE 200 and analyzed by Ion Trap GC/MS/MS.

The MDLs for pesticides and PCBs in fish tissue are presented in Table C-16. Acceptance criteria for PCB SRMs in fish tissue are presented in Tables C-17 and C-18. Fish tissue pesticide and PCB QA/QC summary data are presented in Table C-19. All analyses were performed within the required holding times and with appropriate quality control measures. In cases where constituent concentrations exceeded the calibration range of the instrument, the samples were diluted and reanalyzed. Any variances that occurred during sample preparation or analyses are noted in the Comments/Notes section of each batch summary.

Analytical Methods – Lipid Content

Percent lipid content was determined for each sample of fish using methods described in the ELOM LOPM. Lipids were extracted by dichloromethane from approximately 1 to 2 g of sample and concentrated to 2 mL. A 100 uL aliquot of the extract was placed in a tarred aluminum weighing boat and the solvent allowed to evaporate to dryness. The remaining

residue was weighed, and the percent lipid content calculated. Lipid content QA/QC summary data are presented in Table C-20. All analyses were performed within the required holding times and with appropriate quality control measures. Any variances that occurred during sample preparation or analyses are noted in the Comments/Notes section of the Fish Tissue Percent QA/QC Summary.

Analytical Methods - Mercury

Fish tissue samples were analyzed for mercury in accordance with ELOM SOP 245.1A. Typical QC analyses for a tissue sample batch included a blank, a blank spike, and SRMs (liver and muscle). In the same batch, additional QC samples included duplicate analyses of the sample, spiked samples and duplicate spiked samples, which were run approximately once every ten samples.

The MDL for fish mercury is presented in Table C-21. Acceptance criteria for the mercury SRMs are presented in Table C-22. Fish tissue mercury QA/QC summary data are presented in Table C-23. All samples were analyzed within their 6-month holding times and met the QA criteria guidelines.

Pretreated (resected and 1:1 Muscle: water homogenized) fish samples were analyzed for mercury in accordance with methods described in the ELOM LOPM. QC for a typical batch included a blank, a blank spike, and two SRMs (one for muscle and one for liver). Fish samples with duplicates, spiked samples and duplicate spiked samples were run approximately once every ten fish samples. When sample mercury concentration exceeded the appropriate calibration curve, the sample was diluted with the reagent blank and reanalyzed. Approximately 0.5 g of prepared fish samples was digested in aqua regia using a 95 °C hot block. Once the samples were cooled, ultrapure water and potassium permanganate were added to each sample and the samples were redigested. Once the samples cooled again, sodium chloride-hydroxylamine hydrochloride solution was added to each sample and the samples were brought to 50 mL volume. The same procedure was used to prepare the calibration standards. The samples were analyzed for mercury on a Perkin Elmer FIMS 400 system.

All samples met the QA criteria guidelines for accuracy and precision.

Table C-16. Method detection levels for pesticides and PCB congeners in fish tissue, July 2007–June 2008.

Orange County Sanitation District, California.

Parameters	Method Detection Limit ng/g wet weight	Parameters	Method Detection Limit ng/g wet weight
Pesticides			
o,p'-DDD	0.90	Dieldrin	1.0
o,p'-DDE	0.80	Endrin	1.4
o,p'-DDT	0.68	*gamma*-BHC	0.72
p,p'-DDD	1.2	*gamma*-Chlordane	0.78
p,p'-DDE	0.92	Heptachlor	0.71
p,p'-DDT	0.85	Heptachlor epoxide	0.72
p,p'-DDMU	0.50	Hexachlorobenzene	0.83
Aldrin	0.67	Mirex	0.63
alpha-Chlordane	0.75	*trans*-Nonachlor	0.83
cis-Nonachlor	0.70		
PCB Congeners			
PCB 8	0.86	PCB 128	0.65
PCB 18	0.54	PCB 138	0.86
PCB 28	0.70	PCB 149	1.1
PCB 37	0.66	PCB 151	0.61
PCB 44	0.68	PCB 156	1.0
PCB 49	0.87	PCB 157	1.2
PCB 52	0.73	PCB 158	1.2
PCB 66	0.65	PCB 167	1.3
PCB 70	1.2	PCB 168/153	2.6
PCB 74	1.1	PCB 169	1.5
PCB 77	1.3	PCB 170	1.3
PCB 81	0.83	PCB 177	1.2
PCB 87	0.87	PCB 180	0.64
PCB 99	0.90	PCB 183	0.88
PCB 101	0.84	PCB 187	1.1
PCB 105	1.1	PCB 189	1.3
PCB 110	0.84	PCB 194	0.97
PCB 114	0.59	PCB 195	0.77
PCB 118	1.1	PCB 200	1.2
PCB 119	0.84	PCB 201	0.91
PCB 123	1.1	PCB 206	1.1
PCB 126	1.1	PCB 209	1.2

Table C-17. Acceptance criteria for standard reference materials of PCB congeners in fish tissue, CARP-2, July 2007–June 2008.

CARP-2, Ground Whole Carp Reference Material for Organochlorine Compounds, National Research Council Canada.

Orange County Sanitation District, California.

Parameter	True Value (ng/g)	Acceptance Range (ng/g)	
		Minimum	Maximum
PCB 18	27.3	23.3	31.3
PCB 28	34.0	26.8	41.2
PCB 52	138	95.0	181
PCB 44	86.6	60.7	112
PCB 118	148	115	181
PCB 153	105	83.0	127
PCB 128	20.4	16.0	24.8
PCB 180	53.3	40.3	66.3
PCB 194	10.9	7.80	14.0
PCB 206	4.40	3.30	5.50

Table C-18. Acceptance criteria for standard reference materials of pesticides and PCB congeners in fish tissue, SRM-1946, July 2007–June 2008.

SRM 1946, Organics in Lake Superior Fish Tissue, National Institute of Standards and Technology.

Orange County Sanitation District, California.

Parameter	True Value (ng/g)	Acceptance Range (ng/g)		Parameter	True Value (ng/g)	Acceptance Range (ng/g)	
		Minimum	Maximum			Minimum	Maximum
gamma-BHC	1.14	0.96	1.32	PCB 99	25.6	23.3	27.9
Dieldrin	32.5	29.0	36.0	PCB 101	34.6	32.0	37.2
Heptachlor epoxide	5.50	5.27	5.73	PCB 105	19.9	19.0	20.8
Hexachlorobenzene	7.25	6.42	8.08	PCB 110	22.8	20.8	24.8
alpha-Chlordane	32.5	30.7	34.3	PCB 118	52.1	51.1	53.1
gamma-Chlordane	8.36	7.45	9.27	PCB 126	0.380	0.363	0.397
cis-Nonachlor	59.1	55.5	62.7	PCB 128	22.8	20.9	24.7
trans-Nonachlor	99.6	92.0	107	PCB 138	115	102	128
Mirex	6.47	5.70	7.24	PCB 149	26.3	25.0	27.6
o,p'-DDD	2.20	1.95	2.45	PCB 153/168	170	161	179
p,p'-DDD	17.7	14.9	20.5	PCB 156	9.52	9.01	10.0
p,p'-DDE	373	325	421	PCB 169	0.106	0.092	0.120
p,p'-DDT	37.2	33.7	40.7	PCB 170	25.2	23.0	27.4
PCB 44	4.66	3.80	5.52	PCB 180	74.4	70.4	78.4
PCB 49	3.80	3.41	4.19	PCB 183	21.9	19.4	24.4
PCB 52	8.1	7.10	9.10	PCB 187	55.2	53.1	57.3
PCB 66	10.8	8.90	12.7	PCB 194	13.0	11.7	14.3
PCB 70	14.9	14.3	15.5	PCB 195	5.30	4.85	5.75
PCB 74	4.83	4.32	5.34	PCB 206	5.40	4.97	5.83
PCB 77	0.327	0.302	0.352	PCB 209	1.30	1.09	1.51
PCB 87	9.4	8.00	10.8				

Table C-19. Fish tissue PCB/pesticide QA/QC summary, July 2007–June 2008.

CARP-2: National Research Council Canada; SRM 1946: National Institute of Standards & Technology

Orange County Sanitation District, California.

Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Sample Set – AM (15 Muscle Tissue Samples)				
NRCC CARP-2	10	3	according to published acceptance criteria	NA
SRM 1946	41	15	according to published acceptance criteria	NA
PCB Reporting Level Spike	44	34	75 -125	NA
PCB Matrix Spike:	44	36	70 - 130	NA
PCB Matrix Spike Dup	44	44		
Precision	44	38	NA	< 25%
Pesticide Reporting Level Spike	19	18	75 -125	NA
Pesticide Matrix Spike	19	14	70-130	NA
Pesticide Matrix Spike Dup	19	16		
Precision	19	19	NA	< 25%
PCB/Pesticide Duplicate Analysis				
Duplicate 1 PCB	0	0	NA	< 25% @ 3 x MDL of Sample Mean.
Duplicate 1 Pesticides	1	1		
Duplicate 1 Sum of Pesticides and PCBs	1	1		
Duplicate 2 PCB	0	0	NA	< 25% @ 3 x MDL of Sample Mean.
Duplicate 2 Pesticides	1	1		
Duplicate 2 Sum of Pesticides and PCBs	1	1		
Sample Set – BM (15 Muscle Tissue Samples)				
NRCC CARP-2	10	8	according to published acceptance criteria	NA
SRM 1946	41	23	according to published acceptance criteria	
PCB Reporting Level Spike	44	44	75 -125	NA
PCB Matrix Spike:	44	42	70 - 130	NA
PCB Matrix Spike Dup	44	42		
Precision	44	43	NA	< 25%
Pesticide Reporting Level Spike	19	19	75 -125	NA
Pesticide Matrix Spike	19	17	70-130	NA
Pesticide Matrix Spike Dup	19	15		
Precision	19	19	NA	< 25%
PCB/Pesticide Duplicate Analysis				
Duplicate 1 PCB	0	0	NA	< 25% @ 3 x MDL of Sample Mean.
Duplicate 1 Pesticides	1	1		
Duplicate 1 Sum of Pesticides and PCBs	1	1		
Duplicate 2 PCB	3	3	NA NA	< 25% @ 3 x MDL of Sample Mean.
Duplicate 2 Pesticides	4	4		
Duplicate 2 Sum of Pesticides and PCBs	1	1		

Comments: Analysis also included a review of calibration check standards, extraction notes, and instrument conditions. All calibration check standards passed the QAQC protocol. The consistently low SRM 1946 recoveries may be due to the source of the sample aliquots. All 2007-08 Core Program SRM 1946 aliquots were taken from a jar that had been previously used, and was partially full. Although the SRM had not expired, it is possible that the stability of the constituents had been affected. Current testing is being done on unopened jars of SRM. NRCC CARP-2 constituents PCB 168/153 PCB 118 consistently fail % recovery parameters. This problem is also under investigation.

Table C-19 Continues.

Table C-19 Continued.

Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Sample Set – CM (9 Muscle Tissue and 5 Whole Body Tissue Samples)				
NRCC CARP-2	10	10	according to published acceptance criteria	NA
SRM 1946	41	11	according to published acceptance criteria	
PCB Reporting Level Spike	44	44	75 -125	NA
PCB Matrix Spike:	44	44	70 - 130	NA
PCB Matrix Spike Dup	44	44		
Precision	44	44	NA	< 25%
Pesticide Reporting Level Spike	19	19	75 -125	NA
Pesticide Matrix Spike	19	19	70-130	NA
Pesticide Matrix Spike Dup	19	19		
Precision	19	19	NA	< 25%
PCB/Pesticide Duplicate Analysis				
Duplicate 1 PCB	0	0	NA	< 25% @ 3 x MDL of Sample Mean.
Duplicate 1 Pesticides	1	1		
Duplicate 1 Sum of Pesticides and PCBs	1	1		
Duplicate 2 PCB	0	0	NA	< 25% @ 3 x MDL of Sample Mean.
Duplicate 2 Pesticides	1	1		
Duplicate 2 Sum of Pesticides and PCBs	1	1		
Sample Set – DM (15 Whole Body Tissue Samples)				
NRCC CARP-2	10	7	according to published acceptance criteria	NA
SRM 1946	41	14	according to published acceptance criteria	
PCB Reporting Level Spike	44	43	75 -125	NA
PCB Matrix Spike:	44	27	70 - 130	NA
PCB Matrix Spike Dup	44	25		
Precision	44	43	NA	< 25%
Pesticide Reporting Level Spike	19	17	75 -125	NA
Pesticide Matrix Spike	19	16	70-130	NA
Pesticide Matrix Spike Dup	19	15		
Precision	19	18	NA	< 25%
PCB/Pesticide Duplicate Analysis				
Duplicate 1 PCB	1	1	NA	< 25% @ 3 x MDL of Sample Mean.
Duplicate 1 Pesticides	2	2		
Duplicate 1 Sum of Pesticides and PCBs	1	1		
Duplicate 2 PCB	0	0	NA	< 25% @ 3 x MDL of Sample Mean.
Duplicate 2 Pesticides	1	1		
Duplicate 2 Sum of Pesticides and PCBs	1	1		

Comments: Analysis also included a review of calibration check standards, extraction notes, and instrument conditions. All calibration check standards passed the QAQC protocol. The consistently low SRM 1946 recoveries may be due to the source of the sample aliquots. All 2007-08 Core Program SRM 1946 aliquots were taken from a jar that had been previously used, and was partially full. Although the SRM had not expired, it is possible that the stability of the constituents had been affected. Current testing is being done on unopened jars of SRM. NRCC CARP-2 constituents PCB 168/153 PCB 118 consistently fail % recovery parameters. This problem is also under investigation.

Table C-19 Continues.

Table C-19 Continued.

Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Sample Set – AL (15 Liver Tissue Samples)				
NRCC CARP-2	10	8	according to published acceptance criteria	NA
SRM 1946 *	41	16	according to published acceptance criteria	
PCB Reporting Level Spike	44	43	75 -125	NA
PCB Matrix Spike:	44	38	70 - 130	NA
PCB Matrix Spike Dup	44	41		
Precision	44	44	NA	< 25%
Pesticide Reporting Level Spike	19	18	75 -125	NA
Pesticide Matrix Spike	19	16	70-130	NA
Pesticide Matrix Spike Dup	19	19		
Precision	19	17	NA	< 25%
PCB/Pesticide Duplicate Analysis				
Duplicate 1 PCB	1	1	NA	< 25% @ 3 x MDL of Sample Mean.
Duplicate 1 Pesticides	3	3		
Duplicate 1 Sum of Pesticides and PCBs	1	1		
Duplicate 2 PCB	12	12	NA	< 25% @ 3 x MDL of Sample Mean.
Duplicate 2 Pesticides	4	4		
Duplicate 2 Sum of Pesticides and PCBs	1	1		
Sample Set – BL (15 Liver Tissue Samples)				
NRCC CARP-2	10	8	according to published acceptance criteria	NA
SRM 1946	41	16	according to published acceptance criteria	
PCB Reporting Level Spike	44	34	75 -125	NA
PCB Matrix Spike:	44	41	70 - 130	NA
PCB Matrix Spike Dup	44	44		
Precision	44	41	NA	< 25%
Pesticide Reporting Level Spike	19	16	75 -125	NA
Pesticide Matrix Spike	19	17	70-130	NA
Pesticide Matrix Spike Dup	19	18		
Precision	19	16	NA	< 25%
PCB/Pesticide Duplicate Analysis				
Duplicate 1 PCB	12	14	NA	< 25% @ 3 x MDL of Sample Mean.
Duplicate 1 Pesticides	3	3		
Duplicate 1 Sum of Pesticides and PCBs	1	1		
Duplicate 2 PCB	0	0	NA	< 25% @ 3 x MDL of Sample Mean.
Duplicate 2 Pesticides	0	0		
Duplicate 2 Sum of Pesticides and PCBs	1	1		

Comments: Analysis also included a review of calibration check standards, extraction notes, and instrument conditions. All calibration check standards passed the QAQC protocol. The consistently low SRM 1946 recoveries may be due to the source of the sample aliquots. All 2007-08 Core Program SRM 1946 aliquots were taken from a jar that had been previously used, and was partially full. Although the SRM had not expired, it is possible that the stability of the constituents had been affected. Current testing is being done on unopened jars of SRM. NRCC CARP-2 constituents PCB 168/153 PCB 118 consistently fail % recovery parameters. This problem is also under investigation.

Table C-19 Continues.

Table C-19 Continued.

Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Sample Set – CL (10 Liver Tissue Samples)				
NRCC CARP-2	10	Not analyzed	according to published acceptance criteria	NA
SRM 1946	41	Not analyzed	according to published acceptance criteria	
PCB Reporting Level Spike	44	Not analyzed	75 -125	NA
PCB Matrix Spike:	44	Not analyzed	70 - 130	NA
PCB Matrix Spike Dup	44	Not analyzed		
Precision	44	Not analyzed	NA	< 25%
Pesticide Reporting Level Spike	19	Not analyzed	75 -125	NA
Pesticide Matrix Spike	19	Not analyzed	70-130	NA
Pesticide Matrix Spike Dup	19	Not analyzed		
Precision	19	Not analyzed	NA	< 25%
PCB/Pesticide Duplicate Analysis				
Duplicate 1 PCB	Not analyzed	Not analyzed	NA	< 25% @ 3 x MDL of Sample Mean.
Duplicate 1 Pesticides	Not analyzed	Not analyzed		
Duplicate 1 Sum of Pesticides and PCBs	Not analyzed	Not analyzed		
Duplicate 2 PCB	Not analyzed	Not analyzed	NA	< 25% @ 3 x MDL of Sample Mean.
Duplicate 2 Pesticides	Not analyzed	Not analyzed		
Duplicate 2 Sum of Pesticides and PCBs	Not analyzed	Not analyzed		

Comments: Entire sample set CL lost due to spiking all samples with pesticides solution instead of surrogate solution.

Table C-20. Fish tissue percent lipid QA/QC summary, July 2007–June 2008.

Orange County Sanitation District, California.

Sample Set	Tissue Type	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Precision % RPD
AM	Muscle	Percent Lipid	Duplicate Samples	2	2	<25%
BM	Muscle	Percent Lipid	Duplicate Samples	2	2	<25%
CM	Muscle	Percent Lipid	Duplicate Samples	2	2	<25%
DM	Whole Body	Percent Lipid	Duplicate Samples	2	2	<25%
AL	Liver	Percent Lipid	Duplicate Samples	2	2	<25%
BL	Liver	Percent Lipid	Duplicate Samples	2	2	<25%
CL	Liver	Percent Lipid	Duplicate Samples	2	2	<25%

Table C-21. Method detection levels for mercury in fish tissue, July 2007–June 2008.

Orange County Sanitation District, California.

Parameter	Method Detection Limit (ng/g wet weight)
Mercury	0.002

Table C-22. Acceptance criteria for standard reference materials of mercury in fish tissue, July 2007–June 2008.

Dogfish Muscle and Liver Reference Material for Mercury, National Research Council Canada.

Orange County Sanitation District, California.

Mercury	True Value (ng/g)	Acceptance Range (ng/g)	
		Minimum	Maximum
DORM-2	4.64	4.38	4.90
DOLT-2	2.14	1.86	2.42

Table C-23. Fish tissue mercury QA/QC summary, July 2007–June 2008.

Orange County Sanitation District, California.

Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
HGFISH070806-1	Mercury	Blank	1	1	<2X MDL	NA
		Blank Spike	1	1	90-110	NA
		Matrix Spike	1	1	70-130	
		Matrix Spike Dup	1	1	70-130	
		Matrix Spike Precision	1	1		< 25%
		Duplicate Analysis	1	1	NA	@ ≥ 10 X MDL < 20%
		CRM Analysis	1	1	80-120% or certified value, whichever is greater.	
HGFISH070807-1	Mercury	Blank	1	1	<2X MDL	NA
		Blank Spike	1	1	90-110	NA
		Matrix Spike	1	1	70-130	
		Matrix Spike Dup	1	1	70-130	
		Matrix Spike Precision	1	1		< 25%
		Duplicate Analysis	1	1	NA	@ ≥ 10 X MDL < 20%
		CRM Analysis	1	1	80-120% or certified value, whichever is greater.	
HGFISH070815-1	Mercury	Blank	1	1	<2X MDL	NA
		Blank Spike	1	1	90-110	NA
		Matrix Spike	1	1	70-130	
		Matrix Spike Dup	1	1	70-130	
		Matrix Spike Precision	1	1		< 25%
		Duplicate Analysis	1	1	NA	@ ≥ 10 X MDL < 20%
		CRM Analysis	1	1	80-120% or certified value, whichever is greater.	

NA = Not applicable.

Table C-23 Continues.

Table C-23 Continued.

Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
HGFISH070924-1	Mercury	Blank	1	1	<2X MDL	NA
		Blank Spike	1	1	90-110	NA
		Matrix Spike	1	1	70-130	
		Matrix Spike Dup	1	1	70-130	
		Matrix Spike Precision	1	1		< 25%
		Duplicate Analysis	1	1	NA	@ $\geq$ 10 X MDL < 20%
		CRM Analysis	1	1	80-120% or certified value, whichever is greater.	
HGFISH070925-1	Mercury	Blank	1	1	<2X MDL	NA
		Blank Spike	1	1	90-110	NA
		Matrix Spike	1	1	70-130	
		Matrix Spike Dup	1	1	70-130	
		Matrix Spike Precision	1	1		< 25%
		Duplicate Analysis	1	1	NA	@ $\geq$ 10 X MDL < 20%
		CRM Analysis	1	1	80-120% or certified value, whichever is greater.	

NA = Not applicable.

BENTHIC INFAUNA NARRATIVE

SORTING AND TAXONOMY QA/QC

The QAPP for the Year 2007-08 Ocean Monitoring Program requires that infauna samples collected undergo specific sorting and taxonomic QA procedures. The following sections describe QA/QC protocols used under the program and the status of year 23 samples that have received sorting and taxonomic QA/QC. Sorting and taxonomic QA/QC procedures have been completed for three survey periods: the summer (July 2007, Cruise # OC-2007-038), fall (October 2007, Cruise # OC-2007-052), and winter (January 2008, Cruise # OC-2008-001) surveys.

Sorting QA/QC Procedures

OCSD's NPDES permit designates ten quarterly (summer, fall, winter, and spring) benthic-sampling stations and 39 annual (summer) benthic-sampling stations. Sorting procedures were performed on one replicate infaunal sample collected from each of three randomly selected quarterly stations in the summer, fall, and winter quarters and an additional seven samples (at least one from each of the four major depth-contour intervals) for the annual survey; no QA samples were processed for the spring survey. The sorting procedure involved removal by Weston solutions, Inc. (Weston) personnel of all biological organisms and fragments from benthic samples. Organisms were further sorted by taxa, transferred to separate vials, and total counts per station replicate were made. When all samples from a cruise passed Weston's in-house sorting efficiency criteria, they were shipped along with any remaining particulates (RPs) including sediments and shell and kelp fragments) to Osprey Marine Management (Osprey) for reanalysis. For re-sorting QA, Osprey examined each samples RPs and collected any organisms or fragments that may have been missed by Weston. The sample passed the QA procedure if the total number of animals collected by Osprey from the RPs was less than or equal to 5% of the total number of individuals collected by Weston for that sample. Discrepancies in excess of 5% of the total sample number were evaluated to resolve differences in taxonomic or specimen-condition (e.g., fragments) identifications.

2007-08 Sorting QA/QC Status

Sorting results for all 2007-08 QA samples were well within the 5% QC limit.

Taxonomic Identification QA/QC Procedures

For the summer survey, taxonomic QA/QC procedures include stratifying the stations into five depth ranges (i.e., <60m, 60m, 100m, 200m, and >300m) and then randomly selecting two stations from each depth strata. For fall and winter 60-m cruises, three randomly selected samples are drawn from the fall and winter cruises. These samples undergo comparative taxonomic analysis by two independent groups of taxonomists. The selected infauna samples were identified first by Weston taxonomists, and then re-identified by taxonomists contracted through Osprey. Weston then compares the two datasets and identifies any discrepancies. Taxonomic discrepancies were reviewed and resolved by Weston taxonomists. Following their review, any necessary corrections to taxonomic names or numbers were made, and the project database was modified to reflect these changes.

2007-08 Taxonomic QA/QC Status

There were 383 initial discrepancies associated with taxonomic identifications for the 2007 annual cruise. However, each discrepancy was carefully reviewed, resolved, and provided with a resolution code by Weston (Table C-24).

The majority of identification differences noted for the July 2007 annual cruise were due to Osprey misidentifications (19%), convention discrepancies (19%), Osprey miscounts (15%), and Weston miscounts (11%). Most of the remaining discrepancies were due to, Weston misidentifications (9%), loss during biomassing (7%), data entry error (7%), variations in level of expertise (5%), organisms too small to speciate (4%), and organism fragments (2%). A total of 54 discrepancies resulted in multiple coding (e.g., miscounts by both Weston and Osprey).

A total of 173 discrepancies were recorded initially for the October 2007 quarterly survey (Table C-24). The majority of identification differences noted for the quarterly cruise were due to Osprey misidentifications (25%), Weston miscounts (19%), Osprey miscounts (17%), convention discrepancies (15%), and Weston misidentifications (10%). Most of the remaining discrepancies were due to, loss during biomassing (5%), variations in level of expertise (4%), and data entry error (4%). A total of 19 discrepancies resulted in multiple coding (e.g., miscounts by both Weston and Osprey).

A total of 183 discrepancies were recorded initially for the January 2008 quarterly survey (Table C-24). The majority of identification differences noted for the quarterly cruise were due to Osprey misidentifications (27%), Osprey miscounts (19%), and convention discrepancies (17%). Most of the remaining discrepancies were due to Weston miscounts (9%), variations in level of expertise (9%), Weston misidentifications (8%), loss during biomassing (5%), and data entry error (5%). A total of 26 discrepancies resulted in multiple coding (e.g., miscounts by both Weston and Osprey).

Table C-24. Resolution code counts and percents for year 23, July 2007, October 2007, and January 2008 taxonomic QA data.

Orange County sanitation District, California.

Discrepancy	Resolutions					
	July 2007		October 2007		January 2008	
	Counts	Percent	Counts	Percent	Counts	Percent
Weston misidentification	36	9	18	10	15	8
QA Taxonomist misidentification	74	19	44	25	49	27
Weston miscount	41	11	33	19	17	9
QA Taxonomist miscount	59	15	29	17	35	19
Data entry error (Weston)	13	3	3	2	4	2
Data entry error (QA Taxonomist)	14	4	3	2	5	3
Weston misspelling	0	0	0	0	0	0
QA Taxonomist misspelling	3	1	1	1	0	0
Vouchered specimen	0	0	0	0	0	0
NODC coding problem	0	0	0	0	0	0
Convention discrepancy	72	19	26	15	31	17
Variation in level of expertise	21	5	7	4	16	9
Organism too small to speciate	14	4	0	0	0	0
Organism fragment	7	2	0	0	0	0
Organism added from another vial	0	0	0	0	0	0
Dead animal not counted	1	1	0	0	1	1
Organism lost during biomassing	28	7	9	5	10	5
Keypunch operator error	0	0	0	0	0	0
Total	383	100	173	100	183	100
Multiple codes	54		19		26	

OTTER TRAWL NARRATIVE

The District's trawl sampling protocols are based upon regionally developed sampling methods (Mearns and Stubs 1974; Mearns and Allen 1978) and US Environmental Protection Agency 301(h) guidance documents (Tetra Tech 1986). These include a maximum distance from the nominal trawl station co-ordinates, sampling depth, vessel speed, and distance (trawl track) covered. Table C-25 lists the trawl quality assurance objectives (QAO).

Table C-25. Districts quality assurance objectives for trawl sampling, July 2007–June 2008.

Orange County Sanitation District, California.

Measure	Quality Assurance Objective (QAO)
Trawl Track Depth	±10% of nominal station depth (at any point during the trawl)
Trawl Track Length	450 m
Distance from nominal	100 m
Vessel Speed	1.5 - 2.0 knots

Established regional survey methods for southern California requires that a portion of the trawl track must pass within a 100-m circle that originates from the nominal sample station latitude and be within 10% of the station's depth. The speed of the trawl should range from 0.77 to 1 m/s or 1.5 to 2.0 kts. Since 1985, the District has trawled a set distance of 450 meters (the distance that the net is actually on the bottom collecting fish and invertebrates); regional surveys trawls are based on time on the bottom not distance.

Summer 2007

For summer 2007, all trawl lengths ranged from 449.5 to 488.9 m with the average trawl length being 458.8 m and the average trawl speed being 1.86 kts for all trawls combined (Table C-26). All the trawls passed through the designated 100-meter circle (Figure C-1). Trawl depths and time on the bottom were determined using an attached pressure sensor that showed excellent trawl repeatability in both depth (Table C-27) and distance traveled (Figure C-2). The only anomalous station was T3, which is located on the edge of the Newport submarine canyon where depth changes rapidly (Figure 6-1). A perfectly flat trawl along an isobath is difficult to maintain at this station. While Station T3 appears not to follow the bottom depth contour, it is very likely that net is trawling properly along an irregular bottom.

Winter 2008

For winter 2008, all trawl lengths ranged from 447.1 to 480.2 m with the average trawl length being 456.5 m and the average trawl speed being 1.93 kts for all trawls combined (Table C-28). All the trawls passed through the designated 100-meter circle (Figure C-3). Trawl depths and time on the bottom were determined using an attached pressure sensor that showed excellent trawl repeatability in both depth (Table C-29) and distance traveled (Figure C-4). The only anomalous station was T3, which is located on the edge of the Newport submarine canyon where depth changes rapidly (Figure 6-1). A perfectly flat trawl along an isobath is difficult to maintain at this station. While Station T3 appears not to follow the bottom depth contour, it is very likely that net is trawling properly along an irregular bottom.

Table C-26. Trawl sample dates, track distances, percent difference from target track distance, elapsed time, and vessel speed, July 2007.

Hauls with speeds less than 1.5 knots are denoted in blue, greater than 2 knots are denoted in red.

Orange County Sanitation District, California.

Date	Station	Haul	Distance Trawled (meters)	Percent Difference from Target Distance *	Elapsed Time (seconds)	Trawl speed (knots)**
July 19, 2007	T0	1	454.3	1.0	482	1.8
July 19, 2007	T0	2	452.4	0.5	475	1.9
July 11, 2007	T1	1	449.5	-0.1	446	2.0
July 11, 2007	T1	2	455.3	1.2	480	1.8
July 11, 2007	T1	3	457.4	1.6	510	1.7
July 11, 2007	T2	1	455.1	1.1	460	1.9
July 12, 2007	T2	2	463.8	3.1	483	1.9
July 12, 2007	T3	1	455.1	1.1	448	2.0
July 18, 2007	T3	2	487.4	8.3	417	**2.3**
July 18, 2007	T3	3	458.0	1.8	541	1.6
July 19, 2007	T6	1	457.1	1.6	444	2.0
July 19, 2007	T6	3	449.8	0.0	428	2.0
July 18, 2007	T10	1	488.9	8.6	588	1.6
July 18, 2007	T10	2	455.3	1.2	597	1.5
July 11, 2007	T11	1	478.0	6.2	566	1.6
July 11, 2007	T11	2	451.8	0.4	416	**2.1**
July 11, 2007	T11	3	461.2	2.5	440	2.0
July 12, 2007	T12	1	458.9	2.0	504	1.8
July 12, 2007	T12	2	456.0	1.3	573	1.5
July 12, 2007	T12	4	456.6	1.5	460	1.9
July 12, 2007	T13	1	454.6	1.0	450	2.0
July 12, 2007	T13	2	456.5	1.5	476	1.9
July 12, 2007	T13	3	454.3	1.0	501	1.8
July 18, 2007	T14	1	452.3	0.5	468	1.9
July 18, 2007	T14	2	450.1	0.0	482	1.8
Mean value			**458.8**	**2.0**	**485.4**	**1.86**

* Target Distance – 450 meters
** Target Speed – 1.5 – 2.0 knots

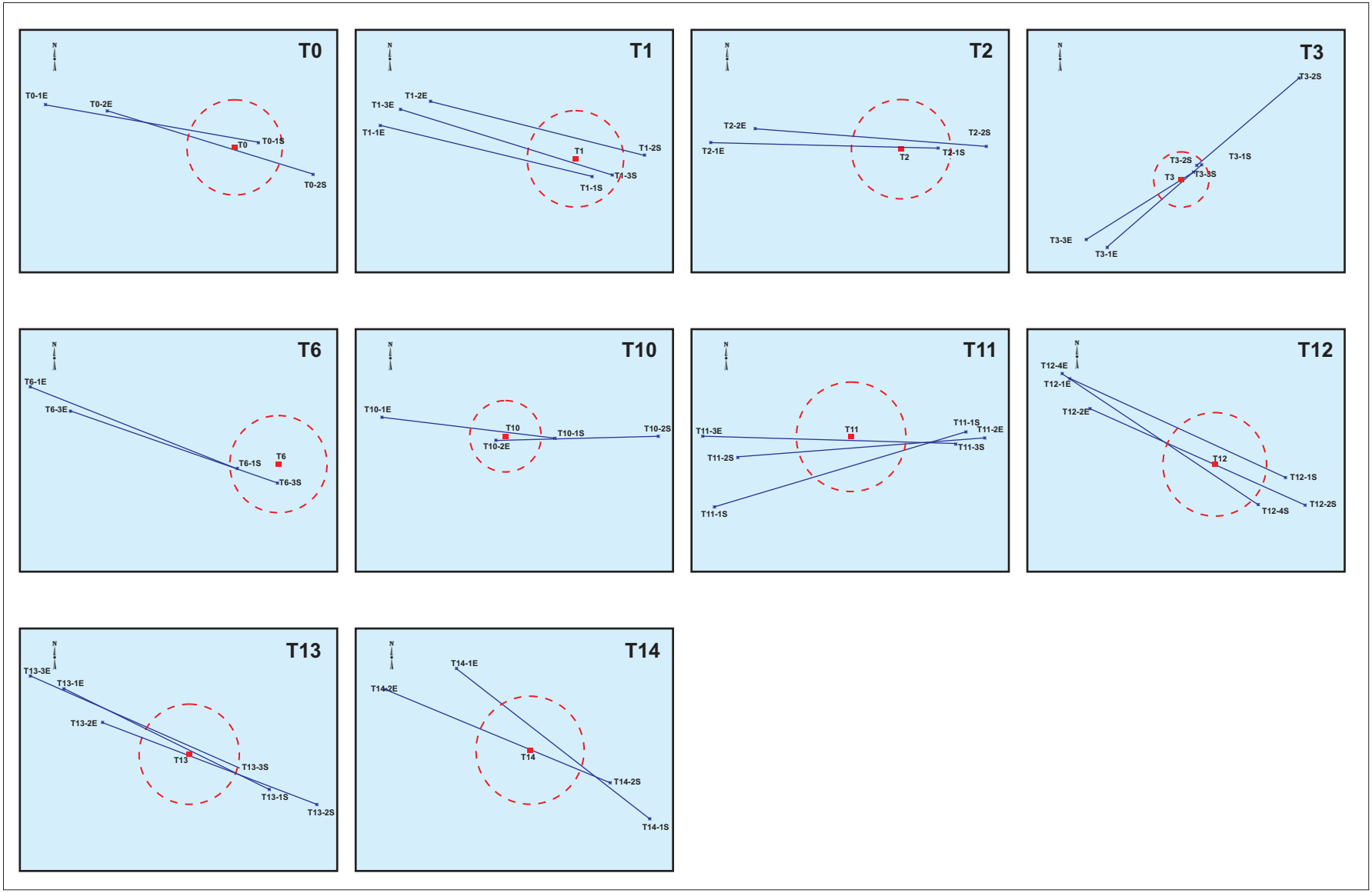

Figure C-1. **Quality assurance plots of distance to station for otter trawl hauls, July 2007.**
Red circle represents 100 meter distance from nominal trawl station center point. Blue lines represent trawl path while net is on the bottom. Trawl endpoints are labeled by station name, haul number, start (S) and end (E).

Table C-27. 10% trawl depth QA, July 2007.

Orange County Sanitation District, California.

Date	Station	Haul	Nominal Depth (m)	QA Range (m)	Data Source	Average Bottom Depth (m)	10% Y/N
7/19/2007	T0	1	18	16.2–19.8	SBE data	19.8	Y
					SOD data	18.5	Y
7/19/2007	T0	2			SBE data	19.7	Y
					SOD data	18.0	Y
7/11/2007	T1	1	55	49.5–60.5	SBE data	NO DATA	N/A
					SOD data	55.0	Y
7/11/2007	T1	2			SBE data	NO DATA	N/A
					SOD data	54.0	Y
7/11/2007	T1	3			SBE data	NO DATA	N/A
					SOD data	54.0	Y
7/11/2007	T2	1	35	31.5–38.5	SBE data	NO DATA	N/A
					SOD data	34.0	Y
7/12/2007	T2	2			SBE data	36.6	Y
					SOD data	34.0	Y
7/12/2007	T3	1	55	49.5–60.5	SBE data	63.5	N
					SOD data	60.0	Y
7/18/2007	T3	2			SBE data	65.9	N
					SOD data	61.5	N
7/18/2007	T3	3			SBE data	64.3	N
					SOD data	57.0	Y
7/19/2007	T6	1	36	32.4–39.6	SOD data	38.1	Y
					SBE data	36.0	Y
7/19/2007	T6	3			SOD data	38.1	Y
					SBE data	36.0	Y
7/18/2007	T10	1	137	123.3–150.7	SOD data	135.9	Y
					SBE data	132.0	Y
7/18/2007	T10	2			SOD data	133.7	Y
					SBE data	131.5	Y
7/11/2007	T11	1	60	54.0–66.0	SBE data	NO DATA	N/A
					SOD data	62.5	Y
7/11/2007	T11	2			SBE data	NO DATA	N/A
					SOD data	62.0	Y
7/11/2007	T11	3			SBE data	NO DATA	N/A
					SOD data	57.5	Y
7/12/2007	T12	1	57	51.3–62.7	SBE data	58.6	Y
					SOD data	55.5	Y
7/12/2007	T12	2			SBE data	58.9	Y
					SOD data	55.0	Y
7/12/2007	T12	4			SBE data	58.8	Y
					SOD data	55.5	Y

Table C-27 Continues.

Table C-27 Continued.

Date	Station	Haul	Nominal Depth (m)	QA Range (m)	Data Source	Average Bottom Depth (m)	10% Y/N
7/12/2007	T13	1	60	54.0–66.0	SOD data	62.2	Y
					SBE data	60.0	Y
7/12/2007	T13	2			SOD data	62.1	Y
					SBE data	59.5	Y
7/12/2007	T13	3			SOD data	60.5	Y
					SBE data	60.0	Y
7/18/2007	T14	1	137	123.3–150.7	SOD data	140.7	Y
					SBE data	134.5	Y
7/18/2007	T14	2			SOD data	138.2	Y
					SBE data	135.5	Y

Notes:
Station T3 depth varies widely. 10% QA may not be applicable.
SBE = Seabird Electronics
SOD = Station occupation data

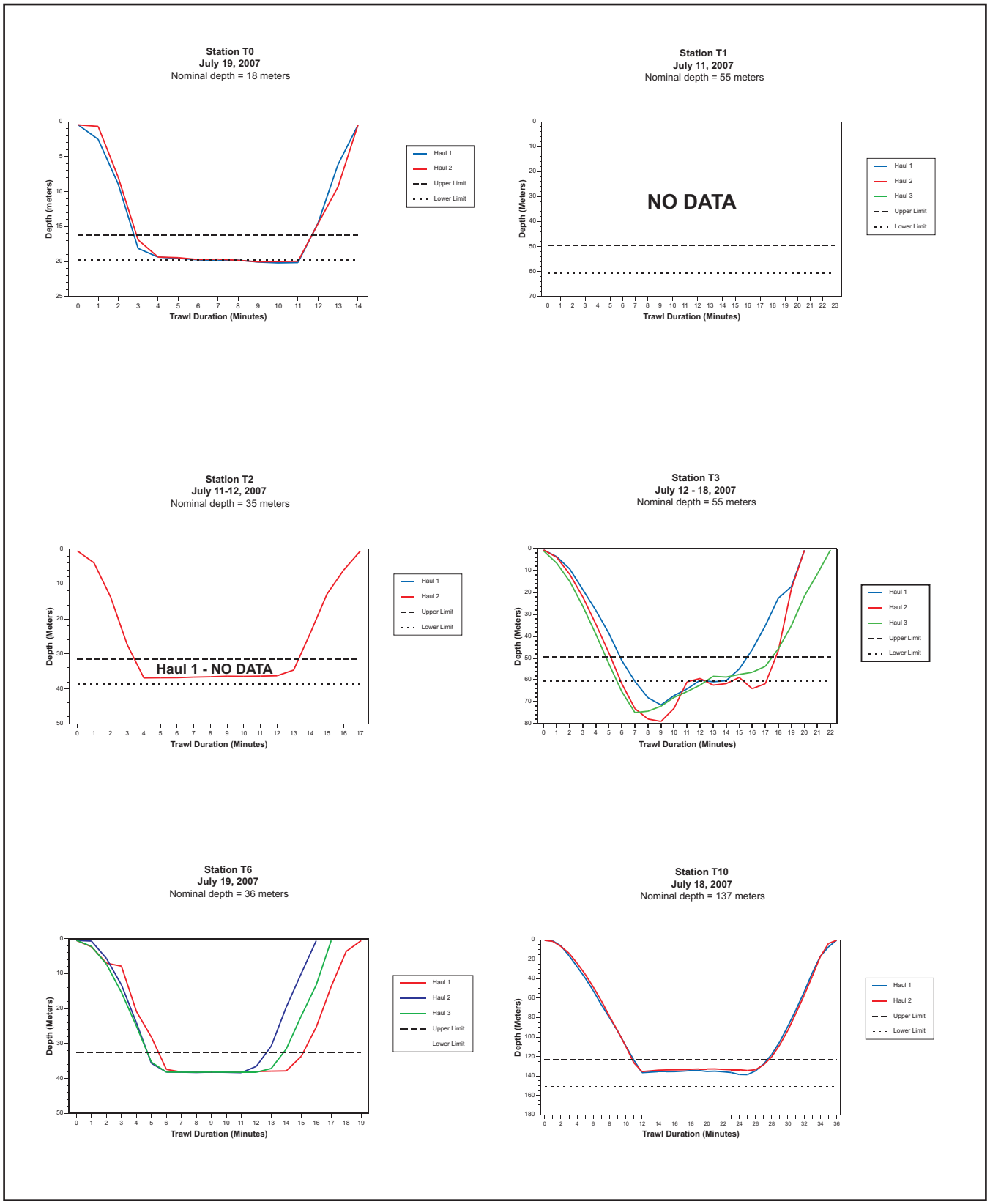

Figure C-2. **Quality assurance plots of trawl duration and trawl depth per haul for otter trawl stations, July 2007.**
Upper and lower limit lines are ± 10% of nominal trawl depth.

Orange County Sanitation District, California.

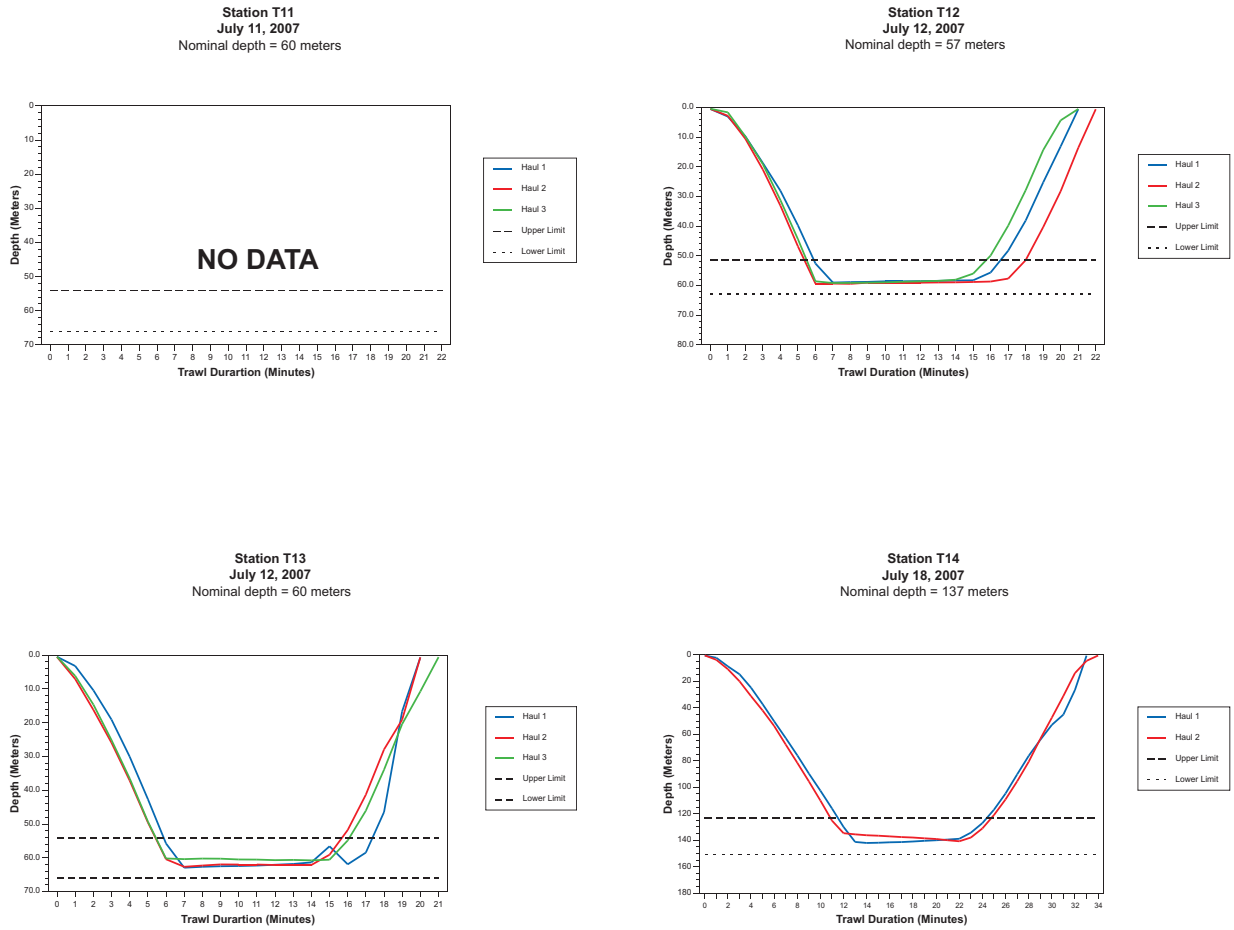

Figure C-2 Continued.

Table C-28. Trawl sample dates, track distances, percent difference from target track distance, elapsed time, and vessel speed, January 2008.

Hauls with speeds less than 1.5 knots are denoted in blue, greater than 2 knots are denoted in red.

Orange County Sanitation District, California.

Date	Station	Haul	Distance Trawled (meters)	Percent Difference from Target Distance *	Elapsed Time (seconds)	Trawl speed (knots)**
January 16, 2008	T0	1	457.1	1.6	435	**2.04**
January 22, 2008	T0	2	455.4	1.2	372	**2.38**
January 14, 2008	T1	1	No Data	No Data	No Data	No Data
January 14, 2008	T1	2	455.4	1.2	467	1.90
January 14, 2008	T1	3	458.9	2.0	550	1.62
January 22, 2008	T2	1	455.1	1.1	401	**2.21**
January 22, 2008	T2	2	458.1	1.8	479	1.86
January 16, 2008	T3	1	451.3	0.3	523	1.68
January 21, 2008	T3	2	476.9	6.0	464	2.00
January 21, 2008	T3	3	451.7	0.4	492	1.78
January 16, 2008	T6	1	480.2	6.7	457	**2.04**
January 16, 2008	T6	2	456.8	1.5	429	**2.07**
January 16, 2008	T10	1	457.0	1.6	480	1.85
January 16, 2008	T10	2	458.3	1.8	493	1.81
January 14, 2008	T11	2	455.2	1.2	430	**2.06**
January 14, 2008	T11	3	454.8	1.1	469	1.88
January 14, 2008	T11	4	451.1	0.2	460	1.91
January 21, 2008	T12	1	450.1	0.0	517	1.69
January 21, 2008	T12	2	457.5	1.7	512	1.74
January 21, 2008	T12	3	454.3	1.0	493	1.79
January 21, 2008	T13	1	453.5	0.8	462	1.91
January 22, 2008	T13	2	456.6	1.5	409	**2.17**
January 22, 2008	T13	3	455.8	1.3	404	**2.19**
January 16, 2008	T14	1	447.6	-0.5	489	1.78
January 16, 2008	T14	2	447.1	-0.6	441	1.97
		Mean value	**456.5**	**1.4**	**463.7**	**1.93**

* Target Distance – 450 meters
** Target Speed – 1.5 – 2.0 knots

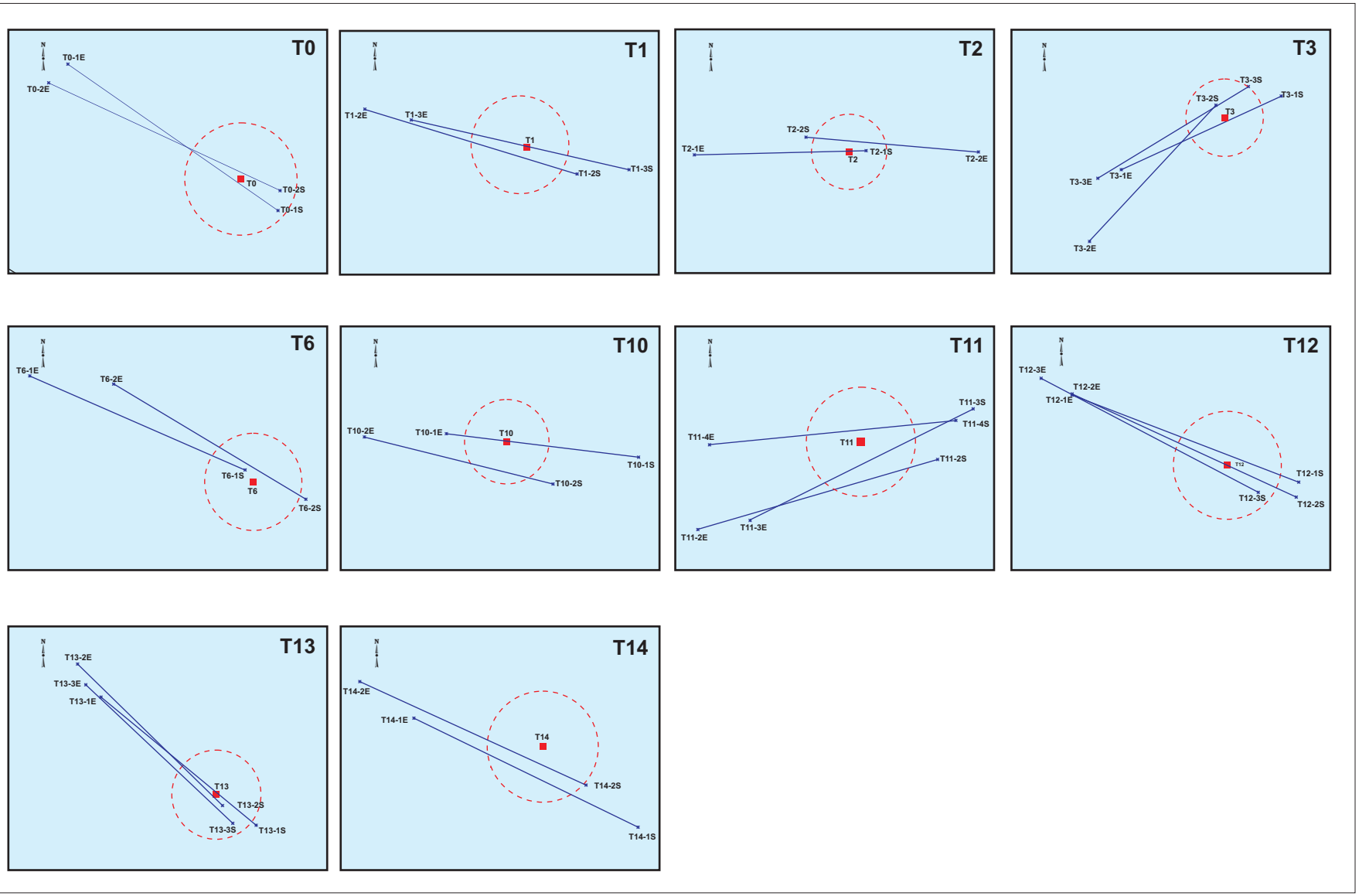

Figure C-3. **Quality assurance plots of distance to station for otter trawl hauls, January 2008.**
Red circle represents 100 meter distance from nominal trawl station center point. Blue lines represent trawl path while net is on the bottom. Trawl endpoints are labeled by station name, haul number, start (S) and end (E).

Table C-29. 10% trawl depth QA, January 2008.

Orange County Sanitation District, California.

Date	Station	Haul	Nominal Depth (m)	QA Range (m)	Data Source	Average Bottom Depth (m)	10% Y/N
1/16/2008	T0	1	18	16.2–19.8	SBE data	19.5	Y
					SOD data	18.0	Y
1/22/2008	T0	2			SBE data	19.8	Y
					SOD data	18.0	Y
1/14/2008	T1	1	55	49.5–60.5	SBE data	57.2	Y
					SOD data	NO DATA	N/A
1/14/2008	T1	2			SBE data	57.3	Y
					SOD data	54.5	Y
1/14/2008	T1	3			SBE data	57.1	Y
					SOD data	54.0	Y
1/22/2008	T2	1	35	31.5–38.5	SBE data	37.6	Y
					SOD data	35.0	Y
1/22/2008	T2	2			SBE data	36.8	Y
					SOD data	35.0	Y
1/16/2008	T3	1	55	49.5–60.5	SBE data	75.4	N
					SOD data	63.0	N
1/21/2008	T3	2			SBE data	61.3	N
					SOD data	57.0	Y
1/21/2008	T3	3			SBE data	63.0	N
					SOD data	57.0	Y
1/16/2008	T6	1	36	32.4–39.6	SBE data	37.6	Y
					SOD data	36.0	Y
1/16/2008	T6	3			SBE data	37.7	Y
					SOD data	35.5	Y
1/16/2008	T10	1	137	123.3–150.7	SBE data	138.9	Y
					SOD data	132.5	Y
1/16/2008	T10	2			SBE data	146.5	Y
					SOD data	138.5	Y
1/14/2008	T11	2	60	54.0–66.0	SBE data	70.2	N
					SOD data	65.0	Y
1/14/2008	T11	3			SBE data	64.4	Y
					SOD data	64.0	Y
1/14/2008	T11	4			SBE data	60.5	Y
					SOD data	58.5	Y
1/21/2008	T12	1	57	51.3–62.7	SBE data	58.7	Y
					SOD data	56.0	Y
1/21/2008	T12	2			SBE data	58.5	Y
					SOD data	55.5	Y
1/21/2008	T12	3			SBE data	57.9	Y
					SOD data	55.0	Y

Table C-29 Continues.

Table C-29 Continued.

Date	Station	Haul	Nominal Depth (m)	QA Range (m)	Data Source	Average Bottom Depth (m)	10% Y/N
1/21/2008	T13	1	60	54.0–66.0	SBE data	64.2	Y
					SOD data	55.0	Y
1/22/2008	T13	2			SBE data	63.3	Y
					SOD data	58.5	Y
1/22/2008	T13	3			SBE data	65.6	Y
					SOD data	60.0	Y
1/16/2008	T14	1	137	123.3 - 150.7	SBE data	141.7	Y
					SOD data	139.0	Y
1/16/2008	T14	2			SBE data	141.4	Y
					SOD data	139.0	Y

Notes:
Station T3 depth varies widely. 10% QA may not be applicable.
SBE = Seabird Electronics
SOD = Station occupation data

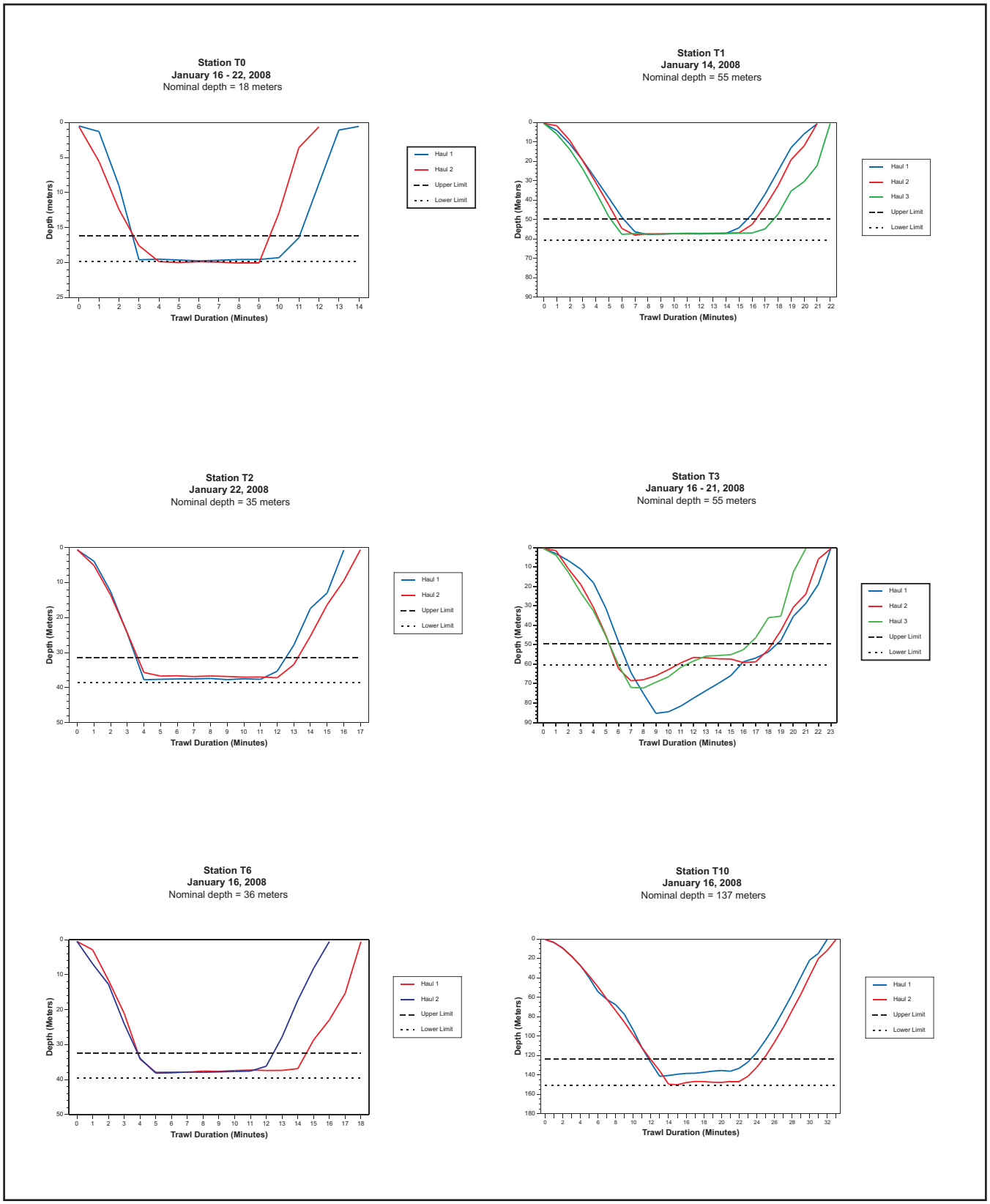

Figure C-4. **Quality assurance plots of trawl duration and trawl depth per haul for otter trawl stations, January 2008.**
Upper and lower limit lines are ± 10% of nominal trawl depth.

Orange County Sanitation District, California.

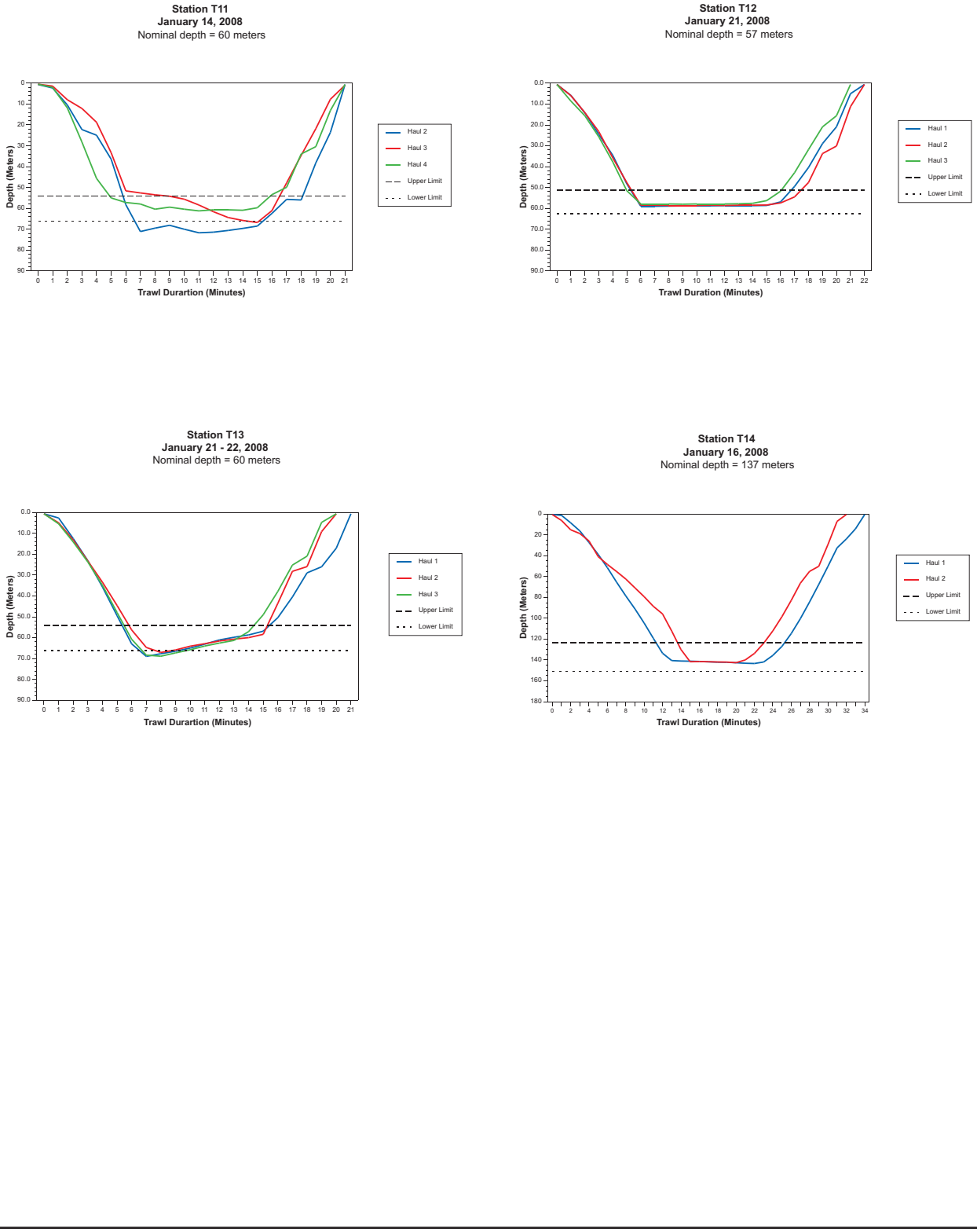

Figure C-4 Continued.

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