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 2009-10 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 >99.8 percent of the required samples, with the exception of the sanddab guild collection for fish tissue. There were no size class 0 sanddab guild fish composites made due to insufficient specimens collected during field sampling. Sampling and data analysis is characterized by quarters 1 through 4, 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 requirements and percent completion, July 2009–June 2010.

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	15	100
		Ammonium	470	469	81	99.8
		Bacteria	260	260	30	100
	Sediment Chemistry	Grain size	69	69	7	100
		TOC	69	69	3	100
		Dissolved Sulfides	69	69	7	100
		Metals	69	69	7	100
		PCB/Pesticides	69	69	7	100
		PAH	69	69	8	100
		LAB	69	69	8	100
	Benthic Infauna	Infauna	49	49	10	100
	Fish Community	Trawls *	23	23	NA	100
2	Water Quality	CTD Drops	105	105	15	100
		Ammonium	470	470	81	100
		Bacteria	260	260	31	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
	Benthic Infauna	Infauna	30	30	3	100
3	Water Quality	CTD Drops	105	105	15	100
		Ammonium	470	470	81	100
		Bacteria	260	260	30	100
	Sediment Chemistry	Grain size	10	10	1	100
		TOC	10	10	0	100
		Dissolved Sulfides	10	10	1	100
		Metals	10	10	1	100
		PCB/Pesticides	10	10	1	100
		PAH	10	10	1	100
	Benthic Infauna	Infauna	30	30	3	100
	Fish Community	Trawls	23	23	NA	100
	Fish Tissue	Hornyhead turbot	20 x 2 *	20 x 2 *	4	100
		English sole	20 x 2 *	20 x 2 *	6	100
		Sanddab Guild	18	15	0	83.3
4	Water Quality	CTD Drops	105	105	15	100
		Ammonium	470	470	81	100
		Bacteria	260	260	30	100
	Sediment Chemistry	Grain size	10	10	1	100
		TOC	10	10	0	100
		Dissolved Sulfides	10	10	1	100
		Metals	10	10	1	100
		PCB/Pesticides	10	10	1	100
		PAH	10	10	1	100
	Benthic Infauna	Infauna	30	30	0	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, 551, 551, and 551 discrete ammonia samples, respectively, during the 4 quarters beginning July 1, 2009 and ending June 30, 2010. All samples were iced upon collection, preserved with 1:1 sulfuric acid upon receipt by the ELOM laboratory staff, 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, OCSD 2009).

Analytical Method - Ammonium

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 ammonium concentration in the sample. The blue color is intensified with sodium nitroprusside and is measured at 660 nm.

QA/QC - Ammonium

A typical sample batch includes 3 blanks, an external reference standard, a spike, and a spike replicate in seawater collected from a control site. One spike and spike replicate are added to the batch every 10 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. Seventy-one out of the 75 analyses met the QA/QC criteria for blanks. All analyses met the QA/QC criteria for the external reference sample. Zero of 58 matrix spike recoveries, 0 of 58 matrix spike replicate recoveries, and 3 of 58 precision measurements for the matrix spike and matrix spike replicate samples were out of control for first quarter samples. Two of 56 matrix spike recoveries, 2 of 56 matrix spike replicate recoveries, and 2 of 56 precision measurements for the matrix spike and matrix spike replicates were out of control for second quarter samples. Seven of 58 matrix spike replicate samples, 11 of 58 matrix spike replicate recoveries and 5 of 58 precision measurements for matrix spike and matrix spike replicates were out of control for third quarter samples. Zero of 57 matrix spike recoveries, 0 of 57 matrix spike replicate recoveries, and 6 of 57 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.

Table C-2. Water quality ammonium QA/QC summary, July 2009–June 2010.

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	NH3WQ090806-1	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	6		< 11%
			ERA Check Standard	1	1	87 - 114	
Summer	NH3WQ090811-1	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, 1**		< 11%
			ERA Check Standard	1	1	87 - 114	
Summer	NH3WQ090813-1	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	
Summer	NH3WQ090818-1	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	11		< 11%
			ERA Check Standard	1	1	87 - 114	
Summer	NH3WQ090819-1	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	7, 2**		< 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	NH3WQ090820-1	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	8		< 11%
			ERA Check Standard	1	1	87 - 114	
Fall	NH3WQ091103-1	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	
Fall	NH3WQ091104-1	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	
Fall	NH3WQ091105-1	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	
Fall	NH3WQ091110-1	Ammonium	Blank	3	2	<2X MDL	N/A
			Matrix Spike	11	11	80-120	
			Matrix Spike Dup	11	11	80-120	
			Matrix Spike Precision	11	11		< 11%
			ERA Check Standard	1	1	87 - 114	
Fall	NH3WQ091112-1	Ammonium	Blank	3	3	<2X MDL	N/A
			Matrix Spike	6	5	80-120	
			Matrix Spike Dup	6	5	80-120	
			Matrix Spike Precision	6	6		< 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	NH3WQ091116-1	Ammonium	Blank	3	2	<2X MDL	N/A
			Matrix Spike	9	9	80-120	
			Matrix Spike Dup	9	8	80-120	
			Matrix Spike Precision	9	7		< 11%
			ERA Check Standard	1	1	87 - 114	
Winter	NH3WQ100209-1	Ammonium	Blank	3	3	<2X MDL	N/A
			Matrix Spike	10	8, 1*	80-120	
			Matrix Spike Dup	10	7	80-120	
			Matrix Spike Precision	10	9, 1**		< 11%
			ERA Check Standard	1	1	87 - 114	
Winter	NH3WQ100210-1	Ammonium	Blank	3	3	<2X MDL	N/A
			Matrix Spike	14	10	80-120	
			Matrix Spike Dup	14	11	80-120	
			Matrix Spike Precision	14	11		< 11%
			ERA Check Standard	1	1	87 - 114	
Winter	NH3WQ100216-1	Ammonium	Blank	3	2	<2X MDL	N/A
			Matrix Spike	10	8	80-120	
			Matrix Spike Dup	10	7	80-120	
			Matrix Spike Precision	10	10		< 11%
			ERA Check Standard	1	1	87 - 114	
Winter	NH3WQ100217-1	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	8, 1*		< 11%
			ERA Check Standard	1	1	87 - 114	
Winter	NH3WQ100222-1	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	

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	NH3WQ100223-1	Ammonium	Blank	3	3	<2X MDL	N/A
			Matrix Spike	8	8	80-120	
			Matrix Spike Dup	8	7	80-120	
			Matrix Spike Precision	8	7		< 11%
			ERA Check Standard	1	1	87 - 114	
Spring	NH3WQ100506-1	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	
Spring	NH3WQ100507-1	Ammonium	Blank	3	3	<2X MDL	N/A
			Matrix Spike	6	6	80-120	
			Matrix Spike Dup	6	6	80-120	
			Matrix Spike Precision	6	6		< 11%
			ERA Check Standard	1	1	87 - 114	
Spring	NH3WQ100513-1	Ammonium	Blank	3	2	<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	
Spring	NH3WQ100517-1	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	11		< 11%
			ERA Check Standard	1	1	87 - 114	
Spring	NH3WQ100519-1	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	7, 1**		< 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
Spring	NH3WQ100527-1	Ammonium	Blank	3	3	<2X MDL	N/A
			Matrix Spike	10	7	80-120	
			Matrix Spike Dup	10	9	80-120	
			Matrix Spike Precision	10	6		< 11%
			ERA Check Standard	1	1	87 - 114	
Spring	NH3WQ100603-1	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	3, 2**		< 11%
			ERA Check Standard	1	1	87 - 114	

* Recovery (70% or 130%) was out of control due to rounding.

** Matrix spike precision 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 2009)

Introduction

OCSD's ELOM laboratory received 70 sediment samples from the ocean monitoring staff during the month of July 2009. All samples were stored according to ELOM LOPM (OCSD 2009). All 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 (OCSD 2009). All sediment samples were extracted using an accelerated solvent extractor (ASE) during the months of August through September 2009. 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 quality control (QC) samples. Sample batches that were analyzed for PAHs included the following QC samples: 1 sand blank, 1 PAH reporting level spike, 2 standard reference materials (SRM), 1 PAH matrix spike set, and 2 sample extraction duplicates. There were 4 batches extracted and analyzed for PAHs. In addition, 1 batch contained 1 rinse sample and 1 field blank. MDLs for PAHs are presented in Table C-3. Acceptance criteria for PAH SRMs are presented in Table C-4.

QC samples for LAB analyses included 1 sand blank, 1 LAB reporting level spike, 2 SRM, 1 LAB matrix spike set, and 2 sample extraction duplicates. In addition, 1 batch contained a field blank and a rinse sample. There were 4 batches extracted and analyzed for LABs. MDLs for LABs are presented in Table C-3.

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 (OCSD 2009). An ASE was used to extract the sediment samples during the months of July through October 2009. All sediment extracts were analyzed by GC/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 1 sand blank, 2 SRM, 1 PCB/pesticide reporting level spike, 1 PCB/pesticide matrix spike set, and 2 duplicate sample extractions. There were 3 batches extracted. In addition, 1 batch contained a rinse sample and a field blank. MDLs for PCBs/pesticides are

Table C-3. Method detection levels for PAH and LAB compounds in sediments, July 2009–June 2010.

Orange County Sanitation District, California.

Parameter	Accelerated Solvent Extraction SIM Detection Limit, (ng/g dry weight)	Parameter	Accelerated Solvent Extraction SIM Detection Limit, (ng/g dry weight)
PAH Compounds			
1,6,7-Trimethylnaphthalene	0.20	Benzo[k]fluoranthene	0.20
1-Methylnaphthalene	0.30	Biphenyl	0.30
1-Methylphenanthrene	0.20	Chrysene	0.20
2,6-Dimethylnaphthalene	0.30	Dibenz[a,h]anthracene	0.10
2-Methylnaphthalene	0.50	Dibenzothiophene	0.20
Acenaphthene	0.40	Fluoranthene	0.30
Acenaphthylene	0.60	Fluorene	0.20
Anthracene	0.70	Indeno[1,2,3-c,d]pyrene	0.20
Benz[a]anthracene	0.20	Naphthalene	0.50
Benzo[a]pyrene	0.10	Perylene	0.20
Benzo[b]fluoranthene	0.30	Phenanthrene	0.40
Benzo[e]pyrene	0.50	Pyrene	0.30
Benzo[g,h,I]perylene	0.30		
PAH Alkylated Homologues			
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			
2-Phenyldecane	0.10	6-Phenyltetradecane	0.40
3-Phenyldecane	0.10	7-Phenyltetradecane	0.10
4-Phenyldecane	0.10	2-Phenylundecane	0.10
5-Phenyldecane	0.10	3-Phenylundecane	0.10
2-Phenyltridecane	0.30	4-Phenylundecane	0.10
3-Phenyltridecane	0.10	5-Phenylundecane	0.10
4-Phenyltridecane	0.20	6-Phenylundecane	0.10
5-Phenyltridecane	0.30	2-Phenyldodecane	0.20
6-Phenyltridecane+7-Phenyltridecane	0.40	3-Phenyldodecane	0.10
2-Phenyltetradecane	0.10	4-Phenyldodecane	0.20
3-Phenyltetradecane	0.10	5-Phenyldodecane	0.20
4-Phenyltetradecane	0.10	6-Phenyldodecane	0.20
5-Phenyltetradecane	0.20		

Table C-4. Acceptance criteria for standard reference materials of PAHs in sediments, July 2009–June 2010.

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 2009–June 2010.

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_Jul09_DF	PAH SRM 1944	15	10	25% of the certified or published acceptance limits[1]	NA	67% Pass
		PAH SRM 1941b	15	13			87% Pass
		PAH Reporting Level Spike	25	25	60 -120		100% Pass
		LAB Reporting Level Spike	25	25			100% Pass
		PAH Matrix Spike					
		Based on Mean of MS and MSD	25	23	40 - 120	NA	92% Pass
		LAB Matrix Spike					
		Based on Mean of MS and MSD	25	23	40 - 120	NA	92% Pass
		PAH Duplicate Analysis - #1	25	24	NA	< 20% @ 3 x MDL of Sample Mean	96% Pass
		PAH Duplicate Analysis - #2	17	10			59% Pass
		LAB Duplicate Analysis - #1	23	22			96% Pass
		PAH Duplicate Analysis - #2	19	16			84% Pass
1	Sedcore_Jul09_ DG	PAH SRM 1944	15	11	25% of the certified or published acceptance limits[1]	NA	73% Pass
		PAH SRM 1941b	15	14			93% Pass
		PAH Reporting Level Spike	25	19	60 -120		76% Pass
		LAB Reporting Level Spike	25	18			72% Pass
		PAH Matrix Spike					
		Based on Mean of MS and MSD	25	25	40 - 120	NA	100% Pass
		LAB Matrix Spike					
		Based on Mean of MS and MSD	*25*	25	40 – 120	NA	100% Pass
		PAH Duplicate Analysis - #1	*10*	4	NA	< 20% @ 3 x MDL of Sample Mean	40% Pass
		PAH Duplicate Analysis - #2	*10*	10			100% Pass
		LAB Duplicate Analysis - #1	*11*	9			81% Pass
		PAH Duplicate Analysis - #2	*13*	9			69% 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 1944a, Organics in Marine Sediment).

OCSD laboratory results are not corrected for surrogate recoveries, causing some analytes with lower molecular weights and boiling points to fail the established criteria for SRM certified values.

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_Jul09_DH	PAH SRM 1944	15	13	25% of the certified or published acceptance limits[1]	NA	87% Pass
		PAH SRM 1941b	15	11			73% Pass
		PAH Reporting Level Spike	25	22	60 -120		88% Pass
		LAB Reporting Level Spike	25	25			100% Pass
		PAH Matrix Spike					
		Based on Mean of MS and MSD	25	25	40 - 120	NA	100% Pass
		LAB Matrix Spike					
		Based on Mean of MS and MSD	25	25	40 - 120	NA	100% Pass
		PAH Duplicate Analysis - #1	15	13	NA	< 20% @ 3 x MDL of Sample Mean	87% Pass
		PAH Duplicate Analysis - #2	14	13			93% Pass
		LAB Duplicate Analysis - #1	20	13			65% Pass
		LAB Duplicate Analysis - #2	15	15			100% Pass
1	Sedcore_Jul09_DI	PAH SRM 1944	15	**10**	25% of the certified or published acceptance limits[1]	NA	67% Pass
		PAH SRM 1941b	15	**10**			67% Pass
		PAH Reporting Level Spike	25	**24**	60 -120		96% Pass
		LAB Reporting Level Spike	25	**24**			96% Pass
		PAH Matrix Spike					
		Based on Mean of MS and MSD	25	24	40 - 120	NA	96% Pass
		LAB Matrix Spike					
		Based on Mean of MS and MSD	25	23	40 - 120	NA	92% Pass
		PAH Duplicate Analysis - #1	11	9	NA	< 20% @ 3 x MDL of Sample Mean	81% Pass
		PAH Duplicate Analysis - #2	9	9			100% Pass
		LAB Duplicate Analysis - #1	14	13			93% Pass
		LAB Duplicate Analysis - #2	8	6			75% 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 1944a, Organics in Marine Sediment).
OCSD laboratory results are not corrected for surrogate recoveries, causing some analytes with lower molecular weights and boiling points to fail the established criteria for SRM certified values.
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_Oct09_DJ	PAH SRM 1944	15	9	25% of the certified or published acceptance limits[1]	NA	60% Pass
		PAH SRM 1941b	15	12			80% Pass
		PAH Reporting Level Spike	25	25	60 -120		100% Pass
		PAH Matrix Spike					
		Based on Mean of MS and MSD	25	25	40 - 120	NA	100% Pass
		PAH Duplicate Analysis - #1	17	11	NA	< 20% @ 3 x MDL of Sample Mean	65% Pass
		PAH Duplicate Analysis - #2	N/A	N/A			N/A
3	Sedcore_Jan10_DK	PAH SRM 1944	15	14	25% of the certified or published acceptance limits[1]	NA	93% Pass
		PAH SRM 1941b	15	13			87% Pass
		PAH Reporting Level Spike	25	22	60 -120		88% Pass
		PAH Matrix Spike					
		Based on Mean of MS and MSD	25	25	40 - 120	NA	100% Pass
		PAH Duplicate Analysis - #1	12	10	NA	< 20% @ 3 x MDL of Sample Mean	83% Pass
		PAH Duplicate Analysis - #2	N/A	N/A			N/A
4	Sedcore_Apr10_DL	PAH SRM 1944	15	1	25% of the certified or published acceptance limits[1]	NA	*7% Pass
		PAH SRM 1941b	15	12			80% Pass
		PAH Reporting Level Spike	25	24	60 -120		96% Pass
		PAH Matrix Spike					
		Based on Mean of MS and MSD	25	24	40 - 120	NA	96% Pass
		PAH Duplicate Analysis - #1	23	20	NA	< 20% @ 3 x MDL of Sample Mean	87% Pass
		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 1941b, SRM 1944a, Organics in Marine Sediment).
OCSD laboratory results are not corrected for surrogate recoveries, causing some analytes with lower molecular weights and boiling points to fail the established criteria for SRM certified values.
* PAH results for SRM 1944 were low, but the surrogate recoveries were within the limits. The reason for low recoveries of the PAHs is being investigated.
N/A=not applicable

presented in Tables C-6 and C-7. Acceptance Criteria for PCB/pesticide SRMs are presented in Table C-8.

Sediment PCB/pesticide QA/QC summary data are presented in Table C-9. 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 (OCSD 2009). A typical sample batch for silver, cadmium, chromium, copper, nickel, lead, zinc, selenium, arsenic, and beryllium analyses included 3 blanks, a blank spike, and 1 SRM. Additionally, duplicate samples, spiked samples and duplicate spiked samples were analyzed a minimum of once every 10 sediment samples. QC for a typical sample batch for aluminum and iron analyses included 3 blanks, an SRM, sediment samples with duplicates, spiked samples and duplicate spiked samples analyzed a minimum of once every 10 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 2 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. Reporting limits (RLs) for metals are presented in Table C-10. Acceptance criteria for trace metal SRMs are presented in Table C-11.

The digested samples were analyzed for silver, cadmium, chromium, copper, nickel, lead, zinc, selenium, arsenic, and beryllium by inductively coupled mass spectroscopy (ICPMS). Aluminum and iron were analyzed using inductively coupled emission spectroscopy (ICPES).

Sediment trace metal QA/QC summary data are presented in Table C-12. The relative percent differences (RPDs) between the sample and its duplicate analysis ranged from -7.1% to 5.4%. The RPDs for the spike and spike duplicate analysis ranged from -4.4% to 3.5%.

Analytical Methods - Mercury

Dried sediment samples were analyzed for mercury in accordance with methods described in the ELOM LOPM (OCSD 2009). 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 10 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 5.0 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

Table C-6. Method detection levels for PCB congeners and pesticides in sediments using GC/MS Ion Trap, July 2009–June 2010.

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		

NA = Not analyzed.

Table C-7. Method detection levels for PCB congeners and pesticides in sediments using GC/MS DSQII, July 2009–June 2010.

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	0.06	PCB 101	0.13
alpha-Chlordane	0.13	PCB 105	0.14
cis-Nonachlor	0.08	PCB 110	0.07
Dieldrin	0.16	PCB 114	0.13
Endrin	0.15	PCB 118	0.07
gamma-BHC	0.06	PCB 119	0.11
gamma-Chlordane	0.05	PCB 123	0.11
Heptachlor	0.06	PCB 126	0.08
Heptachlor epoxide	0.08	PCB 128	0.14
Hexachlorobenzene	0.04	PCB 138	0.13
Mirex	0.14	PCB 149	0.11
trans-Nonachlor	0.09	PCB 151	0.10
2,4'-DDD (o,p'-DDD)	0.14	PCB 153	NA
2,4'-DDE (o,p'-DDE)	0.11	PCB 153/168	0.25
2,4'-DDT (o,p'-DDT)	0.14	PCB 156	0.07
4,4'-DDD (p,p'-DDD)	0.10	PCB 157	0.09
4,4'-DDE (p,p'-DDE)	0.08	PCB 158	0.12
4,4'-DDT (p,p'-DDT)	0.13	PCB 167	0.11
4,4'-DDMU	0.08	PCB 168	NA
PCB 8	0.06	PCB 169	0.13
PCB 18	0.04	PCB 170	0.08
PCB 28	0.05	PCB 177	0.10
PCB 37	0.15	PCB 180	0.11
PCB 44	0.09	PCB 183	0.13
PCB 49	0.07	PCB 187	0.11
PCB 52	0.05	PCB 189	0.10
PCB 66	0.09	PCB 194	0.17
PCB 70	0.11	PCB 195	0.13
PCB 74	0.11	PCB 200	0.11
PCB 77	0.07	PCB 201	0.17
PCB 81	0.07	PCB 206	0.16
PCB 87	0.06	PCB 209	0.29
PCB 99	0.17		

NA = Not analyzed.

Table C-8. Acceptance criteria for standard reference materials of pesticides/PCBs in sediments, July 2009–June 2010.

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-9. Sediment PCB/pesticide QA/QC summary, July 2009–June 2010.

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	EH	PCB	SRM 1944a	27	24	25% of the certified ranges or published acceptance limits	NA
			SRM 1941b	27	25		
			Reporting Level Spike	44	44	60 -120	NA
			Matrix Spike	44	44	40 - 120	NA
			Matrix Spike Dup	44	44	40 - 120	NA
			Matrix Spike Precision	44	44	NA	< 20%
		Pesticide	SRM 1944a	4	4	25% of the certified ranges or published acceptance limits	NA
			SRM 1941b	7	7		
			Reporting Level Spike	19	18	60 -120	NA
			Matrix Spike	19	18	40 - 120	NA
			Matrix Spike Dup	19	18	40 - 120	NA
			Matrix Spike Precision	19	18	NA	< 20%
		PCB	Duplicate 1	16	15	NA	< 20% @ 3 x MDL of Sample Mean.
		Pesticides	Duplicate 1	2	1	NA	
		PCBs and Pesticides	Duplicate 1 Sum	1	1	NA	NA
		PCB	Duplicate 2	1	1	NA	< 20% @ 3 x MDL of Sample Mean.
		Pesticides	Duplicate 2	1	1	NA	
		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							
1	EI	PCB	SRM 1944a	27	16	25% of the certified ranges or published acceptance limits	NA
			SRM 1941b	27	25		
			Reporting Level Spike	44	44	60 -120	NA
			Matrix Spike	44	41	40 - 120	NA
			Matrix Spike Dup	44	44	40 - 120	NA
			Matrix Spike Precision	44	35	NA	< 20%
		Pesticide	SRM 1944a	4	0	25% of the certified ranges or published acceptance limits	NA
			SRM 1941b	7	6		
			Reporting Level Spike	19	19	60 -120	NA
			Matrix Spike	19	18	40 - 120	NA
			Matrix Spike Dup	19	19	40 - 120	NA
			Matrix Spike Precision	19	14	NA	< 20%
		PCB	Duplicate 1	0	0	NA	< 20% @ 3 x MDL of Sample Mean.
		Pesticide	Duplicate 1	2	1	NA	
		PCBs and Pesticides	Duplicate 1 Sum	1	0	NA	NA
		PCB	Duplicate 2	0	0	NA	< 20% @ 3 x MDL of Sample Mean.
		Pesticide	Duplicate 2	1	1	NA	
		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-9 Continues.

Table C-9 Continued.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
1	EJ	PCB	SRM 1944a	27	27	25% of the certified ranges or published acceptance limits	NA
			SRM 1941b	27	27		
			Reporting Level Spike	44	44	60 -120	NA
			Matrix Spike	44	44	40 - 120	NA
			Matrix Spike Dup	44	38	40 - 120	NA
			Matrix Spike Precision	44	43	NA	< 20%
		Pesticide	SRM 1944a	4	7	25% of the certified ranges or published acceptance limits	NA
			SRM 1941b	7	7		
			Reporting Level Spike	19	19	60 -120	NA
			Matrix Spike	19	19	40 - 120	NA
			Matrix Spike Dup	19	17	40 - 120	NA
			Matrix Spike Precision	19	19	NA	< 20%
		PCB	Duplicate 1	2	2	NA	< 20% @ 3 x MDL of Sample Mean.
		Pesticide	Duplicate 1	1	1	NA	
		PCBs and Pesticides	Duplicate 1 Sum	1	1	NA	NA
		PCB	Duplicate 2	2	1	NA	< 20% @ 3 x MDL of Sample Mean.
		Pesticide	Duplicate 2	2	2	NA	
		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							
1	EK	PCB	SRM 1944a	27	27	25% of the certified ranges or published acceptance limits	NA
			SRM 1941b	27	27		
			Reporting Level Spike	44	42	60 -120	NA
			Matrix Spike	44	44	40 - 120	NA
			Matrix Spike Dup	44	44	40 - 120	NA
			Matrix Spike Precision	44	42	NA	< 20%
		Pesticide	SRM 1944a	4	4	25% of the certified ranges or published acceptance limits	NA
			SRM 1941b	7	7		
			Reporting Level Spike	19	18	60 -120	NA
			Matrix Spike	19	19	40 - 120	NA
			Matrix Spike Dup	19	19	40 - 120	NA
			Matrix Spike Precision	19	19	NA	< 20%
		PCB	Duplicate 1	3	3	NA	< 20% @ 3 x MDL of Sample Mean.
		Pesticide	Duplicate 1	4	4	NA	
		PCBs and Pesticides	Duplicate 1 Sum	1	1	NA	NA
		PCB	Duplicate 2	4	4	NA	< 20% @ 3 x MDL of Sample Mean.
		Pesticide	Duplicate 2	3	2	NA	
		PCBs and Pesticides	Duplicate 2 Sum	1	0	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 Continues.

Table C-9 Continued.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
2	EL	PCB	SRM 1944a	27	27	25% of the certified ranges or published acceptance limits	NA
			SRM 1941b	27	25		
			Reporting Level Spike	44	43	60 -120	NA
			Matrix Spike	44	44	40 - 120	NA
			Matrix Spike Dup	44	44	40 - 120	NA
			Matrix Spike Precision	44	44	NA	< 20%
		Pesticide	SRM 1944a	4	4	25% of the certified ranges or published acceptance limits	NA
			SRM 1941b	7	6		
			Reporting Level Spike	19	19	60 -120	NA
			Matrix Spike	19	19	40 - 120	NA
			Matrix Spike Dup	19	19	40 - 120	NA
			Matrix Spike Precision	19	18	NA	< 20%
		PCB	Duplicate 1	0	0	NA	< 20% @ 3 x MDL of Sample Mean.
		Pesticide	Duplicate 1	2	2	NA	
		PCBs and Pesticides	Duplicate 1 Sum	1	0	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	EM	PCB	SRM 1944a	27	27	25% of the certified ranges or published acceptance limits	NA
			SRM 1941b	27	27		
			Reporting Level Spike	44	44	60 -120	NA
			Matrix Spike	44	44	40 - 120	NA
			Matrix Spike Dup	44	43	40 - 120	NA
			Matrix Spike Precision	44	44	NA	< 20%
		Pesticide	SRM 1944a	4	3	25% of the certified ranges or published acceptance limits	NA
			SRM 1941b	7	7		
			Reporting Level Spike	19	19	60 -120	NA
			Matrix Spike	19	19	40 - 120	NA
			Matrix Spike Dup	19	19	40 - 120	NA
			Matrix Spike Precision	19	19	NA	< 20%
		PCB	Duplicate 1	5	3	NA	< 20% @ 3 x MDL of Sample Mean.
		Pesticide	Duplicate 1	1	1	NA	
		PCBs and Pesticides	Duplicate 1 Sum	1	0	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 Continues.

Table C-9 Continued.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
4	EN	PCB	SRM 1944a	27	21	25% of the certified ranges or published acceptance limits	NA
			SRM 1941b	27	25		
			Reporting Level Spike	44	40	60 -120	NA
			Matrix Spike	44	43	40 - 120	NA
			Matrix Spike Dup	44	43	40 - 120	NA
			Matrix Spike Precision	44	44	NA	< 20%
		Pesticide	SRM 1944a	4	4	25% of the certified ranges or published acceptance limits	NA
			SRM 1941b	7	7		
			Reporting Level Spike	19	17	60 -120	NA
			Matrix Spike	19	19	40 - 120	NA
			Matrix Spike Dup	19	19	40 - 120	NA
			Matrix Spike Precision	19	19	NA	< 20%
		PCB	Duplicate 1	3	3	NA	< 20% @ 3 x MDL of Sample Mean.
		Pesticide	Duplicate 1	1	1	NA	
		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-10. Method detection limits for trace metals in sediments, July 2009–June 2010.

Orange County Sanitation District, California.

Parameter	Detection Limits (mg/kg dry weight)
Aluminum	50
Arsenic	0.15
Beryllium	0.01
Cadmium	0.01
Chromium	0.15
Copper	0.10
Iron	50
Lead	0.10
Nickel	0.10
Mercury	0.00011
Selenium	0.15
Silver	0.02
Zinc	0.15

Table C-11. Acceptance criteria for standard reference materials of metals in sediments, July 2009–June 2010.

Orange County Sanitation District, California.

Parameter	True Value (mg/kg)	Certified Acceptance Criteria (mg/kg)	
		Min.	Max.
Resource Technology Corporation CRM016-050 Natural Matrix Certified Reference Material Lot BE016			
Mercury	0.158	0.00	0.357
Environmental Resource Associates D056-540 Priority PollutnT™/CLP Inorganic Soils – Microwave Digestion Environmental Resource Associates			
Aluminum	10400	6370	14400
Arsenic	280	226	333
Beryllium	51	42.4	59.6
Cadmium	182	149	215
Chromium	142	115	170
Copper	132	110	155
Iron	16600	9490	23700
Lead	72.2	59.1	85.4
Nickel	155	128	182
Selenium	165	128	203
Silver	126	83.7	169
Zinc	346	273	418

Table C-12. Sediment metals QA/QC summary, July 2009–June 2010.

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	HMSED090825-1	Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Nickel, Selenium, Silver, Zinc	Blank	10	10	<3X MDL	N/A
			Blank Spike	10	10	90-110	N/A
			Matrix Spike	10	10	70-130	
			Matrix Spike Dup	10	10	70-130	
			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	HMSED090929-1	Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Nickel, Selenium, Silver, Zinc	Blank	10	10	<3X MDL	N/A
			Blank Spike	10	10	90-110	N/A
			Matrix Spike	10	10	70-130	
			Matrix Spike Dup	10	10	70-130	
			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	HMSED091028-1	Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Nickel, Selenium, Silver, Zinc	Blank	10	10	<3X MDL	N/A
			Blank Spike	10	10	90-110	N/A
			Matrix Spike	10	10	70-130	
			Matrix Spike Dup	10	10	70-130	
			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	HMSED091110-1	Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Nickel, Selenium, Silver, Zinc	Blank	10	10	<3X MDL	N/A
			Blank Spike	10	10	90-110	N/A
			Matrix Spike	10	10	70-130	
			Matrix Spike Dup	10	10	70-130	
			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.	

Table C-12 Continues.

Table C-12 Continued.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Summer	ALFESED090826-1	Aluminum, Iron	Blank	2	2	<3X MDL	N/A
			Duplicate Analysis	2	2	NA	@ ≥ 10 X MDL < 20%
			CRM Analysis	2	2	80-120% or certified value, whichever is greater.	
Summer	ALFESED090930-1	Aluminum, Iron	Blank	2	2	<3X MDL	N/A
			Duplicate Analysis	2	2	NA	@ ≥ 10 X MDL < 20%
			CRM Analysis	2	2	80-120% or certified value, whichever is greater.	
Summer	ALFESED091029-1	Aluminum, Iron	Blank	2	2	<3X MDL	N/A
			Duplicate Analysis	2	2	NA	@ ≥ 10 X MDL < 20%
			CRM Analysis	2	2	80-120% or certified value, whichever is greater.	
Summer	ALFESED091113-1	Aluminum, Iron	Blank	2	2	<3X MDL	N/A
			Duplicate Analysis	2	2	NA	@ ≥ 10 X MDL < 20%
			CRM Analysis	2	2	80-120% or certified value, whichever is greater.	
Summer	HGSED091123-1	Mercury	Blank	1	1	<2X MDL	N/A
			Blank Spike	1	1	90-110	N/A
			Matrix Spike	4	4	70-130	
			Matrix Spike Dup	4	4	70-130	
			Matrix Spike Precision	4	4		< 25%
			Duplicate Analysis	4	* 2	NA	@ ≥ 10 X MDL < 30%
			CRM Analysis	1	1	80-120% or certified value, whichever is greater.	

* Two duplicate analysis RPDs failed due to low results and non-homogeneous samples
NA = Not applicable

Table C-12 Continues.

Table C-12 Continued.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Summer And Fall*	HGSED091202-1	Mercury	Blank	1	1	<2X MDL	N/A
			Blank Spike	1	1	90-110	N/A
			Matrix Spike	4	4	70-130	
			Matrix Spike Dup	4	4	70-130	
			Matrix Spike Precision	4	4		< 25%
			Duplicate Analysis	4	4	NA	@ ≥ 10 X MDL < 30%
			CRM Analysis	1	1	80-120% or certified value, whichever is greater.	
Fall	HMSED091110-1	Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Nickel, Selenium, Silver, Zinc	Blank	10	10	<3X MDL	N/A
			Blank Spike	10	10	90-110	N/A
			Matrix Spike	10	10	70-130	
			Matrix Spike Dup	10	10	70-130	
			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.	
Fall	ALFESED091113-1	Aluminum, Iron	Blank	2	2	<3X MDL	N/A
			Duplicate Analysis	2	2	NA	@ ≥ 10 X MDL < 20%
			CRM Analysis	2	2	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-12 Continues.

Table C-12 Continued.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Winter	HMSED100310-1	Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Nickel, Selenium, Silver, Zinc	Blank	10	10	<3X MDL	N/A
			Blank Spike	10	10	90-110	N/A
			Matrix Spike	10	10	70-130	
			Matrix Spike Dup	10	10	70-130	
			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	ALFESED100311-1	Aluminum, Iron	Blank	2	2	<3X 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	HGSED100309-1	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 < 30%
			CRM Analysis	1	1	80-120% or certified value, whichever is greater.	
NA = Not applicable							

Table C-12 Continues.

Table C-12 Continued.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Spring	HMSED100609-1	Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Nickel, Selenium, Silver, Zinc	Blank	10	10	<3X MDL	N/A
			Blank Spike	10	10	90-110	N/A
			Matrix Spike	10	10	70-130	
			Matrix Spike Dup	10	10	70-130	
			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.	
Spring	ALFESED100610-2	Aluminum, Iron	Blank	2	2	<3X MDL	N/A
			Duplicate Analysis	2	2	NA	@ ≥ 10 X MDL < 20%
			CRM Analysis	2	2	80-120% or certified value, whichever is greater.	
Spring	HGSED100607-1	Mercury	Blank	1	1	<3X 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	* 0	NA	@ ≥ 10 X MDL < 30%
			CRM Analysis	1	1	80-120% or certified value, whichever is greater.	

* One duplicate analysis RPD failed due to low result and non-homogeneous sample
NA = Not applicable.

samples cooled again, sodium chloride-hydroxylamine hydrochloride solution was added to each sample and the samples were brought to 100 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.

The MDL for sediment mercury is presented in Table C-10. Acceptance criteria for mercury SRM is presented in Table C-11. All QA/QC summary data are presented in Table C-12.

All samples, with two noted exceptions, met the QA/QC criteria guidelines for accuracy and precision. Two duplicate RPDs were out of range due to low results and non-homogeneous sample matrices.

Analytical Methods - Dissolved Sulfides

Dissolved sulfides samples were analyzed in accordance with methods described in the ELOM LOPM (OCSD 2009). The MDL for dissolved sulfides is presented in Table C-13. Sediment dissolved sulfides QA/QC summary data are presented in Table C-14. All samples were analyzed within their required holding times. All analyses met the QA/QC criteria for blanks, blank spikes, matrix spikes, and matrix spike precisions. One of seven matrix spike duplicate recoveries was out of control due to matrix interferences.

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-13. Sediment TOC QA/QC summary data are presented in Table C-15. The samples were analyzed within their required holding times. Two samples were analyzed in duplicate. The samples and their duplicate analyses had an RPD of less than 10%. The recoveries for matrix spike were within 80–120% range.

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-13. Sediment grain size QA/QC summary data are presented in Table C-16. Ten reference samples were analyzed. All analyses were within 3 standard deviations of the reference standard for the statistical parameters (median phi, dispersion, and skewness), percent gravel, percent sand, percent clay, and percent silt.

SECOND QUARTER (OCTOBER 2009)

OCSD's ELOM laboratory received 10 sediment samples from the ocean monitoring staff during the month of October 2009. All samples were stored according to methods described in the ELOM LOPM (OCSD 2009). 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 November 18, 2009. All sediment samples that were analyzed for PAHs were extracted on October 6, 2009. Any variances that occurred during sample processing or analysis are noted in the Comments/Notes section of each batch summary. All sediment

Table C-13. Method detection limits for dissolved sulfides, total organic carbon, and grain size in sediments, July 2009–June 2010.

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-14. Sediment dissolved sulfides QA/QC summary, July 2009–June 2010.

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	SULFIDE090709-1 SULFIDE090714-1 SULFIDE090715-1 SULFIDE090716-1 SULFIDE090722-1 SULFIDE090729-1 SULFIDE090804-1	Dissolved Sulfides	Method Blank	7	7	<2X MDL	N/A
			Blank Spike	7	7	80 -120	N/A
			Matrix Spike	7	7	70 - 130	
			Matrix Spike Dup	7	6 *	70 - 130	
			Matrix Spike Precision	7	7		<30%
Fall	SULFIDE091013-1	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	SULFIDE100114-2	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	SULFIDE100427-1	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%

* Matrix spike dup recovery (144%) was out of control due to matrix interferences.

Table C-15. Sediment total organic carbon QA/QC summary, July 2009–June 2010.

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-090917-1	Total Organic Carbon	Duplicate Analysis:	5	5	80-120[1]	10%[1]
Fall	TOC-100107-1	Total Organic Carbon	Duplicate Analysis:	1	1	80-120[1]	10%[1]
Winter	TOC-100204-1	Total Organic Carbon	Duplicate Analysis:	1	1	80-120[1]	10%[1]
Spring	TOC-100607-1	Total Organic Carbon	Duplicate Analysis:	1	1	80-120[1]	10%[1]

[1] TOC Target Precision/Accuracy of QC Criteria is not described in the Core Monitoring Quality Assurance Project Plan.

Table C-16. Sediment grain size QA/QC summary, July 2009–June 2010.

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-091015-1	Grain Size	Reference Standard	10	7	NA	Mean ± 3 σ of the reference standard for median phi, skewness, % dispersion, % gravel, % sand, % clay, and % silt
Fall	PSIZ-091209-1	Grain Size	Reference Standard	2	1	NA	Mean ± 3 σ of the reference standard for median phi, skewness, % dispersion, % gravel, % sand, % clay, and % silt
Winter	PSIZ-100310-1	Grain Size	Reference Standard	2	1	NA	Mean ± 3 σ of the reference standard for median phi, skewness, % dispersion, % gravel, % sand, % clay, and % silt
Spring	PSIZ-100609-1	Grain Size	Reference Standard	2	1	NA	Mean ± 3 σ of the reference standard for median phi, skewness, % dispersion, % gravel, % sand, % clay, and % silt

samples were extracted using an ASE. All sediment extracts for PCB congeners and pesticides were analyzed by GC/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-12. All spike recoveries ranged from 90.7% and 103.0%. The RPDs of the sample and its duplicate were less than or equal to 5.4%. The RPDs of the spike and spike duplicate ranged from -0.7% to 1.5%.

Sediment Mercury QA/QC summary data are presented in Table C-12. 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-13 through C-16.

THIRD QUARTER (JANUARY 2010)

OCSD's ELOM laboratory received 10 sediment samples from the ocean monitoring staff during the month of January 2010. All samples were stored according to methods described in the ELOM LOPM (OCSD 2009). 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 January 27, 2010. All sediment samples that were analyzed for PAHs were extracted on February 9, 2010. 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 GC/MS.

All samples were analyzed for metals within their holding times. Sediment metals QA/QC summary data are presented in Table C-12. All spike recoveries ranged from 87.0% to 106.8%. The RPDs of the sample and its duplicate ranged from -8.9% to 6.3%. The RPDs of the spike and spike duplicate ranged from -2.3% to 0.2%.

Sediment mercury QA/QC summary data are presented in Table C-12. 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-13 through C-16.

FOURTH QUARTER (APRIL 2010)

OCSD's ELOM laboratory received 10 sediment samples from the ocean monitoring staff during the month of April 2010. All samples were stored according to ELOM's LOPM (OCSD 2009). 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 12, 2010. All sediment samples being analyzed for PAHs were extracted on June 9, 2010. 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.

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-12. All spike recoveries were between 85.3% and 122.5%. The RPDs of the sample and its duplicate ranged from -10.1% to 8.2%. The RPDs of the spike and spike duplicate ranged from -3.5% to 13.0%.

Sediment mercury QA/QC summary data are presented in Table C-12. All samples met the QA criteria guidelines with one exception. One duplicate RPD was slightly out of range due to low results and a non-homogeneous sample matrix.

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-13 through C-16.

FISH TISSUE CHEMISTRY NARRATIVE

FIRST QUARTER (JULY 2009)

Introduction

OCSD's ELOM laboratory received 40 individual fish samples and 20 composite samples (containing 6 fish per bag), from the ocean monitoring staff during the month of July 2009. The individual samples were stored, dissected, and homogenized according to methods described in the OCSD ELOM LOPM (OCSD 2009). 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 rooms 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 rooms 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 1 hydromatrix blank, 2 duplicate sample extractions, 1 matrix spike, 1 matrix duplicate spike, 2 SRMs, and 1 reporting level spike (matrix of choice was orange roughy).

For mercury analysis, 1 sample batch consisted of 15–20 fish tissue samples and the required QC samples, which included a blank, blank spike, SRM, sample duplicates, matrix spikes, and matrix spikes duplicates.

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 (OCSDS 2009). All fish tissue was extracted using an ASE 200 and analyzed by GC/MS.

The MDLs for pesticides and PCBs in fish tissue are presented in Tables C-17 and C-18. Acceptance criteria for PCB SRMs in fish tissue are presented in Tables C-19 and C-20. Fish tissue pesticide and PCB QA/QC summary data are presented in Table C-21. 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 (OCSD 2009). 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

Table C-17. Method detection levels for pesticides and PCB congeners in fish tissue using GC/MS Ion Trap, July 2009–June 2010

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-18. Method detection levels for pesticides and PCB congeners in fish tissue using GC/MS DSQII, July 2009–June 2010

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	0.33	Dieldrin	0.31
o,p'-DDE	0.23	Endrin	0.64
o,p'-DDT	0.33	*gamma*-BHC	0.21
p,p'-DDD	0.16	*gamma*-Chlordane	0.25
p,p'-DDE	0.31	Heptachlor	0.23
p,p'-DDT	0.24	Heptachlor epoxide	0.37
p,p'-DDMU	0.43	Hexachlorobenzene	0.32
Aldrin	0.30	Mirex	0.29
alpha-Chlordane	0.33	*trans*-Nonachlor	0.21
cis-Nonachlor	0.19		
PCB Congeners			
PCB 8	0.24	PCB 128	0.08
PCB 18	0.24	PCB 138	0.16
PCB 28	0.21	PCB 149	0.33
PCB 37	0.27	PCB 151	0.22
PCB 44	0.36	PCB 156	0.10
PCB 49	0.17	PCB 157	0.10
PCB 52	0.17	PCB 158	0.18
PCB 66	0.26	PCB 167	0.09
PCB 70	0.23	PCB 168/153	0.23
PCB 74	0.24	PCB 169	0.15
PCB 77	0.21	PCB 170	0.18
PCB 81	0.19	PCB 177	0.09
PCB 87	0.17	PCB 180	0.18
PCB 99	0.44	PCB 183	0.13
PCB 101	0.14	PCB 187	0.06
PCB 105	0.13	PCB 189	0.12
PCB 110	0.19	PCB 194	0.17
PCB 114	0.10	PCB 195	0.13
PCB 118	0.22	PCB 200	0.08
PCB 119	0.14	PCB 201	0.20
PCB 123	0.21	PCB 206	0.11
PCB 126	0.11	PCB 209	0.29

Table C-19. Acceptance criteria for standard reference materials of PCB congeners in fish tissue, CARP-2, July 2009–June 2010.

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-20. Acceptance criteria for standard reference materials of pesticides and PCB congeners in fish tissue, SRM-1946, July 2009–June 2010.

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-21. Fish tissue PCB/pesticide QA/QC summary, July 2009–June 2010.

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 – MA (15 Muscle Tissue Samples)				
NRCC CARP-2	10	10	according to published acceptance criteria	NA
SRM 1946	40	39	according to published acceptance criteria	NA
PCB Reporting Level Spike	44	42	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	17	75 -125	NA
Pesticide Matrix Spike	19	17	70-130	NA
Pesticide Matrix Spike Dup	19	17		
Precision	19	19	NA	< 25%
PCB/Pesticide Duplicate Analysis				
Duplicate 1 PCB	1	1	NA	< 25% @ 3 x MDL of Sample Mean.
Duplicate 1 Pesticides	4	3		
Duplicate 1 Sum of Pesticides and PCBs	1	1		
Duplicate 2 PCB	4	2	NA	< 25% @ 3 x MDL of Sample Mean.
Duplicate 2 Pesticides	3	2		
Duplicate 2 Sum of Pesticides and PCBs	1	1		
Sample Set – MB (15 Muscle Tissue Samples)				
NRCC CARP-2	10	10	according to published acceptance criteria	NA
SRM 1946	40	40	according to published acceptance criteria	
PCB Reporting Level Spike	44	44	75 -125	NA
PCB Matrix Spike:	44	43	70 - 130	NA
PCB Matrix Spike Dup	44	43		
Precision	44	40	NA	< 25%
Pesticide Reporting Level Spike	19	19	75 -125	NA
Pesticide Matrix Spike	19	18	70-130	NA
Pesticide Matrix Spike Dup	19	18		
Precision	19	17	NA	< 25%
PCB/Pesticide Duplicate Analysis				
Duplicate 1 PCB	0	0	NA	< 25% @ 3 x MDL of Sample Mean.
Duplicate 1 Pesticides	1	0		
Duplicate 1 Sum of Pesticides and PCBs	1	0		
Duplicate 2 PCB	0	0	NA NA	< 25% @ 3 x MDL of Sample Mean.
Duplicate 2 Pesticides	1	0		
Duplicate 2 Sum of Pesticides and PCBs	1	0		

Table C-21 Continues.

Table C-21 Continued.

Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Sample Set – MC (10 Muscle Tissue and 5 Whole Body Tissue Samples)				
NRCC CARP-2	10	10	according to published acceptance criteria	NA
SRM 1946	40	38	according to published acceptance criteria	
PCB Reporting Level Spike	44	42	75 -125	NA
PCB Matrix Spike:	44	43	70 - 130	NA
PCB Matrix Spike Dup	44	40		
Precision	44	43	NA	< 25%
Pesticide Reporting Level Spike	19	19	75 -125	NA
Pesticide Matrix Spike	19	18	70-130	NA
Pesticide Matrix Spike Dup	19	17		
Precision	19	18	NA	< 25%
PCB/Pesticide Duplicate Analysis				
Duplicate 1 PCB	4	3	NA	< 25% @ 3 x MDL of Sample Mean.
Duplicate 1 Pesticides	3	2		
Duplicate 1 Sum of Pesticides and PCBs	1	1		
Duplicate 2 PCB	4	4	NA	< 25% @ 3 x MDL of Sample Mean.
Duplicate 2 Pesticides	2	2		
Duplicate 2 Sum of Pesticides and PCBs	1	1		
Sample Set – MD (1 Muscle Tissue repeat and 10 Whole Body Tissue Samples)				
NRCC CARP-2	10	10	according to published acceptance criteria	NA
SRM 1946	40	40	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	41		
Precision	44	44	NA	< 25%
Pesticide Reporting Level Spike	19	19	75 -125	NA
Pesticide Matrix Spike	19	18	70-130	NA
Pesticide Matrix Spike Dup	19	18		
Precision	19	19	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		

Table C-21 Continues.

Table C-21 Continued.

Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Sample Set – LA (15 Liver Tissue Samples)				
NRCC CARP-2	10	10	according to published acceptance criteria	NA
SRM 1946 *	40	38	according to published acceptance criteria	
PCB Reporting Level Spike	44	37	75 -125	NA
PCB Matrix Spike:	44	41	70 - 130	NA
PCB Matrix Spike Dup	44	44		
Precision	44	35	NA	< 25%
Pesticide Reporting Level Spike	19	14	75 -125	NA
Pesticide Matrix Spike	19	18	70-130	NA
Pesticide Matrix Spike Dup	19	19		
Precision	19	14	NA	< 25%
PCB/Pesticide Duplicate Analysis				
Duplicate 1 PCB	13	13	NA	< 25% @ 3 x MDL of Sample Mean.
Duplicate 1 Pesticides	4	4		
Duplicate 1 Sum of Pesticides and PCBs	1	1		
Duplicate 2 PCB	10	9	NA	< 25% @ 3 x MDL of Sample Mean.
Duplicate 2 Pesticides	3	2		
Duplicate 2 Sum of Pesticides and PCBs	1	1		
Sample Set – LB (15 Liver Tissue Samples)				
NRCC CARP-2	10	10	according to published acceptance criteria	NA
SRM 1946	40	40	according to published acceptance criteria	
PCB Reporting Level Spike	44	43	75 -125	NA
PCB Matrix Spike:	44	43	70 - 130	NA
PCB Matrix Spike Dup	44	44		
Precision	44	44	NA	< 25%
Pesticide Reporting Level Spike	19	18	75 -125	NA
Pesticide Matrix Spike	19	19	70-130	NA
Pesticide Matrix Spike Dup	19	19		
Precision	19	16	NA	< 25%
PCB/Pesticide Duplicate Analysis				
Duplicate 1 PCB	13	9	NA	< 25% @ 3 x MDL of Sample Mean.
Duplicate 1 Pesticides	3	2		
Duplicate 1 Sum of Pesticides and PCBs	1	0		
Duplicate 2 PCB	7	6	NA	< 25% @ 3 x MDL of Sample Mean.
Duplicate 2 Pesticides	4	4		
Duplicate 2 Sum of Pesticides and PCBs	1	1		

Table C-21 Continues.

Table C-21 Continued.

Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Sample Set – LC (10 Liver Tissue Samples)				
NRCC CARP-2	10	10	according to published acceptance criteria	NA
SRM 1946	40	27	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	6	4	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	4	3	NA	< 25% @ 3 x MDL of Sample Mean.
Duplicate 2 Pesticides	3	1		
Duplicate 2 Sum of Pesticides and PCBs	1	1		

dryness. The remaining residue was weighed, and the percent lipid content calculated. Lipid content QA/QC summary data are presented in Table C-22. 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 10 samples.

The MDL for fish mercury is presented in Table C-23. Acceptance criteria for the mercury SRMs are presented in Table C-24. Fish tissue mercury QA/QC summary data are presented in Table C-25. 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 (OCSD 2009). QC for a typical batch included a blank, a blank spike, and a SRM (whole fish). Fish samples with duplicates, spiked samples and duplicate spiked samples were run approximately once every 10 fish samples. When sample mercury concentration exceeded the appropriate calibration curve, the sample was diluted with the reagent blank and reanalyzed. The samples were analyzed for mercury on a Perkin Elmer FIMS 400 system.

All samples met the QA criteria guidelines for accuracy and precision with one exception. One sample duplicate RPD was slightly out of its acceptable range due to low results and a non-homogeneous sample.

Table C-22. Fish tissue percent lipid QA/QC summary, July 2009–June 2010.

Orange County Sanitation District, California.

Sample Set	Tissue Type	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Precision % RPD
MA	Muscle	Percent Lipid	Duplicate Samples	2	2	<25%
MB	Muscle	Percent Lipid	Duplicate Samples	2	2	<25%
MC	Muscle	Percent Lipid	Duplicate Samples	2	2	<25%
MD	Whole Body	Percent Lipid	Duplicate Samples	2	2	<25%
LA	Liver	Percent Lipid	Duplicate Samples	2	2	<25%
LB	Liver	Percent Lipid	Duplicate Samples	2	2	<25%
LC	Liver	Percent Lipid	Duplicate Samples	2	2	<25%

Table C-23. Method detection levels for mercury in fish tissue, July 2009–June 2010.

Orange County Sanitation District, California.

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

Table C-24. Acceptance criteria for standard reference materials of mercury in fish tissue, July 2009–June 2010.

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
DORM-3	0.382	0.322	0.442

Table C-25. Fish tissue mercury QA/QC summary, July 2009–June 2010.

Orange County Sanitation District, California.

Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
HGFISH090922-2	Mercury	Blank	1	1	<2X MDL	NA
		Blank Spike	1	1	90-110	NA
		Matrix Spike	2	2	70-130	
		Matrix Spike Dup	2	2	70-130	
		Matrix Spike Precision	2	2		< 25%
		Duplicate Analysis	2	2	NA	@ ≥ 10 X MDL < 30%
		CRM Analysis	1	1	80-120% or certified value, whichever is greater.	
HGFISH090930-2	Mercury	Blank	1	1	<2X MDL	NA
		Blank Spike	1	1	90-110	NA
		Matrix Spike	2	2	70-130	
		Matrix Spike Dup	2	2	70-130	
		Matrix Spike Precision	2	2		< 25%
		Duplicate Analysis	2	1	NA	@ ≥ 10 X MDL < 30%
		CRM Analysis	1	1	80-120% or certified value, whichever is greater.	
HGFISH091007-2	Mercury	Blank	1	1	<2X MDL	NA
		Blank Spike	1	1	90-110	NA
		Matrix Spike	2	2	70-130	
		Matrix Spike Dup	2	2	70-130	
		Matrix Spike Precision	2	2		< 25%
		Duplicate Analysis	2	2	NA	@ ≥ 10 X MDL < 30%
		CRM Analysis	1	1	80-120% or certified value, whichever is greater.	

Table C-25 Continues.

Table C-25 Continued.

Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
HGFISH091027-1	Mercury	Blank	1	1	<2X MDL	NA
		Blank Spike	1	1	90-110	NA
		Matrix Spike	2	2	70-130	
		Matrix Spike Dup	2	2	70-130	
		Matrix Spike Precision	2	2		< 25%
		Duplicate Analysis	2	2	NA	@ ≥ 10 X MDL < 30%
		CRM Analysis	1	1	80-120% or certified value, whichever is greater.	
HGFISH091104-1	Mercury	Blank	1	1	<2X MDL	NA
		Blank Spike	1	1	90-110	NA
		Matrix Spike	2	2	70-130	
		Matrix Spike Dup	2	2	70-130	
		Matrix Spike Precision	2	2		< 25%
		Duplicate Analysis	2	* 1	NA	@ ≥ 10 X MDL < 30%
		CRM Analysis	1	1	80-120% or certified value, whichever is greater.	

* One duplicate analysis RPD was out of range due to low result and non-homogeneous sample.
NA = Not applicable.

BENTHIC INFAUNA NARRATIVE

SORTING AND TAXONOMY QA/QC

The QAPP for the Year 2009-10 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 samples that have received sorting and taxonomic QA/QC. Sorting and taxonomic QA/QC procedures have been completed for 3 survey periods: the summer (July 2009, Cruise # OC-2009-025), fall (October 2009, Cruise # OC-2009-035), and winter (January 2010, Cruise # OC-2010-001) surveys.

Sorting QA/QC Procedures

OCSD's NPDES permit designates 10 quarterly (summer, fall, winter, and spring) benthic-sampling stations and 39 annual (summer) benthic-sampling stations. Sorting procedures were performed on 1 replicate infaunal sample collected from each of 3 randomly selected quarterly stations in the summer, fall, and winter quarters and an additional 7 samples (at least 1 from each of the 4 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 OCSD for reanalysis. OCSD resorted the sample RPs and collected any organisms or fragments that had been missed by Weston. The sample passed the QA procedure if the total number of animals collected by OCSD 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.

2009-10 Sorting QA/QC Status

Sorting results for all 2009-10 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 5 depth groups (i.e., <60m, 60m, 100m, 200m, and >300m) and then randomly selecting 2 stations from each depth strata. For fall and winter 60-m cruises, 3 randomly selected samples are drawn from the fall and winter cruises. These samples undergo comparative taxonomic analysis by 2 independent groups of taxonomists. The selected infauna samples were identified first by Weston taxonomists, and then re-identified by taxonomists from OCSD. Weston then compared the 2 datasets and identified 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.

2009-10 Taxonomic QA/QC Status

There were 433 initial discrepancies associated with taxonomic identifications for the 2009 annual cruise. However, each discrepancy was carefully reviewed, resolved, and provided with a resolution code by Weston (Table C-26).

The majority of identification differences noted for the July 2009 annual cruise were due to OCSD/Weston misidentifications (20%), QA taxonomist misidentifications (20%), convention discrepancies (15%), and QA taxonomist miscounts (10%). The remaining discrepancies were due to OCSD/Weston miscounts (9%), variation in level of expertise (7%), organism lost during biomassing (6%), organism fragments (3%), data entry error–OCSD/Weston (2%), organisms too small to speciate (2%), QA taxonomist misspelling (1%), count of a vouchered specimen (1%), NODC coding problem (1%), and OCSD/Weston taxonomist misspelling (<1%). A total of 31 discrepancies resulted in multiple coding (e.g., miscounts by both Weston and OCSD).

A total of 115 discrepancies were recorded initially for the October 2009 quarterly survey (Table C-26). The majority of identification differences noted for the quarterly cruise were due to OCSD/Weston misidentifications (22%), variations in level of expertise (22%), OCSD/Weston miscounts (14%), and convention discrepancies (12%). The remaining discrepancies were due to QA taxonomist misidentifications (5%), QA taxonomist miscounts (5%), data entry error–OCSD/Weston (3%), NODC coding problem (3%), organisms too small to speciate (3%), organism fragments (3%), keypunch operator error (3%), count of a vouchered specimen (2%), and organism lost during biomassing (2%). A total of 17 discrepancies resulted in multiple coding (e.g., miscounts by both Weston and OCSD).

A total of 73 discrepancies were recorded initially for the January 2010 quarterly survey (Table C-26). The majority of identification differences noted for the quarterly cruise were due to convention discrepancies (34%), QA taxonomist miscounts (17%), OCSD/Weston misidentifications (12%), and OCSD/Weston miscounts (12%). The remaining discrepancies were due to variations in level of expertise (7%), organism lost during biomassing (7%), data entry error–OCSD/Weston (6%), organisms too small to speciate (4%), and QA taxonomist misidentifications (1%). A total of 3 discrepancies resulted in multiple coding (e.g., miscounts by both Weston and OCSD).

Table C-26. Resolution code counts and percents for July 2009, October 2009, and January 2010 taxonomic QA data.

Orange County Sanitation District, California.

Discrepancy	Resolutions					
	July 2009		October 2009		January 2010	
	Counts	Percent	Counts	Percent	Counts	Percent
OCSD/Weston misidentification	88	20	26	22	9	12
QA Taxonomist misidentification	85	20	6	5	1	1
OCSD/Weston miscount	41	9	16	14	9	12
QA Taxonomist miscount	44	10	6	5	12	17
Data entry error (OCSD/Weston)	7	2	3	3	4	6
Data entry error (QA Taxonomist)	15	3	1	1	0	0
OCSD/Weston misspelling	1	0	0	0	0	0
QA Taxonomist misspelling	2	1	0	0	0	0
Vouchered specimen	3	1	2	2	0	0
NODC coding problem	2	1	4	3	0	0
Convention discrepancy	67	15	14	12	25	34
Variation in level of expertise	30	7	25	22	5	7
Organism too small to speciate	7	2	3	3	3	4
Organism fragment	15	3	4	3	0	0
Organism added from another vial	0	0	0	0	0	0
Dead animal not counted	0	0	0	0	0	0
Organism lost during biomassing	26	6	2	2	5	7
Keypunch operator error	0	0	3	3	0	0
Total	433	100	115	100	73	100
Multiple codes	31		17		3	

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-27 lists the trawl quality assurance objectives (QAO).

Table C-27. Districts quality assurance objectives for trawl sampling, July 2009–June 2010.

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 2009

For summer 2009, trawl lengths ranged from 313.8 to 522.4 m with the average trawl length being 448.5 m and the average trawl speed being 2.03 kts for all trawls combined (Table C-28). 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-29) 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 the net is trawling properly along an irregular bottom.

Winter 2010

For winter 2010, all trawl lengths ranged from 443.0 to 488.7 m with the average trawl length being 456.4 m and the average trawl speed being 2.03 kts for all trawls combined (Table C-30). 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-31) and distance traveled (Figure C-4). Station T3 was again the only anomalous station. This station is located on the edge of the Newport submarine canyon where depth changes rapidly (Figure 6-1). A perfectly flat trawl along the isobath is difficult to maintain at this station. While Station T3 appears not to follow the bottom depth contour, it is very likely that the net is trawling properly along an irregular bottom.

Table C-28. Trawl sample dates, track distances, percent difference from target track distance, elapsed time, and vessel speed, July 2009.

Orange County Sanitation District, California.

Date	Station	Haul	Distance Trawled (meters)	Percent Difference from Target Distance *	Elapsed Time (seconds)	Trawl speed (knots)**
July 20, 2009	T0	1	454.6	1.0	501	1.8
July 21, 2009	T1	1	453.7	0.8	407	**2.2**
July 21, 2009	T1	2	**522.4**	**16.1**	471	**2.2**
July 21, 2009	T1	3	460.4	2.3	424	**2.1**
July 29, 2009	T2	1	452.9	0.6	416	**2.1**
July 29, 2009	T2	2	461.1	2.5	420	**2.1**
July 20, 2009	T3	1	460.5	2.3	311	**2.9**
July 20, 2009	T3	2	459.7	2.2	424	**2.1**
July 21, 2009	T3	3	460.3	2.3	429	**2.1**
July 22, 2009	T3	4	457.4	1.7	442	2.0
July 20, 2009	T6	1	455.7	1.3	469	1.9
July 29, 2009	T6	2	453.9	0.9	429	**2.1**
July 22, 2009	T10	1	453.8	0.8	440	2.0
July 29, 2009	T10	2	450.4	0.1	475	1.8
July 20, 2009	T11	1	452.9	0.7	488	1.8
July 20, 2009	T11	2	454.6	1.0	476	1.9
July 20, 2009	T11	3	**345.4**	**-23.2**	481	**1.4**
July 30, 2009	T12	1	455.6	1.2	398	**2.2**
July 30, 2009	T12	2	455.8	1.3	402	**2.2**
July 30, 2009	T12	3	456.2	1.4	394	**2.3**
July 21, 2009	T13	1	449.1	-0.2	466	1.9
July 21, 2009	T13	2	452.6	0.6	500	1.8
July 30, 2009	T13	3	**313.8**	**-30.3**	276	**2.2**
July 29, 2009	T14	1	462.4	2.8	465	1.9
July 29, 2009	T14	2	457.6	1.7	489	1.8
Mean value			448.5	-0.3	435.7	**2.03**

Hauls with speeds less than 1.5 knots or greater than 2 knots are denoted in bold.

* Target Distance – 450 meters

** Target Speed – 1.5 – 2.0 knot

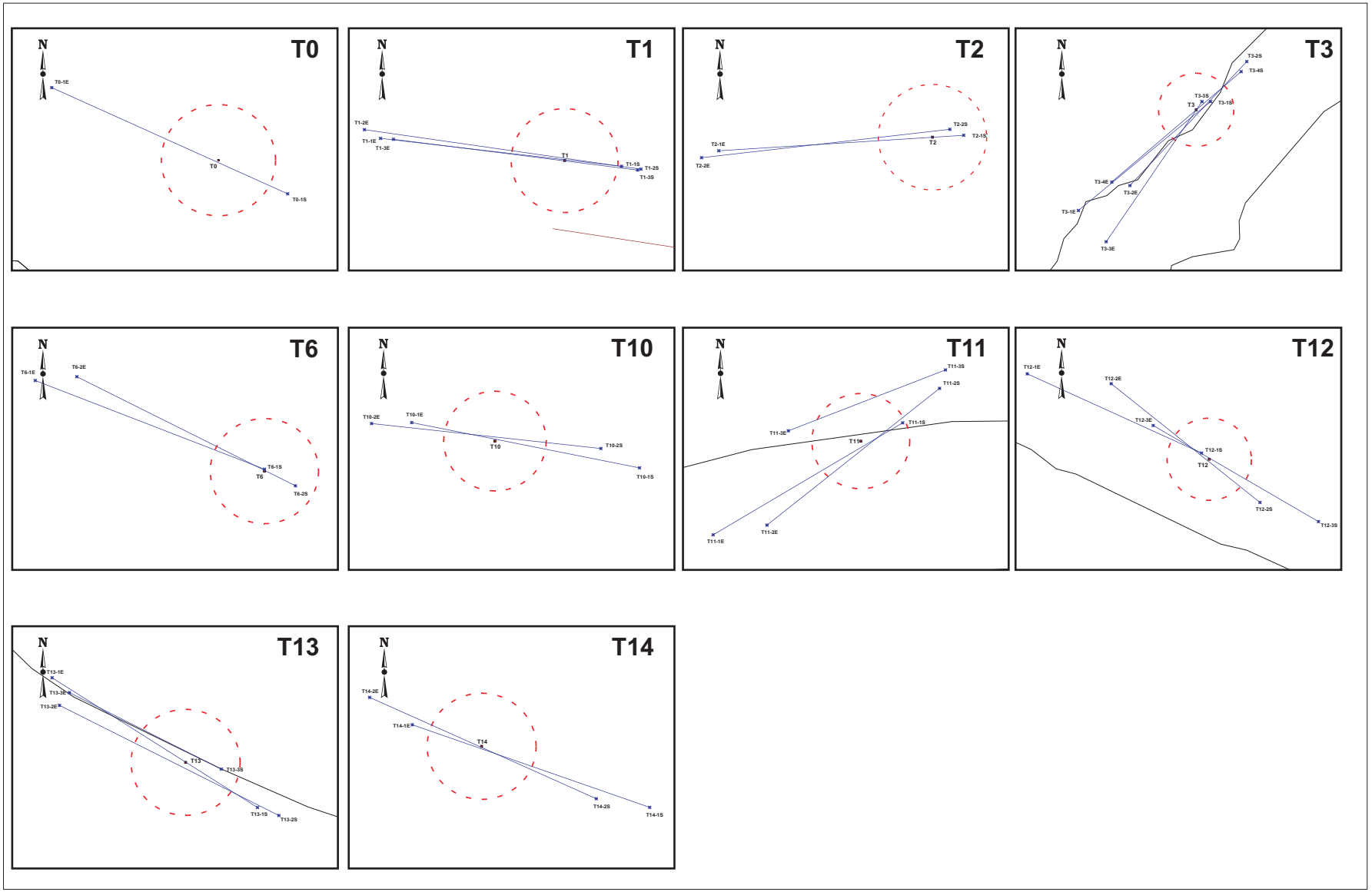

Figure C-1. **Quality assurance plots of distance to station for otter trawl hauls, July 2009.**
Red circle represents 100 meter distance from nominal trawl station center point. Blue lines represent trawl path while net is on the bottom. Trawl endpoints are labeled by station name, haul number, start (S) and end (E).

Table C-29. 10% trawl depth QA, July 2010.

Orange County Sanitation District, California.

Date	Station	Haul	Nominal Depth (m)	QA Range (m)	Data Source	Average Bottom Depth (m)	10% Y/N
7/20/2009	T0	1	18	16.2–19.8	SBE data	N/A	N/A
					SOD data	18.0	Y
7/21/2009	T1	1	55	49.5–60.5	SBE data	56.7	Y
					SOD data	54.5	Y
7/21/2009	T1	2			SBE data	56.9	Y
					SOD data	55.0	Y
7/21/2009	T1	3			SBE data	57.0	Y
					SOD data	55.0	Y
7/29/2009	T2	1	35	31.5–38.5	SBE data	36.0	Y
					SOD data	34.0	Y
7/29/2009	T2	2			SBE data	35.9	Y
					SOD data	34.0	Y
7/20/2009	T3	1	55	49.5–60.5	SBE data	N/A	N/A
					SOD data	N/A	N/A
7/20/2009	T3	2			SBE data	N/A	N/A
					SOD data	61.0	N
7/21/2009	T3	3			SBE data	61.1	N
					SOD data	62.0	N
7/22/2009	T3	4			SBE data	60.0	Y
					SOD data	60.0	Y
7/20/2009	T6	1	36	32.4–39.6	SBE data	N/A	N/A
					SOD data	35.5	Y
7/29/2009	T6	2			SBE data	38.2	Y
					SOD data	36.0	Y
7/22/2009	T10	1	137	123.3–150.7	SBE data	131.4	Y
					SOD data	132.5	Y
7/29/2009	T10	2			SBE data	135.4	Y
					SOD data	135.0	Y
7/20/2009	T11	1	60	54.0–66.0	SBE data	N/A	N/A
					SOD data	61.0	Y
7/20/2009	T11	2			SBE data	N/A	N/A
					SOD data	60.5	Y
7/20/2009	T11	3			SBE data	N/A	N/A
					SOD data	54.0	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
7/30/2009	T12	1	60	54.0–66.0	SBE data	58.3	Y
					SOD data	55.0	Y
7/30/2009	T12	2			SBE data	58.5	Y
					SOD data	55.0	Y
7/30/2009	T12	3			SBE data	61.6	Y
					SOD data	55.5	Y
7/21/2009	T13	1	60	54.0–66.0	SBE data	62.9	Y
					SOD data	58.5	Y
7/21/2009	T13	2			SBE data	63.2	Y
					SOD data	60.0	Y
7/30/2009	T13	3			SBE data	58.6	Y
					SOD data	57.5	Y
7/29/2009	T14	1	137	123.3 - 150.7	SBE data	137.7	Y
					SOD data	135.5	Y
7/29/2009	T14	2			SBE data	138.0	Y
					SOD data	136.5	Y

Notes:
Station T3 depth varies widely. 10% QA may not be applicable.
SBE = Seabird Electronics
SOD = Station occupation data
Y = Yes (Pass)
N = No (Fail)
N/A = Not applicable

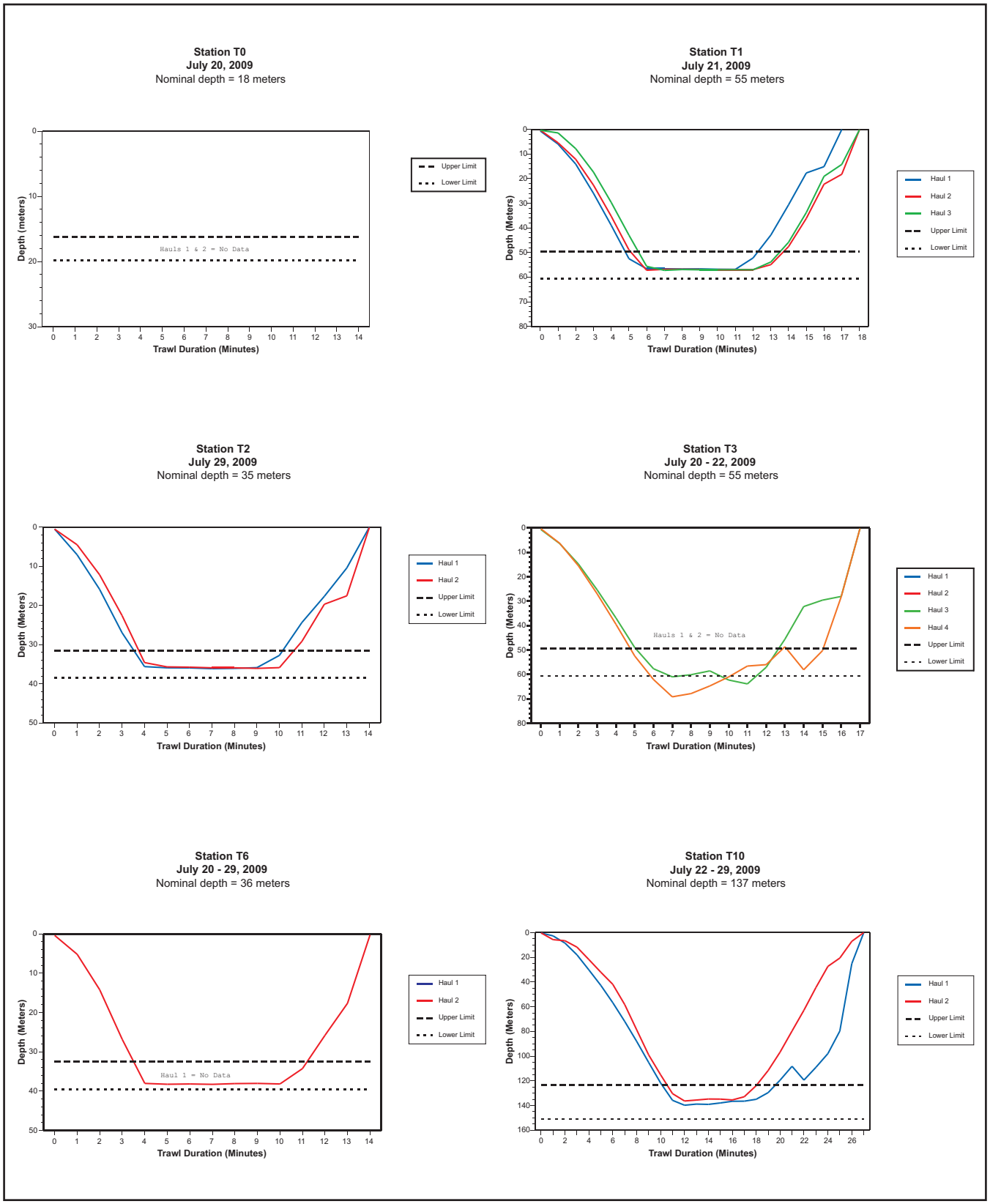

Figure C-2. **Quality assurance plots of trawl duration and trawl depth per haul for otter trawl stations, July 2009.**
Upper and lower limit lines are ± 10% of nominal trawl depth.

Orange County Sanitation District, California.

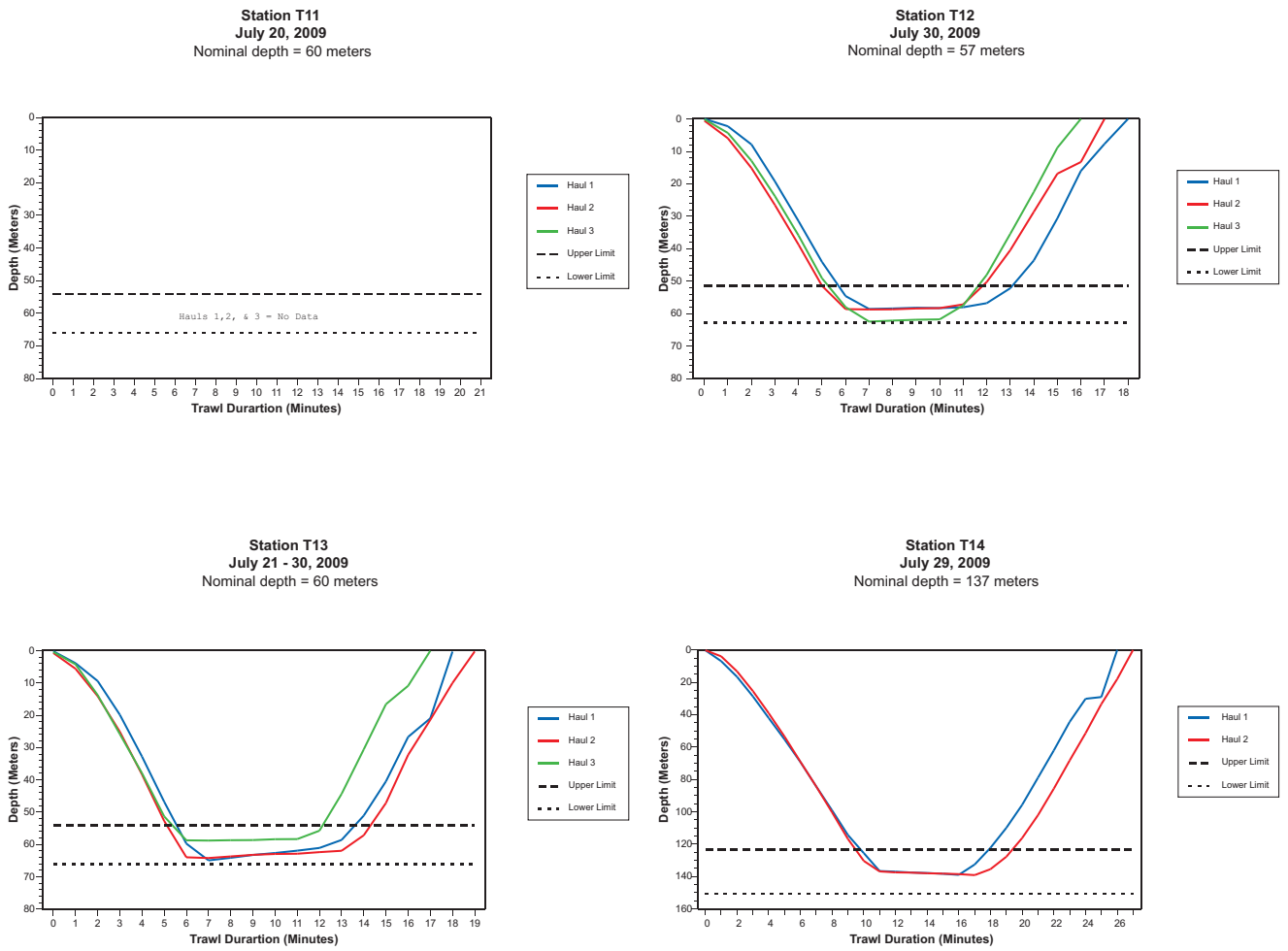

Figure C-2 Continued.

Table C-30. Trawl sample dates, track distances, percent difference from target track distance, elapsed time, and vessel speed, January 2010.

Orange County Sanitation District, California.

Date	Station	Haul	Distance Trawled (meters)	Percent Difference from Target Distance *	Elapsed Time (seconds)	Trawl speed (knots)**
January 13, 2010	T1	1	451.6	0.4	407	**2.16**
January 13, 2010	T1	2	448.4	-0.3	434	**2.01**
January 13, 2010	T1	3	450.4	0.1	430	**2.04**
January 13, 2010	T2	1	451.3	0.3	470	1.87
January 13, 2010	T2	2	453.2	0.7	456	1.93
January 12, 2010	T3	1	462.4	2.8	443	**2.03**
January 12, 2010	T3	2	459.7	2.2	437	**2.04**
January 12, 2010	T3	3	456.6	1.5	421	**2.11**
January 27, 2010	T6	1	453.3	0.7	436	**2.02**
January 27, 2010	T6	2	452.3	0.5	426	**2.06**
January 13, 2010	T10	1	455.8	1.3	456	1.94
January 25, 2010	T10	2	456.6	1.5	433	**2.05**
January 27, 2010	T11	1	455.1	1.1	411	**2.15**
January 27, 2010	T11	2	451.2	0.3	428	**2.05**
January 27, 2010	T11	3	458.2	1.8	446	2.00
January 12, 2010	T12	1	450.7	0.2	444	1.97
January 12, 2010	T12	2	443.0	-1.5	447	1.93
January 12, 2010	T12	3	453.3	0.7	469	1.88
January 25, 2010	T13	1	460.6	2.4	417	**2.15**
January 25, 2010	T13	2	454.3	1.0	424	**2.08**
January 27, 2010	T13	3	459.2	2.0	425	**2.10**
January 25, 2010	T14	1	488.7	8.6	447	**2.13**
January 25, 2010	T14	2	470.7	4.6	458	2.00
Mean value			456.4	1.4	437.6	2.03

Hauls with speeds less than 1.5 knots or greater than 2 knots are denoted in bold.

* Target Distance – 450 meters

** Target Speed – 1.5 – 2.0 knots

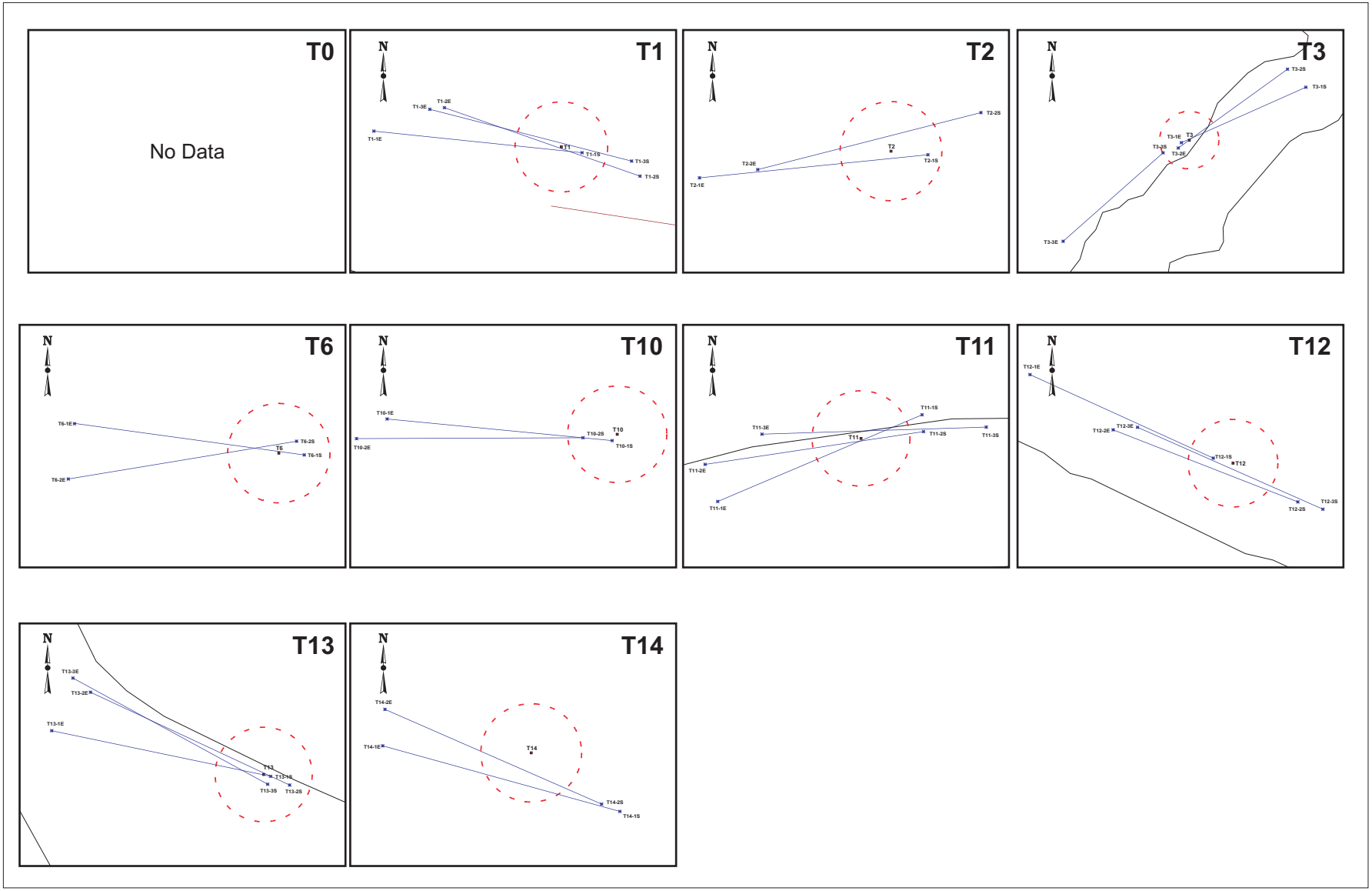

Figure C-3. **Quality assurance plots of distance to station for otter trawl hauls, January 2010.**
Red circle represents 100 meter distance from nominal trawl station center point. Blue lines represent trawl path while net is on the bottom. Trawl endpoints are labeled by station name, haul number, start (S) and end (E).

Orange County Sanitation District, California.

Table C-31. 10% trawl depth QA, January 2010.

Orange County Sanitation District, California.

Date	Station	Haul	Nominal Depth (m)	QA Range (m)	Data Source	Average Bottom Depth (m)	10% Y/N
1/13/2010	T1	1	55	49.5–60.5	SBE data	57.5	Y
					SOD data	55.5	Y
1/13/2010	T1	2			SBE data	57.5	Y
					SOD data	55.0	Y
1/13/2010	T1	3			SBE data	57.0	Y
					SOD data	55.0	Y
1/13/2010	T2	1	35	31.5–38.5	SBE data	35.4	Y
					SOD data	34.0	Y
1/13/2010	T2	2			SBE data	34.5	Y
					SOD data	33.5	Y
1/12/2010	T3	1	55	49.5–60.5	SBE data	73.1	N
					SOD data	64.5	N
1/12/2010	T3	2			SBE data	67.8	N
					SOD data	60.0	Y
1/12/2010	T3	3			SBE data	58.7	Y
					SOD data	55.5	Y
1/27/2010	T6	1	36	32.4–39.6	SBE data	36.5	Y
					SOD data	35.5	Y
1/27/2010	T6	3			SBE data	36.5	Y
					SOD data	35.5	Y
1/13/2010	T10	1	137	123.3–150.7	SBE data	135.3	Y
					SOD data	140.0	Y
1/25/2010	T10	2			SBE data	141.5	Y
					SOD data	143.0	Y
1/27/2010	T11	1	60	54.0–66.0	SBE data	61.0	Y
					SOD data	60.5	Y
1/27/2010	T11	2			SBE data	64.2	Y
					SOD data	59.0	Y
1/27/2010	T11	3			SBE data	61.6	Y
					SOD data	56.5	Y
1/12/2010	T12	1	60	54.0–66.0	SBE data	57.8	Y
					SOD data	55.0	Y
1/12/2010	T12	2			SBE data	57.6	Y
					SOD data	55.0	Y
1/12/2010	T12	3			SBE data	57.2	Y
					SOD data	55.0	Y

Table C-31 Continues.

Table C-31 Continued.

Date	Station	Haul	Nominal Depth (m)	QA Range (m)	Data Source	Average Bottom Depth (m)	10% Y/N
1/25/2010	T13	1	60	54.0–66.0	SBE data	61.8	Y
					SOD data	66.0	Y
1/25/2010	T13	2			SBE data	59.6	Y
					SOD data	59.5	Y
1/27/2010	T13	3			SBE data	63.4	Y
					SOD data	65.5	Y
1/25/2010	T14	1	137	123.3 - 150.7	SBE data	143.6	Y
					SOD data	140.0	Y
1/25/2010	T14	2			SBE data	143.5	Y
					SOD data	138.5	Y

Notes:

Station T3 depth varies widely. 10% QA may not be applicable.

SBE = Seabird Electronics

SOD = Station occupation data

Y = Yes (Pass)

N = No (Fail)

N/A = Not applicable

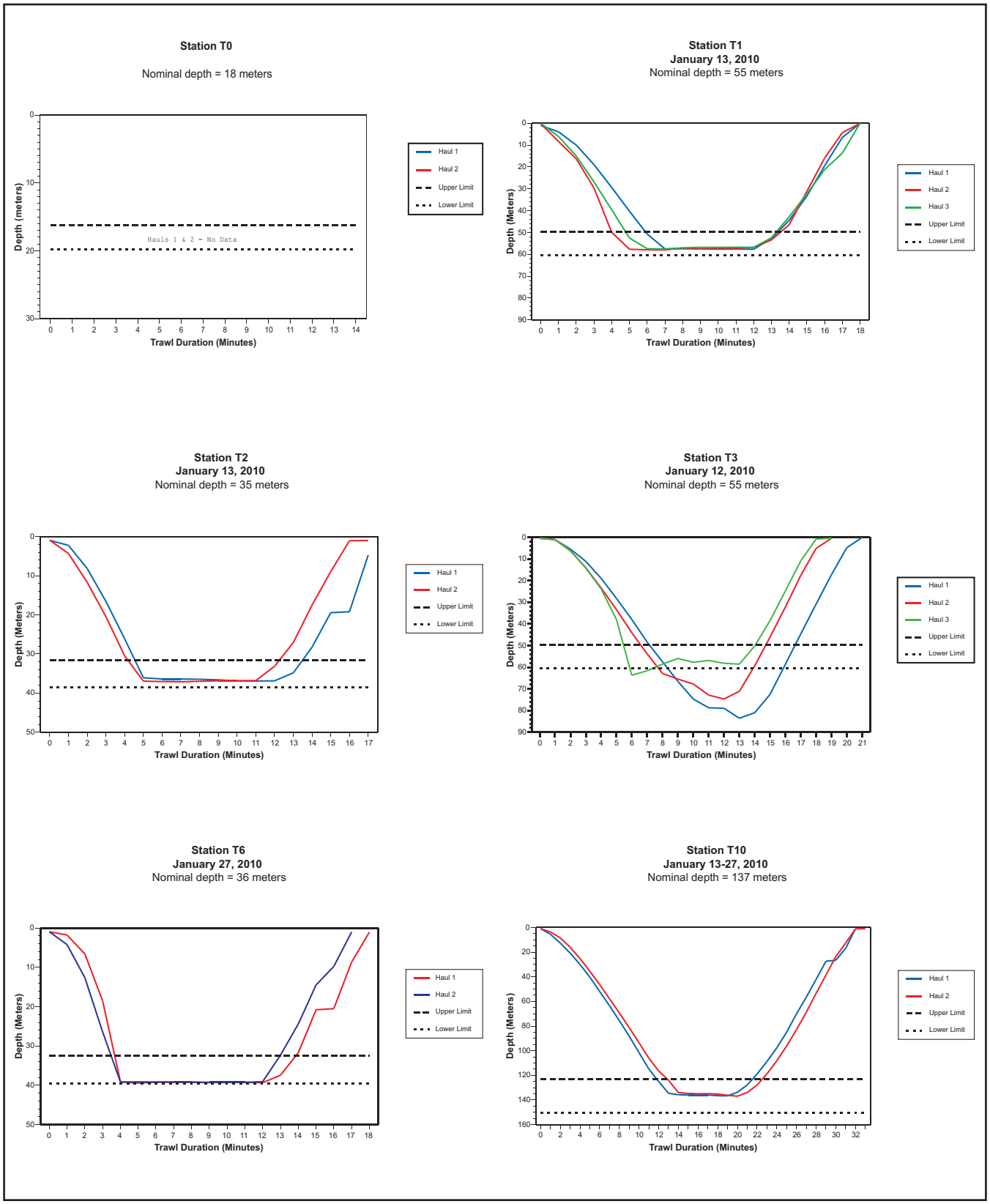

Figure C-4. **Quality assurance plots of trawl duration and trawl depth per haul for otter trawl stations, January 2010.**
Upper and lower limit lines are ± 10% of nominal trawl depth.

Orange County Sanitation District, California.

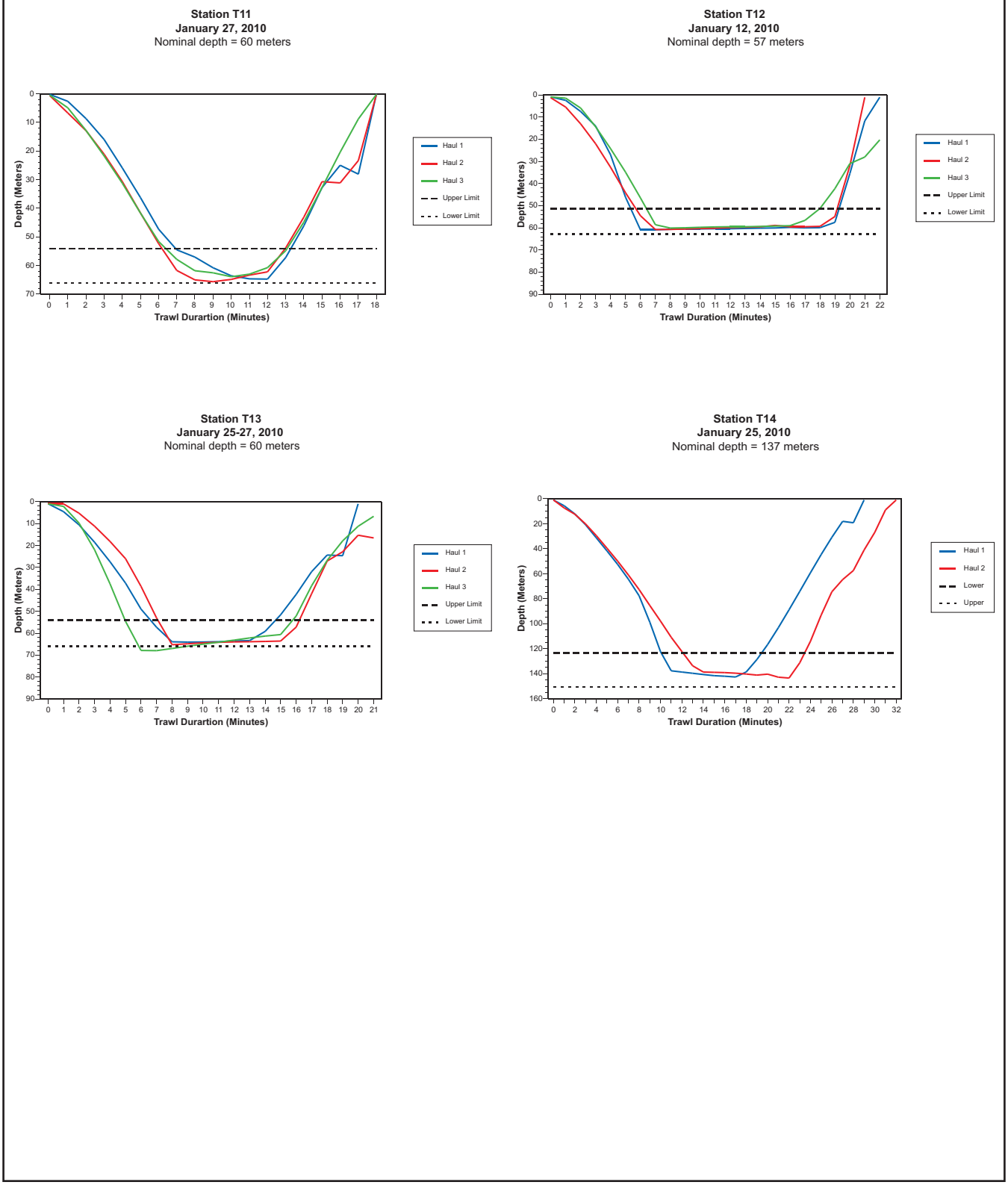

Figure C-4 Continued.

Orange County Sanitation District, California.

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