

# Cruise Report

2015 RMP Water Cruise

Contract No. 1154

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**Submitted to:**

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## 1. Introduction

This report details activities associated with the annual Regional Monitoring Program for Water Quality in the San Francisco Estuary (RMP) water cruise. The RMP water sampling program was redesigned in 2002 to adopt a randomized sampling design at thirty-one sites in place of the twenty-six “spine of the Estuary” stations sampled previously. The 2015 annual sampling continued implementation of the randomized strategy, but as first implemented beginning with the 2007 cruise, the number of sites sampled continued at twenty-two stations sampled in the dry season of alternate years.

## 2. Cruise Report

### 2.1. Objectives

All sampling was conducted from the *RV Turning Tide*. The objectives of the sampling effort were to collect the following:

#### Real-time Data Collection

1. Real-time data over the duration of sampling for conductivity, temperature, optical back scatterance (OBS), and dissolved oxygen (DO) by AMS (1 meter CTD cast for duration of sampling, followed by a full water column profile where water depth allows).
2. Water samples from 22 sites for on-board (field meter) measurement of DO, pH, salinity, conductivity, and temperature by SFEI.
3. Document current and recent weather conditions at each site.

#### Total Fraction

Unfiltered water samples for analysis of **total**:

4. 22 sites (and 1 replicate and 1 blank) for analysis of MeHg by ethylation/CVAFS (Brooks Rand Labs (BRL))
5. 22 sites (and 1 replicate and 1 blank) for analysis of Cu by column chelation and ICP-MS (BRL)
6. 22 sites (and 1 replicate and 1 blank) for analysis of Se by column chelation and ICP-MS (BRL)
7. 22 sites (and 1 replicate and 1 blank) for analysis of CN by colorimetry (ALS Environmental (ALS))
8. 22 sites (and 1 replicate and 1 blank) for analysis of SSC (ALS)
9. 9 sites (and 0 replicates) for analysis of aquatic toxicity by Pacific EcoRisk (PER).
10. 22 sites (and 1 blank) for analysis of bisphenols (SIU).

Unfiltered water samples at 3 sites (and 0 replicates and 1 blank, except Asbestos) for analysis of **CTR Parameters in total fraction**:

11. Sb by ICP-MS (BRL)
12. Be by ICP-MS (BRL)
13. Tl by ICP-MS (BRL)
14. Total Cr by ICP-MS (BRL)
15. TBT by GC/MS (Caltest – subcontracted to Test America in Kelso, WA)
16. 1 sample at BG20 for Asbestos by EPA method 100.1/100.2 (0 replicates and 0 blanks) (Caltest – subcontracted to EMSL)
17. VOCs by GC/MS (Caltest)

18. SVOCs by GC/MS (Caltest)
19. Benzene by GC/MS (Caltest)
20. Pesticides by GC/MS (Caltest)
21. Phthalates by GC/MS (Caltest)
22. Total Solids (Caltest)

Particulate Fraction

23. One particulate (filter) sample from 22 sites (and 1 replicate and 1 blank) for POC analysis by ALS Environmental (ALS)

Dissolved Fraction

Filtered (using pre-cleaned 0.45µm cartridge filter) water samples for analysis of **dissolved**:

24. 22 sites (and 1 replicate and 1 blank) for analysis of MeHg by ethylation/CVAFS (Brooks Rand Labs (BRL))
25. 22 sites (and 1 replicate and 1 blank) for analysis of Cu by column chelation and ICP-MS (BRL)
26. 22 sites (and 1 replicate and 1 blank) for analysis of Se by column chelation and ICP-MS (BRL)
27. 22 sites (and 1 replicate and 1 blank) for analysis of DOC (ALS)
28. 22 sites (and 1 replicate) for analysis of hardness (ALS)

**2.2. Personnel**

The personnel and work assignments for this cruise are shown in Table 1.

**Table 1. Personnel for 2015 RMP Water Cruise**

Name	Affiliation	Duties
Adam Wong	SFEI	Field Sampling (8/31-9/1)
Amy Franz	SFEI	Field Sampling (8/28, 8/31-9/1)
Becky Sutton	SFEI	Field Sampling (8/31-9/1)
Carolyn Doehring	SFEI	Field Sampling (8/26-8/27)
Don Yee	SFEI	Field Sampling (8/26-8/27)
Emily Novick	SFEI	Field Sampling (8/27)
Jennifer Sun	SFEI	Field Sampling (8/26 - 8/28, 9/1)
Patrick Kim	SFEI	Field Sampling (8/26 - 8/28, 9/1)
Phil Trowbridge	SFEI	Field Sampling (8/26, 8/28)
Shira Bezalel	SFEI	Field Sampling (8/28)
Doug George	AMS	Cruise Manager (8/26-9/1)
Paul Salop	AMS	Field Sampling (8/26, 8/28)
Chris Vallee	USGS	<i>RV Turning Tide</i> , Skipper (8/26-9/1)
Norbert Vanden Branden	USGS	<i>RV Turning Tide</i> , Mate (8/26-9/1)

**2.3. Sampling Activities**

Sampling activities for the 2015 RMP Water Cruise are shown in Table 2.

**Table 2. Sampling Activities for 2015 RMP Water Cruise**

<b>Date</b>	<b>Time</b>	<b>Activity</b>
August 25, 2015	1200-1700	SFEI and AMS personnel mobilized all sampling gear aboard vessel <i>R/V Turning Tide</i> at Redwood City Marina.
August 26, 2015	0715-0733	SFEI and AMS personnel mobilized all remaining sampling gear aboard vessel at Redwood City Marina. Conducted safety briefing and departed for BA30.
	0807-1009	Sampled BA30, departed for LSB062W.
	1025-1110	Sampled LSB062W, departed for LSB066W.
	1126-1208	Sampled LSB066W, departed for LSB064W.
	1216-1255	Sampled LSB064W, departed for LSB061W.
	1314-1403	Sampled LSB061W, departed for LSB065W.
	1416-1507	Sampled LSB065W, departed for Redwood City Marina.
	1549	Arrived Redwood City Marina and demobilized vessel. Aloha Transportation retrieved all samples for transport to AMS.
August 27, 2015	0705-0725	SFEI and AMS personnel mobilized all sampling gear aboard vessel at Redwood City Marina. Conducted safety briefing and departed for SB070W.
	0755-0927	Sampled SB070W and field blank, departed for SB068W.
	0940-1020	Sampled SB068W, departed for SB067W.
	1048-1120	Sampled SB067W, departed for CB040W.
	1207-1251	Sampled CB040W, departed for BC10.
	1411-1459	Sampled BC10, departed for Emeryville Marina.
	1527	Arrived Emeryville Marina and demobilized vessel. Aloha Transportation transferred sampling personnel to Redwood City to retrieve personal vehicles, and transported all samples to AMS.
August 28, 2015	0709-0720	SFEI and AMS personnel mobilized all sampling gear aboard vessel at Emeryville Marina. Conducted safety briefing and departed for BC20.
	0845-1005	Sampled BC20, departed for CB042W.
	1121-1205	Sampled CB042W, departed for CB041W.
	1333-1421	Sampled CB041W, departed for Emery Cove Yacht Harbor.
	1455	Arrived Emery Cove Yacht Harbor and demobilized vessel. Aloha Transportation retrieved all samples for transport to AMS.
August 31, 2015	0906-0925	SFEI and AMS personnel mobilized all sampling gear aboard vessel at Emery Cove Yacht Harbor. Conducted safety briefing and departed for SPB039W.
	1037-1245	Sampled SPB039W and field duplicate, departed for SPB041W.
	1307-1355	Sampled SPB041W, departed for SPB040W.
	1413-1454	Sampled SPB040W, departed for Benicia Marina.
	1530 (estimated)	Arrived Benicia Marina and demobilized vessel. Aloha Transportation transferred sampling personnel to Emeryville to retrieve personal vehicles, and transported all samples to AMS.
September 1, 2015	0608-0620	Mobilized sampling gear aboard vessel at Benicia Marina. Conducted safety briefing and departed for SU049W.
	0655-0747	Sampled SU049W, departed for SU048W.
	0802-0848	Sampled SU048W, departed for SU050W.
	0936-1019	Sampled SU050W, departed for BG20.

Date	Time	Activity
	1107-1233	Sampled BG20, departed for BG30.
	1302-1407	Sampled BG30, departed for Driftwood Marina.
	1432	Arrived Driftwood Marina. Demobilized vessel of all water cruise samples and sampling equipment. AMS personnel retrieved all samples and sampling equipment for transport to AMS. Aloha Transportation transferred sampling personnel to Benicia to retrieve personal vehicles.

## 2.4. Discussion

The sample ID system for all samples was as follows:

RMP-15WC-XXXX

Where:

RMP           =     Project  
 15             =     Cruise Year  
 WC            =     Matrix (Water Cruise)  
 XXXX         =     Unique ID number

As in previous years, SFEI staff recorded a profile of standard water quality parameters for the duration of sampling, and AMS personnel recorded a snapshot of these records on the field datasheets. At the first station sampled (BA30), staff was unable to calibrate conductivity properly, so conductivity data for this station are believed to be compromised. The issue is believed to have been resolved for subsequent stations.

Similarly, YSI pH measurement was out of calibration for stations SB068W and SB070W.

2015 sampling included collection of CTR parameters for which representative recent data was unavailable. As part of this effort, sampling personnel filled a total of four VOA vials at each CTR station for analysis of organic parameters. Upon receipt at Caltest, the laboratory project manager determined that the four vials filled at site BA30 did not meet quality standards for analysis due to the presence of too much headspace in the vials. After discussion, SFEI made the determination to replace the samples instead of qualifying data associated with initial sample collections. SFEI staff collected replacement samples of the VOA vials on September 22, 2015, which were submitted to Caltest for analysis. These sample containers were collected by submerging a pre-cleaned sample transfer container supplied by Caltest and pouring into the VOA vials.

During sampling at San Pablo Bay sites, sampling personnel noted a “slippery” feel to the vinyl gloves in use.<sup>1</sup> This led to drop of several sample containers, and requirement for replacement samples for analysis. This issue was communicated to BRL, who will be questioned about whether they have identified an alternate supplier in recent years.

<sup>1</sup> These gloves are typically supplied by BRL in advance of sampling, but were not in 2015. Therefore, gloves used by AMS for CW4CB sampling were pulled from stock for usage.

## 2.5. Sampling Sites

2015 RMP Water Cruise sampling sites are listed in Table 3. All samples collected are listed in Table 4. Sample containers and sample handling procedures are summarized in Table 5. Weather conditions encountered at time of sampling are shown in Table 6. Snapshot of water quality parameters recorded from SFEI YSI meter are shown in Table 7.

**Table 3. 2015 RMP Water Cruise Site Coordinates and Water Depth.** Sample depths are not corrected for tidal action.

Site Code	Latitude		Longitude		Depth (ft)
	Target	Actual	Target	Actual	
BA30	37.51375	37.51361	-122.13462	-122.13436	21
BC10	37.82158	37.82259	-122.34950	-122.34977	23
BC20	37.79150	37.79166	-122.67333	-122.67382	101
BG20	38.05970	38.05897	-121.81127	-121.81440	26.3
BG30	38.02054	38.02277	-121.80627	-121.80856	30.5
CB040W	37.67519	37.67517	-122.35414	-122.35460	27.9
CB041W	37.89051	37.89081	-122.37311	-122.37338	11.8
CB042W	37.72810	37.72777	-122.30636	-122.30599	31.9
LSB061W	37.49578	37.49572	-122.09341	-122.09360	6.9
LSB062W	37.47366	37.47336	-122.06937	-122.06907	22
LSB064W	37.48902	37.48906	-122.08589	-122.08600	15.1
LSB065W	37.49060	37.49079	-122.10451	-122.10474	12.2
LSB066W	37.48521	37.48511	-122.08901	-122.08888	12.2
SB067W	37.63347	37.63318	-122.26367	-122.26368	23.3
SB068W	37.59947	37.59945	-122.19668	-122.19647	9.9
SB070W	37.57892	37.57895	-122.21931	-122.21902	11.8
SPB039W	38.05928	38.05935	-122.43154	-122.43178	8.2
SPB040W	38.07478	38.07473	-122.34803	-122.34761	12.8
SPB041W	38.08731	38.08719	-122.39524	-122.39538	10.9
SU048W	38.10814	38.10830	-122.02202	-122.02161	7.2
SU049W	38.09219	38.09216	-122.05809	-122.05773	13.2
SU050W	38.05298	38.05216	-121.97698	-121.97656	9.5

**Table 4. 2015 RMP Water Samples Collected by Site.**

SITECODE	CTD -AMS	Conventional WQ - SFEI	meHg, T - BRL	Cu, Se, T - BRL	CN, T - ALS	SSC, T - ALS	Toxicity - PER	Bisphenols - SIU	POC - ALS	DOC - ALS	MeHg, D - BRL	Cu, Se, D - BRL	Hardness, D - ALS	Total Solids, T - Caltest	Sb, Be, Tl, Cr, T - BRL	TBT, T - Caltest	Asbestos, T - Caltest	Organics (EPA 625), T - Caltest	Organics (EPA 624), T - Caltest	Pesticides, T - Caltest
Field Blank			1	1	1	1		2	1	1	1	1	1		1	1		1	1	1
BC10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1
BC20	1	1	1	1	1	1		1	1	1	1	1	1							
BG20	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
BG30	1	1	1	1	1	1	1	1	1	1	1	1	1							
BA30	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1
LSB061W	1	1	1	1	1	1	1	1	1	1	1	1	1							
LSB062W	1	1	1	1	1	1		1	1	1	1	1	1							
LSB064W	1	1	1	1	1	1		1	1	1	1	1	1							
LSB065W	1	1	1	1	1	1		1	1	1	1	1	1							
LSB066W	1	1	1	1	1	1		1	1	1	1	1	1							
SB067W	1	1	1	1	1	1	1	1	1	1	1	1	1							
SB068W	1	1	1	1	1	1		1	1	1	1	1	1							
SB070W	1	1	1	1	1	1		1	1	1	1	1	1							
CB040W	1	1	1	1	1	1	1	1	1	1	1	1	1							
CB041W	1	1	1	1	1	1		1	1	1	1	1	1							
CB042W	1	1	1	1	1	1		1	1	1	1	1	1							
SPB039W	1	1	2	2	2	2	1	1	2	2	2	2	2							
SPB040W	1	1	1	1	1	1		1	1	1	1	1	1							
SPB041W	1	1	1	1	1	1		1	1	1	1	1	1							
SU048W	1	1	1	1	1	1	1	1	1	1	1	1	1							
SU049W	1	1	1	1	1	1		1	1	1	1	1	1							
SU050W	1	1	1	1	1	1		1	1	1	1	1	1							
Total	22	22	24	24	24	24	9	24	24	24	24	24	24	3	4	4	1	4	4	4



**Table 5. Containers and Sample Handling for 2015 RMP Water Cruise (T=total, P=particulate, D=dissolved).** Samples to be stored with no additional preservation, on wet ice or refrigerated (4C), and in the dark, unless otherwise noted.

Sample	T/P/D	Lab	Container	Handling Requirements
DO, cond, pH, temp, OBS	T	AMS	None	CTD deployment
DO, cond, pH, temp, sal	T	SFEI	None	Grab measurement on board vessel
MeHg	T	BRL	250 ml FLPE	No rinse; has 1-2 ml 50% H <sub>2</sub> SO <sub>4</sub> ; dup at 1 site (6 month hold time)
Cu, Se	T	BRL	2 L HDPE	Dup at 1 site (6 month hold time)
CN	T	ALS	500 mL HDPE	*Preserve with NaOH to a pH ≥12 (14 day hold if preserved); dup at 1 site
SSC	T	ALS	1 L	Dup at 1 site (7 day hold time)
Toxicity	T	PER	20 L	Place on wet ice, deliver to PER morning after sampling (36 hrs hold time)
Bisphenols	T	SIU	4 L amber glass	Amber glass, fill approx 2/3 (leave headspace)
Total Solids (CTR)	T	Caltest	1 pint polyethylene	No duplicates needed
Sb, Be, Tl, Cr (CTR)	T	BRL	Included with Cu, Se samples	No duplicates needed (6 month hold time)
TBT (CTR)	T	Caltest	1L amber glass	7 day hold time
Asbestos (CTR)	T	Caltest	1 L amber glass	48 hour hold time
VOCs, SVOCs, PAH, phthalates by EPA 625 (CTR)	T	Caltest	4 @ 1 L amber glass (2 L for field blanks)	7 day hold time.
VOCs, SVOCs by EPA 624 (CTR)	T	Caltest	Four 40 mL VOA vials (2 preserved, 2 unpreserved)	*Two vials preserved with HCl (provided), two unpreserved. Hold time is 7 days for preserved bottles, 3 days for unpreserved bottles.
Pesticides by EPA 608 (CTR)	T	Caltest	4 @ 1L amber glass (2 L for field blanks)	7 day hold time.
POC	P	ALS	Filters (1 per site)	1 filter per site. Field filtered; quick freeze -20C; dup at 1 site (100 day hold time)
DOC	D	ALS	250 ml HDPE	Field filtered (filtrate of POC sample); has 1-2 mL H <sub>2</sub> SO <sub>4</sub> , dup at 1 site (28 day hold time)
MeHg	D	BRL	250 ml FLPE	No rinse; has 1-2 ml 50% H <sub>2</sub> SO <sub>4</sub> ; dup at 1 site (6 month hold time)
Cu, Se	D	BRL	2 L HDPE	Dup at 1 site (6 month hold time)
Hardness	D	ALS	500 ml PE	Dup at 1 site

**Table 6. Weather Conditions for 2015 RMP Water Cruise.**

Site	Sea State	Tide Stage & Current (fps)	Wind Speed (kts)	Wind Dir.	Cloud Cover, % Overcast	Comments
Field Blank	Calm	1, NR	5	W	5%	
BC10	Light chop	1, ebb	10	W	Clear	
BC20	Swell 3'-4', 16 sec	NR	5	N	80%	
BG20	Choppy	1.5, NR	8	SW	Clear	
BG30	Calm	1, NR	5	SW	Clear	
BA30	Calm	0.5, flood	<2	NR	100%	
LSB061W	Calm	1, ebb	4	W	10%	
LSB062W	Calm	0.5, flood	5	NR	90%	
LSB064W	Calm	<0.1, ebb	4	W	10%	
LSB065W	Wavelets	1.5, ebb	4	W	20%	
LSB066W	Calm	slack	4	NR	30%	
SB067W	Calm	<0.5, NR	<1	NR	Clear	
SB068W	Calm	<0.5, NR	1	W	Clear	
SB070W	Calm	1, NR	5	W	5%	
CB040W	Calm	slack	2	E	Clear	
CB041W	Choppy	NR, ebb	13	WNW	5%	
CB042W	Calm	<0.5, flood	6	NW	60%	
SPB039W	Choppy	NR, flood	11	S	Clear	Collected Blind here
SPB040W	Choppy	NR, flood	12	S	Clear	
SPB041W	Choppy	NR, flood	11	S	Clear	
SU048W	Choppy	1, NR	10	SW	Clear	
SU049W	Choppy	1, ebb	11	SW	Clear	
SU050W	Choppy	1.5, NR	8	SW	Clear	

**Table 7. Recorded Water Quality Parameters.** All results recorded as snapshot from SFEI YSI meter deployed at approximately 1m depth for duration of sampling. NR=Not recorded.

Site	DO (%)	DO (mg/L)	Cond. (mS/cm)	Temp (°C)	pH	Salinity (ppt)	Comments
BC10	93.5	6.94	50.54	20.4	7.95	33.19	
BC20	91.6	7.13	52.03	17.63	8.00	34.30	
BG20	94.9	8.15	6.12	21.97	8.08	3.30	
BG30	93.3	8.07	4.01	22.34	8.07	2.12	
BA30	103.9	7.25	57.09	22.2	7.96	38.05	YSI conductivity out of calibration
LSB061W	102.4	7.14	51.6	23.7	8.14	33.94	
LSB062W	107.6	7.68	51.54	22.2	8.18	33.92	
LSB064W	109.5	7.8	51.56	22.44	8.16	33.93	
LSB065W	119.5	8.39	51.19	23.33	8.17	33.64	
LSB066W	103.8	7.41	51.68	22.3	8.19	34.03	
SB067W	91.3	6.51	52.06	22.2	7.92	34.31	
SB068W	91.5	6.6	52.20	21.65	6.93	34.41	YSI pH out of calibration
SB070W	90.4	6.49	52.36	21.82	6.92	34.53	YSI pH out of calibration
CB040W	87.3	6.36	51.37	21.29	7.90	33.78	
CB041W	91.7	6.95	49.78	20.3	7.98	32.64	
CB042W	89.9	6.65	51.00	20.43	8.02	33.54	
SPB039W	92.0	6.82	43.20	22.14	8.23	27.85	
SPB040W	93.0	6.93	41.95	22.2	8.22	26.96	
SPB041W	92.4	6.80	43.44	22.61	8.28	28.02	
SU048W	91.9	7.59	20.83	21.17	8.12	12.49	
SU049W	95.1	7.65	25.70	21.21	8.13	15.72	
SU050W	92.1	7.59	20.01	21.71	8.10	11.95	