

## **Supplemental Information**

Perfluoroalkyl Compounds in Wildlife from an Urban Estuary

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### **Quality Assurance and Quality Control (QA/QC)**

Data QA/QC samples included laboratory blanks, laboratory spikes, sample duplicates, matrix spikes and matrix duplicates, and continuing calibration samples, all of which were analyzed in a manner similar to the samples. Initial calibration included a six point calibration curve; continuing calibration verification was conducted every 20 samples. In any given batch, 5% of the samples were procedural blanks, 5% were laboratory duplicates; and 5% were spiked reference materials. The sequence for the analysis was as follows: 1-2 instrument blanks; 6 point initial calibration; 1-2 instrument blanks; spiked reference sample; instrument blank; procedural blank, samples; calibration verifications; followed by samples.

For the seal serum, human and/or bovine serum was used as the sample matrix for blanks, spikes, and calibration standards. For egg and small fish samples, fish tissue was used for the calibration standard matrix.

For seals, four laboratory duplicates were analyzed for seals. Relative percent differences (RPDs) for the duplicates for all analytes were less than 25% with the exception of one batch of samples for which the PFOA RPD was 49%. Laboratory spike reference samples and blanks were run with each batch of samples processed. Laboratory spike samples yielded results within 10% of the expected values for most samples. PFCs were not detected in any laboratory or field blanks (empty vials that accompanied

sampling vials into the field). Due to the limited sample size allowed by the permits, it was not possible to prepare a matrix spike.

For cormorants, laboratory blank and spike was analyzed for each year (nine composites for each year). A replicate composite sample was collected for 2006; a matrix spike (MS) and duplicate (MSD) for 2009. PFCs were not detected above the MDL in any blank. RPDs for compounds detected varied between 1.7 and 19% with an average of 9.9%. Laboratory spike values ranged from 91 to 119%, with an average recovery of 103%. MS recoveries varied between 92 to 115% (average 103%) with an average RPD of 5.4% (range 1.0 to 13.7%).

For small fish, laboratory blank, spike, MS and MSD and laboratory replicate were analyzed. PFCs were not detected in the blank. With the exception of PFHxS, spikes and matrix spikes varied in recoveries from 76.4 to 130%. Spike recoveries for PFHxS (138) were slightly above the QA/QC limits. PFHxS was only detected in one sample slightly above the MDL and was not reported. The RPD between the MS and MSD varied between 0 and 26.4 %. PFC was not detected in the laboratory replicate samples.

## Results

Table 1 Small Fish – Individual Results

StationCode	StationName	Species	Perfluorodecanoate	Perfluorooctanesulfonamide	Perfluorooctanesulfonate
			ng/g	ng/g	ng/g
SF09-23-71OTH	Honker Bay, Back Inlet (Open water)	Mississippi Silverside	ND	ND	9.08
SF09-19-70OTH	SouthWest San Pablo Bay	Topsmelt	ND	ND	ND
SF09-11-FSSDW	Fairfield-Suisun/ Boynton Sl	Mississippi Silverside	ND	ND	80
SF09-13-SVCSD	Sonoma Valley Schell Ck	Mississippi Silverside	ND	ND	8.76
SF09-23-71OTH	Honker Bay, Back Inlet (Open water)	Topsmelt	ND	ND	5.7
SF09-22-72OTH	Alameda Bayshore, Crab Cove	Mississippi Silverside	ND	ND	12.4
SF09-07-OAKIH	Oakland Inner Harbor	Topsmelt	ND	ND	ND
SF09-22-72OTH	Alameda Bayshore, Crab Cove	Topsmelt	ND	ND	13.6
SF09-07-OMHEA	Oakland Middle Harbor	Topsmelt	ND	ND	ND
SF09-24-74OTH	Richmond Bridge SE Shore	Topsmelt	ND	ND	ND
SF09-14-NEWSL	Newark Slough	Topsmelt	ND	ND	41.7
SF09-15-ALVSL	Alviso Slough	Mississippi Silverside	ND	4.31	60.2
SF09-15-PALOA	Palo Alto	Mississippi Silverside	3.4	9.58	28.2
SF09-25-TOMAL	Tomaes Bay, Walker Creek Base	Topsmelt	ND	ND	ND

Table 2 Seal – Individual Results

SITE_NAME	SampleDate	Age	Sex	PFDA	PFDoA	PFHpA	PFHxS	PFNA	PFOS	PFOA	PFUnA
				ng/mL	ng/mL	ng/mL	ng/mL	ng/mL	ng/mL	ng/mL	ng/mL
Mowry	6/2/04	Adult	Female	14.9	9.04	0.25	50.6	12.9	921	3.91	8.16
Mowry	6/2/04	Adult	Male	23.1	8.59	0.25	33.9	20.1	875	5.95	17.8
Mowry	6/2/04	Adult	Female	5.93	2.34	0.25	24.4	6.35	401	8.93	3.25
Mowry	6/2/04	Weaner	Female	11.4	4.92	1.34	154	43.3	1960	10.3	8.13
Mowry	6/2/04	Weaner	Male	6.23	3.72	0.745	36.6	6.83	566	6.6	4.89
Mowry	6/2/04	Adult	Female	16.7	11.5	0.635	88.6	18.5	1540	11.3	10.4
Tomales	6/18/07	Subadult	Male	1.53	0.672	0.25	0.25	2.18	15.1	0.25	4.31
Tomales	6/18/07	Yearling	Female	1.44	0.684	0.25	10.8	1.52	28.7	0.25	5
Tomales	6/18/07	Adult	Female	1.13	0.25	0.25	0.25	1.15	19.2	0.25	2.62
Tomales	6/18/07	Yearling	Male	1.79	0.62	0.25	1.51	1.44	18.7	0.25	5.2
Tomales	6/18/07	Adult	Male	1.4	0.607	0.25	3.38	2.49	22.4	0.25	6.34
Tomales	6/20/07	Subadult	Female	1.31	0.525	0.25	0.25	1.18	21.7	0.25	3.44
Tomales	6/20/07	Weaner	Female	2.25	0.554	0.25	5.92	4.03	80.5	1.07	2.07
Tomales	6/3/08	Weaner	Male	1.67	1.08	0.329	0.25	2.51	22.6	0.329	5.78
Tomales	6/4/08	Weaner	Male	3.82	1.29	0.3155	2.57	4.02	43.8	0.3155	9.69
Tomales	6/4/08	Weaner	Female	2.27	0.775	0.254	2.41	3.81	31.9	0.254	6.34
Tomales	6/4/08	Weaner	Female	0.571	0.517	0.2495	1.04	1.39	18.6	0.2495	2.16

SITE_NAME	SampleDate	Age	Sex	PFDA	PFDoA	PFHpA	PFHxS	PFNA	PFOS	PFOA	PFUnA
Tomales	6/4/08	Weaner	Male	1.14	0.938	0.2735	0.25	2.47	16.1	0.2735	4.42
Tomales	6/4/08	Weaner	Male	2.32	1.28	0.2525	3.04	3.9	50.6	0.2525	5.41
Tomales	6/5/08	Weaner	Female	8.31	2.8	0.2525	4.07	8.31	134	0.2525	23
Tomales	6/5/08	Weaner	Male	1.17	0.744	0.2535	4.26	1.8	32.6	0.2535	3.79
Tomales	6/18/07	Subadult	Female	1.75	0.25	0.25	1.91	3.22	41.4	0.25	2.76
Tomales	6/18/07	Adult	Female	1.53	0.25	0.25	1.59	0.959	29	0.25	3.67
Tomales	6/18/07	Adult	Male	1.99	0.25	0.25	2.29	2.36	59.5	0.25	3.56
Tomales	6/18/07	Adult	Male	1.18	0.25	0.25	1.99	2.29	19.2	0.25	2.75
Tomales	6/18/07	Adult	Female	1.62	0.25	0.25	1.21	1.93	26.3	0.25	2.47
Tomales	6/19/07	Adult	Female	0.25	0.25	0.25	1.12	0.84	13.5	0.25	1.97

SITE_NAME	SampleDate	Age	Sex	PFDA	PFDoA	PFHpA	PFHxS	PFNA	PFOS	PFOA	PFUnA
Castro	5/30/07	Weaner	Male	10.1	4.22	0.25	82.1	26.1	783	4.86	5.72
Castro	6/4/07	Subadult	Female	2.01	0.54	0.25	1.87	2.91	16.5	0.25	5.88
Castro	6/4/07	Weaner	Female	2.06	0.847	0.25	29.7	3.86	184	1.25	2.75
Castro	6/4/07	Weaner	Male	6.27	2.51	0.927	36.8	16.7	295	4.75	4.24
Castro	5/5/08	Weaner	Female	18.3	7.03	1.11	49.9	14.9	314	2.8	9.49
Castro	5/5/08	Weaner	Female	8.64	4.01	0.25	40.3	10.1	217	3.59	4.71
Castro	5/5/08	Weaner	Male	4.36	2.74	0.2435	22.8	3.74	96.8	0.611	4.37
Castro	5/5/08	Weaner	Male	7.3	3.1	1.91	61.7	10.7	324	3.83	3.73
Castro	5/5/08	Weaner	Male	15.4	3.94	0.256	20.1	9.92	195	1.55	7.52
Castro	5/5/08	Weaner	Male	10.1	2.82	0.38	42.9	12	270	2.89	5.01
Castro	5/5/08	Weaner	Female	8.19	3.39	0.329	16	7	160	1.01	4.78
Castro	5/5/08	Weaner	Female	3.38	1.77	0.2425	20.7	3.62	140	0.556	1.87

SITE_NAME	SampleDate	Age	Sex	PFDA	PFDoA	PFHpA	PFHxS	PFNA	PFOS	PFOA	PFUnA
Castro	5/9/08	Weaner	Male	5.2	2.5	0.327	15.4	4.72	123	1.23	4.18
Castro	5/9/08	Weaner	Female	9.1	2.44	0.252	19.8	8.4	176	1.61	6.4
Castro	5/12/08	Weaner	Female	5.16	1.1	0.277	36.5	5.92	169	0.277	3.52
Castro	5/12/08	Weaner	Male	18.1	6.57	0.837	93.2	29.7	697	4.86	7.78
Castro	5/12/08	Weaner	Male	18.6	7.49	0.814	73.4	23.6	592	4.36	12.6
Castro	5/19/08	Weaner	Female	18.6	9.4	2	81.9	15	330	5.34	10.1
Castro	5/19/08	Weaner	Male	11.8	8.02	0.2495	38.6	11.5	254	10.8	14
Castro	5/19/08	Weaner	Female	18.8	8.09	0.881	86.5	27.6	394	4.95	9.96
Castro	5/30/07	Weaner	Female	4.7	1.8	0.607	30.2	9.3	225	2.23	3.72
Castro	5/30/07	Weaner	Male	5.07	2.11	1.86	28	14.7	194	6.15	3.67
Castro	5/30/07	Weaner	Female	3.42	1.99	0.25	83	16.3	361	2.14	2.98
Castro	6/1/07	Weaner	Male	25	11.9	3.36	69	29.4	1280	11	17.5
Castro	6/1/07	Subadult	Female	8.23	2.2	0.25	23.5	9.08	152	4.52	4.28
Castro	6/1/07	Subadult	Male	2.92	0.967	0.25	20.6	7.01	113	2.61	1.27
Castro	6/4/07	Adult	Female	1.84	0.572	0.25	4.57	2.24	44.7	0.903	1.11
Castro	6/4/07	Yearling	Male	1.17	0.25	0.25	6.46	2.05	40.2	0.25	2.32
Castro	6/5/07	Adult	Female	0.981	0.25	0.25	1.6	2.01	30.5	0.909	1.36
Castro	6/6/07	Adult	Male	32.7	14.8	0.25	34.8	24.4	794	1.59	16.7
Castro	6/6/07	Yearling	Female	0.53	0.25	0.25	7.53	1.38	20.3	0.25	1.39
Castro	8/12/06	yearling	male	4.35	1.21	0.25	35.5	12	219	0.81	3.6
Castro	8/12/06	adult	female	7.08	2.81	0.25	26.5	7.33	381	0.927	5.95
Castro	8/12/06	adult	male	29.1	13.1	0.25	28.3	13.5	649	1.34	19.2

Green shading indicates compound was not detected above the detection limit. One half the detection limit is substituted for this value.

Table 3 Bird – Individual Results

Code	Name	Date	PFDA	PFDoA	PFHxS	PFNA	PFOS	PFOA	PFUnA
			ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
WI Comp 1	Wheeler Island	5/1/06	9.5	8.54	2.44	8.59	135	1.22	8.96
WI Comp 2	Wheeler Island	5/1/06	10.3	6.44	2.55	6.19	101	2.7	8.27
WI Comp 3	Wheeler Island	5/1/06	5.25	3.29	3.065	6.33	74.5	1.535	4.22
A Comp 1	Don Edwards	5/1/06	23.4	4.4	13.4	16.4	1630	9.9	8.54
A Comp 2	Don Edwards	5/1/06	24.7	19.5	8.96	10.1	1050	5.14	9.35
A Comp 3	Don Edwards	5/1/06	17.9	14.6	8.77	13.6	1080	8.69	8.85
RB Comp 1	Richmond Bridge	5/1/06	1.39	5.69	2.78	1.39	77.7	1.39	4.47
RB Comp 2	Richmond Bridge	5/1/06	1.495	4.06	2.995	1.495	63	1.495	3.66
RB Comp 3	Richmond Bridge	5/1/06	7.97	8.14	2.745	5.19	700	1.375	6.38

Code	Name	Date	PFDA	PFDoA	PFHxS	PFNA	PFOS	PFOA	PFUnA
			µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg
2RBRMPDCCO	Richmond Bridge	5/1/09	3.73	3.67	2.415	3.81	94.7	5.92	3.61
2RBRMPDCCO	Richmond Bridge	5/1/09	10.5	13.7	5.26	2.94	158	1.24	10.7
2RBRMPDCCO	Richmond Bridge	5/1/09	12.5	11.3	5.63	4.68	116	1.23	7.21
2SBT37DCCO	South Bay (Tower 37)	5/27/09	28.3	8.3	40.1	39.5	1760	28.7	9.42
2SBT38DCCO	South Bay (Tower 38)	5/27/09	20.6	4.64	20.6	26.3	1140	22.8	6.74
2SBT430DCCO	South Bay (Tower 4/30)	5/24/09	19.9	10	14.9	25.7	833	21.3	7.36
2WIRMPDCCO	Wheeler Island	3/19/09	7.73	5.19	2.415	4.85	73.8	1.21	2.92
2WIRMPDCCO	Wheeler Island	3/19/09	8.32	3.45	2.465	4.89	95.7	1.23	4.14
2WIRMPDCCO	Wheeler Island	3/19/09	12.5	3.51	2.475	7.96	83.7	1.24	4.95

Yellow shading indicates compound was not detected above the detection limit. One half the detection limit is substituted for this value.



Table 4 Number of Seals by Age Class

<b>Site</b>	<b>Adult</b>	<b>Sub-adult</b>	<b>Yearling</b>	<b>Weaner</b>
Mowry Slough	4	0	0	2
Castro Rocks	5	3	3	23
Tomales Bay	7	3	2	9
Total	16	6	5	34

Table 5 Range of Method Detection Limits by Matrix

	Small Fish (ng/g)	Seals (ng/ml)	Cormorants (ng/g)
Ethyl-perfluorooctanesulfonamide, N-	1.8-14.7	NA	NA
Ethyl-perfluorooctanesulfonamidoethanol, N-	1.1-4.8	NA	NA
Methyl-perfluorooctanesulfonamide, N-	4.6-31.4	NA	NA
Methyl-perfluorooctanesulfonamidoethanol, N-	1.0-4.9	NA	NA
Perfluorobutanesulfonate	4.9-5.0	1.0-5.0	4.7-8.2
Perfluorobutanoate	2.4-2.5	0.5-0.8	2.4-4.1
Perfluorodecanoate	2.4-2.5	0.5-0.8	2.4-4.1
Perfluorododecanoate	2.4-2.5	0.5-0.8	2.4-4.1
Perfluoroheptanoate	2.4-2.5	0.5-0.8	2.4-4.1
Perfluorohexanesulfonate	4.9-5	1.0-7.4	4.7-8.2
Perfluorohexanoate	2.4-2.5	0.4-1.8	2.4-4.1
Perfluorononanoate	2.4-2.5	0.4-0.8	2.4-4.1
Perfluorooctanesulfonamide	2.4-2.5	NA	2.4-4.1
Perfluorooctanesulfonate	4.9-5.0	1.0-24.5	4.7-8.2
Perfluorooctanoate	2.4-2.5	0.5-0.8	2.4-4.1
Perfluoropentanoate	2.4-2.5	0.5-0.8	2.4-4.1
Perfluoroundecanoate	2.4-2.5	0.5-0.8	2.4-4.1

NA - Not analyzed