

**Draft Technical Report  
for  
Tentative Cleanup and Abatement  
Order No. R9-2012-0024**

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**APPENDIX FOR SECTION 18**

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**SUPPORTING CALCULATIONS FOR  
SEDIMENT QUALITY TRIAD RESULTS**

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**March 14, 2012**

**APPENDIX FOR SECTION 18**

**SUPPORTING CALCULATIONS FOR  
SEDIMENT QUALITY TRIAD RESULTS**

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**SECTION I**

**UPL CALCULATIONS FOR TABLES 18-4 AND 18-5**

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Table A18-1

Surface Sediment UPL Calculations for Tables 18-4 and 18-5

Station		Surface Sediment UPL Calculations																									
		Arsenic <sup>5</sup>	Cadmium <sup>5</sup>	Chromium <sup>3</sup>	Copper <sup>3</sup>	Lead <sup>3</sup>	Mercury <sup>3</sup>	Nickel <sup>3</sup>	Selenium	Silver <sup>3</sup>	Zinc <sup>3</sup>	Total PCB <sup>4</sup>	Natural Log Congeners <sup>4</sup>	Natural Log Total PCB Congeners	Total PAH <sup>4</sup> (PPAH)	Natural Log Total PAH (PPAH)	Fairey TPAH <sup>1</sup>	HPAH <sup>4</sup>	Natural Log HPAH	TOC	Fairey TPAHOC	Fairey Total PCB <sup>5</sup>	MBT	DBT	TBT	TeBt	
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	%	mg/kgOC	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
CP 2231	7.8	0.03	46.6	71.1	40.3	0.36	11.5	NA	0.29	129.0	42.7	3.76	1063	6.97	839.9	536.0	6.28	1.00	84.0	55.8	NA	NA	NA	NA	NA	NA	
CP 2238	7.8	0.13	59.2	71.0	28.8	0.26	16.5	NA	0.51	214.3	11.4	2.44	199	5.29	149.9	199.0	5.29	1.01	14.8	13.6	NA	NA	NA	NA	NA	NA	
CP 2243	5.9	0.14	40.2	56.4	30.7	0.33	10.2	NA	0.65	125.0	20.7	3.03	267	5.59	197.1	118.0	4.77	0.56	35.2	25.1	NA	NA	NA	NA	NA	NA	
CP 2433	5.6	0.29	42.2	43.3	23.3	0.25	11.2	NA	0.38	114.5	27.1	3.30	780	6.66	644.7	415.0	6.03	0.53	121.6	33.9	NA	NA	NA	NA	NA	NA	
CP 2441	8.8	0.41	54.0	78.4	26.7	0.24	17.5	NA	0.39	143.0	33.5	3.51	2143	7.67	1912.4	1210.0	7.10	1.82	105.1	39.5	NA	NA	NA	NA	NA	NA	
SY 2231	8.3	0.10	37.0	82.0	42.0	0.43	10.0	0.45	0.26	120.0	77.1	4.34	687	6.53	520.0	235.0	5.46	1.30	40.0	113.6	9.6	15.0	15.0	1.2	1.2	1.2	
SY 2243	4.3	0.12	23.0	47.0	21.0	0.25	5.6	0.55	0.56	93.0	22.4	3.11	204	5.32	138.7	56.0	4.02	0.51	27.2	35.1	2.7	5.3	2.6	0.8	0.8	0.8	
SY 2433	4.6	0.29	24.0	40.0	19.0	0.21	7.4	0.55	0.39	92.0	20.8	3.04	486	6.19	380.0	169.5	5.13	0.67	56.7	31.6	3.5	9.4	3.3	0.8	0.8	0.8	
SY 2441	5.4	0.29	22.0	37.0	13.0	0.16	9.9	1	0.24	80.0	10.5	2.36	343	5.84	280.0	117.2	4.76	1.10	25.5	15.9	0.9	5.2	3.7	0.9	0.9	0.9	
2235	6.4	0.10	37.5	58.2	21.3	0.24	10.7	NA	0.48	136.0	49.8	3.91	234	5.46	198.0	76.5	4.34	0.64	30.9	35.2	NA	NA	NA	NA	NA	NA	
2241	4.5	0.09	27.5	59.2	26.3	0.21	7.3	NA	0.54	103.7	49.8	3.91	234	5.46	198.0	76.5	4.34	0.52	38.3	35.2	NA	NA	NA	NA	NA	NA	
2242	4.3	0.10	25.4	42.0	17.8	0.30	6.8	NA	0.49	89.8	49.8	3.91	359	5.88	292.4	126.8	4.84	0.74	39.4	35.2	NA	NA	NA	NA	NA	NA	
2243	3.7	0.10	20.8	38.8	19.9	0.24	5.1	NA	0.50	81.2	49.8	3.91	234	5.46	198.0	76.5	4.34	0.49	40.7	35.2	NA	NA	NA	NA	NA	NA	
2256	7.5	0.20	54.3	128.0	54.1	0.63	14.3	NA	1.29	197.0	49.8	3.91	424	6.05	357.6	174.4	5.16	1.26	28.4	35.2	NA	NA	NA	NA	NA	NA	
2257	9.1	0.18	66.7	157.0	64.1	0.51	18.7	NA	1.25	233.0	50.9	3.93	505	6.22	428.3	215.9	5.37	1.63	26.2	37.6	NA	NA	NA	NA	NA	NA	
2258	7.8	0.16	60.0	143.0	53.0	0.66	16.4	NA	0.95	211.0	49.8	3.91	463	6.14	396.6	197.9	5.29	1.44	27.5	35.2	NA	NA	NA	NA	NA	NA	
2260	4.1	0.09	23.9	50.8	20.4	0.22	7.1	NA	0.45	87.5	49.8	3.91	234	5.46	198.0	76.5	4.34	0.51	38.6	35.2	NA	NA	NA	NA	NA	NA	
2265	2.5	0.07	1.5	18.0	12.0	0.07	1.5	NA	0.19	43.2	49.8	3.91	234	5.46	198.0	76.5	4.34	0.35	55.9	35.2	NA	NA	NA	NA	NA	NA	
N	18	18	18	18	18	18	18	4	18	18	9	9	18	18	18	18	18	18	18	18	18.0	4	4	4	4	4	
Minimum	2.5	0.03	1.5	18.0	12.0	0.07	1.5	0.45	0.19	43.2	10.5	2.36	199	5.29	138.7	56	4.02	0.35	14.8	13.6	0.90	5.20	2.60	0.80	0.80	0.80	
Maximum	9.1	0.41	66.7	157.0	64.1	0.66	18.7	1.00	1.29	233.0	77.1	4.34	2143	7.67	1912.4	1210	7.10	1.82	121.6	113.6	9.60	15.00	15.00	1.20	1.20	1.20	
Mean	6.0	0.16	37.0	67.8	29.6	0.31	10.4	0.64	0.55	127.4	29.6	3.21	505	5.98	418.2	231	5.07	0.89	46.4	38.0	4.18	8.73	6.15	0.93	0.93	0.93	
Std Dev	2.0	0.10	17.4	38.3	15.0	0.16	4.7	0.25	0.32	53.4	20.5	0.62	471	0.65	416.9	275	0.80	0.44	28.9	20.9	3.78	4.62	5.92	0.19	0.19		
RSD	33%	62%	47%	56%	51%	51%	45%	39%	58%	42%	69%	19%	93%	11%	100%	119%	16%	50%	62%	55%	90%	53%	96%	20%	20%	20%	
95% PL	7.5	0.33	57	121	53	0.57	15	NA	1.1	192	84	4.4	1264	7.1	NA	663	6.5	NA	NA	NA	NA	14.1	20.9	21.7	1.4	1.4	

1. Sum of PAHs in accordance with Fairey et al., 2001
2. Estimated as the sum of 15 congeners increased by 21.2% (Shipyard data) or 9.5% (CP and B98 data) to estimate the sum of 18 congeners and then multiplied by 2 to estimate total PCBs in accordance with Fairey et al., 2001
3. Metal prediction limit values derived from the Chollas/Paleta fines-metals regression at 50% fines
4. Prediction Limit values derived from the natural log transformed reference station data

**Table A18-2 SQG Ratios for Tables 18-4 and 18-5**

Station	SQG Ratios							SUM	SQGQ1 <sup>1</sup>	Natural Log SQGQ1 <sup>1</sup>
	Cadmium	Copper	Lead	Silver	Zinc	Fairey TPAHOC	Fairey Total PCB			
	SQGQ1 SQGs (Same Units as Surface Sediment Chemistry)									
	4.21	270	112.18	1.77	410	1800	400			
CP 2231	0.01	0.26	0.36	0.16	0.31	0.05	0.14	1.29	0.18	-1.690
CP 2238	0.03	0.26	0.26	0.29	0.52	0.01	0.03	1.40	0.20	-1.606
CP 2243	0.03	0.21	0.27	0.37	0.30	0.02	0.06	1.27	0.18	-1.706
CP 2433	0.07	0.16	0.21	0.22	0.28	0.07	0.08	1.08	0.15	-1.864
CP 2441	0.10	0.29	0.24	0.22	0.35	0.06	0.10	1.35	0.19	-1.645
SY 2231	0.02	0.30	0.37	0.15	0.29	0.02	0.28	1.45	0.21	-1.576
SY 2243	0.03	0.17	0.19	0.32	0.23	0.02	0.09	1.04	0.15	-1.911
SY 2433	0.07	0.15	0.17	0.22	0.22	0.03	0.08	0.94	0.13	-2.006
SY 2441	0.07	0.14	0.12	0.14	0.20	0.01	0.04	0.71	0.10	-2.293
2235	0.02	0.22	0.19	0.27	0.33	0.02	0.09	1.13	0.16	-1.820
2241	0.02	0.22	0.23	0.30	0.25	0.02	0.09	1.14	0.16	-1.814
2242	0.02	0.16	0.16	0.28	0.22	0.02	0.09	0.94	0.13	-2.003
2243	0.02	0.14	0.18	0.28	0.20	0.02	0.09	0.94	0.13	-2.009
2256	0.05	0.47	0.48	0.73	0.48	0.02	0.09	2.32	0.33	-1.106
2257	0.04	0.58	0.57	0.71	0.57	0.01	0.09	2.58	0.37	-0.999
2258	0.04	0.53	0.47	0.54	0.51	0.02	0.09	2.20	0.31	-1.159
2260	0.02	0.19	0.18	0.26	0.21	0.02	0.09	0.97	0.14	-1.976
2265	0.02	0.07	0.11	0.11	0.11	0.03	0.09	0.52	0.07	-2.594
									18	18
									0.07	-2.59
									0.37	-1.00
									0.18	-1.77
									0.08	0.40
									42%	-23%
									<b>0.35</b>	-1.05

1. Calculated in accordance with Fairey et al., 2001 but adjusted for only 7 chemicals by dividing by 7 instead of 9



Table A18-3 Data Set Used for Tables A18-1 and A18-2

Station	Reference Station Average Surface Sediment Concentration																								
	As	Cd	Cr	Cu	Pb	Hg	Ni	Se	Ag	Zn	Total HPAH (half DL)	TPAH (PPAH)	Fairey 13 TPAH (half DL)	TOC	Total PCB Congeners (half DL)	Total PCB Homologs (half DL)	Fairey 15 of 18 PCB Congeners (half DL)	Fairey estimated 18 PCB Congeners (*1.21)	Fairey estimate Total PCBs (*2)	MBT	DBT	TBT	TetBT		
	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
CP 2231	7.78	0.025	46.6	71.1	40.3	0.364	11.5	NA	0.288	129.0	536.0	1063.0	839.9	1.00	42.7	2231	25.5	27.9	55.8	NA	NA	NA	NA	NA	
CP 2238	7.80	0.133	59.2	71.0	28.8	0.262	16.5	NA	0.510	214.3	199.0	199.0	149.9	1.01	11.4	2238	6.2	6.8	13.6	NA	NA	NA	NA	NA	
CP 2243	5.94	0.143	40.2	56.4	30.7	0.332	10.2	NA	0.651	125.0	118.0	267.0	197.1	0.56	20.7	2243	11.4	12.5	25.1	NA	NA	NA	NA	NA	
CP 2433	5.55	0.288	42.2	43.3	23.3	0.251	11.2	NA	0.385	114.5	415.0	780.0	644.7	0.53	27.1	2433	15.5	17.0	33.9	NA	NA	NA	NA	NA	
CP 2441	8.82	0.411	54.0	78.4	26.7	0.238	17.5	NA	0.388	143.0	1210.0	2143.0	1912.4	1.82	33.5	2441	18.0	19.7	39.5	NA	NA	NA	NA	NA	
SY 2231	8.30	0.100	37.0	82.0	42.0	0.430	10.0	0.45	0.260	120.0	235.0	687.0	520.0	1.30	77.1	2231	46.9	56.8	113.6	9.6	15	15	1.2	0.8	
SY 2243	4.30	0.120	23.0	47.0	21.0	0.250	5.6	0.55	0.560	93.0	56.0	204.0	138.7	0.51	22.4	2243	14.5	17.6	35.1	2.7	5.3	2.6	0.8	0.8	
SY 2433	4.60	0.290	24.0	40.0	19.0	0.210	7.4	0.55	0.390	92.0	169.5	486.0	380.0	0.67	20.8	2433	13.0	15.8	31.6	3.5	9.4	3.3	0.8	0.8	
SY 2441	5.40	0.290	22.0	37.0	13.0	0.160	9.9	1	0.240	80.0	117.2	343.0	280.0	1.10	10.5	2441	6.6	7.9	15.9	0.9	5.2	3.7	0.9	0.9	
2235	6.40	0.095	37.5	58.2	21.3	0.239	10.7	NA	0.476	136.0	76.5	234.0	198.0	0.64	49.8	2235	16.1	17.6	35.2	NA	NA	NA	NA	NA	
2241	4.53	0.088	27.5	59.2	26.3	0.213	7.3	NA	0.538	103.7	76.5	234.0	198.0	0.52	49.8	2241	16.1	17.6	35.2	NA	NA	NA	NA	NA	
2242	4.27	0.096	25.4	42.0	17.8	0.300	6.8	NA	0.493	89.8	126.8	358.7	292.4	0.74	49.8	2242	16.1	17.6	35.2	NA	NA	NA	NA	NA	
2243	3.66	0.101	20.8	38.8	19.9	0.239	5.1	NA	0.504	81.2	76.5	234.0	198.0	0.49	49.8	2243	16.1	17.6	35.2	NA	NA	NA	NA	NA	
2256	7.47	0.200	54.3	128.0	54.1	0.632	14.3	NA	1.290	197.0	174.4	424.2	357.6	1.26	49.8	2256	16.1	17.6	35.2	NA	NA	NA	NA	NA	
2257	9.08	0.175	66.7	157.0	64.1	0.511	18.7	NA	1.250	233.0	215.9	504.7	428.3	1.63	50.9	2257	17.2	18.8	37.6	NA	NA	NA	NA	NA	
2258	7.75	0.161	60.0	143.0	53.0	0.664	16.4	NA	0.954	211.0	197.9	462.9	396.6	1.44	49.8	2258	16.1	17.6	35.2	NA	NA	NA	NA	NA	
2260	4.06	0.092	23.9	50.8	20.4	0.216	7.1	NA	0.452	87.5	76.5	234.0	198.0	0.51	49.8	2260	16.1	17.6	35.2	NA	NA	NA	NA	NA	
2265	2.48	0.069	1.5	18.0	12.0	0.065	1.5	NA	0.192	43.2	76.5	234.0	198.0	0.35	49.8	2265	16.1	17.6	35.2	NA	NA	NA	NA	NA	

Values updated due to averaging or calculation discrepancies identified in the original Chollas/Paleta TMDL analysis

## **SECTION II**

### **SEDIMENT CHEMISTRY LINE-OF-EVIDENCE RESULTS FOR TABLE 18-6 AND FIGURE 18-1**

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**Table A18-4 Surface Sediment Concentrations for Table 18-6 and Figure 18-1**

Station	Surface Sediment Concentrations															
	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Zinc	Total PCB Congeners	Total PAH	Fairey TPAH <sup>1</sup>	TOC	Fairey TPAHOC	Fairey Total PCB <sup>2</sup>
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	ug/kg	ug/kg	ug/kg	%	mg/kgOC	ug/kg
UPL	7.5	0.33	57	121	53	0.57	15	NA	1.1	192	84	1264	NA	NA	NA	NA
NA01	10.2	0.24	70	253	84	1.06	15	1.1	1.3	298	375	7050	5580	2.18	256	581
NA03	11.0	0.29	69	220	94	1.10	18	1.1	1.4	260	370	6600	5244	2.33	225	575
NA04	12.0	0.27	73	260	93	1.10	19	1.1	1.2	310	250	3700	2819	2.04	138	382
NA05	9.5	0.17	57	170	65	0.61	15	0.4	0.9	210	180	3000	2277	1.60	142	281
NA06	10.5	0.27	62	395	130	2.35	15	1.1	1.0	335	640	4050	3235	2.14	151	970
NA07	13.5	0.27	61	225	100	1.45	16	0.9	1.2	255	495	16500	13734	2.02	682	751
NA09	13.0	0.40	75	260	97	1.20	20	1.2	1.1	330	290	3000	2248	2.26	99	456
NA11	9.3	0.28	59	180	73	0.85	15	1.0	1.1	230	190	3000	2391	1.69	141	294
NA12	9.5	0.18	54	150	59	0.62	15	1.1	0.8	210	150	2200	1700	1.48	115	236
NA15	12.0	0.25	62	250	83	0.98	16	1.0	1.3	310	340	3600	2714	1.95	139	518
NA16	10.5	0.36	70	253	90	1.09	16	1.0	1.4	313	590	3500	2676	2.00	134	891
NA17	14.5	0.41	74	510	115	0.85	18	1.1	1.3	620	550	3200	2496	2.03	123	822
NA19	14.0	0.37	65	270	100	0.78	17	1.0	1.1	450	990	3200	2415	1.84	131	1471
NA20	6.6	0.44	26	96	53	0.24	8	1.0	0.5	190	120	3200	2639	1.42	186	179
NA22	8.5	0.46	39	150	95	0.38	12	1.1	0.9	230	180	4000	3317	1.65	201	271
SW02	13.8	3.18	119	580	170	4.45	106	1.3	3.9	585	5450	21250	19460	5.98	326	8028
SW03	11.0	0.70	52	190	79	1.20	18	0.8	1.2	230	410	7500	6134	3.11	197	622
SW04	73.0	1.95	88	1500	430	1.75	18	1.5	1.6	3450	4000	16000	14109	2.28	619	6002
SW08	24.0	0.73	83	920	225	2.25	21	1.2	1.5	830	2100	28500	24759	3.80	651	3171
SW09	27.0	1.10	56	660	220	0.96	18	0.8	1.3	1200	710	20000	17383	1.94	896	1081
SW11	9.6	0.24	62	170	74	0.75	17	0.4	1.1	240	200	8500	7001	1.81	387	307
SW13	15.0	0.42	72	800	93	0.86	24	1.1	1.4	580	490	14000	12507	2.33	537	755
SW15	11.0	0.45	67	230	90	0.90	19	1.1	1.3	290	380	8400	7137	2.31	309	574
SW17	12.0	0.37	73	270	93	0.98	20	0.4	1.5	310	540	11000	9199	2.53	364	806
SW18	11.0	0.33	74	220	86	0.75	20	0.4	1.3	280	440	8800	7471	2.19	341	669
SW21	11.0	0.51	70	260	120	1.40	14	1.0	1.3	330	2400	10000	8480	2.10	404	3614
SW22	13.0	0.35	70	260	110	1.10	21	1.1	1.3	310	900	13000	10684	2.46	434	1399
SW23	15.0	0.37	89	280	110	1.00	25	1.1	1.3	330	1000	12000	9880	2.52	392	1552
SW25	11.5	0.36	65	230	86	0.78	17	1.0	1.2	345	350	8800	7505	2.15	349	536
SW27	10.0	0.27	63	210	80	0.68	18	0.4	1.1	250	200	14000	12055	2.08	580	311

1. Sum of PAHs in accordance with Fairey et al., 2001
2. Estimated as the sum of 15 congeners increased by 21.2% to estimate the sum of 18 congeners and then multiplied by 2 to estimate total PCBs in accordance with Fairey et al., 2001

**Table A18-5 Ratios for Table 18-6 and Figure 18-1**

Station	SQG Ratios							SUM	SQGQ1 <sub>1</sub>
	Cadmium	Copper	Lead	Silver	Zinc	Fairey TPAHOC	Fairey Total PCB		
	SQGQ1 SQGs (Same Units as Surface Sediment Chemistry)								
	4.21	270	112.18	1.77	410	1800	400		
NA01	0.06	0.94	0.75	0.75	0.73	0.14	1.45	4.81	0.69
NA03	0.07	0.81	0.84	0.79	0.63	0.13	1.44	4.71	0.67
NA04	0.06	0.96	0.83	0.68	0.76	0.08	0.95	4.32	0.62
NA05	0.04	0.63	0.58	0.50	0.51	0.08	0.70	3.05	0.44
NA06	0.06	1.46	1.16	0.57	0.82	0.08	2.43	6.59	0.94
NA07	0.06	0.83	0.89	0.65	0.62	0.38	1.88	5.32	0.76
NA09	0.10	0.96	0.86	0.62	0.80	0.06	1.14	4.54	0.65
NA11	0.07	0.67	0.65	0.62	0.56	0.08	0.74	3.38	0.48
NA12	0.04	0.56	0.53	0.45	0.51	0.06	0.59	2.74	0.39
NA15	0.06	0.93	0.74	0.73	0.76	0.08	1.30	4.59	0.66
NA16	0.09	0.94	0.80	0.76	0.76	0.07	2.23	5.65	0.81
NA17	0.10	1.89	1.03	0.73	1.51	0.07	2.05	7.38	1.05
NA19	0.09	1.00	0.89	0.62	1.10	0.07	3.68	7.45	1.06
NA20	0.10	0.36	0.47	0.30	0.46	0.10	0.45	2.25	0.32
NA22	0.11	0.56	0.85	0.51	0.56	0.11	0.68	3.38	0.48
SW02	0.75	2.15	1.52	2.20	1.43	0.18	20.07	28.30	4.04
SW03	0.17	0.70	0.70	0.68	0.56	0.11	1.55	4.48	0.64
SW04	0.46	5.56	3.83	0.90	8.41	0.34	15.00	34.52	4.93
SW08	0.17	3.41	2.01	0.82	2.02	0.36	7.93	16.72	2.39
SW09	0.26	2.44	1.96	0.73	2.93	0.50	2.70	11.53	1.65
SW11	0.06	0.63	0.66	0.62	0.59	0.21	0.77	3.54	0.51
SW13	0.10	2.96	0.83	0.79	1.41	0.30	1.89	8.28	1.18
SW15	0.11	0.85	0.80	0.73	0.71	0.17	1.44	4.81	0.69
SW17	0.09	1.00	0.83	0.85	0.76	0.20	2.02	5.74	0.82
SW18	0.08	0.81	0.77	0.73	0.68	0.19	1.67	4.94	0.71
SW21	0.12	0.96	1.07	0.73	0.80	0.22	9.04	12.95	1.85
SW22	0.08	0.96	0.98	0.73	0.76	0.24	3.50	7.26	1.04
SW23	0.09	1.04	0.98	0.73	0.80	0.22	3.88	7.74	1.11
SW25	0.08	0.85	0.76	0.68	0.84	0.19	1.34	4.75	0.68
SW27	0.06	0.78	0.71	0.62	0.61	0.32	0.78	3.89	0.56

**Table A18-6 Contaminants Exceeding Individual SQG and UPL for Table 18-6 and Figure 18-1**

Station	Contaminants Exceeding Individual SQG and UPL											Number > SQG and UPL
	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Silver	Zinc	TPAH	TCPB	
	Individual Chemical SQGs (Same Units as Surface Sediment Chemistry)											
	70	9.6	370	270	218	0.71	51.6	3.7	410	1800	400	
NA01	0	0	0	0	0	1	0	0	0	0	1	2
NA03	0	0	0	0	0	1	0	0	0	0	1	2
NA04	0	0	0	0	0	1	0	0	0	0	0	1
NA05	0	0	0	0	0	0	0	0	0	0	0	0
NA06	0	0	0	1	0	1	0	0	0	0	1	3
NA07	0	0	0	0	0	1	0	0	0	0	1	2
NA09	0	0	0	0	0	1	0	0	0	0	1	2
NA11	0	0	0	0	0	1	0	0	0	0	0	1
NA12	0	0	0	0	0	0	0	0	0	0	0	0
NA15	0	0	0	0	0	1	0	0	0	0	1	2
NA16	0	0	0	0	0	1	0	0	0	0	1	2
NA17	0	0	0	1	0	1	0	0	1	0	1	4
NA19	0	0	0	1	0	1	0	0	1	0	1	4
NA20	0	0	0	0	0	0	0	0	0	0	0	0
NA22	0	0	0	0	0	0	0	0	0	0	0	0
SW02	0	0	0	1	0	1	1	1	1	0	1	6
SW03	0	0	0	0	0	1	0	0	0	0	1	2
SW04	1	0	0	1	1	1	0	0	1	0	1	6
SW08	0	0	0	1	1	1	0	0	1	0	1	5
SW09	0	0	0	1	1	1	0	0	1	0	1	5
SW11	0	0	0	0	0	1	0	0	0	0	0	1
SW13	0	0	0	1	0	1	0	0	1	0	1	4
SW15	0	0	0	0	0	1	0	0	0	0	1	2
SW17	0	0	0	1	0	1	0	0	0	0	1	3
SW18	0	0	0	0	0	1	0	0	0	0	1	2
SW21	0	0	0	0	0	1	0	0	0	0	1	2
SW22	0	0	0	0	0	1	0	0	0	0	1	2
SW23	0	0	0	1	0	1	0	0	0	0	1	3
SW25	0	0	0	0	0	1	0	0	0	0	1	2
SW27	0	0	0	0	0	0	0	0	0	0	0	0

**Table A18-7 Chemistry Line of Evidence for Table 18-6 and Figure 18-1**

Station	Chemistry Line of Evidence				Chem Class
	SQGQ1 $\geq$ 1 and SQGQ1 $\geq$ UPL?	SQGQ1 $<$ 1 and $>$ 5 Chems Exceed SQG and UPL?	SQGQ1 $\geq$ 0.25 and SQGQ1 $\geq$ UPL?	SQGQ1 $\geq$ 0.25 and $\geq$ 1 Chem Exceeds SQG and UPL?	
NA01	no	no	yes	no	Moderate
NA03	no	no	yes	no	Moderate
NA04	no	no	yes	no	Moderate
NA05	no	no	yes	no	Moderate
NA06	no	no	yes	no	Moderate
NA07	no	no	yes	no	Moderate
NA09	no	no	yes	no	Moderate
NA11	no	no	yes	no	Moderate
NA12	no	no	yes	no	Moderate
NA15	no	no	yes	no	Moderate
NA16	no	no	yes	no	Moderate
NA17	yes	no	no	no	High
NA19	yes	no	no	no	High
NA20	no	no	no	no	Low
NA22	no	no	yes	no	Moderate
SW02	yes	no	no	no	High
SW03	no	no	yes	no	Moderate
SW04	yes	no	no	no	High
SW08	yes	no	no	no	High
SW09	yes	no	no	no	High
SW11	no	no	yes	no	Moderate
SW13	yes	no	no	no	High
SW15	no	no	yes	no	Moderate
SW17	no	no	yes	no	Moderate
SW18	no	no	yes	no	Moderate
SW21	yes	no	no	no	High
SW22	yes	no	no	no	High
SW23	yes	no	no	no	High
SW25	no	no	yes	no	Moderate
SW27	no	no	yes	no	Moderate

Table A18-8

Data Set Used for Tables A18-4 through A18-7

Station	Pre-Remedy Average Surface Sediment Concentration														TBT					
	As	Cd	Cr	Cu	Pb	Hg	Ni	Se	Ag	Zn	Total HPAH (half DL)	TPAH	Fairey 13 (half DL)	TOC		Total PCB Congeners (half DL)	Total PCB Homologs (half DL)	Fairey 15 of 18 PCB Congeners (half DL)	Fairey estimated 18 PCB Congeners (*1.21)	Fairey estimate Total PCBs (*2)
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	ug/kg	ug/kg	ug/kg	%	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
NA01	10.2	0.24	69.75	252.5	84	1.06	14.75	1.08	1.33	298	6575	7050	5580	2.18	375	533	240	290	580	157
NA02	10.0	0.21	67.00	170	76	0.70	18.00	1.00	1.00	240	2800	3000	2422	2.00	208	299	134	162	324	82
NA03	11.0	0.29	69.00	220	94	1.10	18.00	1.10	1.40	260	6100	6600	5244	2.33	370	520	237	287	574	180
NA04	12.0	0.27	73.00	260	93	1.10	19.00	1.10	1.20	310	3500	3700	2819	2.04	250	350	158	191	381	300
NA05	9.5	0.17	57.00	170	65	0.61	15.00	0.43	0.89	210	2800	3000	2277	1.60	180	250	116	140	280	110
NA06	10.5	0.27	61.50	395	130	2.35	14.50	1.05	1.02	335	3800	4050	3235	2.14	640	935	400	484	969	225
NA07	13.5	0.27	60.50	225	100	1.45	16.00	0.90	1.15	255	15850	16500	13734	2.02	495	710	310	375	749	111
NA08	18.0	0.31	79.00	270	96	0.82	21.00	1.20	1.00	330	3500	3800	2928	2.18	310	430	197	238	476	110
NA09	13.0	0.40	75.00	260	97	1.20	20.00	1.20	1.10	330	2800	3000	2248	2.26	290	410	188	228	455	120
NA10	6.9	0.22	52.00	160	59	0.58	14.00	1.00	0.78	190	1800	1900	1438	1.18	160	230	100	120	241	91
NA11	9.3	0.28	59.00	180	73	0.85	15.00	1.00	1.10	230	2800	3000	2391	1.69	190	270	121	147	294	38
NA12	9.5	0.18	54.00	150	59	0.62	15.00	1.10	0.79	210	2000	2200	1700	1.48	150	220	97	118	235	80
NA13	10.8	0.24	59.00	185	75	0.65	15.50	1.00	0.94	295	1800	1950	1511	1.92	173	265	113	137	273	68
NA14	9.0	0.25	56.00	130	66	0.55	15.00	1.10	0.78	200	1100	1200	963	1.82	128	183	82	99	199	45
NA15	12.0	0.25	62.00	250	83	0.98	16.00	1.00	1.30	310	3300	3600	2714	1.95	340	480	214	259	517	670
NA16	10.5	0.36	70.25	252.5	90	1.09	15.75	1.03	1.35	313	3200	3500	2676	2.00	590	665	368	445	890	175
NA17	14.5	0.41	74.00	510	115	0.85	17.50	1.10	1.30	620	2950	3200	2496	2.03	550	620	339	410	821	1350
NA18	14.0	0.36	67.00	230	97	0.79	17.00	1.00	1.00	380	2400	2600	1957	2.04	350	490	221	268	536	210
NA19	14.0	0.37	65.00	270	100	0.78	17.00	1.00	1.10	450	3000	3200	2415	1.84	990	1400	607	734	1469	570
NA20	6.6	0.44	26.00	96	53	0.24	8.40	1.00	0.53	190	2900	3200	2639	1.42	120	170	74	89	178	280
NA21	11.0	0.39	51.00	150	83	0.51	14.00	1.10	0.88	250	2100	2200	1829	2.15	177	257	114	137	275	410
NA22	8.5	0.46	39	150	95	0.38	12.00	1.10	0.91	230	3600	4000	3317	1.65	180	250	112	135	270	120
NA23	12.0	0.26	77.00	350	120	1.10	18.00	1.30	1.30	430	3400	3700	2988	2.21	510	730	320	387	774	120
NA24	9.6	0.20	60.00	200	88	0.90	11.00	1.10	0.90	280	2100	2300	1812	2.12	290	410	183	222	443	59
NA25	6.0	0.11	33.00	85	41	0.42	8.50	1.10	0.72	130	1100	1100	906	1.24	83	120	55	66	133	25
NA26	6.2	0.11	32.00	80	41	0.48	8.00	1.00	0.66	140	850	910	707	1.22	180	250	115	139	278	37
NA27	13.0	0.29	100.00	390	110	1.20	27.00	1.30	1.50	500	2800	3000	2465	2.01	210	290	137	166	332	100
NA28	10.0	0.31	86.00	290	84	0.89	23.00	1.20	1.40	390	3400	3700	2993	1.87	180	260	118	143	286	90
NA29	6.9	0.14	39.00	110	56	0.55	11.00	1.10	0.86	170	1900	2000	1559	1.70	190	260	119	144	289	58
NA30	7.5	0.22	37.00	140	59	0.71	9.30	1.00	1.00	170	1000	1100	835	1.38	100	150	70	84	168	22
NA31	5.3	0.13	29.00	71	34	0.35	7.50	1.10	0.57	110	530	580	447	0.92	68	96	44	53	107	20
SW01	13.5	0.71	78.50	560	145	1.45	98.00	0.88	1.07	520	7525	8725	7351	2.24	1600	2400	950	1150	2300	450
SW02	13.8	3.18	118.75	580	170	4.45	106.00	1.26	3.90	585	14500	21250	19460	5.98	5450	8325	3312	4008	8015	167



Table A18-8

Data Set Used for Tables A18-4 through A18-7, Continued

Station	Pre-Remedy Average Surface Sediment Concentration																			
	As mg/kg	Cd mg/kg	Cr mg/kg	Cu mg/kg	Pb mg/kg	Hg mg/kg	Ni mg/kg	Se mg/kg	Ag mg/kg	Zn mg/kg	Total HPAH (half DL) ug/kg	TPAH ug/kg	Fairey 13 TPAH (half DL) ug/kg	TOC %	Total PCB Congeners (half DL) ug/kg	Total PCB Homologs (half DL) ug/kg	Fairey 16 of 18 PCB Congeners (half DL) ug/kg	Fairey estimated 18 PCB Congeners (.121) ug/kg	Fairey estimate Total PCBs (.2) ug/kg	TBT ug/kg
SW03	11.0	0.70	52.00	190	79	1.20	18.00	0.80	1.20	230	6800	7500	6134	3.11	410	580	257	310	621	53
SW04	73.0	1.95	87.50	1500	430	1.75	18.00	1.50	1.60	3450	14000	16000	14109	2.28	4000	5200	2476	2996	5992	3250
SW05	11.0	0.86	53.00	230	120	0.96	19.00	0.75	1.20	280	13000	17000	15067	1.55	1200	1800	769	930	1861	170
SW06	15.0	0.85	56.00	170	81	0.75	20.00	0.83	1.10	280	12000	14000	12641	1.82	380	580	235	284	567	100
SW07	8.1	0.19	43.00	150	57	0.52	13.00	0.81	0.74	170	3800	4100	3450	1.73	170	230	107	129	258	44
SW08	24.0	0.73	82.50	920	225	2.25	21.00	1.20	1.45	830	25500	28500	24759	3.80	2100	2700	1308	1583	3166	1850
SW09	27.0	1.10	56.00	660	220	0.96	18.00	0.84	1.30	1200	17000	20000	17383	1.94	710	1100	446	540	1079	910
SW10	13.0	0.87	45.00	160	79	0.58	17.00	0.84	0.82	360	16000	25000	23410	1.21	610	930	380	459	918	250
SW11	9.6	0.24	62.00	170	74	0.75	17.00	0.39	1.10	240	8000	8500	7001	1.81	200	280	127	153	307	140
SW12	7.4	0.14	39.00	119.5	52	0.53	10.80	0.90	0.76	160	3000	3300	2742	1.47	155	231	100	121	243	36
SW13	15.0	0.42	72.00	800	93	0.86	24.00	1.10	1.40	580	12000	14000	12507	2.33	490	710	312	377	754	790
SW14	10.0	0.31	63.00	280	88	1.00	17.00	1.00	1.20	300	8400	9100	7659	2.13	400	570	257	310	621	450
SW15	11.0	0.45	67.00	230	90	0.90	19.00	1.10	1.30	290	7700	8400	7137	2.31	380	540	237	287	573	170
SW16	12.0	0.66	68.00	430	97	1.00	16.00	1.10	1.90	370	5700	6100	4847	2.24	430	610	273	330	661	1100
SW17	12.0	0.37	73.00	270	93	0.98	20.00	0.44	1.50	310	10000	11000	9199	2.53	540	880	333	403	805	440
SW18	11.0	0.33	74.00	220	86	0.75	20.00	0.44	1.30	280	8100	8800	7471	2.19	440	660	276	334	668	130
SW19	7.1	0.15	42.00	110	51	2.10	12.00	0.70	0.78	150	1100	1200	938	1.15	94	135	61	74	148	37
SW20	14.0	0.41	68.00	290	110	0.99	18.00	1.10	1.10	390	11000	12000	9736	2.14	1600	2600	1023	1238	2476	130
SW21	11.0	0.51	70.00	260	120	1.40	14.00	1.00	1.30	330	9700	10000	8480	2.10	2400	3600	1491	1804	3608	170
SW22	13.0	0.35	70.00	260	110	1.10	21.00	1.10	1.30	310	12000	13000	10684	2.46	900	1400	577	698	1396	190
SW23	15.0	0.37	89.00	280	110	1.00	25.00	1.10	1.30	330	11000	12000	9880	2.52	1000	1500	640	775	1550	210
SW24	10.0	0.33	52.50	300	88	1.90	16.00	0.95	1.15	300	52000	57000	50225	1.75	950	1500	588	711	1423	165
SW25	11.5	0.36	64.50	230	86	0.78	16.50	1.00	1.20	345	8150	8800	7505	2.15	350	500	221	268	535	231
SW26	9.0	0.14	45.00	120	58	0.43	12.00	0.90	0.46	160	1600	1700	1345	1.31	293	418	184	222	444	49
SW27	10.0	0.27	63.00	210	80	0.68	18.00	0.42	1.10	250	12000	14000	12055	2.08	200	320	128	155	311	250
SW28	14.0	0.32	65.50	265	100	0.88	15.00	1.20	1.10	330	17000	19000	16165	2.52	2100	2600	1388	1679	3359	150
SW29	8.3	0.49	44.00	220	72	0.93	37.00	1.10	1.20	230	4600	4900	4142	1.34	820	1200	504	610	1220	190
SW30	8.9	0.23	72.00	240	72	1.10	13.00	1.00	1.20	300	4900	5200	4311	2.05	380	540	240	291	581	200
SW31	4.0	0.06	18.00	54	21	0.23	4.90	1.20	0.36	80	1200	1300	1031	0.66	66	93	42	51	101	36
SW32	9.4	0.06	43.00	92	57	0.51	11.00	1.10	0.33	160	820	900	719	1.56	160	230	101	122	245	30
SW33	10.0	0.07	41.00	100	58	0.53	11.00	1.20	0.24	170	1000	1100	826	2.09	100	150	68	82	164	19
SW34	8.3	0.21	53.00	320	99	0.75	11.00	1.10	0.95	310	1400	1500	1155	1.68	130	180	82	99	198	38
SW36	9.9	0.21	70.00	240	79	0.75	13.00	1.00	1.20	300	4000	4300	3607	2.23	200	282	131	159	318	49

## SECTION III

### TOXICITY T-TEST RESULTS FOR SECTION 18.3

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#### Table A18-9 to Table A18-26

##### AMPHIPOD

NASSCO Site	
Summary	Table A18-9
t-test	Table A18-10
Data	Table A18-11
BAE Site	
Summary	Table A18-12
t-test	Table A18-13
Data	Table A18-14

##### BIVALVE

NASSCO Site	
Summary	Table A18-15
t-test	Table A18-16
Data	Table A18-17
BAE Site	
Summary	Table A18-18
t-test	Table A18-19
Data	Table A18-20

##### ECHINODERM FERTILIZATION

NASSCO Site	
Summary	Table A18-21
t-test	Table A18-22
Data	Table A18-23
BAE Site	
Summary	Table A18-24
t-test	Table A18-25
Data	Table A18-26

## Amphipod Data & Analysis

**Table A18-9 Amphipod, NASSCO Site, Summary of T-Test Analysis in Table A18-10**

<b>Station</b>	<b>Sample Mean</b>	<b>Control Mean</b>	<b>Sample Response (% of control)</b>	<b>T-Test Significantly Different</b>
NA01	80	100	80	Yes
NA03	84	100	84	No
NA04	80	100	80	Yes
NA05	86	97	89	Yes
NA06	78	100	78	Yes
NA07	73	99	74	Yes
NA09	85	97	88	Yes
NA11	70	100	70	Yes
NA12	82	100	82	Yes
NA15	94	97	97	No
NA16	87	97	90	Yes
NA17	92	97	95	No
NA19	86	97	89	No
NA20	90	100	90	Yes
NA22	92	97	95	No



Table A18-10

Amphipod, NASSCO Site, T-Test Analysis of Data in Table A18-11

t-Test: Two-Sample Assuming Unequal Variances

	NA01		NA03		NA04		NA05	
	Sample	Control	Sample	Control	Sample	Control	Sample	Control
Mean	80	100	84	100	80	100	86	97
Variance	112.5	0	242.5	0	200	0	42.5	20
Observations	5	5	5	5	5	5	5	5
Hypothesized Mean Difference	0		0		0		0	
Df	4		4		4		7	
t Stat*	-4.216370214		-2.297466108		-3.16227766		-3.111269837	
P(T<=t) one-tail	0.006758441		0.041585293		0.017054712		0.008525428	
t Critical one-tail	2.131846486		2.131846486		2.131846486		1.894577508	
P(T<=t) two-tail	0.013516882		0.083170585		0.034109423		0.017050855	
t Critical two-tail †	2.776450856		2.776450856		2.776450856		2.36462256	
* absolute value	null hypothesis = means not different							
† critical value	absolute value > critical value, reject null hypothesis							
	4.22 > 2.78							
	reject null hypothesis (p=0.01), therefore means different							
	null hypothesis = means not different							
	absolute value > critical value, reject null hypothesis							
	3.16 > 2.78							
	reject null hypothesis (p=0.03), therefore means different							
	null hypothesis = means not different							
	absolute value > critical value, reject null hypothesis							
	3.11 > 2.36							
	reject null hypothesis (p=0.02), therefore means different							

	NA06		NA07		NA09		NA11	
	Sample	Control	Sample	Control	Sample	Control	Sample	Control
Mean	78	100	73	99	85	97	70	100
Variance	182.5	0	132.5	5	25	20	37.5	0
Observations	5	5	5	5	5	5	5	5
Hypothesized Mean Difference	0		0		0		0	
Df	4		4		8		4	
t Stat*	-3.64146591		-4.958005464		-4		-10.95445115	
P(T<=t) one-tail	0.010968104		0.00385853		0.001974886		0.000197246	
t Critical one-tail	2.131846486		2.131846486		1.85954832		2.131846486	
P(T<=t) two-tail	0.021936208		0.00771706		0.003949773		0.000394492	
t Critical two-tail †	2.776450856		2.776450856		2.306005626		2.776450856	
* absolute value	null hypothesis = means not different							
† critical value	absolute value > critical value, reject null hypothesis							
	3.64 > 2.78							
	reject null hypothesis (p=0.02), therefore means different							
	null hypothesis = means not different							
	absolute value > critical value, reject null hypothesis							
	4.96 > 2.78							
	reject null hypothesis (p=0.01), therefore means different							
	null hypothesis = means not different							
	absolute value > critical value, reject null hypothesis							
	4 > 2.3							
	reject null hypothesis (p=0.004), therefore means different							
	null hypothesis = means not different							
	absolute value > critical value, reject null hypothesis							
	10.9 > 2.78							
	reject null hypothesis (p=0.0004), therefore means different							

**Table A18-10 Amphipod, NASSCO Site, T-Test Analysis of Data in Table A18-11, Continued**

**t-Test: Two-Sample Assuming Unequal Variances**

	NA12		NA15		NA16		NA17	
	Sample	Control	Sample	Control	Sample	Control	Sample	Control
Mean	82	100	94	97	87	97	92	97
Variance	70	0	42.5	20	20	20	20	20
Observations	5	5	5	5	5	5	5	5
Hypothesized Mean Difference	0		0		0		0	
Df	4		7		8		8	
t Stat*	-4.810702354		-0.848528137		-3.535533906		-1.767766953	
P(T<=t) one-tail	0.004290459		0.212103419		0.003834864		0.057538556	
t Critical one-tail	2.131846486		1.894577508		1.85954832		1.85954832	
P(T<=t) two-tail	0.008580919		0.424206838		0.007669728		0.115077112	
t Critical two-tail †	2.776450856		2.36462256		2.306005626		2.306005626	
* absolute value	null hypothesis = means not different							
† critical value	absolute value > critical value, reject null hypothesis							
	4.81 > 2.78							
	reject null hypothesis (p=0.01), therefore means different							

	NA19		NA20		NA22	
	Sample	Control	Sample	Control	Sample	Control
Mean	86	97	90	100	92	97
Variance	142.5	20	50	0	95	20
Observations	5	5	5	5	5	5
Hypothesized Mean Difference	0		0		0	
Df	5		4		6	
t Stat*	-1.929527642		-3.16227766		-1.04257207	
P(T<=t) one-tail	0.05778898		0.017054712		0.168660547	
t Critical one-tail	2.015049176		2.131846486		1.943180905	
P(T<=t) two-tail	0.111557795		0.034109423		0.337321095	
t Critical two-tail †	2.570577635		2.776450856		2.446913641	
* absolute value	null hypothesis = means not different					
† critical value	absolute value > critical value, reject null hypothesis					
	1.92 < 2.57					
	accept null hypothesis (p=0.11), therefore means not different					
	null hypothesis = means not different					
	absolute value > critical value, reject null hypothesis					
	1.04 < 2.45					
	accept null hypothesis (p=0.34), therefore means not different					



**Table A18-11 Amphipod, NASSCO Site, Toxicity Data**

	<b>Batch</b>	<b>Replicates</b>	<b>Sample</b>	<b>Control</b>		<b>Batch</b>	<b>Replicates</b>	<b>Sample</b>	<b>Control</b>
<b>NA01</b>	640-2	1	70	100	<b>NA12</b>	640-2	1	75	100
		2	85	100			2	75	100
		3	95	100			3	95	100
		4	80	100			4	80	100
		5	70	100			5	85	100
<b>NA03</b>	640-2	1	95	100	<b>NA15</b>	640-3	1	95	100
		2	100	100			2	90	95
		3	70	100			3	100	90
		4	90	100			4	100	100
		5	65	100			5	85	100
<b>NA04</b>	640-2	1	55	100	<b>NA16</b>	640-3	1	90	100
		2	85	100			2	90	95
		3	90	100			3	85	90
		4	85	100			4	90	100
		5	85	100			5	80	100
<b>NA05</b>	640-3	1	85	100	<b>NA17</b>	640-3	1	85	100
		2	80	95			2	95	95
		3	80	90			3	95	90
		4	95	100			4	90	100
		5	90	100			5	95	100
<b>NA06</b>	640-2	1	80	100	<b>NA19</b>	640-3	1	70	100
		2	85	100			2	95	95
		3	60	100			3	100	90
		4	95	100			4	85	100
		5	70	100			5	80	100
<b>NA07</b>	640-1	1	75	100	<b>NA20</b>	640-2	1	100	100
		2	85	95			2	90	100
		3	55	100			3	90	100
		4	70	100			4	90	100
		5	80	100			5	80	100
<b>NA09</b>	640-3	1	80	100	<b>NA22</b>	640-3	1	95	100
		2	90	95			2	75	95
		3	90	90			3	95	90
		4	80	100			4	100	100
		5	85	100			5	95	100
<b>NA11</b>	640-2	1	60	100					
		2	75	100					
		3	75	100					
		4	70	100					
		5	70	100					

**Table A18-12 Amphipod, BAE Site, Summary of T-Test Analysis in Table A18-13**

<b>Station</b>	<b>Sample Mean</b>	<b>Control Mean</b>	<b>Sample Response (% of control)</b>	<b>T-Test Significantly Different</b>
SW02	88	100	88	Yes
SW03	92	100	92	No
SW04	93	99	94	No
SW08	91	100	91	Yes
SW09	88	100	88	No
SW11	75	97	77	Yes
SW13	92	100	92	Yes
SW15	92	100	92	No
SW17	92	97	95	No
SW18	72	97	74	No
SW21	91	100	91	Yes
SW22	87	97	90	Yes
SW23	88	97	91	No
SW25	83	97	86	Yes
SW27	71	97	73	Yes

Table A18-13

Amphipod, BAE Site, T-Test Analysis of Data in Table A18-14

t-Test: Two-Sample Assuming Unequal Variances

	SW02		SW03		SW04		SW08	
	Sample	Control	Sample	Control	Sample	Control	Sample	Control
Mean	88	100	92	100	93	99	91	100
Variance	57.5	0	45	0	107.5	5	17.5	0
Observations	5	5	5	5	5	5	5	5
Hypothesized Mean Difference	0		0		0		0	
Df	4		4		4		4	
t Stat*	-3.538606948		-2.666666667		-1.264911064		-4.810702354	
P(T<=t) one-tail	0.012021764		0.028		0.137288315		0.004290459	
t Critical one-tail	2.131846486		2.131846486		2.131846486		2.131846486	
P(T<=t) two-tail	0.024043529		0.056		0.274576629		0.008580919	
t Critical two-tail †	2.776450856		2.776450856		2.776450856		2.776450856	
* absolute value	null hypothesis = means not different							
† critical value	absolute value > critical value, reject null hypothesis							
	3.54 > 2.78							
	reject null hypothesis (p=0.02), therefore means different							
	null hypothesis = means not different							
	absolute value > critical value, reject null hypothesis							
	1.26 < 2.78							
	accept null hypothesis (p=0.27), therefore means not different							
	null hypothesis = means not different							
	absolute value > critical value, reject null hypothesis							
	4.81 > 2.78							
	reject null hypothesis (p=0.01), therefore means different							

	SW09		SW11		SW13		SW15	
	Sample	Control	Sample	Control	Sample	Control	Sample	Control
Mean	88	100	75	97	92	100	92	100
Variance	95	0	37.5	20	20	0	70	0
Observations	5	5	5	5	5	5	5	5
Hypothesized Mean Difference	0		0		0		0	
Df	4		7		4		4	
t Stat*	-2.752988806		-6.487446071		-4		-2.138089935	
P(T<=t) one-tail	0.02560846		0.000169052		0.008065045		0.049650341	
t Critical one-tail	2.131846486		1.894577508		2.131846486		2.131846486	
P(T<=t) two-tail	0.051216921		0.000338104		0.01613009		0.099300683	
t Critical two-tail †	2.776450856		2.36462256		2.776450856		2.776450856	
* absolute value	null hypothesis = means not different							
† critical value	absolute value > critical value, reject null hypothesis							
	2.75 < 2.78							
	accept null hypothesis (p=0.05), therefore means not different							
	null hypothesis = means not different							
	absolute value > critical value, reject null hypothesis							
	6.49 > 2.36							
	reject null hypothesis (p=0.0003), therefore means different							
	null hypothesis = means not different							
	absolute value > critical value, reject null hypothesis							
	4.00 > 2.78							
	reject null hypothesis (p=0.02), therefore means different							
	null hypothesis = means not different							
	absolute value > critical value, reject null hypothesis							
	2.14 < 2.78							
	accept null hypothesis (p=0.10), therefore means not different							

Table A18-13 Amphipod, BAE Site, T-Test Analysis of Data in Table A18-14, Continued

t-Test: Two-Sample Assuming Unequal Variances

	SW17		SW18		SW21		SW22	
	Sample	Control	Sample	Control	Sample	Control	Sample	Control
Mean	92	97	72	97	91	100	87	97
Variance	20	20	407.5	20	17.5	0	7.5	20
Observations	5	5	5	5	5	5	5	5
Hypothesized Mean Difference	0		0		0		0	
Df	8		4		4		7	
t Stat*	-1.767766953		-2.703690352		-4.810702354		-4.264014327	
P(T<=t) one-tail	0.057538556		0.02694399		0.004290459		0.001864042	
t Critical one-tail	1.85954832		2.131846486		2.131846486		1.894577508	
P(T<=t) two-tail	0.115077112		0.053887981		0.008580919		0.003728084	
t Critical two-tail †	2.306005626		2.776450856		2.776450856		2.36462256	
* absolute value	null hypothesis = means not different							
† critical value	absolute value > critical value, reject null hypothesis							
	1.77 < 2.31							
	accept null hypothesis (p=0.11), therefore means not different							
	null hypothesis = means not different							
	absolute value > critical value, reject null hypothesis							
	4.81 > 2.78							
	reject null hypothesis (p=0.01), therefore means different							
	null hypothesis = means not different							
	absolute value > critical value, reject null hypothesis							
	4.26 > 2.36							
	reject null hypothesis (p=0.004), therefore means different							

	SW23		SW25		SW27	
	Sample	Control	Sample	Control	Sample	Control
Mean	88	97	83	97	71	97
Variance	57.5	20	70	20	192.5	20
Observations	5	5	5	5	5	5
Hypothesized Mean Difference	0		0		0	
Df	6		6		5	
t Stat*	-2.286002286		-3.299831646		-3.988217942	
P(T<=t) one-tail	0.031142332		0.00820566		0.005222484	
t Critical one-tail	1.943180905		1.943180905		2.015049176	
P(T<=t) two-tail	0.062284665		0.01641132		0.010444969	
t Critical two-tail †	2.446913641		2.446913641		2.570577635	
* absolute value	null hypothesis = means not different					
† critical value	absolute value > critical value, reject null hypothesis					
	2.29 < 2.45					
	accept null hypothesis (p=0.06), therefore means not different					
	null hypothesis = means not different					
	absolute value > critical value, reject null hypothesis					
	3.30 > 2.45					
	reject null hypothesis (p=0.02), therefore means different					
	null hypothesis = means not different					
	absolute value > critical value, reject null hypothesis					
	3.99 > 2.57					
	reject null hypothesis (p=0.01), therefore means different					

**Table A18-14 Amphipod, BAE Site, Toxicity Data**

	<b>Batch</b>	<b>Replicates</b>	<b>Sample Control</b>			<b>Batch</b>	<b>Replicates</b>	<b>Sample Control</b>	
SW02	640-2	1	95	100	SW17	640-3	1	85	100
		2	90	100			2	90	95
		3	90	100			3	95	90
		4	75	100			4	95	100
		5	90	100			5	95	100
SW03	640-2	1	95	100	SW18	640-3	1	75	100
		2	85	100			2	95	95
		3	95	100			3	40	90
		4	85	100			4	80	100
		5	100	100			5	70	100
SW04	640-1	1	75	100	SW21	640-2	1	85	100
		2	95	95			2	90	100
		3	100	100			3	90	100
		4	100	100			4	95	100
		5	95	100			5	95	100
SW08	640-2	1	95	100	SW22	640-3	1	85	100
		2	95	100			2	90	95
		3	85	100			3	90	90
		4	90	100			4	85	100
		5	90	100			5	85	100
SW09	640-2	1	85	100	SW23	640-3	1	80	100
		2	95	100			2	100	95
		3	85	100			3	90	90
		4	100	100			4	85	100
		5	75	100			5	85	100
SW11	640-3	1	70	100	SW25	640-3	1	90	100
		2	85	95			2	80	95
		3	75	90			3	85	90
		4	70	100			4	70	100
		5	75	100			5	90	100
SW13	640-2	1	85	100	SW27	640-3	1	60	100
		2	90	100			2	65	95
		3	95	100			3	95	90
		4	95	100			4	65	100
		5	95	100			5	70	100
SW15	640-2	1	100	100					
		2	90	100					
		3	90	100					
		4	80	100					
		5	100	100					



## Bivalve Data & Analysis

**Table A18-15      Bivalve, NASSCO Site, Summary of T-Test Analysis in Table A18-16**

<b>Station</b>	<b>Sample Mean</b>	<b>Control Mean</b>	<b>Sample Response (% of control)</b>	<b>T-Test Significantly Different</b>
NA01	43	88	49	Yes
NA03	83	88	94	No
NA04	74	88	84	Yes
NA05	83	88	94	No
NA06	68	92	74	No
NA07	81	92	88	No
NA09	1	88	1	Yes
NA11	74	92	80	No
NA12	13	88	15	Yes
NA15	82	88	93	No
NA16	3	88	3	Yes
NA17	70	88	80	Yes
NA19	2	88	2	Yes
NA20	74	92	80	Yes
NA22	2	88	2	Yes

Table A18-16

Bivalve, NASSCO Site, T-Test analysis of Data in Table A18-17

t-Test: Two-Sample Assuming Unequal Variances

	NA01		NA03		NA04		NA05	
	Sample	Control	Sample	Control	Sample	Control	Sample	Control
Mean	43.4	87.8	83.2	87.8	74.2	87.8	83.4	87.8
Variance	1245.8	16.2	89.7	16.2	82.7	16.2	26.8	16.2
Observations	5	5	5	5	5	5	5	5
Hypothesized Mean Difference	0		0		0		0	
Df	4		5		6		8	
t Stat*	-2.794719948		-0.999527745		-3.057917503		-1.500387547	
P(T<=t) one-tail	0.024537539		0.181712503		0.011142213		0.085952529	
t Critical one-tail	2.131846486		2.015049176		1.943180905		1.85954832	
P(T<=t) two-tail	0.049075079		0.363425007		0.022284425		0.171905058	
t Critical two-tail †	2.776450856		2.570577635		2.446913641		2.306005626	
* absolute value	null hypothesis = means not different							
† critical value	absolute value > critical value, reject null hypothesis							
	2.79 > 2.78							
	reject null hypothesis (p=0.05), therefore means different							
	null hypothesis = means not different							
	absolute value > critical value, reject null hypothesis							
	3.06 > 2.45							
	reject null hypothesis (p=0.02), therefore means different							
	null hypothesis = means not different							
	absolute value > critical value, reject null hypothesis							
	1.50 < 2.31							
	accept null hypothesis (p=0.17), therefore means not different							

	NA06		NA07		NA09		NA11	
	Sample	Control	Sample	Control	Sample	Control	Sample	Control
Mean	68.4	92.2	80.8	92.2	1.2	87.8	74.4	92.2
Variance	449.3	2.7	205.2	2.7	4.7	16.2	500.3	2.7
Observations	5	5	5	5	5	5	5	5
Hypothesized Mean Difference	0		0		0		0	
Df	4		4		6		4	
t Stat*	-2.503183813		-1.76792		-42.35744456		-1.77468391	
P(T<=t) one-tail	0.033269908		0.075903719		5.79281E-09		0.075307353	
t Critical one-tail	2.131846486		2.131846486		1.943180905		2.131846486	
P(T<=t) two-tail	0.066539816		0.151807439		1.15856E-08		0.150614705	
t Critical two-tail †	2.776450856		2.776450856		2.446913641		2.776450856	
* absolute value	null hypothesis = means not different							
† critical value	absolute value > critical value, reject null hypothesis							
	2.50 < 2.78							
	accept null hypothesis (p=0.07), therefore means not different							
	null hypothesis = means not different							
	absolute value > critical value, reject null hypothesis							
	42.4 > 2.45							
	reject null hypothesis (p=1.16E-08), therefore means different							
	null hypothesis = means not different							
	absolute value > critical value, reject null hypothesis							
	1.77 < 2.78							
	accept null hypothesis (p=0.15), therefore means not different							

**Table A18-16 Bivalve, NASSCO Site, T-Test analysis of Data in Table A18-17, Continued**

**t-Test: Two-Sample Assuming Unequal Variances**

	NA12		NA15		NA16		NA17	
	Sample	Control	Sample	Control	Sample	Control	Sample	Control
Mean	13.4	87.8	82	87.8	3.2	87.8	69.8	87.8
Variance	832.8	16.2	50.5	16.2	25.7	16.2	193.7	16.2
Observations	5	5	5	5	5	5	5	5
Hypothesized Mean Difference	0		0		0		0	
Df	4		6		8		5	
t Stat*	-5.709579081		-1.587998467		-29.22458507		-2.778121836	
P(T<=t) one-tail	0.002326632		0.081692803		1.01771E-09		0.019494313	
t Critical one-tail	2.131846486		1.943180905		1.85954832		2.015049176	
P(T<=t) two-tail	0.004653264		0.163385606		2.03542E-09		0.038988626	
t Critical two-tail †	2.776450856		2.446913641		2.306005626		2.570577635	
* absolute value	null hypothesis = means not different							
† critical value	absolute value > critical value, reject null hypothesis							
	5.71 > 2.78							
	reject null hypothesis (p=0.005), therefore means different							
	null hypothesis = means not different							
	absolute value > critical value, reject null hypothesis							
	29.2 > 2.31							
	reject null hypothesis (p=2.03E-09), therefore means different							
	null hypothesis = means not different							
	absolute value > critical value, reject null hypothesis							
	2.78 > 2.57							
	reject null hypothesis (p=0.04), therefore means different							

	NA19		NA20		NA22	
	Sample	Control	Sample	Control	Sample	Control
Mean	1.6	87.8	74.2	92.2	1.8	87.8
Variance	12.8	16.2	111.2	2.7	9.2	16.2
Observations	5	5	5	5	5	5
Hypothesized Mean Difference	0		0		0	
Df	8		4		7	
t Stat*	-35.79260182		-3.771339634		-38.1563299	
P(T<=t) one-tail	2.03287E-10		0.009790886		1.10484E-09	
t Critical one-tail	1.85954832		2.131846486		1.894577508	
P(T<=t) two-tail	4.06573E-10		0.019581773		2.20967E-09	
t Critical two-tail †	2.306005626		2.776450856		2.36462256	
* absolute value	null hypothesis = means not different					
† critical value	absolute value > critical value, reject null hypothesis					
	35.8 > 2.31					
	reject null hypothesis (p=4.07E-10), therefore means different					
	null hypothesis = means not different					
	absolute value > critical value, reject null hypothesis					
	3.77 > 2.78					
	reject null hypothesis (p=0.02), therefore means different					
	null hypothesis = means not different					
	absolute value > critical value, reject null hypothesis					
	38.2 > 2.36					
	reject null hypothesis (p=2.21E-09), therefore means different					

**Table A18-17 Bivalve, NASSCO Site, Toxicity Data**

	<b>Batch</b>	<b>Replicates</b>	<b>Sample</b>	<b>Control</b>		<b>Batch</b>	<b>Replicates</b>	<b>Sample</b>	<b>Control</b>
<b>NA01</b>	2	1	44	83	<b>NA12</b>	2	1	65	83
		2	6	90			2	0	90
		3	10	84			3	0	84
		4	80	92			4	0	92
		5	77	90			5	2	90
<b>NA03</b>	2	1	85	83	<b>NA15</b>	2	1	75	83
		2	90	90			2	89	90
		3	67	84			3	74	84
		4	84	92			4	88	92
		5	90	90			5	84	90
<b>NA04</b>	2	1	60	83	<b>NA16</b>	2	1	1	83
		2	77	90			2	12	90
		3	83	84			3	0	84
		4	80	92			4	0	92
		5	71	90			5	3	90
<b>NA05</b>	2	1	92	83	<b>NA17</b>	2	1	66	83
		2	79	90			2	80	90
		3	82	84			3	77	84
		4	80	92			4	47	92
		5	84	90			5	79	90
<b>NA06</b>	1	1	62	94	<b>NA19</b>	2	1	0	83
		2	38	93			2	0	90
		3	65	91			3	0	84
		4	91	93			4	0	92
		5	86	90			5	8	90
<b>NA07</b>	1	1	81	94	<b>NA20</b>	1	1	71	94
		2	82	93			2	65	93
		3	93	91			3	65	91
		4	57	93			4	81	93
		5	91	90			5	89	90
<b>NA09</b>	2	1	5	83	<b>NA22</b>	2	1	0	83
		2	0	90			2	2	90
		3	1	84			3	0	84
		4	0	92			4	7	92
		5	0	90			5	0	90
<b>NA11</b>	1	1	90	94					
		2	84	93					
		3	84	91					
		4	35	93					
		5	79	90					

**Table A18-18 Bivalve, BAE Site, Summary of T-Test Analysis in Table A18-19**

<b>Station</b>	<b>Sample Mean</b>	<b>Control Mean</b>	<b>Sample Response (% of control)</b>	<b>T-Test Significantly Different</b>
SW02	78	92	85	No
SW03	81	92	88	Yes
SW04	58	92	63	Yes
SW08	86	92	93	Yes
SW09	78	92	85	Yes
SW11	73	88	83	No
SW13	26	92	28	Yes
SW15	8	92	9	Yes
SW17	14	88	16	Yes
SW18	56	88	64	Yes
SW21	62	92	67	No
SW22	1	88	1	Yes
SW23	14	88	16	Yes
SW25	9	88	10	Yes
SW27	19	88	22	Yes



Table A18-19

Bivalve, BAE Site, T-Test Analysis of Data in Table A18-20

t-Test: Two-Sample Assuming Unequal Variances

	SW02		SW03		SW04		SW08	
	Sample	Control	Sample	Control	Sample	Control	Sample	Control
Mean	77.8	92.2	80.8	92.2	58.2	92.2	85.6	92.2
Variance	144.7	2.7	75.2	2.7	379.7	2.7	4.3	2.7
Observations	5	5	5	5	5	5	5	5
Hypothesized Mean Difference	0		0		0		0	
Df	4		4		4		8	
t Stat*	-2.652154087		-2.888159174		-3.887809507		-5.578018081	
P(T<=t) one-tail	0.028426895		0.022322695		0.008861742		0.000261756	
t Critical one-tail	2.131846486		2.131846486		2.131846486		1.85954832	
P(T<=t) two-tail	0.05685379		0.044645389		0.017723483		0.000523512	
t Critical two-tail †	2.776450856		2.776450856		2.776450856		2.306005626	
* absolute value	null hypothesis = means not different							
† critical value	absolute value > critical value, reject null hypothesis							
	2.65 < 2.78							
	accept null hypothesis (p=0.06), therefore means not different							
	null hypothesis = means not different							
	absolute value > critical value, reject null hypothesis							
	3.89 > 2.78							
	reject null hypothesis (p=0.02), therefore means different							
	null hypothesis = means not different							
	absolute value > critical value, reject null hypothesis							
	5.58 > 2.31							
	reject null hypothesis (p=0.0005), therefore means different							

	SW09		SW11		SW13		SW15	
	Sample	Control	Sample	Control	Sample	Control	Sample	Control
Mean	77.8	92.2	73.2	87.8	26	92.2	8.2	92.2
Variance	16.2	2.7	233.7	16.2	890.5	2.7	64.2	2.7
Observations	5	5	5	5	5	5	5	5
Hypothesized Mean Difference	0		0		0		0	
Df	5		5		4		4	
t Stat*	-7.406560798		-2.065164875		-4.953003495		-22.96419518	
P(T<=t) one-tail	0.000353102		0.046907376		0.003872303		1.06524E-05	
t Critical one-tail	2.015049176		2.015049176		2.131846486		2.131846486	
P(T<=t) two-tail	0.000706204		0.093814751		0.007744607		2.13047E-05	
t Critical two-tail †	2.570577635		2.570577635		2.776450856		2.776450856	
* absolute value	null hypothesis = means not different							
† critical value	absolute value > critical value, reject null hypothesis							
	7.41 > 2.57							
	reject null hypothesis (p=0.0007), therefore means different							
	null hypothesis = means not different							
	absolute value > critical value, reject null hypothesis							
	2.06 < 2.57							
	accept null hypothesis (p=0.09), therefore means not different							
	null hypothesis = means not different							
	absolute value > critical value, reject null hypothesis							
	4.95 > 2.78							
	reject null hypothesis (p=0.008), therefore means different							
	null hypothesis = means not different							
	absolute value > critical value, reject null hypothesis							
	23.0 > 2.78							
	reject null hypothesis (p=2.13E-05), therefore means different							

Table A18-19 Bivalve, BAE Site, T-Test Analysis of Data in Table A18-20, Continued

t-Test: Two-Sample Assuming Unequal Variances

	SW17		SW18		SW21		SW22	
	Sample	Control	Sample	Control	Sample	Control	Sample	Control
Mean	13.8	87.8	56	87.8	61.8	92.2	1.2	87.8
Variance	952.2	16.2	586	16.2	1129.2	2.7	2.7	16.2
Observations	5	5	5	5	5	5	5	5
Hypothesized Mean Difference	0		0		0		0	
Df	4		4		4		5	
t Stat*	-5.317277567		-2.897622108		-2.02048		-44.54223369	
P(T<=t) one-tail	0.003008297		0.022111643		0.056717847		5.38358E-08	
t Critical one-tail	2.131846486		2.131846486		2.131846486		2.015049176	
P(T<=t) two-tail	0.006016594		0.044223286		0.113435694		1.07672E-07	
t Critical two-tail †	2.776450856		2.776450856		2.776450856		2.570577635	
* absolute value	null hypothesis = means not different		null hypothesis = means not different		null hypothesis = means not different		null hypothesis = means not different	
† critical value	absolute value > critical value, reject null hypothesis		absolute value > critical value, reject null hypothesis		absolute value > critical value, reject null hypothesis		absolute value > critical value, reject null hypothesis	
	5.32 > 2.78		2.90 > 2.78		2.02 < 2.78		44.5 > 2.57	
	reject null hypothesis (p=0.006), therefore means different		reject null hypothesis (p=0.04), therefore means different		accept null hypothesis (p=0.11), therefore means not different		reject null hypothesis (p=1.08E-07), therefore means different	

	SW23		SW25		SW27	
	Sample	Control	Sample	Control	Sample	Control
Mean	14.4	87.8	8.8	87.8	19.4	87.8
Variance	469.3	16.2	287.7	16.2	880.3	16.2
Observations	5	5	5	5	5	5
Hypothesized Mean Difference	0		0		0	
Df	4		4		4	
t Stat*	-7.448802252		-10.13320301		-5.108177231	
P(T<=t) one-tail	0.000867592		0.000266963		0.003471481	
t Critical one-tail	2.131846486		2.131846486		2.131846486	
P(T<=t) two-tail	0.001735184		0.000533926		0.006942962	
t Critical two-tail †	2.776450856		2.776450856		2.776450856	
* absolute value	null hypothesis = means not different		null hypothesis = means not different		null hypothesis = means not different	
† critical value	absolute value > critical value, reject null hypothesis		absolute value > critical value, reject null hypothesis		absolute value > critical value, reject null hypothesis	
	7.45 > 2.78		10.1 > 2.78		5.11 > 2.78	
	reject null hypothesis (p=0.002), therefore means different		reject null hypothesis (p=0.0005), therefore means different		reject null hypothesis (p=0.007), therefore means different	

**Table A18-20 Bivalve, BAE Site, Toxicity Data**

	<b>Batch</b>	<b>Replicates</b>	<b>Sample</b>	<b>Control</b>		<b>Batch</b>	<b>Replicates</b>	<b>Sample</b>	<b>Control</b>
<b>SW02</b>	1	1	90	94	<b>SW17</b>	2	1	0	83
		2	67	93			2	0	90
		3	90	91			3	0	84
		4	65	93			4	0	92
		5	77	90			5	69	90
<b>SW03</b>	1	1	82	94	<b>SW18</b>	2	1	16	83
		2	74	93			2	54	90
		3	88	91			3	74	84
		4	90	93			4	60	92
		5	70	90			5	76	90
<b>SW04</b>	1	1	65	94	<b>SW21</b>	1	1	2	94
		2	33	93			2	71	93
		3	84	91			3	78	91
		4	46	93			4	80	93
		5	63	90			5	78	90
<b>SW08</b>	1	1	87	94	<b>SW22</b>	2	1	1	83
		2	84	93			2	0	90
		3	88	91			3	0	84
		4	83	93			4	4	92
		5	86	90			5	1	90
<b>SW09</b>	1	1	78	94	<b>SW23</b>	2	1	52	83
		2	82	93			2	3	90
		3	72	91			3	14	84
		4	76	93			4	1	92
		5	81	90			5	2	90
<b>SW11</b>	2	1	84	83	<b>SW25</b>	2	1	39	83
		2	47	90			2	4	90
		3	74	84			3	1	84
		4	77	92			4	0	92
		5	84	90			5	0	90
<b>SW13</b>	1	1	19	94	<b>SW27</b>	2	1	72	83
		2	0	93			2	1	90
		3	41	91			3	4	84
		4	70	93			4	11	92
		5	0	90			5	9	90
<b>SW15</b>	1	1	0	94					
		2	0	93					
		3	16	91					
		4	16	93					
		5	9	90					

## Echinoderm Fertilization Data & Analysis

**Table A18-21 Echinoderm Fertilization, NASSCO Site, Summary of T-Test Analysis in Table A18-22**

<b>Station</b>	<b>Sample Mean</b>	<b>Control Mean</b>	<b>Sample Response (% of control)</b>	<b>T-Test Significantly Different</b>
NA01	79	92	86	Yes
NA03	77	92	84	Yes
NA04	81	92	88	Yes
NA05	71	75	95	No
NA06	96	93	103	No
NA07	95	93	102	No
NA09	74	75	99	No
NA11	94	93	101	No
NA12	82	92	89	Yes
NA15	81	92	88	Yes
NA16	77	92	84	Yes
NA17	81	92	88	Yes
NA19	66	92	72	Yes
NA20	72	92	78	Yes
NA22	83	75	111	Yes*



Table A18-22

Echinoderm Fertilization, NASSCO Site, T-Test Analysis of Data in Table A18-23

t-Test: Two-Sample Assuming Unequal Variances

	NA01		NA03		NA04		NA05	
	Sample	Control	Sample	Control	Sample	Control	Sample	Control
Mean	78.8	92.1	77.2	92.1	80.6	92.1	71.4	75.3
Variance	11.7	1.925	29.2	1.925	9.3	1.925	38.3	5.075
Observations	5	5	5	5	5	5	5	5
Hypothesized Mean Difference	0		0		0		0	
Df	5		5		6		5	
t Stat*	-8.056907686		-5.97195588		-7.675199409		-1.324127683	
P(T<=t) one-tail	0.000238394		0.000942617		0.000127946		0.121380081	
t Critical one-tail	2.015049176		2.015049176		1.943180905		2.015049176	
P(T<=t) two-tail	0.000476787		0.001885234		0.000255892		0.242760163	
t Critical two-tail †	2.570577635		2.570577635		2.446913641		2.570577635	
* absolute value † critical value	null hypothesis = means not different absolute value > critical value, reject null hypothesis 8.06 > 2.57 reject null hypothesis (p=0.0005), therefore means different.		null hypothesis = means not different absolute value > critical value, reject null hypothesis 5.97 > 2.57 reject null hypothesis (p=0.002), therefore means different.		null hypothesis = means not different absolute value > critical value, reject null hypothesis 7.67 > 2.45 reject null hypothesis (p=0.0003), therefore means different.		null hypothesis = means not different absolute value > critical value, reject null hypothesis 1.32 < 2.57 accept null hypothesis (p=0.24), therefore means not different.	

	NA06		NA07		NA09		NA11	
	Sample	Control	Sample	Control	Sample	Control	Sample	Control
Mean	96.4	93.4	95	93.4	74.2	75.3	93.8	93.4
Variance	7.8	4.675	10	4.675	31.7	5.075	5.2	4.675
Observations	5	5	5	5	5	5	5	5
Hypothesized Mean Difference	0		0		0		0	
Df	8		7		5		8	
t Stat*	1.899266813		0.933933449		-0.405603176		0.284627227	
P(T<=t) one-tail	0.047037034		0.190712773		0.350903874		0.391579301	
t Critical one-tail	1.85954832		1.894577508		2.015049176		1.85954832	
P(T<=t) two-tail	0.094074068		0.381425545		0.701807748		0.783158602	
t Critical two-tail †	2.306005626		2.36462256		2.570577635		2.306005626	
* absolute value † critical value	null hypothesis = means not different absolute value > critical value, reject null hypothesis 1.90 < 2.31 accept null hypothesis (p=0.09), therefore means not different.		null hypothesis = means not different absolute value > critical value, reject null hypothesis 0.93 < 2.36 accept null hypothesis (p=0.38), therefore means not different.		null hypothesis = means not different absolute value > critical value, reject null hypothesis 0.41 < 2.57 accept null hypothesis (p=0.70), therefore means not different.		null hypothesis = means not different absolute value > critical value, reject null hypothesis 0.28 < 2.31 accept null hypothesis (p=0.78), therefore means not different.	

**Table A18-22 Echinoderm Fertilization, NASSCO Site, T-Test Analysis of Data in Table A18-23**

**t-Test: Two-Sample Assuming Unequal Variances**

	NA12		NA15		NA16		NA17	
	Sample	Control	Sample	Control	Sample	Control	Sample	Control
Mean	82.2	92.1	80.8	92.1	76.8	92.1	80.6	92.1
Variance	35.2	1.925	10.7	1.925	34.7	1.925	5.3	1.925
Observations	5	5	5	5	5	5	5	5
Hypothesized Mean Difference	0		0		0		0	
Df	4		5		4		7	
t Stat*	-3.633180425		-7.111279563		-5.653112345		-9.566738804	
P(T<=t) one-tail	0.011048787		0.000426245		0.002412122		1.43134E-05	
t Critical one-tail	2.131846486		2.015049176		2.131846486		1.894577508	
P(T<=t) two-tail	0.022097573		0.000852489		0.004824244		2.86269E-05	
t Critical two-tail†	2.776450856		2.570577635		2.776450856		2.36462256	
* absolute value	null hypothesis = means not different							
† critical value	absolute value > critical value, reject null hypothesis							
	3.63 > 2.78							
	reject null hypothesis (p=0.02), therefore means different							
	null hypothesis = means not different							
	absolute value > critical value, reject null hypothesis							
	5.65 > 2.78							
	reject null hypothesis (p=0.005), therefore means different							
	null hypothesis = means not different							
	absolute value > critical value, reject null hypothesis							
	9.57 > 2.36							
	reject null hypothesis (p=0.00003), therefore means different							

	NA19		NA20		NA22	
	Sample	Control	Sample	Control	Sample	Control
Mean	65.8	92.1	72.2	92.1	83	75.3
Variance	42.7	1.925	30.2	1.925	3.5	5.075
Observations	5	5	5	5	5	5
Hypothesized Mean Difference	0		0		0	
Df	4		5		8	
t Stat*	-8.80342434		-7.850846939		5.879747322	
P(T<=t) one-tail	0.000459251		0.000269161		0.000185054	
t Critical one-tail	2.131846486		2.015049176		1.85954832	
P(T<=t) two-tail	0.000918502		0.000538323		0.000370107	
t Critical two-tail†	2.776450856		2.570577635		2.306005626	
* absolute value	null hypothesis = means not different					
† critical value	absolute value > critical value, reject null hypothesis					
	8.80 > 2.78					
	reject null hypothesis (p=0.0009), therefore means different					
	null hypothesis = means not different					
	absolute value > critical value, reject null hypothesis					
	7.85 > 2.57					
	reject null hypothesis (p=0.0006), therefore means different					
	null hypothesis = means not different					
	absolute value > critical value, reject null hypothesis					
	5.88 > 2.31					
	reject null hypothesis (p=0.0004), therefore means different					

**Table A18-23 Echinoderm Fertilization, NASSCO Site, Toxicity Data**

	Batch	Replicates	Sample	Control		Batch	Replicates	Sample	Control
<b>NA01</b>	2	1	78	93	<b>NA12</b>	2	1	86	93
		2	77	90			2	86	90
		3	84	93			3	85	93
		4	75	94			4	72	94
		5	80	92			5	82	92
<b>NA03</b>	2	1	78	93	<b>NA15</b>	2	1	81	93
		2	84	90			2	86	90
		3	74	93			3	78	93
		4	80	94			4	81	94
		5	70	92			5	78	92
<b>NA04</b>	2	1	80	93	<b>NA16</b>	2	1	76	93
		2	77	90			2	85	90
		3	85	93			3	70	93
		4	79	94			4	80	94
		5	82	92			5	73	92
<b>NA05</b>	3	1	75	76	<b>NA17</b>	2	1	77	93
		2	74	78			2	83	90
		3	63	77			3	82	93
		4	78	73			4	81	94
		5	67	74			5	80	92
<b>NA06</b>	1	1	99	95	<b>NA19</b>	2	1	63	93
		2	94	90			2	74	90
		3	97	94			3	57	93
		4	99	96			4	65	94
		5	93	93			5	70	92
<b>NA07</b>	1	1	99	95	<b>NA20</b>	2	1	66	93
		2	93	90			2	81	90
		3	91	94			3	72	93
		4	95	96			4	70	94
		5	97	93			5	72	92
<b>NA09</b>	3	1	69	76	<b>NA22</b>	3	1	83	76
		2	70	78			2	84	78
		3	76	77			3	80	77
		4	73	73			4	85	73
		5	83	74			5	83	74
<b>NA11</b>	1	1	93	95					
		2	95	90					
		3	97	94					
		4	93	96					
		5	91	93					

**Table A18-24 Echinoderm Fertilization, BAE SITE, Summary of T-Test Analysis in Table A18-25**

<b>Station</b>	<b>Sample Mean</b>	<b>Control Mean</b>	<b>Sample Response (% of control)</b>	<b>T-Test Significantly Different</b>
SW02	96	93	103	No
SW03	96	93	103	No
SW04	81	75	108	Yes*
SW08	96	93	103	No
SW09	93	93	100	No
SW11	67	75	89	Yes
SW13	92	93	99	No
SW15	96	93	103	No
SW17	72	75	96	Yes
SW18	62	75	83	Yes
SW21	95	93	102	No
SW22	78	75	104	No
SW23	80	75	107	Yes*
SW25	77	75	103	No
SW27	68	75	91	Yes



Table A18-25

Echinoderm Fertilization, BAE Site, T-Test Analysis of Data in Table A18-26

t-Test: Two-Sample Assuming Unequal Variances

	SW02		SW03		SW04		SW08	
	Sample	Control	Sample	Control	Sample	Control	Sample	Control
Mean	95.8	93.4	95.8	93.4	81.4	75.3	95.6	93.4
Variance	1.7	4.675	2.2	4.675	6.3	5.075	3.3	4.675
Observations	5	5	5	5	5	5	5	5
Hypothesized Mean Difference	0		0		0		0	
Df	7		7		8		8	
t Stat*	2.125475725		2.046726877		4.044260619		1.741976681	
P(T<=t) one-tail	0.035571957		0.039957765		0.001856847		0.059842119	
t Critical one-tail	1.894577508		1.894577508		1.85954832		1.85954832	
P(T<=t) two-tail	0.071143913		0.079915531		0.003713695		0.119684237	
t Critical two-tail†	2.36462256		2.36462256		2.306005626		2.306005626	
* absolute value	null hypothesis = means not different							
† critical value	absolute value > critical value, reject null hypothesis							
	2.12 < 2.36							
	accept null hypothesis (p=0.07), therefore means not different							
	null hypothesis = means not different							
	absolute value > critical value, reject null hypothesis							
	4.04 > 2.31							
	reject null hypothesis (p=0.004), therefore means different							
	null hypothesis = means not different							
	absolute value > critical value, reject null hypothesis							
	1.74 < 2.31							
	accept null hypothesis (p=0.12), therefore means not different							

	SW09		SW11		SW13		SW15	
	Sample	Control	Sample	Control	Sample	Control	Sample	Control
Mean	93	93.4	67.2	75.3	92.4	93.4	95.8	93.4
Variance	2	4.675	31.7	5.075	0.8	4.675	9.2	4.675
Observations	5	5	5	5	5	5	5	5
Hypothesized Mean Difference	0		0		0		0	
Df	7		5		5		7	
t Stat*	-0.346193858		-2.986714293		-0.955636965		1.44072054	
P(T<=t) one-tail	0.369684686		0.015281342		0.191571571		0.096427272	
t Critical one-tail	1.894577508		2.015049176		2.015049176		1.894577508	
P(T<=t) two-tail	0.739369371		0.030562685		0.383143142		0.192854544	
t Critical two-tail†	2.36462256		2.570577635		2.570577635		2.36462256	
* absolute value	null hypothesis = means not different							
† critical value	absolute value > critical value, reject null hypothesis							
	0.35 < 2.36							
	accept null hypothesis (p=0.74), therefore means not different							
	null hypothesis = means not different							
	absolute value > critical value, reject null hypothesis							
	2.99 > 2.57							
	reject null hypothesis (p=0.03), therefore means different							
	null hypothesis = means not different							
	absolute value > critical value, reject null hypothesis							
	0.96 < 2.57							
	accept null hypothesis (p=0.38), therefore means not different							
	null hypothesis = means not different							
	absolute value > critical value, reject null hypothesis							
	1.44 < 2.36							
	accept null hypothesis (p=0.19), therefore means not different							

**Table A18-25 Echinoderm Fertilization, BAE Site, T-Test Analysis of Data in Table A18-26, Continued**

**t-Test: Two-Sample Assuming Unequal Variances**

	SW17		SW18		SW21		SW22	
	Sample	Control	Sample	Control	Sample	Control	Sample	Control
Mean	71.8	75.3	62	75.3	95.2	93.4	78.2	75.3
Variance	1.2	5.075	23.5	5.075	0.7	4.675	17.7	5.075
Observations	5	5	5	5	5	5	5	5
Hypothesized Mean Difference	0		0		0		0	
Df	6		6		5		6	
t Stat*	-3.124252899		-5.563441472		1.73607416		1.358794584	
P(T<=t) one-tail	0.010236884		0.000714112		0.071533502		0.111535068	
t Critical one-tail	1.943180905		1.943180905		2.015049176		1.943180905	
P(T<=t) two-tail	0.020473768		0.001428224		0.143067004		0.223070137	
t Critical two-tail †	2.446913641		2.446913641		2.570577635		2.446913641	
* absolute value	null hypothesis = means not different							
† critical value	absolute value > critical value, reject null hypothesis							
	3.12 > 2.45							
	reject null hypothesis (p=0.02), therefore means different							
	null hypothesis = means not different							
	absolute value > critical value, reject null hypothesis							
	1.74 < 2.57							
	accept null hypothesis (p=0.14), therefore means not different							
	null hypothesis = means not different							
	absolute value > critical value, reject null hypothesis							
	1.36 < 2.45							
	accept null hypothesis (p=0.22), therefore means not different							

	SW23		SW25		SW27	
	Sample	Control	Sample	Control	Sample	Control
Mean	80.6	75.3	77	75.3	67.8	75.3
Variance	7.8	5.075	20	5.075	13.7	5.075
Observations	5	5	5	5	5	5
Hypothesized Mean Difference	0		0		0	
Df	8		6		7	
t Stat*	3.30283785		0.759125277		-3.870403936	
P(T<=t) one-tail	0.005406504		0.238265951		0.003064242	
t Critical one-tail	1.85954832		1.943180905		1.894577508	
P(T<=t) two-tail	0.010813007		0.476531902		0.006128484	
t Critical two-tail †	2.306005626		2.446913641		2.36462256	
* absolute value	null hypothesis = means not different					
† critical value	absolute value > critical value, reject null hypothesis					
	3.30 > 2.31					
	reject null hypothesis (p=0.01), therefore means different					
	null hypothesis = means not different					
	absolute value > critical value, reject null hypothesis					
	5.11 > 2.78					
	reject null hypothesis (p=0.007), therefore means different					

**Table A18-26 Echinoderm Fertilization, BAE Site, Toxicity Data**

	<b>Batch</b>	<b>Replicates</b>	<b>Sample</b>	<b>Control</b>		<b>Batch</b>	<b>Replicates</b>	<b>Sample</b>	<b>Control</b>
<b>SW02</b>	1	1	95	95	<b>SW17</b>	3	1	70	76
		2	96	90			2	72	78
		3	97	94			3	72	77
		4	97	96			4	73	73
		5	94	93			5	72	74
<b>SW03</b>	1	1	96	95	<b>SW18</b>	3	1	67	76
		2	95	90			2	60	78
		3	94	94			3	55	77
		4	96	96			4	66	73
		5	98	93			5	62	74
<b>SW04</b>	3	1	85	76	<b>SW21</b>	1	1	96	95
		2	79	78			2	95	90
		3	79	77			3	95	94
		4	82	73			4	96	96
		5	82	74			5	94	93
<b>SW08</b>	1	1	94	95	<b>SW22</b>	3	1	74	76
		2	94	90			2	85	78
		3	95	94			3	77	77
		4	97	96			4	76	73
		5	98	93			5	79	74
<b>SW09</b>	1	1	94	95	<b>SW23</b>	3	1	82	76
		2	92	90			2	80	78
		3	92	94			3	76	77
		4	95	96			4	83	73
		5	92	93			5	82	74
<b>SW11</b>	3	1	76	76	<b>SW25</b>	3	1	74	76
		2	62	78			2	78	78
		3	66	77			3	82	77
		4	69	73			4	71	73
		5	63	74			5	80	74
<b>SW13</b>	1	1	91	95	<b>SW27</b>	3	1	72	76
		2	93	90			2	66	78
		3	93	94			3	67	77
		4	92	96			4	71	73
		5	93	93			5	63	74
<b>SW15</b>	1	1	94	95					
		2	100	90					
		3	96	94					
		4	97	96					
		5	92	93					

## SECTION IV

### SUPPORTING CALCULATION FOR BIVALVE DEVELOPMENT IN TABLE 18-7

**Table A18-27 Bivalve Combined Survival and Normality**

Station	Batch	Bivalve Combined Survival and Normality (%)						
		Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Average	Control Adjusted Average
2441	2	69	77	60	64	59	66	93
2433	2	24	58	66	39	47	47	66
2231	1	88	86	80	77	80	82	101
2243	2	62	24	75	8	79	50	70
Control	1	85	86	81	88	87	85	
Control	1	77	79	71	75	81	77	
Batch 1 Duplicate Control verage							81	
Control	2	70	75	65	15	83	62	
Control	2	82	80	74	76	89	80	
Batch 2 Duplicate Control verage							71	

N	4
Minimum	66
Maximum	101
Mean	82.5
Stdev	17.1
RSD	21%
95% PL	37.4

**Notes**

All data is from Exponent (2003)