A Submersible Time Integrative Extractive Apparatus To Continuously Monitor the Water Column in the Gulf for Oil and Dispersants

A Division of C.I.Agent Solutions called **C.I.Agent Storm Water Solutions** developed a novel device called the **C.L.A.M.** (Continuous Low -Level Aquatic Monitoring) to monitor the water column in the Gulf waters off Dauphin Island, Alabama. The C.L.A.M. is a small submersible extraction sampler, using EPA approved SPE (Solid Phase Extraction) media to sequester Pesticides, Herbicides, PAH's, TPH, and other trace organics from water.

The **C.L.A.M.** actually extracts the water in-situ, with the same technology the labs use on the bench. It provides a pre-extracted quantitative sampling event representing up to a hundred liters of water, lowering the laboratory detection limits a hundred fold. The small dry extraction disk is all that is sent to the laboratory for solvent elution and analysis. **C.L.A.M.**s weigh just over one pound, including the 4 AA batteries, and many can be easily taken to remote areas and left unattended to sample continuously for days or weeks at submerged depths up to 100 feet in marine or fresh waters.

C.I.Agent Storm Water Solutions developed a novel, separate, two stage filter disk system for the C.L.A.M., specifically designed for the Gulf oil spill situation.

The first SPE disk will extract in-situ from the water column the non-polar TPH oils, allowing the polar dispersants used in COREXIT 9500 and 9575 (Propylene glycol and 2- Butoxyethanol) to pass through and be captured in the second ACF (Activated Carbon Fiber) filter disk. This C.L.A.M. system has the ability to continuously extract the water column for a day or even weeks, and provide two extracted disks, each representing up to one hundred liters of water ready for laboratory elution and analysis for oil and dispersants.

The use of this unique technology provides the ultra low detection necessary to find and quantitate the extremely diluted dispersants and oil in the water column. Before, the laboratory could only analyzed a single liter of water representing only a few seconds snapshot in time. The C.L.A.M. will provide ultra low detection, continuous coverage, and cost savings, as the small pre-extracted disk is all that is sent to the laboratory for a simple elution prior to analysis. **We simply have taken the laboratory to the field, and left the water behind.**

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The Sampling Event

Continuous Extractive sampling, at the C.I.Agent Command Center 3000 Bienville Blvd., Dauphine Island was started May 20, 2010, and finished July 23, 2010. The extracted disks were sent to Anatek Labs in Idaho on a daily basis for elution, silica-gel clean-up, and analysis. The SPE disks were immediately analyzed for Total Petroleum Hydrocarbons and PAH's. The (ACF) disks for the dispersants were kept stored in a frozen state. These disks will be eluted and analyzed for dispersants (Propylene glycol and 2- Butoxyethanol) when analysis and elution methodologies have been developed. The monitoring was established early to develop a water column baseline, and to observe the levels as the spill encroaches into the area.

The water column was sampled at depths between 2-4 feet dependent on the tides, and excluded any surface inclusion. Two sampling sites were selected one on the north side facing the ocean and the other on the protected Southside as show above. Each Disk was pre-spiked with 10 ug of Terphenly d-14 as a recovery field surrogate. The start and finish pumping volumes were recorded along with the time deployed. The total volume in liters extracted was calculated from this information, and was recorded on the chain of custody for the analytical quantitation. Results were reported in PPB for TPH and PPT for the PAH's due to the large volume of water that was extracted, compared to the standard 1 liter grab sample.

Dauphin Island is approximately 105 miles from the Horizon Spill Event. The oil released from this site was chemically dispersed, burned, emulsified and metabolized by wave action and indigenous bacteria . The sampling site at Dauphin Island had an influx of tar balls and emulsified oil mousse, which were analyzed and profiled by others, but it was our intent to study the effects of the oil release on only the water column. In order to do so, it was imperative to have a continuous unbroken extraction sampling event for a three month period, as we were monitoring a constantly changing and dynamic marine environment. It was also essential to obtain ultra-trace levels of detection only afforded by the C.L.A.M extraction system, since the oil was highly diluted and broken down by manmade and natural causation.

The results can be viewed in the appendix in a summary spread sheet on a month by month basis with a display graph below. The TPH values of (C8-C24 and C24-C40) are expressed in ug/l or ppb, and the PAH values are expressed in ng/l or ppt. The PQL for the TPH is 5-10 ppb and the PQL for PAH is 0.1 ppt.

Findings for TPH per EPA Method 8015

Analysis of the TPH as (C8-C24 and C24-C40) was performed using the standard GC/FID detection as for fuel oil analysis. Because this method is analyzing a multi-component peak area of many hundreds of individual isomers, and co-eluting aliphatic and aromatic analytes, very low detection necessary for their detection is not obtainable even extracting 50 liters or more of the Gulf sea water. Normal reporting limits for a 1 liter sample is normally 5 mg/l, the C.L.A.M extraction was analyzing down to 5 ug/l by extracting 50 liters, and found only a few hits that were just above the PQL as shown below;

DATE	5-27-10	5-29-10	5-29-10	5-30-10	6-03-10	6-06-10	6-07-10	PQL
C8-C24 TPH	ND	13.10*	7.72*	ND	ND	6.57	ND	5 ppb
C24-C40 TPH	ND	20.70*	11.40*	ND	ND	10.5	ND	10 ppb

Even waters which had floating mousse on the surface or tar balls below showed little or no dispersed oil in the water column that was detected by the method, due to the hydrophobic nature of the oil and the limitations of the method. This was not the case however for the more polar PAH's which are a constituent of crude oil between 1-7 percent.

Note* Duplicate Analysis

Findings for PAH's per EPA Method 8270

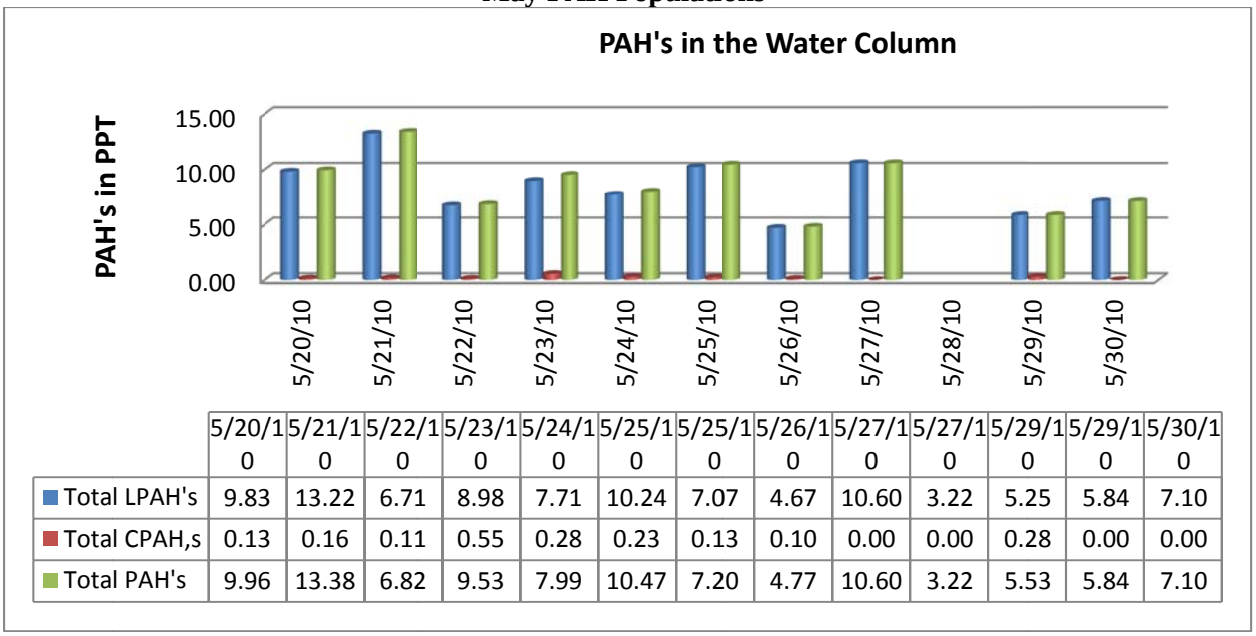
Equal aliquots of sample extract were used to run the PAH analysis, the TSQ triple quadrupole was used in the GC/MS/MS mode. This was to insure that the PAH's found were not false positives that could be the case with other types of analysis such as SIM(single Ion monitoring) GC/MS analysis. This method also removes most if not all matrix interference by looking at full scan daughter ion (mz) profile ratios, and provides very low detection ability.

The extraction sampling began in May before the intrusion of the spill reached the shoreline to obtain a base line of PAH values, and continued through until late July. The values of all the data are in the spread sheet appendix including graphs for each month below. The PAH values are expressed in ng/l or ppt

(parts per trillion), with a reporting limit of 0.1 ppt. The PAH's are reported individually and also summed as Total PAH's, LPAH's (low molecular weight),and CPAH's (carcinogenic).

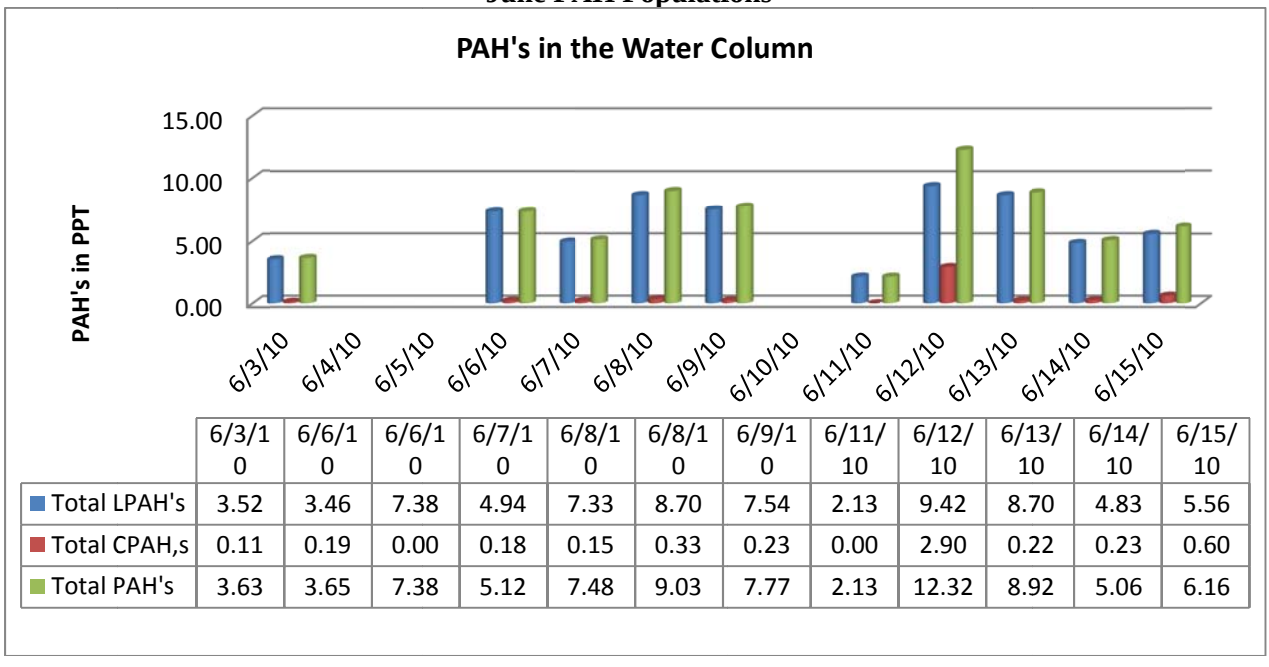
Due to the amount of natural occurring ocean seepage and anthropogenic causes, early baseline revealed LPAH levels to be constant in the water column, however the CPAH populations increased later in June and July suggesting a change in the type of oil present of a less benign nature. The graphs below reflect this changing pattern;

May PAH Populations



	5/20/10	5/21/10	5/22/10	5/23/10	5/24/10	5/25/10	5/25/10	5/26/10	5/27/10	5/27/10	5/29/10	5/29/10	5/30/10
Total LPAH's	9.83	13.22	6.71	8.98	7.71	10.24	7.07	4.67	10.60	3.22	5.25	5.84	7.10
Total CPAH,s	0.13	0.16	0.11	0.55	0.28	0.23	0.13	0.10	0.00	0.00	0.28	0.00	0.00
Total PAH's	9.96	13.38	6.82	9.53	7.99	10.47	7.20	4.77	10.60	3.22	5.53	5.84	7.10

June PAH Populations



	6/3/10	6/6/10	6/6/10	6/7/10	6/8/10	6/8/10	6/9/10	6/11/10	6/12/10	6/13/10	6/14/10	6/15/10
Total LPAH's	3.52	3.46	7.38	4.94	7.33	8.70	7.54	2.13	9.42	8.70	4.83	5.56
Total CPAH,s	0.11	0.19	0.00	0.18	0.15	0.33	0.23	0.00	2.90	0.22	0.23	0.60
Total PAH's	3.63	3.65	7.38	5.12	7.48	9.03	7.77	2.13	12.32	8.92	5.06	6.16

The later June and July months all reflect notable CPAH levels above the first few 10 days in May, all of these values would not have been obtainable with conventional 1 liter grab sampling nor would it reflect the changes of a dynamic changing ocean environment

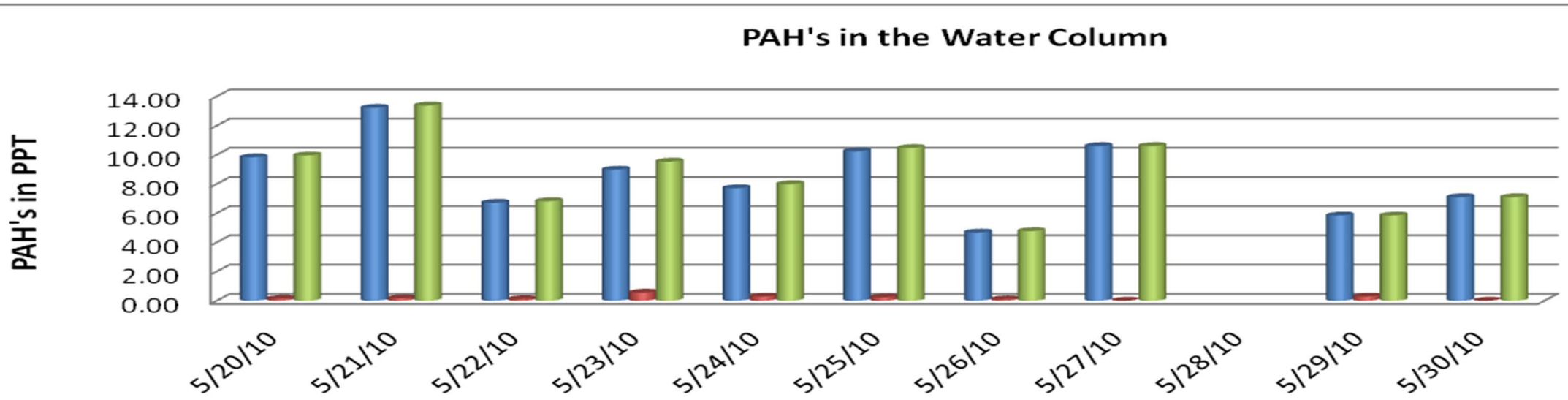
Conclusions

The scope of this study was funded privately, thus was restricted by location and depth of testing that could have been possible. Higher population of sampling points in critical areas at or near the epicenter or impacted estuaries in other locations, could yield new and unobtainable information about this disaster. Fisheries and shell fish locations could be compared to pristine areas to see if those areas are usable, and the biodegrading of the oils could be monitored in the water column of impacted areas to provide confidence of the water quality in those areas. Studies involving contaminate populations at various depths could also have been performed.

The C.L.A.M has the ability to extract through a two stage system of a pre-filter disk, and a sequestering media disk. This would allow pelagic sediments to be captured weighed and analyzed while allowing dissolved trace organic toxicology studies on far greater volumes of water. Other crude oil specific markers could be studied and tracked other than the standard PAH compounds that this study focused on.

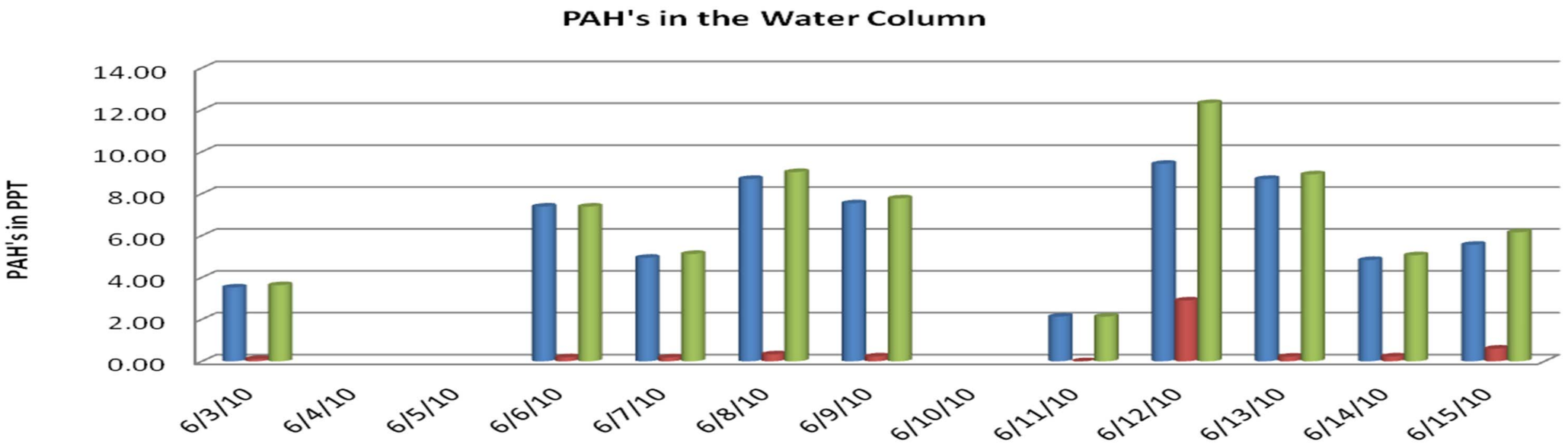
We feel that this technology could monitor other oil rigs allowing them an unbroken record of the water column quality at or near their site, establish confidence of the water quality in the fishing and shell fish areas, and provide a novel tool to evaluate our oceans and streams.

Anatek Lab ID#	100601016-004	100601016-001	100601016-002	100601016-003	100601017-001	100601020-001	100601020-002	100601019-002	100601018-001	100601018-002	100603040-001	100603040-002	100603067-002
Sampling date (IN)	5/20/10	5/21/10	5/22/10	5/23/10	5/24/10	5/25/10	5/25/10	5/26/10	5/27/10	5/27/10	5/29/10	5/29/10	5/30/10
Unit ID (CLAM)	#2	#2	#2	#2	#2	#1	#2	#2	#1	#2	#1	#2	#1
Unit Volume (liters)	46.6	25.4	44.5	38	27	21.8	27.3	30.8	33.1	37.3	33.1	31.2	39.8
(Results in PPT)													
Naphthalene	2.78	3.57	1.92	1.98	1.88	0.96	1.91	1.16	2.72	0.81	1.10	1.35	2.11
2-Methylnaphthalene	1.28	3.85	1.31	1.13	1.16	0.61	1.42	0.87	4.17	0.63	0.91	1.04	1.57
1-Methylnaphthalene	0.74	1.58	0.66	0.67	0.68	0.28	0.65	0.44	1.46	0.28	0.44	0.55	0.86
Acenaphthylene	0.10	0.10		0.11	0.12		0.13	0.11			0.10	0.17	0.13
Acenaphthene	0.57	0.44	0.32	0.56	0.28	0.32	0.30	0.33	0.16	0.18	0.16	0.23	0.22
Fluorene	0.80	0.45	0.35	0.70	0.48	0.44	0.43	0.39	0.19	0.25	0.32	0.34	0.32
Phenanthrene	2.24	2.02	1.28	2.03	1.88	4.55	1.23	0.46	1.25	0.56	1.01	1.19	0.97
Anthracene	0.17	0.17	0.12	0.28		0.16					0.23	0.12	0.11
Fluoranthene	0.64	0.61	0.39	0.91	0.76	2.08	0.67	0.58	0.44	0.34	0.55	0.50	0.49
Pyrene	0.51	0.43	0.36	0.61	0.47	0.84	0.33	0.33	0.21	0.17	0.43	0.35	0.32
Benzo(a)anthracene				0.13							0.14		
Chyrsene	0.13	0.16	0.11	0.27	0.18	0.23	0.13	0.10			0.14		
Benzo(b)fluoranthene				0.15	0.10								
Benzo(k)fluoranthene													
Benzo(a)pyrene													
Indeno(1,2,3-cd)pyrene													
Dibenz(a,h)anthracene													
Benzo(g,h,i)perylene													
Total LPAH's	**9.83**	**13.22**	**6.71**	**8.98**	**7.71**	**10.24**	**7.07**	**4.67**	**10.60**	**3.22**	**5.25**	**5.84**	**7.10**
Total CPAH,s	**0.13**	**0.16**	**0.11**	**0.55**	**0.28**	**0.23**	**0.13**	**0.10**	**0.00**	**0.00**	**0.28**	**0.00**	**0.00**
Total PAH's	**9.96**	**13.38**	**6.82**	**9.53**	**7.99**	**10.47**	**7.20**	**4.77**	**10.60**	**3.22**	**5.53**	**5.84**	**7.10**
(Results in PPT)													
C8-C24 TPH	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**13.1**	**7.72**	**ND**
C24-C40 TPH	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**20.7**	**11.4**	**ND**
(Results in PPB)													



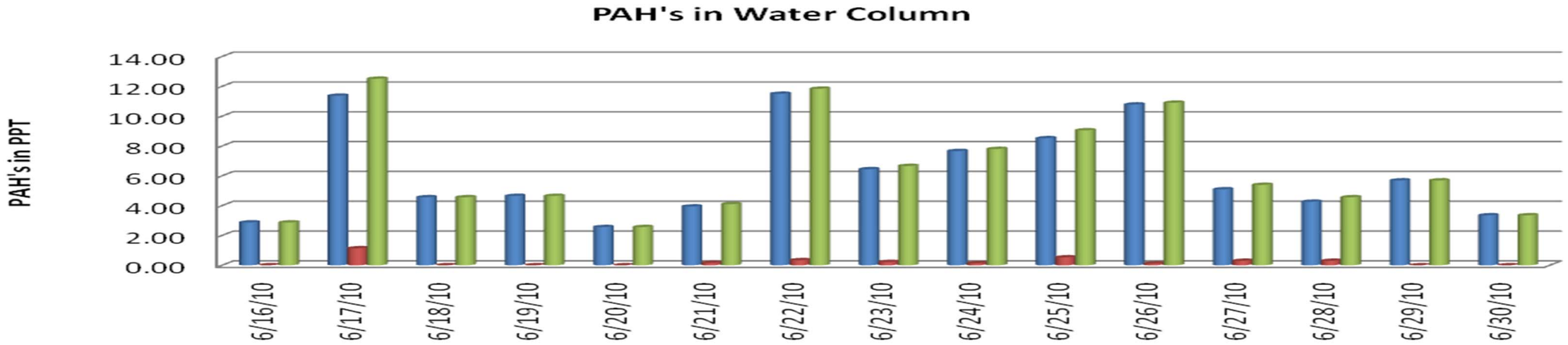
	5/20/10	5/21/10	5/22/10	5/23/10	5/24/10	5/25/10	5/25/10	5/26/10	5/27/10	5/27/10	5/29/10	5/29/10	5/30/10
Total LPAH's	9.83	13.22	6.71	8.98	7.71	10.24	7.07	4.67	10.60	3.22	5.25	5.84	7.10
Total CPAH,s	0.13	0.16	0.11	0.55	0.28	0.23	0.13	0.10	0.00	0.00	0.28	0.00	0.00
Total PAH's	9.96	13.38	6.82	9.53	7.99	10.47	7.20	4.77	10.60	3.22	5.53	5.84	7.10

Anatek Lab ID#	100614003-001	100614041-001	100614041-002	100614038-002	100614005-001	100614005-002	100614039-001	100615032-001	100615032-002	100615032-003	100617049-001	100617048-001
Sampling date (IN)	6/3/10	6/6/10	6/6/10	6/7/10	6/8/10	6/8/10	6/9/10	6/11/10	6/12/10	6/13/10	6/14/10	6/15/10
Unit ID (CLAM)	#1	#1	#2	#2	#2	#6	#2	#2	#2	#2	#2	#2
Unit Volume (liters)	49.4	59.1	41.9	40.9	33.6	40.2	41.6	51.9	45.4	41.9	52.3	40.1
(Results in PPT)												
Naphthalene	0.73	0.97	2.27	1.60	1.62	1.07	2.60	0.59	1.46	2.89	1.12	0.89
2-Methylnaphthalene	0.80	0.83	1.87	1.13	1.50	1.02	1.73	0.46	1.24	2.18	0.84	0.73
1-Methylnaphthalene	0.37	0.46	1.01	0.66	0.77	0.46	0.87	0.26	0.52	1.14	0.45	0.33
Acenaphthylene			0.12	0.11	0.13	0.12	0.14			0.10		
Acenaphthene			0.20	0.16	0.29	0.40	0.17		0.31	0.16	0.25	0.22
Fluorene	0.19	0.14	0.31	0.22	0.41	0.56	0.42	0.10	0.30	0.25	0.27	0.41
Phenanthrene	0.77	0.51	0.88	0.54	1.35	2.61	0.64	0.39	2.30	0.93	0.86	1.59
Anthracene			0.12			0.25			0.19			0.16
Fluoranthene	0.41	0.10	0.36	0.33	0.83	1.42	0.59	0.20	1.86	0.62	0.60	0.73
Pyrene	0.25	0.45	0.24	0.19	0.43	0.79	0.38	0.13	1.24	0.43	0.44	0.50
Benzo(a)anthracene						0.10			0.25			0.11
Chyrsene	0.11	0.19		0.18	0.15	0.23	0.23		1.84	0.22	0.23	0.38
Benzo(b)fluoranthene									0.28			0.11
Benzo(k)fluoranthene									0.40			
Benzo(a)pyrene									0.13			
Indeno(1,2,3-cd)pyrene												
Dibenz(a,h)anthracene												
Benzo(g,h,i)perylene												
Total LPAH's	**3.52**	**3.46**	**7.38**	**4.94**	**7.33**	**8.70**	**7.54**	**2.13**	**9.42**	**8.70**	**4.83**	**5.56**
Total CPAH,s	**0.11**	**0.19**	**0.00**	**0.18**	**0.15**	**0.33**	**0.23**	**0.00**	**2.90**	**0.22**	**0.23**	**0.60**
Total PAH's	**3.63**	**3.65**	**7.38**	**5.12**	**7.48**	**9.03**	**7.77**	**2.13**	**12.32**	**8.92**	**5.06**	**6.16**
(Results in PPT)												
C8-C24 TPH	**ND**	**6.57**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**
C24-C40 TPH	**ND**	**10.5**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**
(Results in PPB)												



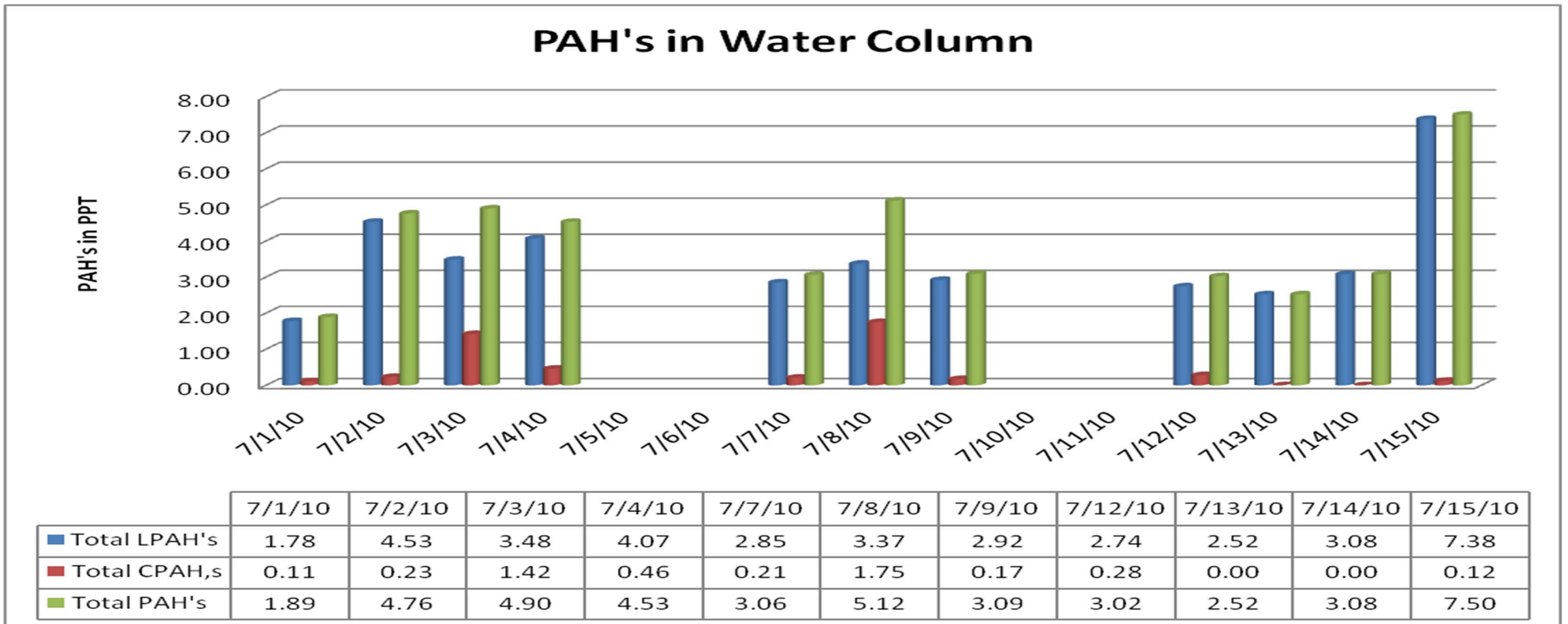
	6/3/10	6/6/10	6/6/10	6/7/10	6/8/10	6/8/10	6/9/10	6/11/10	6/12/10	6/13/10	6/14/10	6/15/10
Total LPAH's	3.52	3.46	7.38	4.94	7.33	8.70	7.54	2.13	9.42	8.70	4.83	5.56
Total CPAH,s	0.11	0.19	0.00	0.18	0.15	0.33	0.23	0.00	2.90	0.22	0.23	0.60
Total PAH's	3.63	3.65	7.38	5.12	7.48	9.03	7.77	2.13	12.32	8.92	5.06	6.16

Anatek Lab ID#	100618004-001	100621017-001	100622058-01	100622060-001	100622059-001	100625053-002	100625053-001	100625052-001	100629038-001	100629038-002	100629038-003	100629038-004	100702004-001	100702004-002	100702039-001
Sampling date (IN)	6/16/10	6/17/10	6/18/10	6/19/10	6/20/10	6/21/10	6/22/10	6/23/10	6/24/10	6/25/10	6/26/10	6/27/10	6/28/10	6/29/10	6/30/10
Unit ID (CLAM)	#2	#2	#2	#2	#2	#2	#2	#2	#2	#2	#2	#2	#2	#2	#2
Unit Volume (liters)	64.5	40.1	45.8	37.9	48.7	39.1	20.8	43.3	45.5	42.2	37.3	41.3	33.2	33.1	35
(Results in PPT)															
Naphthalene	0.93	2.64	1.42	1.91	0.77	0.66	2.49	0.86	1.39	1.78	2.47	0.59	0.63	1.47	0.56
2-Methylnaphthalene	0.60	2.23	0.96	1.17	0.49	0.34	2.45	0.94	1.26	1.50	1.99	0.49	0.63	1.29	0.42
1-Methylnaphthalene	0.30	1.06	0.50	0.58	0.22	0.15	1.09	0.56	0.68	0.77	1.01	0.24	0.27	0.55	0.19
Acenaphthylene		0.19					0.14		0.13	0.15	0.14				
Acenaphthene	0.15	0.30	0.16	0.11	0.12	0.43	0.62	0.63	0.74	0.70	0.87	0.41	0.37	0.20	0.23
Fluorene	0.17	0.59	0.25	0.16	0.18	0.35	0.56	0.49	0.62	0.73	0.99	0.55	0.42	0.44	0.27
Phenanthrene	0.29	1.27	0.62	0.39	0.35	0.89	1.60	1.44	1.34	1.37	1.60	1.12	1.08	1.10	0.63
Anthracene							0.12			0.12	0.11	0.16			
Fluoranthene	0.29	1.77	0.40	0.23	0.30	0.68	1.43	0.86	0.93	0.81	1.01	0.87	0.51	0.43	0.72
Pyrene	0.14	1.32	0.25	0.10	0.13	0.44	1.00	0.66	0.57	0.59	0.59	0.66	0.35	0.21	0.33
Benzo(a)anthracene		0.13					0.11								
Chyrsene		0.48				0.16	0.23	0.22	0.14	0.16	0.12	0.30	0.16		
Benzo(b)fluoranthene		0.24								0.22			0.14		
Benzo(k)fluoranthene		0.16								0.15					
Benzo(a)pyrene		0.13													
Indeno(1,2,3-cd)pyrene															
Dibenz(a,h)anthracene															
Benzo(g,h,i)perylene															
Total LPAH's	**2.87**	**11.37**	**4.56**	**4.65**	**2.56**	**3.94**	**11.50**	**6.44**	**7.66**	**8.52**	**10.78**	**5.09**	**4.26**	**5.69**	**3.35**
Total CPAH,s	**0.00**	**1.14**	**0.00**	**0.00**	**0.00**	**0.16**	**0.34**	**0.22**	**0.14**	**0.53**	**0.12**	**0.30**	**0.30**	**0.00**	**0.00**
Total PAH's	**2.87**	**12.51**	**4.56**	**4.65**	**2.56**	**4.10**	**11.84**	**6.66**	**7.80**	**9.05**	**10.90**	**5.39**	**4.56**	**5.69**	**3.35**
(Results in PPT)															
C8-C24 TPH	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**
C24-C40 TPH	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**
(Results in PPB)															



	6/16/10	6/17/10	6/18/10	6/19/10	6/20/10	6/21/10	6/22/10	6/23/10	6/24/10	6/25/10	6/26/10	6/27/10	6/28/10	6/29/10	6/30/10
Total LPAH's	2.87	11.37	4.56	4.65	2.56	3.94	11.50	6.44	7.66	8.52	10.78	5.09	4.26	5.69	3.35
Total CPAH,s	0.00	1.14	0.00	0.00	0.00	0.16	0.34	0.22	0.14	0.53	0.12	0.30	0.30	0.00	0.00
Total PAH's	2.87	12.51	4.56	4.65	2.56	4.10	11.84	6.66	7.80	9.05	10.90	5.39	4.56	5.69	3.35

Anatek Lab ID#	100712023-001	100712023-002	100712023-003	100712023-004	100712012-001	100712012-002	100712012-003	100719007-001	100719007-002	100719007-003	100719007-004
Sampling date (IN)	7/1/10	7/2/10	7/3/10	7/4/10	7/7/10	7/8/10	7/9/10	7/12/10	7/13/10	7/14/10	7/15/10
Unit ID (CLAM)	#2	#2	#2	#2	#2	#2	#2	#2	#2	#2	#2
Unit Volume (liters)	54.7	43.3	44.9	42.1	45.3	55.8	52.9	46.1	51.8	66.4	49.9
(Results in PPT)											
Naphthalene	0.37	1.44	0.27	0.89	0.61	0.74	0.78	0.73	0.74	1.19	2.92
2-Methylnaphthalene	0.21	0.94	0.18	0.60	0.35	0.56	0.60	0.49	0.49	0.62	2.14
1-Methylnaphthalene	0.10	0.50	0.10	0.27	0.24	0.33	0.30	0.25	0.26	0.34	1.20
Acenaphthylene		0.12									
Acenaphthene	0.11	0.13	0.15	0.14	0.11	0.14	0.10				
Fluorene	0.14	0.21	0.27	0.26	0.18	0.26	0.12	0.15	0.12	0.16	0.16
Phenanthrene	0.35	0.64	0.61	0.67	0.39	0.43	0.39	0.53	0.51	0.49	0.62
Anthracene			0.18								
Fluoranthene	0.35	0.34	1.19	0.85	0.64	0.58	0.33	0.28	0.24	0.15	0.17
Pyrene	0.15	0.21	0.53	0.39	0.33	0.33	0.30	0.31	0.16	0.13	0.17
Benzo(a)anthracene			0.10			0.17					
Chyrsene	0.11	0.23	0.66	0.46	0.21	0.33	0.17	0.28			0.12
Benzo(b)fluoranthene			0.23			0.28					
Benzo(k)fluoranthene			0.12			0.27					
Benzo(a)pyrene			0.10			0.14					
Indeno(1,2,3-cd)pyrene			0.11			0.18					
Dibenz(a,h)anthracene						0.20					
Benzo(g,h,i)perylene			0.10			0.18					
Total LPAH's	**1.78**	**4.53**	**3.48**	**4.07**	**2.85**	**3.37**	**2.92**	**2.74**	**2.52**	**3.08**	**7.38**
Total CPAH,s	**0.11**	**0.23**	**1.42**	**0.46**	**0.21**	**1.75**	**0.17**	**0.28**	**0.00**	**0.00**	**0.12**
Total PAH's	**1.89**	**4.76**	**4.90**	**4.53**	**3.06**	**5.12**	**3.09**	**3.02**	**2.52**	**3.08**	**7.50**
(Results in PPT)											
C8-C24 TPH	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**
C24-C40 TPH	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**
(Results in PPB)											



	7/1/10	7/2/10	7/3/10	7/4/10	7/7/10	7/8/10	7/9/10	7/12/10	7/13/10	7/14/10	7/15/10
Total LPAH's	1.78	4.53	3.48	4.07	2.85	3.37	2.92	2.74	2.52	3.08	7.38
Total CPAH,s	0.11	0.23	1.42	0.46	0.21	1.75	0.17	0.28	0.00	0.00	0.12
Total PAH's	1.89	4.76	4.90	4.53	3.06	5.12	3.09	3.02	2.52	3.08	7.50