

Hydrocarbon and Contaminants Removal (HCOR™) Device

HC  R™



Red Lion Chem Tech

Official Report on Feasibility for the Hydrocarbon and Contaminants Removal (HCOR™) Device

Red Lion Chem Tech, LLC **CONFIDENTIAL**

A. Executive Summary

The Red Lion Chem Tech (RLCT) designed and developed the Hydrocarbon and Contaminants Removal (HCOR™) Device for San Diego Gas and Electric (SDG&E), part of Sempra Energy. The HCOR™ was evaluated under pressure for Removal of Hexane Extractable Total petroleum HydroCarbons and Priority Pollutants from water.

The results of the Feasibility Study are as follows:

- An Overall Concordance of 98.5% was observed between HCOR™ and EPA Methods
- 97.4% of all pollutants tested were below EPA limits after filtration through HCOR™
- The average percent reduction was 90% for all pollutants
- The HCOR™ Device exhibited structural integrity under pressure pumping at 117 GPM

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C. Scope of Priority Pollutants for Utility Vaults: State and Federal Regulations

The Priority Pollutants are defined in two documents:

- The Water Quality Control Plan: Ocean Waters of California, effective Aug., 19, 2012, resolution 2012-0056, as specified by the State Water Resources Control Board; and
- The Federal Water Quality Order 2014-xxxx-DWQ, effective September 23, 2014, General National Pollutant Discharge Elimination System Permit for Discharge from Utility Vaults and Underground Structures to Waters of the United States.

The Priority Pollutant List for utility vaults and underground structures lists a variety of criteria found throughout the document. Each section and the requirements will be reviewed below.

Pollutants Group 1

First, Order 2014-xxx-DWQ in one section (Attachment G) shows a list of 126 pollutants of concern.

Twenty two (22) pollutants on the list have No Water Quality Criteria specified and hence were not tested (see Appendix -- and Attachment G, G-8-11 (page 82)), and Table G-3 in Order 2014-xxxx-DWQ).

Additionally, 8 pollutants on the Priority Pollutant List have Hardness-Based Criteria for result interpretation and these were not tested as HCOR™ does not assess hardness (see Appendix - and Appendix --) and Attachment G, G-5 (page 80), III, B.3 and Attachment G, G-12 (page 85), table G-4 in Order 2014-xxxx-DWQ. These were not tested as they are out of the design specifications for HCOR™ and the SSA.

Pollutants Group 2

Secondly, Order 2014-xxx-DWQ calls for testing of Hexane Extractable Materials (HEM) representing Total Petroleum Hydrocarbons (TPH). These included Oil and Grease, pH, TPH-Diesel Related Organics (DRO), TPH-Gasoline Related Organics (DRO), TPH-Oil Related Organics (ORO), and Total suspended Solids (TSS). Testing requirements for utility vaults are reiterated in numerous places in the Order (see Effluent Monitoring, D-15 (page 50), VII, and C.3.c.IV.d. (b), Table 3) in Order 2014-xxx-DWQ). These were included for testing, in addition to the testable list of 126 Priority Pollutants noted above with specified Water Quality Criteria.

From a practicality standpoint, 19 Pollutants on the Priority Pollutant List were either: Not Tested (NT), Not Available (NAvail), shipped but Not Received (NRec), or Back Ordered (BO). These obviously were not tested.

As a result, 73 Priority Pollutants were tested in this study, in addition to 5 pollutants for HEXANE EXTRACTABLE MATERIAL, totaling 78.

Pollutants Group 3

Thirdly, Order 2014-xxxx-DWQ also lists 12 additional pollutants not on the Priority Pollutant List noted above. Most of these were not on the SSA Contract list. These proposed but not specified pollutants are found: in Appendix - under the categories Peptides, Nutrients and Others, and in Effluent Monitoring, VII.B, D-15 (page 50); again in Rationale for Provisions, D-20 (page 5), VIII, B, 3. B (In this case Xylene): in Receiving Water Limitations, VI, A, 1-13 (pages 9-10). The latter includes: Dissolved Oxygen, pH, Bio stimulatory Substances, color/odor/taste, ambient pH, temperature, chlorine, radionuclides. Also on the list are bacterial indicators and nutrients including ammonia, nitrate, and phosphate (see Attachment G,

G-7 (page 81), IV. A.). No Water quality criteria were set for these contaminants listed in 2014-xxx-DWQ, and these were not in the scope of the SSA, hence they were not tested. Further clarification is needed on all of these contaminants before further work is done.

Pollutant Group 4

Pentachlorophenol, number 53 on the Priority Pollutant List has pH based criteria. This pollutant was tested, as was pH, but pH is not a design feature for the HCOR™ Device, nor is it in the SSA Contract.

D. Feasibility Study

Study Design

This feasibility study for the HCOR™ device incorporated the filtration of 500 gallons (1892.51 Liters) of water to which the 78 afore scribed pollutants were added. Pollutants were added (“Spiked”) into the 500 gal tank at target levels of 150% the EPA Water Quality Criteria cutoff limit expressed in mg/L, ug/L or ng/L values. EPA Cutoff values and Spiked values are noted in the data tables in Appendices 2, 3, 4, 5, 6, and 8 for each pollutant.

After Spiking and thorough hand mixing, a standard SDGE portable pump (Power Flo Pumps and systems; 15 Amp, 1 HP) with an attached 2 inch collapsible hose was added to the tank. Attached to the other end of the hose was an HVOR™ device. The HCOR™ Device was placed in a second empty 500 gal receiving tank. All pollutants as noted in the data tables in the Appendices were run simultaneously in a single pass through HCOR™.

The portable pump was turned on and the contents of the contaminant tank were transferred to the receiving tank without incident. The time course was ~5 minutes to empty the contents of the 500 gal contaminant tank at a rate of 117 GPM.

Samples were collected from the receiving tank and submitted by courier under Chain of Custody control to Weck Labs in Los Angeles for analytical testing. A picture of the container used to collect samples from either the contamination tank or the post-filtration tank and a sample of water pre- and post-filtration is shown in Figures 1 and 2 to show the differences.

Figure 1



Figure 2



Mass Based Standardization
Pollutants

Pollutants, as controlled substances, were obtained from various sources worldwide. Chemicals were received as solids, liquids, or pre-diluted chemical in solvent. The latter were mostly in sealed glass ampoules.

To match EPA Cutoff Values on a ug/L (or other weight) basis, mass based standardization was used for sample Spiking. In each case the amount of chemical to be added to achieve Target Spike Values of 150% EPA Cutoff Values. The mass of chemical to be tested, based on atomic mass units equivalency, was calculated to give the final weight of chemical required to achieve mass equivalency in the 1892.71 Liters (500 gal). After chemical addition the aqueous phase was brought up to the exact final volume required.

For solids in the high ug total weight level, or higher, a Mettler balance with accuracy 5 decimal points past the gram level was used. Below the mid ug total weight level, dilutions of solid in aqueous solution or appropriate solvent solutions were used.

For liquids, mass based calculations took into account the density of the material in gm/ml to account for relative mass and final weight was adjusted up or down if liquid densities at 25C were below or above the density of water (1.00 gm/ml). Pre-diluted chemicals in ampoules below the mid ug/L range were diluted serially in water or appropriate solvent to achieve mass standardization. All dilutions were serial 10-fold and utilized Eppendorf pipettes. Pipette tips were changed between dilutions.

Hexane Extractable Materials (HEM)

A variety of Hexane Extractable Material's were added to cover the full spectrum of hydrocarbon chain lengths from 1 carbon length to > carbon 44, complex grease and waxes. These included:

Asphalt
Stoddard Solvent
Texas Very Heavy Crude Oil (From Gulf Horizon)
Pennsylvania Light Crude Oil
Pitch (roof tar)
Non-synthetic Grease
Diesel Fuel
Kerosene
Jet A Fuel
Gasoline

Total Suspended Solids (TSS)

To further challenge the system and test performance of the HCOR™ Device under pressure under simulated field conditions the following was added:

- One gallon (64 oz.) ultrafine sand

EPA Analyses Conducted

The following EPA Methods were performed by Weck Laboratories, Los Angeles, CA on collected pre- and post-filtration samples. Methods used were dictated by Order 2014-xxx-DWQ and the capabilities of Weck.

EPA 625	Semi volatile Organic Compounds
EPA 8081A	Organochlorine Pesticides
EPA 608	Organochlorine Pesticides and PCB's
EPA SM 4500 H+B	pH
EPA 1664A	Oil and Grease (HEXANE EXTRACTABLE MATERIAL)
EPA 335.4	Total Cyanide
EPA SM 2500D	Total Suspended Solids
EPA 7199	Chromium Hexavalent
EPA 218.6	Chromium Hexavalent
EPA 8015B DRO/ORO	TPH as Diesel and Oil Range Organics
EPA 8015B GRO	TPH as Gasoline Range Organics
EPA 1631E	Mercury, Total, Low-Level
EPA 7470A	Mercury
EPA 200.7	CAM Metals plus Calcium
EPA 200.8	Toxic Heavy Metals
EPA 8082	Polychlorinated Biphenyls
EPA 8270C	Semi volatile Organic compounds
EPA 8260B	Volatile Organic Compounds
EPA 624	Volatile Organic Compounds
EPA ASTM 7511	Cyanide, Total

All samples were handled under full Chain of Custody. Samples were submitted to Weck Lab's by courier June 19, 2015, and full results were obtained by July 9, 2015. Owing to the extremely toxic blend of materials and high concentration of pollutants and HEXANE EXTRACTABLE MATERIAL, Weck was required to do a series of dilutions of submitted samples to get pollutants into the linear portion of surrogate dose response curves in order to quantitate results and to avoid equipment contamination. Multiple dilution attempts were required.

E. Feasibility Study Results

The overall results of the feasibility study on the HCOR™ Device are as follows (**Appendix 1**):

- An Overall Concordance of 98.5% was observed between HCOR™ and EPA Methods

- 97.4% of all pollutants tested were below EPA limits after filtration through HCOR™
- The average percent reduction was 90% for all pollutants
- The HCOR™ Device exhibited structural integrity under pressure pumping at 117 GPM

Total Petroleum Hydrocarbons

The 5 categories of HEXANE EXTRACTABLE MATERIAL in addition to TSS were tested by HCOR™ with 100 % correct results. In spite of the extremely heavy contamination, especially for GRO, all values were ND (Not Detectable) or trace, well below EPA cutoff criteria (see **Appendix 2**).

Priority Pollutants

A total of 73 pollutants were tested by HCOR™ and yielded a 97.4 % correlation with a drop below EPA cutoff levels when Spiked with 150 % epa levels (see **Appendix 3**). Results were dramatic and the majority of pollutants were ND (not detectable). Two pollutants exhibited a decrease but not below EPA limits. These will be investigated further. These two pollutants do not appear on SDG&E's list of vault contaminants based on 3 years of historical testing. The contaminants are: 2, 4- dimethyl phenol and 2, 4, 6-trichlorophenol. There was no difference or trend in type of pollutant removed, and this covered the gamut from HEXANE EXTRACTABLE MATERIAL to VOC's, PCB's, Volatile Organics, Substituted Hydrocarbons, PAH's, and the like.

Toxic Heavy Metals

Fourteen (14) metals appear on the Priority Pollutant List. Eight heavy metal pollutants are hardness based and 1 pollutant (Beryllium) has no Water Quality Criteria established. The HCOR™ device is currently formulated with ion exchange media in 2 locations within the Device for removal of lead, mercury, and cadmium, and no other heavy metals at this time. These heavy metals (* hardness based and 1 No Criteria) are on the list of Pollutants of Possible Concern (see **Appendix 7**) and are not addressed in the SSA (because of hardness). Some pollutants, like mercury, lead and cadmium, were not received in time for this feasibility study. Although no toxic heavy metal samples were spiked, there was trace contribution from other sources like HEXANE EXTRACTABLE MATERIAL, and testing was done according to EPA Methods (see **Appendix 4** and **Appendix 1**). All results gave negative or trace metal results as expected. Trace amounts are likely attributable to HEXANE EXTRACTABLE MATERIAL.

Priority Pollutants- No Criteria, Not Spiked, but Tested

Forty (40) of the Priority Pollutants List pollutants, which have No Water Quality Criteria, or were not Spiked due to availability or backorder, were tested to assess any contribution of pollutants from other sources like HEXANE EXTRACTABLE MATERIAL, and also in order to assess that the HCOR™ device was giving the correct Not Detected negative result (see **Appendix 6**). This is important to know to assure that the HCOR™ device is not giving a false Positive result when utility vaults contain no contaminant. These included 22 pollutants for which no Water Quality Criteria exists, 8 hardness based pollutants, 2 untested pollutants, and the balance Not Available, Not Received but ordered, or Backordered. All pollutants tested in this category gave correct negative results (see **Appendix 1**).

Pentachlorophenol Criteria (pH based)

Pentachlorophenol testing is pH based. Although pH was not on the SSA development list, pentachlorophenol was tested and results were correct at the Weck calculated pH of 7.74.

Non-Tested, Non Specified Pollutants of Concern

The pollutants in **Appendix 7** were not tested. These pollutants have either no Water Quality Criteria, are poorly defined. Some of these are also outside the scope of science and/or the SSA contract.

F. Conclusions

The HCOR™ Device works well especially for a first feasibility run. Study design conditions intentionally challenged the chemistry and its ability to simultaneously remove a very large number of challenging contaminants across a broad spectrum of pollutants, and it did exceptionally well. Such conditions will very unlikely be encountered in the field.

List of Appendices

Appendix 1. Overall Concordance of HCOR™ Device to EPA Analytical Testing

Appendix 2. HEXANE EXTRACTABLE MATERIAL Numeric Action Levels

Appendix 3. Priority Pollutants

Appendix 4. Toxic Heavy Metals

Appendix 5. Hardness Criteria

Appendix 6. Priority Pollutants- No Criteria, Not Spiked, but Tested

Appendix 7. Non-Tested, Non Specified Pollutants of Concern

Appendix 8. Pentachlorophenol Criteria (pH based)

Appendix 1. Overall Concordance of HCOR™ Device to EPA Analytical Testing

Spiked	Number in Category	Pollutants tested	EPA Cutoff		Average Percent Reduction
			< EPA Cutoff	>EPA Cutoff	
Yes	78	Priority Pollutants + Hexane Extractable Material	76	2	90 %

			Corrective Negative Result		
			Yes	No	--
No	14	Toxic Heavy Metals	14	0	--
No	38	Priority Pollutants - No Criteria, Not Spiked, but Tested	38	0	--
		Positive Result Concordance	97.4 %	2.6 %	
		Negative Result concordance	100 %	--	
	Concordance	Overall Concordance to EPA Methods	98.5 %		

Appendix 2. Hexane Extractable Material Numeric Action Levels

	Fontaine				(UG/L)			
17	Acrolein	107028	EPA 8260B	780	1170	ND	Y	100
18	Acrylonitrile	107131	EPA 8260B	0.66	0.99	ND	Y	100
19	Benzene	71432	EPA 8260B	71	106.5	6.55	Y	93.8
20	Bromoform	75252	EPA 8260B	360	540	85.5	Y	84.2
21	Carbon Tetrachloride	56235	EPA 8260B	4.4	6.6	ND	Y	100
22	Chlorobenzene	108907	EPA 8260B	21,000	3150	2700	Y	14.3
23	Chlorodibromo methane	124481	EPA 8260B	34	51	11.5	Y	77.5
27	Dichlorobromo methane	75274	EPA 8260B	46	69	21	Y	54.3
29	1,2-Dichloroethane	107062	EPA 8260B	99	148.5	36.5	Y	63.1
31	1,2-Dichloropropane	78875	EPA 8260B	39	58.5	7.45	Y	87.3
32	1,3-Dichloropropylene	542756	EPA 8260B	1,700	2550	160	Y	89.5
36	Methylene Chloride	75092	EPA 8260B	1,600	2400	760	Y	68.3
37	1,1,2,2-Tetrachloroethane	79345	EPA 8260B	11	16.5	2.4	Y	85.5
38	Tetrachloro ethylene	127184	EPA 8260B	8.85	13.28	ND	Y	100
39	Toluene	108883	EPA 8260B	200,000	300,000	6500	Y	97.9

40	1,2-Trans-Dichloroethylene	156605	EPA 8260B	140,000	210,000	ND	Y	100
42	1,1,2-Trichloroethane	79005	EPA 8260B	42	63	15	Y	76.2
46	2,4-Dichlorophenol	120832	EPA 8270C	790	1185	475	Y	60
47	2,4-Dimethylphenol	105679	EPA 8270C	2,300	3450	2650	N	23.2
48	2-Methyl-4,6-Dinitrophenol	534521	EPA 8270C	765	1147.5	110	Y	90.4
49	2,4-Dinitrophenol	51285	EPA 8270C	14,000	21,000	2800	Y	87.1
55	2,4,6-Trichlorophenol	88062	EPA 8270C	6.5	9.75	8.65	N	11.3
56	Acenaphthene	83329	EPA 8270C	2,700	4050	155	Y	96.2
CTR	Pollutant	CAS	Suggested Analytical	Water Quality Criteria	Amount Spiked	FINAL RESULT	< EPA CUT OFF	% REDUCTION
Number		Number	Method(s)	(µg/L)	(UG/L)			
58	Anthracene	120127	EPA 8270C	110,000	165,000	1.35	Y	99.99
59	Benzidine	92875	EPA 8270C	0.00054	0.00081	ND	Y	100
60	Benzo(a)Anthracene	56553	EPA 8270C	0.049	0.0735	ND	Y	100
61	Benzo(a)Pyrene	50328	EPA 8270C	0.049	0.0735	ND	Y	100

62	Benzo(b)Fluoranthene	205992	EPA 8270C		0.049	0.0735	ND	Y	100
66	Bis(2-Chloroethyl)Ether	111444	EPA 8270C		1.4	2.1	ND		
								Y	42.9
68	Bis(2-Ethylhexyl)Phthalate	117817	EPA 8270C		5.9	8.85	1.25	Y	100
73	Chrysene	218019	EPA 8270C		0.049	0.0735	ND	Y	100
74	Dibenzo(a,h)Anthracene	53703	EPA 8270C		0.049	0.0735	ND	Y	100
75	1,2-Dichlorobenzene	95501	EPA 8260B		17,000	25,500	810	Y	96.8
76	1,3-Dichlorobenzene	541731	EPA 8260B		2,600	3900	120	Y	96.9
77	1,4-Dichlorobenzene	106467	EPA 8260B		2,600	3900	125	Y	96.8
79	Diethyl Phthalate	84662	EPA 8270C		120,000	180,000	31500	Y	82.5
82	2,4-Dinitrotoluene	121142	EPA 8270C		9.1	13.65	ND	Y	100
85	1,2-Diphenylhydrazine	122667	EPA 8270C		0.54	0.81	ND	Y	100
86	Fluoranthene	206440	EPA 8270C		370	555	3.3	Y	99.4
87	Fluorene	86737	EPA 8270C		14,000	21,000	130	Y	99.4
88	Hexachlorobenzene	118741	EPA 8260B		0.00077	0.00116	ND	Y	100
89	Hexachlorobutadiene	87863	EPA 8260B		50	75	ND	Y	100

90	Hexachlorocyclopentadiene	77474	EPA 8270C		17,000	1	ND	Y	100
91	Hexachloroethane	67721	EPA 8260B		8.9	13.35	ND	Y	100
92	Indeno(1,2,3-cd)Pyrene	193395	EPA 8270C		0.049	0.0735	ND	Y	100
93	Isophorone	78591	EPA 8270C		600	900	525	Y	30.6
95	Nitrobenzene	98953	EPA 8270C		1,900	2850	1550	Y	45.6
96	N-Nitrosodimethylamine	62759	EPA 8270C		8.1	12.15	5.2	Y	58.4
97	N-Nitrosodi-n-Propylamine	621647	EPA 8270C		1.4	2.1	ND	Y	100
98	N-Nitrosodiphenylamine	86306	EPA 8270C		16	24	ND	Y	100
100	Pyrene	129000	EPA 8270C		11,000	BO	ND	Y	100
CTR	Pollutant	CAS	Suggested Analytical		Water Quality Criteria	Amount Spiked	FINAL RESULT	< EPA CUT OFF	% REDUCTION
Number		Number	Method(s)		(µg/L)				
102	Aldrin	309002	EPA 8081A		0.00014	0.00021	ND	Y	100
103	alpha-BHC	319846	EPA 8081A		0.013	0.0195	ND	Y	100
104	beta-BHC	319857	EPA 8081A		0.046	0.069	ND	Y	100

105	gamma-BHC	58899	EPA 8081A		0.063	0.0945	0.063	Y	
107	Chlordane	57749	EPA 8081A		0.00059	0.00085	ND	Y	100
109	4,4'-DDE	72559	EPA 8081A		0.00059	0.00085	ND	Y	100
110	4,4'-DDD	72548	EPA 8081A		0.00084	0.00126	ND	Y	100
111	Dieldrin	60571	EPA 8081A		0.00014	0.00021	ND	Y	100
112	alpha-Endosulfan	959988	EPA 8081A		0.22	0.33	ND	Y	100
113	beta-Endosulfan	3321365 9	EPA 8081A		0.22	0.33	ND	Y	100
114	Endosulfan Sulfate	1031078	EPA 8081A		110	NRec	ND	Y	100
115	Endrin	72208	EPA 8081A		0.81	5.7	ND	Y	100
116	Endrin Aldehyde	7421934	EPA 8081A		0.76	1.14	ND	Y	100
117	Heptachlor	76448	EPA 8081A		0.00021	0.00035	ND	Y	100
118	Heptachlor Epoxide	1024573	EPA 8081A		0.00011	0.00016 5	ND	Y	100
119	PCB-1016	1267411 2	EPA 8082			0.00365 5	ND	Y	100
120	PCB-1221	1110428 2	EPA 8082			0.00365 5	ND	Y	100
121	PCB-1232	1114116 5	EPA 8082			0.00365 5	ND	Y	100
					0.00017				

122	PCB-1242	5346921 9	EPA 8082			0.00365 5	ND	Y	100
					(Sum of PCBs)				
123	PCB-1248	1267229 6	EPA 8082				0.00365 5	ND	Y
124	PCB-1254	1109769 1	EPA 8082			0.00365 5	ND	Y	100
125	PCB-1260	1109682 5	EPA 8082			0.00365 5	ND	Y	100
126	Toxaphene	8001352	EPA 8081A		0.00075	0.00112 5	ND	Y	100
									6509.4
							Number of Samples	73	73
							Percent of Samples Below EPA Cutoff	97.3	
							Average Percent Reduction		89.2

Appendix 4. Toxic Heavy Metals

CTR Number	Pollutant	CAS Number	Suggested Analytical Method(s)	Water Quality Criteria (µg/L)	Spiked	Result	Correct Negative result
1	Antimony	7440360	EPA 6020/200.8	4,300	0	ND	Y
2	Arsenic	7440382	EPA 1632	340	0	ND	Y
3	Beryllium	7440417	EPA 6020/200.8	No Criteria ¹	0	ND	Y
4	Cadmium	7440439	EPA 1638/200.8	Hardness Based ²	0	ND	Y
5a	Chromium (III)	16065831	EPA 6020/200.8	Hardness Based ²	0	ND	Y
5a	Chromium (VI)	18540299	EPA 7199/1636	16	0	ND	y
6	Copper	7440508	EPA 6020/200.8	Hardness Based ²	0	ND	Y
7	Lead	7439921	EPA 1638	Hardness Based ²	0	ND	Y
8	Mercury	7439976	EPA 1669/1631	0.051	0	ND	Y
9	Nickel	7440020	EPA 6020/200.8	Hardness Based ²	0	ND	Y
10	Selenium	7782492	EPA 6020/200.8	Hardness Based ²	0	ND	Y
11	Silver	7440224	EPA 6020/200.8	Hardness Based ²	0	ND	Y
12	Thallium	7440280	EPA 6020/200.8	6.3	0	ND	Y
13	Zinc	7440666	EPA 6020/200.8	Hardness Based ²	0	ND	Y
14	Cyanide	57125	EPA 9012A	22	0	ND	Y
Not on List	Calcium (hardness)		EPA 200 Series		0	65	

#	Pollutant	Number	Method(s)	(µg/L)	(UG/L)		
15	Asbestos	1332214	EPA/600/R-93/116(PCM)	No Criteria ¹	0	NT	NT
16	2,3,7,8-TCDD	1746016	EPA 8290MS (HRGC)	0.000000014	3.90E-05	NT	NT
24	Chloroethane	75003	EPA 8260B	No Criteria ¹	0	ND	Y
25	2-Chloro ethylvinyl Ether	110758	EPA 8260B	No Criteria ¹	0	ND	Y
26	Chloroform	67663	EPA 8260B	No Criteria ¹	0	4.1	IND
28	1,1-Dichloroethane	75343	EPA 8260B	No Criteria ¹	0	ND	Y
30	1,1-Dichloro ethylene	75354	EPA 8260B	3.2	NRec	ND	Y
33	Ethylbenzene	100414	EPA 8260B	29,000	NRec	2.3	IND
34	Methyl Bromide	74839	EPA 8260B	4,000	NAvail	ND	Y
35	Methyl Chloride	74873	EPA 8260B	No Criteria ¹	0	ND	Y
41	1,1,1-Trichloro ethane	71556	EPA 8260B	No Criteria ¹	0	ND	Y
43	Trichloroethylene	79016	EPA 8260B	81	BO	ND	Y
44	Vinyl Chloride	75014	EPA 8260B	525	BO	ND	Y
45	2-Chlorophenol	95578	EPA 8270C	400	BO	ND	Y
50	2-Nitrophenol	88755	EPA 8270C	No Criteria ¹	0	ND	Y
51	4-Nitrophenol	100027	EPA 8270C	No Criteria ¹	0	ND	Y
52	3-Methyl-4-Chlorophenol	59507	EPA 8270C	No Criteria ¹	0	ND	Y
53	Pentachlorophenol	87865	EPA 8270C	3	0	ND	Y

54	Phenol	108952	EPA 8270C	4,600,000	BO	ND	Y
57	Acenaphthylene	208968	EPA 8270C	No Criteria ¹	0	ND	Y

CTR #	Pollutant	CAS Number	Suggest Analytical Method(s)	Water Quality Criteria (µg/L)	Amount Spiked	Final Result	Correct Negative Result
63	Benzo(ghi)Perylene	191242	EPA 8270C	No Criteria ¹	0	ND	Y
64	Benzo(k) Fluoranthene	207089	EPA 8270C	0.049	BO	ND	Y
65	Bis(2-Chloro ethoxy)Methane	111911	EPA 8270C	No Criteria ¹	0	ND	Y
67	Bis(2-Chloro isopropyl)Ether	108601	EPA 8270C	170,000	NAvail	ND	Y
68	Bis(2-Ethylhexyl) Phthalate	117817	EPA 8270C	5.9	8.85	ND	Y
69	4-Bromophenyl Phenyl Ether	101553	EPA 8270C	No Criteria ¹	0	ND	Y
70	Butylbenzyl Phthalate	85687	EPA 8270C	5,200	NAvail	ND	Y
71	2-Chloro naphthalene	91587	EPA 8270C	4,300	NAvail	ND	Y
72	4-Chlorophenyl Phenyl Ether	7005723	EPA 8270C	No Criteria ¹	0	ND	Y
78	3,3'-Dichloro benzidine	91941	EPA 8270C	0.077	NRec	ND	Y
80	Dimethyl Phthalate	131113	EPA 8270C	2,900,000	0	ND	Y

81	Di-n-Butyl Phthalate	84742	EPA 8270C	12,000	BO	1.1	IND
83	2,6-Dinitrotoluene	606202	EPA 8270C	No Criteria ¹	0	ND	Y
84	Di-n-Octyl Phthalate	117840	EPA 8270C	No Criteria ¹	0	ND	Y
94	Naphthalene	91203	EPA 8260B	No Criteria ¹	0	15.3	IND
99	Phenanthrene	85018	EPA 8270C	No Criteria ¹	0	ND	Y
100	Pyrene	129000	EPA 8270C	11,000	BO	ND	Y
101	1,2,4-Trichlorobenzene	120821	EPA 8260B	No Criteria ¹	0	ND	Y
CTR	Pollutant	CAS	Suggest Analytical	Water Quality Criteria	Amount Spiked	Final Result	Correct Negative Result
#		Number	Method(s)	(µg/L)			
106	delta-BHC	319868	EPA 8081A	No Criteria ¹	0	ND	Y
114	Endosulfan Sulfate	1031078	EPA 8081A	110	NRec	ND	Y

Abbreviations: NC, No Criteria; NT, Not Tested; ND, Not Detectable; BO, Backordered; NRec, ordered but Not Received; NAvail, chemical Not Available

Appendix 7. Non-Tested, Non Specified Pollutants of Concern

<u>Pollutant</u>	<u>Section</u>	<u>Based</u>	<u>Hardness Possible</u>		<u>Comment</u>
	<u>Citation</u>		<u>Methodology</u>		
Peptides					
Pyrethrins	G7		Fumed, hydrophobic?		Cleaved
Organophosphates	G7		Fumed, hydrophobic?		
Nutrients					
NH ₃ ⁺	G7		-none known-		
Nitrate	G7		add resin?		
Phosphorous	G7		add neutralizer?		
Metals					
Antimony	G8		unknown		no criteria
Beryllium		Y	unknown		
Cadmium		Y	add resin?		
Chr III		Y	add resin?		
Chr IV		Y	add resin?		
Copper		Y	add Resin?		
Nickel		Y	i.d. resin?		
Selenium		Y	i.d resin?		
Silver		Y	i.d resin?		0.077 ppb (77 ppt)
Thallium			i.d resin?		
Zn		Y	add resin?		
Cyanide (CN)			i.d. resin?		
Others					
Xylene					
Dissolved O ₂	VI A1		TBD		< 5 ppb
pH (6-9)	IV A6		TBD		
Chlorine	IV A10			TBD	level not specified
Biostimulating Substances	VI A.4		TBD		Define
Radionuclides	VI A12			TBD	Define
Pentachlorophenol					pH Based
Hardness					
Smell/odor/taste					

Appendix 8. Pentachlorophenol Criteria (pH Based)

pH	Pentachlorophenol (ug/L); Number 53
1-2	0.035
2-3	0.95
3-4	0.26
4-5	0.71
5-6	1.9
6-6.9	5.3
>6.9	8.2

Note: Pentachlorophenol was Spiked and gave the correct result based on a pH of 7.74.