Section 1: Executive Summary

In 2009, water and wastewater agencies in the Santa Ana River region developed a voluntary program to characterize "Emerging Constituents" in 23 municipal wastewater effluents, 2 sites along the Santa Ana River, and in the 2 man-made aqueducts used to import water to the area.[1] "Emerging Constituents (EC)" is a phrase used to describe a large number of pharmaceuticals, personal care products, food additives, pesticides and other common household chemicals for which federal and state authorities have not yet established an official water quality standard, approved a standard analytical method or required routine monitoring and reporting.

The first round of samples was collected and analyzed in the spring of 2010. Final results were reported to the Regional Water Quality Control Board later that same year.[2] The second round of samples was collected and analyzed in the spring of 2011.[3] The final results are presented in this report and summarized in Table 1. Where detected, EC concentrations fell well within the range where other studies have shown that "no adverse health effects would be expected."[4]

Table 1: Summary of Analytical Results for 27 Sampling Sites in 2011

	Compound	Primary Use	Freq. of Detection	Reported Range[5]	Common Dose
1	Acetaminophen	Analgesic	26%	ND – 0.000048 mg/L	500 mg
2	Bisphenol A (BPA)	Plastic Coating	26%	ND – 0.000220 mg/L	n/a
3	Caffeine	Food Additive	33%	ND – 0.000280 mg/L	100 mg
4	Carbamazepine	Anti-Convulsant	85%	ND – 0.000360 mg/L	200 mg
5	DEET	Insecticide	78%	ND – 0.000610 mg/L	270 mg
6	Diuron[6]	Herbicide	81%	ND – 0.000260 mg/L	n/a
7	17a Ethinyl Estradiol	Hormone	0%	Not Detected	1 mg
8	17b Estradiol	Hormone	0%	Not Detected	1 mg
9	Gemfibrozil	Anti-cholesterol	74%	ND – 0.005800 mg/L	600 mg
10	Ibuprofen	Analgesic	67%	ND – 0.001800 mg/L	300 mg
11	Sulfamethoxazole	Antibiotic	44%	ND – 0.001800 mg/L	800 mg
12	TCEP	Flame Retardant	89%	ND – 0.000670 mg/L	n/a
13	Triclosan	Antiseptic Biocide	26%	ND – 0.000130 mg/L	1 mg

Note: "mg/L" = milligram per Liter; 1 mg/L is one part per million. "ND" = Not Detected.

---

1 The proposed program was reviewed and endorsed by the Santa Ana Regional Water Quality Control Board in Res. No. R8-2009-0071 (Dec. 10, 2009). Task Force members are listed on page 7 of this report.

2 Santa Ana Watershed Project Authority. 2010 Emerging Constituents Sampling Report of the Emerging Constituents Program Task Force. December, 2010.

3 The final Sampling and Analysis Plan is attached as Appendix A to this report.

4 Intertox, Inc. Comparison of Analytical Results for Trace Organics in the Santa Ana River at the Imperial Highway to Health Risk-based Screening Levels. Seattle, WA. June 25, 2009. This report did not develop or evaluate health based screening levels for BPA, 17a-Ethinyl Estradiol, or 17b-Estradiol.

5 The study imposed a mandatory reporting limit of 0.000010 mg/L (10 nanograms per liter). In some cases, a laboratory may have reported a value less than this level.

6 Diruon is Bayer's registered trade name for DCMU [3-(3,4-dichloropheynl)-1,1-dimethylurea] No endorsement or criticism is implied by this or any other trade name used in this document.

FAQ for Draft Regulations for Groundwater Replenishment with Recycled Water

Last Update: November 22, 2011

This page includes frequently asked questions (FAQ) for the CDPH Drinking Water Program's draft regulations for groundwater replenishment with recycled water. Such replenished groundwater will supplement drinking water supplies.

Portions of the draft regulations mention indicator compounds to evaluate the effectiveness of treatment processes.

* * * * * *

FAQ 1. Section 60320.118(f) of the November 21, 2011 draft regulations refers to indicator compounds for soil treatment process. What are examples of such indicator compounds?

Answer: The following are examples of chemicals that may be suitable as indicator compounds:

Acetaminophen
Atenolol
Atorvastatin (Lipitor)
Bisphenol A
Caffeine
DEET
Diclofenac
Dilantin
Erythromycin–H_2O
17β-Estradiol (E2)
Estriol (E3)
Estrone (E1)
Fluoxetine (Prozac)
Gemfibrozil
Hydrocodone (Vicodin)
Ibuprofen
Iopromide
Ketoprofen
Meprobamate
Metoprolol (Lopressor)
Naproxen
NDMA
Nonylphenol
Propranolol
Salicylic acid
Sulfamethoxazole
Triclosan
Trimethoprim

FAQ 2. Section 60320.201(c)(1) of the November 21, 2011 draft regulations refers to indicator compounds, at least one from each of nine functional groups, to demonstrate that a sufficient oxidation process has been designed for implementation. What are examples of such indicator compounds?

Answer: Examples of indicator compounds associated with each of the nine functional groups (A through I) mentioned in the regulations are presented below:

(A) Hydroxy Aromatic: Acetominophen, Benzyl salicylate, Bisphenol A, Estrone, Hexyl salicylate, Isobutylparaben, Methyl salicylate, Nonylphenol, Oxybenzone, Propylparaben, Salicylclic acid, Triclosan, Clorfibric Acid

(B) Amino/Acylamino Aromatic: Sulfamethoxazole, Atorvastatin, Triclocarban

(C) Nonaromatic with carbon double bonds: Acetyl cedrene, Carbamazepine, Codeine, Hexylcinnamaldehyde, Methyl ionine, OTNE, Simvastatin hydroxyl, Terpineol

(D) Deprotonated Amine: Atenolol, Caffeine, Diclofenac, EDTA, Erythromycin-H_2O, Fluoxetine, Metoprolol, Nicotine, Norfluoxetine, Ofloxacin, Paraxanthine, Pentoxifylline, Trimethoprim

(E) Alkoxy Polyaromatic: Naproxen, Propranolol

(F) Alkoxy Aromatic: Gemfibrozil, Hydrocodone

(G) Alkyl Aromatic: Benzophenone, Benzyl acetate, Bucinal, DEET, Dilantin, Dibutyl Phthalate, Diphenhydramine, Galazolide, Ibuprofen, Indolebutyric acid, Primidone, Tonalide

(H) Saturated Aliphatic: Iopromide, Isobornyl acetate, Meprobamate, Methyl dihydrojasmonate

(I) Nitro Aromatic: Musk ketone, musk xylene

* * * * * *

More Information

TABLE A-12 Summary of Risk-Based Action Values and Sources

Name of Chemical	Unit	Source of Risk Value	Risk Based Action Level
Nitrosamines			
NDMA	ng/L	EPA HA (EPA, 2011)	0.7
Disinfection Byproducts			
Bromate	µg/L	EPA MCL (EPA, 2011)	10
Bromoform	µg/L	EPA MCL (EPA, 2011)	80
Chloroform	µg/L	EPA MCL (EPA, 2011)	80
DBCA	µg/L	EPA MCL (EPA, 2011)	60
DBAN	µg/L	WHO Drinking Water Guideline Value (WHO, 2008)	70
DBCM	µg/L	EPA MCL (EPA, 2011)	80
DCAA	µg/L	EPA MCL (EPA, 2011)	60
DCAN	µg/L	WHO Drinking Water Guideline Value (WHO, 2008)	20
HAA5[a]	µg/L	EPA MCL (EPA, 2011)	60
THM	µg/L	EPA MCL (EPA, 2011)	80
Pharmaceuticals			
Acetominophen	ng/L	FDA MRTD (FDA, 2011)	350,000,000
Ibuprofen	ng/L	FDA MRTD (FDA, 2011)	280,000,000
Carbamazepine	ng/L	FDA MRTD (FDA, 2011)	190,000,000
Gemfibrozil	ng/L	FDA MRTD (FDA, 2011)	140,000,000
Sulfamethoxazole	ng/L	FDA MRTD (FDA, 2011)	160,000,000
Meprobamate	ng/L	FDA MRTD (FDA, 2011)	280,000,000
Primidone	ng/L	FDA MRTD (FDA, 2011)	58,000,000
Other			
Caffeine	ng/L	FDA MRTD (FDA, 2011)	70,000,000
17-β Estradiol	ng/L	FDA MRTD (FDA, 2011)	3,500,000
Triclosan	ng/L	EPA RfD (EPA, 2008)	2,100,000
TCEP	ng/L	ASTDR MRL (ASTDR, 2009)	2,100,000
PFOS	ng/L	Provisional EPA HA (EPA, 2011)	200
PFOA	ng/L	Provisional EPA HA (EPA, 2011)	400

[a]HAA5: monochloroacetic acid (MCAA) + dichloroacetic acid (DCAA) + trichloroacetic acid (TCAA) + Monobromoacetic acid (MBAA) + dibromoacetic acid (DBAA).

NYC, 2010

Table 11: Number of Glasses of Water Required to Exceed Derived Drinking Water Guideline

Detected Compound	NYS Standard[Ω] (ng/L)	∞Max Conc. (ng/L)	Toxicity Threshold	Units	Basis	Derived DWG (ng/L)	[#]No. of 8 oz. glasses of water/day to exceed DWG	Reference
Acetaminophen	5,000	68	50	µg/kg/day	ADI	175,000	21,772	v
Butalbital	50,000	14	5,000	µg/kg/day	MRTD	175,000,000	105,750,000	vi
Caffeine	50,000	20	100	mg/(8-oz-cup)		423,000,000	178,929,000	vii
Carbamazepine	50,000	7.1	200	mg/day	LTD	100,000	119,155	iii
cis-Testosterone	50,000	0.1	2	µg/kg/day	ADI	7,000	592,200	iii
Cotinine	50,000	4.3	20	mg/day	LTD	10,000	19,674	iii
DEET	5,000	9	0.1	mg/kg/day	ADI	3,500,000	3,290,000	viii
Diazepam^	50,000	2.1	5	mg/day	LTD	2,500	10,071	iii
Diltiazem*	5,000	0.1	1.7	µg/kg/day	ADI	60,000	5,076,000	iii
Estrone**	50,000	2.1	0.013	µg/kg/day	ADI	460	1,853	ix
Gemfibrozil	50,000	1.9	1,200	mg/day	LTD	600,000	2,671,579	iii
Ibuprofen	50,000	3.4	800	mg/day	LTD	400,000	995,294	iii
Iopromide*	5,000	14	21	µg/kg/day	ADI	750,000	453,214	iii
Lasalocid^	50,000	3	NI				NA	
Meprobamate*	50,000	2	40	µg/kg/day	MRTD	1,400,000	5,922,000	iv
Nicotine^	50,000	11	NI				NA	
Paraxanthine	50,000	10	NI				NA	
Primidone*	5,000	13	8.33	µg/kg/day	MRTD	291,550	189,732	iv
Progesterone	50,000	0.1	30	µg/kg/day	ADI	105,000	8,883,000	iii
Sulfamethoxazole	5,000	6	10	µg/kg/day	ADI	35,000	49,350	iii

[Ω]NYS standard for UOCs = 50,000 ng/L and POCs = 5,000 ng/L.
[#]No. of 8 oz glasses/day = [DWG (ng/L)* 2 (L/d)*4.23 8oz glasses]/L/(maximum water concentration (ng/L))
∞Max Concentration is for 2010 results except for compounds not detected in 2010
*Compounds detected only in 2010
^Compounds detected in 2009 but not in 2010
ADI = Acceptable Daily Intake. Maximum amount of a substance to which an individual can be exposed, on a daily basis over his or her life span, without causing any harmful effects.
DWG = Drinking Water Guideline. Health-based guideline values representing minimum requirements for drinking water safety. Values cited are from reference 1 unless otherwise noted.
LTD = Lowest Therapeutic Dose. The LTD which produces the desired clinical effect.
MRTD = Maximum Recommended Therapeutic Dose. The recommended maximum amount of a drug to be given to a patient without causing adverse health effects.
PHA = Provisional Health Advisory. PHAs are developed to provide information in response to an urgent or rapidly developing situation. They reflect reasonable, health-based hazard concentrations above which action should be taken to reduce exposure to unregulated contaminants in drinking water.
NI =No Information

---

[v] *Australian Guidelines for Water Recycling*, Augmentation of Drinking Water Supplies, May 2008, Environment Protection and Heritage Council, National Health and Medical Research Council, Natural Resource Management Ministerial Council.
[vi] U.S. Food and Drug Administration (FDA), Maximum Recommended Therapeutic Dose (MRTD) Database. http://www.fda.gov/aboutfda/centersoffices/cder/ucm092199.htm.
[vii] Gilbert SG. *A Small Dose of Toxicology – The Health Effects of Common Chemicals*. CRC Press, Boca Raton, February 2004.
[viii] Blanset, D.L., Zhang, J., Robson, M.G., 2007. Probabilistic estimates of lifetime daily doses from consumption of drinking water containing trace levels of N, N diethyl-meta-toluamide (DEET), triclosan, or acetaminophen and the associated risk to human health. *Hum. Ecol. Risk Assess.* 13, 615–631.
[ix] Snyder, S.A.; Trenholm, R.A.; Pleus, R.C.; Bruce, G.M.; Snyder, E.M.; Bennett, E.; Hemming, J.C.D. *Toxicological Relevance of EDCs and Pharmaceuticals in Drinking Water*, Awwa Research Foundation and Water Research Foundation: Denver, CO, 2008.