23 January 2007

Technical Memorandum No. 15

To: Bob Castle, MMWD

From: Jean Debroux, Kennedy/Jenks
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Reviewed: Joel Faller, Kennedy/Jenks

Subject: Results of CTR Analysis of SWRO Brine
MMWD Seawater Desalination Pilot Plant Program
K/J 0468029

This technical memorandum summarizes and documents the results of testing of the brine from the Marin Municipal Water District (MMWD) Seawater Desalination Pilot Program.

Analysis of the SWRO Brine

Desalination pilot plant seawater reverse osmosis (SWRO) brine samples were taken on 11 October 2005 and 14 February 2006 for analyses of California Toxics Rule (CTR) constituents as specified by the California Regional Water Quality Control Board, San Francisco Bay Region letter entitled, "Requirement for Monitoring of Pollutants in Effluent and Receiving Water to implement New Statewide Regulations and Policy" dated 6 August 2001. The samples were analyzed by Caltest Analytical Laboratory, located in Napa, California. These efforts were undertaken to fulfill the pilot plant's NPDES Permit No. CA0038814.

During both sampling events, the pilot plant SWRO units were operating at approximately 50% recovery, therefore, nearly doubling the dissolved constituent concentration found in the source water. The 11 October sample is representative of the dry season and the average total dissolved solids (TDS) concentration of the source water on this day was 21,000 mg/l. The source water average TDS concentration was 13,800 on 6 February the representative wet season sample.

Table 1 below presents the results of the CTR analysis of the brine for the two sample dates.

Table 1: MMWD SWRO Brine CTR Analysis Results

CTR No.	Pollutant/Parameter	10/11/05 sample			2/14/2006 sample		
		Result	units	MRL[(a)]	Result	units	MRL[(a)]
1	Antimony	2.6	ug/l	2.5	ND	ug/l	2.5
2	Arsenic	3.35	ug/l	0.05	0.117	ug/l	0.05
3	Beryllium	ND	ug/l	0.5	ND	ug/l	0.5
4	Cadmium	ND	ug/l	0.5	ND	ug/l	0.5
5a.	Chromium (III)	ND	ug/l	2.5	ND	ug/l	2.5
5b.	Chromium (VI)	ND	ug/l	10	ND	ug/l	10

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		Result	units	MRL[(a)]	Result	units	MRL[(a)]
6	Copper	19	ug/l	2.5	8.2	ug/l	2.5
7	Lead	ND	ug/l	2.5	ND	ug/l	1.2
8	Mercury	0.0009	ug/l	0.0005	0.0011	ug/l	0.0005
9	Nickel	26	ug/l	2.5	14	ug/l	2.5
10	Selenium	0.214	ug/l	0.05	0.181	ug/l	0.05
11	Silver	ND	ug/l	0.5	ND	ug/l	0.5
12	Thallium	ND	ug/l	1	ND	ug/L	0.5
13	Zinc	13	ug/l	5	20	ug/l	5
14	Cyanide	ND	ug/l	3	ND	ug/l	3
15	Asbestos (only required for dischargers to MUN waters[2])	ND	MFL	0.5	<0.2	MFL	0.2
16	2,3,7,8-TCDD, 17 congeners (Dioxin)	ND	pg/l	0.767	ND	pg/l	0.453
17	Acrolein	ND	ug/l	5	ND	ug/l	5
18	Acrylonitrile	ND	ug/l	2	ND	ug/l	2
19	Benzene	ND	ug/l	0.5	ND	ug/l	0.5
33	Ethylbenzene	ND	ug/l	0.5	ND	ug/l	0.5
39	Toluene	ND	ug/l	0.5	ND	ug/l	0.5
20	Bromoform	0.7	ug/l	0.5	ND	ug/l	0.5
21	Carbon Tetrachloride	ND	ug/l	0.5	ND	ug/l	0.5
22	Chlorobenzene	ND	ug/l	0.5	ND	ug/l	0.5
23	Chlorodibromomethane	ND	ug/l	0.5	ND	ug/l	0.5
24	Chloroethane	ND	ug/l	0.5	ND	ug/l	0.5
25	2-Chloroethylvinyl Ether	ND	ug/l	1	ND	ug/l	1
26	Chloroform	ND	ug/l	0.5	ND	ug/l	0.5
75	1,2-Dichlorobenzene	ND	ug/l	2	ND	ug/l	2
76	1,3-Dichlorobenzene	ND	ug/l	1	ND	ug/l	1
77	1,4-Dichlorobenzene	ND	ug/l	1	ND	ug/l	1
27	Dichlorobromomethane	ND	ug/l	0.5	ND	ug/l	0.5
28	1,1-Dichloroethane	ND	ug/l	0.5	ND	ug/l	0.5
29	1,2-Dichloroethane	ND	ug/l	0.5	ND	ug/l	0.5
30	1,1-Dichloroethylene or 1,1-Dichloroethene	ND	ug/l	0.5	ND	ug/l	0.5
31	1,2-Dichloropropane	ND	ug/l	0.5	ND	ug/l	0.5
32	1,3-Dichloropropylene or 1,3-Dichloropropene	ND	ug/l	0.5	ND	ug/l	0.5
34	Methyl Bromide or Bromomethane	ND	ug/l	0.5	ND	ug/l	0.5
35	Methyl Chloride or Chloromethane	ND	ug/l	0.5	ND	ug/l	0.5

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36	Methylene Chloride or Dichlorormethane	ND	ug/l	0.5	ND	ug/l	0.5
37	1,1,2,2-Tetrachloroethane	ND	ug/l	0.5	ND	ug/l	0.5
38	Tetrachloroethylene	ND	ug/l	0.5	ND	ug/l	0.5
40	1,2-Trans-Dichloroethylene	ND	ug/l	0.5	ND	ug/l	0.5
41	1,1,1-Trichloroethane	ND	ug/l	0.5	ND	ug/l	0.5
42	1,1,2-Trichloroethane	ND	ug/l	0.5	ND	ug/l	0.5
43	Trichloroethene	ND	ug/l	0.5	ND	ug/l	0.5
44	Vinyl Chloride	ND	ug/l	0.5	ND	ug/l	0.5
45	2-Chlorophenol	ND	ug/l	2	ND	ug/l	2
46	2,4-Dichlorophenol	ND	ug/l	1	ND	ug/l	1
47	2,4-Dimethylphenol	ND	ug/l	2	ND	ug/l	2
48	2-Methyl-4,6-Dinitrophenol or Dinitro-2-methylphenol	ND	ug/l	5	ND	ug/l	5
49	2,4-Dinitrophenol	ND	ug/l	5	ND	ug/l	5
50	2-Nitrophenol	ND	ug/l	5	ND	ug/l	5
51	4-Nitrophenol	ND	ug/l	5	ND	ug/l	5
52	4-chloro-3-methylphenol	ND	ug/l	1	ND	ug/l	1
53	Pentachlorophenol	ND	ug/l	1	ND	ug/l	1
54	Phenol	ND	ug/l	1	ND	ug/l	1
55	2,4,6-Trichlorophenol	ND	ug/l	5	ND	ug/l	5
56	Acenaphthene	ND	ug/l	0.3	ND	ug/l	0.3
57	Acenaphthylene	ND	ug/l	0.2	ND	ug/l	0.2
58	Anthracene	ND	ug/l	0.3	ND	ug/l	0.3
60	Benzo(a)Anthracene or 1,2 Benzanthracene	ND	ug/l	0.3	ND	ug/l	0.3
61	Benzo(a)Pyrene	ND	ug/l	0.3	ND	ug/l	0.3
62	Benzo(b)Fluoranthene or 3,4 Benzofluoranthene	ND	ug/l	0.3	ND	ug/l	0.3
63	Benzo(ghi)Perylene	ND	ug/l	0.1	ND	ug/l	0.1
64	Benzo(k)Fluoranthene	ND	ug/l	0.3	ND	ug/l	0.3
74	Dibenzo(a,h) Anthracene	ND	ug/l	0.1	ND	ug/l	0.1
86	Fluoranthene	ND	ug/l	0.05	ND	ug/l	0.05
87	Fluorene	ND	ug/l	0.1	ND	ug/l	0.1
92	Indeno(1,2,3-cd)Pyrene	ND	ug/l	0.05	ND	ug/l	0.05
100	Pyrene	ND	ug/l	0.05	ND	ug/l	0.05
68	Bis(2-Ethylhexyl) Phthalate	ND	ug/l	3	ND	ug/l	3
70	Butylbenzyl Phthalate	ND	ug/l	5	ND	ug/l	5

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79	Diethyl Phthalate	ND	ug/l	2	ND	ug/l	2
80	Dimethyl Phthalate	ND	ug/l	2	ND	ug/l	2
81	Di-n-Butyl Phthalate	ND	ug/l	5	ND	ug/l	5
84	Di-n-Octyl Phthalate	ND	ug/l	5	ND	ug/l	5
59	Benzidine	ND	ug/l	5	ND	ug/l	5
65	Bis(2-Chloroethoxy) Methane	ND	ug/l	5	ND	ug/l	5
66	Bis(2-Chloroethyl) Ether	ND	ug/l	1	ND	ug/l	1
67	Bis(2-Chloroisopropyl) Ether	ND	ug/l	2	ND	ug/l	2
69	4-Bromophenyl Phenyl Ether	ND	ug/l	5	ND	ug/l	5
71	2-Chloronaphthalene	ND	ug/l	5	ND	ug/l	5
72	4-Chlorophenyl Phenyl Ether	ND	ug/l	5	ND	ug/l	5
73	Chrysene	ND	ug/l	0.3	ND	ug/l	0.3
78	3,3'-Dichlorobenzidine	ND	ug/l	5	ND	ug/l	5
82	2,4-Dinitrotoluene	ND	ug/l	5	ND	ug/l	5
83	2,6-Dinitrotoluene	ND	ug/l	5	ND	ug/l	5
85	1,2-Diphenylhydrazine	ND	ug/l	1	ND	ug/l	1
88	Hexachlorobenzene	ND	ug/l	1	ND	ug/l	1
89	Hexachlorobutadiene	ND	ug/l	1	ND	ug/l	1
90	Hexachlorocyclopentadiene	ND	ug/l	1	ND	ug/l	1
91	Hexachloroethane	ND	ug/l	1	ND	ug/l	1
93	Isophorone	ND	ug/l	1	ND	ug/l	1
94	Naphthalene	ND	ug/l	0.2	ND	ug/l	0.2
95	Nitrobenzene	ND	ug/l	1	ND	ug/l	1
96	N-Nitrosodimethylamine	ND	ug/l	5	ND	ug/l	5
97	N-Nitrosodi-n-Propylamine	ND	ug/l	5	ND	ug/l	5
98	N-Nitrosodiphenylamine	ND	ug/l	1	ND	ug/l	1
99	Phenanthrene	ND	ug/l	0.05	ND	ug/l	0.05
101	1,2,4-Trichlorobenzene	ND	ug/l	5	ND	ug/l	5
102	Aldrin	ND	ug/l	0.005	ND	ug/l	0.005
103	-BHC	ND	ug/l	0.01	ND	ug/l	0.01
104	-BHC	ND	ug/l	0.005	ND	ug/l	0.005
105	-BHC (Lindane)	ND	ug/l	0.01	ND	ug/l	0.01
106	δ-BHC	ND	ug/l	0.005	ND	ug/l	0.005
107	Chlordane	ND	ug/l	0.02	ND	ug/l	0.02
108	4,4'-DDT	ND	ug/l	0.01	ND	ug/l	0.01
109	4,4'-DDE	ND	ug/l	0.01	ND	ug/l	0.01
110	4,4'-DDD	ND	ug/l	0.01	ND	ug/l	0.01
111	Dieldrin	ND	ug/l	0.01	ND	ug/l	0.01
112	Endosulfan (alpha)	ND	ug/l	0.01	ND	ug/l	0.01

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113	Endosulfan (beta)	ND	ug/l	0.01	ND	ug/l	0.01
114	Endosulfan Sulfate	ND	ug/l	0.01	ND	ug/l	0.01
115	Endrin	ND	ug/l	0.01	ND	ug/l	0.01
116	Endrin Aldehyde	ND	ug/l	0.01	ND	ug/l	0.01
117	Heptachlor	ND	ug/l	0.01	ND	ug/l	0.01
118	Heptachlor Epoxide	ND	ug/l	0.01	ND	ug/l	0.01
119-125	PCBs: Aroclors 1016, 1221, 1232, 1242, 1248, 1254, 1260	ND	ug/l	0.1	ND	ug/l	0.1
126	Toxaphene	ND	ug/l	0.5	ND	ug/l	0.5

Notes:

(a) All MRLs are at or below California Regional Water Quality Control Board, San Francisco Bay Region August 6, 2001 letter requirements for required analytical methods except for six metals (antimony, copper, lead, nickel, silver, and zinc) quantified by EPA method 200.8. Two of the analyses (lead and silver) for these metals resulted in non-reportable results at the higher MRL.

cc: Project File