



WaterCycle Rx(tm)

Cooling Tower System Specifications Used in Dosage and Feed Rate Calculations

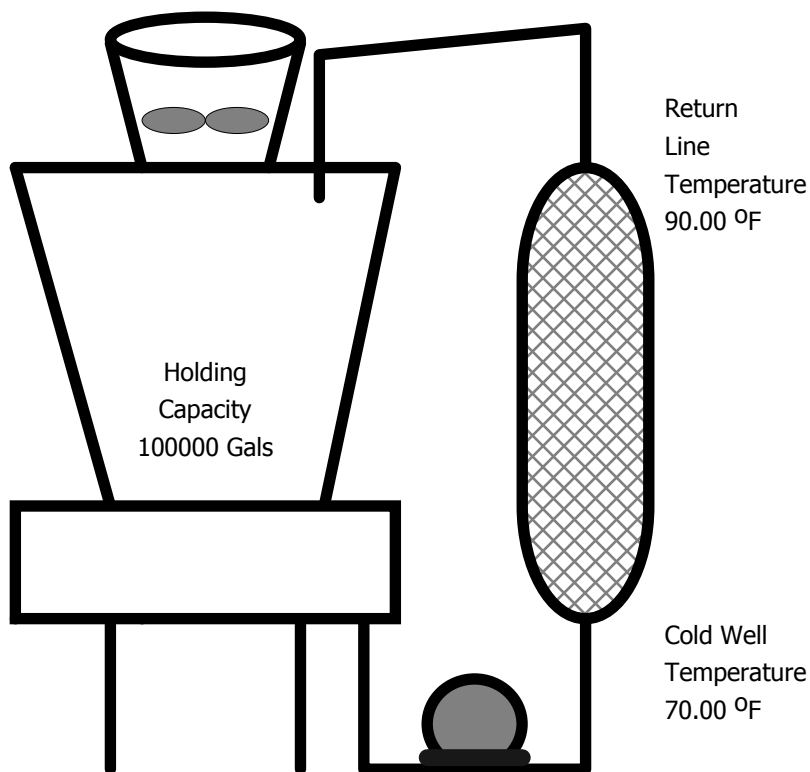
WaterCycle(tm) French Creek S.W.
Cooling Tower Exam. Kimberton, PA

Report Date: 1990-11-17 Sampled: 1990-11-17
Sample #: 0 at 1645

Evaporation
as % per 10°F
1.00 %

Drift %
0.0050

Leaks(gpm)
5.00



Recirculation
Rate 10000(gpm)

Calculated Parameters at 7.00 cycles

Makeup (gpm)	233.33
Blowdown (gpm)	27.83
Evaporation (gpm)	200.00
Drift (gpm)	0.500
Half life(Hrs)	34.65

FRENCH CREEK SOFTWARE, INC.
KIMBERTON ROAD, KIMBERTON, PA 19442



WaterCycle Rx(tm)

MAKEUP WATER INPUT

WaterCycle(tm) French Creek S.W.
Cooling Tower Exam. Kimberton, PA

Report Date: 1990-11-17 Sampled: 1990-11-17
Sample #: 0 at 1645

CATIONS

Calcium (as CaCO ₃)	123.00
Magnesium (as CaCO ₃)	34.00
Sodium (as Na)	18.00
Potassium (as K)	0.00
Ammonia (as NH ₃)	0.100
Iron (as Fe)	0.0700
Aluminum (as Al)	0.01000
Zinc (as Zn)	0.00
Boron (as B)	0.00

ANIONS

Chloride (as Cl)	34.00
Sulfate (as SO ₄)	23.00
"M" Alkalinity (as CaCO ₃)	123.00
"P" Alkalinity (as CaCO ₃)	0.00
Oxalic acid	0.00
Cyanide (as HCN)	0.00
Phosphate (as PO ₄)	1.90
Pyrophosphate (as PO ₄)	0.00
Silica (as SiO ₂)	23.00
Nitrate (as NO ₃)	5.00
Fluoride (as F)	0.100

PARAMETERS

pH	7.60
Temperature (°F)	77.00
Calculated T.D.S.	332.40
Calculated Cond.	389.89
Suspended Solids(mg/L)	0.00

COMMENTS

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WaterCycle Rx(tm)

DEPOSITION POTENTIAL INDICATORS

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Sample #: 0 at 1645

SATURATION LEVEL

Calcite (CaCO ₃)	0.818
Aragonite (CaCO ₃)	0.712
Anhydrite (CaSO ₄)	0.00560
Gypsum (CaSO ₄ *2H ₂ O)	0.00909
Calcium phosphate	0.605
Hydroxyapatite	< 0.001
Fluorite (CaF ₂)	< 0.001
Silica (SiO ₂)	0.195
Brucite (Mg(OH) ₂)	< 0.001
Magnesium silicate	< 0.001
Iron hydroxide (Fe(OH) ₃)	48.47
Siderite (FeCO ₃)	1.77
Strengite (FePO ₄ *2H ₂ O)	2.11
Calcium oxalate (CaC ₂ O ₄)	0.00
Ca pyrophosphate (CaP ₂ O ₇)	0.00
Zinc hydroxide (Zn(OH) ₂)	0.00
Zinc carbonate (ZnCO ₃)	0.00
Zinc phosphate (Zn ₃ (PO ₄) ₂)	0.00
Zinc pyrophosphate (ZnP ₂ O ₇)	0.00

FREE ION MOMENTARY EXCESS (ppm)

Calcite (CaCO ₃)	-0.124
Aragonite (CaCO ₃)	-0.225
Anhydrite (CaSO ₄)	-798.78
Gypsum (CaSO ₄ *2H ₂ O)	-689.06
Calcium phosphate	>-0.001
Hydroxyapatite	-389.25
Fluorite (CaF ₂)	-36.40
Silica (SiO ₂)	-96.95
Brucite (Mg(OH) ₂)	-4.59
Magnesium silicate	-191.06
Iron hydroxide (Fe(OH) ₃)	< 0.001
Siderite (FeCO ₃)	0.0478
Strengite (FePO ₄ *2H ₂ O)	< 0.001
Calcium oxalate (CaC ₂ O ₄)	-0.349
Ca pyrophosphate (CaP ₂ O ₇)	-0.00286
Zinc hydroxide (Zn(OH) ₂)	>-0.001
Zinc carbonate (ZnCO ₃)	-1.39
Zinc phosphate (Zn ₃ (PO ₄) ₂)	-0.0138
Zinc pyrophosphate (ZnP ₂ O ₇)	-1.58

SIMPLE INDICES

Langelier	-0.0512
Ryznar	7.70
Practical	7.71
Larson-Skold Index	0.590
Max. Sol. Zn:	0.446
Max. Sol. Pyro:	3.46
Max. Sol. Ortho:	5.18

BOUND IONS

Calcium	49.26	46.36
Carbonate	0.820	0.336
Phosphate	1.90	< 0.001

TOTAL

FREE

OPERATING CONDITIONS

Temperature (°F)	77.00
Time(hrs.)	69.30

FRENCH CREEK SOFTWARE, INC.
KIMBERTON ROAD, KIMBERTON, PA 19442



WaterCycle Rx(tm)

DEPOSITION POTENTIAL INDICATORS VERSUS CONCENTRATION RATIO

WaterCycle(tm) French Creek S.W.
Cooling Tower Exam. Kimberton, PA

Report Date: 1990-11-17 Sampled: 1990-11-17
Sample #: 0 at 1645

SATURATION LEVEL	Concentration Ratio						
	1.00	2.00	3.00	4.00	5.00	6.00	7.00
Calcite	1.43	12.17	38.79	83.00	143.31	216.97	301.14
Aragonite	1.22	10.37	33.04	70.68	122.04	184.77	256.45
Calcium oxalate	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Anhydrite	0.00753	0.0210	0.0367	0.0533	0.0704	0.0879	0.106
Gypsum	0.00823	0.0230	0.0401	0.0582	0.0769	0.0960	0.115
Calcium phosphate	2.73	221.79	1995	7937	20934	43393	77245
Hydroxyapatite	0.00712	18.80	1049	13757	86248	349416	1070577
Ca pyrophosphate	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fluorite	< 0.001	< 0.001	< 0.001	< 0.001	0.00103	0.00157	0.00224
Silica	0.126	0.246	0.360	0.465	0.561	0.650	0.730
Brucite	< 0.001	< 0.001	0.00412	0.0112	0.0237	0.0433	0.0714
Magnesium silicate	0.00456	0.117	0.727	2.55	6.54	13.81	25.59
Ferric hydroxide	115.47	874.20	1642	2005	2134	2160	2143
Siderite	3.84	18.94	26.51	25.38	21.78	18.13	15.00
Strengite	7.73	11.22	7.14	3.86	2.13	1.24	0.763
Struvite	< 0.001	< 0.001	< 0.001	< 0.001	0.00100	0.00145	0.00193
Zinc hydroxide	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zinc carbonate	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zinc phosphate	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zinc pyrophosphate	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SIMPLE INDICES							
Langelier	0.216	1.21	1.78	2.19	2.50	2.75	2.96
Ryznar	7.17	5.63	4.74	4.12	3.63	3.24	2.91
Practical	7.18	5.64	4.75	4.13	3.65	3.25	2.92
Larson-Skold	0.587	0.588	0.590	0.592	0.594	0.596	0.599
Ca Total	49.26	98.52	147.78	197.05	246.31	295.57	344.83
Ca Free	44.94	83.37	116.25	144.44	168.92	190.60	210.23
CO3 Total	1.23	9.18	27.82	57.96	98.41	147.28	202.66
CO3 Free	0.452	2.53	6.60	12.54	19.98	28.55	37.91
PO4 Total	1.90	3.80	5.70	7.60	9.50	11.40	13.30
PO4 Free	< 0.001	< 0.001	< 0.001	< 0.001	0.00113	0.00154	0.00196
MAXIMUM SOLUBILITIES (mg/L)							
Max. Sol. Zn	0.455	0.914	2.17	2.90	3.66	4.34	4.91
Max. Sol. Pyro	4.12	2.81	2.36	2.14	2.02	1.94	1.88
Max. Sol. Ortho	3.63	1.27	0.918	0.828	0.813	0.829	0.859



WaterCycle Rx(tm)

DEPOSITION POTENTIAL INDICATORS VERSUS CONCENTRATION RATIO

WaterCycle(tm) French Creek S.W.
Cooling Tower Exam. Kimberton, PA

Report Date: 1990-11-17 Sampled: 1990-11-17
Sample #: 0 at 1645

MOMENTARY EXCESS mg/L above Equil.	Concentration Ratio						
	1.00	2.00	3.00	4.00	5.00	6.00	7.00
Calcite	0.227	3.87	10.72	20.64	33.08	47.38	62.99
Aragonite	0.136	3.80	10.67	20.59	33.03	47.34	62.95
Calcium oxalate	-0.365	-0.241	-0.198	-0.175	-0.162	-0.153	-0.146
Anhydrite	-657.64	-666.73	-664.03	-657.00	-647.99	-637.86	-627.03
Gypsum	-708.01	-714.70	-709.21	-699.45	-687.81	-675.14	-661.84
Calcium phosphate	< 0.001	< 0.001	0.00131	0.00228	0.00339	0.00460	0.00588
Hydroxyapatite	-450.41	0.172	0.515	0.878	1.26	1.65	1.96
Ca pyrophosphate	-0.0031	-0.0019	-0.0016	-0.0016	-0.0016	-0.0016	-0.0017
Fluorite	-39.42	-34.05	-31.10	-29.20	-27.85	-26.82	-25.98
Silica	-162.61	-140.12	-119.01	-99.42	-81.44	-65.03	-50.16
Brucite	-4.82	-3.97	-3.49	-3.14	-2.86	-2.60	-2.36
Magnesium silicate	-225.56	-234.40	-240.39	0.244	0.557	0.877	1.21
Ferric hydroxide	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Siderite	0.0851	0.122	0.0757	0.0419	0.0242	0.0148	0.00962
Strengite	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	>-0.001
Struvite	-191.47	-191.41	-191.35	-191.29	-191.24	-191.18	-191.12
Zinc hydroxide	>-0.001	>-0.001	>-0.001	>-0.001	>-0.001	>-0.001	>-0.001
Zinc carbonate	-0.993	-0.412	-0.191	-0.112	-0.0759	-0.0565	-0.0449
Zinc phosphate	-0.0139	-0.0161	-0.0175	-0.0186	-0.0194	-0.0200	-0.0205
Zinc pyrophosphate	-1.61	-2.22	-2.78	-3.31	-3.80	-4.28	-4.75

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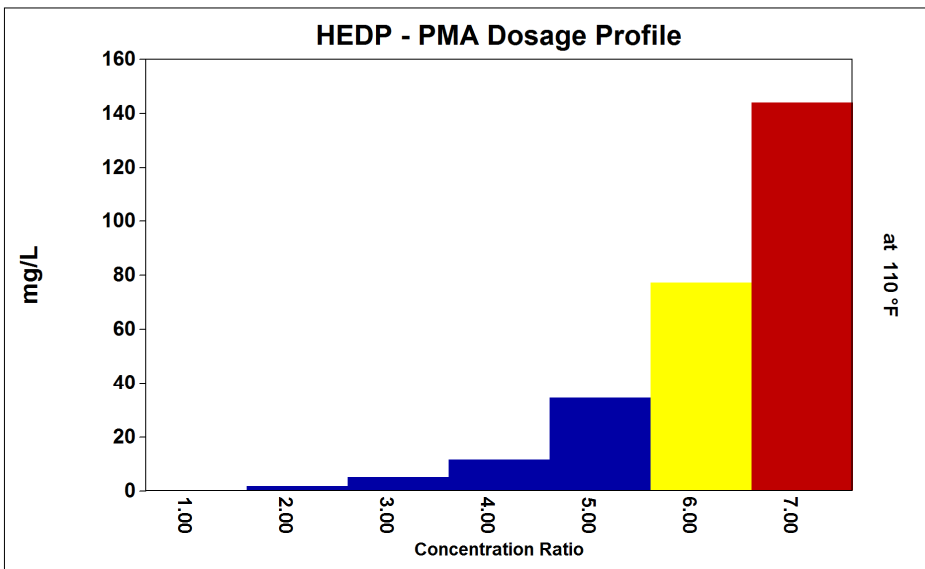
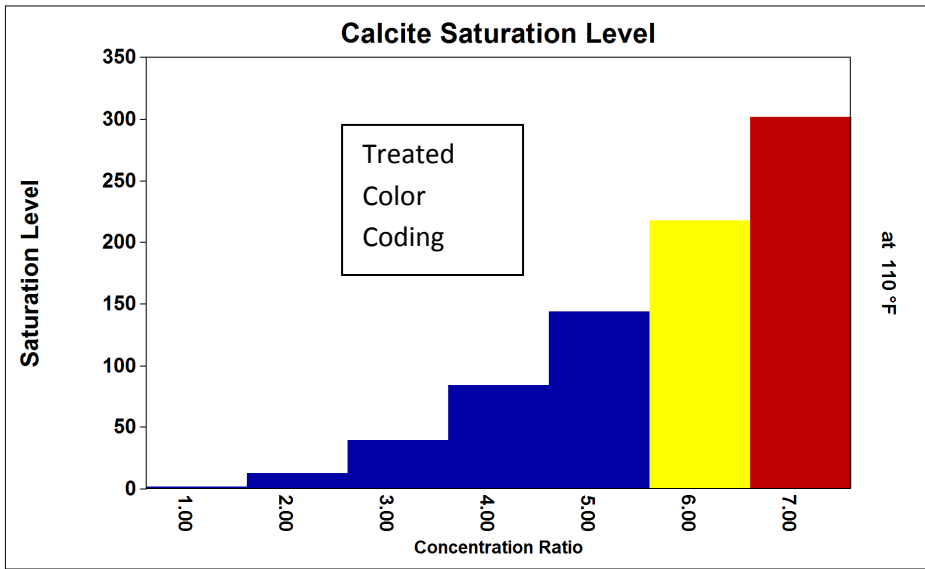
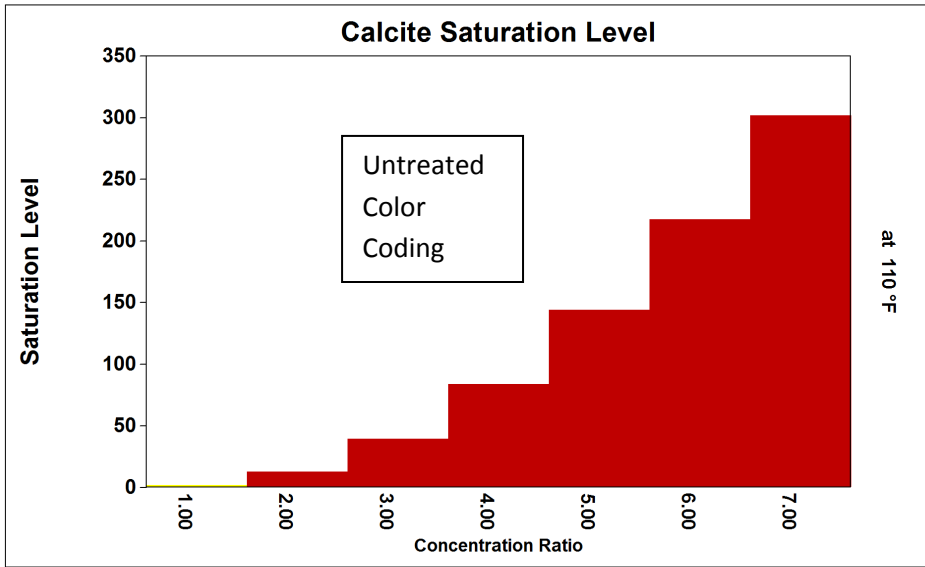
WaterCycle Rx(tm)

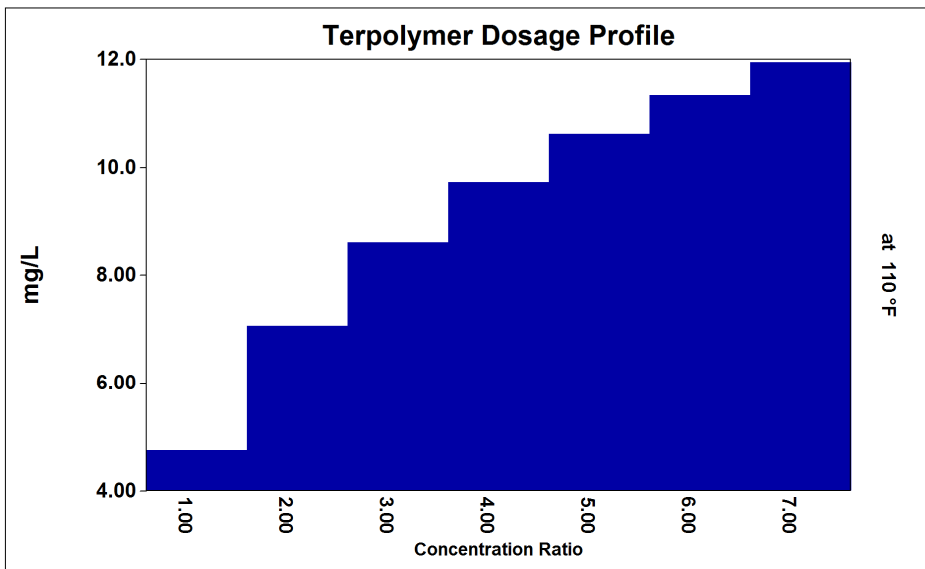
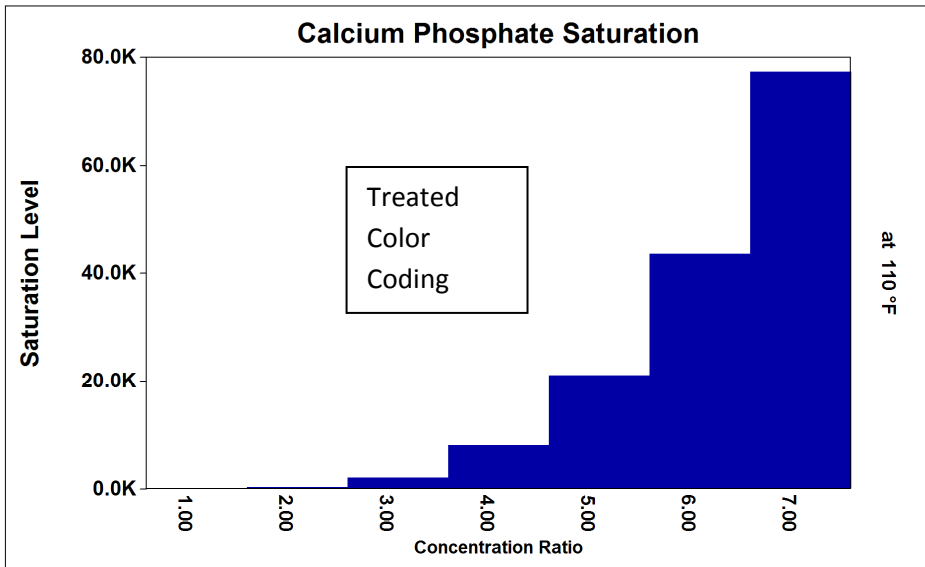
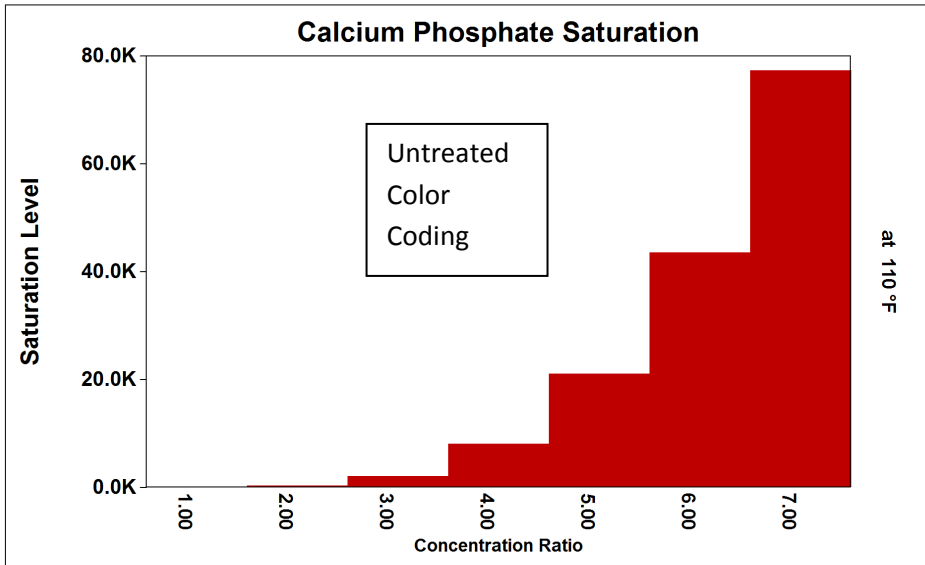
RECIRCULATING WATER CHEMISTRY VERSUS CONCENTRATION RATIO

WaterCycle(tm) French Creek S.W.
Cooling Tower Exam. Kimberton, PA

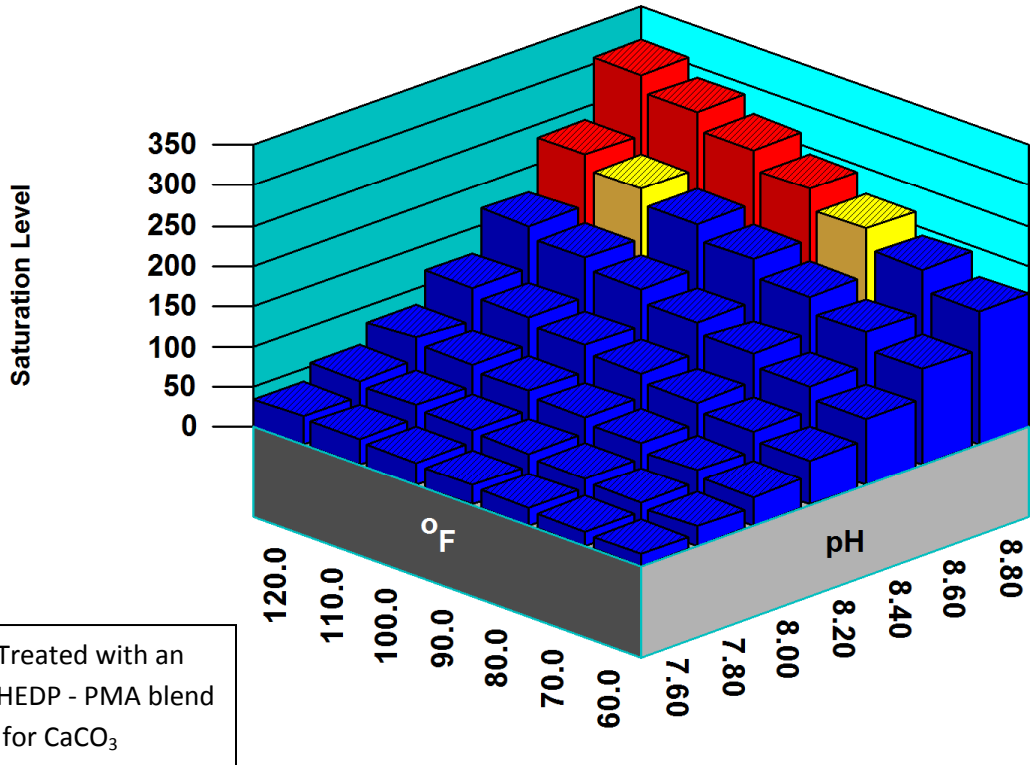
Report Date: 1990-11-17 Sampled: 1990-11-17
Sample #: 0 at 1645

CATIONS	Concentration Ratio						
	1.00	2.00	3.00	4.00	5.00	6.00	7.00
Calcium (as CaCO ₃)	123.00	246.00	369.00	492.00	615.00	738.00	861.00
Magnesium (as CaCO ₃)	34.00	68.00	102.00	136.00	170.00	204.00	238.00
Sodium (as Na)	18.00	36.00	54.00	72.00	90.00	108.00	126.00
Potassium (as K)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron (as Fe)	0.0700	0.140	0.210	0.280	0.350	0.420	0.490
Ammonia (as NH ₃)	0.100	0.200	0.300	0.400	0.500	0.600	0.700
Aluminum (as Al)	0.01000	0.0200	0.0300	0.0400	0.0500	0.0600	0.0700
Zinc (as Zn)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Boron (as B)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ANIONS							
Chloride (as Cl)	34.00	68.00	102.00	136.00	170.00	204.00	238.00
Sulfate (as SO ₄)	23.00	46.00	69.00	92.00	115.00	138.00	161.00
Dissolved CO ₂	7.2	5.0	4.0	3.4	3.0	2.7	2.4
"M" Alkalinity	122.6	244.8	366.3	487.0	606.8	725.4	843.2
"P" Alkalinity	1.1	7.9	23.7	49.1	83.1	124.1	170.6
Oxalate(moles/L)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Silica(as SiO ₂)	23.00	46.00	69.00	92.00	115.00	138.00	161.00
Phosphate(as PO ₄)	1.90	3.80	5.70	7.60	9.50	11.40	13.30
Pyrophosphate(PO ₄)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H ₂ S(as H ₂ S)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fluoride(as F)	0.100	0.200	0.300	0.400	0.500	0.600	0.700
Nitrate(as NO ₃)	5.00	10.00	15.00	20.00	25.00	30.00	35.00
PARAMETERS							
pH	7.60	8.05	8.31	8.49	8.63	8.74	8.84
Temperature(°F)	110.00	110.00	110.00	110.00	110.00	110.00	110.00
Calculated TDS	331.96	647.01	951.35	1243	1523	1793	2056
Calculated Cond.	382.22	699.29	970.01	1204	1410	1594	1761
Suspended Solids(mg/L)	0.00	0.00	0.00	0.00	0.00	0.00	0.00



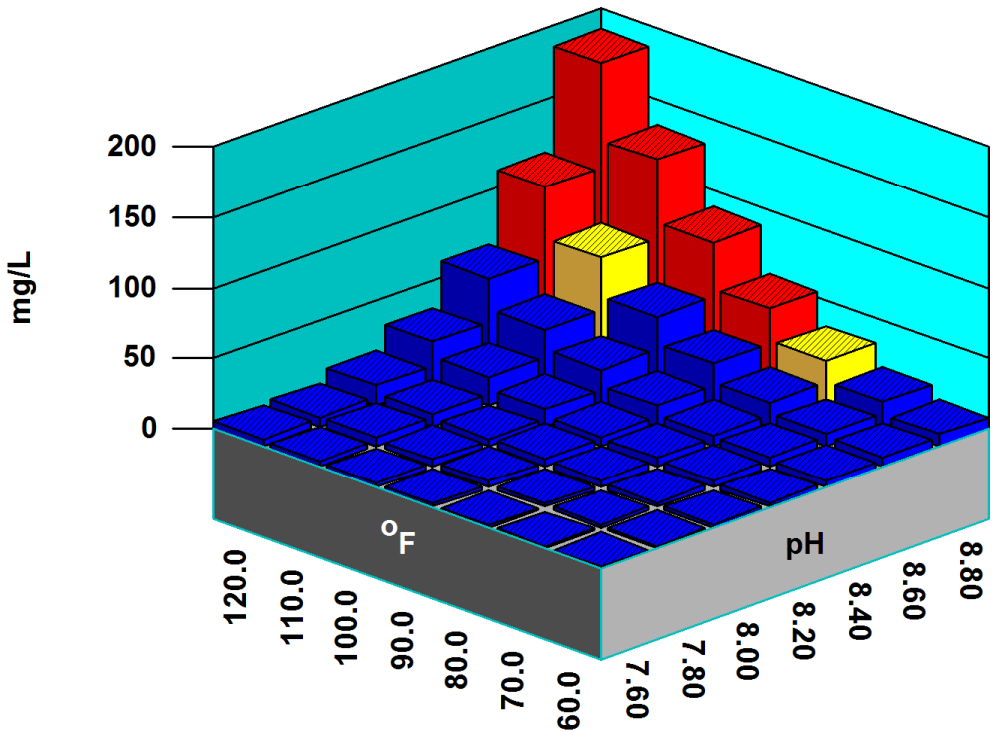


Calcite Saturation Level



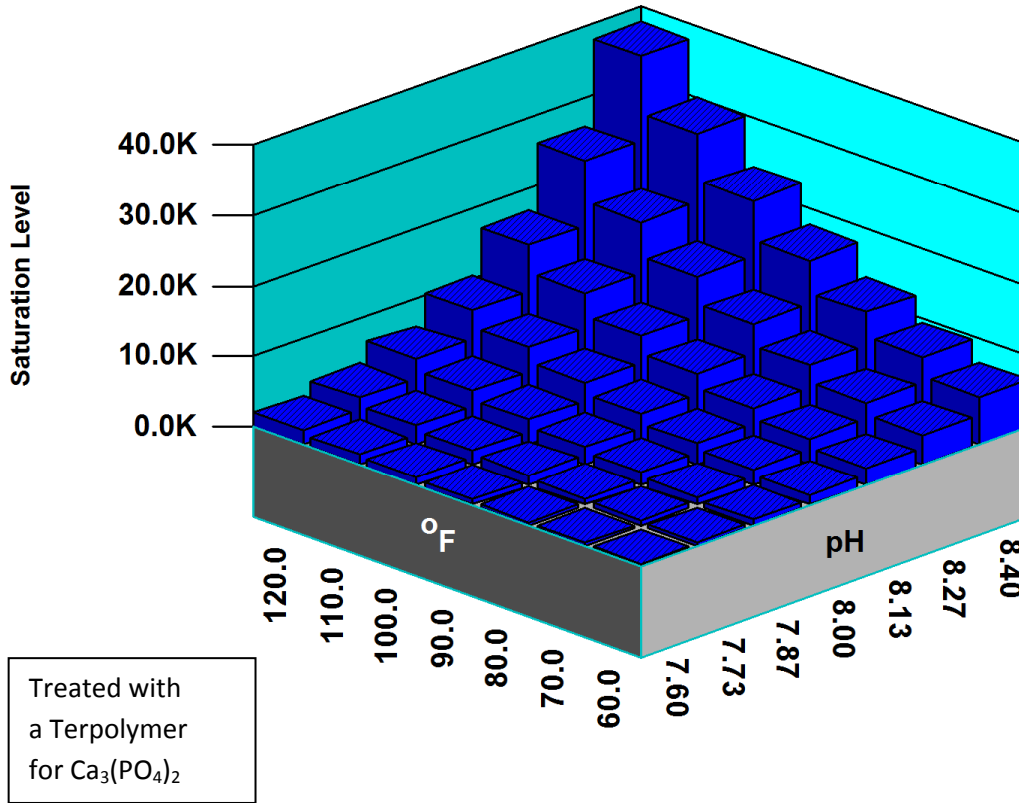
OPERATING RANGE PROFILE
at 7.00 cycles

HEDP - PMA Dosage Profile



OPERATING RANGE PROFILE
at 7.00 cycles

Calcium Phosphate Saturation



Terpolymer

