

# Welcome to the WaterCycle<sup>®</sup> Walkabout

WaterCycle Rx Laboratory Edition

FILES INPUT WHAT-IF REPORTS FORMULARY LABORATORY PREFERENCES HELP

WaterCycle<sup>®</sup> 



French Creek Software  
Scale & Corrosion Software Tools



# Cooling Water can be evaluated as Once Through or Open Recirculating

WaterCycle Rx Laboratory Edition

FILES INPUT WHAT-IF REPORTS FORMULARY LABORATORY PREFERENCES HELP

- New
- Open Workspace
- Save Workspace
- Save Workspace As
- Open Chemistry
- Save Chemistry
- Save Chemistry As
- Open System Specs
- Save System Specs
- Save System Specs As
- Printer Setup
- What's Stored
- About WaterCycle Rx
- QUIT

## Once Through Cooling Water

WaterCycle<sup>®</sup> 



French Creek Software  
Scale & Corrosion Software Tools



# The first step is Source Water Chemistry Input

Always check the Analytical Units  
Click on **Change Units** if they aren't just right!

WaterCycle Rx Laboratory Edition

FILES INPUT WHAT-IF REPORTS FORMULARY LABORATORY PREFERENCES HELP

ONCE THROUGH  
Source Analysis  
COOLING TOWER  
Make-Up Analysis  
Input pH Curve  
SYSTEM PARAMETERS  
Once Through  
Cooling Tower

### Water Chemistry Input


Sample Date: 04-13-1995 Time: 13:39 ID#: 0 Report Date: 04-13-1995

Sample Description


Cooling Lake	24 Hour Water
Example	Chemistry Variation

Calcium (as CaCO3)	114.00	Aluminum (as Al)	0.00	Hydrogen sulfide (as H2S)	0.00
Magnesium (as CaCO3)	35.00	Zinc (as Zn)	0.00	Silica (as SiO2)	7.00
Sodium (as Na)	6.41	Boron (as B)	0.00	Phosphate (as PO4)	0.100
Potassium (as K)	0.00	Chloride (as Cl)	23.00	Polyphosphate (as PO4)	0.00
Iron (as Fe)	0.0500	Sulfate (as SO4)	35.00	Fluoride (as F)	0.00
Ammonia (as NH3)	0.00	M Alkalinity (as CaCO3)	94.00	Nitrate (as NO3)	0.00
pH	8.05	P Alkalinity (as CaCO3)	0.00	Temperature (as °C)	25.00
Comments	Texas Utility	Oxalic Acid (moles/L)	0.00	Corrosion target (as mm/year)	1.00
		Cyanide (as HCN)	0.00	Suspended Solids (mg/L)	0.00

OK Change Units Set Constant Recalculate Cancel



French Creek Software



# The first step is Water Chemistry Input

Make sure that temperature, pressure, and flows are expressed in your units.

Also check ions, e.g. Ca as Ca? Ca as CaCO<sub>3</sub>

Click **OK** to save the new units

**Water Chemistry Input**

Sample Date: 1990-11-17

Sample Description: WaterCycle(tm), Cooling Tower Exam

Calcium (as CaCO<sub>3</sub>): 123.00  
Magnesium (as CaCO<sub>3</sub>): 34.00  
Sodium (as Na): 18.00  
Potassium (as K): 0.00  
Iron (as Fe): 0.0100  
Ammonia (as NH<sub>3</sub>): 0.100  
pH: 7.00  
Comments: at Chicago

**ANALYTICAL UNITS SELECTION**

Calcium	(as CaCO <sub>3</sub> )	Aluminum	(as Al)	Sulfide	(as H <sub>2</sub> S)
Magnesium	(as CaCO <sub>3</sub> )	Boron	(as B)	Silica	(as SiO <sub>2</sub> )
Sodium	(as Na)	Zinc	(as Zn)	Phosphate	(as PO <sub>4</sub> )
Potassium	(as K)	Chloride	(as Cl)	Polyphosphate	(as PO <sub>4</sub> )
Iron	(as Fe)	Sulfate	(as SO <sub>4</sub> )	Fluoride	(as F)
Ammonia	(as NH <sub>3</sub> )	M Alkalinity	(as CaCO <sub>3</sub> )	Nitrate	(as NO <sub>3</sub> )
pH	(pH Units)	P Alkalinity	(as CaCO <sub>3</sub> )	Temperature	(as °F)
Flow rate	gpm	Oxalate	(moles/L)	Corrosion rate	mpy
System capacity	gal	Cyanide	(as HCN)	Date	YR/MM/DD

**REPORTED AS**

ppm   
mg/L   
epm   
moles/L

**BALANCING IONS CATIONS**

Sodium   
Potassium

**ANIONS**

Chloride   
Sulfate   
Nitrate

**COMPANY UNITS**

ASHLAND  
BUCKMAN  
Betz-Dearborn  
CHEMTREAT  
CALGON  
NALCO

OK Cancel

French Creek Software

# Press OK and review the water chemistry, scale potential, and corrosivity

WaterCycle Rx Laboratory Edition

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**Water Chemistry Input**

Sample Date: 1990-11-17 Time: 16:45 ID#: 0 Report Date: 1990-11-17

Sample Description

WaterCycle(tm)	Lake Michigan
Cooling Tower Exam	Make-up Water

Calcium (as CaCO3)	123.00	Aluminum (as Al)	0.230	Hydrogen sulfide (as H2S)	0.00
Magnesium (as CaCO3)	34.00	Zinc (as Zn)	0.00	Silica (as SiO2)	23.00
Sodium (as Na)	18.00	Boron (as B)	0.00	Phosphate (as PO4)	0.00
Potassium (as K)	0.00	Chloride (as Cl)	34.00	Polyphosphate (as PO4)	0.00
Iron (as Fe)	0.0100	Sulfate (as SO4)	23.00	Fluoride (as F)	0.100
Ammonia (as NH3)	0.100	M Alkalinity (as CaCO3)	123.00	Nitrate (as NO3)	5.00
pH	7.00	P Alkalinity (as CaCO3)	0.00	Temperature (as °F)	77.00
Comments	at Chicago	Oxalic Acid (moles/L)	0.00	Corrosion target (as mpy)	1.00
		Cyanide (as HCN)	0.00	Suspended Solids (mg/L)	0.00

OK Change Units Set Constant Recalculate Cancel

WaterCycle® 



French Cree  
Software

Sample ID: 0 Report Date: 04-13-1995 Sampled: 04-13-1995 at 1339

## CATIONS

Calcium(as CaCO <sub>3</sub> )	114.00
Magnesium(as CaCO <sub>3</sub> )	35.00
Sodium(as Na)	6.41
Potassium(as K)	0.00
Iron(as Fe)	0.0500
Ammonia(as NH <sub>3</sub> )	0.00
Aluminum(as Al)	0.00
Zinc(as Zn)	0.00
Boron(as B)	0.00

## PARAMETERS

pH	8.05
Temperature(Deg C)	25.00
Calculated T.D.S.	244.81
Calculated Cond.	320.74
Suspended Solids(mg/L)	0.00

## ANIONS

Chloride(as Cl)	23.00
Sulfate(as SO <sub>4</sub> )	35.00
"M" Alkalinity(as CaCO <sub>3</sub> )	94.00
"P" Alkalinity(as CaCO <sub>3</sub> )	0.00
Oxalic acid(moles/L)	0.00
Silica(as SiO <sub>2</sub> )	
Phosphate	
Pyrophosphate	
H <sub>2</sub> S (as S)	
Cyanide (as C)	
Fluoride (as F)	
Nitrate (as N)	

## COMMENTS

Texas Utility

# Two windows open. The Water Chemistry Input and the Scale and Corrosion Evaluation

## SOURCE WATER DEPOSITION POTENTIAL INDICATORS

## OPTIONS

Sample ID: 0 Report Date: 04-13-1995 Sampled: 04-13-1995 at 1339

SATURATION LEVEL as IAP/Ksp			BOUND IONS		Total	Free
Calcite:	CaCO <sub>3</sub>	1.64	Calcium:		45.7	42.6
Aragonite:	CaCO <sub>3</sub>	1.43	Carbonate:		1.7	0.7
Calcium oxalate:	CaC <sub>2</sub> O <sub>4</sub>	0.00	Phosphate:		0.1	0.0
Anhydrite:	CaSO <sub>4</sub>	0.01				
Gypsum:	CaSO <sub>4</sub> *2H <sub>2</sub> O	0.01				
Calcium phosphate:	Ca <sub>3</sub> (PO <sub>4</sub> ) <sub>2</sub>	0.01				
Hydroxyapatite:	Ca <sub>5</sub> (PO <sub>4</sub> ) <sub>3</sub> (OH)	0.00				
Ca polyphosphate:	CaP <sub>2</sub> O <sub>7</sub>	0.00				
Silica:	SiO <sub>2</sub>	0.06				
Fluorite:	CaF <sub>2</sub>	0.00				
Brucite:	Mg(OH) <sub>2</sub>	0.00				
Magnesium silicate:	MgSiO <sub>3</sub>	0.00				
Ferric hydroxide:	Fe(OH) <sub>3</sub>	141.53				
Siderite:	FeCO <sub>3</sub>	1.39				
Strengite:	FePO <sub>4</sub> *2H <sub>2</sub> O	0.04				
Zinc hydroxide:	Zn(OH) <sub>2</sub>	0.00				
Zinc carbonate:	ZnCO <sub>3</sub>	0.00				
Zinc phosphate:	Zn <sub>3</sub> (PO <sub>4</sub> ) <sub>2</sub>	0.00				
Zn polyphosphate:	ZnP <sub>2</sub> O <sub>7</sub>	0.00				

## FREE ION MOMENTARY EXCESS

Calcite:	0.46
Aragonite:	0.35
Calcium oxalate:	-0.37
Anhydrite:	-780.39
Gypsum:	-671.94
Calcium phosphate:	-0.00
Hydroxyapatite:	-383.84
Ca polyphosphate:	-0.00
Silica:	-113.41
Fluorite:	-37.06
Brucite:	-4.49
Magnesium silicate:	-189.73
Ferric hydroxide:	0.00
Siderite:	0.01
Strengite:	-0.00
Zinc hydroxide:	-0.00
Zinc carbonate:	-1.09
Zinc phosphate:	-0.01
Zn polyphosphate:	-1.50

## SIMPLE INDICES

Langelier:	0.26
Ryznar:	7.53
Practical:	8.15
Larson-Skold:	0.73
Zinc solubility:	2.39
Pyro solubility:	3.73
Ortho solubility:	1.84

## OPERATING CONDITIONS

Temperature:	25.0
Time (secs):	5.60

Both Windows can  
be printed, or saved  
in Microsoft Word  
(.rtf) format.

# Set-up 'What-if' Scenario Options for Profiles

WaterCycle Rx Laboratory Edition

FILES INPUT WHAT-IF REPORTS FORMULARY LABORATORY PREFERENCES HELP

- ONCE THROUGH
  - Vary Temperature
  - Graph vs Temperature
  - Vary pH
  - Graph vs pH
  - 3D Profile
  - Select OT Parameters
- COOLING TOWER
  - Select Parameters
  - 2D TABLES and GRAPHS
    - Cycle
    - Graph vs Cycles (C,R,)
    - Vary Cycled Water Temperature
    - Graph vs Temperature
    - Vary Cycled Water pH
    - Graph vs pH
  - 3D GRAPHS
    - pH-T 3D Profile (typical)
    - pH-T 4D Profile (min-max)
    - pH-Cycles 3D Profile

### Once Through 'What-if' Scenarios

**pH Selection**

Low pH  High pH  Evaluation pH

**Temperature Selection**

Low Temp  High Temp  Evaluation Temp

**pH Control Method**

**Acids**

- 98% H2SO4
- 35% HCl
- 53% HNO3
- CO2
- NONE

**Alkalies**



- Caustic soda (NaOH)
- Caustic potash (KOH)
- Soda ash (Na2CO3)
- Sodium bicarbonate (NaHCO3)
- Lime (Ca(OH)2)
- NONE

pH Target

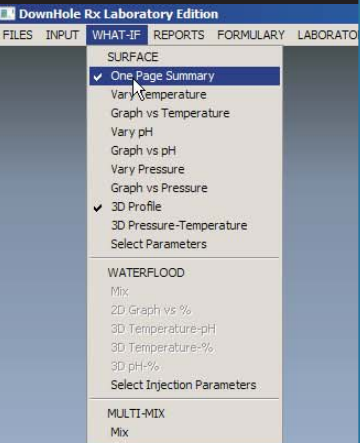
**pH Prediction Method**

- Default Curve
- User Curve
- Translate Source pH
- Caplan Curve

OK Cancel



# Display the One Page Summary Coming to WaterCycle Version 7 Fall 2009



## WaterCycle® Cooling System Evaluation

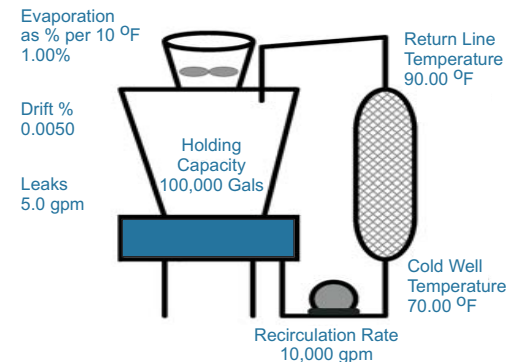


Calculated Using the French Creek Engine

### SYSTEM IDENTIFICATION

WaterCycle(tm) Cooling Tower Exam  
Lake Michigan Make-up Water

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



### WATER CHEMISTRY

#### Concentration Ratio

CATIONS	Makeup	5.00	5.50	6.00
Calcium (as CaCO3)	123.0	615.00	656.00	738.00
Magnesium (as CaCO3)	23.0	170.00	187.00	204.00
Sodium (as Na)	18.0	90.00	99.00	108.00
Potassium (as K)	0.0	0.00	0.00	0.00
Iron (as Fe)	0.01	0.0500	0.0550	0.0600
Ammonia (as NH3)	0.10	0.500	0.550	0.600
Aluminum (as Al)	0.2	1.15	1.26	1.38
Zinc (as Zn)	0.00	0.00	0.00	0.00
Boron (as B)	0.00	0.00	0.00	0.00

#### ANIONS

Chloride (as Cl)	34.0	170.00	187.00	204.00
Sulfate (as SO4)	23.0	115.00	126.50	138.00
Dissolved CO2	0.6	3.0	2.8	2.7
"M" Alkalinity	121.8	609.0	708.6	728.4
"P" Alkalinity	17.1	85.5	112.6	127.2
Oxalate (as C2O4)	0.00	0.00	0.00	0.00
Silica (as SiO2)	23.0	115.00	126.50	138.00
Phosphate (as PO4)	0.00	0.00	0.00	0.00
Pyrophosphate (PO4)	0.00	0.00	0.00	0.00
H2S (as H2S)	0.00	0.00	0.00	0.00
Fluoride (as F)	0.10	0.500	0.550	0.600
Nitrate (as NO3)	5.0	25.00	27.50	30.00

#### PARAMETERS

pH	7.00	8.63	8.69	8.74
Temperature (°F)	77.0	110.00	110.00	110.00
Calculated TDS		1517	1652	1786
Calculated Cond.		1412	1506	1596
Suspended Solids	0.00	0.00	0.00	0.00

#### DOSAGE (mg/L)

100% PBTC		6.77	7.88	[ 9.0 ]
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### SCALE POTENTIAL

#### Concentration Ratio

#### SATURATION LEVEL

SATURATION LEVEL	5.00	5.50	6.00
Calcite	144.32	179.99	218.62
Aragonite	122.90	153.28	186.18
Calcium oxalate	0.00	0.00	0.00
Anhydrite	0.0709	0.0797	0.0886
Gypsum	0.0775	0.0871	0.0967
Calcium phosphate	0.00	0.00	0.00
Hydroxyapatite	0.00	0.00	0.00
Ca pyrophosphate	0.00	0.00	0.00
Fluorite	0.00104	0.00129	0.00159
Silica	0.561	0.606	0.649
Brucite	0.0239	0.0328	0.0437
Magnesium silicate	6.58	9.78	13.94
Ferric hydroxide	305.12	307.98	308.68
Siderite	3.11	2.84	2.58
Strengite	0.00	0.00	0.00
Struvite	0.00	0.00	0.00
Zinc hydroxide	0.00	0.00	0.00
Zinc carbonate	0.00	0.00	0.00
Zinc phosphate	0.00	0.00	0.00
Zinc pyrophosphate	0.00	0.00	0.00

#### SIMPLE INDICES

Langelier	2.50	2.63	2.75
Ryznar	3.63	3.43	3.24
Practical	3.64	3.44	3.25
Larson-Skold	0.594	0.595	0.596
Ca Total	246.31	270.94	295.57
Free	170.63	181.95	192.67
CO3 Total	98.87	122.55	148.06
Free	19.94	24.10	28.49
PO4 Total	0.00	0.00	0.00
Free	0.00	0.00	0.00

# Profile versus pH, or temperature

## Output as Tables or 2D Graphs

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DEPOSITION POTENTIAL INDICATORS VERSUS TEMPERATURE

OPTIONS CHANGE RANGE

Sample ID: 0 Report Date: 04-13-1995 Sampled: 04-13-1995 at 1339

Sample ID: 0 Report Date: 04-13-1995 Sampled: 04-13-1995 at 1339

Sample ID: 0 Report Date: 04-13-1995 Sampled: 04-13-1995 at 1339

TEMPERATURE (°C)

	22.00	26.00	30.00	34.00	38.00	42.00	46.00
<b>SATURATION LEVEL</b>							
Calcite (CaCO <sub>3</sub> )	3.14	3.60	4.09	4.60	5.13	5.67	6.24
Aragonite (CaCO <sub>3</sub> )	2.74	3.13	3.54	3.96	4.39	4.83	5.30
Calcium oxalate	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Anhydrite (CaSO <sub>4</sub> )	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Gypsum (CaSO <sub>4</sub> *2H <sub>2</sub> O)	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Tricalcium phosphate	0.05	0.06	0.09	0.11	0.15	0.19	0.24
Hydroxylapatite	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ca polyphosphate	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fluorite (CaF <sub>2</sub> )	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Silica (SiO <sub>2</sub> )	0.06	0.06	0.05	0.05	0.04	0.04	0.03
Brucite (Mg(OH) <sub>2</sub> )	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Magnesium silicate	0.01	0.01	0.01	0.02	0.03	0.05	0.07
Ferric hydroxide	137.56	170.76	210.48	258.04	313.96	379.24	454.67
Siderite (FeCO <sub>3</sub> )	0.58	0.71	0.87	1.04	1.23	1.44	1.68
Strengite (FePO <sub>4</sub> )	0.01	0.01	0.01	0.02	0.02	0.03	0.04
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 polyphosphate	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>SIMPLE INDICES</b>							
Langelier Saturation	0.6	0.6	0.7	0.7	0.8	0.9	0.9
Ryznar Stability	7.3	7.1	7.0	6.9	6.8	6.7	6.6
Practical	8.3	8.1	8.0	7.9	7.8	7.7	7.6
Larson-Skold	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Max. Sol. Zn	2.1	1.4	0.9	0.6	0.4	0.3	0.2
Max. Sol. Pyro	3.6	3.8	3.9	4.1	4.3	4.4	4.6
Max. Sol. Ortho	1.0	0.9	0.9	0.8	0.8	0.8	0.7
<b>TOTAL VERSUS FREE IONS</b>							
Total Calcium	45.7	45.7	45.7	45.7	45.7	45.7	45.7
Free Calcium	42.4	42.1	41.8	41.5	41.2	40.8	40.5
Total Carbonate	3.4	3.7	4.1	4.4	4.7	5.1	5.4
Free Carbonate	1.4	1.5	1.6	1.7	1.8	1.9	2.0
Total Phosphate	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Free Phosphate	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<b>MOMENTARY EXCESS (mg/L above Equil.)</b>							
Calcite (CaCO <sub>3</sub> )	1.61	1.84	2.06	2.26	2.45	2.63	2.80
Aragonite (CaCO <sub>3</sub> )	1.50	1.73	1.95	2.16	2.35	2.53	2.70
Calcium oxalate	-0.37	-0.37	-0.37	-0.38	-0.38	-0.38	-0.39
Anhydrite (CaSO <sub>4</sub> )	-807.39	-771.25	-737.60	-706.23	-676.94	-649.56	-623.94
Gypsum (CaSO <sub>4</sub> *2H <sub>2</sub> O)	-668.86	-672.76	-676.66	-680.56	-684.46	-688.37	-692.28
Tricalcium phosphate	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
Hydroxylapatite	-373.91	-386.71	-399.61	-412.60	-425.68	-438.85	-452.10
Ca polyphosphate	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
Fluorite (CaF <sub>2</sub> )	-36.65	-37.31	-37.97	-38.64	-39.30	-39.96	-40.63
Silica (SiO <sub>2</sub> )	-104.67	-116.60	-129.45	-143.24	-158.02	-173.82	-190.67

WATER CHEMISTRY VERSUS TEMPERATURE

OPTIONS NEW TREATMENT CHANGE RANGE

Sample ID: 0 Report Date: 04-13-1995 Sampled: 04-13-1995 at 1339

TEMPERATURE (°C)

	22.00	26.00	30.00	34.00	38.00	42.00	46.00
<b>CATIONS</b>							
Calcium(as CaCO <sub>3</sub> )	114.00	114.00	114.00	114.00	114.00	114.00	114.00
Magnesium(as CaCO <sub>3</sub> )	35.00	35.00	35.00	35.00	35.00	35.00	35.00
Sodium(as Na)	6.41	6.41	6.41	6.41	6.41	6.41	6.41
Potassium(as K)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron(as Fe)	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Ammonia(as NH <sub>3</sub> )	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aluminum(as Al)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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
<b>ANIONS</b>							
Chloride(as Cl)	23.0	23.0	23.0	23.0	23.0	23.0	23.0
Sulfate(as SO <sub>4</sub> )	35.0	35.0	35.0	35.0	35.0	35.0	35.0
Dissolved CO <sub>2</sub>	1.0	1.0	1.0	0.9	0.9	0.9	0.9
"M" Alkalinity	93.3	93.3	93.4	93.4	93.5	93.6	93.8
"P" Alkalinity	2.9	3.2	3.6	3.9	4.3	4.7	5.1
Oxalic acid(moles/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Silica(as SiO <sub>2</sub> )	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Phosphate(as PO <sub>4</sub> )	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Pyrophosphate(as PO <sub>4</sub> )	0.0	0.0	0.0	0.0	0.0	0.0	0.0
H <sub>2</sub> S (as H <sub>2</sub> S)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fluoride(as F)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitrate(as NO <sub>3</sub> )	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>PARAMETERS</b>							
pH	8.40	8.40	8.40	8.40	8.40	8.40	8.40
Temperature(Deg C)	22.00	26.00	30.00	34.00	38.00	42.00	46.00
Calculated T.D.S.	241.16	240.78	240.40	240.03	239.69	239.36	239.04
Calculated Cond.	318.40	316.67	314.89	313.08	311.28	309.49	307.70
Suspended Solids	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Start Server Manager WATLAB32 - Microsoft Vi... CorelDRAW X4 - [E:]amt... WaterCycle Rx Labor... 4:56 PM

# Profile versus pH, or temperature

## Output as Tables or 2D Graphs

WaterCycle Rx Laboratory Edition

FILES INPUT WHAT-IF REPORTS FORMULARY LABORATORY PREFERENCES HELP

SOURCE WATER DEPOSITION POTENTIAL INDICATORS

OPTIONS

Sample ID: 0 Report Date: 04-13-1995 Sampled: 04-13

DEPOSITION POTENTIAL INDICATORS VERSUS TEMPERATURE

OPTIONS CHANGE RANGE

Sample ID: 0 Report Date: 04-13-1995 Sampled: 04-13-1995 at 1339

	TEMPERATURE (°C)						
SATURATION LEVEL	22.00	26.00	30.00	34.00	38.00	42.00	46.00
Calcite (CaCO <sub>3</sub> )	3.14	3.60	4.09	4.60	5.13	5.67	6.24

SOURCE WATER ANALYSIS

OPTIONS

Sample ID: 0 Report Date: 04-13-1995 Sampled: 04-13-1995 at 1339

WATER CHEMISTRY VERSUS TEMPERATURE

OPTIONS NEW TREATMENT CHANGE RANGE

Sample ID: 0 Report Date: 04-13-1995 Sampled: 04-13-1995 at 1339

	TEMPERATURE (°C)					
CATIONS	22.00	26.00	30.00	34.00	38.00	42.00
Calcium(as CaCO <sub>3</sub> )	114.00	114.00	114.00	114.00	114.00	114.00
Magnesium(as CaCO <sub>3</sub> )	35.00	35.00	35.00	35.00	35.00	35.00
Sodium(as Na)	6.41	6.41	6.41	6.41	6.41	6.41
Potassium(as K)	0.00	0.00	0.00	0.00	0.00	0.00
Iron(as Fe)	0.05	0.05	0.05	0.05	0.05	0.05
Ammonia(as NH <sub>3</sub> )	0.00	0.00	0.00	0.00	0.00	0.00

Calcite Saturation Level

Temperature (°C)	Saturation Level
22.0	3.14
26.0	3.60
30.0	4.09
34.0	4.60
38.0	5.13
42.0	5.67
46.0	6.24

UTILITY ONE Dosage Profile

Temperature (°C)	Dosage (mg/L)
22.0	0.28
26.0	0.38
30.0	0.50
34.0	0.65
38.0	0.85
42.0	1.00
46.0	1.08

VERSUS FREE IONS

1 Calcium	45.7	45.7	45.7	45.7	45.7	45.7	45.7
Calcium	42.4	42.1	41.8	41.5	41.2	40.8	40.5
1 Carbonate	3.4	3.7	4.1	4.4	4.7	5.1	5.4
Carbonate	1.4	1.5	1.6	1.7	1.8	1.9	2.0
1 Phosphate	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Phosphate	0.0	0.0	0.0	0.0	0.0	0.0	0.0

ARY EXCESS (mg/L above Equil.)

ite (CaCO <sub>3</sub> )	1.61	1.84	2.06	2.26	2.45	2.63	2.80
onite (CaCO <sub>3</sub> )	1.50	1.73	1.95	2.16	2.35	2.53	2.70
ium oxalate	-0.37	-0.37	-0.37	-0.38	-0.38	-0.38	-0.39
drite (CaSO <sub>4</sub> )	-807.39	-771.25	-737.60	-706.23	-676.94	-649.56	-623.94
um (CaSO <sub>4</sub> *2H <sub>2</sub> O)	-668.86	-672.76	-676.66	-680.56	-684.46	-688.37	-692.28
alcium phosphate	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
Hydroxylapatite	-373.91	-386.71	-399.61	-412.60	-425.68	-438.85	-452.10
Ca polyphosphate	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
Fluorite (CaF <sub>2</sub> )	-36.65	-37.31	-37.97	-38.64	-39.30	-39.96	-40.63
Silica (SiO <sub>2</sub> )	-104.67	-116.60	-129.45	-143.24	-158.02	-173.82	-190.67

Start Server Manager WATLAB32 - Microsoft Vi... CorelDRAW X4 - [E:]am... WaterCycle Rx Labor... 4:56 PM

# Profile versus pH, or temperature

## Display and Output as Tables or 2D Graphs

WaterCycle Rx Laboratory DEPOSITION POTENTIAL INDICATORS VERSUS pH

Sample ID: 0 Report Date: 04-13-1995 Sampled: 04-13-1995

	pH				
SATURATION LEVEL	7.60	7.80	8.00	8.20	8.40
Calcite (CaCO <sub>3</sub> )	1.00	1.56	2.43	3.74	5.68
Aragonite (CaCO <sub>3</sub> )	0.85	1.33	2.07	3.19	4.84
Calcium oxalate	0.00	0.00	0.00	0.00	0.00
Anhydrite (CaSO <sub>4</sub> )	0.01	0.01	0.01	0.01	0.01
Gypsum (CaSO <sub>4</sub> *2H <sub>2</sub> O)	0.01	0.01	0.01	0.01	0.01
Tricalcium phosphate	0.01	0.02	0.04	0.09	0.15
Hydroxylapatite	0.00	0.00	0.00	0.00	0.00

	pH				
TOTAL PHOSPHATE	7.60	7.80	8.00	8.20	8.40
Total Phosphate	0.1	0.1	0.1	0.1	0.1
Free Phosphate	0.0	0.0	0.0	0.0	0.0

FREE ION MOMENTARY EXCESS (ppm)					
	pH				
	7.60	7.80	8.00	8.20	8.40
Calcite (CaCO <sub>3</sub> )	-0.00	0.31	0.79	1.53	2.63
Aragonite (CaCO <sub>3</sub> )	-0.10	0.22	0.70	1.43	2.53
Calcium oxalate	-0.38	-0.38	-0.38	-0.38	-0.38
Anhydrite (CaSO <sub>4</sub> )	-649.79	-649.76	-649.72	-649.67	-649.60
Gypsum (CaSO <sub>4</sub> *2H <sub>2</sub> O)	-688.52	-688.51	-688.48	-688.45	-688.42
Tricalcium phosphate	-0.00	-0.00	-0.00	-0.00	-0.00
Hydroxylapatite	-439.67	-439.57	-439.42	-439.19	-438.87
Ca polyphosphate	-0.00	-0.00	-0.00	-0.00	-0.00
Fluorite (CaF <sub>2</sub> )	-39.74	-39.77	-39.81	-39.87	-39.96
Silica (SiO <sub>2</sub> )	-173.42	-173.47	-173.54	-173.65	-173.82
Brucite (Mg(OH) <sub>2</sub> )	-4.70	-4.69	-4.66	-4.62	-4.55

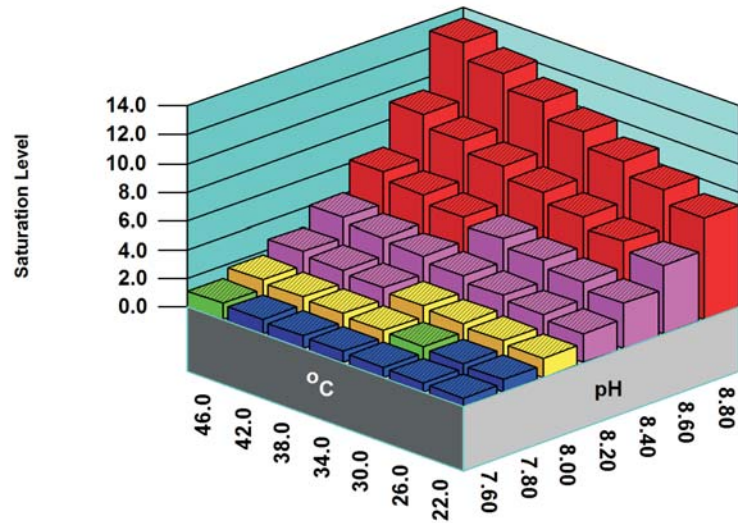
at 42.0 °C

at 42.0 °C

# Profile versus pH & Temperature plot indices, predicted corrosion rates, dosage

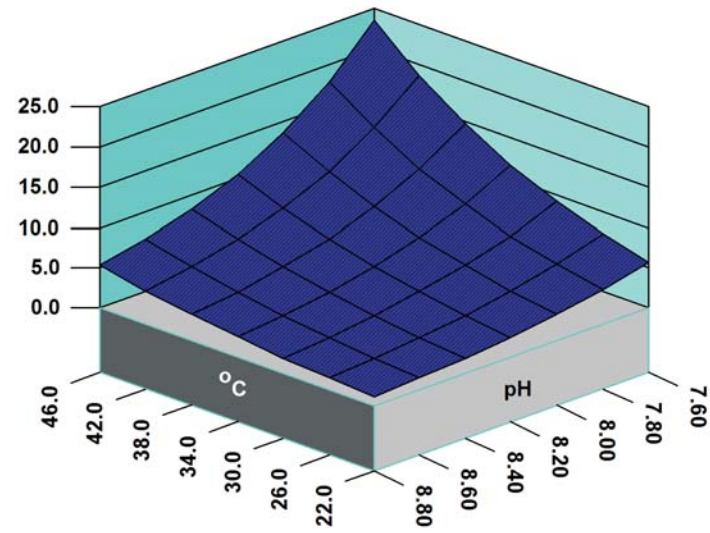
Display and Output as  
3D Contour or Bar Graphs

### Calcite Saturation Level

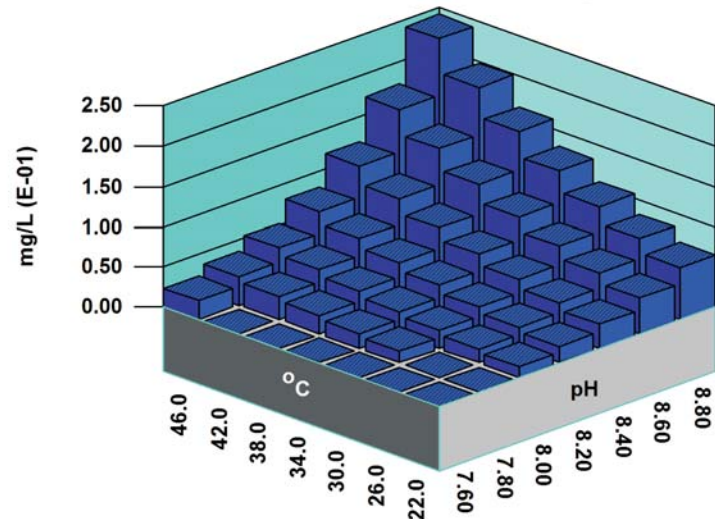


Select a Treatment  
for Dosage Profiles

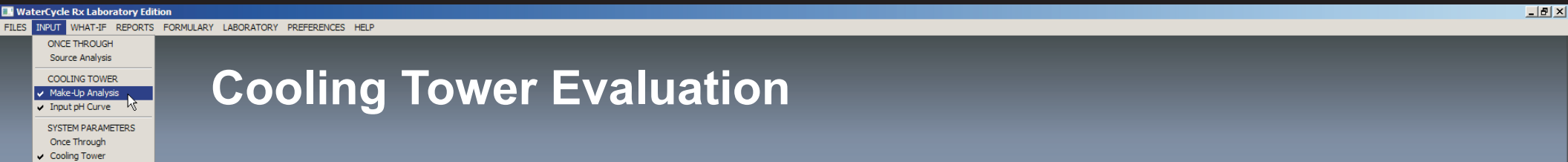
### 1010 Carbon Steel



### HEDP-PAA Blend Dosage Profile



# Profile Cooling Water Over a Broad Range of COC with and without pH control compare treatment dosages and limits



WaterCycle<sup>®</sup> 



French Creek Software  
Scale & Corrosion Software Tools

# The first step is the Make-up Water Chemistry Input

Always check the Analytical Units  
Click on **Change Units** if they aren't just right!

**WaterCycle Rx Laboratory Edition**

FILES INPUT WHAT-IF REPORTS FORMULARY LABORATORY PREFERENCES HELP

ONCE THROUGH  
Source Analysis

COOLING TOWER

Make-Up Analysis  
Input pH Curve

SYSTEM PARAMETERS  
Once Through  
Cooling Tower

### Water Chemistry Input

Sample Date 1990-11-17 Time 16:45 ID# 0 Report Date 1990-11-17

Sample Description

WaterCycle(tm)	Lake Michigan
Cooling Tower Exam	Make-up Water

Calcium (as CaCO3)	123.00	Aluminum (as Al)	0.230	Hydrogen sulfide (as H2S)	0.00
Magnesium (as CaCO3)	34.00	Zinc (as Zn)	0.00	Silica (as SiO2)	23.00
Sodium (as Na)	18.00	Boron (as B)	0.00	Phosphate (as PO4)	0.00
Potassium (as K)	0.00	Chloride (as Cl)	34.00	Polyphosphate (as PO4)	0.00
Iron (as Fe)	0.0100	Sulfate (as SO4)	23.00	Fluoride (as F)	0.100
Ammonia (as NH3)	0.100	M Alkalinity (as CaCO3)	123.00	Nitrate (as NO3)	5.00
pH	7.00	P Alkalinity (as CaCO3)	0.00	Temperature (as °F)	77.00
Comments at Chicagod		Oxalic Acid (moles/L)	0.00	Corrosion target (as mpy)	1.00
		Cyanide (as HCN)	0.00	Suspended Solids (mg/L)	0.00

OK Change Units Set Constant Recalculate Cancel

**French Creek Software**

WaterCycle<sup>®</sup> Rx

# The second step: System Specifications

Always check the Units for flows, volumes  
Go to PREFERENCES and UNITS to change

WaterCycle Rx Laboratory Edition

FILES INPUT WHAT-IF REPORTS FORMULARY LABORATORY PREFERENCES HELP

- ONCE THROUGH  
Source Analysis
- COOLING TOWER
  - Make-Up Analysis
  - Input pH Curve
- SYSTEM PARAMETERS
  - Once Through
  - Cooling Tower

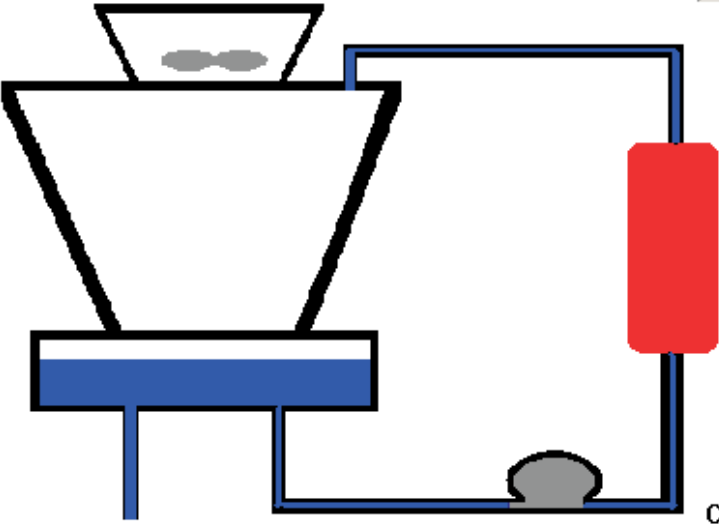
### Cooling Tower System Specifications

Evaporation: 1. %  
per 10 °F

Drift (%): 5.e-003

Leaks (GPM): 5.

Return Line Temperature: 90. °F



C.R.: 5.2

Makeup: 247.62 (GPM)

Evaporation: 200. (GPM)

Drift: 0.5 (GPM)

Leaks: 5. (GPM)

Blowdown: 42.119 (GPM)

Half Life: 24.255 (Hours)

Holding Capacity (Gals): 100000.

Recirculation Rate (GPM): 10000.

Cold Well Temperature: 70. °F

System Identification

WaterCycle(tm)	Lake Michigan
Cooling Tower Exam	Make-up Water

OK RECALC PRINT COPY SAVE FILE LOAD FILE CANCEL

French Creek Software

Cycle® Rx

5:23 PM

# Set-up the Cycles of Concentration range and other Parameters for 'What-if' Scenarios

WaterCycle Rx Laboratory Edition

FILES INPUT WHAT-IF REPORTS FORMULARY LABORATORY PREFERENCES HELP

ONCE THROUGH  
Vary Temperature  
Graph vs Temperature  
Vary pH  
Graph vs pH  
3D Profile  
Select OT Parameters

COOLING TOWER  
Select Parameters  
2D TABLES and GRAPHS  
✓ Display Cycled H2O  
✓ Graph vs Cycles (C.R.)  
Vary Cycled Water Temperature  
Graph vs Temperature  
Vary Cycled Water pH  
Graph vs pH  
3D GRAPHS  
pH-T 3D Profile (typical)  
pH-T 4D Profile (min-max)  
pH-Cycles 3D Profile

### Select Cycled Parameters

Concentration Ratio Range For Cycled Water

Start Cycles  Final Cycles  Increment

pH Control Method

Acids

- 98% H2SO4
- 35% HCl
- 53% HNO3
- CO2
- NONE

Alkalies

- Caustic soda (NaOH)
- Caustic potash (KOH)
- Soda ash (Na2CO3)
- Sodium bicarbonate (NaHCO3)
- Lime (Ca(OH)2)
- NONE

pH Target

pH Prediction Method

- Default Curve
- User Curve
- Translate Source pH
- Caplan Curve

Temperature Range For 3D And 4D Graphs

Minimum  Maximum

Typical Temperature

Used For Cycled Water Table And 2D Graphs




pH Range For 3D And 4D Graphs

Low pH  High pH

Concentration Ratio Selection For 3D And 4D Graphs

4D Minimum  4D Maximum  3D And Typical

OK Cancel



# Cycle

## Output & Display as Tables or 2D Graphs

WaterCycle Rx Laboratory Edition

FILES INPUT WHAT-IF REPORTS FORMULARY LABORATORY PREFERENCES HELP

ONCE THROUGH  
 Vary Temperature  
 Graph vs Temperature  
 Vary pH  
 Graph vs pH  
 3D Profile  
 Select OT Parameters

COOLING TOWER  
 Select Parameters  
 2D TABLES and GRAPHS  
**Cycle**  
 Graph vs Cycles (C.R.)  
 Vary Cycled Water Temperature  
 Graph vs Temperature

RECIRCULATING WATER CHEMISTRY  
 OPTIONS NEW TREATMENT CHANGE RANGE

Sample ID: 0 Report Date: 1990-11-17 Sampled: 1990-11-17

	5.00	5.17	5.33	5.50	5.67
<b>CATIONS</b>					
Calcium(as CaCO <sub>3</sub> )	615.00	635.50	656.00	676.50	697.00
Magnesium(as CaCO <sub>3</sub> )	170.00	175.67	181.33	187.00	192.67
Sodium(as Na)	90.00	93.00	96.00	99.00	102.00
Potassium(as K)	0.00	0.00	0.00	0.00	0.00
Iron(as Fe)	0.05	0.05	0.05	0.05	0.06
Ammonia(as NH <sub>3</sub> )	0.50	0.52	0.53	0.55	0.57
Aluminum(as Al)	1.15	1.19	1.23	1.26	1.30
Zinc(as Zn)	0.00	0.00	0.00	0.00	0.00
Boron(as B)	0.00	0.00	0.00	0.00	0.00
<b>ANIONS</b>					
Chloride(as Cl)	170.0	175.7	181.3	187.0	192.7
Sulfate(as SO <sub>4</sub> )	115.0	118.8	122.7	126.5	130.3
Dissolved CO <sub>2</sub>	3.0	2.9	2.9	2.8	2.8
"M" Alkalinity	609.0	629.0	648.9	668.8	688.7
"P" Alkalinity	85.5	92.0	98.7	105.6	112.6
Oxalic acid(moles/L)	0.0	0.0	0.0	0.0	0.0
Silica(as SiO <sub>2</sub> )	115.0	118.8	122.7	126.5	130.3
Phosphate(as PO <sub>4</sub> )	0.0	0.0	0.0	0.0	0.0
Pyrophosphate(as PO <sub>4</sub> )	0.0	0.0	0.0	0.0	0.0
H <sub>2</sub> S (as H <sub>2</sub> S)	0.0	0.0	0.0	0.0	0.0
Fluoride(as F)	0.50	0.52	0.53	0.55	0.57
Nitrate(as NO <sub>3</sub> )	25.00	25.83	26.67	27.50	28.33
<b>PARAMETERS</b>					
pH	8.63	8.65	8.67	8.69	8.71
Temperature(Deg F)	110.00	110.00	110.00	110.00	110.00
Calculated T.D.S.	1516.58	1562.00	1607.19	1652.14	1696.84
Calculated Cond.	1411.71	1443.74	1475.25	1506.21	1536.66
Suspended Solids	0.00	0.00	0.00	0.00	0.00
<b>DOSAGE</b>					
100% PBTC	6.77	7.14	7.51	7.88	[ 8.26] [

RECIRCULATING WATER DEPOSITION POTENTIAL INDICATORS  
 OPTIONS CHANGE RANGE

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

	5.00	5.17	5.33	5.50	5.67	5.83	6.00
<b>SATURATION LEVEL</b>							
Calcite (CaCO <sub>3</sub> )	144.32	155.89	167.77	179.99	192.55	205.43	218.62
Aragonite (CaCO <sub>3</sub> )	122.90	132.75	142.87	153.28	163.98	174.95	186.18
Calcium oxalate	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Anhydrite (CaSO <sub>4</sub> )	0.07	0.07	0.08	0.08	0.08	0.09	0.09
Gypsum (CaSO <sub>4</sub> *2H <sub>2</sub> O)	0.08	0.08	0.08	0.09	0.09	0.09	0.10
Tricalcium phosphate	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydroxylapatite	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ca polyphosphate	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fluorite (CaF <sub>2</sub> )	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Silica (SiO <sub>2</sub> )	0.56	0.58	0.59	0.61	0.62	0.64	0.65
Brucite (Mg(OH) <sub>2</sub> )	0.02	0.03	0.03	0.03	0.04	0.04	0.04
Magnesium silicate	6.58	7.55	8.61	9.78	11.05	12.44	13.94
Ferric hydroxide	305.12	306.33	307.30	307.98	308.42	308.64	308.68
Siderite (FeCO <sub>3</sub> )	3.11	3.02	2.93	2.84	2.75	2.67	2.58
Strengite (FePO <sub>4</sub> )	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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 polyphosphate	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>SIMPLE INDICES</b>							
Langelier Saturation	2.5	2.5	2.6	2.6	2.7	2.7	2.8
Ryznar Stability	3.6	3.6	3.5	3.4	3.4	3.3	3.2
Practical	3.6	3.6	3.5	3.4	3.4	3.3	3.2
Larson-Skold	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Max. Sol. Zn	3.6	3.8	3.9	4.0	4.1	4.2	4.3
Max. Sol. Pyro	2.0	2.0	2.0	2.0	1.9	1.9	1.9
Max. Sol. Ortho	0.8	0.8	0.8	0.8	0.8	0.8	0.8
<b>TOTAL VERSUS FREE IONS</b>							
Total Calcium	246.3	254.5	262.7	270.9	279.1	287.4	295.6
Free Calcium	170.6	174.5	178.2	181.9	185.6	189.2	192.7
Total Carbonate	98.9	106.6	114.4	122.5	130.9	139.4	148.1
Free Carbonate	19.9	21.3	22.7	24.1	25.5	27.0	28.5
Total Phosphate	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Free Phosphate	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<b>FREE ION MOMENTARY EXCESS (ppm)</b>							
Calcite (CaCO <sub>3</sub> )	33.01	35.28	37.60	39.96	42.36	44.80	47.28
Aragonite (CaCO <sub>3</sub> )	32.96	35.24	37.55	39.91	42.32	44.76	47.24
Calcium oxalate	-0.16	-0.16	-0.16	-0.16	-0.15	-0.15	-0.15
Anhydrite (CaSO <sub>4</sub> )	-646.38	-644.71	-643.02	-641.30	-639.56	-637.79	-636.01
Gypsum (CaSO <sub>4</sub> *2H <sub>2</sub> O)	-685.99	-683.90	-681.77	-679.62	-677.45	-675.26	-673.05
Tricalcium phosphate	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
Hydroxylapatite	-547.57	-549.96	-552.29	-554.56	-556.77	-558.93	-561.04
Ca polyphosphate	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
Fluorite (CaF <sub>2</sub> )	-27.73	-27.54	-27.36	-27.19	-27.02	-26.85	-26.70
Silica (SiO <sub>2</sub> )	-81.43	-78.60	-75.80	-73.04	-70.33	-67.67	-65.04
Brucite (Mg(OH) <sub>2</sub> )	-2.85	-2.80	-2.76	-2.72	-2.67	-2.63	-2.59

# Cycle

## Output & Display as Tables or 2D Graphs

WaterCycle Rx Laboratory Edition

FILES INPUT WHAT-IF REPORTS FORMULARY LABORATORY PREFERENCES HELP

ONCE THROUGH  
 Vary Temperature  
 Graph vs Temperature  
 Vary pH  
 Graph vs pH  
 3D Profile  
 Select OT Parameters

COOLING TOWER  
 Select Parameters  
 2D TABLES and GRAPHS  
**Cycle**  
 Graph vs Cycles (C.R.)  
 Vary Cycled Water Temperature  
 Graph vs Temperature

RECIRCULATING WATER CHEMISTRY  
 OPTIONS NEW TREATMENT CHANGE RANGE

Sample ID: 0 Report Date: 1990-11-17 Sampled: 1990-11-17

RECIRCULATING WATER DEPOSITION POTENTIAL INDICATORS  
 OPTIONS CHANGE RANGE

Sample ID: 0 Report Date: 1990-11-17 Sampled: 1990-11-17

SATURATI  
 Calcit  
 Aragon  
 Calcit  
 Anhydr  
 Gypsum  
 Trical  
 Hydrox  
 Ca pol  
 Fluori  
 Silica  
 Brucit

Concentration Ratio

Level

220

200

untreated  
 color  
 coding

at 110 °F

100% PBTC Dosage Profile

mg/L

9.50

9.00

8.50

8.00

7.50

7.00

6.50

5.00 5.17 5.33 5.50

Concentration Ratio

CATIONS  
 Calcium(as CaCC  
 Magnesium(as Ca  
 Sodium(as Na)  
 Potassium(as K)  
 Iron(as Fe)  
 Ammonia(as NH3)  
 Aluminum(as Al)  
 Zinc(as Zn)  
 Boron(as B)

ANIONS  
 Chloride(as Cl)  
 Sulfate(as SO4)  
 Dissolved CO2  
 "M" Alkalinity  
 "P" Alkalinity  
 Oxalic acid(mol  
 Silica(as SiO2)  
 Phosphate(as PC  
 Pyrophosphate(a  
 H2S (as H2S)  
 Fluoride(as F)  
 Nitrate(as NO3)

PARAMETERS

pH	8.63	8.65	8.67	8.69	8.71
Temperature(Deg F)	110.00	110.00	110.00	110.00	110.00
Calculated T.D.S.	1516.58	1562.00	1607.19	1652.14	1696.84
Calculated Cond.	1411.71	1443.74	1475.25	1506.21	1536.66
Suspended Solids	0.00	0.00	0.00	0.00	0.00

DOSAGE

100% PBTC	6.77	7.14	7.51	7.88	[ 8.26 ] [ 8.63 ]
-----------	------	------	------	------	-------------------

Calcite Saturation Level

Saturation Level

220

200

180

160

140

treated

at 110 °F

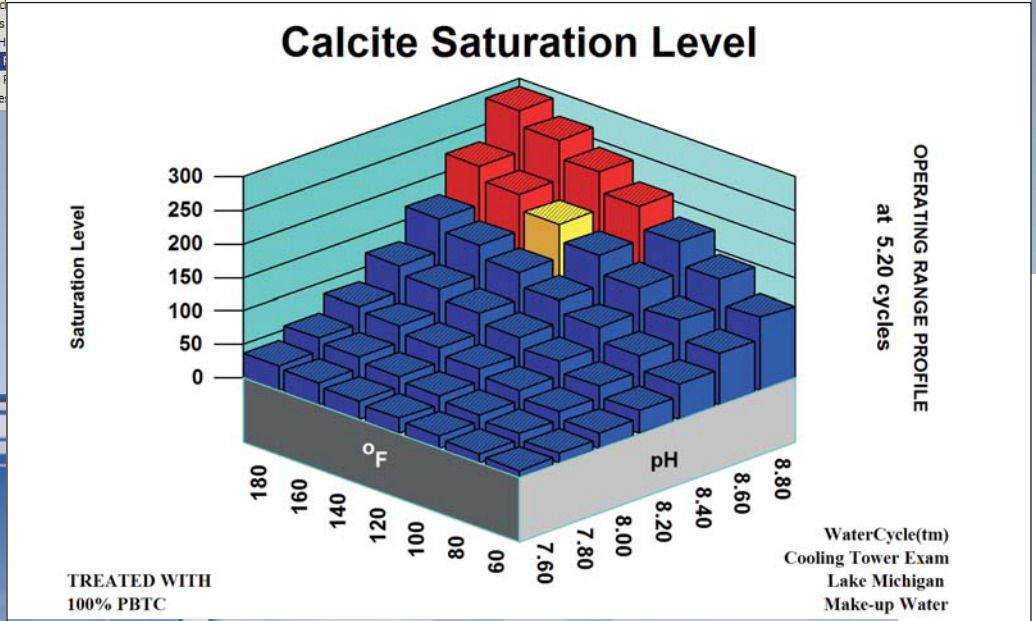
5.00 5.17 5.33 5.50 5.67 5.83 6.00

Concentration Ratio

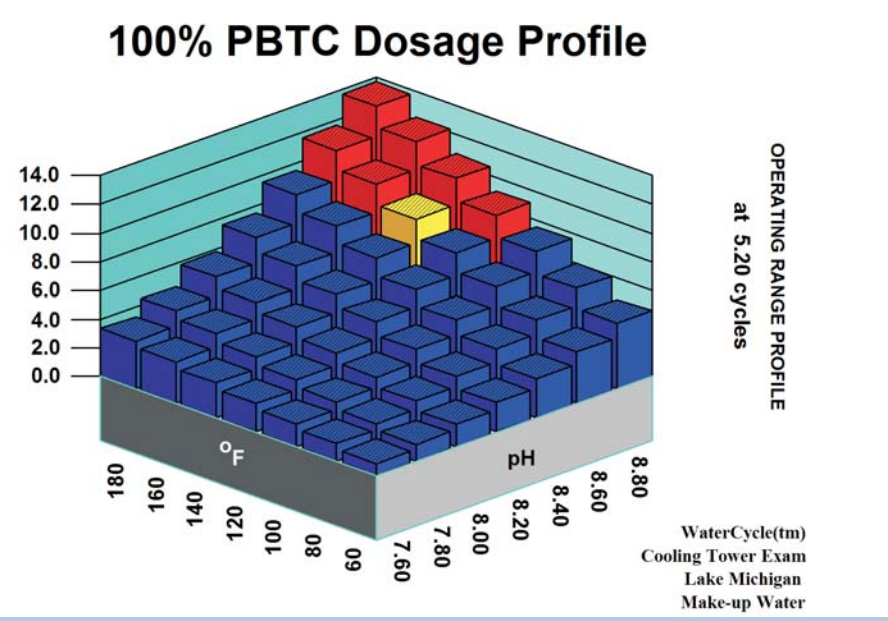
# Profile Operating Range

Profile versus Temperature & pH at Target COC (3D)  
 or versus pH & Temperature at the Min and Max COC (4D)  
 or versus pH & Cycles

- ONCE THROUGH
  - Vary Temperature
  - Graph vs Temperature
  - Vary pH
  - Graph vs pH
  - 3D Profile
  - Select OT Parameters
- COOLING TOWER
  - Select Parameters
  - 2D TABLES and GRAPHS
  - Display Cycled H2O
  - Graph vs Cycles (C.R.)
  - Vary Cycled Water Temperature
  - Graph vs Temperature
  - Vary Cycled Water
  - Graph vs
  - 3D GRAPH
  - pH-T 3D
  - pH-T 4D
  - pH-Cycle



Plot any Indices,  
 Dosages, or  
 Corrosion Rates  
 calculated by the program



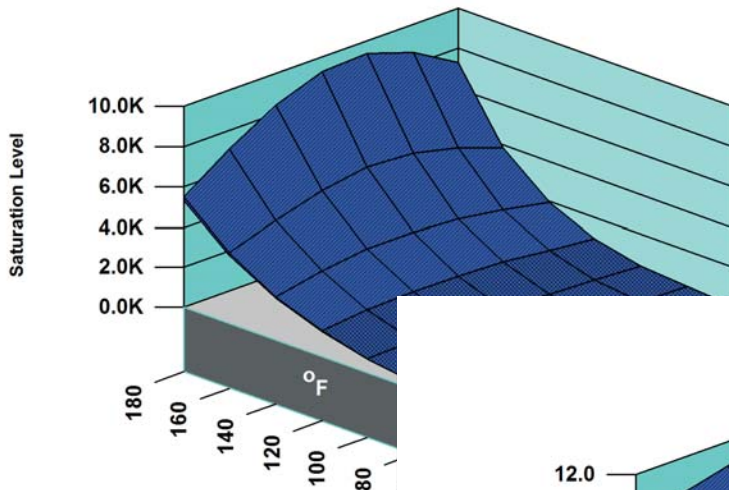
Scale & Corrosion So

# Profile Operating Range

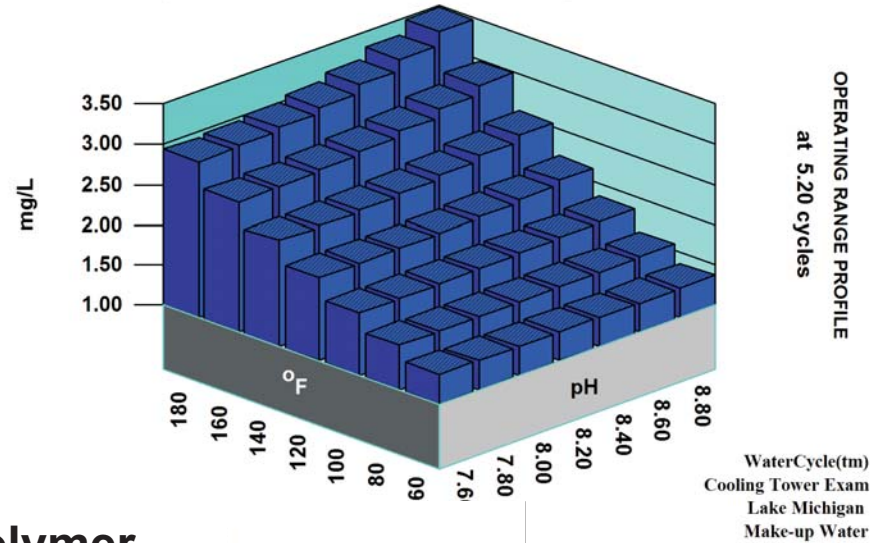
Profile versus Temperature & pH at Target COC (3D)  
 or versus pH & Temperature at the Min and Max COC (4D)  
 or versus pH & Cycles

- ONCE THROUGH
  - Vary Temperature
  - Graph vs Temperature
  - Vary pH
  - Graph vs pH
  - 3D Profile
  - Select OT Parameters
- COOLING TOWER
  - Select Parameters
  - 2D TABLES and GRAPHS
  - Display Cycled H2O
  - Graph vs Cycles (C.R.)
  - Vary Cycles
  - Graph vs
  - Vary Cycles
  - Graph vs
  - 3D GRAPH
  - pH-T 3D
  - pH-T 4D
  - pH-Cycle

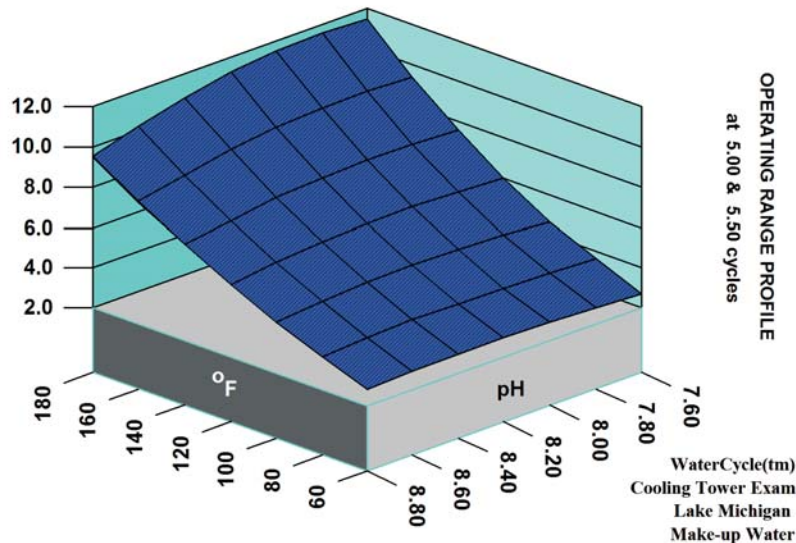
## Calcium Phosphate Saturation



## Pyrophosphate Dosage Profile



## Copolymer



French Creek  
 Software

some say Cycles,  
 others COC (cycles of concentration)  
 and others CR (concentration ratio)

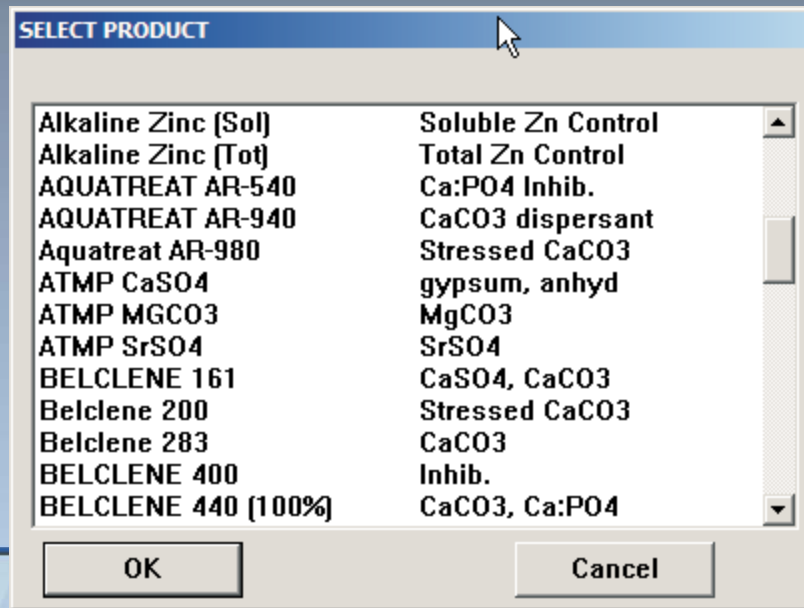
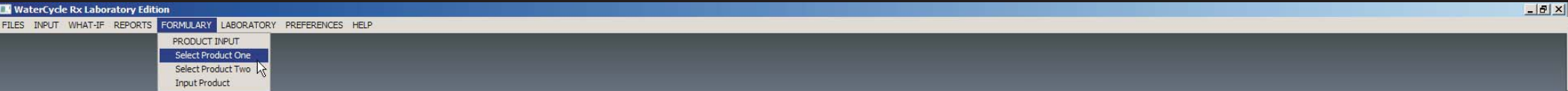
# Antiscalant & Corrosion Inhibitor Selection

Products can be selected in several convenient locations in the program.

Under FORMULARY in the Main Menu system –

At the top of graphs by clicking NEW TREATMENT

At the top of tables by clicking NEW TREATMENT



WaterCycle® 



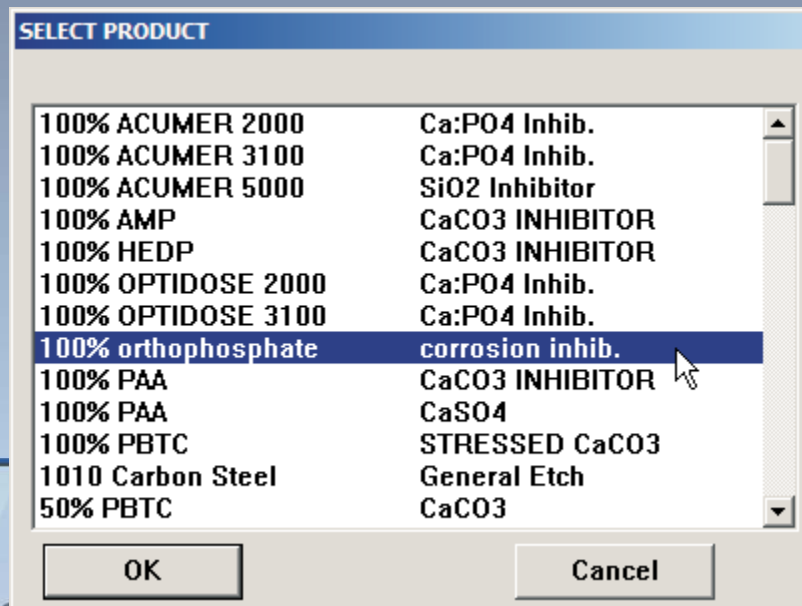
French Creek Software  
Scale & Corrosion Software Tools



# Select Two Products for Sequential Processing



**Product 1** should be a solubility limited inhibitor such as Orthophosphate, polyphosphate, or zinc



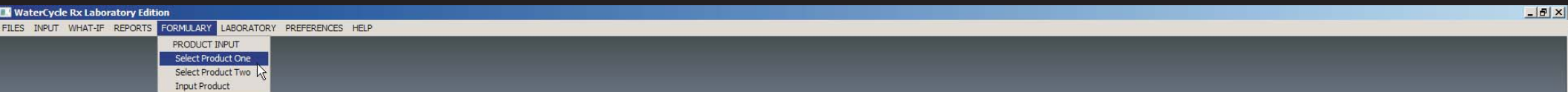
WaterCycle<sup>®</sup> 



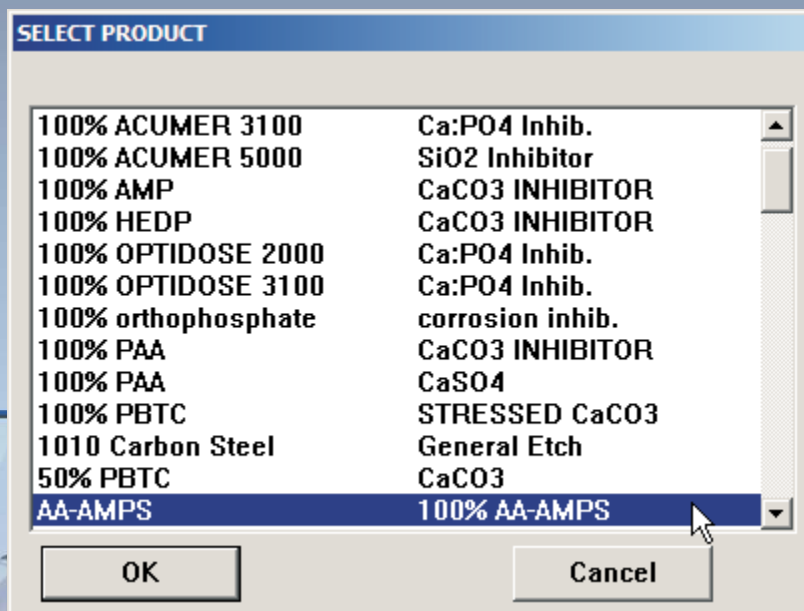
French Creek Software  
Scale & Corrosion Software Tools



# Select Two Products for Sequential Processing



**Product 2** should include inhibitors that control inhibitor formed scales such as tricalcium phosphate, zinc phosphates, zinc and calcium pyrophosphate



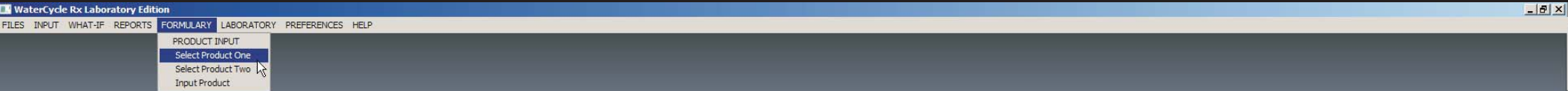
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Scale & Corrosion Software Tools



# Sequential Processing?



Step One: The program concentrates the water, calculates all indices, and then determines the solubility limited inhibitor requirements.

Step Two: The program doses the water with the solubility limited inhibitors, recalculates all indices, and then determines the requirements for zinc stabilizers, calcium phosphate control agents, etc..

WaterCycle<sup>®</sup> 

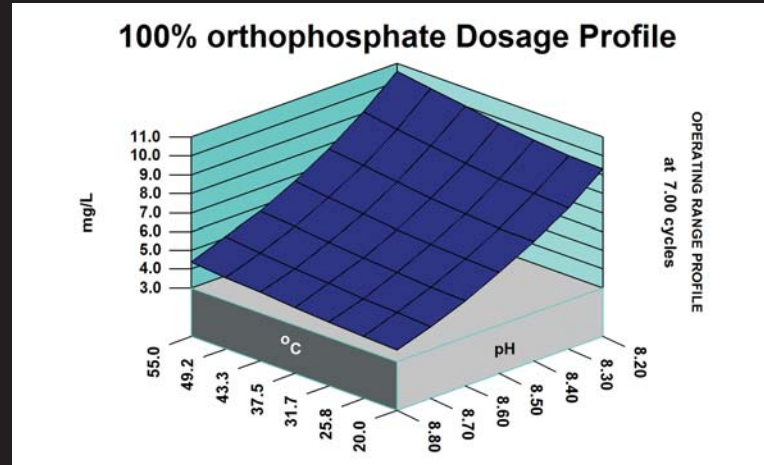


French Creek Software  
Scale & Corrosion Software Tools

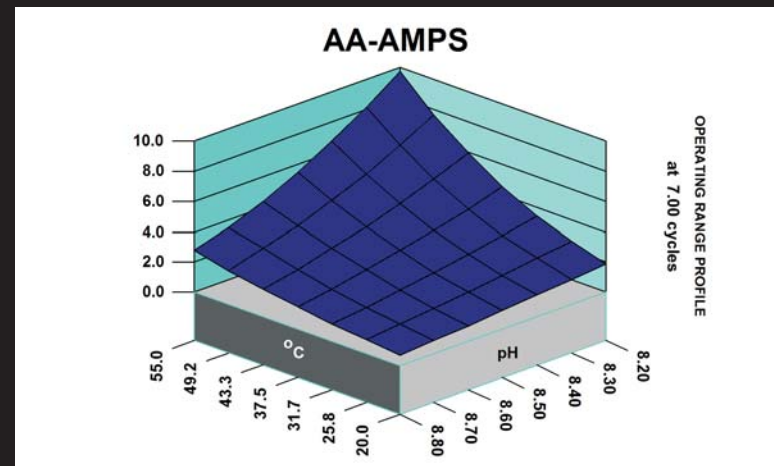
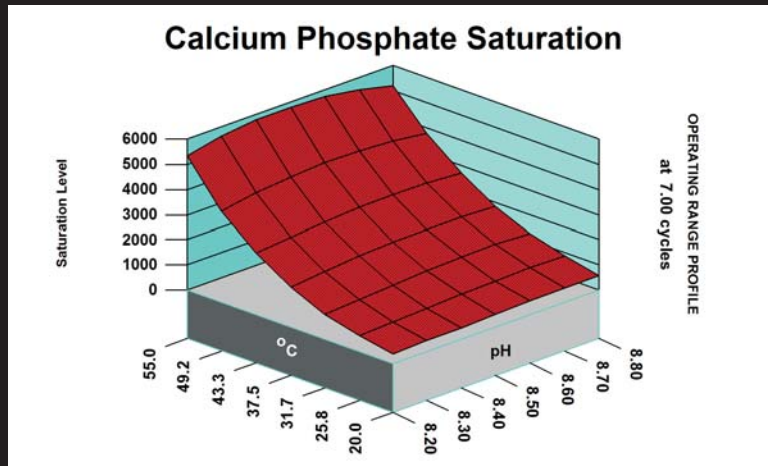


# Sequential Processing?

Step One: The program concentrates the water, calculates all indices, and then determines the solubility limited inhibitor requirements.

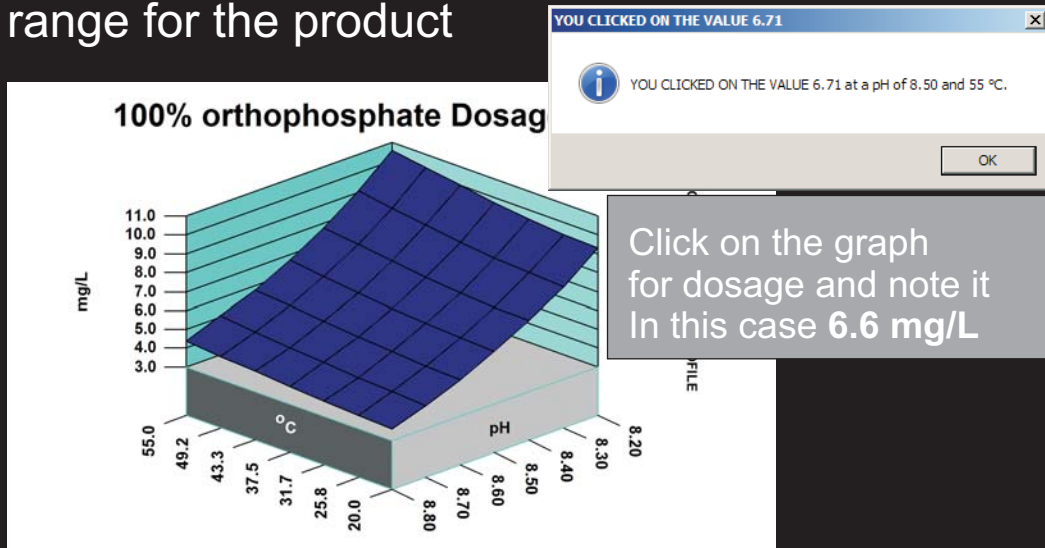


Step Two: The program doses the water with the solubility limited inhibitors, recalculates all indices, and then determines the requirements for zinc stabilizers, calcium phosphate control agents, etc..

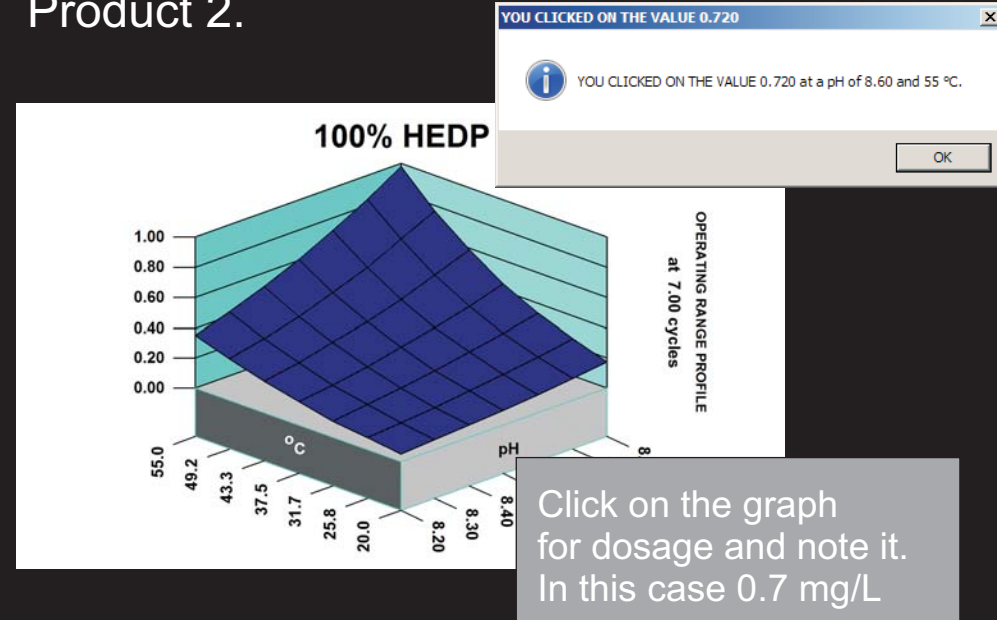


# Optimize Inhibitor Ratios Using Sequential Processing

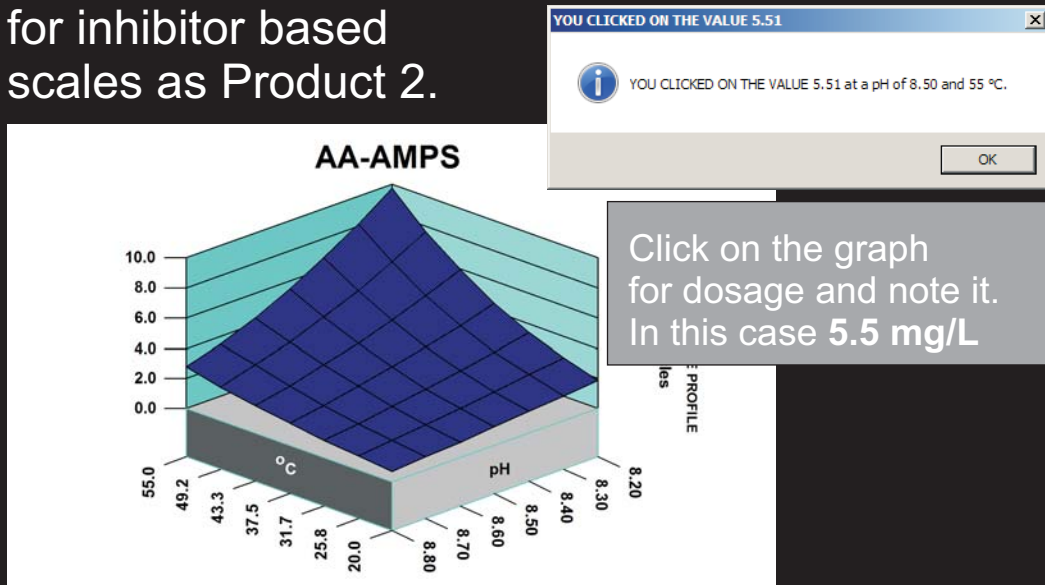
**Step One:** Select the solubility limited corrosion inhibitor as Product 1.. Enter your make-up water, cycle to the target range for the product



**Step Three:** Select the desired calcium carbonate inhibitor as Product 2.



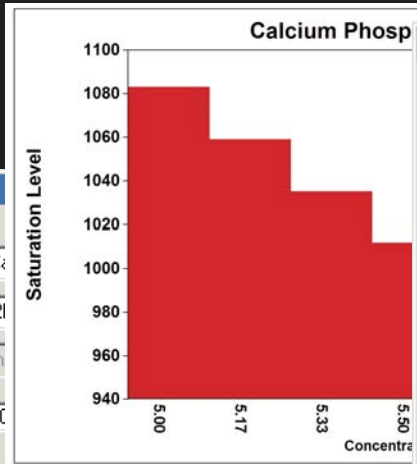
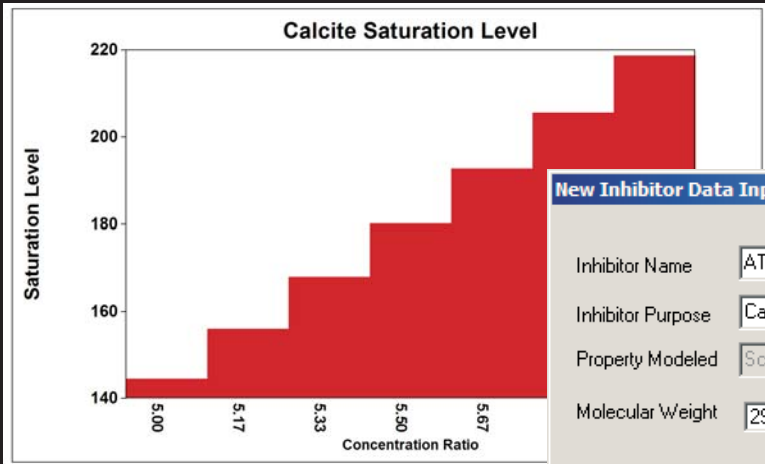
**Step Two:** Select the stabilizer for inhibitor based scales as Product 2.



**Result: Formulation for Dosage of 100 mg/L at Target pH, CR**

Raw Material	Active % to achieve 100 mg/L dosage
Orthophosphate active PO <sub>4</sub>	6.7
AA-AMPS active Polymer	5.5
HEDP active Phosphonate	0.7

# Premium Editions Add Profiling Capabilites, Modeling Capabilites



### Inhibitor Formulation Input Form

Formulation Name:  Description:

Product File Name:

Inhibitor	Chemical	Percentage
Inhibitor 1	ATMP (SrSO4)	29.200 %
Inhibitor 2	ATMP (MT MgCO3)	29.200 %
Inhibitor 3	ATMP (MT BaSO4)	29.200 %
Inhibitor 4	ATMP (CaF2)	29.200 %
Inhibitor 5	AMP	29.200 %
Inhibitor 6	AMP	29.200 %
Inhibitor 7		0.000 %

Minimum Dosage:  (mg/L) % Actives:  %

Password:  % Water:  %

Buttons: OK, Calc %, Set Limits, More, ENCRYPT ON, Delete File, Help, Cancel

### New Inhibitor Data Input

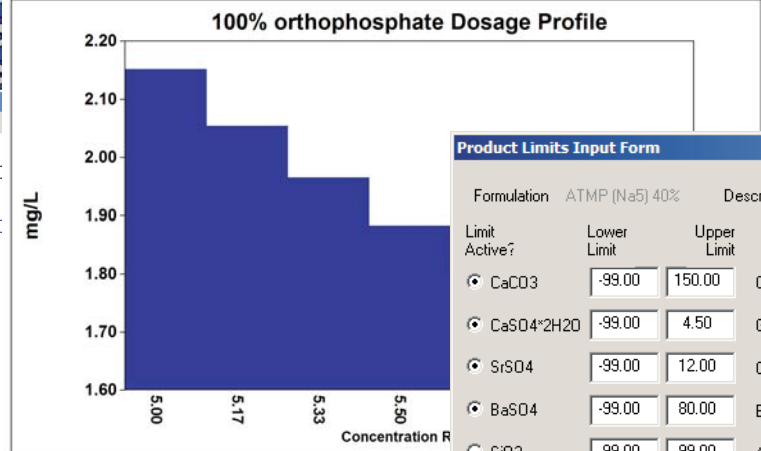
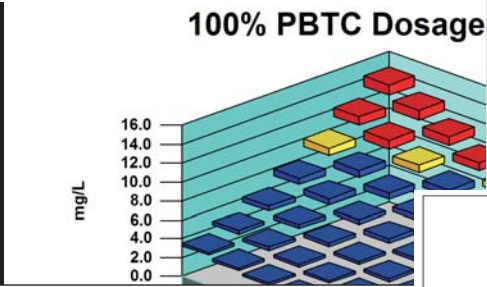
Inhibitor Name:

Inhibitor Purpose:

Property Modeled:

Molecular Weight:

Property	Variable	Transform	Lower Limit	Upper Limit
Dosage		LOG(X)		
Variable 1	Gypsum [CaSO4*2H2O]	LOG(X-1)	-99.00	
Variable 2			-99.00	
Variable 3			-99.00	



### Product Limits Input Form

Formulation:  Descriptor:  Product File:

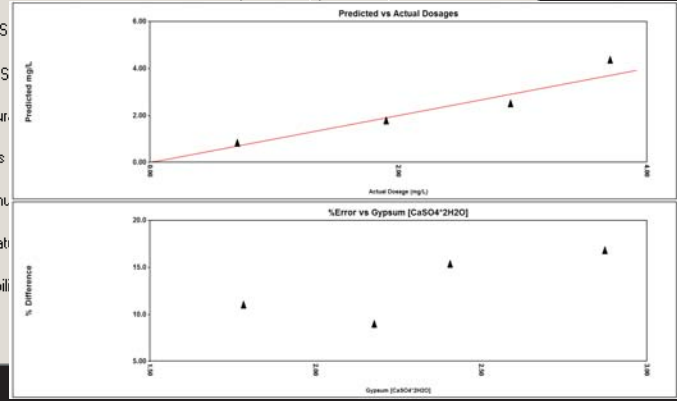
Limit Active?	Lower Limit	Upper Limit	Property	Limit Active?	Lower Limit	Upper Limit	Property
<input checked="" type="checkbox"/>	-99.00	150.00	Calcite Saturation Level	<input type="checkbox"/>	-99.00	-99.00	Puckorius Index
<input checked="" type="checkbox"/>	-99.00	4.50	Gypsum Saturation Level	<input type="checkbox"/>	-99.00	-99.00	Stiff Davis Index
<input checked="" type="checkbox"/>	-99.00	12.00	Celestite Saturation Level	<input type="checkbox"/>	-99.00	-99.00	TCP Saturation
<input checked="" type="checkbox"/>	-99.00	80.00	Barite Saturation Level	<input type="checkbox"/>	-99.00	-99.00	Hydroxylapatite Sat
<input type="checkbox"/>	-99.00	-99.00	Amorphous S				
<input type="checkbox"/>	-99.00	-99.00	Magnesium S				
<input checked="" type="checkbox"/>	-99.00	120.00	Fluorite Satur				
<input type="checkbox"/>	-99.00	-99.00	mg/L Iron as				
<input type="checkbox"/>	-99.00	-99.00	mg/L Aluminu				
<input type="checkbox"/>	-99.00	-99.00	Langelier Sat				
<input type="checkbox"/>	-99.00	-99.00	Ryznar Stabli				

OK

MIXED WATER DEPOSITION POTENTIAL INDICATORS

Sample ID:  Report Date:

Property	Value	Limit
SATURATION LEVEL	100.00	83.33
Calcite (CaCO3)	4.07	1.65
Aragonite (CaCO3)	3.50	1.42
Witherite (BaCO3)	0.00	0.00
Strontianite (SrCO3)	0.00	0.00
Magnesite (MgCO3)	0.66	0.27
Anhydrite (CaSO4)	0.02	0.03
Gypsum (CaSO4*2H2O)	0.02	0.03
Barite (BaSO4)	0.01	0.01
Celestite (SrSO4)	0.00	0.00
Tricalcium phosphate	0.00	0.00
Hydroxylapatite	0.00	0.00
Fluorite (CaF2)	0.00	0.00
Silica (SiO2)	0.00	0.00
Brucite (Mg(OH)2)	0.00	0.00
Magnesium silicate	0.00	0.00
Ferric hydroxide	132.82	0.00
Siderite (FeCO3)	10.83	4.27
Strengite (FePO4)	0.00	0.00
Halite (NaCl)	0.24	0.22
Thenardite (Na2SO4)	0.00	0.00



# The Salesman's Edition adds the ability to optimize treatments

Antiscalants can be selected in several convenient locations in the program.

- Under FORMULARY in the Main Menu system –
- At the top of graphs by clicking NEW TREATMENT
- At the top of tables by clicking NEW TREATMENT

WaterCycle Rx Laboratory Edition

FILES INPUT WHAT-IF REPORTS FORMULARY LABORATORY PREFERENCES HELP

**SELECT PRODUCT**

100% HEDP	CaCO3 INHIBITOR
100% OPTIDOSE 2000	Ca:PO4 Inhib.
100% OPTIDOSE 3100	Ca:PO4 Inhib.
100% PAA	Ca, CO3, SO4, Ba
100% PAA	CaCO3 INHIBITOR
100% PBTC	STRESSED CaCO3
1010 Carbon Steel	General Etch
BC-161 ANHYD	Anhydrite Inhib
BC-161 GYPSUM	Gypsum Inhib
BELCLENE 161	Gypsum, Anhydrite
det test	baso4
DETA 50%	HDTMP
HDTMP BaSO4	BaSO4

OK Cancel

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# The Product Manager Edition adds the ability to input products

**Inhibitor Formulation Input Form**

Formulation Name: 10% Active ATMP      Description: Antiscalant.

Product File Name: amp10.prd

Inhibitor	Chemical Name	Concentration (%)
Inhibitor 1	ATMP (MT BaSO4)	10.000
Inhibitor 2	ATMP (MT CaCO3)	10.000
Inhibitor 3	ATMP (CaSO4*2H2O)	10.000
Inhibitor 4	ATMP (CaF2)	10.000
Inhibitor 5	ATMP (SrSO4)	10.000
Inhibitor 6		0.000
Inhibitor 7		0.000

Minumum Dosage: 0.000 (mg/L)      % Actives: 10.000

Password:      % Water: 90.000

Buttons: OK, Calc %, Set Limits, More, ENCRYPT OFF, Delete File, Help, Cancel

French Creek provides models for most inhibitors and scales

**SELECT INHIBITOR**

AQUAFEED 800	CaCO3
AQUATREAT AR 540	Ca:PO4 Inhibitor
AQUATREAT AR-900A	CaCO3 Scale Inhib.
ATMP (CaF2)	CaF2
ATMP (CaSO4)	CaSO4 anhyd
ATMP (CaSO4)	CaSO4 anhyd
ATMP (CaSO4*2H2O)	CaSO4*2H2O
ATMP (CaSO4*2H2O)	CaSO4*2H2O
ATMP (MT BaSO4)	BaSO4
ATMP (MT CaCO3)	CaCO3
ATMP (MT MgCO3)	MgCO3
ATMP (MT MgCO3)	MgCO3
ATMP (SrSO4)	SrSO4

Buttons: OK, Cancel

Software

re  
Tools



# The Laboratory Edition adds the ability to develop your own inhibitor models from laboratory data, field data, or existing curves.

WaterCycle Rx Laboratory Edition

FILES INPUT WHAT-IF REPORTS FORMULARY LABOR

## New Inhibitor Data Input

Inhibitor Name:  Raw Data File:



Inhibitor Purpose:  Output File:

Property Modeled:  Scale Inhibitor Dosage

Molecular Weight:  % Orthophosphate as PO4:  ID#:

Property	Variable	Transform	Lower Limit	Upper Limit
	<input type="text" value="Dosage"/>	<input type="text" value="LOG(X)"/>		
Variable 1	<input type="text" value="Anhydrite [CaSO4]"/>	<input type="text" value="LOG(X)"/>	<input type="text" value="-99.00"/>	<input type="text" value="4.5"/>
Variable 2	<input type="text"/>	<input type="text"/>	<input type="text" value="-99.00"/>	<input type="text" value="-99.00"/>
Variable 3	<input type="text"/>	<input type="text"/>	<input type="text" value="-99.00"/>	<input type="text" value="-99.00"/>
Variable 4	<input type="text"/>	<input type="text"/>	<input type="text" value="-99.00"/>	<input type="text" value="-99.00"/>
Variable 5	<input type="text"/>	<input type="text"/>	<input type="text" value="-99.00"/>	<input type="text" value="-99.00"/>
Variable 6	<input type="text"/>	<input type="text"/>	<input type="text" value="-99.00"/>	<input type="text" value="-99.00"/>

OK Select the parameters to model Cancel

## CORRELATION

PRINT GRAPH CLOSE CHANGE MODEL

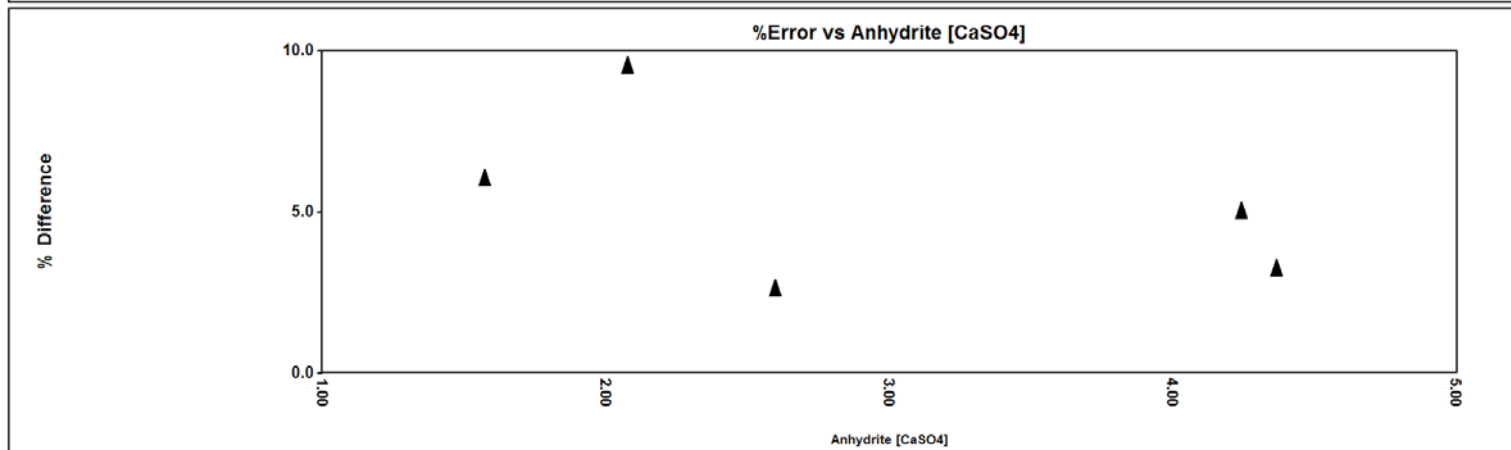
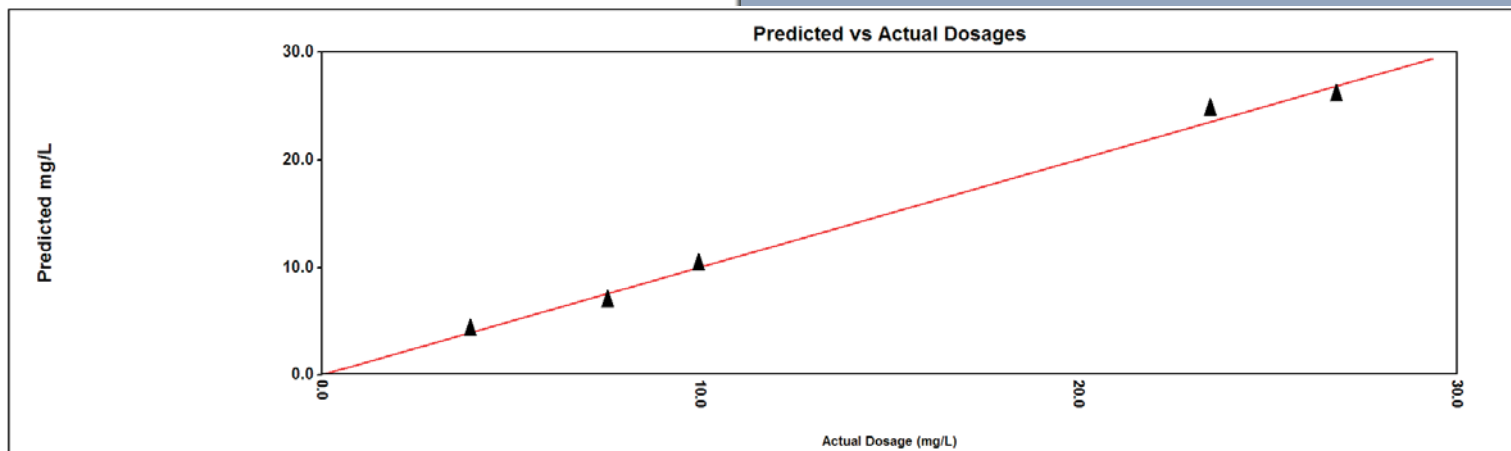
Inhibitor Modelled: PC-391 (CaSO4)  
 Inhibitor Purpose: CaSO4  
 Raw Data File: E:\HYDRO\COR\pc391caso4.COR  
 Output File: E:\HYDRO\INHIB\pc391caso4.inh

	Intercept	X CaSO4 LOG(X)
Coef.	-12.00	1.80
Std.Error	0.09	0.09
Sig.Level <	0.001	< 0.001

R-SQRD 0.993 Correlation Problems? NO

ANAL.#	OBSERVED	PREDICTED	DIFFERENCE	% ERROR
0	3.91000	4.14406	0.2340	5.98619
1	7.54000	6.82634	-0.7136	-9.46497
2	9.95000	10.20483	0.2548	2.56118
3	23.45999	24.62213	1.1621	4.95370
4	26.79000	25.93737	-0.8526	-3.18262

The Laboratory Edition then provides the model coefficients, statistics, and a graph of goodness of fit.



# Learn to Fully Harness the Power of the French Creek Engine

## The French Creek Seminar Series

### **Session One: "Learning the French Creek Standard"**

*Last Offered: August 4 & 5, 2009*

Explore the uses and nuances of using French Creek Software products with chemist and program author Rob Ferguson. This popular - two day session - covers the basic and more advanced use of all French Creek products; perfect for both the novice and seasoned user. Bring your own water analyses for class evaluation. Learn to truly harness the power of the French Creek engine.

### **Session Two: "Inhibitor Modeling, Product Formulation, and Developing your own models"**

*Last Offered: August 6, 2009*

Session two expands on Session One. Explore French Creek's inhibitor, corrosion rate, and product modeling. Gain a fuller understanding of formulating products and creating your own inhibitor and corrosion rate models

An absolute must for any French Creek users with Product Manager/ Formulator or Laboratory editions!



**French Creek Software**  
**Scale & Corrosion Software Tools**



# Favorite Quotes

***“I see the use of WaterCycle becoming a status symbol among water treatment consultants .... “***

Software Reviewer Marvin Silbert, Industrial Water Treatment 1992

***“Despite all the chemistry and our best intentions, water treatment still remains more of an art than science. We understand the limitations of Langelier and Ryznar yet continue to use them because of their simplicity and speed of use in the field.***

***We also understand the tremendous ‘What-if’ and other benefits of WaterCycle® software, yet the cost and complexities of use can often overwhelm us.”***

Colin Frayne, AWT Analyst, 2009

***“You mean anyone can get French Creek?  
I thought only <major service company> had it. “***

former <major service company> sales representative at AWT 2008



**French Creek Software**  
**Scale & Corrosion Software Tools**





# French Creek Software

## Scale & Corrosion Software Tools





# French Creek Software

## Scale & Corrosion Software Tools



# Thank you for joining us for a WaterCycle walk-about

DownHole Rx Laboratory Edition

FILES INPUT WHAT-IF REPORTS FORMULARY LABORATORY PREFERENCES HELP

DownHole SAT™ 



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