APPENDIX 5.15A

WPCF Expected Water Quality Data

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Process Model - Table of Contents

General Notes:

1. **Cells colored green contain formulas - do not change unless you're sure.**
2. **Cells colored yellow require entry.**
3. **Cell Range A1:H27 MUST remain the same for all sheets**

This workbook contains the following spreadsheets:

Spreadsheet	Purpose
Contents	Lists contents of this workbook
Cost History Module	History of capital costs for major equipment from bids.
Dispatch Summary	Calculates average system throughput based on plant dispatch schedule.
Cost Data Entry Module	Spreadsheet for entering general cost information.
Parameter Data Entry Module	Spreadsheet for entering critical control parameters for equipment.
Cost Summary Module	Summarizes O&M and Capital Cost estimates.
Raw Water Module	Calculates combined water quality based on a mix of up to three separate water sources.
Lime Soda Softener Module	Calculates combined influent water quality based on a mix of up to three separate water sources. Uses combined influent water quality and user-entered values to calculate softened effluent water quality assuming precipitation softening. Calculates sludge volumes and chemical feeds using either caustic/soda or lime/soda chemistry.
Acid Feed Module	Calculates acid feed (sulfuric or hydrochloric) required to reduce Lime Soda Softener effluent pH to a user entered value.
Gravity and Micro Filters	Calculates backwash and other flows and costs associated with MMF operation.
Cooling Tower Module	Uses combined influent water quality and user-entered values to calculate cycled water chemistry.
Makeup RO Acid Feed Module	Calculates acid feed (sulfuric or hydrochloric) required to reduce makeup RO influent pH to a user entered value.
1st Pass RO	Accepts up to three influent water sources. Calculates permeate and reject water qualities and quantities.
Hydrogen SAC IX Module	Uses combined influent water quality and user-entered values to calculate effluent water quality, regenerant influent water quality, and regenerant effluent water quality. Assumes the use of Strong Acid Cation resin.
Sodium SAC IX Module	Uses combined influent water quality and user-entered values to calculate sodium-softened effluent water quality, regenerant influent water quality, and regenerant effluent water quality. Assumes the use of Strong Acid Cation resin.
Hydrogen WAC IX Module	Uses combined influent water quality and user-entered values to calculate softened effluent water quality assuming regeneration with acid, regenerant influent water quality, and regenerant effluent water quality. Assumes the use of Weak Acid Cation resin.
Sodium WAC IX Module	Uses combined influent water quality and user-entered values to calculate softened effluent water quality assuming regeneration with acid followed by regeneration with caustic (to convert resin from the H+ form to the Na+ form). Also calculates regenerant influent water quality, and regenerant effluent water quality.
MU Degas/Acid Feed Module	Uses combined influent water quality and user-entered values to calculate acid feed required to remove alkalinity. Allows use of either hydrochloric or sulfuric acid for pH adjustment.
SBA IX Module	Uses combined influent water quality and user-entered values to calculate effluent water quality, regenerant influent water quality, and regenerant effluent water quality. Assumes the use of Strong Base Anion resin.
Polishing Mixed Bed IX Module	Uses combined influent water quality and user-entered values to calculate effluent water quality, regenerant influent water quality, and regenerant effluent water quality. Assumes the use of Mixed Bed IX resin.
Offsite Polishing Mixed Bed IX Module	Uses combined influent water quality and user-entered values to calculate effluent water quality. Assumes the use of Mixed Bed IX resin regenerated offsite by others.
WWRO Degas/Acid Feed Module	Calculates combined influent water quality based on a mix of up to three separate water sources. Uses combined influent water quality and user-entered values to calculate acid feed required to remove alkalinity from the feedwater to the WWRO. Allows use of either hydrochloric or sulfuric acid for pH adjustment.
WWRO Caustic Feed Module	Calculates combined influent water quality based on a mix of up to three separate water sources. Uses combined influent water quality and user-entered values to calculate acid feed required caustic feed to stabilize silica prior to feed to the WWRO.
Side Stream RO	Accepts up to three influent water sources. Calculates permeate and reject water qualities and quantities.
Side Stream RO Filter	Calculates backwash and other flows and costs associated with MMF operation.
Evaporator Acid Feed Module	Uses combined influent water quality and user-entered values to calculate acid feed required to remove alkalinity from the feedwater to the Brine Concentrator. Allows use of either hydrochloric or sulfuric acid for pH adjustment.
Evaporator	Accepts up to three influent water sources. Calculates combined influent feedwater, BC distillate, and BC blowdown water chemistry and quanities.
Crystallizer Module	Accepts up to three influent water sources. Calculates combined influent feedwater and distillate water chemistry and quanities. Also calculates volume and quality of sludge produced.
Evaporation Pond Module	Accepts up to three influent water sources. Calculates combined influent feedwater chemistry and quanity. Also calculates volume and quality of sludge produced.
Revisons	List of revisions to this document

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Water Demands

Case or Scenario:	Case 1 Annual Average	Case 2 Summer Typical	Case 3 Summer Max	Case 4 Winter Typical	Case 5 Annual Average	Case 6 Summer Typical	Case 7 Summer Max	Case 8	Case 9	Case 10	Case 11	Case 12	Case 13	Case 14	Case 15
Design Case															
Configuration	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1
CTGs Operating	1	1	1	1	1	1	1								
Net Power Output (kW)	261,300	251,700	247,800	271,600	285,300	277,100	273,400								
Duct Firing	Off	Off	Off	Off	On	On	On								
Dry Bulb Temperature, deg. F	61.2	94.0	107.7	32.6	61.2	94.0	107.7								
Dry Bulb After Inlet Air Cooling, deg F	55.8	72.6	78.0	32.6	55.8	72.6	78.0								
Realtive Humidity (%)	66.80%	27.50%	18.20%	74.00%	66.80%	27.50%	18.20%								
Wet Bulb Temperature, deg. F	54.8	68.9	72.9	29.7	54.8	68.9	72.9								
Inlet Air Cooling	Yes	Yes	Yes	No	Yes	Yes	Yes								
Site Altitude (Feet)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zero Discharge	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ambient Pressure, psia	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70
Power Augmentation	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Cooling Tower Water Demands Method 1															
Condenser Water Flow, gpm	59,952	59,952	59,952	59,952	59,952	59,952	59,952	59,952	59,952	59,952	59,952	59,952	59,952	59,952	59,952
Auxiliary Cooling Water Flow, gpm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cooling Water Supply Temperature, deg. F	64.7	74.2	77.0	49.7	65.8	74.9	77.6								
Cooling Water Return Temperature, deg. F	82.8	92.1	94.8	68.3	87.6	96.5	99.1								
L/G Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00								
Temperature of Exit Air, deg F	78.01	86.79	89.39	64.42	81.60	89.69	92.12								
Cycles of Concentration	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Drift (as % of Recirc Water Flow)	0.0005%	0.0005%	0.0005%	0.0005%	0.0005%	0.0005%	0.0005%	0.0005%	0.0005%	0.0005%	0.0005%	0.0005%	0.0005%	0.0005%	0.0005%
Total Cooling Water Flow, gpm	59,952	59,952	59,952	59,952	59,952	59,952	59,952	59,952	59,952	59,952	59,952	59,952	59,952	59,952	59,952
Makeup Water Temperature, deg. F	64.7	74.2	77.0	49.7	65.8	74.9	77.6	-	-	-	-	-	-	-	-
Enthalpy of Entering Air, Btu/lb	23.06	32.95	36.31	10.79	23.06	32.95	36.31	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Water Content of Entering Air, grains/lb dry air	53.88	65.93	66.06	19.30	53.88	65.93	66.06	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51
Enthalpy of Leaving Air, Btu/lb	41.59	51.68	55.11	29.62	45.45	55.52	58.96	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Water Content of Leaving Air, grains/lb dry air	146.12	196.38	214.03	90.96	165.03	216.17	234.12	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51
Humidity Ratio of Leaving Air, lb water/lb dry air	0.02087	0.02805	0.03058	0.01299	0.02358	0.03088	0.03345	0.00079	0.00079	0.00079	0.00079	0.00079	0.00079	0.00079	0.00079
Dry Air Flow, lb/min	498,120	498,120	498,120	498,120	498,120	498,120	498,120	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Humidity Ratio of Entering Air, lb water/lb dry air	0.0077	0.0094	0.0094	0.0028	0.0077	0.0094	0.0094	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008
Heat Rejected from CW, MMBtu/hr	542	536	533	557	653	647	644	-	-	-	-	-	-	-	-
Heat Removed by Air, MMBtu/hr	541	536	533	557	653	647	644	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Qair/Qcw	100%	100%	100%	100%	100%	100%	100%	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Evaporation, gpm	788	1,114	1,264	612	950	1,283	1,436	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Drift, gpm	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Cooling Tower Water Demands Method 2															
Allowance to WB Temp to Account for Recirc, deg. F															
Number of Cells															
Number of Fans Operating															
Leaving Air Flow/Fan, cfm															
Wet Bulb Temperature of Leaving Air, deg. F															
Cooling Tower Design Wet Bulb Temp, deg. F	54.8	68.9	72.9	29.7	54.8	68.9	72.9	-	-	-	-	-	-	-	-
Total Leaving Air Flow, cfm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Enthalpy of Leaving Air, Btu/lb	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Moisture Content of Leaving Air, grains/lb dry air	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Humidity Ratio of Leaving Air, lb water/lb dry air	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Density of Leaving Air, lbs/cf	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Total Dry Air Flow, lb/min	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
L/G Ratio	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Enthalpy of Entering Air, Btu/lb	23.1	32.9	36.3	10.8	23.1	32.9	36.3	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Moisture Content of Entering Air, grains/lb dry air	54	66	66	19	54	66	66	6	6	6	6	6	6	6	6
Humidity Ratio of Entering Air, lb water/lb dry air	0.0077	0.0094	0.0094	0.0028	0.0077	0.0094	0.0094	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008
Heat Rejected from CW, MMBtu/hr	542	536	533	557	653	647	644	-	-	-	-	-	-	-	-
Heat Removed by Air, MMBtu/hr	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Qair/Qcw	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Evaporation, gpm	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Enter 1 to use Method 1. Any other entry uses Meth 2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

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Water Demands

Case or Scenario:	Case 1 Annual Average	Case 2 Summer Typical	Case 3 Summer Max	Case 4 Winter Typical	Case 5 Annual Average	Case 6 Summer Typical	Case 7 Summer Max	Case 8	Case 9	Case 10	Case 11	Case 12	Case 13	Case 14	Case 15
Design Case															
Configuration	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1
CTGs Operating	1	1	1	1	1	1	1								
Net Power Output (kW)	261,300	251,700	247,800	271,600	285,300	277,100	273,400								
Duct Firing	Off	Off	Off	Off	On	On	On								
Dry Bulb Temperature, deg. F	61.2	94.0	107.7	32.6	61.2	94.0	107.7								
Dry Bulb After Inlet Air Cooling, deg F	55.8	72.6	78.0	32.6	55.8	72.6	78.0								
Realtive Humidity (%)	66.80%	27.50%	18.20%	74.00%	66.80%	27.50%	18.20%								
Wet Bulb Temperature, deg. F	54.8	68.9	72.9	29.7	54.8	68.9	72.9								
Inlet Air Cooling	Yes	Yes	Yes	No	Yes	Yes	Yes								
Site Altitude (Feet)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zero Discharge	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ambient Pressure, psia	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70
Power Augmentation	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Boiler Makeup															
HP Drum Flow, lb/hr	413,318	411,102	408,693	414,259	558,985	564,103	561,083								
IP Drum Flow, lb/hr	82,703	79,496	78,344	86,970	73,592	69,101	67,907								
LP Drum Flow, lb/hr	59,386	56,187	55,175	63,984	40,441	36,229	35,150								
HP Blowdown, % of HP steam flow	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
IP Blowdown, % of IP steam flow	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
LP Blowdown, % of LP steam flow	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
HP Drum Pressure, psia	1759.4	1756.1	1746.2	1749.4	2331.9	2361.6	2354.3								
IP Drum Pressure, psia	438.3	433.5	431.3	443.0	535.7	536.0	533.8								
LP Drum Pressure. psia	67.6	66.3	65.8	69.3	75.5	74.8	74.4								
HP Blowdown to Flash Separator No. 1, lb/hr	8266.4	8222.0	8173.9	8285.2	11179.7	11282.1	11221.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
IP Vent Steam from Flash Separator No. 1, lb/hr	2267.4	2260.4	2238.6	2249.8	3783.9	3870.7	3841.8	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
IP Condensate from Flash Separator No. 1, lb/hr	5999.0	5961.6	5935.3	6035.4	7395.8	7411.3	7379.8	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
IP Blowdown to Flash Separator No. 2, lb/hr	1654.1	1589.9	1566.9	1739.4	1471.8	1382.0	1358.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LP Vent Steam from Flash Separator No. 2, lb/hr	1375.9	1357.0	1347.2	1395.3	1757.4	1748.8	1736.1	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
LP Condensate from Flash Separator No. 2, lb/hr	6277.2	6194.5	6155.0	6379.5	7110.3	7044.6	7001.9	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
LP Blowdown to Atmospheric Flash Tank, lb/hr	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Vent Steam from Atmospheric Flash Tank, lb/hr	581.3	565.1	558.2	602.0	714.8	703.4	696.4	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Condensate from Atmospheric Flash Tank, lb/hr	5695.9	5629.4	5596.8	5777.5	6395.5	6341.2	6305.5	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Blowdown Vented to Atmosphere, gpm	1.2	1.1	1.1	1.2	1.4	1.4	1.4	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Blowdown to Drain, gpm	11.4	11.3	11.2	11.6	12.8	12.7	12.6	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Boiler Makeup, gpm	12.56	12.39	12.31	12.76	14.23	14.09	14.01	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Power Augmentation															
PAG Steam, lb/hr															
Attemperation Water, lb/hr															
Total PAG Flow, gpm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Inlet Air Cooling															
Inlet Air Cooling Effectiveness, %	85.00%	85.00%	85.00%	85.00%	85.00%	85.00%	85.00%	85.00%	85.00%	85.00%	85.00%	85.00%	85.00%	85.00%	85.00%
Inlet Air Filter Pressure Loss, inches of water	4.00	4.00	4.00	4.00	4.00	4.00	4.00								
Cooled CTG Inlet Flow, lb/hr	3,545,091	3,411,012	3,363,020	3,713,493	3,545,091	3,411,012	3,363,020								
Ambient CTG Inlet Air Flow, lb/hr	3,541,229	3,393,913	3,339,775	3,713,493	3,541,229	3,393,913	3,339,775	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR
Ambient Moisture, grains/lb of dry air	53.88	65.93	66.06	19.30	53.88	65.93	66.06	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51
CTG Inlet Air Temperature, deg. F	56.80	72.67	78.12	32.60	56.80	72.67	78.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Moisture after Cooling, grains/lb of dry air	61.57	101.53	115.24	19.54	61.57	101.53	115.24	5.51	5.51	5.51	5.51	5.51	5.51	5.51	5.51
Inlet Air Chiller Evaporation, gpm	7.72	34.17	46.45	0.00	7.72	34.17	46.45	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!

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Water Balance Input Data

	Annual Average	Summer Typical	Summer Max	Winter Typical	Annual Average	Summer Typical	Summer Max	0	0	0	0	0	0	0	0	Comments
Design Case	**Case 1**	**Case 2**	**Case 3**	**Case 4**	**Case 5**	**Case 6**	**Case 7**	**Case 8**	**Case 9**	**Case 10**	**Case 11**	**Case 12**	**Case 13**	**Case 14**	**Case 15**	
Configuration (CT x ST)	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1	
Fogging (Yes/No?)	Yes	Yes	Yes	No	Yes	Yes	Yes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Power Augmentation (Yes/No?)	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	
Duct Firing (Yes/No?)	Off	Off	Off	Off	On	On	On	0	0	0	0	0	0	0	0	
Dry Bulb Temperature, deg F	61.2	94.0	107.7	32.6	61.2	94.0	107.7	-	-	-	-	-	-	-	-	
Wet Bulb Temperature, deg F	54.8	68.9	72.9	29.7	54.8	68.9	72.9	-	-	-	-	-	-	-	-	
Ambient Pressure, psia	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	
CTGs Operating	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	
Net Power Output (kW)	261,300	251,700	247,800	271,600	285,300	277,100	273,400	0	0	0	0	0	0	0	0	
Potable Water System																
Number of Personnel	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	
Gallons/day per person	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	
Percent Wastewater	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	
Cooling Tower																
Cycles of Concentration	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	
Drift	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	
Evaporation, gpm	788	1,114	1,264	612	950	1,283	1,436	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	
Plant Service Water																
Plant Washdown Water, gpm	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Oil in Wastewater, %	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	
HRSG's																
Boiler Blowdown, gpm	12.56	12.39	12.31	12.76	14.23	14.09	14.01	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	
Blowdown Vented to Atm, gpm	1.16	1.13	1.12	1.20	1.43	1.41	1.39	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	assumes HP blowdown to IP drum
Blowdown to Drain, gpm	11.40	11.26	11.20	11.56	12.80	12.69	12.62	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	assumes HP blowdown to IP drum
Drain Temp (deg F)	105.64	105.64	105.64	105.64	105.64	105.64	105.64	105.64	105.64	105.64	105.64	105.64	105.64	105.64	105.64	
Blowdown Quench Water, gpm	29.60	38.10	41.58	21.98	34.16	43.89	47.85	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	assumes 140 degree F drain temperature
Quench Rtn Flow, gpm	41.00	49.36	52.78	33.54	46.95	56.58	60.46	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	
Leaks & Drains, gpm	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	
Power Augmentation																
Power Augmentation, gpm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Power Augmentation, hrs/day	-	-	-	-		-	-	-	-	12	12	12	12	12	12	
Combustion Turbines																
Inlet Air Chiller Evaporation, gpm	7.72	34.17	46.45	-	7.72	34.17	46.45	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	
Wash Water, gpm	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	
Fire Water																
Fire Water to Diesel Pump	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Fire Water to Electric Booser	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Misc Drains/OWS																
Misc Drains/OWS	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	

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Dispatch Summary

MW Dispatch Range / Case Assignment																				CT ER	Demin	Quench	Blr BD	Q Rtn	ChEvap	NU 2
Case	**Case 1**	**Case 2**	**Case 3**	**Case 4**	**Case 5**	**Case 6**	**Case 7**	**Case 8**	**Case 9**	**Case 10**	**Case 11**	**Case 12**	**Case 13**	**Case 14**	**Case 15**	**Calc 1**	**Calc 2**	**Calc 3**	**Off**	**GPM**	**GPM**	**GPM**	**GPM**	**GPM**	**GPM**	**GPM**
Power (MW)	**261,300**	**251,700**	**247,800**	**271,600**	**285,300**	**277,100**	**273,400**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**							
	Enter number of hours in each case for each month in the cells below.																									
January																				0.00	0.00	0.00	0.00	0.00	0.00	0.00
February																				0.00	0.00	0.00	0.00	0.00	0.00	0.00
March																				0.00	0.00	0.00	0.00	0.00	0.00	0.00
April																				0.00	0.00	0.00	0.00	0.00	0.00	0.00
May																				0.00	0.00	0.00	0.00	0.00	0.00	0.00
June																				0.00	0.00	0.00	0.00	0.00	0.00	0.00
July																				0.00	0.00	0.00	0.00	0.00	0.00	0.00
August																				0.00	0.00	0.00	0.00	0.00	0.00	0.00
September																				0.00	0.00	0.00	0.00	0.00	0.00	0.00
October																				0.00	0.00	0.00	0.00	0.00	0.00	0.00
November																				0.00	0.00	0.00	0.00	0.00	0.00	0.00
December																				0.00	0.00	0.00	0.00	0.00	0.00	0.00
Average Flow Required																				0.00	0.00	0.00	0.00	0.00	0.00	0.00
Case to Evaluate																										Case 1
Flows Associated with the Evaluated Case																				**788.0**	**20.3**	**29.6**	**12.6**	**41.0**	**7.7**	**0.0**
Total Hours	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							

Total Hours/Year Online	0
Total Hours/Year Offline	0
Total Hours/Year (Online + Offline)	0
Dispatch (%)	#DIV/0!

Case	**CT ER**	**Demin**	**Quench**	**Blr BD**	**Q Rtn**	**ChEvap**	**NU 2**
Case 1	788.00	20.26	29.60	12.56	41.00	7.72	
Case 2	1114.35	20.09	38.10	12.39	49.36	34.17	
Case 3	1264.03	20.01	41.58	12.31	52.78	46.45	
Case 4	612.16	20.46	21.98	12.76	33.54	0.00	
Case 5	949.54	21.93	34.16	14.23	46.95	7.72	
Case 6	1283.44	21.79	43.89	14.09	56.58	34.17	
Case 7	1435.65	21.71	47.85	14.01	60.46	46.45	
Case 8	0.00	0.00	0.00	0.00	0.00	0.00	
Case 9	0.00	0.00	0.00	0.00	0.00	0.00	
Case 10	0.00	0.00	0.00	0.00	0.00	0.00	
Case 11	0.00	0.00	0.00	0.00	0.00	0.00	
Case 12	0.00	0.00	0.00	0.00	0.00	0.00	
Case 13	0.00	0.00	0.00	0.00	0.00	0.00	
Case 14	0.00	0.00	0.00	0.00	0.00	0.00	
Case 15	0.00	0.00	0.00	0.00	0.00	0.00	
Calc 1							
Calc 2							
Calc 3							
Peak	1435.65	21.93	47.85	14.23	60.46	46.45	0.00
Average	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dispatch:	91.32%						

Common Flows (Don't Vary with Case)	
Potable Water Usage	0.58
Plant Service Water Usage	1.00
HRSG Leaks and Drains	7.00
CT Wash Water	0.70
Firewater (Diesel Pump)	0.00
Firewater (Electric Booster)	0.00
Misc Drains/OWS	10.00

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Cost Data Entry Module

O&M Costs	Units	Concentration	Cost
Raw Water Source 1 Cost	$/1000 Gal		$0.00
Raw Water Source 2 Cost	$/1000 Gal		$0.00
Raw Water Source 3 Cost	$/1000 Gal		$0.00
Sulfuric Acid Cost	$/Lb	93.00%	$0.05
Cooling Tower Chem Feed	$/mmLb BD		$245.00
Oxidizing Biocide Cost	$/Lb	12.50%	$0.15
Salt Cost	$/Lb		$0.05
HCl Cost	$/Lb	30.00%	$0.15
Lime Cost	$/Lb	90.00%	$0.10
MgO (Mag Oxide) Cost	$/Lb	36.00%	$0.18
Mag Chloride	$/Lb	36.00%	$0.04
Calcium Chloride	$/Lb	100.00%	$0.04
Soda Ash Cost	$/Lb	90.00%	$0.18
Caustic Cost	$/Lb	50.00%	$0.15
Other Coagulant Cost	$/Lb	100.00%	$0.28
Flocculant Cost	$/Lb	100.00%	$2.50
Hydrated Aluminum Sulfate	$/Lb	50%	$0.07
Ferric Sulfate	$/Lb	50%	$0.07
Ferric Chloride	$/Lb	50%	$0.07
RO Anti-Scalant Cost	$/Lb		$2.90
Bisulfite Cost	$/Lb	100.00%	$0.80
Sludge Disposal Cost	$/Wet Ton		$45.00
BC CaCl2 Cost	$/Lb	35.00%	$0.45
BC Polymer Chemical Cost	$/Lb		$2.00
BC Anti-Foam Cost	$/Lb		$2.50
Labor Cost	$/Hr		$48.00
Power Cost	$/MW-Hr		$35.00
Capital Costs	**Units**		**Value**
Lime Soda Softener	$/1000 GPM		$220,000
Multimedia Filter	$/1000 GPM		$150,000
MU RO	$/100 GPM		$100,000
H+ SAC IX	$/100 GPM		$45,000
Na+ SAC IX	$/100 GPM		$45,000
H+ WAC IX	$/100 GPM		$45,000
Na+ WAC IX	$/100 GPM		$45,000
Degassifier	$/100 GPM		$23,000
SBA IX	$/100 GPM		$45,000
MB IX (Onsite Regen)	$/100 GPM		$54,000
WW RO	$/100 GPM		$200,000
Crystallizer (10 GPM)	$/Unit		$250,000
Crystallizer (70 GPM)	$/Unit		$1,000,000
Evap Pond	$/Acre		$200,000
Interconnecting Piping	$/Process		$25,000
Field Erected Tanks	$/Gal Installed		$0.50
NPV Calculator	**Units**		**Value**
Interest Rate	%		10.00%
Term to Evaluate	Years		20

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Case Evaluated: **Case 1**

Cost Summary Module	Enter 1 for Eval, 0 for Estimate:		0
O&M Costs	**Process Used? 1=Yes**	**Units**	**Value**
Raw Water Module	1		
Raw Water Source 1 Cost		$/Day	$0.00
Raw Water Source 2 Cost		$/Day	$0.00
Raw Water Source 3 Cost		$/Day	$0.00
Lime Soda Softener Module	1		
Chemical Cost		$/Day	$1,068.09
Sludge Disposal Cost		$/Day	$618.69
Gravity and Micro Filters	1		
Polymer Cost		$/Day	$61.70
Cooling Tower Module	1		
Sulfuric Acid Cost		$/Day	$20.52
Cooling Tower Chem Cost		$/Day	$386.43
Cooling Tower Biocide Cost		$/Day	$55.76
1st Pass RO	1		
Membrane Replacement		$/Day	$19.18
Acid Cost	1	$/Day	$2.13
Bisulfite Cost		$/Day	$1.64
Anti-Scalant Cost		$/Day	$5.75
Power Cost		$/Day	$8.31
Hydrogen SAC IX Module	0		
Resin Replacement Cost		$/Day	$0.00
Acid Cost		$/Day	$0.00
Sodium SAC IX Module	0		
Resin Replacement Cost		$/Day	$0.00
Salt Cost		$/Day	$0.00
Hydrogen WAC IX Module	0		
Resin Replacement Cost		$/Day	$0.00
Acid Cost		$/Day	$0.00
Sodium WAC IX Module	0		
Resin Replacement Cost		$/Day	$0.00
Acid Cost		$/Day	$0.00
Caustic Cost		$/Day	$0.00
MU Degas/Acid Feed Module	0		
Acid Cost		$/Day	$0.00
SBA IX Module	0		
Resin Replacement Cost		$/Day	$0.00
Caustic Cost		$/Day	$0.00
Polishing Mixed Bed IX Module	0		
Resin Replacement Cost		$/Day	$0.00
Acid Cost		$/Day	$0.00
Caustic Cost		$/Day	$0.00
Offsite Polishing Mixed Bed IX Mod	0		
Rental and Regen Cost		$/Day	$0.00
Side Stream RO	1		
Membrane Replacement		$/Day	$6.85
Acid Cost	0	$/Day	$0.00
Bisulfite Cost		$/Day	$0.00
Caustic Cost	0	$/Day	$0.00
Anti-Scalant Cost		$/Day	$8.43
Power Cost		$/Day	$54.75
Side Stream RO Filter	1		
Polymer Cost		$/Day	$8.87
Bisulfite Cost		$/Day	$2.52
Evaporator Acid Feed Module	1		
Acid Cost		$/Day	$6.58
Evaporator	1		
Power Cost		$/Day	$312.76
CaCl2 Cost		$/Day	$18.49
Polymer Cost		$/Day	$1.66
Anti-Foam Cost		$/Day	$1.04
Crystallizer Module	1		
Caustic Cost		$/Day	$44.36
Sludge Disposal Cost		$/Day	$111.48
Anti-Foam Cost		$/Day	$0.05
Power Cost		$/Day	$34.75
Evaporation Pond Module	0		
Sludge Disposal Cost		$/Day	$0.00
Monitoring Cost		$/Day	$0.00
Labor Cost			
Process Operating Hrs/Day		Hours	0.00
Manhours/Operating Hour		Ratio	1.50
Labor Cost		$/Day	$0.00
O&M Cost Summary			
Total O&M Cost		$/Day	$2,860.80
O&M NPV		$	$8,889,803

Capital Costs	**Units**	**Value**
Lime Soda Softener Module	$	$185,332
Gravity and Micro Filters	$	$136,986
1st Pass RO	$	$85,169
Hydrogen SAC IX Module	$	$0
Sodium SAC IX Module	$	$0
Hydrogen WAC IX Module	$	$0
Sodium WAC IX Module	$	$0
MU Degas/Acid Feed Module	$	$0
SBA IX Module	$	$0
Polishing Mixed Bed IX Module	$	$0
WWRO Degas/Acid Feed Module	$	$0
Side Stream RO	$	$249,533
Side Stream RO Filter	$	$19,700
Evaporator	$	$1,578,986
Crystallizer Module	$	$350,000
Water Treatment Equipment (Complete System Price)	$	$0
Evaporation Pond Module	$	$0
Interconnecting Piping	$	$150,000
Field Erected Tanks	$	$5,044
Total Capital Cost		$2,760,750
Total Cost (Capital + O&M NPV)		**$11,650,552**

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Raw Water Module

Contaminant	Units	Conduct Conv	CaCO3 Conv Factors	Makeup Water			Combined Raw Water
Flow	GPM			806.76			806.76
Alkalinity-Bicarbonate	mg/L	0.72	0.82	170.73			170.73
Alkalinity-Carbonate	mg/L	2.82	1.67	0.00			0.00
Alkalinity-P-BaCl2	mg/L		2.94	0.00			0.00
Aluminum	mg/L			0.10			0.10
Ammonia	mg/L			0.00			0.00
Barium	mg/L		0.73	0.00			0.00
Boron	mg/L			0.30			0.30
Cadmium	mg/L			0.00			0.00
Chloride	mg/L	2.14	1.41	66.00			66.00
Chromium	mg/L			0.00			0.00
Copper	mg/L			0.00			0.00
Fluoride	mg/L		2.63	0.00			0.00
Calcium	mg/L	2.6	2.50	32.00			32.00
Magnesium	mg/L	3.82	4.12	12.00			12.00
Iron	mg/L		2.69	0.09			0.09
Lead	mg/L			0.00			0.00
Lithium	mg/L			0.00			0.00
Manganese	mg/L			0.00			0.00
Molybdenum	mg/L			0.00			0.00
Nickel	mg/L			0.00			0.00
Nitrate	mg/L	1.15	0.81	40.00			40.00
Nitrite	mg/L			1.00			1.00
pH	s.u.			8.30			8.30
Phosphorus	mg/L			0.00			0.00
Phosphate	mg/L		1.58	0.40			0.40
Potassium	mg/L	1.84	1.28	15.00			15.00
Silica	mg/L		0.83	69.00			69.00
Sodium	mg/L	2.13	2.18	72.00			72.00
Strontium	mg/L			0.27			0.27
Sulfate	mg/L	1.54	1.04	31.00			31.00
Vanadium	mg/L			0.00			0.00
Zinc	mg/L			0.00			0.00
Bromide	mg/L			0.00			0.00
TSS	mg/L			0.00			0.00
TOC	mg/L			6.30			6.30
Total Dissolved Solids	mg/L			508.22	0.00	0.00	508.22
Specific Conductance	umhos/cm			667.05	0.00	0.00	667.05
Free CO2	mg/L			1.42	0.00	0.00	1.42
Total Cations	mg/L CaCO3			305.84	0.00	0.00	305.84
Total Anions	mg/L CaCO3			355.60	0.00	0.00	355.60
Total Hardness	mg/L CaCO3			129.44	0.00	0.00	129.44
Raw Water Source 1 Cost	$/1000 Gal			$0.00			
Raw Water Source 2 Cost	$/1000 Gal				$0.00		
Raw Water Source 3 Cost	$/1000 Gal					$0.00	
Raw Water Source 1 Cost	$/Day			$0.00			
Raw Water Source 2 Cost	$/Day				$0.00		
Raw Water Source 3 Cost	$/Day					$0.00	
Required Storage Time	Hrs						0.00
Required Storage Volume	Gal						0
Required Storage Volume	$ Installed						$0

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Lime Soda Softener Module

Combined Raw Water

Contaminant	Units	Conduct Conv	CaCO3 Conv Factors	Combined Raw Water	Gravity/uF Backwash		Combined Influent	Lime Softener Effluent	Lime Softener Sludge	Lime Softener Not Used
Flow	GPM	0.00	0.00	796.76	45.66		842.42	840.59	1.83	
Alkalinity-Bicarbonate	mg/L	0.72	0.82	170.73	40.38		163.67	43.87	43.87	
Alkalinity-Carbonate	mg/L	2.82	1.67	0.00	0.00		0.00	0.00	0.00	
Alkalinity-P-BaCl2	mg/L	0.00	2.94	0.00	14.44		0.78	15.68	15.68	
Barium	mg/L	0.00	0.73	0.00	0.00		0.00	0.00	0.00	
Chloride	mg/L	2.14	1.41	66.00	76.43		66.57	82.98	82.98	
Fluoride	mg/L	0.00	2.63	0.00	0.00		0.00	0.00	0.00	
Calcium	mg/L	2.6	2.50	32.00	22.96		31.51	24.93	24.93	
Magnesium	mg/L	3.82	4.12	12.00	8.49		11.81	9.22	9.22	
Iron	mg/L	0.00	2.69	0.09	0.01		0.09	0.01	0.01	
Nitrate	mg/L	1.15	0.81	40.00	36.67		39.82	39.82	39.82	
pH	s.u.	0.00	0.00	8.30	10.13		8.40	10.40	10.40	
Phosphate	mg/L	0.00	1.58	0.40	0.37		0.40	0.40	0.40	
Potassium	mg/L	1.84	1.28	15.00	13.75		14.93	14.93	14.93	
Silica	mg/L	0.00	0.83	69.00	4.61		65.51	5.00	5.00	
Sodium	mg/L	2.13	2.18	72.00	66.02		71.68	71.68	71.68	
Sulfate	mg/L	1.54	1.04	31.00	28.49		30.86	30.86	30.86	
Total Dissolved Solids	mg/L			508.22	312.61		497.62	339.38	339.38	0.00
Specific Conductance	umhos/cm			667.05	536.53		659.98	582.45	582.45	0.00
Free CO2	mg/L			1.42	0.01		1.11	0.01	0.01	0.00
Total Cations	mg/L CaCO3			305.84	253.93		303.03	275.70	275.70	0.00
Total Anions	mg/L CaCO3			355.60	247.05		349.72	268.22	268.22	0.00
Total Hardness	mg/L CaCO3			129.44	92.39		127.43	100.31	100.31	0.00

CHEMICAL ADDITIONS	PPM	% Active	Delvd Prod $ per Lb	Product #/Day	TO CaCO3	PPM CaCO3	$/Day
CAUSTIC ppm as NaOH	0.00	50%	$0.15	0.00	1.25	0.00	$0.00
LIME ppm as Ca(OH)2	160.00	90%	$0.10	1797.16	1.35	216.00	$179.72
SODA ASH ppm as Na2CO3	0.00	90%	$0.18	0.00	0.94	0.00	$0.00
MAG OXIDE ppm as MgO	165.00	36%	$0.18	4633.31	2.48	409.20	$834.00
MAG Chloride ppm as MgCl2	0.00	36%	$0.04	0.00	1.05	0.00	$0.00
Calcium Chloride ppm as CaCl2	0.00	100%	$0.04	0.00	0.90	0.00	$0.00
Sulfuric Acid	0.00	93%	$0.05	0.00			$0.00
Flocculant ppm as Product	0.75	100%	$2.50	7.59			$18.97
Other Coagulant ppm as Product	0.00	100%	$0.28	0.00			$0.00
Hydrated Aluminum Sulfate (Coag) ppm as Produc	0.00	50%	$0.07	0.00			$0.00
Ferric Sulfate (Coag) ppm as Prod	0.00	50%	$0.07	0.00			$0.00
Ferric Chloride (Coag) ppm as Prod	50.00	50%	$0.07	505.86			$35.41
Chlorine ppm as Product	0.00	12.5%	$0.15	0.00			$0.00
Total							$1,068.09

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Lime Soda Softener Module

Combined Raw Water

SOFTENER LIMITS		Typ Cold	Typ Hot	Input
Min CaCO3		30	5	30.00
TDS inc in solubility		0.012	0	0.012
Mg to Si reduction		4-8	1-2	5.00
Min Si O2		4-8	1-2	5.00
Min PO4		0.1-1.0	<0.1	0.50
% reduction of Mg to OH		90%	98%	90.00%
% Mg partial lime soften		10%		10.00%
Min Mg		5	2	5.00
Final Sludge Cake Solids (% Solids)		15-45%	15-45%	20.00%
Final effluent % CO3 reduction with acid				0.00%
Lime	2P-M	-5 + 5	0 - 10	46.11
Soda Ash	2(M-P) - Ca	0 - 40	0 -10	-26.36

Mg(OH)2 Sludge	Lb/Day	2447.88			
CaCO3 Sludge	Lb/Day	2351.64			
Alum Sludge	Lb/Day	0.00			
Iron Sludge	Lb/Day	87.79			
Silica Sludge	Lb/Day	612.18			
Phosphate Sludge	Lb/Day	0.00			
Dry Sludge Total	Lb/Day	5499.48			
Water Loss with Solids	GPM	1.83			
Wet Sludge Total	Lb/Day	27497.41			
Sludge Disposal Cost	$/Wet Ton	$45.00			
Sludge Disposal Cost	$/Day	$618.69			
Capital Cost	$/1000 GPM	$220,000			
Capital Cost	$	$185,332			
Required Storage Time	Hrs	0.00	0.20	0.00	0.00
Required Storage Volume	Gal	0	10,087	0	0
Required Storage Volume	$ Installed	$0	$5,044	$0	$0

NALCO

NCPA Lodi

Gravity and Micro Filters

Contaminant	Units	Conduct Conv	CaCO3 Conv Factors	Lime Softener Effluent	2nd Pass RO Reject	Inlet Air Chiller BD	Evaporator Distillate	Crystallizer Distillate	Combined Influent	Gravity/uF Effluent	Gravity/uF Backwash	Gravity/uF Not Used
Flow	GPM	0.00	0.00	840.59	2.50	1.54	65.50	3.10	913.24	867.58	45.66	
Alkalinity-Bicarbonate	mg/L	0.72	0.82	43.87	0.40	0.24	0.00	0.00	40.38	40.38	40.38	
Alkalinity-Carbonate	mg/L	2.82	1.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Alkalinity-P-BaCl2	mg/L	0.00	2.94	15.68	0.14	0.00	0.00	0.00	14.44	14.44	14.44	
Barium	mg/L	0.00	0.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Chloride	mg/L	2.14	1.41	82.98	0.76	0.46	0.49	2.91	76.43	76.43	76.43	
Fluoride	mg/L	0.00	2.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Calcium	mg/L	2.6	2.50	24.93	0.23	0.14	0.15	0.88	22.96	22.96	22.96	
Magnesium	mg/L	3.82	4.12	9.22	0.08	0.05	0.05	0.33	8.49	8.49	8.49	
Iron	mg/L	0.00	2.69	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.01	
Nitrate	mg/L	1.15	0.81	39.82	0.37	0.22	0.23	1.40	36.67	36.67	36.67	
pH	s.u.	0.00	0.00	10.40	7.00	7.00	7.00	7.00	10.13	10.13	10.13	
Phosphate	mg/L	0.00	1.58	0.40	0.00	0.00	0.00	0.02	0.37	0.37	0.37	
Potassium	mg/L	1.84	1.28	14.93	0.14	0.08	0.09	0.53	13.75	13.75	13.75	
Silica	mg/L	0.00	0.83	5.00	0.05	0.03	0.03	0.20	4.61	4.61	4.61	
Sodium	mg/L	2.13	2.18	71.68	0.66	0.40	0.42	3.14	66.02	66.02	66.02	
Sulfate	mg/L	1.54	1.04	30.86	0.69	17.78	0.53	3.16	28.49	28.49	28.49	
Total Dissolved Solids	mg/L			339.38	3.53	19.40	1.99	12.57	312.61	312.61	312.61	
Specific Conductance	umhos/cm			582.45	5.99	30.34	3.77	23.90	536.53	536.53	536.53	
Free CO2	mg/L			0.01	0.15	0.04	0.00	0.00	0.01	0.01	0.01	
Total Cations	mg/L CaCO3			275.70	2.54	1.52	1.62	11.06	253.93	253.93	253.93	
Total Anions	mg/L CaCO3			268.22	2.89	19.54	1.45	8.72	247.05	247.05	247.05	
Total Hardness	mg/L CaCO3			100.31	0.92	0.55	0.59	3.54	92.39	92.39	92.39	
Backwash Rate	% of Influent								5.00%			
Polymer Feed	ppm								1.94			
Polymer Feed	Lb/Day								21.28			
Polymer Cost	$/Lb								$2.90			
Polymer Cost	$/Day								$61.70			
Capital Cost	$/1000 GPM								$150,000			
Capital Cost	$								$136,986			
Required Storage Time	Hrs								0.00	0.00	0.00	0.00
Required Storage Volume	Gal								0	0	0	0
Required Storage Volume	$ Installed								$0	$0	$0	$0

NALCO

NCPA Lodi

Cooling Tower Module

Contaminant	Units	Conduct Conv	CaCO3 Conv Factors	Gravity/uF Effluent	1st Pass RO Reject	EDI Reject	Quench Return	OWS Effluent	Side Stream RO Permeate	Combined Influent	Cooling Tower Blowdown
Flow	GPM	0.00	0.00	782.41	21.29	2.25	41.00	10.00	62.38	919.33	131.33
Alkalinity-Bicarbonate	mg/L	0.72	0.82	40.38	161.40	0.00	0.03	170.73	7.51	40.47	107.31
Alkalinity-Carbonate	mg/L	2.82	1.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Alkalinity-P-BaCl2	mg/L	0.00	2.94	14.44	57.71	0.00	0.01	0.00	0.00	13.62	0.00
Barium	mg/L	0.00	0.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chloride	mg/L	2.14	1.41	76.43	305.47	0.00	0.06	66.00	36.92	75.34	527.40
Fluoride	mg/L	0.00	2.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calcium	mg/L	2.6	2.50	22.96	91.79	0.00	0.02	32.00	11.16	22.78	159.43
Magnesium	mg/L	3.82	4.12	8.49	33.93	0.00	0.01	12.00	4.13	8.42	58.95
Iron	mg/L	0.00	2.69	0.01	0.03	0.00	0.00	0.09	0.00	0.01	0.06
Nitrate	mg/L	1.15	0.81	36.67	146.59	0.00	0.03	40.00	17.76	36.25	253.74
pH	s.u.	0.00	0.00	10.13	7.00	7.00	8.06	8.30	7.50	9.76	7.50
Phosphate	mg/L	0.00	1.58	0.37	1.47	0.00	0.61	0.40	0.19	0.39	2.74
Potassium	mg/L	1.84	1.28	13.75	54.97	0.00	0.01	15.00	6.66	13.59	95.15
Silica	mg/L	0.00	0.83	4.61	18.41	0.00	0.10	69.00	2.59	5.28	36.94
Sodium	mg/L	2.13	2.18	66.02	263.87	0.00	0.66	72.00	31.99	65.28	456.95
Sulfate	mg/L	1.54	1.04	28.49	276.99	0.00	0.05	31.00	34.17	33.32	488.19
Total Dissolved Solids	mg/L			312.61	1412.63	0.00	1.58	508.22	153.08	314.75	2186.87
Specific Conductance	umhos/cm			536.53	2395.72	0.01	1.74	667.05	282.60	538.62	4037.10
Free CO2	mg/L			0.01	61.31	0.00	0.00	1.42	0.40	0.03	5.65
Total Cations	mg/L CaCO3			253.93	1014.96	0.00	1.52	305.84	123.17	251.37	1759.58
Total Anions	mg/L CaCO3			247.05	1157.12	0.00	1.26	355.60	110.59	248.49	1579.86
Total Hardness	mg/L CaCO3			92.39	369.27	0.00	0.07	129.44	44.90	91.64	641.46
pH Target	Units										7.50
Use Acid for pH Control?	Enter 1 if used, otherwise enter 0.										1.00
Sulfuric Acid Feed	mg/L										260.26
Sulfuric Acid Strength	%										93.00%
Sulfuric Acid Feed	Lb/Day										441.40
Sulfuric Acid Cost	$/Lb										$0.05
Sulfuric Acid Cost	$/Day										$20.52
Cycles of Concentration											7.00
Phosphate Target	mg/L										0.00
Peak Evap Rate	GPM										1435.65
Avg Evap Rate	GPM										0.00
Evap Rate to Use	GPM										788.00
Cooling Tower Chem Feed	$/MMLb BD										$245.00
Cooling Tower Chem Feed	$/Day										$386.43
Oxidizing Biocide Demand	ppm										3.00
Cooling System Volume	Gal			If unknown, use ten times recirc rate as an estimate.							1,668,000
Oxidizing Biocide Demand	Lb/Day										46.47
Oxidizing Biocide Strength	%										12.50%
Oxidizing Biocide Feed	Lb/Day										371.72
Oxidizing Biocide Cost	$/Lb										$0.15
Oxidizing Biocide Cost	$/Day										$55.76
Required Storage Time	Hrs									0.00	0.00
Required Storage Vol	Gal									0	0
Required Storage Cost	$ Installed									$0	$0

NALCO

NCPA Lodi

Makeup RO Acid Feed Module

Contaminant	Units	Conduct Conv	CaCO3 Conv Factors	Gravity/uF Effluent			Combined Influent	MU RO Acid Feed Effl
Flow	GPM	0.00	0.00	85.17			85.17	85.17
Alkalinity-Bicarbonate	mg/L	0.72	0.82	40.38			40.38	40.38
Alkalinity-Carbonate	mg/L	2.82	1.67	0.00			0.00	0.00
Alkalinity-P-BaCl2	mg/L	0.00	2.94	14.44			14.44	14.44
Barium	mg/L	0.00	0.73	0.00			0.00	0.00
Chloride	mg/L	2.14	1.41	76.43			76.43	76.43
Fluoride	mg/L	0.00	2.63	0.00			0.00	0.00
Calcium	mg/L	2.6	2.50	22.96			22.96	22.96
Magnesium	mg/L	3.82	4.12	8.49			8.49	8.49
Iron	mg/L	0.00	2.69	0.01			0.01	0.01
Nitrate	mg/L	1.15	0.81	36.67			36.67	36.67
pH	s.u.	0.00	0.00	10.13			10.13	7.00
Phosphate	mg/L	0.00	1.58	0.37			0.37	0.37
Potassium	mg/L	1.84	1.28	13.75			13.75	13.75
Silica	mg/L	0.00	0.83	4.61			4.61	4.61
Sodium	mg/L	2.13	2.18	66.02			66.02	66.02
Sulfate	mg/L	1.54	1.04	28.49			28.49	69.30
Total Dissolved Solids	mg/L			312.61			312.61	353.42
Specific Conductance	umhos/cm			536.53			536.53	599.38
Free CO2	mg/L			0.01			0.01	15.34
Total Cations	mg/L CaCO3			253.93			253.93	253.93
Total Anions	mg/L CaCO3			247.05			247.05	289.50
Total Hardness	mg/L CaCO3			92.39			92.39	92.39

Target pH in Feed Stream	Units	7.00	
H+ Concentration in Feed	Moles/L	7.4668E-11	
Required H+ Concentration	Moles/L	1.0000E-07	
Acid Type	Enter 1 for HCl, 0 for H2SO4	0	
H+ to Add for Alkalinity	Moles/L	8.4925E-04	
H+ to Add for pH	Moles/L	9.9925E-08	
Total H+ to Add	Moles/L	8.4935E-04	
H+ to Add	mg/L	0.85	
HCl to Add	mg/L	0.00	
H2SO4 to Add	mg/L	41.66	
Cl- Added	mg/L	0.00	
SO4 Added	mg/L	40.81	
HCl Strength	%	30.00%	
H2SO4 Strength	%	93.00%	
HCl to Add	Lb/Day	0.00	
H2SO4 to Add	Lb/Day	45.82	
HCl Acid Cost	$/Lb	$0.15	
HCl Acid Cost	$/Day	$0.00	
Sulfuric Acid Cost	$/Lb	$0.05	
Sulfuric Acid Cost	$/Day	$2.13	
Influent Free Chlorine	ppm	0.50	
Bisulfite Required	ppm/ppm Cl	4.00	
Bisulfite Required	ppm Pure	2.00	
Bisulfite Strength	%	100.00%	
Bisulfite Feed	Lb/Day Prod	2.05	
Bisulfite Cost	$/Lb	$0.80	
Bisulfite Cost	$/Day	$1.64	
Required Storage Time	Hrs	0.00	0.00
Required Storage Volume	Gal	0	0
Required Storage Volume	$ Installed	$0	$0

NALCO

NCPA Lodi

1st Pass RO

Contaminant	Units	Conduct Conv	CaCO3 Conv Factors	MU RO Acid Feed Effl			Combined Influent	1st Pass RO Permeate	1st Pass RO Reject	1st Pass RO Not Used
Flow	GPM	0.00	0.00	85.17			85.17	63.88	21.29	
Alkalinity-Bicarbonate	mg/L	0.72	0.82	40.38			40.38	0.04	161.40	
Alkalinity-Carbonate	mg/L	2.82	1.67	0.00			0.00	0.00	0.00	
Alkalinity-P-BaCl2	mg/L	0.00	2.94	14.44			14.44	0.01	57.71	
Barium	mg/L	0.00	0.73	0.00			0.00	0.00	0.00	
Chloride	mg/L	2.14	1.41	76.43			76.43	0.08	305.47	
Fluoride	mg/L	0.00	2.63	0.00			0.00	0.00	0.00	
Calcium	mg/L	2.6	2.50	22.96			22.96	0.02	91.79	
Magnesium	mg/L	3.82	4.12	8.49			8.49	0.01	33.93	
Iron	mg/L	0.00	2.69	0.01			0.01	0.00	0.03	
Nitrate	mg/L	1.15	0.81	36.67			36.67	0.04	146.59	
pH	s.u.	0.00	0.00	7.00			7.00	7.00	7.00	
Phosphate	mg/L	0.00	1.58	0.37			0.37	0.00	1.47	
Potassium	mg/L	1.84	1.28	13.75			13.75	0.01	54.97	
Silica	mg/L	0.00	0.83	4.61			4.61	0.00	18.41	
Sodium	mg/L	2.13	2.18	66.02			66.02	0.07	263.87	
Sulfate	mg/L	1.54	1.04	69.30			69.30	0.07	276.99	
Total Dissolved Solids	mg/L			353.42			353.42	0.35	1412.63	
Specific Conductance	umhos/cm			599.38			599.38	0.60	2395.72	
Free CO2	mg/L			15.34			15.34	0.02	61.31	
Total Cations	mg/L CaCO3			253.93			253.93	0.25	1014.96	
Total Anions	mg/L CaCO3			289.50			289.50	0.29	1157.12	
Total Hardness	mg/L CaCO3			92.39			92.39	0.09	369.27	

RO Recovery Rate	% of Influent	75.00%			
RO Ion Reject Rate	% of Influent	99.90%			
Anti-Scalant Feed	ppm	1.94			
Anti-Scalant Feed	Lb/Day	1.98			
Anti-Scalant Cost	$/Lb	$2.90			
Anti-Scalant Cost	$/Day	$5.75			
1st Stage RO Pump Prssr	PSIG	190.00			
1st Stage RO Pump Prssr	Feet	438.90			
2nd Stage RO Pump Prssr	PSIG	0.00			
2nd Stage RO Pump Prssr	Feet	0.00			
2nd Stage Flow	% of Influent	42.80%			
Pump Efficiency	%	76.00%			
Motor Efficiency	%	94.00%			
1st Stage Power Consump	KWHr/1000 G	1.94			
2nd Stage Power Consump	KWHr/1000 G	0.00			
Power Consumption	MW-Hr/Day	0.24			
Power Cost	$/MW-Hr	$35.00			
Power Cost	$/Day	$8.31			
1st Stage Membrane Cost	$/Element	$500.00			
1st Stage No. of Elements		24.00			
Replacement Frequency	Years	3.00			
Replacement Cost	$/Day	$10.96			
2nd Stage Membrane Cost	$/Element	$500.00			
2nd Stage No. of Elements		18.00			
Replacement Frequency	Years	3.00			
Replacement Cost	$/Day	$8.22			
Capital Cost	$/100 GPM	$100,000			
Capital Cost	$	$85,169			
Required Storage Time	Hrs	0.00	0.00	0.00	0.00
Required Storage Volume	Gal	0	0	0	0
Required Storage Volume	$ Installed	$0	$0	$0	$0

NALCO

NCPA Lodi

HRSG Quench System

Contaminant	Units	Conduct Conv	CaCO3 Conv Factors	1st Pass RO Permeate	HRSG BD		Quench Influent
Flow	GPM	0.00	0.00	29.60	12.56		42.16
Alkalinity-Bicarbonate	mg/L	0.72	0.82	0.04	0.00		0.03
Alkalinity-Carbonate	mg/L	2.82	1.67	0.00	0.00		0.00
Alkalinity-P-BaCl2	mg/L	0.00	2.94	0.01	0.00		0.01
Barium	mg/L	0.00	0.73	0.00	0.00		0.00
Chloride	mg/L	2.14	1.41	0.08	0.00		0.05
Fluoride	mg/L	0.00	2.63	0.00	0.00		0.00
Calcium	mg/L	2.6	2.50	0.02	0.00		0.02
Magnesium	mg/L	3.82	4.12	0.01	0.00		0.01
Iron	mg/L	0.00	2.69	0.00	0.00		0.00
Nitrate	mg/L	1.15	0.81	0.04	0.00		0.03
pH	s.u.	0.00	0.00	7.00	9.80		7.83
Phosphate	mg/L	0.00	1.58	0.00	2.00		0.60
Potassium	mg/L	1.84	1.28	0.01	0.00		0.01
Silica	mg/L	0.00	0.83	0.00	0.33		0.10
Sodium	mg/L	2.13	2.18	0.07	2.00		0.64
Sulfate	mg/L	1.54	1.04	0.07	0.00		0.05
Total Dissolved Solids	mg/L			0.35	4.33	0.00	1.54
Specific Conductance	umhos/cm			0.60	4.26	0.00	1.69
Free CO2	mg/L			0.02	0.00	0.00	0.00
Total Cations	mg/L CaCO3			0.25	4.36	0.00	1.48
Total Anions	mg/L CaCO3			0.29	3.43	0.00	1.22
Total Hardness	mg/L CaCO3			0.09	0.00	0.00	0.06

NALCO

NCPA Lodi

Inlet Air Cooling

Contaminant	Units	Conduct Conv	CaCO3 Conv Factors	1st Pass RO Permeate					Combined Influent	Inlet Air Chiller BD
Flow	GPM	0.00	0.00	9.26					9.26	1.54
Alkalinity-Bicarbonate	mg/L	0.72	0.82	0.04					0.04	0.24
Alkalinity-Carbonate	mg/L	2.82	1.67	0.00					0.00	0.00
Alkalinity-P-BaCl2	mg/L	0.00	2.94	0.01					0.01	0.00
Barium	mg/L	0.00	0.73	0.00					0.00	0.00
Chloride	mg/L	2.14	1.41	0.08					0.08	0.46
Fluoride	mg/L	0.00	2.63	0.00					0.00	0.00
Calcium	mg/L	2.6	2.50	0.02					0.02	0.14
Magnesium	mg/L	3.82	4.12	0.01					0.01	0.05
Iron	mg/L	0.00	2.69	0.00					0.00	0.00
Nitrate	mg/L	1.15	0.81	0.04					0.04	0.22
pH	s.u.	0.00	0.00	7.00					7.00	7.00
Phosphate	mg/L	0.00	1.58	0.00					0.00	0.00
Potassium	mg/L	1.84	1.28	0.01					0.01	0.08
Silica	mg/L	0.00	0.83	0.00					0.00	0.03
Sodium	mg/L	2.13	2.18	0.07					0.07	0.40
Sulfate	mg/L	1.54	1.04	0.07					0.07	17.78
Total Dissolved Solids	mg/L			0.35					0.35	19.40
Specific Conductance	umhos/cm			0.60					0.60	30.34
Free CO2	mg/L			0.02					0.02	0.04
Total Cations	mg/L CaCO3			0.25					0.25	1.52
Total Anions	mg/L CaCO3			0.29					0.29	19.54
Total Hardness	mg/L CaCO3			0.09					0.09	0.55
pH Target	Units									7.00
Use Acid for pH Control?	Enter 1 if used, otherwise enter 0.									0.00
Sulfuric Acid Feed	mg/L									17.73
Sulfuric Acid Strength	%									93.00%
Sulfuric Acid Feed	Lb/Day									0.35
Sulfuric Acid Cost	$/Lb									$0.05
Sulfuric Acid Cost	$/Day									$0.02
Cycles of Concentration										6.00
Phosphate Target	mg/L									0.00
Peak Evap Rate	GPM									46.45
Avg Evap Rate	GPM									0.00
Evap Rate to Use	GPM									7.72
Chem Feed	$/MMLb BD									$245.00
Chem Feed	$/Day									$4.54
Oxidizing Biocide Demand	ppm									3.00
System Volume	Gal			If unknown, use ten times recirc rate as an estimate.						1,668,000
Oxidizing Biocide Demand	Lb/Day									41.79
Oxidizing Biocide Strength	%									12.50%
Oxidizing Biocide Feed	Lb/Day									334.31
Oxidizing Biocide Cost	$/Lb									$0.15
Oxidizing Biocide Cost	$/Day									$50.15
Required Storage Time	Hrs								0.00	0.00
Required Storage Vol	Gal								0	0
Required Storage Cost	$ Installed								$0	$0

NALCO

NCPA Lodi

2nd Pass RO

Contaminant	Units	Conduct Conv	CaCO3 Conv Factors	1st Pass RO Permeate			Combined Influent	2nd Pass RO Permeate	2nd Pass RO Reject	2nd Pass RO Not Used
Flow	GPM	0.00	0.00	25.01			25.01	22.51	2.50	
Alkalinity-Bicarbonate	mg/L	0.72	0.82	0.04			0.04	0.00	0.40	
Alkalinity-Carbonate	mg/L	2.82	1.67	0.00			0.00	0.00	0.00	
Alkalinity-P-BaCl2	mg/L	0.00	2.94	0.01			0.01	0.00	0.14	
Barium	mg/L	0.00	0.73	0.00			0.00	0.00	0.00	
Chloride	mg/L	2.14	1.41	0.08			0.08	0.00	0.76	
Fluoride	mg/L	0.00	2.63	0.00			0.00	0.00	0.00	
Calcium	mg/L	2.6	2.50	0.02			0.02	0.00	0.23	
Magnesium	mg/L	3.82	4.12	0.01			0.01	0.00	0.08	
Iron	mg/L	0.00	2.69	0.00			0.00	0.00	0.00	
Nitrate	mg/L	1.15	0.81	0.04			0.04	0.00	0.37	
pH	s.u.	0.00	0.00	7.00			7.00	7.00	7.00	
Phosphate	mg/L	0.00	1.58	0.00			0.00	0.00	0.00	
Potassium	mg/L	1.84	1.28	0.01			0.01	0.00	0.14	
Silica	mg/L	0.00	0.83	0.00			0.00	0.00	0.05	
Sodium	mg/L	2.13	2.18	0.07			0.07	0.00	0.66	
Sulfate	mg/L	1.54	1.04	0.07			0.07	0.00	0.69	
Total Dissolved Solids	mg/L			0.35			0.35	0.00	3.53	
Specific Conductance	umhos/cm			0.60			0.60	0.00	5.99	
Free CO2	mg/L			0.02			0.02	0.00	0.15	
Total Cations	mg/L CaCO3			0.25			0.25	0.00	2.54	
Total Anions	mg/L CaCO3			0.29			0.29	0.00	2.89	
Total Hardness	mg/L CaCO3			0.09			0.09	0.00	0.92	
RO Recovery Rate	% of Influent						90.00%			
RO Ion Reject Rate	% of Influent						99.90%			
Anti-Scalant Feed	ppm						1.94			
Anti-Scalant Feed	Lb/Day						0.58			
Anti-Scalant Cost	$/Lb						$2.90			
Anti-Scalant Cost	$/Day						$1.69			
1st Stage RO Pump Prssr	PSIG						190.00			
1st Stage RO Pump Prssr	Feet						438.90			
2nd Stage RO Pump Prssr	PSIG						0.00			
2nd Stage RO Pump Prssr	Feet						0.00			
2nd Stage Flow	% of Influent						42.80%			
Pump Efficiency	%						76.00%			
Motor Efficiency	%						94.00%			
1st Stage Power Consump	KWHr/1000 G						1.94			
2nd Stage Power Consump	KWHr/1000 G						0.00			
Power Consumption	MW-Hr/Day						0.07			
Power Cost	$/MW-Hr						$35.00			
Power Cost	$/Day						$2.44			
1st Stage Membrane Cost	$/Element						$500.00			
1st Stage No. of Elements							24.00			
Replacement Frequency	Years						3.00			
Replacement Cost	$/Day						$10.96			
2nd Stage Membrane Cost	$/Element						$500.00			
2nd Stage No. of Elements							18.00			
Replacement Frequency	Years						3.00			
Replacement Cost	$/Day						$8.22			
Capital Cost	$/100 GPM						$100,000			
Capital Cost	$						$25,012			
Required Storage Time	Hrs						0.00	0.00	0.00	0.00
Required Storage Volume	Gal						0	0	0	0
Required Storage Volume	$ Installed						$0	$0	$0	$0

NALCO

NCPA Lodi

EDI

Contaminant	Units	Conduct Conv	CaCO3 Conv Factors	2nd Pass RO Permeate			Combined Influent	EDI Permeate	EDI Reject	EDI Not Used
Flow	GPM	0.00	0.00	22.51			22.51	20.26	2.25	
Alkalinity-Bicarbonate	mg/L	0.72	0.82	0.00			0.00	0.00	0.00	
Alkalinity-Carbonate	mg/L	2.82	1.67	0.00			0.00	0.00	0.00	
Alkalinity-P-BaCl2	mg/L	0.00	2.94	0.00			0.00	0.00	0.00	
Barium	mg/L	0.00	0.73	0.00			0.00	0.00	0.00	
Chloride	mg/L	2.14	1.41	0.00			0.00	0.00	0.00	
Fluoride	mg/L	0.00	2.63	0.00			0.00	0.00	0.00	
Calcium	mg/L	2.6	2.50	0.00			0.00	0.00	0.00	
Magnesium	mg/L	3.82	4.12	0.00			0.00	0.00	0.00	
Iron	mg/L	0.00	2.69	0.00			0.00	0.00	0.00	
Nitrate	mg/L	1.15	0.81	0.00			0.00	0.00	0.00	
pH	s.u.	0.00	0.00	7.00			7.00	7.00	7.00	
Phosphate	mg/L	0.00	1.58	0.00			0.00	0.00	0.00	
Potassium	mg/L	1.84	1.28	0.00			0.00	0.00	0.00	
Silica	mg/L	0.00	0.83	0.00			0.00	0.00	0.00	
Sodium	mg/L	2.13	2.18	0.00			0.00	0.00	0.00	
Sulfate	mg/L	1.54	1.04	0.00			0.00	0.00	0.00	
Total Dissolved Solids	mg/L			0.00			0.00	0.00	0.00	
Specific Conductance	umhos/cm			0.00			0.00	0.00	0.01	
Free CO2	mg/L			0.00			0.00	0.00	0.00	
Total Cations	mg/L CaCO3			0.00			0.00	0.00	0.00	
Total Anions	mg/L CaCO3			0.00			0.00	0.00	0.00	
Total Hardness	mg/L CaCO3			0.00			0.00	0.00	0.00	

RO Recovery Rate	% of Influent	90.00%
RO Ion Reject Rate	% of Influent	99.90%
Anti-Scalant Feed	ppm	1.94
Anti-Scalant Feed	Lb/Day	0.52
Anti-Scalant Cost	$/Lb	$2.90
Anti-Scalant Cost	$/Day	$1.52
1st Stage RO Pump Prssr	PSIG	190.00
1st Stage RO Pump Prssr	Feet	438.90
2nd Stage RO Pump Prssr	PSIG	0.00
2nd Stage RO Pump Prssr	Feet	0.00
2nd Stage Flow	% of Influent	42.80%
Pump Efficiency	%	76.00%
Motor Efficiency	%	94.00%
1st Stage Power Consump	KWHr/1000 G	1.94
2nd Stage Power Consump	KWHr/1000 G	0.00
Power Consumption	MW-Hr/Day	0.06
Power Cost	$/MW-Hr	$35.00
Power Cost	$/Day	$2.20
1st Stage Membrane Cost	$/Element	$500.00
1st Stage No. of Elements		24.00
Replacement Frequency	Years	3.00
Replacement Cost	$/Day	$10.96
2nd Stage Membrane Cost	$/Element	$500.00
2nd Stage No. of Elements		18.00
Replacement Frequency	Years	3.00
Replacement Cost	$/Day	$8.22
Capital Cost	$/100 GPM	$100,000
Capital Cost	$	$22,510

Required Storage Time	Hrs	0.00	0.00	0.00	0.00
Required Storage Volume	Gal	0	0	0	0
Required Storage Volume	$ Installed	$0	$0	$0	$0

NALCO

NCPA Lodi

Side Stream RO Filter

Contaminant	Units	Conduct Conv	CaCO3 Conv Factors	Cooling Tower Blowdown					Combined Influent	SSRO Filter Effluent	SSRO Filter Backwash	SSRO Filter Not Used
Flow	GPM	0.00	0.00	131.33					131.33	124.77	6.57	
Alkalinity-Bicarbonate	mg/L	0.72	0.82	107.31					107.31	107.31	107.31	
Alkalinity-Carbonate	mg/L	2.82	1.67	0.00					0.00	0.00	0.00	
Alkalinity-P-BaCl2	mg/L	0.00	2.94	0.00					0.00	0.00	0.00	
Barium	mg/L	0.00	0.73	0.00					0.00	0.00	0.00	
Chloride	mg/L	2.14	1.41	527.40					527.40	527.40	527.40	
Fluoride	mg/L	0.00	2.63	0.00					0.00	0.00	0.00	
Calcium	mg/L	2.6	2.50	159.43					159.43	159.43	159.43	
Magnesium	mg/L	3.82	4.12	58.95					58.95	58.95	58.95	
Iron	mg/L	0.00	2.69	0.06					0.06	0.06	0.06	
Nitrate	mg/L	1.15	0.81	253.74					253.74	253.74	253.74	
pH	s.u.	0.00	0.00	7.50					7.50	7.50	7.50	
Phosphate	mg/L	0.00	1.58	2.74					2.74	2.74	2.74	
Potassium	mg/L	1.84	1.28	95.15					95.15	95.15	95.15	
Silica	mg/L	0.00	0.83	36.94					36.94	36.94	36.94	
Sodium	mg/L	2.13	2.18	456.95					456.95	456.95	456.95	
Sulfate	mg/L	1.54	1.04	488.19					488.19	488.19	488.19	
Total Dissolved Solids	mg/L			2186.87					2186.87	2186.87	2186.87	
Specific Conductance	umhos/cm			4037.10					4037.10	4037.10	4037.10	
Free CO2	mg/L			5.65					5.65	5.65	5.65	
Total Cations	mg/L CaCO3			1759.58					1759.58	1759.58	1759.58	
Total Anions	mg/L CaCO3			1579.86					1579.86	1579.86	1579.86	
Total Hardness	mg/L CaCO3			641.46					641.46	641.46	641.46	
Backwash Rate	% of Influent								5.00%			
Polymer Feed	ppm								1.94			
Polymer Feed	Lb/Day								3.06			
Polymer Cost	$/Lb								$2.90			
Polymer Cost	$/Day								$8.87			
Blowdown Free Chlorine	ppm								0.50			
Bisulfite Required	ppm/ppm Cl								4.00			
Bisulfite Required	ppm Pure								2.00			
Bisulfite Strength	%								100.00%			
Bisulfite Feed	Lb/Day Prod								3.15			
Bisulfite Cost	$/Lb								$0.80			
Bisulfite Cost	$/Day								$2.52			
Capital Cost	$/1000 GPM								$150,000			
Capital Cost	$								$19,700			
Required Storage Time	Hrs								0.00	0.00	0.00	0.00
Required Storage Volume	Gal								0	0	0	0
Required Storage Volume	$ Installed								$0	$0	$0	$0

NALCO

NCPA Lodi

Side Stream RO

Contaminant	Units	Conduct Conv	CaCO3 Conv Factors	SSRO Filter Effluent			Combined Influent	Side Stream RO Permeate	Side Stream RO Reject	Side Stream RO Not Used
Flow	GPM	0.00	0.00	124.77			124.77	62.38	62.38	
Alkalinity-Bicarbonate	mg/L	0.72	0.82	107.31			107.31	7.51	207.10	
Alkalinity-Carbonate	mg/L	2.82	1.67	0.00			0.00	0.00	0.00	
Alkalinity-P-BaCl2	mg/L	0.00	2.94	0.00			0.00	0.00	0.00	
Barium	mg/L	0.00	0.73	0.00			0.00	0.00	0.00	
Chloride	mg/L	2.14	1.41	527.40			527.40	36.92	1017.89	
Fluoride	mg/L	0.00	2.63	0.00			0.00	0.00	0.00	
Calcium	mg/L	2.6	2.50	159.43			159.43	11.16	307.71	
Magnesium	mg/L	3.82	4.12	58.95			58.95	4.13	113.78	
Iron	mg/L	0.00	2.69	0.06			0.06	0.00	0.12	
Nitrate	mg/L	1.15	0.81	253.74			253.74	17.76	489.73	
pH	s.u.	0.00	0.00	7.50			7.50	7.50	7.50	
Phosphate	mg/L	0.00	1.58	2.74			2.74	0.19	5.28	
Potassium	mg/L	1.84	1.28	95.15			95.15	6.66	183.65	
Silica	mg/L	0.00	0.83	36.94			36.94	2.59	71.29	
Sodium	mg/L	2.13	2.18	456.95			456.95	31.99	881.92	
Sulfate	mg/L	1.54	1.04	488.19			488.19	34.17	942.20	
Total Dissolved Solids	mg/L			2186.87			2186.87	153.08	4220.65	
Specific Conductance	umhos/cm			4037.10			4037.10	282.60	7791.59	
Free CO2	mg/L			5.65			5.65	0.40	10.90	
Total Cations	mg/L CaCO3			1759.58			1759.58	123.17	3395.99	
Total Anions	mg/L CaCO3			1579.86			1579.86	110.59	3049.12	
Total Hardness	mg/L CaCO3			641.46			641.46	44.90	1238.03	

RO Recovery Rate	% of Influent	50.00%			
RO Ion Reject Rate	% of Influent	93.00%			
Anti-Scalant Feed	ppm	1.94			
Anti-Scalant Feed	Lb/Day	2.91			
Anti-Scalant Cost	$/Lb	$2.90			
Anti-Scalant Cost	$/Day	$8.43			
1st Stage RO Pump Prssr	PSIG	400.00			
1st Stage RO Pump Prssr	Feet	924.00			
2nd Stage RO Pump Prssr	PSIG	1000.00			
2nd Stage RO Pump Prssr	Feet	2310.00			
2nd Stage Flow	% of Influent	30.00%			
Pump Efficiency	%	65.00%			
Motor Efficiency	%	90.00%			
1st Stage Power Consump	KWHr/1000 G	4.98			
2nd Stage Power Consump	KWHr/1000 G	12.44			
Power Consumption	MW-Hr/Day	1.56			
Power Cost	$/MW-Hr	$35.00			
Power Cost	$/Day	$54.75			
1st Stage Membrane Cost	$/Element	$500.00			
1st Stage No. of Elements		10.00			
Replacement Frequency	Years	3.00			
Replacement Cost	$/Day	$4.57			
2nd Stage Membrane Cost	$/Element	$500.00			
2nd Stage No. of Elements		5.00			
Replacement Frequency	Years	3.00			
Replacement Cost	$/Day	$2.28			
Capital Cost	$/100 GPM	$200,000			
Capital Cost	$	$249,533			
Required Storage Time	Hrs	0.00	0.00	0.00	0.00
Required Storage Volume	Gal	0	0	0	0
Required Storage Volume	$ Installed	$0	$0	$0	$0

NALCO

NCPA Lodi

Evaporator Acid Feed Module

Contaminant	Units	Conduct Conv	CaCO3 Conv Factors	SSRO Filter Backwash	Side Stream RO Reject		Combined Influent	Evaporator Acid Feed Effluent
Flow	GPM	0.00	0.00	6.57	62.38		68.95	68.95
Alkalinity-Bicarbonate	mg/L	0.72	0.82	107.31	207.10		197.60	0.07
Alkalinity-Carbonate	mg/L	2.82	1.67	0.00	0.00		0.00	0.00
Alkalinity-P-BaCl2	mg/L	0.00	2.94	0.00	0.00		0.00	0.00
Barium	mg/L	0.00	0.73	0.00	0.00		0.00	0.00
Chloride	mg/L	2.14	1.41	527.40	1017.89		971.17	971.17
Fluoride	mg/L	0.00	2.63	0.00	0.00		0.00	0.00
Calcium	mg/L	2.6	2.50	159.43	307.71		293.59	293.59
Magnesium	mg/L	3.82	4.12	58.95	113.78		108.55	108.55
Iron	mg/L	0.00	2.69	0.06	0.12		0.11	0.11
Nitrate	mg/L	1.15	0.81	253.74	489.73		467.25	467.25
pH	s.u.	0.00	0.00	7.50	7.50		7.50	6.00
Phosphate	mg/L	0.00	1.58	2.74	5.28		5.04	5.04
Potassium	mg/L	1.84	1.28	95.15	183.65		175.22	175.22
Silica	mg/L	0.00	0.83	36.94	71.29		68.01	68.01
Sodium	mg/L	2.13	2.18	456.95	881.92		841.45	841.45
Sulfate	mg/L	1.54	1.04	488.19	942.20		898.96	1054.60
Total Dissolved Solids	mg/L			2186.87	4220.65		4026.96	3985.07
Specific Conductance	umhos/cm			4037.10	7791.59		7434.02	7532.48
Free CO2	mg/L			5.65	10.90		10.40	0.12
Total Cations	mg/L CaCO3			1759.58	3395.99		3240.15	3240.15
Total Anions	mg/L CaCO3			1579.86	3049.12		2909.19	2909.08
Total Hardness	mg/L CaCO3			641.46	1238.03		1181.21	1181.21

Target pH in Feed Stream	Units	6	
H+ Concentration in Feed	Moles/L	3.1623E-08	
Required H+ Concentration	Moles/L	1.0000E-06	
Acid Type	Enter 1 for HCl, 0 for H2SO4	0	
H+ to Add for Alkalinity	Moles/L	3.2382E-03	
H+ to Add for pH	Moles/L	9.6838E-07	
Total H+ to Add	Moles/L	3.2392E-03	
H+ to Add	mg/L	3.24	
HCl to Add	mg/L	0.00	
H2SO4 to Add	mg/L	158.88	
Cl- Added	mg/L	0.00	
SO4 Added	mg/L	155.64	
HCl Strength	%	30.00%	
H2SO4 Strength	%	93.00%	
HCl to Add	Lb/Day	0.00	
H2SO4 to Add	Lb/Day	141.47	
HCl Acid Cost	$/Lb	$0.15	
HCl Acid Cost	$/Day	$0.00	
Sulfuric Acid Cost	$/Lb	$0.05	
Sulfuric Acid Cost	$/Day	$6.58	
Required Storage Time	Hrs	0.00	0.00
Required Storage Volume	Gal	0	0
Required Storage Volume	$ Installed	$0	$0

NALCO

NCPA Lodi

Evaporator

Contaminant	Units	Conduct Conv	CaCO3 Conv Factors	Evaporator Acid Feed Effluent			Combined Influent	Evaporator Distillate	Evaporator Blowdown	Evaporator Not Used
Flow	GPM	0.00	0.00	68.95			68.95	65.50	3.45	
Alkalinity-Bicarbonate	mg/L	0.72	0.82	0.07			0.07	0.00	1.40	
Alkalinity-Carbonate	mg/L	2.82	1.67	0.00			0.00	0.00	0.00	
Alkalinity-P-BaCl2	mg/L	0.00	2.94	0.00			0.00	0.00	0.00	
Barium	mg/L	0.00	0.73	0.00			0.00	0.00	0.00	
Chloride	mg/L	2.14	1.41	971.17			971.17	0.49	19414.25	
Fluoride	mg/L	0.00	2.63	0.00			0.00	0.00	0.00	
Calcium	mg/L	2.6	2.50	293.59			293.59	0.15	5868.94	
Magnesium	mg/L	3.82	4.12	108.55			108.55	0.05	2170.06	
Iron	mg/L	0.00	2.69	0.11			0.11	0.00	2.24	
Nitrate	mg/L	1.15	0.81	467.25			467.25	0.23	9340.60	
pH	s.u.	0.00	0.00	6.00			6.00	7.00	6.00	
Phosphate	mg/L	0.00	1.58	5.04			5.04	0.00	100.69	
Potassium	mg/L	1.84	1.28	175.22			175.22	0.09	3502.72	
Silica	mg/L	0.00	0.83	68.01			68.01	0.03	1359.64	
Sodium	mg/L	2.13	2.18	841.45			841.45	0.42	16820.92	
Sulfate	mg/L	1.54	1.04	1054.60			1054.60	0.53	21082.03	
Total Dissolved Solids	mg/L			3985.07			3985.07	1.99	79663.50	
Specific Conductance	umhos/cm			7532.48			7532.48	3.77	150577.97	
Free CO2	mg/L			0.12			0.12	0.00	2.33	
Total Cations	mg/L CaCO3			3240.15			3240.15	1.62	64772.13	
Total Anions	mg/L CaCO3			2909.08			2909.08	1.45	58154.04	
Total Hardness	mg/L CaCO3			1181.21			1181.21	0.59	23613.00	
BC Recovery Rate	% of Influent						95.00%			
BC Ion Reject Rate	% of Influent						99.95%			
Power Consumption	MW/1000 Gal						0.09			
Power Consumption	MW-Hr/Day						8.94			
Power Cost	$/MW-Hr						$35.00			
Power Cost	$/Day						$312.76			
Seed Chemical Feed	Lbs/Startup						3,000.00			
BC Startups/Year							5.00			
BC Calcium/Silca Ratio	Target						3.00			
BC Required Calcium Feed	ppm						0.00			
Chloride Added With Ca	ppm						0.00			
BC CaCl2 Feedrate	ppm						0.00			
BC CaCl2 Feedrate	Lbs/Day	as pure CaCl2					0.00			
CaCl2 Strength	%						35.00%			
CaCl2 Feedrate	Lbs/Day	Lbs of product as delivered					0.00			
CaCl2 Cost	$/Lb						$0.45			
CaCl2 Cost	$/Day						$18.49			
Polymer Feed	ppm						1.00			
Polymer Cost	$/Lb						$2.00			
Polymer Cost	$/Day						$1.66			
Anti-Foam Feed	ppm						0.50			
Anti-Foam Cost	$/Lb						$2.50			
Anti-Foam Cost	$/Day						$1.04			
Number of BCs							2			
Capacity of Each BC	%						50.00%			
Capacity of Each BC	GPM						50.00			
BC Equipment Cost	$						$1,278,986			
BC Structural Steel Cost	$/BC						$150,000			
BC Structural Steel Cost	$ Total						$300,000			
BC Total Capital Cost	$						$1,578,986			
Required Storage Time	Hrs						0.00	0.00	0.00	0.00
Required Storage Volume	Gal						0	0	0	0
Required Storage Volume	$ Installed						$0	$0	$0	$0

NALCO

NCPA Lodi

Crystallizer Module

Contaminant	Units	Conduct Conv	CaCO3 Conv Factors	Evaporator Blowdown			Combined Influent	Crystallizer Distillate	Crystallizer Not Used 1	Crystallizer Not Used 2
Flow	GPM	0.00	0.00	3.45			3.45	3.10		
Alkalinity-Bicarbonate	mg/L	0.72	0.82	1.40			1.40	0.00		
Alkalinity-Carbonate	mg/L	2.82	1.67	0.00			0.00	0.00		
Alkalinity-P-BaCl2	mg/L	0.00	2.94	0.00			0.00	0.00		
Barium	mg/L	0.00	0.73	0.00			0.00	0.00		
Chloride	mg/L	2.14	1.41	19414.25			19414.25	2.91		
Fluoride	mg/L	0.00	2.63	0.00			0.00	0.00		
Calcium	mg/L	2.6	2.50	5868.94			5868.94	0.88		
Magnesium	mg/L	3.82	4.12	2170.06			2170.06	0.33		
Iron	mg/L	0.00	2.69	2.24			2.24	0.00		
Nitrate	mg/L	1.15	0.81	9340.60			9340.60	1.40		
pH	s.u.	0.00	0.00	6.00			6.00	7.00		
Phosphate	mg/L	0.00	1.58	100.69			100.69	0.02		
Potassium	mg/L	1.84	1.28	3502.72			3502.72	0.53		
Silica	mg/L	0.00	0.83	1359.64			1359.64	0.20		
Sodium	mg/L	2.13	2.18	16820.92			20928.30	3.14		
Sulfate	mg/L	1.54	1.04	21082.03			21082.03	3.16		
Total Dissolved Solids	mg/L			79663.50			83770.88	12.57	0.00	0.00
Specific Conductance	umhos/cm			150577.97			159326.69	23.90	0.00	0.00
Free CO2	mg/L			2.33			2.33	0.00	0.00	0.00
Total Cations	mg/L CaCO3			64772.13			73726.22	11.06	0.00	0.00
Total Anions	mg/L CaCO3			58154.04			58154.04	8.72	0.00	0.00
Total Hardness	mg/L CaCO3			23613.00			23613.00	3.54	0.00	0.00

Crystallizer Recovery Rate	% of Influent	90.00%
Crystallizer Ion Reject Rate	% of Influent	99.99%
Power Consumption	MW/1000 Gal	0.20
Power Consumption	MW-Hr/Day	0.99
Power Cost	$/MW-Hr	$35.00
Power Cost	$/Day	$34.75
Anti-Foam Feed	ppm	0.50
Anti-Foam Cost	$/Lb	$2.50
Anti-Foam Cost	$/Day	$0.05
Caustic Feed Required?	1=Yes	1
Magnesium in Influent	Moles/Min	1.1654
Magnesium in Effluent	Moles/Min	0.0002
Magnesium Precipitated	Moles/Min	1.1653
OH Precipitated	Moles/Min	2.3305
Sodium Added	mg/L	4107.38
Caustic Feed Required	mg/L	7143.27
Caustic Feed Required	Lb/Day	295.75
Caustic Cost	$/Lb	$0.15
Caustic Cost	$/Day	$44.36
Number of Crystallizers		2
Capacity of Each Xtalizer	%	50.00%
Capacity of Each Xtalizer	GPM	1.72
Xtal Equipment Cost	$	$250,000
Structural Steel Cost	$/Xtal	$50,000
Xtal Structural Steel Cost	$ Total	$100,000
Xtal Total Capital Cost	$	$350,000

Required Storage Time	Hrs	0.00	0.00	0.00	0.00
Required Storage Volume	Gal	0	0	0	0
Required Storage Volume	$ Installed	$0	$0	$0	$0

Total Dry Sludge Discharged	Tons/Year	632.98
Sludge Solids	%	70.00%
Total Sludge Discharged	Tons/Year	904.25
Bulk Density of Sludge	Lbs/ft^3	55
Vol of Sludge Discharged	Ft^3/Year	32881.99
Sludge Disposal Cost	$/Wet Ton	$45.00
Sludge Disposal Cost	$/Day	$111.48