Field Pilot Test Report
Paraiso Hot Springs
Potable Water Treatment Plant

Fluoride Reduction
AD74 Adsorption

Pilot Conducted: March 13th – 26th, 2012

Prepared for:
Culligan of Salinas/Thompson Holdings, LLC

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Introduction

AdEdge Water Technologies, LLC (AdEdge) was selected in conjunction with Culligan of Salinas to provide a pilot demonstration for the Paraiso Springs Resort Project. The pilot demonstration is based on a proposed fluoride treatment process utilizing an activate alumina (AD74) adsorption media. Activate Alumina is considered by the USEPA a Best Available Technology (BAT) for fluoride reduction. Field work commenced on March 13, 2012 and concluded on March 25, 2012. The intention is to use information gathered in the pilot demonstration as not only proof of concept but also for implementing a full scale potable water treatment system at the site. This report defines the pilot operations, monitoring, sampling, laboratory analysis, quality assurance and calibration data for the AD74 pilot from AdEdge.

I. Objectives

A full scale treatment plant will be representatively scaled based on a demonstration of the following performance objectives:

1. *Determine fluoride removal efficiencies of the system with the goals of attaining the State of California primary drinking water MCL of 2.0 mg/L for fluoride*
2. *Determine a consistent service throughput between regeneration*
3. *Determine waste water volumes and characteristics*
4. *Utilize information to refine full scale operational costs for chemicals*

II. Treatment Approach

The approach for reducing the targeted contaminant; fluoride, utilizes a dual stage down flow adsorption process. The total water flow enters the first adsorption bed and then enters the second vessel in a series or lead lag design. The fluoride adsorption process is preceded with an injection of hydrochloric acid to create an optimized pH for addressing fluoride with AD74. Following fluoride adsorption the pH is raised for distribution.

AD74 has a finite capacity for fluoride dependent on pH, with an optimal range of 5.5 to 6.5. As adsorption sites on the media are filled, lower efficiencies are achieved until an exhaustion point is reached. Prior to exhaustion a regeneration process breaks the bond between the contaminants and the adsorbent media. The regeneration process restores the media capacity for adsorbing contaminants.

Pilot Scale

The pilot design is based on a full scale proposed treatment solution prepared on October 11, 2011 in response to a request for proposal by Culligan of Salinas. The scale of the pilot is based on a single vessel due to the fact that both vessels in the lead lag design are identical. The pilot operation and results provide critical information for final design of the proposed treatment solution. Table 1 summarizes the comparison of the proposed full scale parameters to the pilot design.

Table 1 Pilot Scale

System Design	Full Scale	Pilot
Target design flow (gpm)	35	2.30
Vessel diameter (Inches)	36	10
Number of vessels	2	2
Total square feet (system) Single Vessel	7.07	0.55
Hydraulic Loading Rate (gpm/ft²)	4.3	4.3
Bed Volume (Gallons) Single Vessel	150	11.22
Empty Bed Contact Time, EBCT (Minutes)	4.27	4.68
Media Bed Depth / Vessel (Inch)	34	32

III. Well Water Quality

The anticipated full scale operation of an adsorption plant and reflective pilot study consider site specific operational requirements and groundwater water characteristics. Table 2 presents the priority pre-pilot baseline water quality data provided in the RFP and raw water characteristics observed for the pilot study..

The full scale plant will operate with Well #1 and / or Well #2 in operation. The pilot study evaluated the difference in the well water qualities and determined to provide a study of well #2 being the worst case scenario.

Table 2 Raw Water Characteristics
Paraiso Springs Resort, California

Parameter	Well #1 Lab Data (mg/L) 12/11/07	Well #1 Pilot Data (mg/L)	Well #2 Lab Data (mg/L) 12/11/07	Well #2 Pilot Data (mg/L) 3/30/12
Fluoride	2.80	No Data	9.10	8.7
pH	8.10	No Data	8.90	9.2
Iron (Fe)	0.056	No Data	<0.050	0.026
Total Sulfide	No Data	No Data	No Data	2.4
Manganese (Mn)	<0.01	No Data	<0.010	<0.02
Arsenic (As)	<0.002	No Data	<0.002	<0.0005
Phosphate (PO4)	No Data	No Data	No Data	0.34

Silica (SiO2)	No Data	No Data	No Data	28
Chloride (Cl)	52	No Data	48	51
Sulfate (SO4)	400	No Data	480	510
Calcium (Ca)	24	No Data	23	22
Hardness (CaCO3)	130	No Data	110	55
Total Alkalinity (CaCO3)	220	No Data	39	40
Bicarbonate	220	No Data	22	26
Total Organic Carbon	No Data	No Data	No Data	< 1.0
Turbidity - NTU	0.31	No Data	0.10	0.42
Total Suspended Solids	No Data	No Data	No Data	<1.2
Total Dissolved Solids	890	No Data	850	900
Temperature F°	No Data	No Data	No Data	85

IV. Pilot Setup

The AD74 pilot unit was set up and commissioned on March 13, 2012. Attached is the Process & Instrumentation Diagram for the pilot system indicating the planned treatment process (Exhibit 1). A connection was made to the existing water system at the well head.

The well water designated for the pilot study was injected with hydrochloric acid in a 1-inch hose supply line 5 feet prior to a 10-inch pressure vessel with AD74 media. Following the first (lead) vessel water entered the second (lag) 10-inch pressure vessel with AD74 media. Following the adsorption process sodium hydroxide was injected in the treated water line prior to discharge.

Test Conditions

A target flow rate of 2.30 gpm equates to a 4.3 gpm / ft² filter loading rate. The target flow rate is demonstrated on well #2 with consecutive service runs at the same velocity. The fluoride levels were monitored following the lead vessel to determine regeneration frequency. When fluoride reached 1.5 mg/L the lead vessel (A) was taken offline and the lag vessel (B) was rotated to the lead position. With the rotation from the lag position to the lead position vessel (B) possesses capacity to reduce the influent fluoride to acceptable levels while vessel (A) regenerates. The vessel rotation is repeated when vessel (B) now in the lead position reaches a breakthrough of 1.5 mg/L.

Flow through the pilot is controlled by a series of gate valves and ball valves manually adjusted to restrict water flow through the treatment system. The raw water supply is injected with hydrochloric acid to achieve a pH range between 5.5 and 6.5 during service. Following the setup and optimization over the course of 2 days, the pilot study was conducted for 24 hours a day for four consecutive service runs. The pilot study was paused for the weekend on Friday, March 16 and was initiated again on Monday, March 19.

Laboratory samples were obtained throughout the service run to monitor fluoride between the lead and the lag vessel at Sample Valve (SV 102) per the Sampling Matrix (see Exhibit 2) and preserved on ice during the study period. Off-site analyses were contracted to a state certified laboratory;

Century Environmental Services. Off-site analysis were logged, labeled, packaged, and delivered under a chain of custody in pre-determined lab sample bottles.

Field test results were obtained daily per the Sampling Matrix (see Exhibit 2). The following table (Table 3) indicates the field instrumentation utilized for analyzing field samples.

Table 3 Field Instruments

Hach, DR890, portable spectro-photometer	Hach, Model 17-N	Great Plains Industrial, TM075, flow element	PGT, PRG-100-S, pressure gauge	Taylor 9840N – Instrument
Fluoride	pH	Flow Rate	Pressure	Temperature
		Total Gallons		

Sample locations are designated on the Process and Instrumentation Diagram (P&ID) (Exhibit 1) which identify the location of obtained samples. Also, an Operation Log was kept to record time, instantaneous and total flow, pressure readings, pH, temperature, as well as field results for fluoride as summarized in (Exhibit 4). A battery powered GPI 3/4-inch turbine flow meter and gallon totalizing meter was used on the system influent to determine the amount of water processed.

V. Pilot Results

The study period lasted for four service runs as determined by fluoride breakthrough at the lead vessel. A summary of pilot results follow:

A. Fluoride Removal Efficiency

Lead Vessel:
Influent fluoride levels at sample valve (SV-101) averaged 8.85 mg/L, ranging from 8.8 – 8.9 mg/L.

Effluent fluoride levels at sample valve (SV-102) averaged 0.58 mg/L, ranging from the minimum detection limit of 0.10 – 1.50 mg/L.

Lag Vessel:
Effluent fluoride levels at sample valve (SV-103) averaged 0.74 mg/L, ranging from the minimum detection limit of 0.10 – 1.3 mg/L. * Data point indicated 3.7 mg/L of fluoride at SV-103 on March 15th at 6:50 pm is excluded from calculation. Explanation of exclusion is provided with *VI. Pilot Results, section E. Regeneration.*

A comparison of lab and field fluoride results taken at the same time and location are provided for comparison in Table 4.

Table 4 Field and Lab Fluoride Result Comparison

Sample Location	Date / Time	Field Result Fluoride mg/L	Laboratory Result Fluoride mg/L
SV-101	3/14/12 12:25	9.6	8.8
SV-101	3/19/12 17:50	9.0	8.9
SV-102	3/14/12 12:24	0.6	0.1
SV-102	3/14/12 22:00	1.6	1.4
SV-102	3/16/12 10:00	1.3	1.4
SV-102	3/27/12 12:02	1.7	1.5
SV-103	3/14/12 12:45	0.0	<0.1
SV-103	3/19/12 18:20	1.4	1.3
SV-103	3/22/12 15:00	1.1	0.6

B. pH Adjustment

Raw water pH from the well measured at sample valve (SV-100) averaged 9.0, ranging from 8.9 – 9.1 units.

Influent pH adjustment at sample valve (SV-101) occurred with an average of 5.6, ranging from 5.3 - 6.0 units. See (Exhibit 6) hydrochloric acid usage calculation for the pilot study.

Effluent pH adjustment at sample valve (SV-104) occurred with an average of 6.8, ranging from 6.5 – 7.0 units. See (Exhibit 7) sodium hydroxide usage calculation for the pilot study.

C. Service Operation – Run Length

Service run (#1) produced a run length of 4,311 gallons or 384 bed volumes of vessel (A) in the lead position. The end point for the service run was determined by the effluent fluoride levels between the lead and the lag vessel reaching 1.4 mg/L.

Service run (#1) continued to operate to 6,397 gallons with a lead vessel (A) fluoride breakthrough of 6.6 mg/L at SV-102. Despite the breakthrough of the lead vessel (A) the lag vessel (B) treated fluoride below treatment goal. Results from vessel (B) following vessel rotation provide fluoride results below < 0.10 mg/L, indicating the (B) vessel had remaining capacity to reduce fluoride below detection limits.

Service run (#2) produced a run length of 2,507 gallons or 223 bed volumes of vessel (B) in the lead position. The end point for the service run was determined by the effluent fluoride levels between the lead and lag vessel reaching 1.4 mg/L as verified by lab results.

Service run (#2) continued to operate to 3,407 gallons with a lead vessel (B) fluoride breakthrough of 2.1 mg/L at SV-102. Despite the breakthrough of the lead vessel (B) the lag vessel (A) treated fluoride below treatment goal. Results from vessel (A) following vessel rotation provide fluoride results at 0.17 mg/L, indicating the (A) vessel had remaining capacity to reduce fluoride below 0.17 mg/L.

Service run (#3) produced a run length of 3,258 gallons or 290 bed volumes of vessel (A) in the lead position. The end point of the service run was determined by the effluent fluoride levels between the lead and lag vessel reaching 1.40 mg/L as indicated by field results.

Service run (#3) continued to operate to 4,148 gallons with a lead vessel (A) fluoride breakthrough at 2.2 mg/L.

Service run (#4) produced a run length of 2,636 gallons or 235 bed volumes of vessel (B) in the lead position. The end point for the service run was determined by the effluent fluoride levels between the lead and lag vessel reaching 1.5 mg/L as verified by lab results.

D. Pressure Differential

The differential pressure across the treatment process including the lead and lag vessels averaged 2 psi, ranging from 1 – 2 psi. No correlation exists between the service run time and differential pressure.

E. Regeneration

A regeneration cycle begins with the rotation of the lag vessel to the lead position to supply treated water to the vessel in regeneration. Following the rotation of vessels the following regeneration process was followed during the pilot.

- Backwash for 10 minutes at 9 gallons per minute (gpm) / square foot (ft^2) in an up flow direction.
- Regeneration with 1% sodium hydroxide solution at 1.2 gpm / ft^2 in a down flow direction. Until pH consistently reaches 11 pH for a duration of 35 minutes.
- Rinse for 5 minutes at 9 gpm / ft^2 in a down flow direction.
- Neutralization with hydrochloric acid at 1.2 gpm / ft^2 in a down flow direction. Until fluoride effluent is less than 2.0 mg/L while ensuring pH is not lowered to less than 5.5.

The regeneration volumes and water quality are presented in table 4.

Table 4 Regeneration Waste Discharge

Regeneration Event	Waste Volume Gallons	Fluoride mg/L	Aluminum mg/L
Prior to Service #1 3/13/2012	175	N/A	N/A
Prior to Service #2 3/15/2012	150*	250	56
Prior to Service #3 3/19/2012	317	110	99
Prior to Service #4 3/21/2012	371	140	28

* Regeneration event on 3/15/2012 produced 150 gallons of discharge waste. Fluoride results following regeneration indicate the vessel was brought online prior to complete neutralization. Data point indicating 3.7 mg/L of fluoride at SV-103 on March 15th at 6:50 pm is excluded from fluoride breakthrough calculations, because the high fluoride was a result of the regeneration procedure. Following regeneration and neutralization the lag vessel is intended to be brought online at the point that fluoride and pH and are within operating range for the system.

Backwash prior to service run #2 contained 141,750 mg of Fluoride, 31,752 mg of Aluminum. Backwash prior to service run #3 contained 131,780 mg of Fluoride, 118,602 mg of Aluminum. Backwash prior to service run #4 contained 196,280 mg of Fluoride, 39,256 mg of Aluminum.

For the purposes of the pilot, liquid discharge during regeneration was collected in multiple polyethylene tanks for offsite disposal.

VI. Conclusions and Recommendations for Full Scale

1. The adsorption pilot achieved the primary objective of reducing fluoride to less than California state primary drinking water MCL of 2.0 mg/L for multiple service runs.

2. The operation of a lead-lag redundant design is critical to provide a tolerance for overrunning the fluoride breakthrough point across the lead filter. Operation of the full-scale will be aimed at regenerating when 1.5 mg/L of fluoride observed following the lead vessel (SV-102). This aimed regeneration point and reserve capacity in the lag vessel provides a safeguard in operation.

   In cases where there are overruns of the lead vessel, as demonstrated in the pilot with 6.6 mg/L of fluoride, the lag vessel still has capacity for providing well below the 2.0 mg/L treatment requirement. Specifically related to fluoride breakthrough, at no time did fluoride levels exceed 2.0 mg/L across both treatment vessels despite service throughput overruns of the lead vessel.

3. The shortest run of the lead vessel with substantiated lab results near 1.5 mg/L occurred during run #2 at 2,507 gallons. For full-scale design considerations the 2,507 is a conservative estimate in ensuring the lead vessel comes off-line for regeneration.

   The most accepted measurement for scaling service throughput of an adsorption treatment process is a bed volume. A bed volume is the volume of media; in this case we are evaluating the bed volume of one pilot vessel with 11.22 gallons of media. The service throughput of 2,507 divided by a single bed volume (11.22) equates to 223 bed volumes per service cycle.

   When comparing 223 bed volumes to a vessel containing 150 gallons of media as proposed in full scale, multiply 223 (service bed volumes) by 150 (media volume) resulting in 33,450 gallons for a service throughput of the lead vessel.

   The full-scale system is recommended to operate with a routine regeneration every 33,450 gallons, which will allow for consistent fluoride loading of the lead and lag vessels.

   In determining a consistent run length between regeneration of the lead vessel, service run #1, #2 and #4 are the primary considerations, given that no laboratory data was gathered to substantiate field results for service run #3 beyond a result indicating fluoride of 0.25 mg/L, 2,094 gallons at sample valve 102. However secondary consideration may be given to service run #3 based on field and laboratory results tracking very close together throughout the study. Field result of 1.4 mg/L, 3,258 gallons at SV-102 does indicate service run #3 provided treatment within operational guidelines beyond the 2,094 gallons.

4. Regenerate volumes averaged 344 gallons for the last two regeneration processes. When compared to the service run time of 2,507 gallons, waste generation is approximately 14%. For every 1000 gallons of treated water 140 gallons of waste generation will be created.

   Discharged regenerate show high levels of fluoride and aluminum. While the fluoride quantity does fluctuate due to operational loading of fluoride to the media, concentrations are loosely related to the volume of water discharged, indicating a fixed quantity of fluoride is released from the media during the regeneration process. The fluoride is then diluted or concentrated based on the rinse and neutralization volume.

   Aluminum levels appear to fluctuate from one regeneration process to the next, a regeneration in which neutralization takes place at pH levels below 5.0 may contribute to higher levels of aluminum being released from the media. Consistent regeneration procedures at the site will minimize the fluctuations in aluminum levels.

   The regeneration procedures did require adjustment by the site operator, as demonstrated in the regeneration prior to service run #2 when the system was put online early. The subsequent regenerations were neutralized longer to allow for the filter to rinse to quality. Testing of pH, fluoride and aluminum to verify when to bring the filter online following regeneration may be a necessary requirement until procedures are routine and repeatable for the operator.

The pilot utilized a single opening vessel, which followed the anticipated full scale design. A modification to equipment is recommended to limit the regenerate volume, this would include a top and bottom opening on the vessel to allow for the vessel to be drained of water between regeneration steps. Approximately 60% of the vessel is displaced by media and the other 40% is displaced with liquid. By allowing the vessel to drain following backwash, regeneration with caustic and acid neutralization the chemicals are not diluted by the existing liquid in the vessel. For instance following a backwash the 1% sodium hydroxide would not be diluted by the existing water in the vessel and therefore requires less chemical wasted to displace the water.

5. In a worst case scenario as demonstrated on Well #2, the AD74 will be able to effectively address fluoride. The regeneration frequency is expected to decrease with the use of Well #1. Given when the operation of the plant utilizes Well #1 the pre-treatment pH adjustment remains inline with the 5.5 to 6.0 demonstrated on well #2.

   When comparing the water quality of well #1 and well #2 a few known characteristics should be noted. Well #1 has a high level of bicarbonates (220 mg/L) compared to (26 mg/L) in Well #2. In the treatment process utilized, pH adjustments will require greater quantities of acids and bases to overcome the bicarbonate present.

   Well #2 has a history of fluoride levels 3 times as high as Well #1. The amount of fluoride present in the water is a key determinant in service throughput.

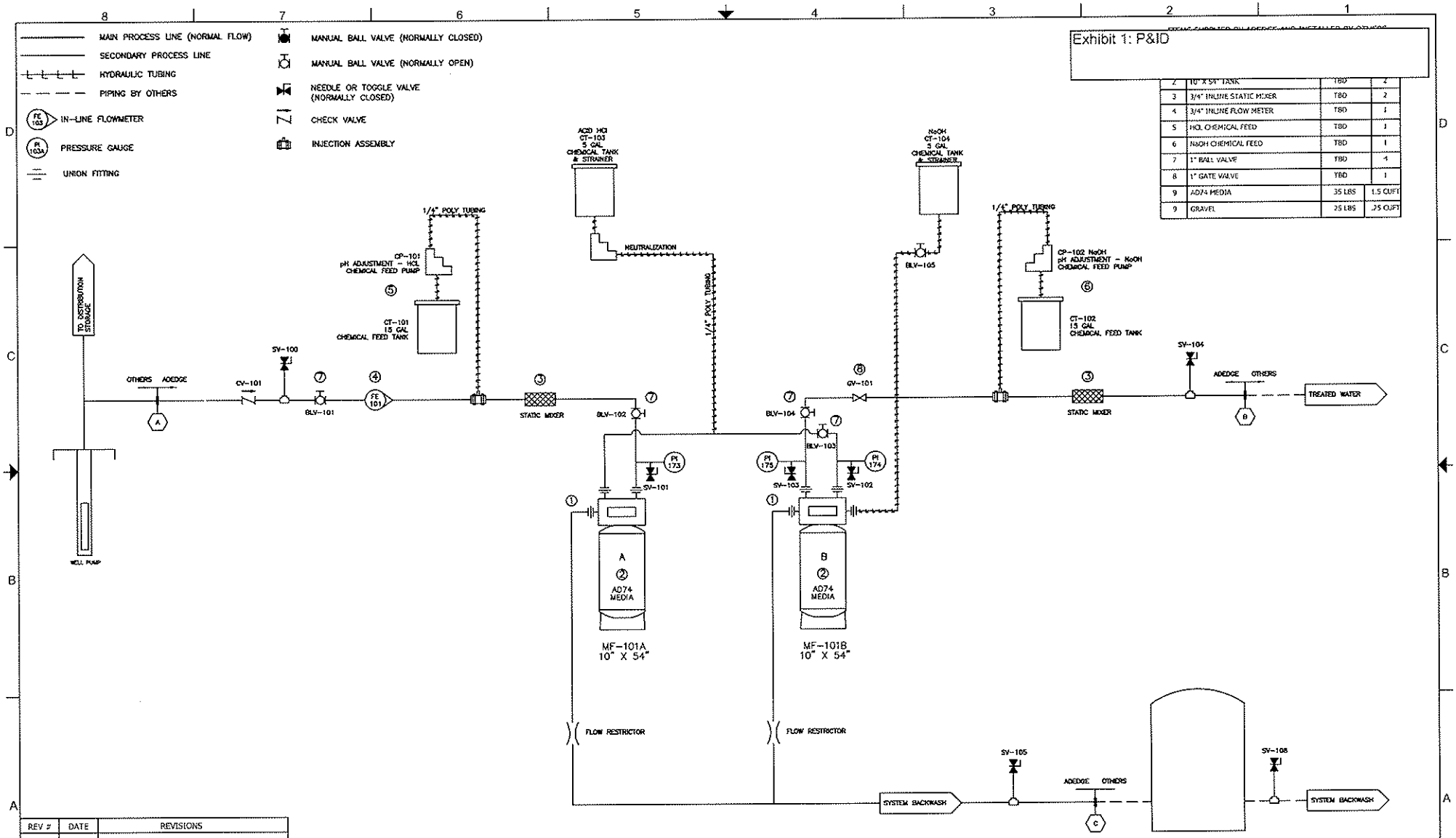
   Well #2 has sulfates 20% higher than well #1. The AD74 adsorption process reduces sulfates. The removal of sulfates in the process reduces the surface area availability on the media to reduce fluoride. Fewer sulfates indicate more capacity for fluoride.

   Therefore, the anticipated service life between regeneration is expected to be at least 3 times greater for well #1. However, the feasibility and design shall consider the worst case as presented in the pilot study of well #2.

VII. Attachments (Figures and Exhibits)

Exhibit 1	P&ID Drawing	(Attached)
Exhibit 2	Sampling and Analysis Matrix	(Attached)
Exhibit 3	Service Run Data	(Attached)
Exhibit 4	Laboratory with Field Results Table	(Attached)
Exhibit 5	Laboratory Analytical Report	(Attached)
Exhibit 6	Acid calculation for pH	(Attached)
Exhibit 7	Caustic calculation for pH	(Attached)
Exhibit 8	Well #2 Full Scale Operating Costs	(Attached)
Exhibit 9	Product Specifications & Instructions	(Attached)

Exhibit 1: P&ID



2	10" X 54" TANK	TBD	2
3	3/4" INLINE STATIC MIXER	TBD	2
4	3/4" INLINE FLOW METER	TBD	1
5	HCL CHEMICAL FEED	TBD	1
6	NaOH CHEMICAL FEED	TBD	1
7	1" BALL VALVE	TBD	4
8	1" GATE VALVE	TBD	1
9	AD74 MEDIA	35 LBS	1.5 CUFT
9	GRAVEL	25 LBS	.25 CUFT

REV #	DATE	REVISIONS

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TP	SERVICE CONNECTIONS	TYPE / MATERIAL
A	WELL WATER FEED INLET	1" HOSE ADAPTER
B	TREATED WATER OUTLET	1" HOSE ADAPTER
C	SYSTEM BACKWASH OUTLET	3/4" HOST ADAPTER

Title
PARAISO HOT SPRINGS
ADEDGE TREATMENT SYSTEM
PROCESS & INSTRUMENTATION DIAGRAM
MODEL: PILOT TREATMENT SCHEMATIC

Drawn by	Checked by	Approved by	Project	Date	Scale
YS	CM	-	TBD	3/7/2012	NTS

Customer: PARAISO HOT SPRINGS - CULLIGAN OF SALINAS CA

Dwg. File	Rev. Date	Rev.No	Sheet
PARAISO_SPRINGS_PILOT_PID_R(1)	-	-	1 OF 1

Exhibit 2: Sample Matrix

3/8/2012 crm

AdEdge Technologies, Inc.
Paraiso Hot Springs - Pilot
Pilot Test - Proposed Sampling Matrix

Location			Raw Water Inlet	AD74 Vessel Influent	Lead AD74 Vessel Effluent	Lag AD74 Vessel Effluent	Post Treatment pH Adjust	AD74 Regeneration	AD74 Regeneration
Proposed Frequency			Daily	Daily	Daily	Daily	Weekly	2X during pilot	2X during pilot
Location			Raw Water	Inlet	Outlet	Outlet	Post - Treatment	Regen Line	Regen Tank
Sample Port Designation			SV-100 (post chlorination and pH adjustment)	SV-101	SV-102	SV-103	SV-104	SV-105	SV-106
On-site Field Analysis / Measurements	Parameter	units							
pH			X	X	X	X	X	X	X
Temperature	deg C	C	X		X	X			
Pressure		PSI		X	X	X			
Flow rate	Flow	gpm	X						
Flow totalizer readings	Flow	U.S gal	X						
Fluoride	F	mg/L	X	X	X	X			X (supernatant)

Proposed Frequency			1X (baseline)	Daily	Daily	Daily	N/A	N/A	2 X during pilot
Sample Port Designation			Influent valve	Inlet	Outlet	Outlet	Post-Treatment	Regen Line	Regen Tank
Location			SV-100	SV-101	SV-102	SV-103	SV-104	SV-105	SV-106
Off-site Laboratory Analysis	Parameter	Units	Initial baseline analysis						
Sulfides	S-	mg/L	X						
Iron	Fe	mg/L	X						
Manganese	Mn	mg/L	X						
Silica	as SiO2	mg/L	X						
Phosphate	as PO4	mg/L	X						
Turbidity	units	NTU	X						
Total Organic Carbon	TOC	mg/L	X						
Suspended Solids	TSS	mg/L	X						
Hardness	$CaCO_3$	mg/L	X						
Alkalinity	$CaCO_3$	mg/L	X						
Nitrate	NO3	mg/L	X						
Sulfates	SO4	mg/L	X						
Chlorides	Cl	mg/L	X						
Bicarbonate	HCO3	mg/L	X						
Fluoride	F	mg/L	X	X	X	X			X
Arsenic	As	mg/L	X						
Aluminum	Al	mg/L	X			(Once per Service Run)			X

Notes:

1. Take Influent / Effluent samples at the same time during the weekly field sampling events
2. If a Backwash is performed, be sure to wait at least 30 minutes after a backwash before taking any samples
3. Use state certified laboratory with typical detection limits / methods to be used
4. Temperature and pH to be measured in the field only.

Service Run Times based on Fluoride Breakthrough of 1.5 mg/L at SV-102

Exhibit 3

Adsorption Pilot
Fluoride Reduction
Paraiso Hot Springs-CA

crm 043012

Calculation Sheet

	Lead Vessel	Date	Time	Flow Rate GPM	Total Service Run Gallons	1 Vessel Bed Volumes	1 Vessel EBCT	Raw Water SV-100 pH	Raw Water SV-100 Temp F	Influent Water SV-101 Inlet PSI	Influent Water SV-101 pH	Influent Water SV-101 F mg/L	Influent Water SV-101 F Lab	Lead Effluent Water SV-102 Outlet PSI	Lead Effluent Water SV-102 pH	Lead Effluent Water SV-102 F mg/L	Lead Effluent Water SV-102 F Lab	Lag Effluent Water SV-103 Outlet PSI	Lag Effluent Water SV-103 pH	Lag Effluent Water SV-103 F mg/L	Lag Effluent Water SV-103 F Lab	Post SV-104 pH
Service #1	A	Mar 13	4:46 PM	2.47			4.5	9.00	85.0	54	6.00	10.20		54	6.80	0.60		52	4.50	-		
	A	Mar 13	10:00 PM	2.45	831	74	4.6			54				52			0.10	52				
	A	Mar 14	12:08 PM	2.44	2,889	257	4.6	9.00	84.0	54	6.00	9.60	8.80	54	6.80	0.60	0.10	52	6.80	-	0.10	6.5
	A	Mar 14	10:00 PM	2.39	4,311	384	4.7			50				48		1.60	1.40	48				
Service #2	B	Mar 15	4:10 PM																			
	B	Mar 15	6:50 PM	2.47	263	23	4.5	9.00	86.9	50	5.70		8.80	48		0.60	0.10	48	10.00	>2.3	3.7	
	B	Mar 15	8:30 PM																6.50	0.7		
	B	Mar 15	10:00 PM	2.43	776	69	4.6			50				48				48				
	B	Mar 16	6:10 AM	2.45	1,960	175	4.6			50				48		0.80		48				
	B	Mar 16	10:00 AM	2.43	2,507	223	4.6			50				48		1.30	1.40	48				
Service #3	A	Mar 16											8.80								0.15	
	A	Mar 19	5:34 PM	2.47	317	28	4.5	9.10	86.5	50	5.65	9.00	8.90	48	6.10	0.50		48	8.68	0.8		
	A	Mar 19	6:20 PM	2.35	453	40	4.8										0.17		8.51	1.4	1.3	
	A	Mar 20	11:00 AM		465	41														1.3		
	A	Mar 20	2:00 PM		909	81				50				48				48				
	A	Mar 20	2:15 PM	2.43	1,034	92	4.6	8.94	83.0	50	5.39	9.00	8.90	58	6.17	0.50		48	8.17	1.1		
	A	Mar 20	6:00 PM	2.51	1,499	134	4.5			50				48								
	A	Mar 20	6:07 PM	2.51	1,522	136	4.5			50				48				48				
	A	Mar 20	10:00 PM	2.51	2,094	187	4.5			50				48			0.25	48				
	A	Mar 20	10:11 PM	2.41	2,115	189	4.7			50				48				48			0.52	
	A	Mar 21	6:02 AM	2.45	3,258	290	4.6			50				48		1.40		48	7.65	0.5		
Service #4	B	Mar 21	12:36 PM							50	5.40			48	6.60	2.20		48	7.56	0.5		
	B	Mar 21	7:13 PM	2.45	661	59	4.6		84.3	50	5.50	9.60	8.90	48	7.50	0.70	0.22	48	> 10	1.3	1.0	
	B	Mar 22	3:40 PM	2.43	1,230	110	4.6	9.00	83.0	50	5.25	9.00		50	5.00	0.70		50	7.00	1.1	0.6	7.0
	B	Mar 22	6:22 PM	2.45	1,608	143	4.6			50				50				48				
	B	Mar 22	9:30 PM	2.44	2,035	181	4.6			50				50				48				
	B	Mar 23	10:02 AM	2.52	2,334	208	4.5	9.00	83.0	50	5.25	10.40		48		0.90		48				
	B	Mar 23	12:02 PM	2.54	2,636	235	4.4			50						1.70	1.50	48				
Average				2.45		146	4.6	9.0	84	51	5.57	9.5	8.85	49	6.4	1.01	0.58	49	7.5	0.79	0.15	6.75
Min				2.35	2,507	223	4.4	8.9	83	50	5.25	9.0	8.80	48	5.0	0.50	0.10	48	4.5	-	0.10	6.50
Max				2.54	4,311	384	4.8	9.1	87	54	6.00	10.4	8.90	58	7.5	2.20	1.50	52	10.0	1.40	0.15	7.00

Service # 1 stayed online for 6,397 gallons with breakthrough at 6.6 mg/L of F at SV-102 (field result)
Service # 2 stayed online for 3,407 gallons with breakthrough at 2.1 mg/L of F at SV-102 (field result)
Service #3 stayed online for 4,148 gallons with breakthrough at 2.2 mg/L of F at SV-102 (field result)

Adsorption Pilot | **Lab and Field Data Combined** | **Exhibit 4**

Fluoride Reduction
Paraiso Hot Springs-CA

Lab Results in Red

crm 043012

Date	Time	Flow Rate	Totalizer Readings	Raw Water SV-100			Influent Water SV-101					Lead Effluent Water SV-102				Lag Effluent Water SV-103					Post SV-104	Regen		Lead Vessel	Comments & Observations
		GPM	Gals	pH	Temp F	Fe mg/L	Inlet PSI	pH	F mg/L	F Lab	Al Lab	Outlet PSI	pH	F mg/L	F Lab	Outlet PSI	pH	F mg/L	F Lab	Al Lab	pH	Begin Gallons	End Gallons	A or B	
Mar 13	4:46 PM	2.47	1,205	9.00	85	10.20	54	6.00	10.20			54	6.80	0.60		52	4.50	-						A	START PILOT
Mar 13	10:00 PM	2.45	2,036				54					52			0.10	52								A	Pulled Lab Sample
Mar 14	12:05 PM	2.44	4,094	9.00	84	9.60	54	6.00	9.60	8.80		54	6.80	0.60	0.10	52	6.80	-	0.10	0.05	6.5			A	Added 30GPM Bypass for Pump Protection
Mar 14	10:00 PM	2.39	5,516				50					48		1.60	1.40	48								A	4528 Run Reduced PSI (-4)
Mar 15	6:32 AM	2.37	6,729				50					48		4.80		48								A	
Mar 15	10:05 AM	2.39	7,243				50					48		5.40		48								A	
Mar 15	1:50 PM	2.38		8.70	87	9.00	50	6.50				48		5.40				0.5						A	
Mar 15	2:00 PM	2.40	7,602				50					48		6.60		48								A	
Mar 15	4:10 PM		7,959																			7,959	8,109	A-B	Regan Start 7959 End 8109
Mar 15	6:50 PM	2.47	8,222	9.00	87		50	5.70		8.80		48		0.60	0.10	48	10.00	>2.3	3.7	3.7				B	
Mar 15	8:30 PM																6.50	0.7						B	
Mar 15	10:00 PM	2.43	8,735				50					48				48								B	
Mar 16	6:10 AM	2.45	9,919				50					48		0.80		48								B	
Mar 16	10:09 AM	2.43	10,466				50					48		1.30	1.40	48								B	
Mar 16	2:00 PM	2.44	11,047				50					48		1.90		48								B	
Mar 16	4:13 PM	2.41	11,366	8.50		9.60	50	6.00	9.60			48	7.00	2.10		48	6.00	0.6		0.05				B	
Mar 16			11,593							8.80	0.05								0.15			11,593	11,910	A	Stopped Pilot- Regen Lead B
Mar 19	5:34 PM	2.47	11,910	9.10	87		50	5.65	9.00	8.90		48	6.10	0.50		48	8.68	0.8						A	Post Regeneration
Mar 19	6:20 PM	2.35	12,046												0.17	-	8.51	1.4	1.3					A	Shut Down 18:36 @ 12058Gal
Mar 20	11:00 AM		12,058															1.3							
Mar 20	2:00 PM		12,502				50					48				48								A	Start up 2nd Pilot (Restart following shutdown)
Mar 20	2:15 PM	2.43	12,627	8.94	83		50	5.39	9.00	8.90		58	6.17	0.50		48	8.17	1.1						A	
Mar 20	6:00 PM	2.51	13,092				50					48												A	
Mar 20	8:07 PM	2.51	13,115				50					48				48								A	
Mar 20	10:00 PM	2.51	13,687				50					48			0.25	48								A	
Mar 20	10:11 PM	2.41	13,708				50					48				48			0.52	0.05				A	
Mar 21	6:02 AM	2.45	14,851				50					48		1.40		48	7.65	0.5						A	
Mar 21	6:07 AM	2.41	14,861				50					48				48								A	Sample to LAB-Run= 3485
Mar 21	7:00 AM	2.50	15,135				50					48				48								A	
Mar 21	8:00 AM	2.50	15,135				50					48				48								A	
Mar 21	8:11 AM	2.46	15,158				50					48				48								A	
Mar 21	10:00 AM	2.50	15,430				50					48		2.10		48								A	
Mar 21	10:06 AM	2.46	15,443				50					48				48								A	
Mar 21	12:00 PM	2.53	15,725				50					48				48								A	
Mar 21	12:07 PM	2.45	15,741				50					48				48								A	
Mar 21	12:36 PM		15,814				50	5.40				48	6.60	2.20		48	7.56	0.5				15,814	16,185	A-B	Stopped to Regenerate vessel
Mar 21	7:13 PM	2.45	16,475		84		50	5.50	9.60	8.90		48	7.50	0.70	0.22	48	> 10	1.3	1.0	7.1					Shut Down for the Night
Mar 22	3:40 PM	2.43	17,044	9.00	83	9.00	50	5.25	9.00			50	5.00	0.70		50	7.00	1.1	0.6		7.0			B	
Mar 22	6:22 PM	2.45	17,422				50					50				48								B	
Mar 22	9:30 PM	2.44	17,849				50					50				48								B	Shut Down for the Night
Mar 23	10:02 AM	2.52	18,148	9.00	83	10.40	50	5.25	10.40			48		0.90		48								B	
Mar 23	12:02 PM	2.54	18,450				50							1.70	1.50	48								B	

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Exhibit 5: Lab Report

SOIL CONTROL LAB

42 HANGAR WAY
WATSONVILLE
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USA

Century Environmental Services
18499 Moro Road
Salinas, CA 93907
Attn: Paul Schneider

Work Order #: 2030532
Reporting Date: March 27, 2012

Date Received: March 20, 2012
Project # / Name: None / Paraiso Springs
Water System #: 2701001 PARAISO HOT SPRINGS WS
Sample Identification: SV102-313-2200-L, sampled 3/13/2012 10:00:00PM
Sampler Name / Co.: LCR / Century Environmental Services
Matrix: Water
Laboratory #: 2030532-01

	Results	Units	RL	State Drinking Water Limits [1]	Analysis Method	Date Analyzed	Flags
Fluoride	ND	mg/L	0.10	2	EPA 300.0	03/21/12	

RL - are levels down to which we can quantify with reliability, a result below this level is reported as "ND" for Not Detected.
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Century Environmental Services
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Attn: Paul Schneider

Work Order #: 2030532
Reporting Date: March 27, 2012

Date Received: March 20, 2012
Project # / Name: None / Paraiso Springs
Water System #: 2701001 PARAISO HOT SPRINGS WS
Sample Identification: SV102-314-1224-L, sampled 3/14/2012 12:24:00PM
Sampler Name / Co.: TPB / Century Environmental Services
Matrix: Water
Laboratory #: 2030532-05

	Results	Units	RL	State Drinking Water Limits ₁	Analysis Method	Date Analyzed	Flags
Fluoride	ND	mg/L	0.10	2	EPA 300.0	03/21/12	

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Work Order #: 2030532
Reporting Date: March 27, 2012

Date Received: March 20, 2012
Project # / Name: None / Paraiso Springs
Water System #: 2701001 PARAISO HOT SPRINGS WS
Sample Identification: SV101-314-1225-L, sampled 3/14/2012 12:25:00PM
Sampler Name / Co.: TPB / Century Environmental Services
Matrix: Water
Laboratory #: 2030532-06

	Results	Units	RL	State Drinking Water Limits [1]	Analysis Method	Date Analyzed	Flags
* Fluoride	8.8	mg/L	0.10	2	EPA 300.0	03/21/12	

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Work Order #: 2030532
Reporting Date: March 27, 2012

Date Received: March 20, 2012
Project # / Name: None / Paraiso Springs
Water System #: 2701001 PARAISO HOT SPRINGS WS
Sample Identification: SV103-314-1245-L, sampled 3/14/2012 12:45:00PM
Sampler Name / Co.: TPB / Century Environmental Services
Matrix: Water
Laboratory #: 2030532-04

	Results	Units	RL	State Drinking Water Limits ‹	Analysis Method	Date Analyzed	Flags
Fluoride	ND	mg/L	0.10	2	EPA 300.0	03/21/12	
Aluminum	ND	ug/L	50	1000	EPA 200.7	03/22/12	

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Work Order #: 2030532
Reporting Date: March 27, 2012

Date Received:	March 20, 2012
Project # / Name:	None / Paraiso Springs
Water System #:	2701001 PARAISO HOT SPRINGS WS
Sample Identification:	SV102-314-2200-L, sampled 3/14/2012 10:00:00PM
Sampler Name / Co.:	LCR / Century Environmental Services
Matrix:	Water
Laboratory #:	2030532-07

	Results	Units	RL	State Drinking Water Limits ‹	Analysis Method	Date Analyzed	Flags
Fluoride	1.4	mg/L	0.10	2	EPA 300.0	03/21/12	

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Profile of Liquid Waste Discharge

Century Environmental Services
18499 Moro Road
Salinas, CA 93907
Attn: Paul Schneider

Work Order #: 2030532
Reporting Date: March 27, 2012

Date Received: March 20, 2012
Project # / Name: None / Paraiso Springs
Water System #: 2701001 PARAISO HOT SPRINGS WS
Sample Identification: BW01-315-1800-L, sampled 3/15/2012 6:00:00PM
Sampler Name / Co.: RPS / Century Environmental Services
Matrix: Water
Laboratory #: 2030532-02

	Results	Units	RL	State Drinking Water Limits	Analysis Method	Date Analyzed	Flags
* Fluoride	250	mg/L	5.0	2	EPA 300.0	03/23/12	
* Aluminum	56000	ug/L	50	1000	EPA 200.7	03/22/12	

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Century Environmental Services
18499 Moro Road
Salinas, CA 93907
Attn: Paul Schneider

Work Order #: 2030532
Reporting Date: March 27, 2012

Date Received: March 20, 2012
Project # / Name: None / Paraiso Springs
Water System #: 2701001 PARAISO HOT SPRINGS WS
Sample Identification: SV101-315-1844-L, sampled 3/15/2012 6:44:00PM
Sampler Name / Co.: RPS / Century Environmental Services
Matrix: Water
Laboratory #: 2030532-08

	Results	Units	RL	State Drinking Water Limits [1]	Analysis Method	Date Analyzed	Flags
* Fluoride	8.8	mg/L	0.10	2	EPA 300.0	03/21/12	

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Work Order #: 2030532
Reporting Date: March 27, 2012

Date Received: March 20, 2012
Project # / Name: None / Paraiso Springs
Water System #: 2701001 PARAISO HOT SPRINGS WS
Sample Identification: SV102-315-1850-L, sampled 3/15/2012 6:50:00PM
Sampler Name / Co.: LCR / Century Environmental Services
Matrix: Water
Laboratory #: 2030532-09

	Results	Units	RL	State Drinking Water Limits [1]	Analysis Method	Date Analyzed	Flags
Fluoride	ND	mg/L	0.10	2	EPA 300.0	03/21/12	

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Work Order #: 2030532
Reporting Date: March 27, 2012

Date Received: March 20, 2012
Project # / Name: None / Paraiso Springs
Water System #: 2701001 PARAISO HOT SPRINGS WS
Sample Identification: SV103-315-1853-L, sampled 3/15/2012 6:53:00PM
Sampler Name / Co.: RPS / Century Environmental Services
Matrix: Water
Laboratory #: 2030532-10

	Results	Units	RL	State Drinking Water Limits	Analysis Method	Date Analyzed	Flags
* Fluoride	3.7	mg/L	0.10	2	EPA 300.0	03/21/12	
* Aluminum	3700	ug/L	50	1000	EPA 200.7	03/22/12	

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Work Order #: 2030532
Reporting Date: March 27, 2012

Date Received: March 20, 2012
Project # / Name: None / Paraiso Springs
Water System #: 2701001 PARAISO HOT SPRINGS WS
Sample Identification: SV102-316-1000-L, sampled 3/16/2012 10:00:00AM
Sampler Name / Co.: LCR / Century Environmental Services
Matrix: Water
Laboratory #: 2030532-11

	Results	Units	RL	State Drinking Water Limits [1]	Analysis Method	Date Analyzed	Flags
Fluoride	1.4	mg/L	0.10	2	EPA 300.0	03/21/12	

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Work Order #: 2030532
Reporting Date: March 27, 2012

Date Received: March 20, 2012
Project # / Name: None / Paraiso Springs
Water System #: 2701001 PARAISO HOT SPRINGS WS
Sample Identification: SV103-316-1631-L, sampled 3/16/2012 4:31:00PM
Sampler Name / Co.: RPS / Century Environmental Services
Matrix: Water
Laboratory #: 2030532-12

	Results	Units	RL	State Drinking Water Limits [1]	Analysis Method	Date Analyzed	Flags
Fluoride	0.15	mg/L	0.10	2	EPA 300.0	03/21/12	

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Work Order #: 2030532
Reporting Date: March 27, 2012

Date Received: March 20, 2012
Project # / Name: None / Paraiso Springs
Water System #: 2701001 PARAISO HOT SPRINGS WS
Sample Identification: SV101-316-1655-L, sampled 3/16/2012 4:55:00PM
Sampler Name / Co.: RPS / Century Environmental Services
Matrix: Water
Laboratory #: 2030532-13

	Results	Units	RL	State Drinking Water Limits [1]	Analysis Method	Date Analyzed	Flags
* Fluoride	8.8	mg/L	0.10	2	EPA 300.0	03/21/12	
Aluminum	ND	ug/L	50	1000	EPA 200.7	03/22/12	

RL - are levels down to which we can quantify with reliability, a result below this level is reported as "ND" for Not Detected.
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Work Order #: 2030532
Reporting Date: March 27, 2012

Date Received: March 20, 2012
Project # / Name: None / Paraiso Springs
Water System #: 2701001 PARAISO HOT SPRINGS WS
Sample Identification: BW02-319-1730-L, sampled 3/19/2012 5:30:00PM
Sampler Name / Co.: RPS / Century Environmental Services
Matrix: Water
Laboratory #: 2030532-03

	Results	Units	RL	State Drinking Water Limits [1]	Analysis Method	Date Analyzed	Flags
* Fluoride	110	mg/L	5.0	2	EPA 300.0	03/23/12	
* Aluminum	99000	ug/L	120	1000	EPA 200.7	03/22/12	

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Work Order #: 2030532
Reporting Date: March 27, 2012

Date Received:	March 20, 2012
Project # / Name:	None / Paraiso Springs
Water System #:	2701001 PARAISO HOT SPRINGS WS
Sample Identification:	SV101-319-1750-L, sampled 3/19/2012 5:50:00PM
Sampler Name / Co.:	TPB / Century Environmental Services
Matrix:	Water
Laboratory #:	2030532-14

	Results	Units	RL	State Drinking Water Limits ₁	Analysis Method	Date Analyzed	Flags
* Fluoride	8.9	mg/L	0.10	2	EPA 300.0	03/21/12	

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Work Order #: 2030532
Reporting Date: March 27, 2012

Date Received: March 20, 2012
Project # / Name: None / Paraiso Springs
Water System #: 2701001 PARAISO HOT SPRINGS WS
Sample Identification: SV102-319-1805-L, sampled 3/19/2012 6:05:00PM
Sampler Name / Co.: RPS / Century Environmental Services
Matrix: Water
Laboratory #: 2030532-15

	Results	Units	RL	State Drinking Water Limits [1]	Analysis Method	Date Analyzed	Flags
Fluoride	0.17	mg/L	0.10	2	EPA 300.0	03/21/12	

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Work Order #: 2030532
Reporting Date: March 27, 2012

Date Received: March 20, 2012
Project # / Name: None / Paraiso Springs
Water System #: 2701001 PARAISO HOT SPRINGS WS
Sample Identification: SV103-319-1820-L, sampled 3/19/2012 6:20:00PM
Sampler Name / Co.: RPS / Century Environmental Services
Matrix: Water
Laboratory #: 2030532-16

	Results	Units	RL	State Drinking Water Limits [1]	Analysis Method	Date Analyzed	Flags
Fluoride	1.3	mg/L	0.10	2	EPA 300.0	03/21/12	

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Work Order #: 2030697
Reporting Date: April 4, 2012

Date Received:	March 27, 2012
Project # / Name:	Paraiso / None
Water System #:	2701001 PARAISO HOT SPRINGS WS
Sample Identification:	SV101-320-1506-L, sampled 3/20/2012 3:06:00PM
Sampler Name / Co.:	TPB / Century Environmental Services
Matrix:	Water
Laboratory #:	2030697-01

	Results	Units	RL	State Drinking Water Limits [1]	Analysis Method	Date Analyzed	Flags
* Fluoride	8.9	mg/L	0.10	2	EPA 300.0	03/28/12	

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Work Order #: 2030697
Reporting Date: April 4, 2012

Date Received: March 27, 2012
Project # / Name: Paraiso / None
Water System #: 2701001 PARAISO HOT SPRINGS WS
Sample Identification: SV102-320-2200-L, sampled 3/20/2012 10:00:00PM
Sampler Name / Co.: LCR / Century Environmental Services
Matrix: Water
Laboratory #: 2030697-02

	Results	Units	RL	State Drinking Water Limits [1]	Analysis Method	Date Analyzed	Flags
Fluoride	0.25	mg/L	0.10	2	EPA 300.0	03/28/12	

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Work Order #: 2030697
Reporting Date: April 4, 2012

Date Received: March 27, 2012
Project # / Name: Paraiso / None
Water System #: 2701001 PARAISO HOT SPRINGS WS
Sample Identification: SV103-320-2211-L, sampled 3/20/2012 10:11:00PM
Sampler Name / Co.: LCR / Century Environmental Services
Matrix: Water
Laboratory #: 2030697-03

	Results	Units	RL	State Drinking Water Limits [1]	Analysis Method	Date Analyzed	Flags
Fluoride	0.52	mg/L	0.10	2	EPA 300.0	03/28/12	
Aluminum	ND	ug/L	50	1000	EPA 200.7	04/02/12	

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Work Order #: 2030697
Reporting Date: April 4, 2012

Date Received: March 27, 2012
Project # / Name: Paraiso / None
Water System #: 2701001 PARAISO HOT SPRINGS WS
Sample Identification: BW03-321-1700-L, sampled 3/21/2012 5:00:00PM
Sampler Name / Co.: RPS / Century Environmental Services
Matrix: Water
Laboratory #: 2030697-04

	Results	Units	RL	State Drinking Water Limits [1]	Analysis Method	Date Analyzed	Flags
* Fluoride	140	mg/L	5.0	2	EPA 300.0	03/28/12	
* Aluminum	28000	ug/L	50	1000	EPA 200.7	04/02/12	

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Work Order #: 2030697
Reporting Date: April 4, 2012

Date Received: March 27, 2012
Project # / Name: Paraiso / None
Water System #: 2701001 PARAISO HOT SPRINGS WS
Sample Identification: SV101-321-1827-L, sampled 3/21/2012 6:27:00PM
Sampler Name / Co.: RPS / Century Environmental Services
Matrix: Water
Laboratory #: 2030697-05

	Results	Units	RL	State Drinking Water Limits ₁	Analysis Method	Date Analyzed	Flags
* Fluoride	8.9	mg/L	0.10	2	EPA 300.0	03/28/12	

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Work Order #: 2030697
Reporting Date: April 4, 2012

Date Received: March 27, 2012
Project # / Name: Paraiso / None
Water System #: 2701001 PARAISO HOT SPRINGS WS
Sample Identification: SV102-321-1842-L, sampled 3/21/2012 6:42:00PM
Sampler Name / Co.: RPS / Century Environmental Services
Matrix: Water
Laboratory #: 2030697-06

	Results	Units	RL	State Drinking Water Limits [1]	Analysis Method	Date Analyzed	Flags
Fluoride	0.22	mg/L	0.10	2	EPA 300.0	03/28/12	

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Work Order #: 2030697
Reporting Date: April 4, 2012

Date Received: March 27, 2012
Project # / Name: Paraiso / None
Water System #: 2701001 PARAISO HOT SPRINGS WS
Sample Identification: SV103-321-1843-L, sampled 3/21/2012 6:43:00PM
Sampler Name / Co.: RPS / Century Environmental Services
Matrix: Water
Laboratory #: 2030697-07

	Results	Units	RL	State Drinking Water Limits [1]	Analysis Method	Date Analyzed	Flags
Fluoride	1.0	mg/L	0.10	2	EPA 300.0	03/28/12	
Aluminum	710	ug/L	50	1000	EPA 200.7	04/02/12	

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Work Order #: 2030697
Reporting Date: April 4, 2012

Date Received: March 27, 2012
Project # / Name: Paraiso / None
Water System #: 2701001 PARAISO HOT SPRINGS WS
Sample Identification: SV103-322-1500-L, sampled 3/22/2012 3:00:00PM
Sampler Name / Co.: TPB / Century Environmental Services
Matrix: Water
Laboratory #: 2030697-08

	Results	Units	RL	State Drinking Water Limits [1]	Analysis Method	Date Analyzed	Flags
Fluoride	0.56	mg/L	0.10	2	EPA 300.0	03/28/12	

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Work Order #: 2030697
Reporting Date: April 4, 2012

Date Received:	March 27, 2012
Project # / Name:	Paraiso / None
Water System #:	2701001 PARAISO HOT SPRINGS WS
Sample Identification:	SV102-323-1202-L, sampled 3/23/2012 12:02:00PM
Sampler Name / Co.:	LCR / Century Environmental Services
Matrix:	Water
Laboratory #:	2030697-09

	Results	Units	RL	State Drinking Water Limits [1]	Analysis Method	Date Analyzed	Flags
Fluoride	1.5	mg/L	0.10	2	EPA 300.0	03/28/12	

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Work Order #: 2030697
Reporting Date: April 4, 2012

Date Received: March 27, 2012
Project # / Name: Paraiso / None
Water System #: 2701001 PARAISO HOT SPRINGS WS
Sample Identification: SV103-323-1945-L, sampled 3/23/2012 7:45:00PM
Sampler Name / Co.: LCR / Century Environmental Services
Matrix: Water
Laboratory #: 2030697-10

	Results	Units	RL	State Drinking Water Limits ₁	Analysis Method	Date Analyzed	Flags
Fluoride	1.9	mg/L	0.10	2	EPA 300.0	03/28/12	
Aluminum	ND	ug/L	50	1000	EPA 200.7	04/02/12	

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Work Order #: 2030697
Reporting Date: April 4, 2012

Date Received: March 27, 2012
Project # / Name: Paraiso / None
Water System #: 2701001 PARAISO HOT SPRINGS WS
Sample Identification: SV103-316-1631-L, sampled 3/16/2012 4:31:00PM
Sampler Name / Co.: RPS / Century Environmental Services
Matrix: Water
Laboratory #: 2030697-11

	Results	Units	RL	State Drinking Water Limits [1]	Analysis Method	Date Analyzed	Flags
Aluminum	50	ug/L	50	1000	EPA 200.7	04/02/12	

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Work Order #: 2030531
Reporting Date: March 30, 2012

Date Received: March 20, 2012
Project # / Name: None / Paraiso Springs
Sample Identification: SV100-319-1500-A,B,C,D,E, F, sampled 3/19/2012 3:00:00PM
Sampler Name / Co.: RPS / Century Environmental Services
Matrix: Water
Laboratory #: 2030531-01

	Results	Units	RL	Analysis Method	Date Analyzed	Flags
pH	9.2	pH Units	0.1	SM4500-H+ B	03/20/12	
Carbonate as CO3	11	mg/L	2.0	SM 2320B	03/20/12	
Bicarbonate as HCO3	26	mg/L	2.0	SM 2320B	03/20/12	
Total Alkalinity as CaCO3	40	mg/L	2.0	SM 2320B	03/20/12	
Total Organic Carbon	ND	mg/L	1.0	SM 5310B	03/28/12	
Chloride	51	mg/L	1.0	EPA 300.0	03/21/12	
Fluoride	8.7	mg/L	0.10	EPA 300.0	03/21/12	
Hardness	55	mg/L	5.0	SM 2340 B	03/22/12	
Hydroxide as OH	ND	mg/L	2.0	SM 2320B	03/20/12	
Specific Conductance (EC)	1400	uS/cm	1.0	SM2510B	03/20/12	
Sulfate as SO4	510	mg/L	1.0	EPA 300.0	03/21/12	
Total Sulfide	2.4	mg/L	0.10	SM4500-S-F	03/21/12	
Turbidity	0.42	NTU	0.10	SM 2130B	03/20/12	
Nitrate as NO3	ND	mg/L	0.50	EPA 300.0	03/21/12	
Total Phosphate (as PO4)	0.34	mg/L	0.030	SM4500-P E	03/28/12	
Total Dissolved Solids	900	mg/L	10	SM2540C	03/21/12	
Total Suspended Solids	ND	mg/L	1.2	SM 2540D	03/21/12	
Silica (SiO2)	28	mg/L	1.0	EPA 200.7	03/22/12	
Total Aluminum (Al)	ND	ug/L	25	EPA 200.7	03/22/12	
Total Arsenic (As)	ND	ug/L	0.50	EPA 200.8	03/22/12	
Total Calcium (Ca)	22	mg/L	0.50	EPA 200.7	03/22/12	

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Work Order #: 2030531
Reporting Date: March 30, 2012

Date Received: March 20, 2012
Project # / Name: None / Paraiso Springs
Sample Identification: SV100-319-1500-A,B,C,D,E, F, sampled 3/19/2012 3:00:00PM
Sampler Name / Co.: RPS / Century Environmental Services
Matrix: Water
Laboratory #: 2030531-01

	Results	Units	RL	Analysis Method	Date Analyzed	Flags
Total Copper (Cu)	ND	ug/L	20	EPA 200.7	03/22/12	
Total Iron (Fe)	26	ug/L	25	EPA 200.7	03/22/12	
Total Magnesium (Mg)	ND	mg/L	0.50	EPA 200.7	03/22/12	
Total Manganese (Mn)	ND	ug/L	20	EPA 200.7	03/22/12	
Total Potassium (K)	4.0	mg/L	0.50	EPA 200.7	03/22/12	
Total Sodium (Na)	260	mg/L	0.50	EPA 200.7	03/22/12	
Total Zinc (Zn)	ND	ug/L	10	EPA 200.7	03/22/12	

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Work Order #: 2030531
Reporting Date: March 30, 2012

Nitrogen - Quality Control

Soil Control Lab

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch PC20248 - Default Prep GenChem											
Blank (PC20248-BLK1)					Prepared & Analyzed: 21-Mar-12						
Nitrate as NO3	ND		0.50	mg/L							
LCS (PC20248-BS1)					Prepared & Analyzed: 21-Mar-12						
Nitrate as NO3	9.180		0.50	mg/L	10.0		91.8	80-120			
LCS Dup (PC20248-BSD1)					Prepared & Analyzed: 21-Mar-12						
Nitrate as NO3	9.148		0.50	mg/L	10.0		91.5	80-120	0.349	20	
Duplicate (PC20248-DUP1)		**Source: 2030548-01**			Prepared & Analyzed: 21-Mar-12						
Nitrate as NO3	0.1430		0.50	mg/L		0.1480			3.44	20	
Matrix Spike (PC20248-MS1)		**Source: 2030548-01**			Prepared & Analyzed: 21-Mar-12						
Nitrate as NO3	9.819		0.50	mg/L	10.0	0.1480	96.7	80-120			
Matrix Spike Dup (PC20248-MSD1)		**Source: 2030548-01**			Prepared & Analyzed: 21-Mar-12						
Nitrate as NO3	9.480		0.50	mg/L	10.0	0.1480	93.3	80-120	3.51	20	
Reference (PC20248-SRM1)					Prepared & Analyzed: 21-Mar-12						
Nitrate as NO3	35.30		1.0	mg/L	35.7		98.9	80-120			

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Work Order #: 2030531
Reporting Date: March 30, 2012

Phosphorus - Quality Control

Soil Control Lab

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch PC20337 - Default Prep GenChem											
Blank (PC20337-BLK1)					Prepared & Analyzed: 28-Mar-12						
Total Phosphate (as PO4)	ND		0.030	mg/L							
Duplicate (PC20337-Dup1)		**Source: 2030610-02**			Prepared & Analyzed: 28-Mar-12						
Total Phosphate (as PO4)	3.925		0.30	mg/L		4.003			1.95	20	
Matrix Spike (PC20337-MS1)		**Source: 2030610-02**			Prepared & Analyzed: 28-Mar-12						
Total Phosphate (as PO4)	6.740		0.30	mg/L	3.07	4.003	89.2	80-120			
Matrix Spike Dup (PC20337-MSD1)		**Source: 2030610-02**			Prepared & Analyzed: 28-Mar-12						
Total Phosphate (as PO4)	6.792		0.30	mg/L	3.07	4.003	90.8	80-120	0.763	20	
Reference (PC20337-SRM1)					Prepared & Analyzed: 28-Mar-12						
Total Phosphate (as PO4)	10.28		0.60	mg/L	12.2		84.2	80-120			

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Reporting Date: March 30, 2012

Classical Chemistry Parameters - Quality Control

Soil Control Lab

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch PC20239 - Default Prep GenChem											
Duplicate (PC20239-Dup1)		**Source: 2030540-01**			Prepared & Analyzed: 20-Mar-12						
pH	8.20		0.1	pH Units		8.19			0.122	20	
Reference (PC20239-SRM1)					Prepared & Analyzed: 20-Mar-12						
pH	6.93		0.1	pH Units	7.22		96.0	80-120			
Batch PC20240 - Default Prep GenChem											
Blank (PC20240-BLK1)					Prepared & Analyzed: 20-Mar-12						
Specific Conductance (EC)	ND		1.0	uS/cm							
Duplicate (PC20240-Dup1)		**Source: 2030540-01**			Prepared & Analyzed: 20-Mar-12						
Specific Conductance (EC)	846.0		1.0	uS/cm		846.0			0.00	20	
Reference (PC20240-SRM1)					Prepared & Analyzed: 20-Mar-12						
Specific Conductance (EC)	504.0		1.0	uS/cm	495		102	80-120			
Batch PC20242 - Default Prep GenChem											
Blank (PC20242-BLK1)					Prepared & Analyzed: 20-Mar-12						
Total Alkalinity as CaCO3	ND		1.0	mg/L							
Duplicate (PC20242-Dup1)		**Source: 2030540-01**			Prepared & Analyzed: 20-Mar-12						
Total Alkalinity as CaCO3	218.1		2.0	mg/L		220.4			1.06	20	
Batch PC20245 - Default Prep GenChem											
Blank (PC20245-BLK1)					Prepared & Analyzed: 20-Mar-12						
Turbidity	ND		0.10	NTU							

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Work Order #: 2030531
Reporting Date: March 30, 2012

Classical Chemistry Parameters - Quality Control

Soil Control Lab

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch PC20245 - Default Prep GenChem											
Duplicate (PC20245-Dup1)			**Source: 2030543-01**		Prepared & Analyzed: 20-Mar-12						
Turbidity	5.670		0.10	NTU		5.540			2.32	20	
Batch PC20246 - Default Prep GenChem											
Blank (PC20246-BLK1)					Prepared & Analyzed: 21-Mar-12						
Total Sulfide	ND		0.10	mg/L							
Duplicate (PC20246-Dup1)			**Source: 2030531-01**		Prepared & Analyzed: 21-Mar-12						
Total Sulfide	2.290		0.10	mg/L		2.350			2.59	20	
Batch PC20248 - Default Prep GenChem											
Blank (PC20248-BLK1)					Prepared & Analyzed: 21-Mar-12						
Sulfate as SO4	ND		1.0	mg/L							
Chloride	ND		1.0	"							
Fluoride	ND		0.10	"							
LCS (PC20248-BS1)					Prepared & Analyzed: 21-Mar-12						
Fluoride	0.4450		0.10	mg/L	0.500		89.0	80-120			
Chloride	18.55		1.0	"	20.0		92.8	80-120			
Sulfate as SO4	19.22		1.0	"	20.0		96.1	80-120			
LCS Dup (PC20248-BSD1)					Prepared & Analyzed: 21-Mar-12						
Chloride	18.44		1.0	mg/L	20.0		92.2	80-120	0.584	20	
Fluoride	0.4610		0.10	"	0.500		92.2	80-120	3.53	20	
Sulfate as SO4	19.10		1.0	"	20.0		95.5	80-120	0.637	20	

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Batch PC20248 - Default Prep GenChem											
Duplicate (PC20248-DUP1)			**Source: 2030548-01**		Prepared & Analyzed: 21-Mar-12						
Sulfate as SO4	6.252		1.0	mg/L		6.272			0.319	20	
Fluoride	ND		0.10	"		0.08100				20	
Chloride	5.707		1.0	"		5.734			0.472	20	
Matrix Spike (PC20248-MS1)			**Source: 2030548-01**		Prepared & Analyzed: 21-Mar-12						
Sulfate as SO4	26.23		1.0	mg/L	20.0	6.272	99.8	80-120			
Chloride	25.15		1.0	"	20.0	5.734	97.1	80-120			
Fluoride	0.5350		0.10	"	0.500	0.08100	90.8	80-120			
Matrix Spike Dup (PC20248-MSD1)			**Source: 2030548-01**		Prepared & Analyzed: 21-Mar-12						
Fluoride	0.5340		0.10	mg/L	0.500	0.08100	90.6	80-120	0.187	20	
Sulfate as SO4	25.50		1.0	"	20.0	6.272	96.2	80-120	2.80	20	
Chloride	24.43		1.0	"	20.0	5.734	93.5	80-120	2.92	20	
Reference (PC20248-SRM1)					Prepared & Analyzed: 21-Mar-12						
Fluoride	7.552		0.20	mg/L	7.66		98.6	80-120			
Sulfate as SO4	97.74		2.0	"	94.1		104	80-120			
Chloride	25.56		2.0	"	25.5		100	80-120			
Batch PC20252 - Default Prep GenChem											
Blank (PC20252-BLK1)					Prepared & Analyzed: 21-Mar-12						
Total Suspended Solids	ND		1.0	mg/L							
Blank (PC20252-BLK2)					Prepared & Analyzed: 21-Mar-12						
Total Suspended Solids	ND		1.0	mg/L							

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Batch PC20252 - Default Prep GenChem											
Duplicate (PC20252-Dup1)		**Source: 2030427-01**			Prepared & Analyzed: 21-Mar-12						
Total Suspended Solids	51.50		4.3	mg/L		48.67			5.65	20	
Duplicate (PC20252-Dup2)		**Source: 2030486-01**			Prepared & Analyzed: 21-Mar-12						
Total Suspended Solids	302.1		4.1	mg/L		369.6			20.1	20	A-01
Batch PC20254 - Default Prep GenChem											
Blank (PC20254-BLK1)					Prepared & Analyzed: 28-Mar-12						
Total Organic Carbon	ND		1.0	mg/L							
Duplicate (PC20254-Dup1)		**Source: 2030486-01**			Prepared & Analyzed: 28-Mar-12						
Total Organic Carbon	20.64		4.0	mg/L		22.64			9.24	20	
Matrix Spike (PC20254-MS1)		**Source: 2030486-01**			Prepared & Analyzed: 28-Mar-12						
Total Organic Carbon	61.60		4.0	mg/L	40.0	22.64	97.4	80-120			
Matrix Spike Dup (PC20254-MSD1)		**Source: 2030486-01**			Prepared & Analyzed: 28-Mar-12						
Total Organic Carbon	63.52		4.0	mg/L	40.0	22.64	102	80-120	3.07	20	
Reference (PC20254-SRM1)					Prepared & Analyzed: 28-Mar-12						
Total Organic Carbon	65.92		4.0	mg/L	62.5		105	80-120			
Batch PC20255 - Default Prep GenChem											
Blank (PC20255-BLK1)					Prepared & Analyzed: 21-Mar-12						
Total Dissolved Solids	ND		10	mg/L							

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Batch PC20255 - Default Prep GenChem											
Duplicate (PC20255-Dup1)		**Source: 2030531-01**			Prepared & Analyzed: 21-Mar-12						
Total Dissolved Solids	914.0		10	mg/L		902.0			1.32	20	
Reference (PC20255-SRM1)					Prepared & Analyzed: 21-Mar-12						
Total Dissolved Solids	720.0		10	mg/L	746		96.5	80-120			
Batch PC20265 - EPA 3005A											
Blank (PC20265-BLK1)					Prepared & Analyzed: 22-Mar-12						
Hardness	ND		5.0	mg/L							
Blank (PC20265-BLK2)					Prepared & Analyzed: 22-Mar-12						
Hardness	ND		5.0	mg/L							
LCS (PC20265-BS1)					Prepared & Analyzed: 22-Mar-12						
Hardness	167.9		5.0	mg/L	167		101	80-120			
Duplicate (PC20265-DUP1)		**Source: 2030495-01**			Prepared & Analyzed: 22-Mar-12						
Hardness	113.4		5.0	mg/L		113.8			0.407	20	
Duplicate (PC20265-DUP2)		**Source: 2030497-01**			Prepared & Analyzed: 22-Mar-12						
Hardness	228.5		5.0	mg/L		230.7			0.973	20	
Matrix Spike (PC20265-MS1)		**Source: 2030495-01**			Prepared & Analyzed: 22-Mar-12						
Hardness	275.0		5.0	mg/L	167	113.8	96.5	80-120			
Matrix Spike (PC20265-MS2)		**Source: 2030497-01**			Prepared & Analyzed: 22-Mar-12						
Hardness	389.1		5.0	mg/L	167	230.7	94.9	80-120			

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Batch PC20265 - EPA 3005A											
Matrix Spike Dup (PC20265-MSD1)		**Source: 2030495-01**			Prepared & Analyzed: 22-Mar-12						
Hardness	275.6		5.0	mg/L	167	113.8	96.9	80-120	0.200	20	
Matrix Spike Dup (PC20265-MSD2)		**Source: 2030497-01**			Prepared & Analyzed: 22-Mar-12						
Hardness	388.8		5.0	mg/L	167	230.7	94.7	80-120	0.0750	20	
Reference (PC20265-SRM2)					Prepared & Analyzed: 22-Mar-12						
Hardness	54.28		5.0	mg/L	54.2		100	80-120			
Reference (PC20265-SRM4)					Prepared & Analyzed: 22-Mar-12						
Hardness	54.46		5.0	mg/L	54.2		100	80-120			

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Batch PC20265 - EPA 3005A											
Blank (PC20265-BLK1)				Prepared & Analyzed: 22-Mar-12							
Total Sodium (Na)	ND		0.50	mg/L							
Silica (SiO2)	ND		1.0	"							
Total Copper (Cu)	ND		20	ug/L							
Total Calcium (Ca)	ND		0.50	mg/L							
Total Iron (Fe)	ND		25	ug/L							
Total Manganese (Mn)	ND		20	"							
Total Potassium (K)	ND		0.50	mg/L							
Total Zinc (Zn)	ND		10	ug/L							
Total Aluminum (Al)	ND		25	"							
Total Magnesium (Mg)	ND		0.50	mg/L							
Blank (PC20265-BLK2)				Prepared & Analyzed: 22-Mar-12							
Total Calcium (Ca)	ND		0.50	mg/L							
Total Iron (Fe)	ND		25	ug/L							
Total Sodium (Na)	ND		0.50	mg/L							
Total Manganese (Mn)	ND		20	ug/L							
Silica (SiO2)	ND		1.0	mg/L							
Total Aluminum (Al)	ND		25	ug/L							
Total Potassium (K)	ND		0.50	mg/L							
Total Magnesium (Mg)	ND		0.50	"							
Total Copper (Cu)	ND		20	ug/L							
Total Zinc (Zn)	ND		10	"							
LCS (PC20265-BS1)				Prepared & Analyzed: 22-Mar-12							
Total Magnesium (Mg)	25.15		0.50	mg/L	25.0		101	85-115			
Total Copper (Cu)	356.0		20	ug/L	360		98.9	85-115			
Silica (SiO2)	7.103		1.0	mg/L				85-115			
Total Iron (Fe)	434.4		25	ug/L	435		99.9	85-115			
Total Calcium (Ca)	25.25		0.50	mg/L	25.0		101	85-115			

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Batch PC20265 - EPA 3005A											
LCS (PC20265-BS1)					Prepared & Analyzed: 22-Mar-12						
Total Zinc (Zn)	913.8		10	ug/L	906		101	85-115			
Total Aluminum (Al)	1992		25	"	1970		101	85-115			
Total Potassium (K)	25.38		0.50	mg/L	25.0		102	85-115			
Total Sodium (Na)	26.19		0.50	"	25.0		105	85-115			
Total Manganese (Mn)	1697		20	ug/L	1690		100	85-115			
Duplicate (PC20265-DUP1)		**Source: 2030495-01**			Prepared & Analyzed: 22-Mar-12						
Total Manganese (Mn)	125.3		20	ug/L		125.2			0.0798	20	
Total Potassium (K)	2.308		0.50	mg/L		2.254			2.37	20	
Total Zinc (Zn)	ND		10	ug/L		2.100				20	
Silica (SiO2)	26.04		1.0	mg/L		25.40			2.49	20	
Total Iron (Fe)	154.6		25	ug/L		165.0			6.51	20	
Total Copper (Cu)	ND		20	"		ND				20	
Total Sodium (Na)	14.92		0.50	mg/L		14.95			0.201	20	
Total Aluminum (Al)	ND		25	ug/L		3.200				20	
Total Magnesium (Mg)	4.200		0.50	mg/L		4.203			0.0714	20	
Total Calcium (Ca)	38.34		0.50	"		38.52			0.468	20	
Duplicate (PC20265-DUP2)		**Source: 2030497-01**			Prepared & Analyzed: 22-Mar-12						
Total Sodium (Na)	34.87		0.50	mg/L		35.23			1.03	20	
Total Magnesium (Mg)	24.91		0.50	"		25.14			0.919	20	
Total Potassium (K)	14.05		0.50	"		14.17			0.850	20	
Total Zinc (Zn)	7.100		10	ug/L		5.500			25.4	20	QR-04
Total Aluminum (Al)	ND		25	"		ND				20	
Total Calcium (Ca)	49.87		0.50	mg/L		50.38			1.02	20	
Total Copper (Cu)	ND		20	ug/L		ND				20	
Total Manganese (Mn)	284.4		20	"		285.7			0.456	20	
Total Iron (Fe)	2562		25	"		2575			0.506	20	
Silica (SiO2)	39.83		1.0	mg/L		39.79			0.100	20	

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Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch PC20265 - EPA 3005A											
Matrix Spike (PC20265-MS1)		**Source: 2030495-01**			Prepared & Analyzed: 22-Mar-12						
Total Calcium (Ca)	62.34		0.50	mg/L	25.0	38.52	95.3	80-120			
Total Zinc (Zn)	882.3		10	ug/L	906	2.100	97.2	80-120			
Total Magnesium (Mg)	28.60		0.50	mg/L	25.0	4.203	97.6	80-120			
Total Iron (Fe)	580.3		25	ug/L	435	165.0	95.5	80-120			
Total Copper (Cu)	348.6		20	"	360	ND	96.8	80-120			
Silica (SiO2)	25.93		1.0	mg/L		25.40		80-120			
Total Potassium (K)	26.87		0.50	"	25.0	2.254	98.5	80-120			
Total Manganese (Mn)	1785		20	ug/L	1690	125.2	98.2	80-120			
Total Aluminum (Al)	1879		25	"	1970	3.200	95.2	80-120			
Total Sodium (Na)	40.14		0.50	mg/L	25.0	14.95	101	80-120			
Matrix Spike (PC20265-MS2)		**Source: 2030497-01**			Prepared & Analyzed: 22-Mar-12						
Total Manganese (Mn)	1903		20	ug/L	1690	285.7	95.7	80-120			
Total Copper (Cu)	339.8		20	"	360	ND	94.4	80-120			
Total Sodium (Na)	59.96		0.50	mg/L	25.0	35.23	98.9	80-120			
Total Calcium (Ca)	73.68		0.50	"	25.0	50.38	93.2	80-120			
Silica (SiO2)	39.88		1.0	"		39.79		80-120			
Total Zinc (Zn)	897.2		10	ug/L	906	5.500	98.4	80-120			
Total Iron (Fe)	2936		25	"	435	2575	83.0	80-120			
Total Aluminum (Al)	1901		25	"	1970	ND	96.5	80-120			
Total Potassium (K)	38.59		0.50	mg/L	25.0	14.17	97.7	80-120			
Total Magnesium (Mg)	49.18		0.50	"	25.0	25.14	96.2	80-120			
Matrix Spike Dup (PC20265-MSD1)		**Source: 2030495-01**			Prepared & Analyzed: 22-Mar-12						
Total Zinc (Zn)	888.6		10	ug/L	906	2.100	97.8	80-120	0.712	20	
Total Manganese (Mn)	1792		20	"	1690	125.2	98.6	80-120	0.391	20	
Total Sodium (Na)	40.26		0.50	mg/L	25.0	14.95	101	80-120	0.299	20	
Total Aluminum (Al)	1897		25	ug/L	1970	3.200	96.1	80-120	0.953	20	
Silica (SiO2)	26.11		1.0	mg/L		25.40		80-120	0.692	20	

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Batch PC20265 - EPA 3005A											
Matrix Spike Dup (PC20265-MSD1)		**Source: 2030495-01**			Prepared & Analyzed: 22-Mar-12						
Total Magnesium (Mg)	28.81		0.50	mg/L	25.0	4.203	98.4	80-120	0.732	20	
Total Iron (Fe)	575.7		25	ug/L	435	165.0	94.4	80-120	0.796	20	
Total Copper (Cu)	346.0		20	"	360	ND	96.1	80-120	0.749	20	
Total Potassium (K)	26.98		0.50	mg/L	25.0	2.254	98.9	80-120	0.409	20	
Total Calcium (Ca)	62.21		0.50	"	25.0	38.52	94.8	80-120	0.209	20	
Matrix Spike Dup (PC20265-MSD2)		**Source: 2030497-01**			Prepared & Analyzed: 22-Mar-12						
Total Copper (Cu)	342.0		20	ug/L	360	ND	95.0	80-120	0.645	20	
Total Manganese (Mn)	1900		20	"	1690	285.7	95.5	80-120	0.158	20	
Total Potassium (K)	38.60		0.50	mg/L	25.0	14.17	97.7	80-120	0.0259	20	
Total Iron (Fe)	2939		25	ug/L	435	2575	83.7	80-120	0.102	20	
Total Magnesium (Mg)	49.17		0.50	mg/L	25.0	25.14	96.1	80-120	0.0203	20	
Total Calcium (Ca)	73.58		0.50	"	25.0	50.38	92.8	80-120	0.136	20	
Silica (SiO2)	40.28		1.0	"		39.79		80-120	0.998	20	
Total Sodium (Na)	60.06		0.50	"	25.0	35.23	99.3	80-120	0.167	20	
Total Aluminum (Al)	1899		25	ug/L	1970	ND	96.4	80-120	0.105	20	
Total Zinc (Zn)	896.3		10	"	906	5.500	98.3	80-120	0.100	20	
Reference (PC20265-SRM1)					Prepared & Analyzed: 22-Mar-12						
Total Zinc (Zn)	1149		10	ug/L	1130		102	80-120			
Total Manganese (Mn)	653.2		20	"	640		102	80-120			
Total Copper (Cu)	365.8		20	"	359		102	80-120			
Total Aluminum (Al)	850.6		25	"	810		105	80-120			
Total Iron (Fe)	307.2		25	"	308		99.7	80-120			
Reference (PC20265-SRM2)					Prepared & Analyzed: 22-Mar-12						
Total Potassium (K)	6.834		0.50	mg/L	6.70		102	80-120			
Total Calcium (Ca)	8.771		0.50	"	8.82		99.4	80-120			
Total Magnesium (Mg)	7.765		0.50	"	7.85		98.9	80-120			
Total Sodium (Na)	14.52		0.50	"	14.5		100	80-120			

RL - are levels down to which we can quantify with reliability, a result below this level is reported as "ND" for Not Detected.

Mike Galloway

ANALYTICAL CHEMISTS
and
BACTERIOLOGISTS
Approved by State of California

SOIL CONTROL LAB

42 HANGAR WAY
WATSONVILLE
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95076
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TEL: 831-724-5422
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Century Environmental Services
18499 Moro Road
Salinas, CA 93907
Attn: Paul Schneider

Work Order #: 2030531
Reporting Date: March 30, 2012

Metals - Quality Control

Soil Control Lab

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch PC20265 - EPA 3005A											
Reference (PC20265-SRM3)					Prepared & Analyzed: 22-Mar-12						
Total Copper (Cu)	356.9		20	ug/L	359		99.4	80-120			
Total Iron (Fe)	302.3		25	"	308		98.1	80-120			
Total Manganese (Mn)	647.3		20	"	640		101	80-120			
Total Aluminum (Al)	839.6		25	"	810		104	80-120			
Total Zinc (Zn)	1158		10	"	1130		102	80-120			
Reference (PC20265-SRM4)					Prepared & Analyzed: 22-Mar-12						
Total Calcium (Ca)	8.733		0.50	mg/L	8.82		99.0	80-120			
Total Sodium (Na)	14.68		0.50	"	14.5		101	80-120			
Total Magnesium (Mg)	7.830		0.50	"	7.85		99.7	80-120			
Total Potassium (K)	6.852		0.50	"	6.70		102	80-120			
Batch PC20271 - EPA 3005A											
Blank (PC20271-BLK1)					Prepared & Analyzed: 22-Mar-12						
Total Arsenic (As)	ND		0.50	ug/L							
LCS (PC20271-BS1)					Prepared & Analyzed: 22-Mar-12						
Total Arsenic (As)	38.16		0.50	ug/L	40.0		95.4	85-115			
LCS Dup (PC20271-BSD1)					Prepared & Analyzed: 22-Mar-12						
Total Arsenic (As)	38.26		0.50	ug/L	40.0		95.6	85-115	0.262	20	
Duplicate (PC20271-DUP1)		**Source: 2030543-01**			Prepared & Analyzed: 22-Mar-12						
Total Arsenic (As)	0.9550		0.50	ug/L		0.9040			5.49	20	
Duplicate (PC20271-DUP2)		**Source: 2030497-01**			Prepared & Analyzed: 22-Mar-12						
Total Arsenic (As)	1.305		0.50	ug/L		1.334			2.20	20	

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Reporting Date: March 30, 2012

Metals - Quality Control

Soil Control Lab

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch PC20271 - EPA 3005A											
Matrix Spike (PC20271-MS1)		**Source: 2030543-01**			Prepared & Analyzed: 22-Mar-12						
Total Arsenic (As)	38.92		0.50	ug/L	40.0	0.9040	95.0	80-120			
Matrix Spike (PC20271-MS2)		**Source: 2030497-01**			Prepared & Analyzed: 22-Mar-12						
Total Arsenic (As)	38.39		0.50	ug/L	40.0	1.334	92.6	80-120			
Matrix Spike Dup (PC20271-MSD1)		**Source: 2030543-01**			Prepared & Analyzed: 22-Mar-12						
Total Arsenic (As)	37.80		0.50	ug/L	40.0	0.9040	92.2	80-120	2.92	20	
Matrix Spike Dup (PC20271-MSD2)		**Source: 2030497-01**			Prepared & Analyzed: 22-Mar-12						
Total Arsenic (As)	39.34		0.50	ug/L	40.0	1.334	95.0	80-120	2.44	20	
Reference (PC20271-SRM1)					Prepared & Analyzed: 22-Mar-12						
Total Arsenic (As)	22.98		0.50	ug/L	21.3		108	80-120			

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Notes and Definitions

QR-04	The RPD of the sample duplicates was outside the normal acceptance range, but this is because the analyte concentration was below or near the reporting limit. This leads to high RPDs.
A-01	The RPD of the TSS results for this sample was slightly beyond the control limits for the analysis, this was due to the presence of coarse particles that settle very quickly and make reproducibility a challenge.

RL - are levels down to which we can quantify with reliability, a result below this level is reported as "ND" for Not Detected.

Mike Galloway

Exhibit 6

Acid Chemical Feed Pump Sizing and Usage

Well #2 - Pilot

Project: Paraiso Hot Springs, Lower pH Date: 3/1/12 By: CRM

Design Basis:

Gals per day usage	3,312	gallons per day (per site profile)
Gallons per minute flow	2.3	gpm max design flow rate
Initial pH	8.90	(site specific from worksheet)
Final pH (desired)	6.00	(site specific from worksheet)
Acid (H2SO4)	0.00	mg/L (from RTW calculation sheet)
Acid (HCl)	19.00	mg/L (from RTW calculation sheet)
Base (NaOH)	0.00	mg/L (from RTW calculation sheet)
Other	0.00	mg/L (from RTW calculation sheet)

Chemical	HCl	
Chemical % (as purchased)	36	% solution
Pump type	Stenner	pump
Injection Pressure	50-100	psi

Pump Sizing

Well pump rate (gpm) x Required dosage (ppm) x 1440 / Solution strength ppm = Feed pump output (gpd)

Well pump rate =	2.3	(from above)
Dosage for pH adjustment =	19.00	mg/L (from RTW calculation sheet)
Concentration of chemical =	36.00	% solution
Chemical strength =	360,000	ppm
Dilution =	6:1	dilution of delivered chemical
Final concentration as Fed =	51,429	ppm
Feed pump output (GPD) =	1.22	Gals per day capacity needed
Feed pump output (GPH) =	0.051	Gals per hr capacity needed
Feed pump output (lPH) =	0.193	liters per hr capacity needed
Stroke setting	100%	(typical mid point for chem metering diaphragm)
Frequency (speed) setting	40%	(typical mid point for chem metering diaphragm)

Chemical Usage / Tank Sizing

Hrs per day pump runs	24.00	(based on utilization above)
Daily usage	1.22	(gals)
Weekly usage	8.57	gals / week
Monthly usage	36.71	gals / month

Exhibit 7

Base Chemical Feed Pump Sizing and Usage
Well #2, Pilot

Project: Paraiso Hot Springs, Raise pH Date: 3/1/12 By: CRM

Design Basis:

Gals per day usage	3,312	gallons per day (per site profile)
Gallons per minute flow	2.3	gpm max design flow rate
Initial pH	6.20	(site specific from worksheet)
Final pH (desired)	6.80	(site specific from worksheet)
Acid (H2SO4)	0.00	mg/L (from RTW calculation sheet)
Acid (HCl)	0.00	mg/L (from RTW calculation sheet)
Base (NaOH)	20.00	mg/L (from RTW calculation sheet)
Other	0.00	mg/L (from RTW calculation sheet)

Chemical	NaOH	
Chemical % (as purchased)	50	% solution
Pump type	Stenner	pump
Injection Pressure	50-100	psi

Pump Sizing

Well pump rate (gpm) x Required dosage (ppm) x 1440 / Solution strength ppm = Feed pump output (gpd)

Well pump rate =	2.3	(from above)
Dosage for pH adjustment =	20.00	mg/L (from RTW calculation sheet)
Concentration of chemical =	50.00	% solution
Chemical strength =	500,000	ppm
Dilution =	6:1	dilution of delivered chemical
Final concentration as Fed =	71,429	ppm
Feed pump output (GPD) =	0.93	Gals per day capacity needed
Feed pump output (GPH) =	0.039	Gals per hr capacity needed
Feed pump output (lPH) =	0.146	liters per hr capacity needed
Stroke setting	100%	(typical mid point for chem metering diaphragm)
Frequency (speed) setting	30%	(typical mid point for chem metering diaphragm)

Chemical Usage / Tank Sizing

Hrs per day pump runs	24.00	(based on utilization above)
Daily usage	0.93	(gals)
Weekly usage	6.49	gals / week
Monthly usage	27.82	gals / month

Exhibit 8

Operating Costs - Chemical and Media

Paraiso Well #2 crm 043012

TOTAL	4,919	total gallons wastewater per event (all vessels)
	2,460	Total gallons per ONE vessel
	152	Min of Total cycle time
	365	# regenerations per year
	7,764.82	Total gallons of NaOH (50%) used
	$4.00	NaOH cost / gallon
Caustic Regen	$31,059	Est. chemical NaOH cost per year
	2,160.90	Total gallons of H2SO4 (98%) used
	$5.00	H2SO4 cost / gallon (quotation)
Acid Regen	$10,804	Est. chemical H2SO4 cost per year
Total Regen	$41,864	Total Chemical per annum for Regeneration
	$3.00	Cost of acid for pH adjustment . Gallon
	179.00	gallons/month
	2,148.00	Gallons/year
	$4.00	Cost of caustic for pH adjustment per Gallon
	66.00	gallons/month
	792.00	Gallons/year
pH adjust	$9,612.00	cost / year
	14.60	Media replacement per year (at 25 regens)
	$584.00	Cost to project ($2.0/lb)
Media replace	$9,782.00	Total cost per annum
Totals	$41,863.78	Total Regen Chemical Costs
	$9,612.00	Total pH adjustment chemical costs
	$9,782.00	Media Replacement pro-rated Cost
	$61,257.78	Total Operating Cost

Exhibit 9

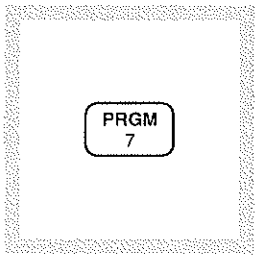
Method 8029

FLUORIDE (0 to 2.00 mg/L F^-)

For water, wastewater and seawater

SPADNS Method* (Reagent Solution or AccuVac Ampuls)

Using SPADNS Reagent Solution

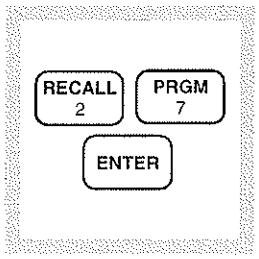


1. Enter the stored program number for fluoride (F) powder pillows.

Press: **PRGM**

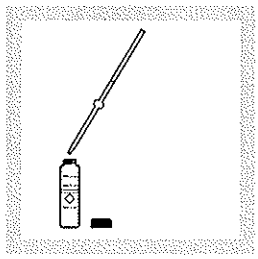
The display will show:

PRGM ?

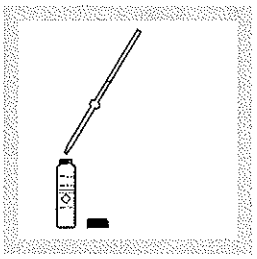


2. Press: **27 ENTER**

The display will show **mg/L, F** and the **ZERO** icon.

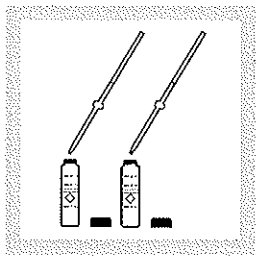


3. Pipet 10.0 mL of sample into a dry 10-mL sample cell (the prepared sample).



4. Measure 10.0 mL of deionized water into a second dry sample cell (the blank).

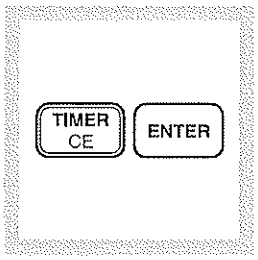
Note: *The sample and blank should be at the same temperature (±1 °C). Temperature adjustments may be made before or after reagent addition.*



5. Pipet 2.00 mL of SPADNS Reagent into each cell. Swirl to mix.

Note: *SPADNS Reagent is toxic and corrosive; use care while measuring. Use a pipet filler.*

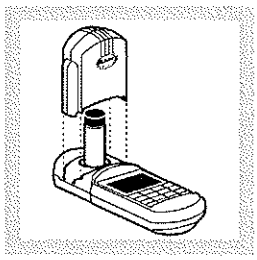
Note: *The SPADNS Reagent must be measured accurately.*



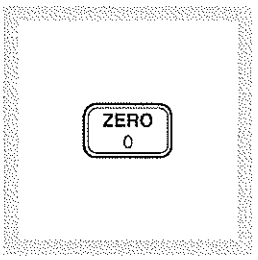
6. Press:

TIMER ENTER

A one minute reaction period will begin.



7. When the timer beeps, place the blank into the cell holder. Tightly cover the sample cell with the instrument cap.



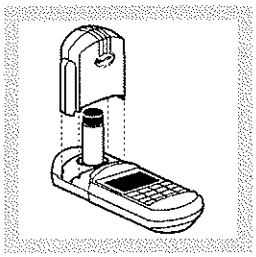
8. Press: **ZERO**

The cursor will move to the right, then the display will show:

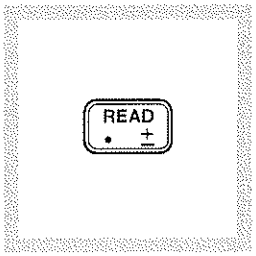
0.00 mg/L F

---

* Adapted from *Standard Methods for the Examination of Water and Wastewater. The procedure for this instrument uses an alternate wavelength outside the accepted 550-580 nm range. The reagents used are the same as those in the USEPA accepted method.*



9. Place the prepared sample into the cell holder. Tightly cover the sample cell with the instrument cap.

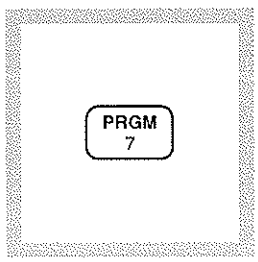


10. Press: **READ**

The cursor will move to the right, then the result in mg/L fluoride will be displayed.

Note: Use of the Standard Adjust feature with each new lot of reagent is highly recommended. See Accuracy Check following these steps.

Using AccuVac Ampuls

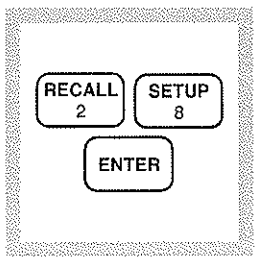


1. Enter the stored program number for fluoride (F^-)- AccuVac Ampuls.

Press: **PRGM**

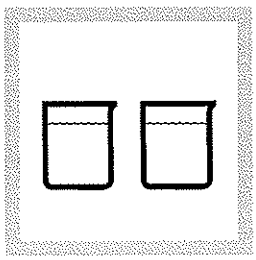
The display will show:

PRGM ?

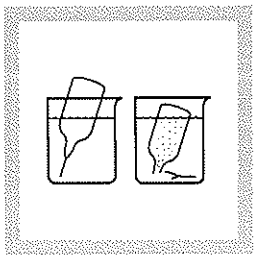


2. Press: **28 ENTER**

The display will show **mg/L, F** and the **ZERO** icon.

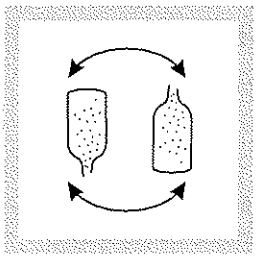


3. Collect at least 40 mL of sample in a 50-mL beaker. Pour at least 40 mL of deionized water into a second beaker.



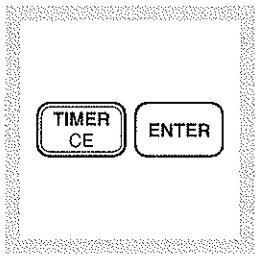
4. Fill a SPADNS Fluoride Reagent AccuVac Ampul with sample by breaking the tip on the bottom of the beaker. Fill a second AccuVac Ampul with deionized water (the blank).

Note: Keep the tip immersed while the ampule fills completely.



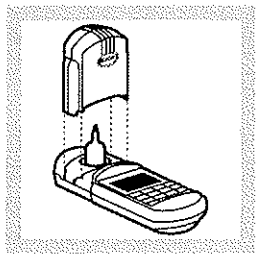
5. Quickly invert the ampules several times to mix. Wipe off any liquid or fingerprints.

Note: Do not place finger over the broken tip- the liquid will remain in the ampul.

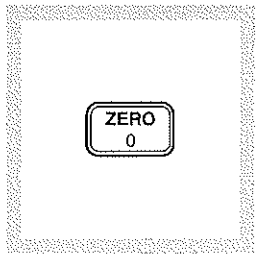


6. Press:
TIMER ENTER

A one-minute reaction period will begin.



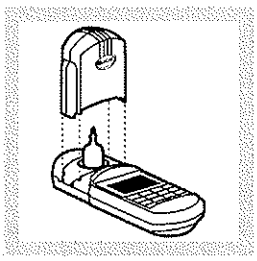
7. After the timer beeps place the blank into the cell holder. Tightly cover the ampule with the instrument cap.



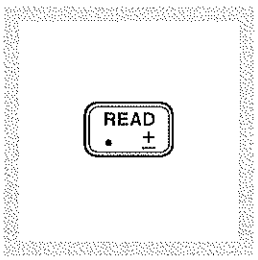
8. Press: **ZERO**

The cursor will move to the right, then the display will show:

0.0 mg/L F



9. Place the AccuVac Ampul containing the sample into the instrument. Tightly cover the sample cell with the instrument cap.



10. Press: **READ**

The cursor will move to the right, then the result in mg/L fluoride will be displayed.

Note: Use of the Standard Adjust feature with each new lot of reagent is highly recommended. See Accuracy Check following these steps.

Sampling and Storage

Collect samples in plastic bottles. Samples may be stored up to 28 days.

Accuracy Check

Standard Solution Method

A variety of standard solutions covering the entire range of the test are available from Hach. Use these in place of sample to verify technique. Minor variations between lots of reagent become measurable above
1.5 mg/L. While results in this region are usable for most purposes, better accuracy may be obtained by diluting a fresh sample 1:1 with deionized water and retesting. Multiply the result by 2.

Standard Adjust

To adjust the calibration curve using the reading obtained with a 1.80-mg/L Standard Solution, press **SETUP** and use the arrow keys to scroll to the "STD" setup option. Press **ENTER** to activate the option. Then enter **1.80** to edit the standard concentration to match that of the standard used. Press **ENTER** to complete the adjustment. See *Standard Curve Adjustment* in *Section 1* for more information.

Method Performance

Precision

In a single laboratory, using standard solutions of 1.00 mg/L fluoride and two lots of SPADNS Reagent with the instrument, a single operator obtained standard deviations of ±0.035 mg/L fluoride.

In a single laboratory, using standard solutions of 1.00 mg/L fluoride and two lots of SPADNS AccuVac Reagent with the instrument, a single operator obtained standard deviations of ±0.040 mg/L fluoride.

Estimated Detection Limit (EDL)

The EDL for programs 27 and 28 is 0.05 mg/L F^-. For more information on derivation and use of Hach's estimated detection limit, see *Section 1*.

Interferences

This test is sensitive to small amounts of interference. Glassware must be very clean. Repeating the test with the same glassware is recommended to ensure that results are accurate.

The following substances interfere to the extent shown:

Substance	Concentration	Error
Alkalinity (as $CaCO_3$)	5000 mg/L	-0.1 mg/L F^-
Aluminum	0.1 mg/L	-0.1 mg/L F^-
Chloride	7000 mg/L	+0.1 mg/L F^-
Iron, ferric	10 mg/L	-0.1 mg/L F^-
Phosphate, ortho	16 mg/L	+0.1 mg/L F^-
Sodium Hexametaphosphate	1.0 mg/L	+0.1 mg/L F^-
Sulfate	200 mg/L	+0.1 mg/L F^-

SPADNS Reagent contains enough arsenite to eliminate interference up to 5 mg/L chlorine. For higher chlorine levels, add one drop of Sodium Arsenite Solution to 25 mL of sample for each 2 mg/L of chlorine.

To check for interferences from aluminum, read the concentration one minute after reagent addition, then again after 15 minutes. An appreciable increase in concentration suggests aluminum interference. Waiting two hours before making the final reading will eliminate the effect of up to 3.0 mg/L aluminum.

Most interferences can be eliminated by distilling the sample from an acid solution as described below:

a) Set up the distillation apparatus for the general purpose distillation. See the Hach Distillation Apparatus Manual. Turn on the water and make certain it is flowing through the condenser.

b) Measure 100 mL of sample into the distillation flask. Add a magnetic stirring bar and turn on the heater power switch.
Turn the stir control to 5.

c) Cautiously measure 150 mL of StillVer Distillation Solution (2:1 Sulfuric Acid) into the flask. If high levels of chloride are present, add 5 mg silver sulfate for each mg/L chloride present.

d) Turn the heat control to setting 10, with the thermometer in place. The yellow pilot lamp shows when the heater is on.

e) When the temperature reaches 180 °C (about one hour), turn the still off.

f) Dilute the collected distillate to 100 mL, if necessary. Analyze the distillate by the above method.

Summary of Method

The SPADNS Method for fluoride determination involves the reaction of fluoride with a red zirconium-dye solution. The fluoride combines with part of the zirconium to form a colorless complex, thus bleaching the red color in an amount proportional to the fluoride concentration. Seawater and wastewater samples require distillation. See Optional Apparatus for Distillation Apparatus listing.

Pollution Prevention and Waste Management

SPADNS Reagent contains sodium arsenite. Final solutions will contain sodium arsenite (D004) in sufficient concentration to be regulated as hazardous waste for Federal RCRA. See *Section 3* for more information on disposal of these materials.

REQUIRED REAGENTS (Using Solution)

Description	Quantity Required Per Test	Unit	Cat. No.
SPADNS Reagent for Fluoride	4 mL	500 mL	444-49
Water, deionized	10 mL	4 L	272-56

REQUIRED APPARATUS (Using Solution)

Pipet Filler safety bulb	1	each	14651-00
Pipet, volumetric, Class A, 10.00 mL	1	each	14515-38
Pipet, volumetric, Class A, 2.00 mL	1	each	14515-36
Sample Cell, 10-20-25 mL w/ cap	2	6/pkg	24019-06
Thermometer, –20 to 110°C, non-mercury	1	each	26357-02

REQUIRED REAGENTS (Using AccuVac Ampuls)

SPADNS Fluoride Reagent AccuVac Ampuls	2 ampuls	25/pkg	25060-25
Water, deionized	varies	4 L	272-56

FLUORIDE, continued

REQUIRED APPARATUS (Using AccuVac Ampuls)

Beaker, 50 mL	2	each	500-41H

OPTIONAL REAGENTS

Drinking Water Inorganics Standard for F^-, NO_3^-, PO_4^{3-}, and SO_4^{2-}	500 mL		28330-49
Fluoride Standard Solution, 0.2 mg/L F^-	500 mL		405-02
Fluoride Standard Solution, 0.5 mg/L F^-	500 mL		405-05
Fluoride Standard Solution, 0.8 mg/L F^-	500 mL		405-08
Fluoride Standard Solution, 1.0 mg/L F^-	1000 mL		291-53
Fluoride Standard Solution, 1.0 mg/L F^-	500 mL		291-49
Fluoride Standard Solution, 1.2 mg/L F^-	500 mL		405-12
Fluoride Standard Solution, 1.5 mg/L F^-	500 mL		405-15
Fluoride Standard Solution, 2.0 mg/L F^-	500 mL		405-20
Silver Sulfate, ACS	113 g		334-14
Sodium Arsenite Solution	100 mL MDB		1047-32
StillVer Distillation Solution	500 mL		446-49

OPTIONAL APPARATUS

AccuVac Snapper Kit		each	24052-00
Cylinder, graduated, 100 mL		each	508-42
Cylinder, graduated, 250 mL		each	508-46
Distillation Heater and Support Apparatus Set, 115 V, 50/60 Hz		each	22744-00
Distillation Heater and Support Apparatus Set, 230 V, 50/60 Hz		each	22744-02
Distillation Apparatus General Purpose Accessories		each	22653-00
pH Meter, *sension™1*, portable, with electrode		each	51700-10
Pipet, TenSette, 1.0 to 10.0 mL		each	19700-10
Pipet Tips, for 19700-10 TenSette Pipet		50/pkg	21997-96
Stopper		6/pkg	1731-06

For Technical Assistance, Price and Ordering

In the U.S.A.—Call 800-227-4224

Outside the U.S.A.—Contact the Hach office or distributor serving you.

pH, Wide Range (4 to 10 pH units)
For test kit 147011 (Model 17-N)

DOC326.98.00012

Additional copies available on www.hach.com

Test preparation

- Assemble the color comparator by placing the color disc on the center pin with the lettering facing out.
- Rinse tubes with the sample water before testing. Rinse with deionized water after testing.
- To check reagent accuracy, use a buffer solution in place of the sample (see Optional items).
- Chlorine interferes at concentrations over 1 mg/L Cl_2. To remove chlorine from the sample water, add one drop of 0.1 N sodium thiosulfate solution (see Optional items) to 25 mL of sample and mix. Use 5 mL of this treated sample in the test procedure. The sodium thiosulfate will remove up to 10 mg/L chlorine.
- Read the pH at the matching disc segment or as the value halfway between the two segments closest in color.
- If the disc becomes wet, carefully separate the two halves of the plastic case and dry them and the colored plastic insert with a soft cloth. Assemble the parts when completely dry.

CAUTION: Handle chemical standards and reagents carefully. Review Material Safety Data Sheets before handling chemicals.

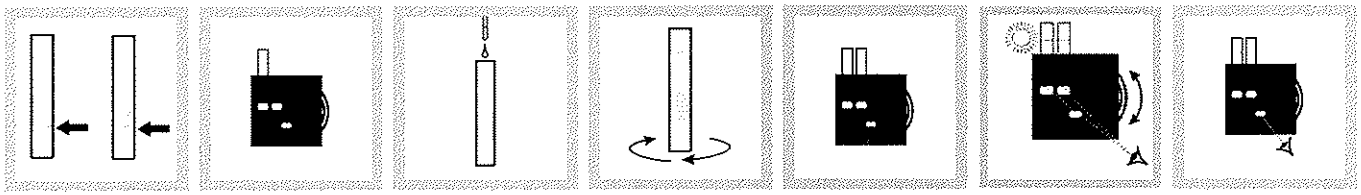
Replacement items

Description	Unit	Catalog no.
Color Comparator Box	each	173200
Color Disc, pH 4–10, wide range	each	990100
Color Viewing Tube, plastic, with cap	4/pkg	4660004
Wide Range pH Indicator Solution	100 mL	2329332

Optional items

Description	Unit	Catalog no.
Buffer Solution, pH 7.00	500 mL	1222249
Caps, for plastic viewing tubes 4660004	4/pkg	4660014
Color Viewing Tube, glass	6/pkg	173006
Deionized Water	500 mL	27249
Sodium Thiosulfate Standard Solution, 0.1 N	100 mL	32332
Stoppers, for glass viewing tubes 173006	6/pkg	173106

Test procedure



1. Fill two tubes to the first (5-mL) line with sample.

2. Insert one tube into the left opening of the comparator.

3. Add six drops of Wide Range pH Indicator Solution to the second tube.

4. Swirl to mix.

5. Insert the second tube into the right opening of the comparator.

6. Hold the comparator so that a daylight or fluorescent light source is directly behind the tubes. Rotate the color disc until the colors in the front windows match. The best match may occur between two color segments.

7. Read the result (in pH units) in the scale window. If the best match occurs between two color segments, determine the value halfway between the two printed numbers.

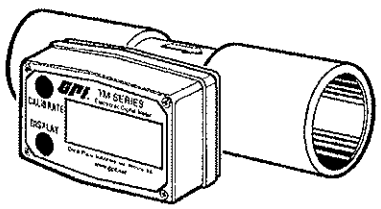
SAVE THESE INSTRUCTIONS

5252 East 36th Street North
Wichita, KS USA 67220-3205
TEL: 316-686-7361
FAX: 316-686-6746

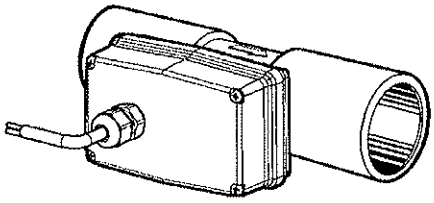
GREAT PLAINS INDUSTRIES, INC.
"A Great Plains Ventures Subsidiary"
www.gpi.net
1-888-996-3837

TM Series Electronic Water Meters CE

User Manual



TM Meter with Computer Display



TM Digital Pulse Meter

TABLE OF CONTENTS

ENGLISH

IMPORTANT NOTICE

Use TM Series meters with water and other chemicals compatible with wetted components (see Specifications Section). Do not use to meter fuel or incompatible chemicals. TM Series meters are available with either a computer for local electronic display, or a conditioned signal output module to provide a digital signal to customer interfacing equipment. TM Series meters with computer display measure in gallons or litres. Refer to the Calibration Section for details.

These meters are not legal for trade applications.

TM Series meters are very sensitive to electric noise if operated within 1 to 2 inches of some electric motors or other sources of electronic noise.

INSTALLATION

Connections

Install your meter in-line either horizontally or vertically or at the end of the hose adjacent to the nozzle. Installation to metal connections is not recommended. Install as follows:

1. Plan to install turbine with a minimum straight pipe length as follows:
   - Upstream from the turbine, allow a minimum straight pipe length of 10 times the internal diameter of the turbine.
   - Downstream from the turbine, allow a minimum straight pipe length of 5 times the internal diameter of the turbine.
2. For Spigot (Pipe) End use only primer and solvents approved for PVC gluing.

For NPT Fittings wrap all connections with 3 to 4 wraps of thread tape. Make sure the tape does not intrude into the flow path.

3. Attach meter with arrow pointed in the direction of flow.
4. For NPT Fittings - Hand tighten the meter at the housing ends. Do no use a wrench or similar tool to tighten. This can damage the housing.

Conditioned Signal Output Module Wiring

This conditioned signal output module can be wired to provide an open collector signal output or 6-volt square wave output.

Open Collector Signal Output

To achieve an open collector signal output, reference Wiring Diagram 1. The terminal block is located on the back side of the module. The module is factory assembled for open collector signal output. Please provide the (820 ohm minimum) resistor.

Ten feet (3m) of cable is provided with the module. Trim it to desired length or extend it as necessary. Distances up to 5,000 feet (1,524m) can be achieved for open collector signal output.

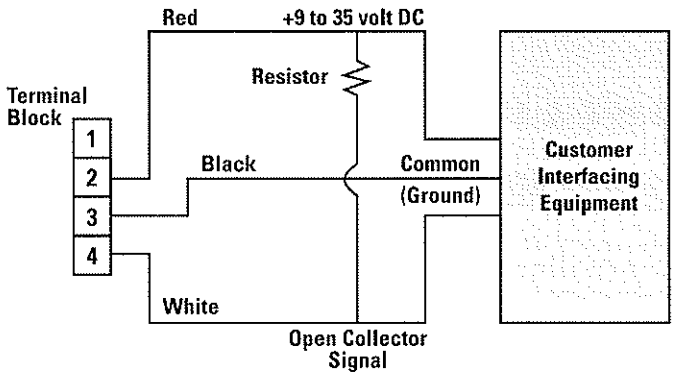
Square Wave Output

To achieve square wave output, reference Wiring Diagram 2 and use an Electronic Digital Meter Battery Kit (sold separately) for battery power. The terminal block and battery location are located on the back side of the module. Access as follows:

1. Remove the four Phillips-head screws from the front of the module and lift the module from the turbine.
2. To change terminal block connections, loosen the appropriate screws. Reconnect the wires in the proper positions and tighten the screws.
3. Install the batteries. Make sure the positive post is in the correct position.
4. Position the module on the turbine housing. To avoid moisture damage, make sure the seal is fully seated. Tighten the four screws on the front of the module.

Wiring Diagram 1

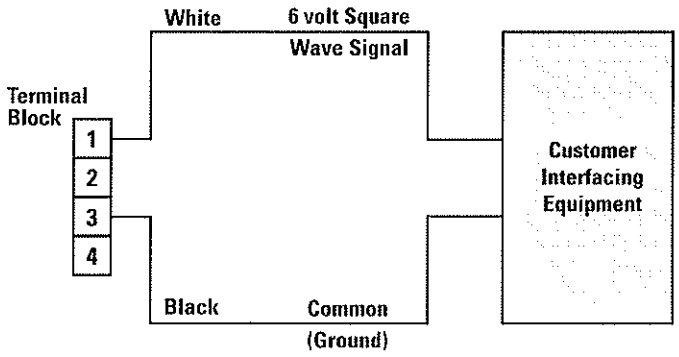
OPEN COLLECTOR SIGNAL OUTPUT



The terminal block is identified as follows:
Pin #1 6 volt square wave (not used)
Pin #2 +9 to 35 volt DC Input
Pin #3 Common Ground
Pin #4 Open Collector signal Output

Wiring Diagram 2

SQUARE WAVE OUTPUT



The terminal block is identified as follows:
Pin #1 6 volt square wave
Pin #2 +9 to 35 volt DC Input (not used)
Pin #3 Common Ground
Pin #4 Open Collector signal Output (not used)

Ten feet (3m) of cable is provided with the module. Trim the cable to desired length or extend it as necessary.

Verify Meter Accuracy

Before using, check the meter's accuracy and verify calibration.

1. Make sure there is no air in the system by starting the flow until it runs steadily. Then, stop the flow using a valve or nozzle.
2. Meter an exact known volume into an accurate container. For best results, meter with one continuous full stream.
3. Check the volume against the display or recording equipment. If the amount metered is accurate, further calibration is not necessary. If not, refer to the Calibration Section for further instructions.

OPERATION

Computer Display – Batch and Cumulative Totals

The computer maintains two totals. The Cumulative Total provides continuous measurement and cannot be manually reset. The Batch Total can be reset to measure flow during a single use. The Cumulative Total is labeled with TOTAL 1 LOCKED indicating that this total is locked and cannot be manually zeroed. Batch Total is labeled with TOTAL 2.

When the Cumulative Total reaches a maximum reading of 999,999, it will automatically reset to zero.

Press the DISPLAY button briefly to switch between the batch, cumulative total, and flowrate.

NOTE: Totalization counts total units without differentiating between gallons, litres or field calibrated units.

Flowrate Feature

To use this feature, press and release DISPLAY until FLOWRATE appears to the left of the bottom line.

When FLOWRATE is displayed, the numbers on the middle line reflect the rate of flow, for example, the current gallons per minute (GPM) or litres per minute (LPM).

Activate the Meter

Turn the computer display ON by starting water flow or briefly pressing the DISPLAY button. The Batch or Cumulative Total from last use will be displayed.

Press DISPLAY briefly to display the Batch Total. Hold the DISPLAY button down for 3 seconds to reset the Batch Total to zero.

The computer display is programmed to turn off automatically if not used for 4 minutes.

Factory and Field Calibration Curves

All calibration information is visible to the user as words in the upper part of the display, above the numeric digits.

All units are configured with a "factory" calibration curve. Both gallons and litres are available ("GAL" or "LTR" will be displayed). Use the CALIBRATE and DISPLAY buttons to switch between gallons and litres. This curve is NOT user adjustable: the word "PRESET" is displayed to show this. (The factory calibration is stored permanently in the computer's memory.)

The "field" calibration curve may be set by the user, and can be changed or modified at any time using the calibration procedure described below in the Calibration Section. Totals or flowrate derived from the field calibration are visible when the field calibration setting is selected ("CAL B" will be visible on the top line).

Selecting a Different Calibration Setting

You can switch between GAL and LTR modes at will without "corrupting" totalizer contents. For example, the computer can totalize 10.00 gallons. If the user switches to LTR mode, the display will immediately change to "37.85" (the same amount in units of litres). GAL / LTR switching also works in FLOWRATE mode.

To select a different calibration setting, first press and hold the CALIBRATE button. Continue to hold it while also pressing and releasing the DISPLAY button. (You may then also release the CALIBRATE button.) The flag indicators in the top line of the display will change to show the newly selected calibration setting. Calibration settings change in this order: GAL, LTR, CAL B, GAL, etc. While fluid is flowing, only the GAL and LTR selections may be made. However, when NO fluid flow is occurring, any setting may be selected.

CALIBRATION

Before Beginning Field Calibration

For the most accurate results, dispense at a flowrate which best simulates your actual operating conditions. Avoid "dribbling" more fluid or repeatedly starting and stopping the flow. This can result in less accurate calibrations.

Make sure you meet the meter's minimum flowrate requirements:

TM Series Meters	
1/2 inch meter	1 GPM (3.8 LPM)
3/4 inch meter	2 GPM (7.5 LPM)
1 inch meter	5 GPM (18.8 LPM)
1-1/2 inch meter	10 GPM (37.5 LPM)
2 inch meter	20 GPM (75 LPM)

The use of a uniformly dependable, accurate calibration container is highly recommended for the most accurate results. Due to high flowrate, it is strongly recommended that calibration be completed with a combination of volume and weight using fine resolution scales.

For best results, the meter should be installed and purged of air before field calibration.

Field Calibration with Computer Display

Field Calibration and Factory Calibration are defined in the previous section. Factory calibration settings are custom programmed into each computer during production, using water at 70°F (21°C). Readings using the standard factory calibration curves may not be accurate in some situations, for example, under extreme temperature conditions or with fluids other than water.

For improved accuracy under such conditions, the GPI flow computer allows for "field" calibration, that is, user entry of custom calibration parameters. A "single point" calibration may yield acceptable accuracy in the middle of the flow range, but five or more calibration points may yield a higher level of accuracy, especially at the lower end of the flow range. Up to 15 custom calibration points can be entered.

Dispense/Display Field Calibration Procedures

1. Hold down CALIBRATE while pressing and releasing DISPLAY until the field calibration curve appears ("CAL B" message will be displayed). Release both buttons.
2. To calibrate, press and hold the CALIBRATE button. While continuing to hold CALIBRATE, also press and hold the DISPLAY button. Hold both buttons for about 3 seconds until you see a blinking "dd CAL" message. Once the "dd CAL" message appears, release both buttons. You are now in field calibration mode.
3. Once the buttons have been released from Step 2, the display will show the blinking message "run 01". If you want to exit the calibration now before dispensing any fluid, go to Step 11.
4. If you want to continue with the calibration, but have not dispensed any fluid yet, make your final preparations to your pumping system, but don't start pumping yet.
5. Start your pumping system so that fluid flows through the meter. The display will stop blinking and show the "run 01" message. Dispense into a container that allows you to judge the amount of fluid pumped. When you have pumped the desired amount (for example, 10 gallons), stop the fluid flow quickly.
6. Once the flow has stopped, briefly press and release both buttons. At this point the computer display will change to "0000.00" with the left-hand digit blinking.
7. Enter the volume (amount) of fluid that you dispensed (for example, if your 10-gallon container is full, enter "10.0" for gallons or "37.85" for litres). To enter numbers, use the CALIBRATE button to change the value of the digit that is blinking and use the DISPLAY button to shift the "blink" to the next digit.
8. Once the correct number is entered, briefly press and release both buttons. The display will now change to a blinking "run 02" message. You have installed the new cal-curve point. You are ready to end calibration (Step 10) or enter another new calibration point (Step 9).
9. To enter another calibration point, go back and repeat Steps 3 through 8. It is possible to set up to 15 cal-curve points, and the "run ##" message will increment each time you repeat the calibration process (run 01, run 02, run 03, etc., up to run 15).
10. To end calibration, press and hold both buttons for about 3 seconds until you see the "CAL End" message. After you release the buttons the computer will resume normal operations with the new cal point(s) active.
11. If you HAVE NOT dispensed any fluid, you can exit calibration without changing the cal curve. If the message "run 01" is showing and you have not dispensed any fluid, hold both buttons for about 3 seconds until you see a "CAL End" message. After you release the buttons, the computer will resume normal operation and the old curve (if you entered one in the past) is still intact.

Calibration with Conditioned Signal Output Module

The K-factor of your meter appears on the calibration report as the number of pulses per gallon. The factor is determined during production using water at 70°F (21°C). This K-factor may be used for "single point" calibration and provide acceptable accuracy. However, readings may not be accurate when using this calibration method in some situations. One example is when using the meter under extreme temperature conditions or with fluids other than water.

For improved accuracy under such conditions, we recommend that a K-factor specific to the application be determined and used for calibration. A "single point" calibration may yield acceptable accuracy in the middle of the flow range, but five or more calibration points may yield a high level of accuracy, especially at the lower end of the flow range.

MAINTENANCE

Proper handling and care will extend the life and service of the meter.

Turbine Rotor

The meter is virtually maintenance-free. However, it is important the rotor moves freely. Keep the meter clean and free of contaminants.

If the rotor does not turn freely, apply a penetrating lubricant on the rotor, shaft, and bearings. Remove any debris or deposits from the rotor using a soft brush or small probe. Be careful not to damage the turbine rotor or supports.

⚠ CAUTION

Blowing compressed air through the turbine assembly could damage the rotor.

Battery Replacement

The computer display is powered by two 3-volt lithium batteries which may be replaced while the meter is installed. When batteries are removed or lose power, the batch and cumulative totals reset to zero but the field and factory calibrations are retained.

If the display becomes dim or blank, replace the batteries as follows:

1. Remove the four Phillips-head screws from the face of the meter and lift the faceplate from the turbine.
2. Remove the old batteries and clean any corrosion from the terminals.
3. Install new batteries. Make sure the positive post is in the correct position.
4. When the batteries are replaced, the faceplate will power ON. Check the display to ensure normal functions have resumed before assembling again.
5. Reseat batteries, if necessary, and position the faceplate on the turbine housing. To avoid moisture damage, make sure the seal is fully seated. Tighten the four screws on the faceplate.

SPECIFICATIONS

Inlet and Outlet:

Spigot (Pipe) End Models:

TM050/TM050-P	1/2 inch Schd. 80, Spigot (Pipe)
TM075/TM075-P	3/4 inch Schd. 80, Spigot (Pipe)
TM100/TM100-P	1 inch Schd. 80, Spigot (Pipe)
TM150/TM150-P	1-1/2 inch Schd. 80, Spigot (Pipe)
TM200/TM200-P	2 inch Schd. 80, Spigot (Pipe)

NPT Models:

TM050-N/TM050-N-P	1/2 inch NPT
TM075-N/TM075-N-P	3/4 inch NPT
TM100-N/TM100-N-P	1 inch NPT
TM150-N/TM150-N-P	1-1/2 inch NPT
TM200-N/TM200-N-P	2 inch NPT

Design Type: Turbine

Wetted Components:

Housing: PVC
Journal Bearings: Ceramic
Shaft: Tungsten Carbide
Rotor and Supports: PVDF
Retaining Washer: Stainless Steel

Fitting Types: Spigot - Schd. 80 or NPT (female)

Max. Working Pressure: 225 PSIG @ 73°F

U.S. Measurement

Unit of Measure: Gallon

Flow Range:

1/2 inch	1 - 10 GPM
3/4 inch	2 - 20 GPM
1 inch	5 - 50 GPM
1-1/2 inch	10 - 100 GPM
2 inch	20 - 200 GPM

Accuracy with Computer: ± 3.0% (Accuracy can be improved with field calibration)

Operating Temperature: +32° to +140° F (Do not allow fluid to freeze inside meter.)

Storage Temperature: –40° to +158° F

Product Weight:*

	Spigot (Pipe)	NPT
1/2 inch	.38 lbs.	.55 lbs.
3/4 inch	.43 lbs.	.67 lbs.
1 inch	.49 lbs.	.84 lbs.
1-1/2 inch	.66 lbs.	1.38 lbs.
2 inch	.78 lbs.	1.78 lbs.

Dimensions - Inches (W x H x L):**

	Without Fitting	With Fitting
1/2"	2.0 x 2.6 x 3.8	2.0 x 2.8 x 5.5
3/4"	2.0 x 2.7 x 3.8	2.0 x 2.9 x 5.5
1"	2.0 x 3.1 x 4.1	2.0 x 3.3 x 6.2
1-1/2"	2.1 x 3.7 x 5.4	2.3 x 3.9 x 7.6
2"	2.4 x 4.2 x 5.5	3.5 x 4.5 x 7.9

* Weight with computer display. Conditioned signal output module adds .30 lbs.

** Dimensions with computer display. Conditioned signal output module adds 1.1 inch to height.

Metric Measurement

Unit of Measure: Litre

Flow Range:

1/2 inch	3.8 - 38 LPM
3/4 inch	7.6 - 76 LPM
1 inch	19 - 190 LPM
1-1/2 inch	38 - 380 LPM
2 inch	76 - 760 LPM

Accuracy with Computer: ± 3.0% (Accuracy can be improved with field calibration)

Operating Temperature: 0° to +60° C (Do not allow fluid to freeze inside meter.)

Storage Temperature: -40° to +70° C

Product Weight:*

	Spigot (Pipe)	NPT
1/2 inch	.172 kg	.249 kg
3/4 inch	.195 kg	.304 kg
1 inch	.222 kg	.381 kg
1-1/2 inch	.299 kg	.626 kg
2 inch	.354 kg	.807 kg

Dimensions - cm (W x H x L):**

	Without Fitting	With Fitting
1/2"	5.0 x 6.6 x 9.6	5.0 x 7.1 x 13.9
3/4"	5.0 x 6.8 x 9.6	5.0 x 7.3 x 13.9
1"	5.0 x 7.8 x 10.4	5.0 x 8.3 x 15.7
1-1/2"	5.8 x 9.3 x 13.7	5.8 x 9.9 x 19.3
2"	6.0 x 10.6 x 13.9	8.8 x 11.4 x 20.0

* Weight with computer display. Conditioned signal output module adds .136 kg.

** Dimensions with computer display. Conditioned signal output module adds 2.8 cm to height.

PARTS

The following replacement parts and accessories are available for the TM Series meters:

Part No.	Description
113435-1	Conditioned Signal Output Module
113520-1	Battery Replacement Kit
116000-1	Calibration Container, Large (5 gallon)
125508-03	1/2 inch, Turbine Assy Kit
125508-04	1/2 inch NPT, PVC Turbine Assy Kit
125510-03	3/4 inch, Turbine Assy Kit
125510-04	3/4 inch NPT, PVC Turbine Assy Kit
125512-03	1 inch, Turbine Assy Kit
125512-04	1 inch NPT, PVC Turbine Assy Kit
125514-03	1-1/2 inch, Turbine Assy Kit
125514-04	1-1/2 inch NPT, PVC Turbine Assy Kit
125516-03	2 inch, Turbine Assy Kit
125516-04	2 inch NPT, PVC Turbine Assy Kit
901002-52	Seal
Computer Kits:	
125509-03	1/2 inch, Computer Assy Kit
125511-03	3/4 inch, Computer Assy Kit
125513-03	1 inch, Computer Assy Kit
125515-03	1-1/2 inch, Computer Assy Kit
125517-03	2 inch, Computer Assy Kit

SERVICE

For warranty consideration, contact your local distributor. If you need further assistance, contact the GPI Customer Service Department at:

1-800-835-0113

You will need to:

- Provide information from the decal on your meter.
- Receive a Return Authorization number.
- Flush any fluid from the meter before shipping to the factory.
- If possible leave customer installed fittings or ample length of bare pipe for reinstallation.

⚠ CAUTION

Do not return the meter without specific authority from the GPI Customer Service Department. Due to strict regulations governing transportation, handling, and disposal of hazardous or flammable liquids, GPI will not accept meters for rework unless they are completely free of liquid residue.

Declaration of Conformity

Manufacturer's Name:	Great Plains Industries, Inc.
Manufacturer's Address:	5252 East 36th Street North Wichita, KS USA 67220-3205

Declares, that the product:

Product Name:	Conditioned Signal Module TM Water Meter / Pulse Out
Model Numbers:	0N-0278 TM***-P TM***-N-P

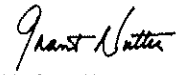
Model numbers include all combinations of an alpha-numeric series as illustrated above.

Conform to the following Standards:

EMC:	EN 50081-1 (Reference EN 55022) EN 55082-1 EN 61000-3-2 EN 61000-3-3 EN 61000-4-2 EN 61000-4-3

Supplementary Information:
"The products comply with the requirements of the EMC Directive 89/336/EEC."

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s) and Standard(s).

Signature:	
Full Name:	Mr. Grant Nutter
Position:	President Great Plains Industries, Inc.
Place:	Wichita, KS USA November 2007

CE

Declaration of Conformity

Manufacturer's Name:	Great Plains Industries, Inc.
Manufacturer's Address:	5252 East 36th Street North Wichita, KS USA 67220-3205

Declares, that the product:

Product Name:	TM Series Water Meter
Model Numbers:	TM050 TM075 TM100 TM150 TM200

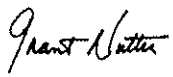
Model numbers may include the suffix "-N" to indicate thread type.

Conform to the following Standards:

EMC:	EN 50081-1 (Reference EN 55022) EN 55082-1

Supplementary Information:
"The products comply with the requirements of the EMC Directive 89/336/EEC."

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s) and Standard(s).

Signature:	
Full Name:	Mr. Grant Nutter
Position:	President Great Plains Industries, Inc.
Place:	Wichita, KS USA November 2007

CE

Limited Warranty Policy

Great Plains Industries, Inc. 5252 E. 36th Street North, Wichita, KS USA 67220-3205, hereby provides a limited warranty against defects in material and workmanship on all products manufactured by Great Plains Industries, Inc. This product includes a 1 year warranty. Manufacturer's sole obligation under the foregoing warranties will be limited to either, at Manufacturer's option, replacing or repairing defective Goods (subject to limitations hereinafter provided) or refunding the purchase price for such Goods theretofore paid by the Buyer, and Buyer's exclusive remedy for breach of any such warranties will be enforcement of such obligations of Manufacturer. The warranty shall extend to the purchaser of this product and to any person to whom such product is transferred during the warranty period.

The warranty period shall begin on the date of manufacture or on the date of purchase with an original sales receipt. This warranty shall not apply if:

A. the product has been altered or modified outside the warrantor's duly appointed representative;
B. the product has been subjected to neglect, misuse, abuse or damage or has been installed or operated other than in accordance with the manufacturer's operating instructions.

To make a claim against this warranty, contact the GPI Customer Service Department at 316-686-7361 or 888-996-3837. Or by mail at:

Great Plains Industries, Inc.
5252 E. 36th St. North
Wichita, KS, USA 67220-3205

The company shall, notify the customer to either send the product, transportation prepaid, to the company at its office in Wichita, Kansas, or to a duly authorized service center. The company shall perform all obligations imposed on it by the terms of this warranty within 60 days of receipt of the defective product.

GREAT PLAINS INDUSTRIES, INC., EXCLUDES LIABILITY UNDER THIS WARRANTY FOR DIRECT, INDIRECT, INCIDENTAL AND CONSEQUENTIAL DAMAGES INCURRED IN THE USE OR LOSS OF USE OF THE PRODUCT WARRANTED HEREUNDER.

The company herewith expressly disclaims any warranty of merchantability or fitness for any particular purpose other than for which it was designed.

This warranty gives you specific rights and you may also have other rights which vary from U.S. state to U.S. state.

Note: In compliance with MAGNUSON MOSS CONSUMER WARRANTY ACT – Part 702 (governs the resale availability of the warranty terms).

GPI®
5252 East 36th Street North
Wichita, KS USA 67220-3205
TEL: 316-686-7361
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GREAT PLAINS INDUSTRIES, INC.
"A Great Plains Ventures Subsidiary"
www.gpi.net
1-888-996-3837

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Rev. - 920786-02

Fluoride Treatment

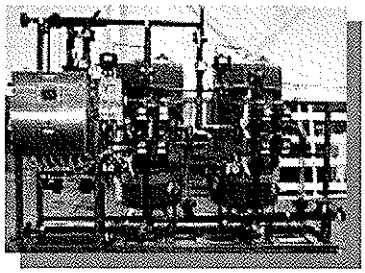
AdEdge AD74 Fluoride Treatment Systems

Q: Why do we need to remove excessive fluoride from drinking water?

A. *The US EPA has set a Maximum Contaminant Level (MCL) for fluoride in drinking water at 4.0 mg/L and a secondary limit of 2.0 mg/L because fluoride can cause chronic health issues such as bone and tooth density loss, heart problems, respiratory disease and cancer at higher levels. More and more communities are taking steps to remove excess fluoride from drinking water due to these known health concerns.*

Q: What is AD74 technology?

A. *AD74 is an adsorptive alumina-based metal oxide which has been certified for use in drinking water under NSF Standard 61. This media has been designated as the "Best Available Technology" for fluoride removal in drinking water by the Water Quality Association, the American Water Works Association, and the US Environmental Protection Agency. It is capable of removing fluoride at levels of 1-8 mg/L with > 90% removal efficiency. The media is used in AdEdge's manual or automated filtration systems that are pre-engineered, customized, and packaged by AdEdge for site-specific requirements.*



AdEdge APU Treatment System

Q: What are the two treatment options for removing fluoride using AD74 technology?

A. *The AD74 adsorption based technology can be utilized in one of two ways depending on the site specific requirements, limitations, and permitting requirements: (1) as a one-time use media that is discarded when the capacity is reached; or (2) in reusable mode through the process of on-site regeneration of the media enabling it to be used repeatedly without offsite disposal.*

Option 1: *One-time use mode (disposal)*

The AD74 media has a high affinity for fluoride. Therefore the media can be run to exhaustion without any regeneration or on-site wastewater discharges and then disposed offsite as non-hazardous waste. This process is most often used in very small to medium sized water systems and in cartridges for point-of-use (household) units. Features of this option include:

- *One time use is best utilized when fluoride concentrations are less than 4 mg/L.*
- *Media life will depend on daily water usage, pH, fluoride level, and other parameters such as silica and sulfates.*
- *Capacity is very pH dependent; lower the better; optimal is 5.5 pH. Therefore, pH adjustment of the raw water is common for optimizing performance.*
- *Typical life is days to several months, depending on size/throughput and water chemistry.*
- *Requires minimal operator effort and attention.*
- *Media can be disposed as non-hazardous waste.*
- *Relatively high overall operating cost due to media replacement frequency.*

Option 2: On-site Regeneration (continuous use)

AD74 can be regenerated on-site with dilute caustic (sodium hydroxide) after the media has been run to exhaustion, as measured by fluoride breakthrough. This removes the fluoride from the media so it can be placed back in service. Process control is required to neutralize the media before it is put back in service and the wastewater before disposal in sanitary sewer, drain or leach field, wastewater plant, or other option.
Features of this option include:

- *Effective fluoride removal up to 8 mg/L.*
- *Moderate filtration rates.*
- *Typical media life is 3-4 years as capacity exhausts with time.*
- *AdEdge provides ancillary equipment for regeneration and neutralization as part of the packaged solution.*
- *Wastewater is non-hazardous after neutralization and can be discharged to sanitary sewer, drain or leach field, wastewater plant, or other option.*
- *Lowest overall capital and operating cost option.*
- *Optimum operating pH is from 5.5 – 6.5. Adjustment may be necessary using sulfuric or hydrochloric acid for pH adjustment prior to the adsorption process.*
- *Requires more operator time and involvement than single use option because of the regeneration and chemical handling.*

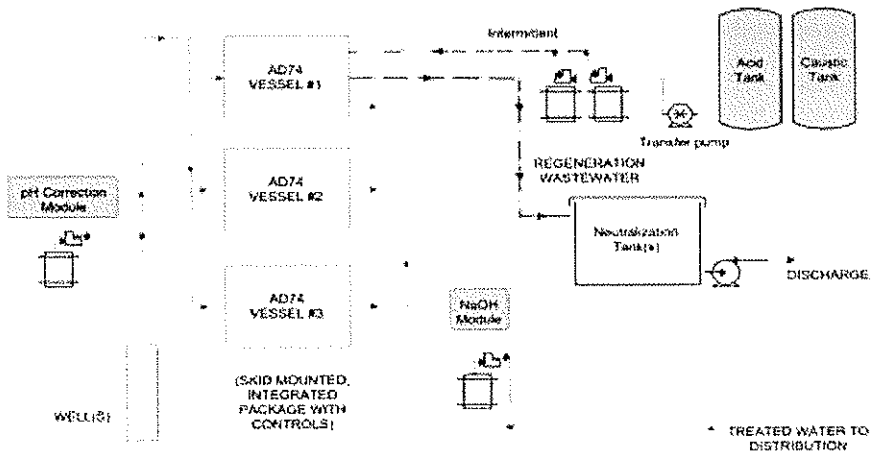
Q: How long does the media last before replacement is needed?

A. *The AD74 media life is based on several primary factors, including specific site water quality parameters (fluoride concentration, pH, silica, and other anions) treatment objectives, and water usage. Capacity predictions are run by AdEdge using a proven, predictive model for calculating run life and media capacity at the proposal stage prior to installation to establish expectations for performance.*

Q: How do I obtain a site specific proposal or determine the best option for my water system?

A. *For specific information or cost and sizing proposal, contact AdEdge Technologies, Inc. at 678-835-0052 or visit our website at www.adedgetechnologies.com. You will be asked to provide some site specific information and a complete water analysis upon which a proposal can gladly be provided by our technical staff.*

AD74 FLUORIDE REDUCTION PROCESS SCHEMATIC



adedge technologies
AdEdge Technologies Inc. 5152 Belle Wood Ct. Buford, GA 30518 (678) 835-0052
info@adedgetechnologies.com www.adedgetechnologies.com

AdEdge

Paraiso Hot Springs — Site Profile and Proposal

Contact Information

Customer / Utility:	Paraiso Hot Springs	Date:	10/11/2011
Site or Well Identity / Location:	California	AdEdge Rep:	Not Applicable
Local Engineer / Firm:	CHM2 Hill	Rep Email:	Not Applicable
Other Pertinent Notes:		Site Contact:	Tim Bushman - Culligan Salinas
Operator:	TBD	Phone	cell: 831-320-8589
Target Date for Installation:	TBD	Email:	timb@culliganqwe.com
Treatment Goals:	Fluoride < 1.5 mg/L		

System Parameters / Site Specific Info

System Type / Application:	PWS	(utility, school, MHP, other)
Population Served:	TBD	(estimated)
Number of Connections:	1	
Number of Wells to be treated:	2	(# wells to be treated)
Design Flow (GPM):	35	(Max design flow rate)
Ave Flow (GPM):	35	(Typical demand)
Adedge Sizing Basis (GPM):	35	(Sizing Basis - Adedge)
Gallons per day:	43000	(Ave throughput per day)
Est. Usage (Gals / Year):	15695000	(Best estimate)
Existing Pretreatment or disinfection:	None	
Equipment available for offloading:	None	
Pump Operation / Pressure:	TBD	
Electrical Power Availability:	TBD	
Atm Storage Tank Present / Size:	1,000,000 gallon	
Hydropneumatic Tank Present / Size:	TBD	
Building present:	TBD	
Any additives ie, phosphates, fluoride:	None	
Discharge Options available:	Sanitary Discharge	

Site Specific Notes:

Design based on information provided to AdEdge at the time of the proposal.

Process Flow:

Well>>HCl>>APU74>>NaOH>>Storage>>Distribution

Water quality based on 50/50 blend of well 1 & 2

Site Shipping Address:

Water Analysis

Project Specific Parameters

Codes: 1 = Arsenic project
2 = Arsenic, Iron / Mn / S project
3 = Fluoride project
4 = Uranium, Radium project
5 = Nitrate project
6 = General Filtration

Codes		Parameters		Codes		Parameters	
All	pH	8.50	units	All	Total Organic Carbon	No Data	mg/L TOC
1, 2	Total As	<0.002	mg/L As	All	Sulfate	440.00	mg/L as SO4
1, 2	As(III)	<0.002	mg/L (average)	4, 5	Nitrates	2.55	mg/L as NO3
All	Sulfides	No Data	mg/L	4, 5	Chlorides	50.00	mg/L Cl
All	Hardness	120.00	mg/L @ CaCO3	4	Uranium	No Data	mg/L U
All	Alkalinity	129.50	mg/L @ CaCO3	4	Gross Alpha	No Data	pCi/L
All	Silica	No Data	mg/L SiO2	3, 4, 5	TDS:	870.00	mg/L
All	Phosphate	No Data	mg/L P04	3	Fluoride	5.95	mg/L F
3, 4, 5	Bicarbonate	121.00	mg/L HCO3	All	Turbidity	0.21	NTU
All	Iron	<0.05	mg/L Fe	All	Suspended Solids	No Data	mg/L TSS
All	Manganese	<0.01	mg/L Mn	All	Temperature	No Data	degrees F

Fluoride

AD74 Packaged System:	APU74-3672CO-2-LL	Contact time (EBCT):	8.5	(based on peak flow)
No of vessels:	(2) 36" x 72"	Ave flow rate:	35	(typical expected)
Qty of media (cu ft):	40.0	Ave gallons/day:	43000	(based on utilization)
Approximate System footprint:	100"L x 60"W x 105"H	Hydraulic Utilization %:	85.32%	(actual system utilization 24-7)
Media:	AD74	Est. working capacity:	1,396	(bed volumes)
Filtration Rate:	4.3 gpm / sq ft	Bed volumes/day:	144	(throughput)
Service Operation:	Series	Est. Gallons to breakthrough:	417,534	(media regen)
Backwash Flow Rate:	64 gpm	Est. Regen (Days) per vessel:	10	(est frequency of regen)
Est. Regen water (gallons) per vessel:	1,752	Est. Media Replacement (Days):	466	(est media replacement)

AdEdge Treatment Solution
System Scope of Supply and Features

Paraiso Hot Springs **10/11/2011**

Pressure Vessels/Media

Model APU74-3672CO-2-LL, regenerating fluoride treatment system
Pre-packaged, skid mounted system
Stainless steel tubular skid
(2) 36 x 72-inch composite vessel
SCH 80 PVC hub and lateral collection system
AD74 Activated Alumina, 28x48 mesh, (40) cubic feet total
Garnet underbedding

Example: APU74-3672CO-2-LL

Process Valves & Piping

(2) 2.0-inch top mount Noryl® process control valve, chemical resistant
Throttling valves for backwash and service flow control
SCH 80 PVC interconnecting pipe, check valves, unions & isolation valves
2.0-inch flanged inlet / outlet / backwash connection on skid
2.0-inch flange for auxiliary backwash supply
2.0-inch diaphragm valve for backwash flow control
In-line sight glass
Local and panel mounted sample valves

Instrumentation & Controls

(2) 2.0-inch top mount Noryl® process control valve, chemical resistant
0-100 psi pressure gauges, local and panel mount
0-15 differential pressure gauge panel mount
In-line flow sensor with panel mount display
InGenius mechanical logic panel

pH Adjustment Module

(2) Peristaltic dosing pump
Flow paced pump rate
Foot valve and injection valve
Potable grade NaOH supplied by others
Potable grade HCl supplied by others

Customer Provided Support

Single phase 115v, 20 amp electrical service
Drain or discharge point for periodic backwash water
Concrete slab or base for treatment skid
Enclosure / weather protected if outdoors as necessary
Consistent water supply at 30 to 100 PSIG
Plumbing & electrical connections

Field Services & Miscellaneous

System startup & commissioning by AdEdge
AdEdge onsite training with certified operator
System installation & final electrical connections by site
AdEdge shop drawings & design report for submittals
(1) O & M manual hard copy, (1) Electronic Disk

Terms

Lead time is 7-10 weeks for shipment upon release to mfg
Freight is not included in capital pricing; FOB mfg location Atlanta, GA
10% due upon order; 20% release to mfg; 65% shipment; 5% balance on startup
1 year manufacturer warranty on equipment (terms and conditions to be provided)
Pricing valid for 30 days
Sales / use tax not included

AD-74 Technical Information

Description of the Product

AD-74 is a granular activated alumina designed for removal of fluoride from water. It is available in several sizes although tests have shown the 14 x 28 mesh size to be most suitable. Conditioning of the material with dilute aluminum sulfate prior to use greatly enhances performance.

Background

Fluoride containing effluents which are treated with lime still contain about 8 ppm of fluoride. This level is not acceptable to most pollution boards and further treatment is required. Moreover some natural waters contain too much fluoride for drinking purposes and also many people wish to remove the municipality-added fluoride from their water. Activated alumina is known to adsorb fluoride efficiently at these low levels and Adedge is offering a superior product with good adsorption capacity and long life.

Advantages

Easy to Condition: the adsorbent needs only to be contacted for 1 h with 29 g/L aluminum sulfate ($AL_2(SO_4)_3 \cdot 18H_2O$) solution and is ready for use.

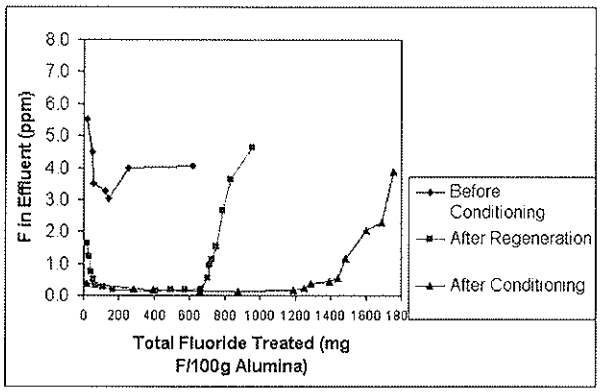
Easy to Use: the feed solution is simply pumped through the bed, to yield an effluent containing less than 1 ppm fluoride.

Highly Adsorbent: AD-74 is able to adsorb as much as 1.4 g fluoride per 100 g alumina. For example, a 10 kg unit will keep a stream containing 8 ppm F with 120L/h flow rate virtually free of F for 6 days without risking fluoride break-through.

Easy to Regenerate: Once saturated, the alumina bed can be regenerated by following three simple steps:

- Neutralization with 1% NaOH
- Rinse with H_2O
- Reactivation with 0.05 N H_2SO_4

Economical: Because of its high adsorption capacity, a unit will be operative for a longer time before change out. This means savings on handling costs too.



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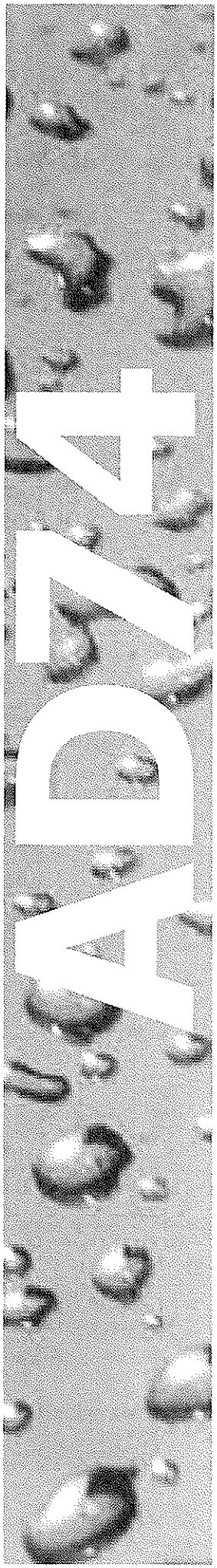

AD-74 Media Technical Specifications

AD-74 Media from Adedge Technologies, Inc. is a synthetic granular aluminum oxide material for specialty water treatment applications. AD-74 Media shows particular adsorptive affinity for fluoride, arsenic (V) and heavy metals. The AD-74 Media has been designed with particle size distribution and surface area which make it ideal for incorporation into new filter materials.

Physical Properties	**AD-74 Media**
Matrix	Activated Alumina
Physical Form	Flowable, dry, granular
CAS #	1344-28-1
Color	White
Particle Size Distribution	28x48 or 14x28 mesh options
Mean Particle Size	(0.6 x 0.3 mm) or (1.7 mm x 0.5) typical range
Moisture Content	< 5% by wt.
Density	45 lb/ft^3 at 20° C
Specific Surface Area	Min. 250-350 m^2/g
Packaged	Dry, drums or supersacks
Typical Analysis Results	
FeOOH	0.02%
H2O	5.0%
SiO2	0.02%
Na2O	0.35%
Al2O3	94.0%
TiO2	0.002%

adedge technologies, inc., 5152 Belle Wood Court, Suite A, Buford, GA 30518
Toll Free: (866) 8ADEDGE Toll Free Fax: (866) 823-3243
www.adedgetechnologies.com info@adedgetechnologies.com

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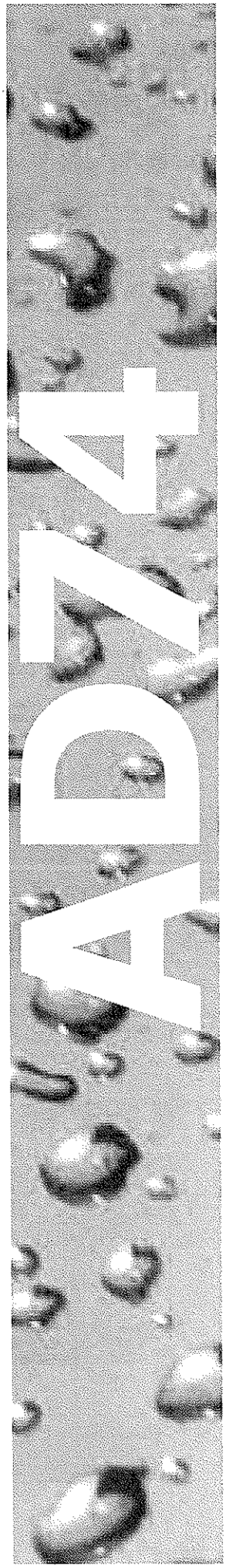

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NSF/ANSI STANDARD 61
Drinking Water System Components - Health Effects

NOTE: Unless otherwise indicated for Materials, Certification is only for the Water Contact Material shown in the Listing. Click here for a list of Abbreviations used in these Listings.

ALCAN INC.
1188 SHERBROOKE STREET WEST
MONTREAL, QUÉBEC H3A 3G2
CANADA
514-848-8000

Facility : BROCKVILLE, ONTARIO, CANADA

Process Media

Trade Designation	Size	Water Contact Temp	Water Contact Material
Activated Alumina			
Activated Alumina AA-400G	14 x 28 mesh	CLD 23	AL2O3
Activated Alumina AA-400G	28 x 48 mesh	CLD 23	AL2O3
Activated Alumina AAFS-50	14 x 28 mesh	CLD 23	AL2O3
Activated Alumina AAFS-50	28 x 48 mesh	CLD 23	AL2O3

NOTE: Certified for water treatment plant applications.
This product has not been evaluated for point of use applications.

Number of matching Manufacturers is 1
Number of matching Products is 4
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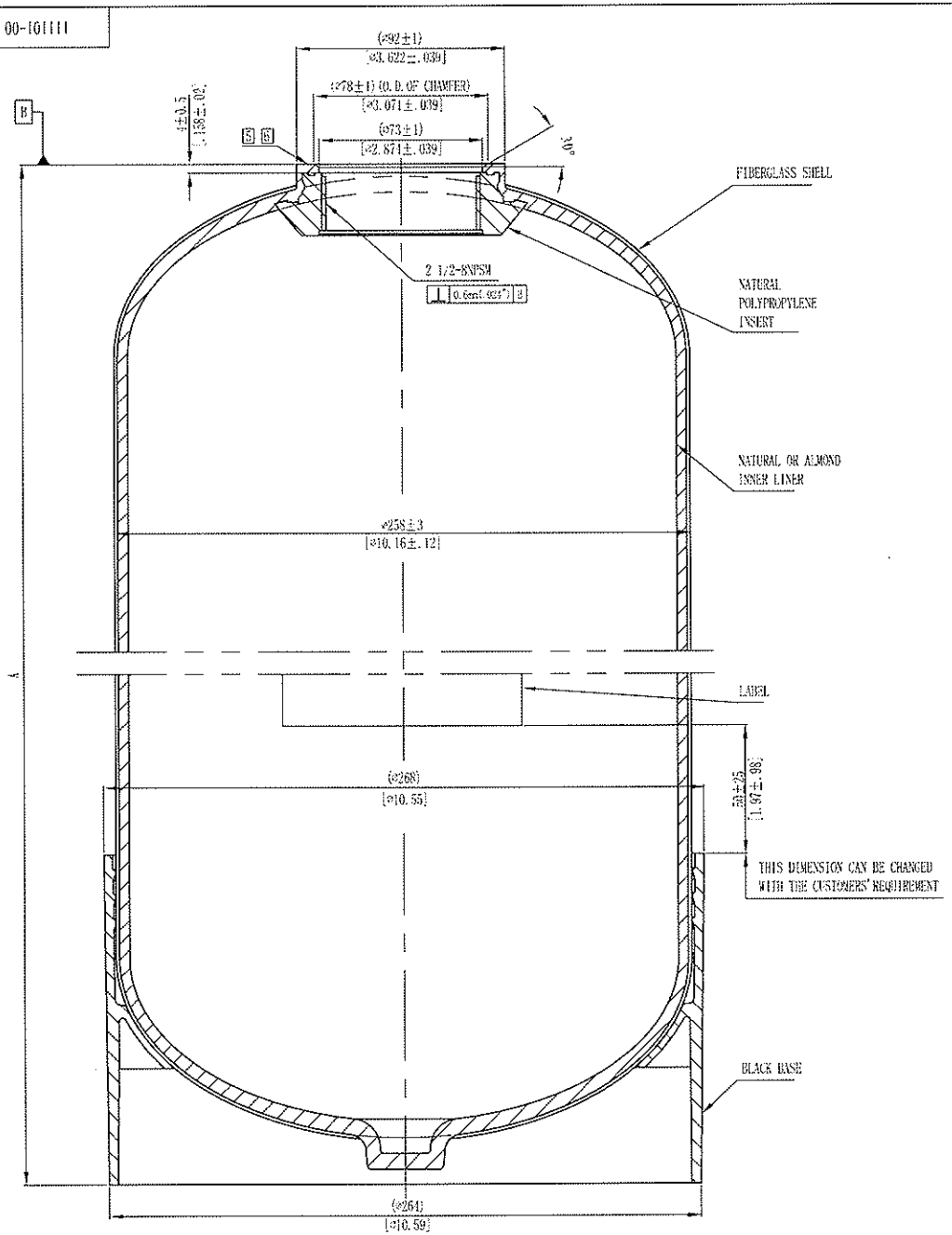

MODEL	A		+/-		VOLUME			DOME VOLUME			WEIGHT	
	mm	inch	mm	inch	Liters	U.S.GAL.	CUBIC FT	Liters	U.S.GAL.	CUBIC FT	Kg	LBS
10x17	436	17.17	4	.16	16.8	4.44	0.59	2.29	0.60	0.08	3.0	6.61
10x35	897	35.31	4	.16	38.4	10.15	1.36	2.29	0.60	0.08	5.1	11.23
10x44	1126	44.33	5	.20	50.1	13.24	1.77	2.29	0.60	0.08	6.55	14.43
10x54	1386	54.57	5	.20	62.4	16.49	2.20	2.29	0.60	0.08	7.90	17.38
10x16	403	15.87	4	.16	15.6	4.12	0.55	2.29	0.60	0.08	2.91	6.41
10x18	461	18.15	4	.16	18.0	4.76	0.64	2.29	0.60	0.08	3.17	6.98
10x19	487	19.17	4	.16	19.2	5.07	0.68	2.29	0.60	0.08	3.30	7.27
10x30	766	30.16	4	.16	32.4	8.56	1.14	2.29	0.60	0.08	4.49	9.89
10x40	1020	40.16	5	.20	44.9	11.86	1.59	2.29	0.60	0.08	5.86	12.91
10x17	1188	46.77	5	.20	54.0	14.27	1.91	2.29	0.60	0.08	6.95	15.31
10x13	345	13.58	4	.16	12.2	3.22	0.43	2.29	0.60	0.08	2.62	5.76
10x22	559	22.01	4	.16	22.9	6.05	0.81	2.29	0.60	0.08	3.66	8.05
10x24	605	23.82	4	.16	25.1	6.63	0.89	2.29	0.60	0.08	3.89	8.56

NOTES:

1. TANK MUST MEET ALL APPLICABLE SPECIFICATIONS OF NSF/ANSI 044 STANDARD, LATEST REVISION.
2. OPERATING SPECIFICATIONS:
   - A. MAXIMUM WORKING PRESSURE - 150 PSI(10.5BAR)
   - B. TEMPERATURE RANGE - 34-120° F(1-49°C)
   - C. MAXIMUM VACUUM - 5"Hg(127mm Hg)
3. VISUAL LINER INSPECTION
   - A. NO MORE THAN 10 INTERNAL OR EXTERNAL BLEMISHES OR BURNT DEBRIS.
   - B. NO INTERNAL OR EXTERNAL BLEMISHES OR BURNT DEBRIS LARGER THAN 3×3mm.
   - C. NO INTERNAL BLEMISHES OR BURNT DEBRIS ALLOWED.
4. ALL GLASS STRANDS FROM FIBERGLASS LINER TO BE BONDED AND COVERED.

[5]. SURFACE TO BE FREE OF NICKS, SCRATCHES, RESIN AND GLASS.

[6]. SURFACE FINISH.

7. DIMENSIONS IN PARENTHESIS ARE REFERENCE ONLY.
8. DIMENSIONS IN SQUARE PARENTHESIS ARE INCH UNIT.

5	THIS DRAWING IS UPDATED ACCORDING WITH THE CHINESE VERSION		2008/6/12
VERSION NO.	DESCRIPTION OF CHANGES:	SIGNATURE	DATE

DIFFERENTIAL PLASTIC SHRINKAGE (IF NECESSARY):

SIGNATURE	NAME	DATE
DESIGN		
INSPECTION		
APPROVAL		

WAVE CYBER (SHANGHAI) CO., LTD.

SCALE: 1 : 2	MATERIAL:	MODEL:
QUANTITY:	SMOOTHNESS:	DESCRIPTION: 10"FRP PRESSURE VESSEL
PROJECTION:	COMPUTER CODE:	DRAWING NO.: 111101-00 / VERSION NO.: 5
DO NOT MEASURE THE DIMENSIONS.	UNIT: MM	TOTAL PAGE: 1

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http://nsf.org/Certified/DWTU/Listings.asp?Standard=044&Company=0T640&

Note: Certain claims, such as Arsenic (Pentavalent) Reduction, appear as active links, allowing you to access additional information regarding the specific contaminants.

NSF/ANSI STANDARD 044
Cation Exchange Water Softeners

Wave Cyber (Shanghai) Co., Ltd.

No. 218 Songhai Road
Songze Industries Zone
Shanghai New City, Shanghai 201703
China
86 21 6975 8588
Visit this company's website

Facility : Shanghai, China

COMPONENTS: Tanks, Water Softener[1] [2] [Pb]
6x10, 2.5" Inlet
6x12, 2.5" Inlet
6x13, 2.5" Inlet
6x17, 2.5" Inlet
6x18, 2.5" Inlet
6x29, 2.5" Inlet
6x35, 2.5" Inlet
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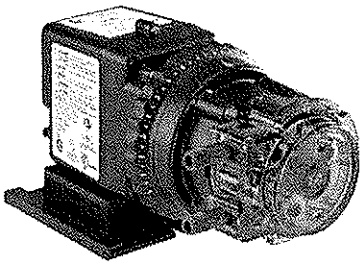
14x52, 4" Inlet
14x52, 4" x 2.5" Inlet
14x52, 4" x 4" Inlet

CLASSIC 45 PUMP SERIES SPECIFICATIONS

STENNER PUMPS

SINGLE HEAD ADJUSTABLE OUTPUT

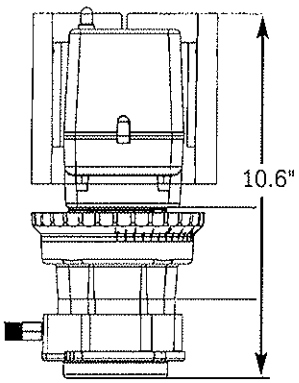


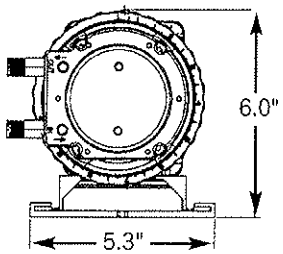
100 psi (6.9 bar) MODELS

- 45MHP2
- 45MHP10
- 45MHP22

25 psi (1.7 bar) MODELS

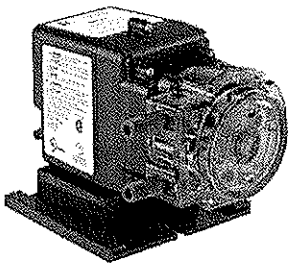
- 45M1
- 45M2
- 45M3
- 45M4
- 45M5





SHIPPING WEIGHT 9 lbs (4 kg)

SINGLE HEAD FIXED OUTPUT

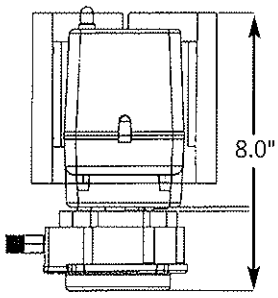


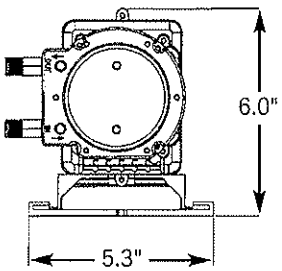
100 psi (6.9 bar) MODELS

- 45MPHP2
- 45MPHP10
- 45MPHP22

25 psi (1.7 bar) MODELS

- 45MP1
- 45MP2
- 45MP3
- 45MP4
- 45MP5





SHIPPING WEIGHT 8 lbs (3.6 kg)

METERING PUMP
UL LISTED
96F8

METERING PUMP
LR79585
C SA® US

CE IPX4

Intertek
94247
CONFORMS TO
STD. NSF-50
CIRCULATION SYSTEM
COMPONENTS FOR SWIMMING
POOLS, SPAS, OR HOT TUBS

THIS PRODUCT IS TESTED AND CERTIFIED BY WATER QUALITY ASSOCIATION ACCORDING TO NSF/ANSI 61 AND WQA ORDB902 FOR LOW LEAD COMPLIANCE

Product listings vary by model. Contact factory for details.

FEATURES

- 3-point roller design assists in anti-siphon protection
- Pump head requires no valves, allows for easy maintenance
- Self-priming against maximum working pressure, foot valve not required
- Pump does not lose prime or vapor lock
- Pumps off-gassing solutions and can run dry
- Output volume is not affected by back pressure
- Injection check valve included with models rated up to 100 psi (6.9 bar)
- Easy to change pump tube; lubrication is not required
- Pump tubes and pump heads interchange between models
- Models tested by Water Quality Association to conform to ANSI/NSF STD 61 (Santoprene® only)
- Adjustable models tested by ETL to conform to ANSI/NSF STD 50
- All pump accessories included allow a fast and easy installation

STENNER

Stenner Pump Company
3174 DeSalvo Road
Jacksonville, Florida 32246 USA

Phone 904.641.1666
US Toll Free 800.683.2378
Fax 904.642.1012

www.stenner.com
sales@stenner.com

CLASSIC 45 PUMP SERIES SPECIFICATIONS

STENNER PUMPS

OUTPUT CONTROL
Adjustable models only, external dial ring adjustment from 5%-100% in 2.5% increments

MAXIMUM WORKING PRESSURE
100 psi (6.9 bar) 45MHP2, 45MHP10, 45MHP22, 45MPHP2, 45MPHP10, 45MPHP22
25 psi (1.7 bar) 45M1, 45M2, 45M3, 45M4, 45M5, 45MP1,45MP2, 45MP3, 45MP4, 45MP5

MAXIMUM OPERATING TEMPERATURE
125° F (52° C)

MAXIMUM SUCTION LIFT
25 ft (7.6 m) vertical lift, based on water

MOTOR TYPE
1/30 HP, shaded pole, class B

APPROXIMATE GEAR MOTOR RPM
26

DUTY CYCLE
Continuous

MOTOR VOLTAGE (AMP DRAW)
120V 60Hz 1PH (1.7)
220V 60Hz 1PH (0.9)
230V 50Hz 1PH (0.9) *International*
250V 50Hz 1PH (0.9) *International*

POWER CORD TYPE
SJTOW

POWER CORD PLUG END
120V 60Hz NEMA 5/15
220V 60Hz NEMA 6/15
230V 50Hz CEE 7/VII
250V 50Hz CEE 7/VII

MATERIALS OF CONSTRUCTION
All Housings Polycarbonate
Pump Tube & Check Valve Duckbill Santoprene*, optional Tygothane** #2, #5 tubes, FDA approved
CV Duckbill with Tygothane Tube** Pellathane*†
Pump Head Rollers HDPE
Roller Bushings Oil impregnated sintered bronze
Suction/Discharge Tubing, Ferrules 1/4" & 6 mm LDPE polyethylene, NSF and FDA approved
Tube Fittings, Check Valve Fittings
Gray fittings: Type 1 Rigid PVC , NSF listed
Black fittings: PP, NSF listed
Connecting Nuts PP or Type 1 Rigid PVC
Suction Strainer PP or Type 1 Rigid PVC body with Type 1 Rigid PVC cap, NSF listed; ceramic weight
All Fasteners Stainless steel

ACCESSORY KIT SHIPPED WITH EACH PUMP
3 connecting nuts 1/4" or 3/8"
3 ferrules 1/4" or 6 mm *Europe*
OR 2 ferrules 3/8"
1 injection check valve 100 psi (6.9 bar)
OR 1 injection fitting 25 psi (1.7 bar)
1 weighted suction line strainer 1/4", 3/8" or 6 mm *Europe*
1 20' roll suction/discharge tubing 1/4" or 3/8", white or UV black
OR 6 mm white *Europe*
1 additional pump tube
1 mounting bracket
1 manual

* Santoprene® is a registered trademark of Exxon Mobil Corporation.
** Tygothane® is a registered trademark of Saint-Gobain Performance Plastics.
† Pellathane® is a registered trademark of The Dow Company.

45 SERIES PUMP ADJUSTABLE OUTPUT

			Approximate Output @ 60Hz						Approximate Output @ 50Hz		
Single Head Model	Maximum Pressure	Pump Tube Number	Gallons per Day	Liters per Day	Gallons per Hour	Liters per Hour	Ounces per Minute	Milliliters per Minute	Liters per Day	Liters per Hour	Milliliters per Minute
45MHP2* 45M1	100 psi (6.9 bar) 25 psi (1.7 bar)	#1 #1	0.2 to 3.0	0.8 to 11.4	0.01 to 0.13	0.03 to 0.48	0.02 to 0.27	0.56 to 7.92	0.6 to 9.1	0.03 to 0.38	0.31 to 6.32
45MHP10* 45M2	100 psi (6.9 bar) 25 psi (1.7 bar)	#2 #2	0.5 to 10.0	1.9 to 37.9	0.02 to 0.42	0.08 to 1.58	0.04 to 0.89	1.32 to 26.32	1.5 to 30.3	0.06 to 1.26	1.04 to 21.04
45MHP22* 45M3	100 psi (6.9 bar) 25 psi (1.7 bar)	#7 #3	1.1 to 22.0	4.2 to 83.3	0.05 to 0.92	0.18 to 3.47	0.10 to 1.96	2.92 to 57.85	3.3 to 66.6	0.14 to 2.78	2.29 to 46.25
45M4	25 psi (1.7 bar)	#4	1.7 to 35.0	6.4 to 132.5	0.07 to 1.46	0.27 to 5.52	0.15 to 3.11	4.44 to 92.01	5.1 to 106.0	0.21 to 4.42	3.54 to 73.61
45M5	25 psi (1.7 bar)	#5	2.5 to 50.0	9.5 to 189.3	0.10 to 2.08	0.40 to 7.89	0.22 to 4.44	6.60 to 131.43	7.6 to 151.4	0.32 to 6.31	5.28 to 105.14

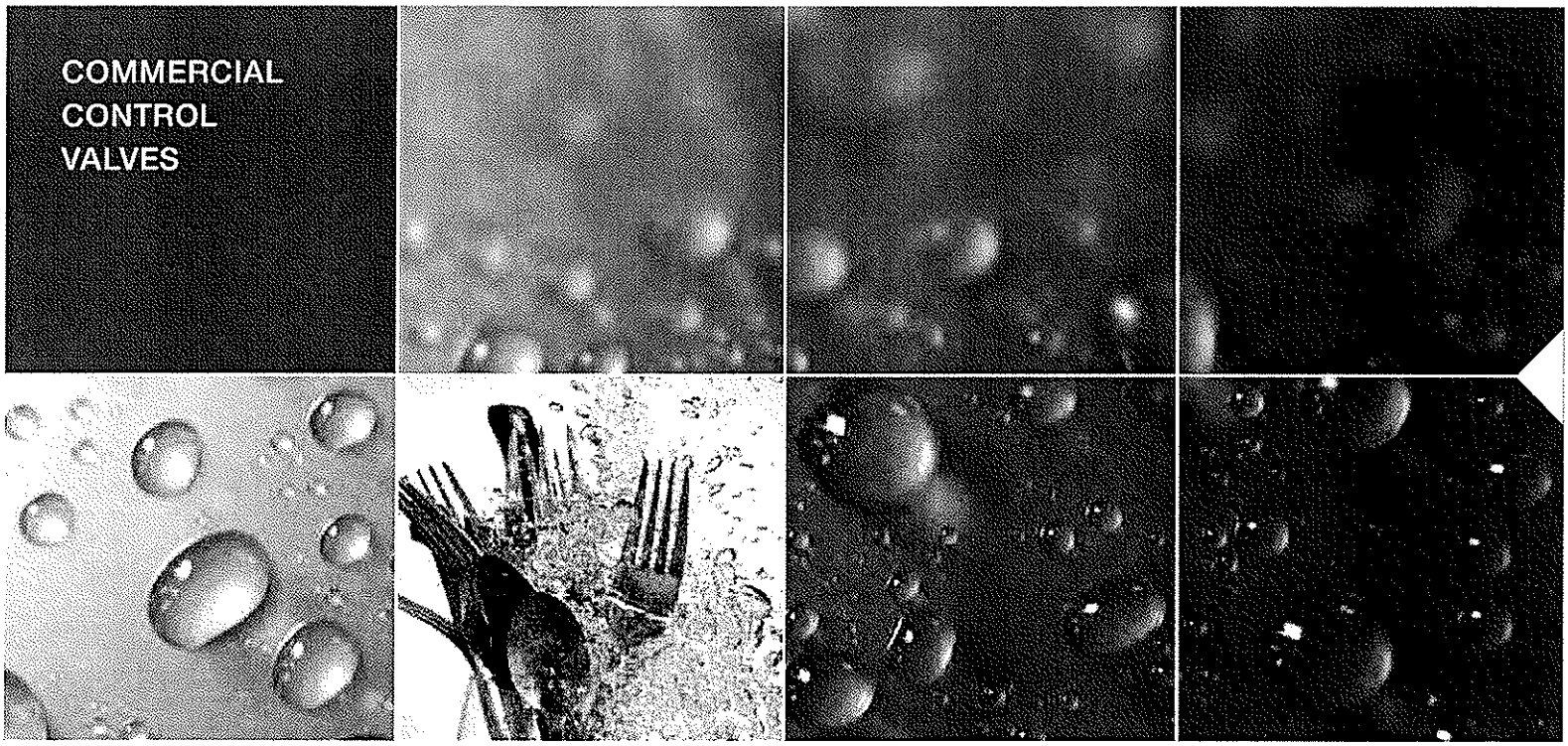
45 SERIES PUMP FIXED OUTPUT

			Approximate Output @ 60Hz						Approximate Output @ 50Hz		
Single Head Model	Maximum Pressure	Pump Tube Number	Gallons per Day	Liters per Day	Gallons per Hour	Liters per Hour	Ounces per Minute	Milliliters per Minute	Liters per Day	Liters per Hour	Milliliters per Minute
45MPHP2* 45MP1	100 psi (6.9 bar) 25 psi (1.7 bar)	#1 #1	3.0	11.4	0.13	0.48	0.27	7.92	9.1	0.38	6.32
45MPHP10* 45MP2	100 psi (6.9 bar) 25 psi (1.7 bar)	#2 #2	10.0	37.9	0.42	1.58	0.89	26.32	30.3	1.26	21.04
45MPHP22* 45MP3	100 psi (6.9 bar) 25 psi (1.7 bar)	#7 #3	22.0	83.3	0.92	3.47	1.96	57.85	66.6	2.78	46.25
45MP4	25 psi (1.7 bar)	#4	35.0	132.5	1.46	5.52	3.11	92.01	106.0	4.42	73.61
45MP5	25 psi (1.7 bar)	#5	50.0	189.3	2.08	7.89	4.44	131.43	151.4	6.31	105.14

*Injection check valve included with pumps rated 26-100 psi (1.8-6.9 bar).

NOTICE: The information within this chart is solely intended for use as a guide. The output data is an approximation based on pumping water under a controlled testing environment. Many variables can affect the output of the pump. Stenner Pump Company recommends that all metering pumps undergo field calibration by means of analytical testing to confirm their outputs. The information contained in this flyer is not intended for specific application purposes. Stenner Pump Company reserves the right to make changes to prices, products, and specifications at any time without prior notice.

COMMERCIAL
CONTROL
VALVES



Performa™ Cv Control Valves

273 and 278 Configurations

Pentair Water® offers a full range of Autotrol® Control Valves to meet a wide range of water conditioning applications.

Logix™ Series

742 Time Clock

- Simple, economic electronic time clock (chronometric)
- 7- or 99-day regeneration setting
- 12-volt operation
- Filter or conditioner setting in one control
- Fully programmable cycle times
- Salt setting in 1-pound increments
- Operates 255, 263, 268, 273, 278, and Magnum® IT with one controller

762 Demand

- Simple, economic electronic demand (volumetric)
- Calendar override
- 12-volt operation
- 28-day variable reserve
- Automatic capacity calculations
- Fully programmable cycle times
- Salt setting in 1-pound increments
- Operates 255, 263, 268, 273, 278, and Magnum IT with one controller

764 Demand

Same features as the 762, plus:

- Multi-tank applications (twin alternating, multi-tank parallel)
- Control lockout
- Remote regeneration

Autotrol
Pentair Water

COMMERCIAL
CONTROL
VALVES

Performa™ Cv Control Valves

273 and 278 Configurations

Specifications

Electrical

Controller Operating Voltage	12 Volt – AC (Requires use of Pentair Water®-supplied transformer)
Input Supply Frequency	50 or 60 Hz (Controller configuration dependent)
Motor Input Voltage	12 Volt – AC
Controller System Power Consumption	3 Watts average

Transformer – All Controllers

All Controllers require the use of a Pentair Water-supplied transformer.

Transformer Output Voltage	12 Volt – AC 400mA	
Transformer Input Options	115 Volt – AC 50/60 Hz; 230 Volt – AC 50/60 Hz; 100 Volt – AC 50/60 Hz	
Transformer Plug Options	Indoor North American Plug	Taiwan/Korea Plug
	Outdoor North American (UL Listed for outdoor use)	Australian Plug
		United Kingdom Plug
	Japanese Plug	Mainland Europe Plug

Additional transformers may be available – call for more information.

Design Specifications/Ratings

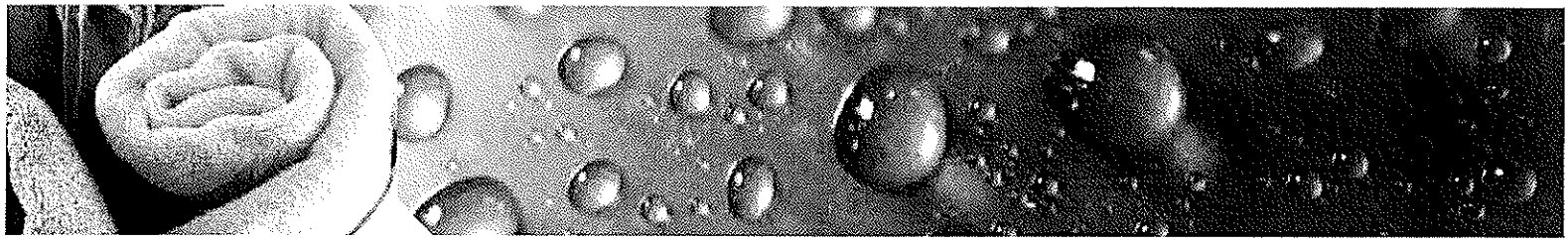
Valve Body	Glass-filled thermoplastic – NSF Listed material
Rubber Components	Compounded for cold water – NSF Listed material
Valve Materials Certification	WQA Gold Seal Certified to ORD0902 and NSF/ANSI 44 Rated component for material safety
Weight (Valve with Control)	5.34 lbs (2.42 kg)
Recommended Operating Pressure Canada	20 - 120 psi (1.38 - 8.27 bar) 20 - 100 psi (1.38 - 6.89 bar)
Hydrostatic Test Pressure	300 psi (20.69 bar)
Water Temperature	35° - 100°F (2° - 38°C)
Ambient Temperature*	35° - 120°F (2° - 48.9°C)

*Recommend use of outdoor cover for direct sunlight applications.

Options

Turbine for Demand Systems	Internal Standard Autotrol® 1-inch (25 mm) turbine
Bypass Valve, Model 1265	Thermoplastic, 1-inch flow path
Bypass Fitting Kits:	
Copper, Sweat Tube Adapter	1-1/4-inches, 1-inch or 3/4 inch (32 mm, 25 mm or 19 mm)
CPVC, Solvent Weld Tube Adapter	1-inch or 3/4-inch (25 mm or 19 mm)
Plastic NPT or BSPT Pipe Adapter	1-inch male or 3/4-inch male (25 mm or 19 mm)
Stainless Steel NPT or BSPT Pipe Adapter	1-inch male or 3/4-inch male (25 mm or 19 mm)
Brine Refill Controls	.33 gpm (1.25 lpm) fixed; .74 gpm (2.8 lpm) fixed; 1.3 gpm (4.92 lpm) fixed
Compatible with Regenerants/Chemicals	Sodium chloride, potassium chloride, potassium permanganate, sodium bisulfite†, sodium hydroxide†, hydrochloric acid†, chlorine†† and chloramines††

†See owners manual for specific concentrations. ††Valve for use on potable water supply.

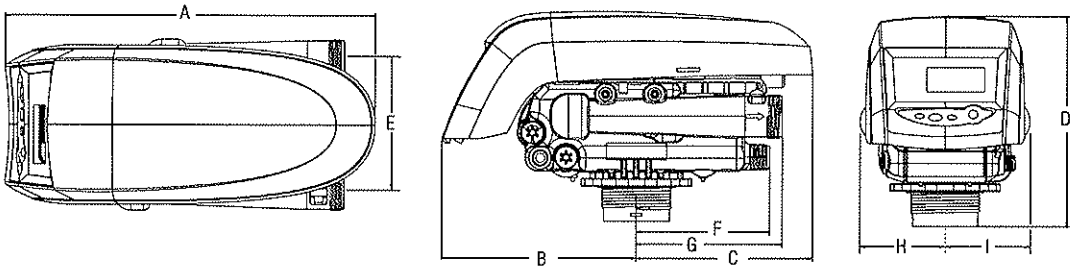


Dimensions

Valve Connections

Tank Thread	2-1/2-inches – 8, male
Inlet/Outlet Threads	1-3/4-inches – 12 UNC-2A male
Drain Line	3/4-inch NPT, male
Brine Line	3/8-inch NPT, male
Distributor Tube Diameter	1.050 inches (27 mm)
Distributor Tube Length	1/2 ± 1/2-inches (13 ± 13 mm) above top of tank

Outline Dimensions



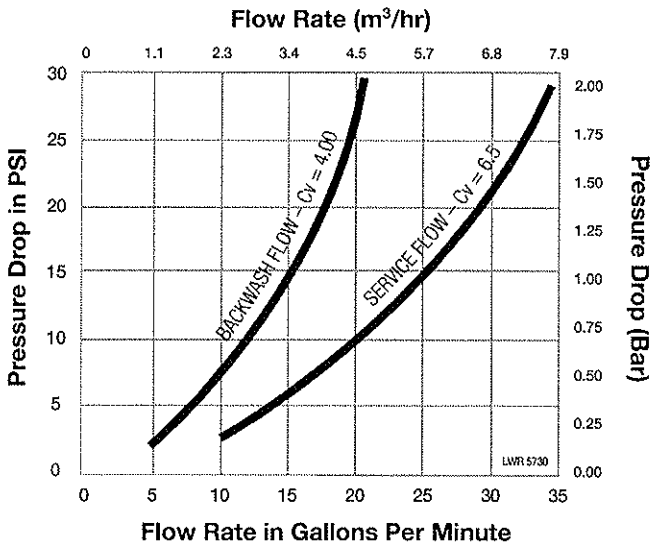
Units	A	B	C	D	E	F	G	H	I
inches	14.9	7.8	7.1	8.5	5.0	5.3	5.8	3.4	3.4
cm	37.8	19.9	17.9	21.5	12.7	13.5	14.8	8.7	8.7

Performance

Flow Rates (Valve Only)

Service @ 15 psi (1.03 bar) drop	25.0 gpm (5.7 m^3/h)
Backwash @ 25 psi (1.72 bar) drop	20.0 gpm (4.5 m^3/h)
Service	Cv = 6.50 (Kv = 5.6)
Backwash	Cv = 4.00 (Kv = 3.5)

Logix™ Series Controller Flow Rate Characteristics



Backwash Flow Control Table

Backwash Number*	Flow Rate (gpm)	Flow Rate (lpm)
9	2.2	8.3
10	2.7	10.2
12	3.9	14.76
13	4.5	17.0
14	5.3	20.0

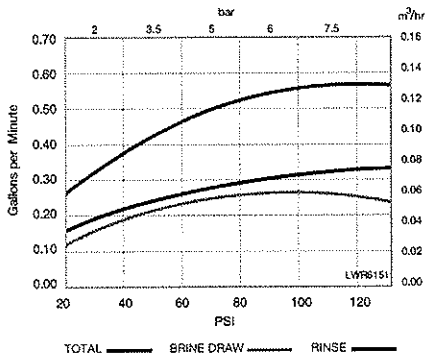
*Backwash flow controls sized for 5.0 gpm/ft^2.

NOTE: External drain line flow controls available for flow rates from 1.3 gpm (4.9 lpm) to 20 gpm (75.7 lpm).

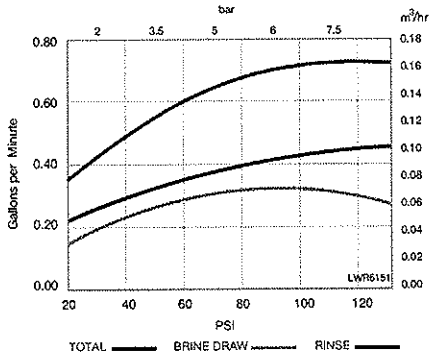
Injector* Performance

Logix™ Series Controllers

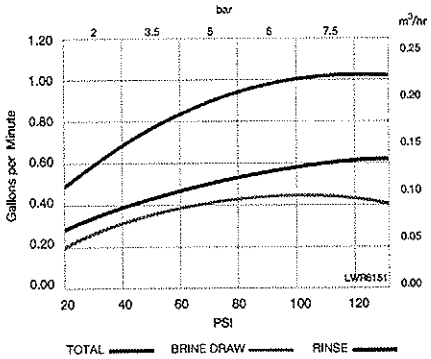
Injector "H" (Light Purple)
For 9-inch Tanks



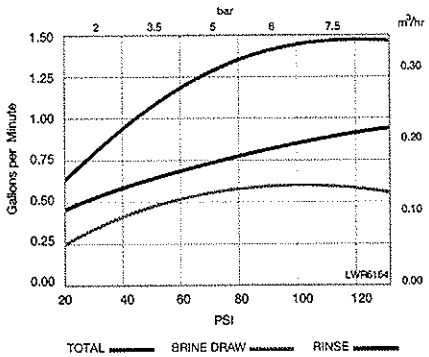
Injector "J" (Light Blue)
For 10-inch Tanks



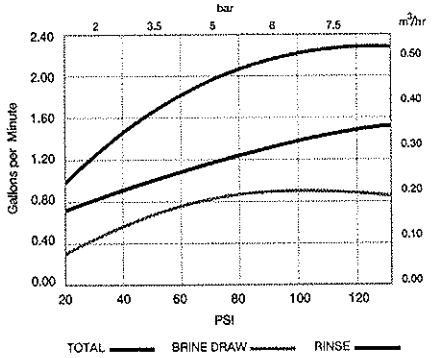
Injector "K" (Pink)
For 12-inch Tanks



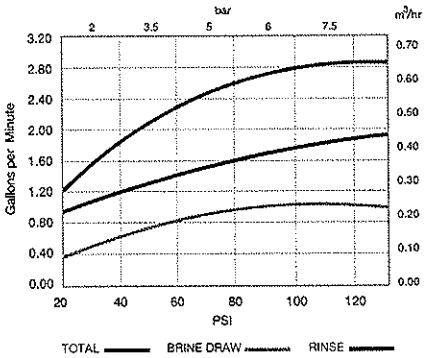
Injector "L" (Orange)
For 13- and 14-inch Tanks



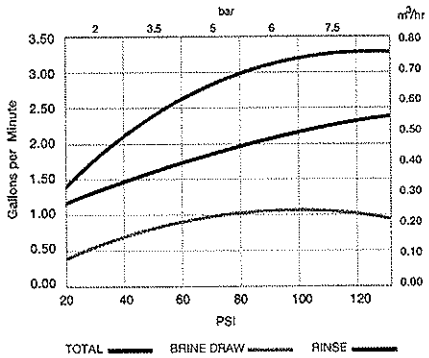
Injector "N" (Green)
For 16-inch Tanks



Injector "Q" (Purple)
For 18-inch Tanks



Injector "R" (Dark Grey)
For 21-inch Tanks



*New injectors for high-efficiency regeneration sequence are standard with Logix Controllers.

NOTE: Actual injector performance is dependent on the resin used, tank geometry, elevated drain, etc. This injector data was taken using an empty tank (no resin).

Pentair Water

20580 Enterprise Avenue
Brookfield, WI 53045
Tel: 262.784.4490
Fax: 262.784.7794

5730 North Glen Park Road
Milwaukee, WI 53209
Tel: 262.238.4400
Fax: 262.238.4402

Customer Care: 800.279.9404 www.pentairaquapro.com

4000570 Rev A AP10

Sierra Chemical Co.

Material Safety Data Sheet

This MSDS has been prepared within the guidelines of the Federal OSHA Hazard Communication Standard, 29CFR 1910.1200.

Product Name: Caustic Soda Solution 50%, Commercial Grade

I. GENERAL INFORMATION

Manufacturer: Sierra Chemical Co.
Address: 2302 Larkin Cr.
Sparks, NV 89431

Emergency Phone: (800) 424-9300
Information Phone: (775) 358-0888
CHEMTREC Phone: (800) 424-9300

Issue Date: 03/23/2010

II. HAZARDS IDENTIFICATION

Color: Colorless

Physical State: Liquid above freezing point

Odor: Odorless

Hazards of Product: DANGER! Causes severe eye burns. Causes severe skin burns. Causes burns of the mouth and throat. Causes respiratory tract irritation. Aspiration hazard. Can enter lungs and cause damage. May react with water. Evacuate area. Keep upwind of spill

OSHA Hazard Communication Standard: This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200

III. COMPOSITION INFORMATION

Componet	CAS#	Amount
Water	7732-18-5	49 – 51%
Sodium Hydroxide	1310-73-2	51 – 49%

IV. POTENTIAL HEALTH AFFECTS

Eye Contact: May cause severe irritation with corneal injury which may result in permanent impairment of vision, even blindness. Chemical burns may occur. Mist may cause eye irritation.

Skin Contact: Brief contact may cause severe skin burns. Symptoms may include pain, severe local redness and tissue damage.

Skin Absorption: Prolonged skin contact is unlikely to result in absorption of harmful amounts.

Inhalation: Mist may cause severe irritation of upper respiratory tract (nose and throat).

Ingestion: Swallowing may result in burns of the mouth and throat. Swallowing may result in

gastrointestinal irritation or ulceration.

Aspiration hazard: Aspiration into the lungs may occur during ingestion or vomiting, causing tissue damage or lung injury.

V. FIRST AID MEASURES

Eye Contact: Wash eyes immediately and continuously with water for 30 minutes. Remove contact lenses after the first 5 minutes and continue washing. Seek medical attention immediately, preferably from an ophthalmologist. Wash eyes in route if possible. Washing with water is the only acceptable method of removal of caustic soda (lye) from the eyes and skin. You may have 10 seconds or less to avoid serious permanent injury.

Skin Contact: Immediate continued and thorough washing in flowing water for at least 30 minutes is imperative while removing contaminated clothing. Prompt medical consultation is essential. Wash clothing before reuse. Properly dispose of leather items such as shoes, belts, and watchbands. Remove chemical goggles last to keep material from washing into the eyes. First Aid responders should pay attention to self-protection and use the recommended protective clothing (chemical resistant gloves, splash protection).

Inhalation: Move person to fresh air. If not breathing, give artificial respiration; if by mouth to mouth use rescuer protection (pocket mask, etc). If breathing is difficult, oxygen should be administered by qualified personnel. Call a physician or transport to a medical facility.

Ingestion: Do not induce vomiting. Give one cup (8 ounces or 240 ml) of water or milk if available and transport to a medical facility. Do not give anything by mouth unless the person is fully conscious.

Notes to Physician: Material is a strong alkali. First Aid responders should pay attention to self-protection and use the recommended protective clothing (chemical resistant gloves, splash protection). Due to irritant properties, swallowing may result in burns/ulceration of mouth, stomach and lower gastrointestinal tract with subsequent stricture. Aspiration of vomitus may cause lung injury. Suggest endotracheal/esophageal control if lavage is done. Eye irrigation may be necessary for an extended period of time to remove as much caustic as possible. Duration of irrigation and treatment is at the discretion of medical personnel. Maintain adequate ventilation and oxygenation of the patient. For burns of skin only. If burn is present, treat as any thermal burn, after decontamination. No specific antidote. Treatment of exposure should be directed at the control of symptoms and the clinical condition of the patient.

VI. FIRE FIGHTING MEASURES

Extinguishing Media: This material does not burn. If exposed to fire from another source, use suitable extinguishing agent for that fire. Do not use water.

Fire Fighting Procedures: Keep people away. Isolate fire and deny unnecessary entry. Water is not recommended, but may be applied in large quantities as a fine spray when other extinguishing agents are not available. This material does not burn. Fight fire for other material that is burning.

Special Protective Equipment for Firefighters: Wear positive-pressure self-contained breathing apparatus (SCBA) and protective fire fighting clothing (includes fire fighting helmet, coat, trousers, boots, and gloves). Avoid contact with this material during fire fighting operations. If contact is likely, change to full chemical resistant fire fighting clothing with self-contained breathing apparatus. If this is not available,

wear full chemical resistant clothing with self-contained breathing apparatus and fight fire from a remote location. For protective equipment in post-fire or non-fire clean-up situations, refer to the relevant sections.

Unusual Fire and Explosion Hazards: Product reacts with water. Reaction may produce heat and/or gases. This reaction may be violent. Violent steam generation or eruption may occur upon application of direct water stream to hot liquids.

Hazardous Combustion Products: Not applicable

VII. ACCIDENTAL RELEASE MEASURES

Steps to be taken if material is released or spilled: Contain spilled material if possible.

Small spills: Dilute with water.

Large spills: Dike area to contain spill. Collect in suitable and properly labeled containers. Attempt to neutralize by adding materials such as Acetic acid. See Section XIV, Disposal Considerations, for additional information.

Personal Precautions: Evacuate area. Only trained and properly protected personnel must be involved in clean-up operations. Refer to Section VIII, Handling, for additional precautionary measures. Keep upwind of spill. Ventilate area of leak or spill. See Section XI for more specific information. Use appropriate safety equipment. For additional information, refer to Section IX, Exposure Controls and Personal Protection.

Environmental Precautions: Prevent from entering into soil, ditches, sewers, waterways and/or groundwater. See Section XIII, Ecological Information.

VIII. HANDLING AND STORAGE

General Handling: Do not get in eyes. Do not get on skin or clothing. Do not swallow. Avoid breathing mist. Keep container closed. Use with adequate ventilation. Wash thoroughly after handling.

1. ALWAYS add caustic soda solution to water with constant agitation. NEVER add water to the caustic soda solution.

2. The water should be lukewarm (27-38°C or 80-100°F). NEVER start with hot or cold water. The addition of caustic soda to liquid will cause a rise in temperature. If caustic soda becomes concentrated in one area, is added too rapidly, or is added to hot or cold liquid, a rapid temperature increase can result in DANGEROUS mists, boiling or spattering which may cause an immediate VIOLENT ERUPTION. See Section IX, EXPOSURE CONTROLS AND PERSONAL PROTECTION.

Storage: Keep container closed.

Do not store in: Zinc. Aluminum. Brass. Tin. See Section XI for more specific information.

Storage temperature: > 16 °C

Shelf life: Use within 24 Months

IX. EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure Limits

Component	List	Type	Value
Sodium Hydroxide	ACGIH	Ceiling	2mg/m3
	OSHA Table Z - 1	PEL	2mg/m3

Personal Protection

Eye/Face Protection: Use chemical goggles. Eye wash and drench shower should be located in immediate work area.

Skin Protection: Use protective clothing chemically resistant to this material. Selection of specific items such as face shield, boots, apron, or full body suit will depend on the task. Safety shower should be located in immediate work area. Remove contaminated clothing immediately, wash skin area with soap and water, and launder clothing before reuse or dispose of properly. Items which cannot be decontaminated, such as shoes, belts and watchbands, should be removed and disposed of properly.

Hand protection: Use gloves chemically resistant to this material. Examples of preferred glove barrier materials include Polyethylene. Neoprene. Natural rubber ("latex"). Polyvinyl chloride ("PVC" or "vinyl"). Nitrile/butadiene rubber ("nitrile" or "NBR"). Ethyl vinyl alcohol laminate ("EVAL"). Avoid gloves made of: Polyvinyl alcohol ("PVA"). NOTICE: The selection of a specific glove for a particular application and duration of use in a workplace should also take into account all relevant workplace factors such as, but not limited to other chemicals which may be handled, physical requirements (cut/puncture protection, dexterity, thermal protection), potential body reactions to glove materials, as well as the instructions/specifications provided by the glove supplier.

Respiratory Protection: Respiratory protection should be worn when there is a potential to exceed the exposure limit requirements or guidelines. If there are no applicable exposure limit requirements or guidelines, wear respiratory protection when adverse effects, such as respiratory irritation or discomfort have been experienced, or where indicated by your risk assessment process. In misty atmospheres, use an approved particulate respirator.

Ingestion: Avoid ingestion of even very small amounts; do not consume or store food or tobacco in the work area; wash hands and face before smoking or eating.

Engineering Controls:

Ventilation: Use engineering controls to maintain airborne level below exposure limit requirements or guidelines. If there is no applicable exposure limit requirements or guidelines, use only with adequate ventilation. Local exhaust ventilation may be necessary for some operations.

X. PHYSICAL AND CHEMICAL PROPERTIES

Physical State: Liquid above freezing point **Color:** Colorless

Odor: Odorless

Flash Point – Closed Cup: None

Flammable Limits in Air:

Upper: Not applicable

Lower: Not applicable

Autoignition Temperature: Not applicable

Vapor Pressure: 1.5 mmHg @ 20 °C Literature

Vapor Density (air-1): Not applicable

Specific Gravity (H2O = 1): 1.52 Literature

Liquid Density: 1.5 g/cm3 @ 20 °C Literature

Freezing Point: 14 °C (57 °F) Literature

Melting Point: 14 °C (57 °F) Calculated

pH: 14

Decomposition: No test data available

Kinematic Viscosity: 0.35 St @ 25 °C Calculated

Boiling Point (760 mmHg): 145 °C (293 °F) Literature

XI. STABILITY AND REACTIVITY

Stability/Instability: Stable under recommended storage conditions. See Storage, Section VIII.

Conditions to Avoid: Avoid moisture. Product absorbs carbon dioxide from the air.

Incompatible Materials: Heat is generated when mixed with water. Spattering and boiling can occur. Caustic soda solution reacts readily with various reducing sugars (i.e. fructose, galactose, and maltose, dry whey solids) to produce CO. Take precautions including monitoring the tank atmosphere for CO to ensure safety of personnel before vessel entry.

Avoid contact with: Acids. Glycols. Halogenated organics. Organic nitro compounds. Flammable hydrogen may be generated from contact with metals such as Zinc, Aluminum, Tin and Brass.

Hazardous Polymerization: Will not occur.

Thermal Decomposition: Does not decompose.

XII. TOXICOLOGICAL INFORMATION

Acute Toxicity

Ingestion: Single dose oral LD50 has not been determined.

Skin Absorption: The dermal LD50 has not been determined.

Repeated Dose Toxicity: Based on available data, repeated exposures are not anticipated to cause additional significant adverse effects.

Genetic Toxicology: For the major component(s); In vitro genetic toxicity studies were negative

XIII. ECOLOGICAL INFORMATION

Chemical Fate

Data for Component: Sodium Hydroxide

Movement & Partitioning: No bioconcentration is expected because of the relatively high water solubility. Potential for mobility in soil is very high (Koc between 0 and 50).

Partition coefficient, n-octanol/water (log Pow): -3.88 Estimated.

Partition coefficient, soil organic carbon/water (Koc): 14 Estimated.

Persistence and Degradability Biodegradation is not applicable.

Data for Component: Sodium Chloride

Movement and Partitioning: No bioconcentration is expected because of the relatively high water solubility. Potential for mobility in soil is very high (Koc between 0 and 50). Partitioning from water to n-octanol is not applicable.

Ecotoxicity

Data for Component: Sodium hydroxide. Material is slightly toxic to aquatic organisms on an acute basis (LC50/EC50 between 10 and 100 mg/L in the most sensitive species tested). May increase pH of aquatic systems to > pH 10 which may be toxic to aquatic organisms.

Fish Acute & Prolonged Toxicity: LC50, rainbow trout (Oncorhynchus mykiss), 96 h: 45.5 mg/l

Aquatic Invertebrate Acute Toxicity: LC50, water flea Daphnia magna: 40 - 240 mg/l

Data for Component: Sodium Chloride. Material is practically non-toxic to aquatic organisms on an acute basis. (LC50/EC50 >100 mg/L in the most sensitive species tested).

Fish Acute & Prolonged Toxicity: LC50, fathead minnow (Pimephales promelas): 10,610 mg/l

Aquatic Invertebrate Acute Toxicity: LC50, water flea Daphnia magna: 4,571 mg/l

Toxicity to Micro-organisms: IC50, OECD 209 Test; activated sludge, respiration inhibition: >1,000 mg/l

XIV. DISPOSAL CONSIDERATIONS

DO NOT DUMP INTO ANY SEWERS, ON THE GROUND, OR INTO ANY BODY OF WATER. All disposal practices must be in compliance with all Federal, State/Provincial and local laws and regulations. Regulations may vary in different locations. Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator. AS YOUR SUPPLIER, WE HAVE NO CONTROL

OVER THE MANAGEMENT PRACTICES OR MANUFACTURING PROCESSES OF PARTIES HANDLING OR USING THIS MATERIAL. THE INFORMATION PRESENTED HERE PERTAINS ONLY TO THE PRODUCT AS SHIPPED IN ITS INTENDED CONDITION AS DESCRIBED IN MSDS SECTION: Composition Information. FOR UNUSED & UNCONTAMINATED PRODUCT, the preferred options include sending to a licensed, permitted recycler.

XV. TRANSPORT INFORMATION

DOT Non-Bulk
Proper Shipping Name: SODIUM HYDROXIDE SOLUTION
Hazard Class: 8 **ID Number:** UN1824 **Packing Group:** PG II

DOT Bulk
Proper Shipping Name: SODIUM HYDROXIDE SOLUTION
Hazard Class: 8 **ID Number:** UN1824 **Packing Group:** PG II

IMDG
Proper Shipping Name: SODIUM HYDROXIDE SOLUTION
Hazard Class: 8 **ID Number:** UN1824 **Packing Group:** PG II
EMS Number: F-A, S-B
Marine pollutant: No

ICAO/IATA
Proper Shipping Name: SODIUM HYDROXIDE SOLUTION
Hazard Class: 8 **ID Number:** UN1824 **Packing Group:** PG II
Cargo Packing Instruction: 812
Passenger Packing Instruction: 808

Additional Information

Reportable quantity: 1,961 lb – SODIUM HYDROXIDE

This information is not intended to convey all specific regulatory or operational requirements/information relating to this product. Additional transportation system information can be obtained through an authorized sales or customer service representative. It is the responsibility of the transporting organization to follow all applicable laws, regulations and rules relating to the transportation of the material.

XVI. REGULATORY INFORMATION

OSHA Hazard Communication Standard

This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

Superfund Amendments and Reauthorization Act of 1986 Title III (Emergency Planning and Community Right-to-Know Act of 1986) Sections 311 and 312

Immediate (Acute) Health Hazard: Yes
Delayed (Chronic) Health Hazard: No

Fire Hazard: No
Reactive Hazard: Yes
Sudden Release of Pressure Hazard: No

Superfund Amendments and Reauthorization Act of 1986 Title III (Emergency Planning and Community Right-to-Know Act of 1986) Section 313

To the best of our knowledge, this product does not contain chemicals at levels which require reporting under this statute.

Pennsylvania (Worker and Community Right-To-Know Act): Pennsylvania Hazardous Substances List and/or Pennsylvania Environmental Hazardous Substance List:

The following product components are cited in the Pennsylvania Hazardous Substance List and/or the Pennsylvania Environmental Substance List, and are present at levels which require reporting.

Component	CAS #	Amount
Sodium hydroxide	1310-73-2	<= 51.0 %

Pennsylvania (Worker and Community Right-To-Know Act): Pennsylvania Special Hazardous Substances List:

To the best of our knowledge, this product does not contain chemicals at levels which require reporting under this statute.

California Proposition 65 (Safe Drinking Water and Toxic Enforcement Act of 1986):
This product contains no listed substances known to the State of California to cause cancer, birth defects or other reproductive harm, at levels which would require a warning under the statute.

U.S. Toxic Substances Control Act:
All components of this product are on the TSCA Inventory or are exempt from TSCA Inventory requirements under 40 CFR 720.30. European Inventory of Existing Commercial Chemical Substances (EINECS). The components of this product are on the EINECS inventory or are exempt from inventory requirements.

CEPA - Domestic Substances List (DSL):
All substances contained in this product are listed on the Canadian Domestic Substances List (DSL) or are not required to be listed.

NFPA Hazard Rating System

Health	Fire	Reactivity
3	0	1

XVII. OTHER INFORMATION

Recommended Uses and Restrictions: Pulp and paper industry (pulping and bleaching, de-inking waste paper, water treatment). Textile industry (fiber processing and dyeing). Soaps and detergents industry (saponification of fats and oils, anionic surfactant manufacturing). Bleach manufacturing. Petroleum exploration and processing. Aluminum production. Chemical processing. Waste neutralization. Acid gas scrubbing. Neutralizing of acids and acid gases.

Legend

N/A:	Not available
W/W:	Weight/Weight
OEL:	Occupational Exposure Limit
STEL:	Short Term Exposure Limit
TWA:	Time Weighted Average
ACGIH:	American Conference of Governmental Industrial Hygienists, Inc.

Disclaimer

Sierra Chemical Co. expressly disclaims all express or implied warranties of merchantibility and fitness for a particular purpose with respect to the product or information provided herein, and shall under no circumstances be liable for incidental or consequential damages.

Do not use ingredient information and/or ingredient percentages in this MSDS as a product specification. For product specification information, refer to a Product Specification Sheet and/or a Certificate of Analysis. These can be obtained from your local Sierra Chemical Co. Sales Office.

All information appearing herein is based upon data obtained from the manufacturer and/or recognized technical sources. While the information is believed to be accurate, Sierra Chemical Co. makes no representations as to its accuracy or sufficiency. Conditions of use are beyond Sierra Chemical's control. Therefore, users are responsible to verify this data under their own operating conditions to determine whether the product is suitable for their particular purposes, and they assume all risks of their use, handling, and disposal of the product or from the publication or use of, or reliance upon, information contained herein. This information relates only to the product designated herein and does not relate to its use in combination with any other material or in any other process.

Sierra Chemical Co.

Material Safety Data Sheet

This MSDS has been prepared within the guidelines of the Federal OSHA Hazard Communication Standard, 29CFR 1910.1200.

Product Name: Hydrochloric Acid – 17 to 39%

I. GENERAL INFORMATION

Supplier: Sierra Chemical Co.
Address: 2302 Larkin Cr.
Sparks, NV 89431

Emergency Phone: (800) 424-9300
Information Phone: (775) 358-0888
CHEMTREC Phone: (800) 424-9300

Issue Date: 03/18/2010

II. PRODUCT INGREDIENTS

Product Name: Hydrochloric Acid, HCl (17 to 39%)

General or Generic Identification: Inorganic Acid, Muriatic Acid, Dilute Hydrochloric Acid

Chemical Formula: HCl

Hazardous Components

Ingredient	Baume Degree	% by Weight	Ceiling Pel	Ceiling TLV
Hydrogen Chloride	11.4 to 23°	17 to 39%	5PPM / 7MG/M³	5PPM / 7MG/M³
Water	N/A	61 to 83%	N/A	N/A

III. HAZARDOUS HEALTH DATA

PRINCIPLE HEALTH HAZARDS, INCLUDING SIGNIFICANT ROUTES, EFFECTS, SYMPTOMS OF OVEREXPOSURE, AND MEDICAL CONDITIONS AGGRAVATED BY EXPOSURES MAY BE:

Eye: Rapidly causes severe burns, possibly with permanent impairment of vision.

Skin Contact: Rapidly causes severe burns.

Skin Absorption: Not likely to be absorbed in toxic amounts.

Inhalation: OSHA 8 hour "TWA" and ACGIH "TLV" = 5 PPM (7MG/M³). These are also ceiling limits.

Ingestion: The greatest hazard is the corrosive action.

Carcinogenicity: Not listed as carcinogen by IARC, NTF, OSHA or ACGIH

IV. FIRST AID

Eye Contact: Immediately flush with clean water, holding eyelids open for fifteen (15) minutes. Call a physician. Do not use chemical antidotes. Speed is essential.

Skin Contact: Immediately flush exposed area with water for fifteen (15) minutes. Remove all contaminated clothing (do not reuse until laundered). Seek medical evaluation. Keep affected area cool.

Inhalation: Immediately remove to fresh air. Call a physician. If breathing is difficult, give oxygen (6 liters per minute). If breathing has stopped, give artificial respiration.

Ingestion: DO NOT INDUCE VOMITING. Give large quantities of water. Call a physician immediately. Keep warm. Never give anything by mouth to an unconscious person.

V. FIRE AND EXPLOSION HAZARD DATA

Flash point: N/A (Will not burn)

Explosive Limits
Upper: N/A
Lower: N/A

Extinguishing media: Water fog, CO_2, Dry Chemical, or as appropriate for combustibles in area.

Hazardous Thermal Decomposition Products: May form toxic materials; hydrogen chloride, acid vapors.

Unusual Fire and Explosion Hazards: Reacts with most metals to produce potentially explosive hydrogen gas. Explosive concentrations of hydrogen may accumulate inside metal equipment.

Special Fire Fighting Procedures: Use water spray to cool containers and control vapors. Run-off from fire control may cause pollution. Wear self-contained breathing apparatus with a full face-piece operated in pressure-demand or other positive pressure mode and full body protection (see section 8 for more information on personal protective equipment) clothing when fighting fires.

VI. SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

REPORTABLE QUANTITY (RQ): 5,000 lb (100% Basis) APPROX. 1,300 GALLONS

Small spills: Cover the contaminated surface with Sodium Bicarbonate, Soda Ash or Lime. Mix and add water if necessary to form a slurry. Scoop up slurry and wash site with Sodium Bicarbonate solution.

Large spills: Evacuate persons from area that are not equipped with proper protective equipment (see

section 8). Stay upwind of any spill. Stop leak at source. Dike to prevent spreading. Pump to non-metallic salvage truck / tank.

VII. SAFE HANDLING AND STORAGE

- Do not get in eyes, on skin or clothing
- Avoid breathing vapors
- Wash thoroughly with soap and water after handling
- Wear all recommended protective equipment when handling
- Keep containers tightly closed
- Keep away from heat, sparks and flame
- Keep in cool place
- Do not store or mix with cyanides, amines, sulfides, oxidizers or formaldehyde
- Protect containers from mechanical damage

VIII. PERSONAL PROTECTION DATA

Ventilation: If possible, provide sufficient mechanical (general and/or local exhaust) ventilation to maintain exposure below exposure limits.

Respiratory protection: For exposure levels greater than 5PPM but no more than 50PPM use a NIOSH approved respirator for Hydrogen Chloride gas, or Hydrogen Chloride mists in order to maintain exposure levels below exposure limits. For gas concentration greater than 50PPM, use supplied air, full face-piece respirator or self-contained breathing apparatus.

Protective gloves: Wear acid resistant gloves such as; rubber or neoprene polyvinyl chloride.

Eye protection: Chemical splash goggles as a minimum. Face shield use is also advisable.

Other protective equipment: Rubber or plastic aprons, coats, shoes, hard hat with brim. Long sleeve wool, polyester, or acrylic clothing as a minimum. In case of emergency, or where there is a possibility of considerable exposure. Wear complete acid suit with hood and forced air or self-contained breathing apparatus.

IX. PHYSICAL AND CHEMICAL PROPERTIES

Property	Refinement	Value				
		17%	25%	31.5%	35.2%	38.5%
Initial Boiling Point	Water=212°F	221°F	219°F	183°	144°F	106°F
Vapor Pressure	760 MM Hg @ 20°C	0.1MM	2MM	20MM	84MM	260MM
Freezing Point	Water=32°F	-40°F	-122°F	-49°F	-29°F	-18°F
Specific Gravity	Water=1.0	1.085	1.13	1.16	1.18	1.20
Evaporation Rate	Butyl Acetate=1			>1		
Solubility in Cold Water				45%		

Description: Colorless to yellow, acrid, pungent liquid

X. REACTIVITY DATA

Stability: Stable

Incompatibility: Materials to avoid; most metals, bases,alkalis, metallis oxides, amines, carbonates, sulfides,strong oxidizers and hypochlorite solution.

- Reacts with metals to give hydrogen gas
- Reacts with oxidizers to give chlorine gas
- Reacts with cyanides to give hydrogen cyanide gas
- Reacts with sulfides to give hydrogen sulfide gas
- Reacts with formaldehyde to give bischloromethyl ether (an OSHA regulated carcinogen)
- Reacts with amines to form ammonia
- Reacts with carbonates to form carbon dioxide

Hazardous Polymerization: Will not occur

XI. TOXICOLOGICAL INFORMATION

Notes to Physician

Eyes

Liquid: Conjuctival edema and corneal destruction that may cause blindness. Pain, tearing and photophobia.

Vapor: Eye irritant. May cause permanent eyesight damage.

Skin: Sever pain with burns and possible ulceration. Usually penetrates the full thickness of the skin. Significant skin permeation and systemic toxicity after contact appears unlikely.

Inhalation: Can completely destroy mucous membranes. Can cause choking, coughing, headache, dizziness. Pulmonary edema may follow after several hours (24-48 hours). Fatality may occur from gross overexposure, particularly in individuals with pre-existing lung diseases.

Ingestion: Severe burning of the mouth, pharynx, abdomen, corrosion of upper gastro-intestinal tract, followed by vomiting. Dental erosions, weakness from falling blood pressure. Asphyxia may occur from edema of the glottis.

Target Organs: Respiratory system, eyes and skin.

XII. ECOLOGICAL INFORMATION

Animal Test Data

1. LC_{50} (RAT): 3124 PPM/1 HOURS @ 100% HCl
2. LD_{50} (RABBIT): 900 mg/kg 100% HCl

3. AQUATIC TOXICITY: Hydrochloric Acid is slightly toxic (96 hour LC50 = 50 – 500 mg/liter). The 96 hour LC50 in Mosquito Fish is 282 mg/liter

XIII. DISPOSAL CONSIDERATIONS

Waste disposal methods: Comply with all federal, state and local regulations.

XIV. TRANSPORTATION INFORMATION

Hazard Classification (DOT): Corrosive

Proper D.O.T. Shipping name: Hydrochloric Acid, 8, UN 1789, PGII

D.O.T. Code Number: 49-302-28

Standard Transportation Commodity Code (STTC): 28-194-50

XV. REGULATORY INFORMATION

CAS Number: 7647-01-0

NIOSH Registry No.: MW 4025000

Other Registries: ANABSTR, APILIT, APILIT2, APIPAT, APIPAT2, BEILSTEIN, BIOBUSINESS, BIOSIS, CA, CAOLD, CAPREVIEWS, CASREACT, CEN, CHEMINFORMRX, CHEMLIST, CBNB, CIN, CJACS, CSCHEM, CSNB, DETHERM, DIPPR, DSL, EINECS, EMBASE, GMELIN, HSDS, IFICDB, IFIPAT, IFIUDB, IPA, JANAF, MEDLINE, MRCK, MSDS-PEST, MSDS-SUM, PDLCOM, PIRA, PNI, PROMT, RTECS, TOXLINE, TOXLIT, TRCTHERMO, TSCA, USAN, VTB.

OSHA Hazard Communications Health Hazard Classification: Corrosive

Sara Title III Hazard Category: This product is a toxic chemical subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

Hazardous Materials Identification System (HMIS) Rating:

Health	Flammability	Reactivity	Protective Equipment
3	0	0	X

National Fire Protection Association (NFPA) Rating:

Health	Flammability	Reactivity	Special Notice
3	0	0	None

XVI. MISCELLANEOUS INFORMATION

Disclaimer

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