October 22, 2003

Re: Wyoming Field Test

Executive Summary

The Wyoming well water can be purified with 3 stages to drinking water quality at a cost of $0.26 per barrel with a 90% recovery .

Simply the Most Advanced Water Technology in The World

Water issues are at a critical mass. Worldwide, our rivers, lakes and underground waters are contaminated with hazardous chemicals that can only be addressed in totality with a new technology. The old technology can't work on brackish wastewater. Thus the EWP technology is being applied. Arsenics, nitrates, chrome, nickel, and organic compounds for example, can't be removed by the technologies of yesterday. The EWP represents the first fundamental breakthrough in technology in over 50 years.

For years, reverse osmosis with its membrane filters, and ion exchange have been the primary means to decrease contaminants, minerals and hardness in water, a process that is known as lowering the TDS (total dissolved solids). However, lowering TDS in this manner is not economical, practical or efficient as TDS levels increase into the brackish water range (beyond 2,500 ppm--parts per million-a measure of TDS). It is not economical or practical for two reasons: one, ion exchange needs strong and expensive acids and bases to regenerate the which is not a very practical solution to acids and bases added to the regeneration waste water. Two, the membranes in reverse osmosis have to be replaced very frequently when used with polluted wastewaters; especially when confronted with organic compounds in the feed water. At high salinities and low temperatures the recovery for RO is not likely to be greater than 40% (i.e. 60% waste water).

The Electronic Water Purifier has low operating costs, low rejection wastewater (i.e. high recovery), low cost-of-ownership, no chemicals and a small footprint.

How Does the Technology Work?

Various Dissolved salts and Silica in water are the major components of TDS (total dissolved solids). These dissolved salts need to be removed on many applications, or they will form deposits and affect equipment performance. (Figure 1)

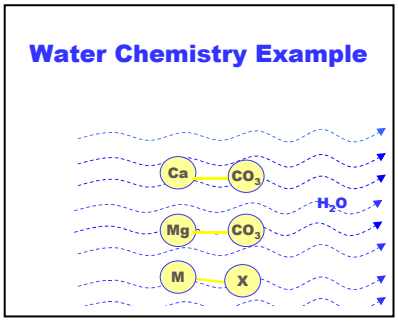


Figure 1

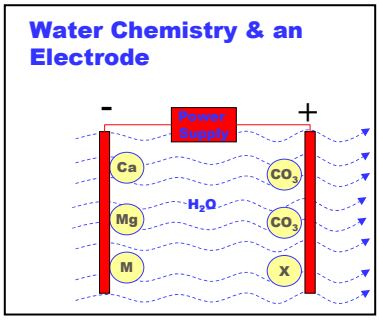


Figure 2

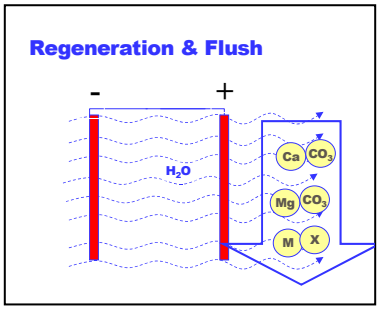


Figure 3

The Electronic Water Purifier makes patented technology available to generate low TDS quality water by removing these dissolved salts electronically.

Electrodes used are made from activated carbon and a conductive material. When these electrodes are layered and a DC power supply is applied, the individual electrodes are charged with different polarities. The dissolved ions (minerals) in the water have polarity charges called Nernst Potential (the molecular bond energy). The applied DC voltage is slightly below the Nernst potential which causes the ions to separate. The ions are then attracted to the opposite polarity of the electrode, thus removing the dissolved ions (minerals) from the water. The dissolved (ions) minerals are adsorbed electrochemically on the activated carbon electrode surface creating the pure water. (Figure 2)

When sufficient dissolved minerals are deposited on the electrodes and conductivity increases beyond the set point desired, the electrodes are regenerated by shorting the electrodes to ground. The contaminants fall off the electrode in the same chemical form as was removed. After the regeneration, a higher concentration waste is discharged through a valve to drain. (Figure 3) Upon completion of this cycle, the polarities are reversed for normal operation.

Discussion

Part I:Test Unit

Figure 4

A 4 stage test unit (Figure 4) was used and configured into 3 stages of processing and one stage of waste recovery. A 500 gallon sample was used and supplied by ABCO.

Analytical tests

Figure 5

Lab ID	C 8114	C8128	C8116
Unit #	1	3	6
Stream	Influent	Effluent	waste
Test #	2	1	2
pH, std. units	7.73	7.18	7.3
Chloride, mg/L	2,699	186	6,648
Sulfate	184	4	930
Total dissolved solids, mg/L	6,730	990	14,230
Alkalinity as CaCO3 mg/L	1,058	233	1,079
Carbonate, mg/L	-	-	-
Bicarbonate, mg/L	1,058	233	1,079
Conductivity, umhos/cm @ 25	10,010	1,316	19,470
Sodium	1,735	207	3,370
Potassium	175	5	368
Calcium	391	10	1,297
Magnesium	79	0	340
Iron	0.43	0.4	0.45
Barium	0.71	<0.5	<0.5

These test result (fig 5) were samples pulled by Aqua EWP but tested by ABCO.

The results show that the water can be purified to 990 mg/l in total dissolve solids while keeping Calcium and Magnesium to rather low levels which helps to hold the polymeric emulsion for frac.

We did notice that the feed water has a substantial amounts of organics by the color of the water, which appeared to be removed in the first stage, however COD tests were not run.

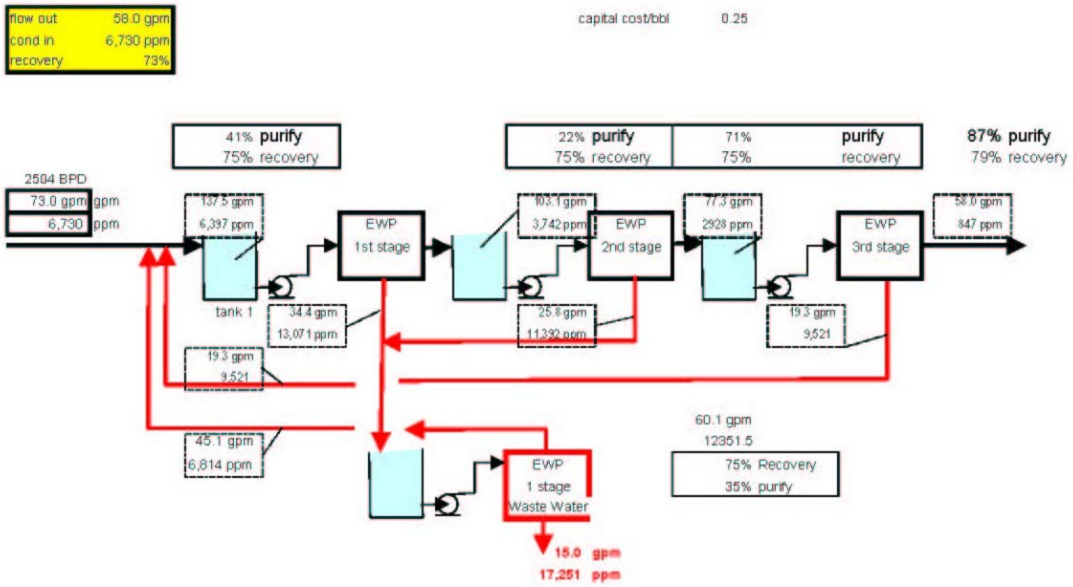
Field Data

The data from the field test is summarized below

Fig 7

		Cond	TDS
Waste		Us	mg/l
Unit 1	C8124	18,430	13,071
Unit 2	C8132	16,080	11,392
Unit 3	C8121	13,460	9,521
Unit 4	C 8115	20,800	14,764
Purify			
Unit 1	C8118	5,370	3,742
Unit 2	C8131	4,230	2,928
Unit 3	C8128	1,316	847
Unit 4	C8119	9,670	6,814
Tank Con-centrations			
Unit 1	C8133	6,970	4,885
Unit 2	C8113	4,010	2,771
Unit 3	C8129	21,100	14,978
Unit 4	C8130	1,081	679

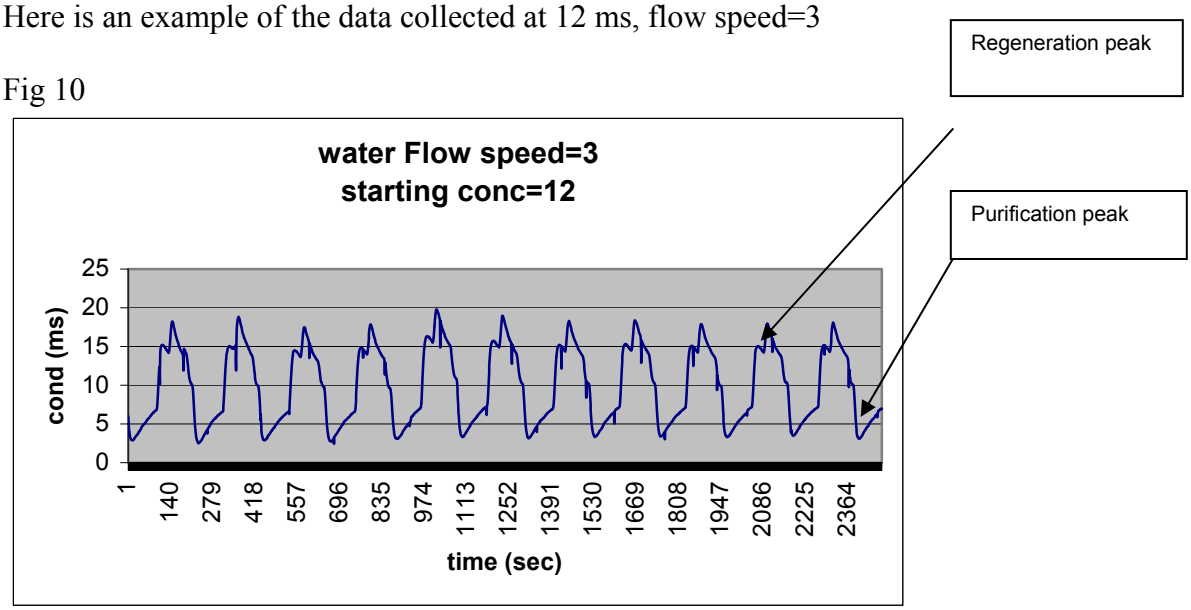
Process Flow Diagram (fig 9)



The recovery for each stage was 75% and the overall recovery was 87% and probably can be optimized to 90%.

Here is an example of the data collected at 12 ms, flow speed=3

Fig 10



Total Recovery of Volume is calculated using the following formula:

$$\textbf{Recovery} = \left(\frac{\text{Total Purification flow}}{\text{Total Waste flow + Total purification flow}} \right)$$