Continuous Flow Seawater RO System for Recovery of Silica-Saturated RO Concentrate

(WRF-09-12)
(TWDB No. 0704830769-Amendment No. 3)

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Participating Utilities and Organizations:
Texas Water Development Board
Austin, TX

El Paso Water Utilities
El Paso, TX

Quarterly Report No. 2
(Jan thru March 2010)

Status Summary

A. Summary of Tasks Completed

Task 1 (*Design, Build, and Install System*) was completed and Task 2 (*Collect Data and analyze samples*) was initiated. The on-site Kick-Off Meeting/Pilot Plant Demonstration was completed at EPWU on March 9, 2010. Meeting Minutes were prepared and distributed.

B. Assessment of Actual vs. Planned Progress

Task 1 was scheduled for the October thru January time period, but it was not completed until the end of March. As pointed out in the previous quarterly report, the three-month delay in executing the contract between all of the parties involved resulted in the project starting out significantly behind schedule (i.e. contracts were not fully executed until late December instead of early October). Therefore, the pilot plant that was scheduled to be delivered in early January was not delivered until the last week of February. From that time thru the end of March, efforts were directed toward "shaking down the system" to render it as fully functional as it was designed to be.

Task 2 was barely started at the end of March instead of in February as scheduled.

C. Tasks for Upcoming Period

The upcoming period (and part of the next one) will be devoted to Task 2. It is expected that most of the data collection will occur during this time, unless further, unexpected, equipment-induced delays are encountered. Our plan is to increase the recovery by 5% each week until the maximum recovery is identified (i.e. until something begins to precipitate from the concentrate).

D. Problems Encountered

A number of problems were encountered in starting up the system, but this was expected because of the complexity of the pilot plant with its sensors, control systems, and data-logging functions. (See Appendix for screen shots of the control panel). For example, one of the conductivity sensors (the one in the feed tank) was giving highly erratic readings or not functioning at all. After replacing it with a completely new unit and getting the same result, it was determined that the Variable Frequency Drive (VFD) was emitting electromagnetic radiation that created a voltage and current flow in the feed tank, thereby interfering with the functioning of the conductivity meter. Several attempts at grounding various components of the system were unsuccessful, so a meter with a different type of conductivity sensor (toroidal) was installed and that problem was eliminated.

Next, a problem with the water-level switch was discovered: it indicated that the water level was above the sensor even when the tank was empty. This would allow the pump to run in a dry condition, thereby causing it to fail. A different type of level sensor was acquired and the problem was eliminated.

In running the unit intermittently during the shake-down period, an unusual noise was noticed in the positive-displacement pump whenever the pump was stopped at the end of a test run. One of the piston sleeves was subsequently replaced, but the problem did not seem to be completely resolved. In the weeks that followed, it became obvious that there was still a problem with the pump. It has been removed again and is currently with the manufacturer who is evaluating the problem.

The process control and data-logging systems were not functioning smoothly at first, but calibration of the sensors and various modifications to the software seem to have those components functioning very well. Similarly, software modifications have been made that enable the system to be remotely monitored and controlled, a condition that will be extremely valuable after routine operation of the system begins. The same is true for a remotely-controlled camera that has been installed at the lab site.

After the issue with pump is resolved, it is believed that the rather sophisticated system will be fully functional and ready for operation on a continuous flow basis.

E. Technical Summary

Response to Comments from WRF or PAC

No comments were received from either the WRF or the PAC

Data Collection, Data Analysis, and Findings

Only a minimal amount of data was collected during the second quarter of the project. The bulk of the effort was directed toward becoming familiar with system by operating it under intermittent, constant surveillance, low-recovery conditions until its reliability could be firmly established. Thus, only one set of data was collected and analyzed during the quarter as discussed below.

Methods and Materials

A schematic diagram of the seawater treatment system is shown in Figure 1. Concentrate from the Kay Bailey Hutchison (KBH) desalting plant is the feed water to the SWRO unit. A control valve opens and closes as necessary to maintain a pre-selected conductivity in the feed tank. Samples are collected after equilibrium conditions are established. The Appendix at the end of this report provides a visual representation of the monitoring instrumentation, control panels and process flow sequence for the pilot plant.

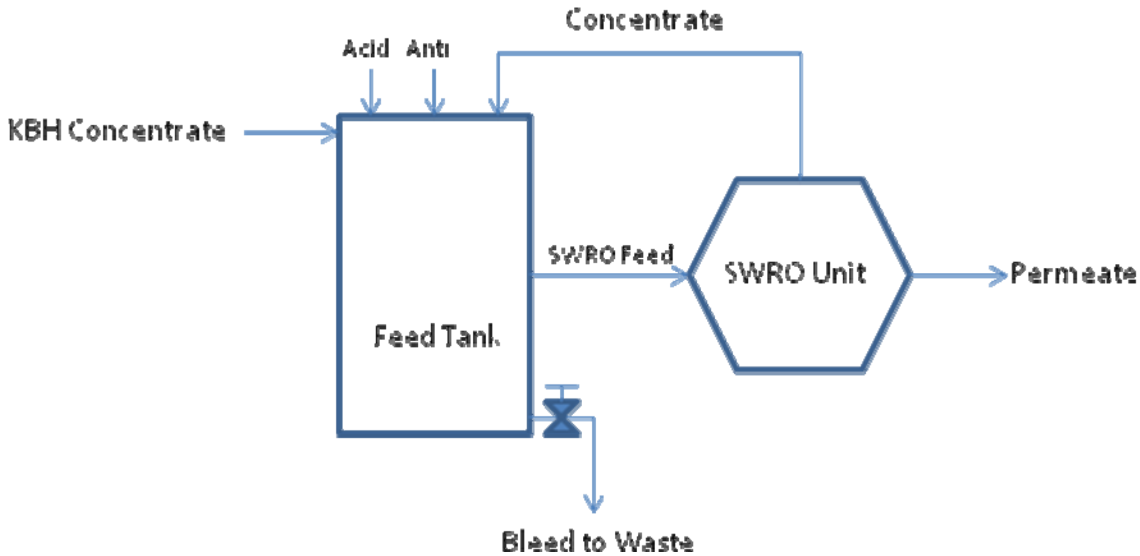


Figure 1 Basic Schematic of Pilot Plant

Table 1 shows the results of the chemical analysis of samples collected from the feed, permeate, and bleed-off of the seawater RO system. The unit was operating at approximately 25% recovery when these samples were taken. The concentrations in the bleed water indicate that nothing measureable was precipitating from the solution (mass balances of the parameters ranged from -7% to +5%). The high conductivity of the permeate is due to its low pH, which happened because this test run was conducted before the pH control system was properly adjusted. In general, these results are good and indicate that the project is progressing as expected to this point in the project.

Table 1 – Results at 25% Recovery

	SWRO Sample I.D.		
Parameter	**KBH Conc**	**Perm**	**Bleed**
Ca Hardness,mg/L as $CaCO_3$	1450	23	1800
T Hardness, mg/L as $CaCO_3$	2000	30	2600
Chlorides, mg/L	5250	370	6650
Sulfates, mg/L	2200	16.3	2975
Conductivity, uS/cm	17300	2884	22000
TDS, mg/L	9600	350	13150
Silica, mg/L	121	3	168
pH	7.7	2.7	2.9

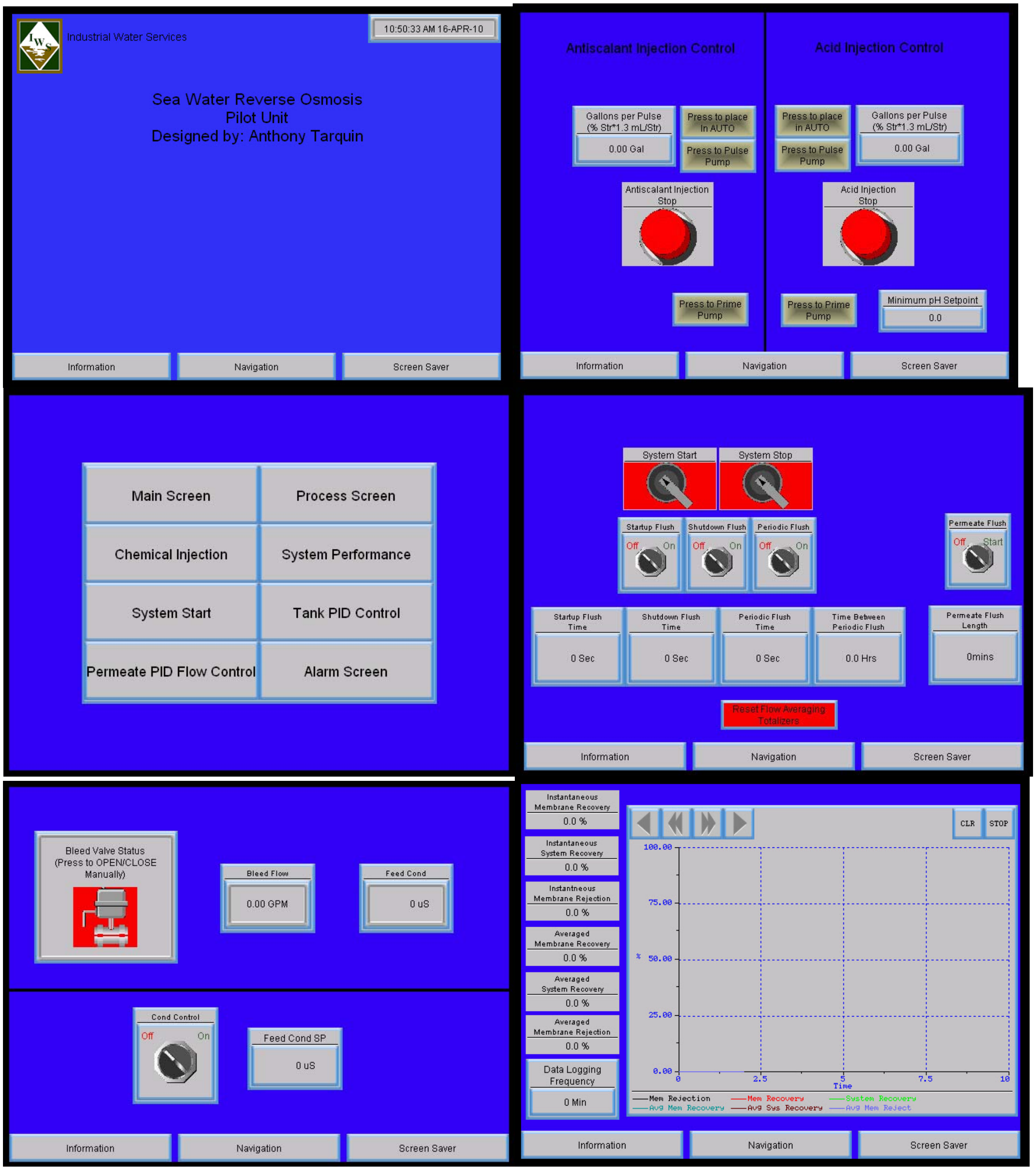
Budget Summary

The Budget is attached showing EPWU's in-kind services expensed against the project to date. EPWU anticipates receipt of the first invoice from UTEP under the EPWU-UTEP Subcontract. These invoices will form the basis for upcoming reimbursement requests from TWDB and the WateReuse Foundation.

Outreach and Publications

No papers were submitted during this reporting period.

Appendix



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Pilot Unit
Designed by: Anthony Tarquin
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Navigation
Screen Saver
Antiscalant Injection Control
Acid Injection Control
Gallons per Pulse (% Str*1.3 mL/Str)
0.00 Gal
Press to place In AUTO
Press to Pulse Pump
Antiscalant Injection Stop
Acid Injection Stop
Press to Prime Pump
Minimum pH Setpoint
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Main Screen
Process Screen
Chemical Injection
System Performance
System Start
Tank PID Control
Permeate PID Flow Control
Alarm Screen
System Start
System Stop
Startup Flush
Shutdown Flush
Periodic Flush
Permeate Flush
Off
On
Start
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Shutdown Flush Time
Periodic Flush Time
Time Between Periodic Flush
Permeate Flush Length
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Bleed Flow
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Feed Cond
0 uS
Cond Control
Feed Cond SP
Instantaneous Membrane Recovery
Instantaneous System Recovery
Instantneous Membrane Rejection
Averaged Membrane Recovery
Averaged System Recovery
Averaged Membrane Rejection
0.0 %
Data Logging Frequency
0 Min
CLR
STOP
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25.00
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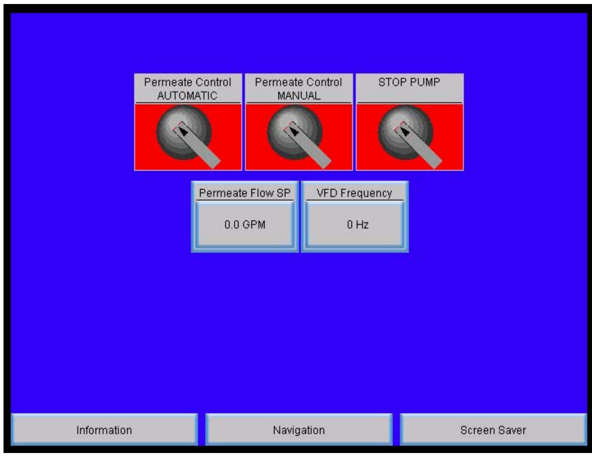
Avg Mem Reject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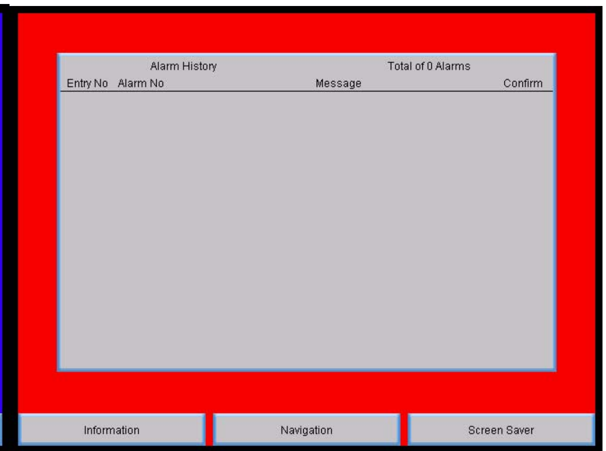
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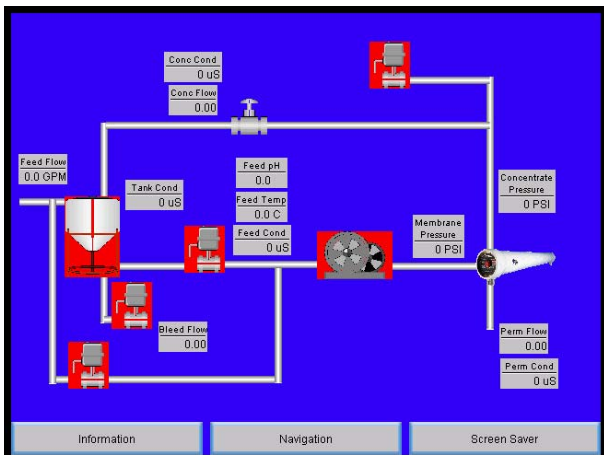
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Information
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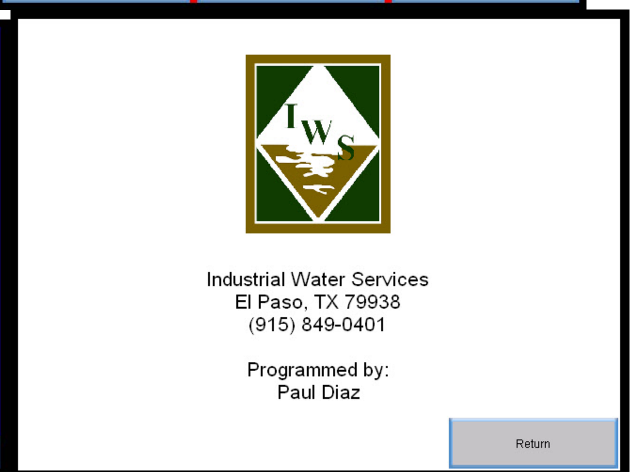
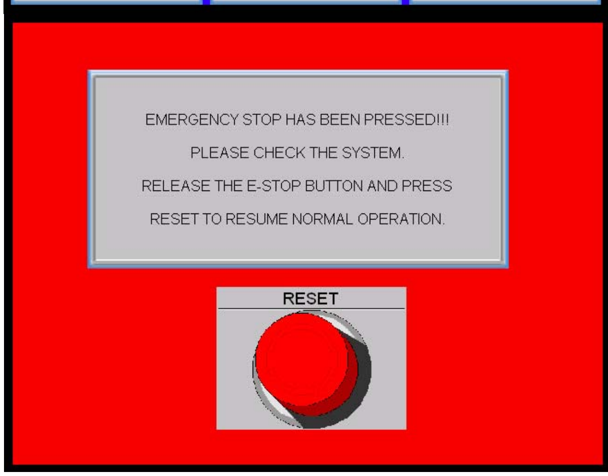
Screen Saver


IWS
Industrial Water Services
El Paso, TX 79938
(915) 849-0401
Programmed by:
Paul Diaz
Return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PLEASE CHECK THE SYSTEM.
RELEASE THE E-STOP BUTTON AND PRESS
RESET TO RESUME NORMAL OPERATION.
RESET