September 14th 2009

THE USE OF THE SPECTREX PARTICLE COUNTER FOR MONITORING SEAWATER INJECTION FOR OFFSHORE OIL DRILLING IN AFRICA

We have been very pleased with the instrument. Results are quick, accurate/repeatable and the instrument holds calibration very well. The following is a brief summary of our process and use:

We operate a seawater injection unit on a oil production facility to maintain reservoir pressure. The seawater must be filtered and treated to specifications to prevent plugging injection lines and the formation.

The seawater injection unit utilizes 3 types of filtration: (1) Coarse Strainer to remove large particulates (2) multi-media filters which are packed beds which cycle between filtration and backwash to remove particles down to >5 micron (3) Cartridge Filters (10 micron) to polish the water prior to it's entering the SRU Membranes. The SRU membranes remove the sulfates present in the seawater down to >20 ppm to prevent scale formation downhole. Same concept as reverse osmosis .

The SRU membranes are quite expensive and upstream filtration is most important to prevent fouling the membranes. Likewise the cartridge filters are not cheap and it is important that the multi-media filters are operating near 90+% efficiency to extend the cartridge filter life.

This is where the particle counter has proven very helpful as we can now monitor the particulates across the system and identify problem areas where efficiencies are low and try to remedy them. This is often times a problem with a valve during the media filter backwash which is not operating properly. Being offshore West Africa, we have times during the year when the seawater temps increase and algae blooms occur along with heavy rains which bring particulates out from rivers which increase solid loading and require our increasing the media filter backwash cycles. Again the particle counter helps us see this and allows us to take corrective actions to reduce changing the cartridge filters out so often. In a sense we're more proactive now vs reactive.

I am also attaching a spreadsheet we put together to monitor our weekly testing. Hope this information is helpful. Please let me know if you have any questions.

Best regards,

Steve Hall
Nalco

NALCO

SRU - PARTICLE COUNT DATA

SAMPLE LOCATION	Micron Size Distribution / Total Counts/cc										Calculated Data				COMMENTS
	1-5 um		5-15 um		15-30 um		30-50 um		50-100 um		Filter Efficiency	Total Counts	Mean Size	TSS	
	Counts	%	Counts	%	Counts	%	Counts	%	50-100	%	>5 um	Counts/cc	(um)	mg/L	
Coarse Filter I/L	73.86	5.96	1089.96	87.9	62.05	5	9.98	0.8	2.5	0.20		1240	7.65	0.50	
Media Filter Inlet	192.39	15.7	974.24	79.53	48.55	3.96	6.8	0.55	1.51	0.12		1225	6.85	0.40	
Media Filter #1 O/L	491.89	92.46	29.14	5.48	10.97	2.06	0	0	0	0	96.11%	532	2.38	0.03	
Media Filter #2 O/L	416.44	97.3	10.32	2.41	0.69	0.16	0.54	0.13	0	0	98.88%	428	2.03	0.01	
Media Filter #3 O/L	358.04	29.81	814.35	67.81	24.55	2.04	2.03	0.17	2.03	0.17	18.25%	1201	6.11	0.25	
Media Filter #4 O/L	629.31	88.64	73.05	10.29	5.39	0.76	2.25	0.32	0	0	92.17%	710	2.79	0.04	
Media Filer O/L Comp	503.39	91.03	38.37	6.94	11.24	2.03	0	0	0	0	95.19%	553	2.47	0.04	
Cartridge Filter I/L	580.62	94.72	30.07	4.91	2.31	0.38	0	0	0	0	96.86%	613	2.28	0.01	
Cartridge Filter O/L	238.62	94.32	12.15	4.8	1.72	0.68	0.13	0.05	0.13	0.05	98.63%	253	1.88	0.02	