TREATING WASTE WATER FROM GLYCOL RECOVERY SYSTEMS – PART II

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Wastewater treatment on a land location is not to difficult a task because most of the time the water is disposed of in a disposal well. However for an offshore platform, you will most likely have to discharge the water overboard. To discharge overboard you will naturally have to meet the discharge permit for produce water containing hydrocarbons according to the 29/42 rule, that is 29 mg/l monthly average and 42 mg/l daily maximum. This in itself would not present a real problem or dilemma except the components of the water does sometimes require a certain treatment criteria.

Brief History: The Shell Mensa WD143 produces approximately 200 mmscf, 300 BOPD with 300 BW/MEG/PD. MEG(Monoethylene glycol) is used as a hydrate control for the three subsea wells that tie back to the surface platform through a pipeline which is over sixty miles long. The process train for handling the returned fluid is the standard HP Inlet Separator, IP Separator and Retention Vessel. The retention vessel is the supply point for the first Glycol Recovery Unit on an offshore platform. Produced water that is removed from the processed MEG averages about 55 – 100 BWPD. For any other process, this would be an ideal water treating problem to design and maintain.

Based on our preliminary data, it was decided to use CETCO media filtration with granular activated carbon as the final polishing before discharging overboard. This combination was selected due to the low expected oil PPM and low water volume. The anticipated oil concentration entering into the media filters was anticipated to be 100 PPM with a 20 – 30 % of which would be soluble oil or other components that would be measured as oil & grease by the EPA 413.1 gravimetric method. Unfortunately for us, the actual inlet to the filtration system was 200 – 1000 PPM varying the concentration through out the day. Of course this not a major problem until you consider the cost to stay within the 29/42 mg/l discharge requirement. The cost to demonstrate compliance was roughly $200,000 a year, in addition to a minimum of weekly change out of media and carbon filters. An alternate approach was justified to either add additional equipment or use an alternate technology.

The number one driver in the process was to reduce the treating cost and determine what else could be used effectively, to remove the O&G content. Equipment considered were: a centrifuge, floatation vessel, hydrocyclone, and a coalescer. In addition to the equipment search, we also reviewed past lab data that would reflect the components of the water and this would dictate the type of equipment best suited for the application.

The data below is an indication of the wastewater from the glycol recovery unit but this sample was taken from the process that was originally being processed on land. This process was being used during the period of time of shutting down the TEG offshore skid to the installation of the MEG Reclamation offshore.

OIL & GREASE:

Hexane Solvent	Gravimetric:	399 mg/l
Freon Solvent	Gravimetric:	440 mg/l
	IR:	581 mg/l

CONTAMINANTS (in PPM):

Phenols & substituted phenols	200	Acetic acid	40
1,2-ethandiol monoacetate	50	hydroxybensenesulfonic acid	50
1,4dioxane	15	Monoethanolamine	52
NH4	56	Na	1.0
Indane	1.5	Methyl ester butanoic acid	1.0
2,3,4,5-tetramethyl1,4-hexadiene	0.5	Octahydro4,7-methano-1H-indene	0.5
Xylenes	0.7		

Since phenols was the major concern, other samples were collected from the temporary reclamation unit onshore. Other lab data indicated the phenols level could be as high as 2000 PPM. As can be easily seen, the choice of the CETCO CrudeSorb media filter with GAC was based on the knowledge and experience of best available technology at the time.

Phase 1: Determine oil droplet size distribution to identify treating equipment.

Based on that data, floatation cells and hydrocyclones were eliminated but a centrifuge was still applicable in accordance with droplet size.

Phase 2: Test centrifuge performance.

As shown in table 1, the centrifuge should be able to remove 94% of the oil with no problem. During the discussion prior to testing, this may not be the solution because of the percentage of dissolved oil or other soluble components that show up as O&G using EPA 413.1 method.

From the field test data we concluded that the centrifuge performed as advertised to remove dispersed oil but the dissolved components remained pretty high.

Phase 3: Document performance of the CETCO media filters.

From the performance data, it was determined the media filters needed something to reduce the not only the "Total O&G"

Phase 4: Test Coalescer Skid:

PALL Corporation supplied a small test skid for field trial. The test skid used was a PALL 6" liquid/liquid coalescer filter and with a 10 micron & 40 micron pre-filter. Based on those results, a full scale coalescer was installed upstream of the filtration media filters.

Table 1:

Full Scale Model Test Data.

Date	Time	GPM	V525	Pall Out	PALL Eff(%)	GAC
12/13/00	20:00	2	2639	278	89.5	196
1/10/01	13:00		594	279	53.0	188

It was later determined in the year, that an in-line pump was needed to maintain adequate pressure on the entire water treating system. In conjunction with the pump addition was the water soluble organics chemical to determine if it would lower the total O&G coming from the coalescer. Ondeo-NALCO EC2068 was added but the evaluation is continuing to determine how effective it really is at the current injection point.

Ondeo-NALCO EC2068 WSO Chemical Test									
Date	Time		GR	GRS(TPH)	WSO	%WSO	L/LC TPH Efficiency	EC2068	Comments
8/1/01	17:00	V525	172	13	159	92%		0	
8/1/01	17:00	PALL L/L C	134	2	132	99%	85%	5	
8/1/01	20:00	V525	154	25	129	84%		1.5	Reduced to 1.5 gal/day
8/1/01	20:00	PALL L/L C	155	4	151	97%	84%	1.5	
8/1/01	22:30	V525	153	26	127	83%		1.5	
8/1/01	22:30	PALL L/L C	129	2	127	98%	92%	1.5	
8/2/01	5:20	V525	200	27	173	87%		1.5	
8/2/01	5:20	PALL L/L C	102	0.9	101.1	99%	97%	1.5	
10/16/01	11:00	V525	267	79	188	70%		1.5	
10/16/01	11:00	PALL L/L C	119	4	115	97%	95%		

Conclusion:

- Further testing need to be done to further optimize WSO treating.
- Test 15-30% HCL vs. EC2068.
- Modify vessels to hold bulk carbon and test flowing carbon in series for longer life.