

Offshore Water Treatment

The following discussion is based on data and information provided by one of the major oil companies prominent in onshore and offshore exploration and production activities, refining and transportation of crude oil and finished petroleum based products. The issues of concern are shared by all E & P companies currently active in the offshore arena worldwide. The topic of this discussion is focused on treatment of produced waters as Phase I.

Existing Volumes and Conditions:

Flow rate = 18,000 bbl per day
Oil = 320 mg/l (tight emulsion)
Metals = high Zinc

Prior Treatment Method:

Water and oil enters the free oil knockout vessel where retention time allows oil, water, and solids to separate. The discharge from this vessel is an emulsion which then enters the heater treater where emulsion breaking chemicals are introduced, high temperature is present and oliophillic, electrically charged (+) plates attract oil droplets. The oil droplets coalesce at the plate surfaces and rise up the plates where the oil is then removed.

Problem:

The effluent water exiting the heater treater is our challenge. Where oil has been removed, soluble organic remain present which results in the treated water not meeting the allowable specification for discharge. The discharge requirement for oil (TPH) is 29 mg/l. Common practice utilizes phosphorous acid for pH adjustment and emulsion splitting. This chemistry is unreliable and difficult to control which often results in the discharge of bad water. Phosphorous acid changes the bonding characteristics of oil and water, therefore masking the analytical procedure resulting in false readings.

Ecolotron Solution:

Ecolotron, Inc. utilized its patented electrocoagulation process and plate & frame reactor to resolve these concerns. The system is designed to provide the following benefits:

- Maximize the beneficial reuse of resource materials on location.
- Minimize waste disposal volume, transportation costs and associated liabilities.
- Minimize operator attention and maintenance concerns.
- Provide reliable results and a high quality effluent.
- Establish client confidence and minimize risks.
- Reduce costs to the operator.

System Overview:

Ecolotron's electrocoagulation system and process:

- consist of three subsystems that can operate independently or sequentially depending on the required treatment.
- has the ability to accept and treat all wastewater sources on location.
- allows subsystems to be installed alone, if all are not required.
- may be expanded modularly as required.

Economics:

For the purpose of this discussion we shall focus on two scenarios, (1) the electrocoagulation component can be installed as a retrofit to existing systems replacing chemical mixing and metering equipment and utilize existing liquid – solids equipment (i.e. skimmers, CPI and API separators, ISF and DAF separators) and (2) where applicable the electrocoagulation component can be installed with the Megacell, vertical DAF separator.

EC Component as a Retrofit:

A budgetary estimate for a 500 gpm (12 bbl / min) electrocoagulation system was \$600 K. Assuming changing the reactor core every sixty (60) days at \$ 10K per exchange, the total out of pocket expense amortized over a three (3) year term is \$780 K. This unit processes 17,280 bpd (535,680 bbl / mo. or 6,307,200 bbl / yr.). Over a three year period the system processed 18,921,600 total bbl at a per bbl cost of \$0.03. Upon consideration of the added benefits and advantages of the electrocoagulation process with its low cost of treatment, the decision was made to move away from the existing excessive chemical processing and costs.