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## **Question 58: What issues are experienced at the desalter and pre-heat train when recirculating brine at the desalter?**

**SHENKLE** (Flint Hills Resources, Ltd.)

Before answering this question, I want to clarify that the panel has defined 'recirculating brine' as brine going back to the freshwater makeup. For example, it may be used when insufficient makeup is available to maintain recommended washwater rates. We do not recirculate brine. We inject makeup water upstream of the second stage mix valve. Second-stage brine is pumped back to the first stage upstream of the mix valve, and then the first-stage brine is effluent. We operate washwater rates that are typically in the range of 4 to 5%.

**SLOLEY** (CH2M Hill)

Brine can be recirculated at the desalter. Additionally, there are some plants that recirculate brine found upstream in the heat train network. This is used in plants that have insufficient water to get proper contacting across the mix filter and which are often trying, in extreme cases, to move even from 2 or 3% water up to around 4 or 5% water. Since the freshwater rate does not increase when you do this operation, if it is more effective, you will increase the solid content of the brine. After all, that is the objective.

In some units, problems can arise due to oil and water emulsification because the pump that needs to recirculate this water – if you have oil in it – is a great mixing device. If the brine does not effectively de-oil, this water will recirculate and could cause problems with the rag layer in the desalter. Additionally, if the soap content of the water is high, you will get emulsions forming. With higher total water rates in many of these desalters also, the total water residence time is reduced, making the oil and water emulsions more difficult. The downstream exchange of equipment fouling and corrosion rate should be lower. If it is not changed or gotten worse, you should stop the brine recirculation.

**HODGES** (Athlon Solutions)

We are huge fans of recycling brine. In most cases, it is the Best Practice to increase the effectiveness of your desalter by increasing the effective washwater percentage through brine recycle, which will drive optimum desalting. As I mentioned earlier, one of the key items that is often overlooked when doing this is your seal flush. Make sure that you do not use the recycled water for your seal flush because it will erode your seal. Use fresh water. This may be subtle to some and obvious to others. Make sure that when you are recycling, you are not replacing your fresh water with recirculated brine. Recirculating brine is only used to add more effective percentage washwater. If you back out the freshwater, you will be taking a step back in effective desalting and contaminant removal across the desalter.

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**TOM COLLINS** (Forum Energy Technologies)

Recirculating effluent water back to the desalter can improve efficiency by increasing water droplet population, allowing for larger droplets and faster settling. When recycle water is used, it is typically injected just before the mixing valve, not into the pre-heat train. It is also recommended that you divert the recycle when mud-washing unless a continuous mud-wash is used. Additional water volume may also allow for improved mixing efficiency, due to an increase in the water droplets created in the mixing valve or emulsification device. Care should be taken not to recycle water high in oily solids or other emulsifiers that may help stabilize interface emulsions and increase BS&W.

**GLENN SCATTERGOOD** (Nalco Champion Energy Services)

It is important to recognize the benefits of desalter washwater recycle, which improves dehydration and leads to improved salt removal. A higher rate of desalter washwater may also increase solids removal when processing high solids crudes.

**DENNIS HAYNES** (Nalco Champion Energy Services)

Recirculation of brine is a very good strategy to increase washwater to the desalter while minimizing effluent flow to wastewater treatment. The issues that may be experienced during this recirculating brine include a potential reduction in solids removal due to sending desalter effluent containing some solids through a pump motivating the flow back to the combined washwater inlet. More so, an issue is that if there is any upset or degree of oil in the effluent, the shearing action of the recycle pump will tighten the effluent emulsion. This emulsion, combined with the washwater into the raw crude oil which is then emulsified via the mix valve, may create interface growth in the desalter to the point that the system upsets. The brine recycle should be used with a non-oily effluent.

**PHILIP THORNTHWAITE** (Nalco Champion Energy Services)

It should be remembered that if a desalter operation is washwater-limited, the use of a brine recycle is an effective means of increasing the washwater volume and improving both dehydration and desalting performance. However, the operation is not without risk, and there are operation considerations to be made.

First, the recirculation of effluent brine is, in effect, adding salt to the crude oil when the two are mixed together. As a consequence of this combination, if the salinity of the brine significantly increases, the mixture can limit the salt removal efficiency across the desalters, the optimum salt content of the desalted crude increases, and the process efficiency can actually decrease. This reaction can be mitigated to an extent since the increased washwater volume leads to improved dehydration and

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desalting efficiency. Additionally, any increase in overhead chlorides can be mitigated to a degree through good monitoring and caustic management practices.

The other major consideration is that any deterioration in the effluent quality can have a significant impact on the whole desalter operation. If there is an upset leading to an oil undercarry, the oily brine will be passed through the brine recycle pump leading to the formation of a very stable emulsion. As this stable emulsion forms part of the total washwater feed, it can lead to emulsion layer growth within the desalter vessel and begin to exacerbate the already upset conditions. Key to mitigating this threat is regular visual checks of the try lines and effluent quality so that any onset in effluent deterioration can be quickly acted upon.

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