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## **Question 30: When injecting wash water upstream of the cold train in a 2-stage system, do you use fresh wash water or brine water from the 2nd stage desalter?**

**MICHAEL KIMBRELL** (Becht Engineering)

For two stage desalting, injecting all the fresh wash water upstream of the second stage desalter provides the opportunity to use the lowest salt water on partially desalted crude which should result in the lowest level of salt in the desalted crude oil. Water from the second stage desalter is then used to provide wash water for the first stage. This water is typically split between being injected upstream of the exchanger train and upstream of the mix valve for the first stage desalter.

For crude oils that contain calcium sulfate salts, enough water should be injected into the preheat train to prevent all the water from dissolving into the oil. The goal is to keep enough water to maintain a separate water phase as the crude oil enters the desalter vessel for water separation. Calcium sulfate salts form very tenacious scale that is extremely difficult to remove.

**SAM LORDO** (Consultant)

Most all the multistage desalting units apply fresh water to the last stage. This is done to achieve the “polishing” of the crude with respect to salt removal and reduction in the salt carry over from BS&W. by using fresh water, the mixing energy going to the second stage can be increased since, in theory, the natural emulsifiers have been removed in the first stage and the potential of forming a stable emulsion is minimized.

**BILL CATES** (Hunt Refining)

Operation of a desalter system presents the operating company with the option of where to inject wash water for the leading or only desalter. One option as indicated by this question is whether to inject some or all the wash water upstream of the cold train. For companies operating a two-stage system, the next question comes as to what the source of water is to use as the wash water injected to the cold train.

A potential benefit of injecting wash water ahead of the preheat train is the ability of the water to help keep the exchangers cleaner to help with heat transfer efficiency. The option of either fresh makeup water or brine from the second stage desalter as the wash water source has pros and cons to be considered.

Using fresh water is desirable due to the clean nature of the wash stream. This stream typically does not contain oil or solids that can help to create or stabilize an emulsion within the first stage desalter. A

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potential downside to using fresh water is that this stream will take away from the amount of water available for feed to the second stage desalter.

Using the brine from the second stage desalter has the benefit of not requiring any additional fresh makeup wash water when compared to simply putting the brine ahead of the first stage desalter mix valve. The potential problem is the contaminants that the brine can contain. If the second stage desalter is in upset, the brine stream can contain a substantial amount of oil that can create a stabilized emulsion entering the first stage desalter. Additionally, using the hot brine at the inlet to the preheat train may cause heat transfer shifts that affect downstream equipment such as additional loading on the naphtha air-cooled and/or water-cooled exchangers.

If the choice is made to use water in the preheat train, typically 0.5-1.5% of charge is used. The point of injection would be preferable to be in the discharge of the crude charge pump, but this requires the wash water pump to have a higher discharge head as compared to injecting just upstream of the mix valve on the desalter.

One chemical company has the preference to put this water into the suction side of the crude charge pump to keep from having to upgrade the brine pump on the second stage desalter or the freshwater pump feeding the desalter system. Their injection rate is suggested to be 1-2% fresh water into the suction of the charge pump. Another company states using 0.5-1.5% fresh water without stating their preference as to the injection point around the crude charge pump.

Ultimately it comes down to an assessment of the equipment capabilities and achieving the best balance for the overall desalting system.

**DENNIS HAYNES** and **CHRISTIAN LEEDLE** (Nalco Champion)

Technically, it would be best to have fresh wash water to inject upstream of the cold train in a 2-stage system. This is due to the issue of moving solids from the 2nd stage into the feed during mud washing of the 2nd stage vessel. In most systems, availability or line ups do not allow for fresh water to be used for this purpose, so an alternative in processing of high levels of solids is to divert the water from the cold preheat during mud wash of the 2nd stage. Due to much of the solids being removed in the 1st stage, many refineries can operate in a mode where they do not use fresh water to the 1st stage or divert the recycle water from the 2nd stage even during mud wash.

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