The CONTACTOR™

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Blowing Down Ammonia in Amine Regenerators

That ammonia can build up and become trapped in regenerators is well known. The main explanation put forth for this buildup is ammonia's high volatility and high solubility which allows the relatively cold overhead condenser to re-condense and re-absorb ammonia that has already been removed by the stripping trays. Thus, a recirculating loop of ammonia, rising with the vapor and descending with the liquid, occurs. But there is another factor: ammonia is usually present with hydrogen sulfide. The H_2S condenses and reacts with the ammonia, so what ends up being refluxed to the regenerator is roughly equal parts ammonia and hydrogen sulfide in water. *These components trap each other!*

The way this is usually handled in amine systems with significant ammonia in the rich amine is to blow down condensate from the overhead condenser and add it to the sour water system. But there is a potentially very troublesome component that, if not carefully eliminated from the blow-down, will wreak havoc on downstream processes that use the water from the sour water stripper. That component is amine.

If the stripped water goes to a "bug pond" for biological treatment before being discharged, any amine content is bad for the water treatment process because it has a high biological oxygen demand (BOD). In fact, an amine loss can masquerade as an ammonia loss because both are alkaline and the assay method is usually just an acid-base titration, i.e., an alkalinity measurement. So it can be hard even to determine whether there is really an amine loss at all. However, if the stripped water is used in a refinery desalter, any amines may quickly make their presence known. In a desalter, amines can form soaps with naphthenic acids and cause heavy ends to foam into the gas stream. Corrosion rates can be expected to escalate. Finally, amine in reflux water blow-down means an amine loss that must be made up over time with fresh amine.

The way to keep amine out of the reflux blow-down is to keep it from going overhead with acid gases from the regenerator. There are several reasons amine might go overhead:

- Vaporization of hot rich amine feed;
- Via entrainment overhead resulting from poorly operating trays, or a poorly operating feed distributor in a packed column;
- By operating too close to flood;
- As carry-over from significant foaming.

Process simulators do not usually deal with entrainment. This is a function of closeness to flood and is more in the purview of tray designers. Nor do process simulators usually deal with the occurrence and effects of foaming (although ProTreat will allow you to account for the effect of foaming on mass transfer if the foaming is not severe enough to render the column inoperable). But process simulators can certainly provide a good estimate of amine vaporization losses.

The most effective way to prevent significant amounts of amine from getting into the condensate reflux stream is to prevent it from going overhead. Several reflux trays or a packed reflux section should be installed above the rich amine feed point. This will reduced the amine content of the overhead vapor to parts per billion or less. It is also an effective way to capture entrainment and prevent carryover of amine which ends up in the blown-down condensate going to the bug pond.

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