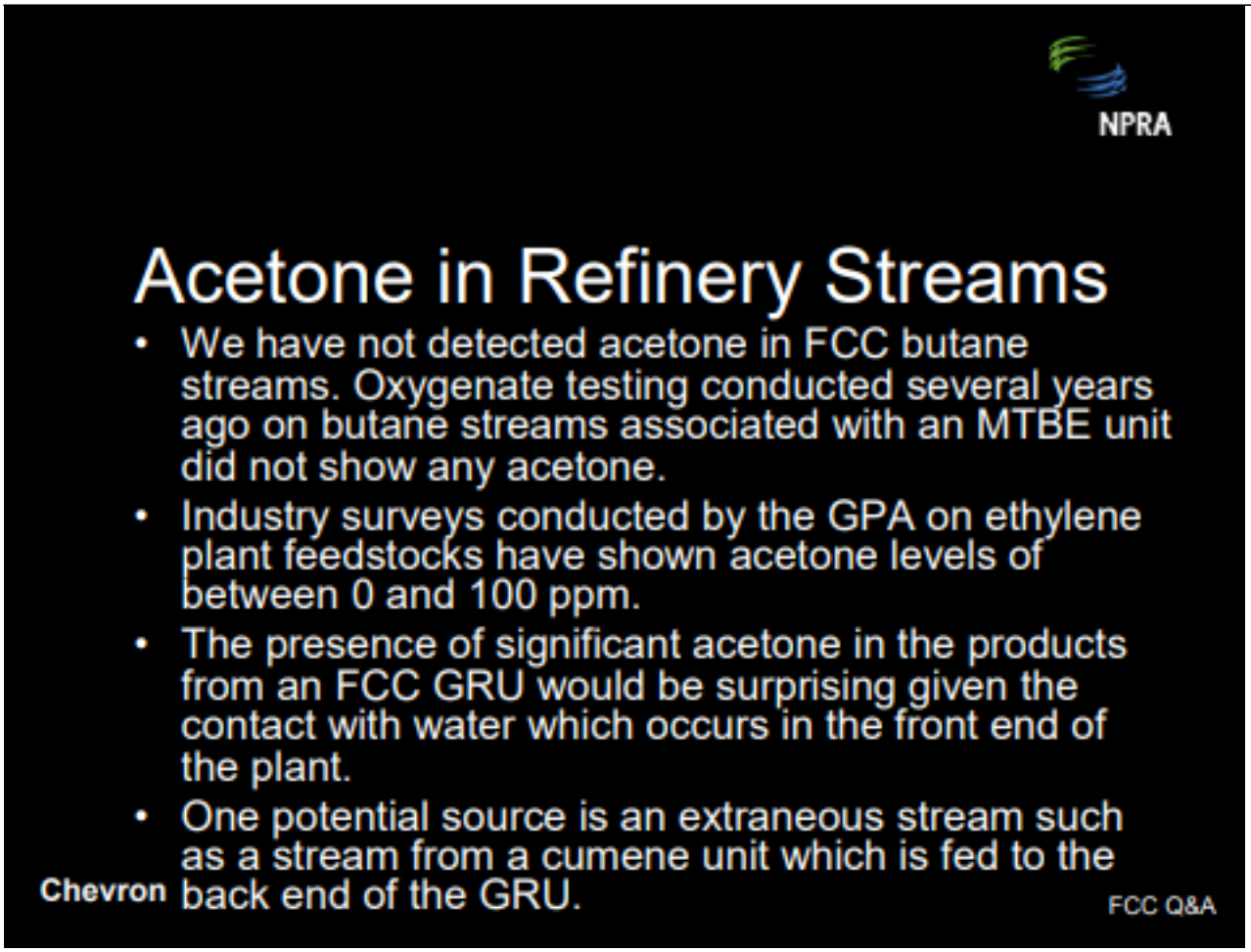
Question 14: What reactions lead to acetone formation and how can they be mitigated? We have measured acetone concentrations between 100 and 1,200 ppm in the FCC butanes/butylenes stream.

WALKER (UOP)

We have very little data on this subject. We did find data on one virgin gas oil operation with 70 ppm to 110 ppm of acetone. If you are getting 1200 ppm, you probably have organic oxygen coming from some type of catalytically converted feedstock or recycle stream. We do not think you can have this level of acetone with pure virgin feedstock.

THOMPSON (Chevron)

We have not detected acetone in FCC butane streams. Oxygenate testing conducted several years ago on an MTBE unit did not show acetone. There is some industry survey information that indicates that acetone levels might be in the 0 ppm to 100 ppm level. However as Pat alluded, it is very likely that the source of acetone is either oxygen or, more likely, contamination from a unit such as a cumene unit that produces acetone as a byproduct.



HEATER (BASF Catalysts)

There is a theoretical chain of reactions to produce acetone in the FCC. Propylene can hydrate to isopropanol (C_3H_7OH) in the presence of acid sites. However, the equilibrium is heavy in favor of propylene in this reaction. The FCC catalyst provides active acid sites. Isopropanol can decompose to acetone (C_3H_6O) in the presence of basic sites. Magnesium oxide (MgO) from the SOx additives provides basic sites, as does copper oxide from NOx additives. So theoretically, acetone can be formed from propylene via isopropanol. However, we would expect this reaction to be extremely minor, down in the ppm range.

WARDINSKY (ConocoPhillips)

This response is based on some feedback I got from our HF alkylation experts. They informed me that they thought that acetone formation could be due to the hydrolysis of propylene in the FCC riser, as Rex mentioned. We are not aware of any correlations between acetone levels and the FCC BB stream and the use of something like a ZSM-5 additive to boost C-3 and C-4 olefin yields. Acetone is miscible with water so a properly designed main fractionator overhead waterwash system may be beneficial in

extracting acetone to the sour water. FCC BB streams typically contain acetone levels of 50 ppm to 180 ppm. Acetone impurities in BB streams to alkylation units result in increased acid makeup rates and increased acid soluble oil or ASO formation although the increase in ASO formation is not as extensive from acetone being an impurity relative to other impurities, such as dimethylether or methanol. At high levels of acetone in FCC BB stream to an HF alky unit, the ASO properties change and the ASO develops a red discoloration, known as red oil, and that may be more difficult to separate from the acid.

Print as PDF:

Tags

Alkylation

HF Alkylation (HF Alky)

Submitter

Licensor

Operator

Vendor