Comparative Quantitative Risk Assessment of Mitigation Options for HF Alkylation Units

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ABSTRACT

HF and Sulfuric Alkylation units provide an effective way for refiners to produce highly valued alkylate needed for high octane gasoline and aviation fuel production. With the growing concerns of MTBE use and their potential phase out, the need for alkylate production is becoming more pronounced. Since MTBE production also helps use up excess butylenes refiners would also like to use butylenes as a feedstock in their alkylate production. HF Alkylation technology provides a very promising way to produce alkylate production from a mixed olefin butylenes feedstock. However, due to the potential for aerosolization and the toxicity associated with the catalyst Hydrogen Fluoride many operators have to deal with increased risks associated with an HF alkylation unit. Many of the current HF alkylation unit operators have employed a variety of mitigation options to reduce the potential risks of an accidental release of HF from the unit. To demonstrate the effectiveness of current as well as new potential mitigation options a Quantitative Risk Assessment (QRA) was conducted.

The QRA study evaluated the risks of a “base” case design of the unit and then compared the risk reduction obtained from a variety of passive and active mitigation systems. Passive mitigation systems are particularly attractive as they help an operator demonstrate risk reduction benefits to the communities even based upon the EPA RMP protocols. Over the years, Phillips Petroleum Company has developed several mitigation systems to help improve the safety of the HF alkylation process, including a new ReVAP technology that introduces an additive to help reduce the volatilization of HF acid and reduce the amount of acid that becomes airborne. Several combinations of mitigation options were also analyzed to determine potential synergistic benefits. The analysis can be used to optimize risk reduction strategies on a site specific basis.

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