NPRA

Inherently Safer Technology and the Refining Industry

A Case Study: Hydrofluoric vs. Sulfuric Acid

Executive Summary

What Is IST?

IST (Inherently Safer Technology) is a conceptual approach to engineering involving chemical processing procedures, equipment, protection and, when feasible, the use of less hazardous substances in these processes. IST is not a technique; it is a philosophical approach to reviewing a facility's operations and may or may not involve the substitution of certain chemicals for alternatives. Proponents of mandating IST as part of new security legislation believe that the substitution of chemicals will lead to more secure facilities that are less vulnerable to a terrorist attack.

Some argue that IST should be mandated as a security measure in the refining and petrochemical industry. In refining specifically, advocates of such an approach wish to force a switch from the use of hydrofluoric acid to sulfuric acid in a refinery's alkylation process. These proponents imply that sulfuric acid is the "safer" alternative.

What Does This Case Study Examine?

This paper examines whether IST results in more secure facilities that are less vulnerable to a terrorist attack, and if the proposed chemical substitute is a "safer" alternative. Ultimately, it concludes that a decision on which chemical to use is a complex one that requires an analysis of safety, risk and potential risk-shifting. One acid is not necessarily "safer" than the other; decisions as to which acid to use are best left to highly-trained and professional practitioners from the appropriate scientific disciplines.

Arguments that a refinery can easily switch from hydrofluoric acid to the "safer" sulfuric acid are not based on facts:

The Facts

- Sulfuric acid can be just as dangerous as hydrofluoric acid in certain terrorist attack scenarios.
- The alkylation process takes roughly 250 times more sulfuric acid than hydrofluoric acid to achieve the same result; therefore, a forced switch to sulfuric acid would result in a significant increase in transportation and transfer of the substance.
    - For a 10,000 barrel per day alkylation unit, this equates to one to two truckloads of hydrofluoric acid delivered to the refinery *each month,* compared to three to four truckloads of regenerated sulfuric acid coming in and three to four truckloads of spent sulfuric acid going out *each day*.
- Mitigation techniques and equipment appropriate to the delivery, storage and use of each acid minimize off-site consequences for a potential accidental release of either acid.
- A mandate for a refinery to switch from hydrofluoric acid to sulfuric acid will result in capital and design *costs between $45 and $150 million dollars per refinery and an increase in operating costs of between 200 and 400 percent*.

In conclusion, both acids have advantages and disadvantages in areas such as environmental impact, safety and cost. This paper does not demonstrate a preference for the use of one acid over another. Rather, it proves there are real-world challenges and unacknowledged consequences when safety decisions are made by lawmakers rather than specially trained professionals. In other words, IST is not a panacea for chemical site security.