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Standard Practice

Design, Fabrication, and Inspection of Tanks for the Storage of Petroleum Refining Alkylation Unit Spent Sulfuric Acid at Ambient Temperatures

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NACE International
15835 Park Ten Place
Houston, TX 77084-5145
+1 281-228-6200

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Foreword

Sulfuric acid (H_2SO_4) is the largest-volume commodity chemical in use today. It plays some part in the production of nearly all manufactured goods. One large use of concentrated sulfuric acid is as a catalyst for refinery alkylation units. In these units, C3-C5 olefins such as propylene or butylene are reacted with isobutane to form gasoline-blending components such as isoheptane and isooctane. These gasoline-blending components are used to boost octane for automobile and aviation fuels.

Most refineries have an alkylation unit that uses either hydrofluoric acid (HF) or sulfuric acid as the alkylation catalyst. This standard deals with spent sulfuric acid associated with the sulfuric acid alkylation process only.

Refineries using sulfuric acid alkylation typically require tanks for the storage of fresh (not yet used in the alkylation process) and spent (used in the alkylation process and in need of regeneration) acid. Design, fabrication, and inspection of fresh sulfuric acid tanks are covered in NACE SP0294.[1] This standard covers additions and deviations from SP0294 that apply to spent sulfuric acid storage tanks.

Large, vertical sulfuric acid storage tanks are usually built in accordance with API[(1)] Standard 650[2] or API Standard 620,[3] and horizontal cylindrical tanks are built in accordance with the ASME[(2)] Boiler and Pressure Vessel Code, Section VIII, Division 1.[4] Although these codes and standards are sufficient for design strength and toughness considerations, they do not address the peculiarities of corrosion by alkylation unit spent sulfuric acid service. In addition, alkylation unit spent acid may contain dissolved hydrocarbons and hydrogen that release into the vapor space of these tanks and potentially produce an explosive environment. Thus, special care must be taken to deal with vapor leakage from the vapor space of these tanks and air intrusion into the vapor space of these tanks.

Carbon steel corrodes moderately when in contact with alkylation unit spent sulfuric acid. If tanks are properly designed and adequately maintained, use of carbon steel is an economical option for the storage of these acids at ambient temperatures. However, accelerated corrosion can occur in various forms, and a catastrophic failure of a spent acid tank in Delaware City, Delaware, U.S., has focused attention on the hazards associated with corrosion, vapor space leakage, and hot work on or around alkylation spent sulfuric acid tanks. The Chemical Safety Board[(3)] report[5] provides more details regarding this failure.

This standard is to be used in conjunction with NACE SP0294. It is intended for use by owners/operators and fabricators of alkylation unit spent sulfuric acid storage tanks. This standard was prepared by Task Group (TG) 300, "Petroleum Refining Spent Sulfuric Acid Storage Tank Requirements: Standard." It was published in 2005 and reaffirmed in 2010 and 2015 by TG 300. TG 300 is administered by Specific Technology Group (STG) 34, "Petroleum Refining and Gas Processing," and sponsored by STG 36, "Process Industry—Materials Performance in Chemicals." These committees include representatives of companies involved in the production, transportation, and use of large quantities of spent sulfuric acid. This standard is issued by NACE International under the auspices of STG 34.

In NACE standards, the terms *shall, must, should*, and *may* are used in accordance with the definitions of these terms in the *NACE Publications Style Manual*. The terms *shall* and *must* are used to state a requirement, and are considered mandatory. The term *should* is used to state something good and is recommended, but is not considered mandatory. The term *may* is used to state something considered optional.

(1) American Petroleum Institute (API), 1220 L St. NW, Washington, DC 20005-4070.
(2) ASME, Two Park Avenue, New York, NY 10016-5990.
(3) U.S. Chemical Safety and Hazard Investigation Board (CSB), 2175 K St. NW, Suite 400, Washington, DC 20037-1809.

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