SULFURIC ACID STORAGE TANKS

Almost every process plant, power plant and water treatment plant has one or more concentrated (70% to 99.5%) sulfuric acid storage tank. It may surprise you to learn that concentrated sulfuric acid can be stored in uncoated, unlined carbon steel tanks at ambient temperature because, concentrated sulfuric acid forms a protective iron sulfate film on the carbon steel that prevents carbon steel metal loss. They key word here is concentrated. Concentrations less than 70% or greater than 99.5% will be very corrosive to carbon steel and these sulfuric acids cannot be stored in unlined carbon steel vessels. It is extremely important that these tanks be properly designed and maintained throughout their lifetime. Concentrated sulfuric acid has a tendency to absorb water causing it to become diluted and hence corrosive. Unlike most corrosive substances, sulfuric acid becomes more corrosive as it is diluted by water. Thus a very minor leak in a sulfuric acid system can rapidly become a major leak when the acid absorbs water from the air.

GENERAL DESIGN BASES:

As noted above, it is not necessary to coat or line a concentrated sulfuric acid tank; however some carbon steel tanks are lined with a high-temperature baked phenolic coating or are lead or brick lined to maintain acid purity.

It is necessary to recognize and design the tank to prevent the ingress of moisture into the tank that will dilute the acid leading to excessive metal loss. It is also necessary to recognize and design the ancillary piping and pumping systems to reduce or mitigate the erosion-corrosion effect of the moving sulfuric acid. Tank sidewalls and roof inlet nozzles and discharge nozzles are areas of particular concern due to localized disturbance.

Concentrated sulfuric acid storage tanks greater than 10,000 gallon are normally vertical carbon steel tanks often built in accordance with API Standard 650 (Welded Steel Tanks for Oil Storage).

Tanks up to 10,000 gallon are normally horizontal tanks built to UL142 Standard with a significant corrosion allowance.

Many tanks are designed and built to internal company standards that include specific design features such as corrosion allowance and nozzle configuration that will minimize the erosion-corrosion effect of the acid. Since sulfuric acid is almost twice as heavy as water, the plate thickness required would be more than for a tank designed to store water. Also additional corrosion allowance is generally incorporated into most designs to allow for some metal loss due to corrosion.
Tanks built since 1994 often incorporate some or all of the recommendations listed in NACE International, Recommended Practice RP3294-94 (Design, Fabrication, and Inspection of Tanks for the Storage of Concentrated Sulfuric Acid and Oleum at Ambient Temperatures).

It is absolutely necessary that these tanks are inspected and maintained on a regular basis or they will eventually fail.

The State of Florida requires that every facility that has aboveground storage tanks (AST’s) greater than 110 gallon capacity that contain mineral acids abide by the rules of Chapter 62-761.890 Florida Administrative Code. Although there are a few exceptions, these facilities are required to provide a Containment Integrity Plan (CIP) that establishes procedures for the inspection and maintenance of tanks storing mineral acids at that facility. The purpose of the CIP is to ensure control of the specific mineral acid for the expected lifetime of the tank. A professional engineer registered in the State of Florida must certify the CIP for compliance with the rule and the CIP must be reviewed and updated by a Florida P.E. at least every two years to ensure that:

1. The tanks covered by the CIP for that facility have been inspected and maintained in accordance with the CIP.
2. The integrity and containment of the tanks has not been compromised.
3. The tanks have secondary containment in accordance with the requirements.

Mineral acids includes: hydrobromic acid (HBr), hydrochloric acid (HCl), hydrofluoric acid (HF), phosphoric acid (H₃PO₄), and sulfuric acid (H₂SO₄), including those five acids in solution, if at least 20% by weight of the solution is one of the five listed acids.

Tank Engineering And Management Consultants, Inc. has registered engineers familiar with mineral acid storage facilities available to assist you with your Containment Integrity Plans.