Acid Storage Tank Protection

Sulphuric Acid is normally stored in large vertical cylindrical tanks fabricated from carbon steel. Tank design can vary from region to region but is usually based on available 'local' standards such as American Petroleum Industry [API] 650 Welded Steel Tanks for Oil Storage or an equivalent specification. While these specifications are a sound basis for storage of oil and other fluids they fail to take full recognition of the unique physical properties of sulphuric acid in particular its density and the corrosive nature of the liquid.

Commercially sulphuric acid is normally produced in grades ranging from 93 to 99% H₂SO₄ plus Oleums which are greater than 100% H₂SO₄. 93–95% acids are widely produced due to their low freezing points.

CORROSION
Sulphuric acid is highly corrosive and the corrosion within a given storage tank is dependant on a number of issues: e.g. temperature, concentration and activity of tank and purity of acid.

General corrosion rates in a 95% H₂SO₄ tank with 'cold' < 25°C acid can range from 5 – 20 mils/year [0.12 - 0.50 mm/yr] dependant on tank activity and purity of the incoming acid. Modern sulphuric acid plants produce acid with very low levels of contaminants e.g. Iron and as a rule the lower the contaminants the more aggressive is the acid so corrosion rates increase.

HYDROGEN INDUCED CORROSION
The by-products of corrosion are iron sulphate and hydrogen. Liberated hydrogen rapidly rises to the surface, but as it rises it cuts into the natural sulphate film formed on the tank wall and eventually cuts deep groves into the metal. If allowed to go on unabated these groves can attain a depth where the remaining metal has insufficient strength to contain the acid. There have been several reported incidences where sulphuric acid storage tanks have split open. Another area prone to grooving corrosion is the top section of the inspection manway, where the gas can collect and form deep groves ultimately resulting in leakage.

Hydrogen can also permeate into the shell plates and collect in any voids present, creating blisters on the plate surface and ultimately splitting the plate.
**CORROSION CONTROL**
Fortunately, carbon steel can be anodically polarized to greatly reduce both general corrosion and the effects of hydrogen grooving.

By passing an anodic current between an immersed Cathode and the tank wall, a stable protective oxide film is formed on all wetted tank surfaces which reduces further corrosion and resultant liberation of hydrogen.

Any small amounts of hydrogen liberated are immediately drawn to the Cathode where they harmlessly rise to surface without contacting the tank.

Chemetics has been supplying acid storage tank protection systems since 1976 and has accumulated several million operating hours of experience on tank with contents ranging from 77% to 99% H$_2$SO$_4$ and up to 35% Oleum.

**ANOTROL® SYSTEM**
The hardware required is the same ANOTROL® system as that used on Chemetics anodically protected acid coolers with the exception that multiple power supplies are required on very large tanks. Tanks in excess of 30,000 ton capacity have been successfully protected for many years using Chemetics Anotrol Systems.

Components internal to the tank required to measure anodic potential [Reference Electrodes] and the Cathodes to supply the anodic current are all roof mounted to enable ease of servicing.

The Controller/Power Supply(s) is recommended to be mounted as close as possible to the tank to reduce wiring runs and installation costs.

**Controller/Power Supply**
The Remote Display Unit [RDU] which is the Operator interface with the system should be mounted either in the Control Room or a location regularly visited by an Operator.

In addition to the anodic status of the tank the RDU has the capability to display a 4-20 mA output from a level sensing device in the tank giving a visual readout on the RDU screen.