Two-Stage Neutralization Sumps

BY KENNETH A. KUMAR

Neutralization sumps are essential components of a laboratory's environmental management system. They are usually installed in-line to capture and neutralize wastes as they drain from the lab or other critical areas of a facility and before they are discharged to the municipal sewer and carried to the publicly owned treatment works (POTW).

Traditionally, most laboratories have used single-stage limestone tanks for neutralization. In some instances, a second tank provides for destruction of pathogens and other potentially hazardous biological materials in the waste. Many medical and biotechnology facilities now add this "kill" tank to their drainage treatment system. Installed as a second-stage treatment tank directly downstream of the limestone neutralization sump, this tank serves as a chamber in which the waste is brought into contact with chlorine or another biological sterilizing chemical before discharge.

With environmental regulations and the controls imposed on the discharge of wastes increasing, the trend is toward preferring two- stage over single-stage systems. The National Pretreatment Standards (40 CFR 403.5) prohibit discharge of wastes with pH of less than 5.0. The National Standard Plumbing Code, Section 9.7.2, specifies that corrosive wastes should not be discharged from the acid waste plumbing system into the sanitary plumbing system without being thoroughly neutralized or treated by a properly constructed and approved neutralizing device. Section 612 of the Uniform Plumbing Code requires that "chemical or industrial liquid wastes which are likely to damage or increase maintenance costs on the sanitary sewer, detrimentally affect sewage treatment, or contaminate surface or subsurface water shall be pretreated to render them innocuous prior to discharge into a drainage system."

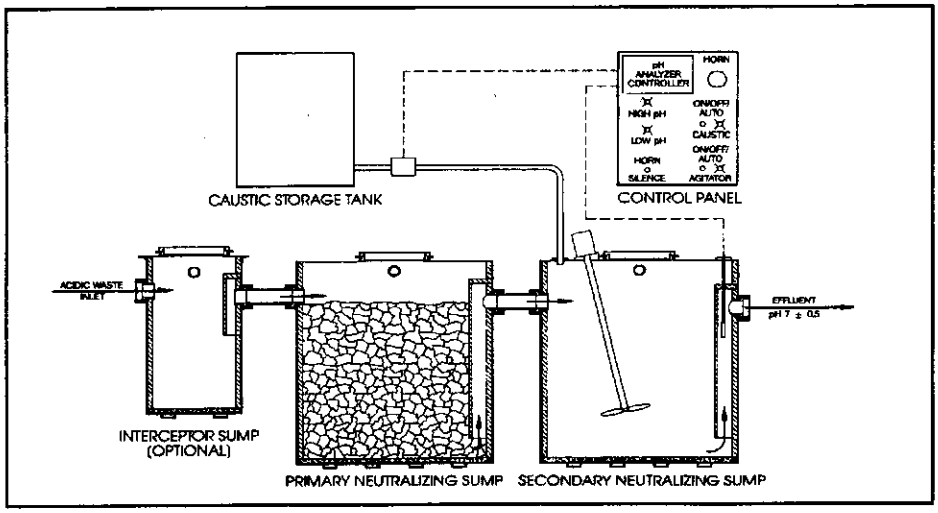
Increasingly, single-stage systems having a pH output of between 4.5 and 7 do not satisfy local codes. When the municipality requires that the pH of the discharge be close to 7.0, two-stage system (as in the illustration) should be used.

In a two-stage system, the first stage, or primary neutralization sump, contains limestone. Most of the neutralization occurs in this limestone tank where a natural chemical reaction between calcium and magnesium carbonate and the entering acid raises the pH. In the second stage, or secondary neutralizing sump, caustic or soda ash is added in accordance with needs for pH control. At times an acid tank may be provided for the purpose of metering in required amounts of acid if the solution happens to be alkaline. An agitator employed in the second stage produces better mixing and more effective control of wastes.

Neutralization tanks are commonly constructed of either molded plastic, fiberglass or ceramic. Molded plastic tanks are available mostly in polyethylene (PE) or polypropylene (PP). They resist most acids but are susceptible to attack from organic fluids. They may be weakened by hot fluids and by heat from exothermal reactions in the drainage. Fiberglass tanks are physically stronger than molded plastic, but their resin-rich coating should be prevented from wicking liquid into the tank and causing delamination. It is extremely important that neutralization tanks do not leak or fail so as to discharge untreated wastes into the soil or surrounding work facility.

Ceramic tanks are temperature-resistant, and because they are homogenous, there is no coating that can be breached. Virtually inert, they are immune to attack by all classes of chemicals except some fluorides and strong caustics. However, even these chemicals, in the amounts and concentrations typically used in a laboratory, do not significantly affect ceramic. For sumps of up to 250 gallons capacity, ceramic tanks are molded in a single piece. Larger ceramic tanks are fabricated from ceramic blocks and acid resistant mortar encased within a steel shell. The monolithic tanks are capable of handling up to 70 lab stations, whereas the larger units can accommodate as many as 1000 lab station applications.

Two-stage neutralization tanks are designed to provide compliance documentation when required by the U.S. Environmental Protection Agency or local POTW, and ensure safe handling of corrosive laboratory wastes.



A typical two-stage acid waste neutralization system in which caustic is added automatically to the secondary sump when pH of the waste is not close to 7.0.

Kenneth A. Kumar *is product manager for environmental systems at Schott Laboratory Systems Division, a Vineland, NJ, manufacturer and supplier of laboratory corrosive management systems. Ken has an MS in chemical engineering and several years of environmental experience.*