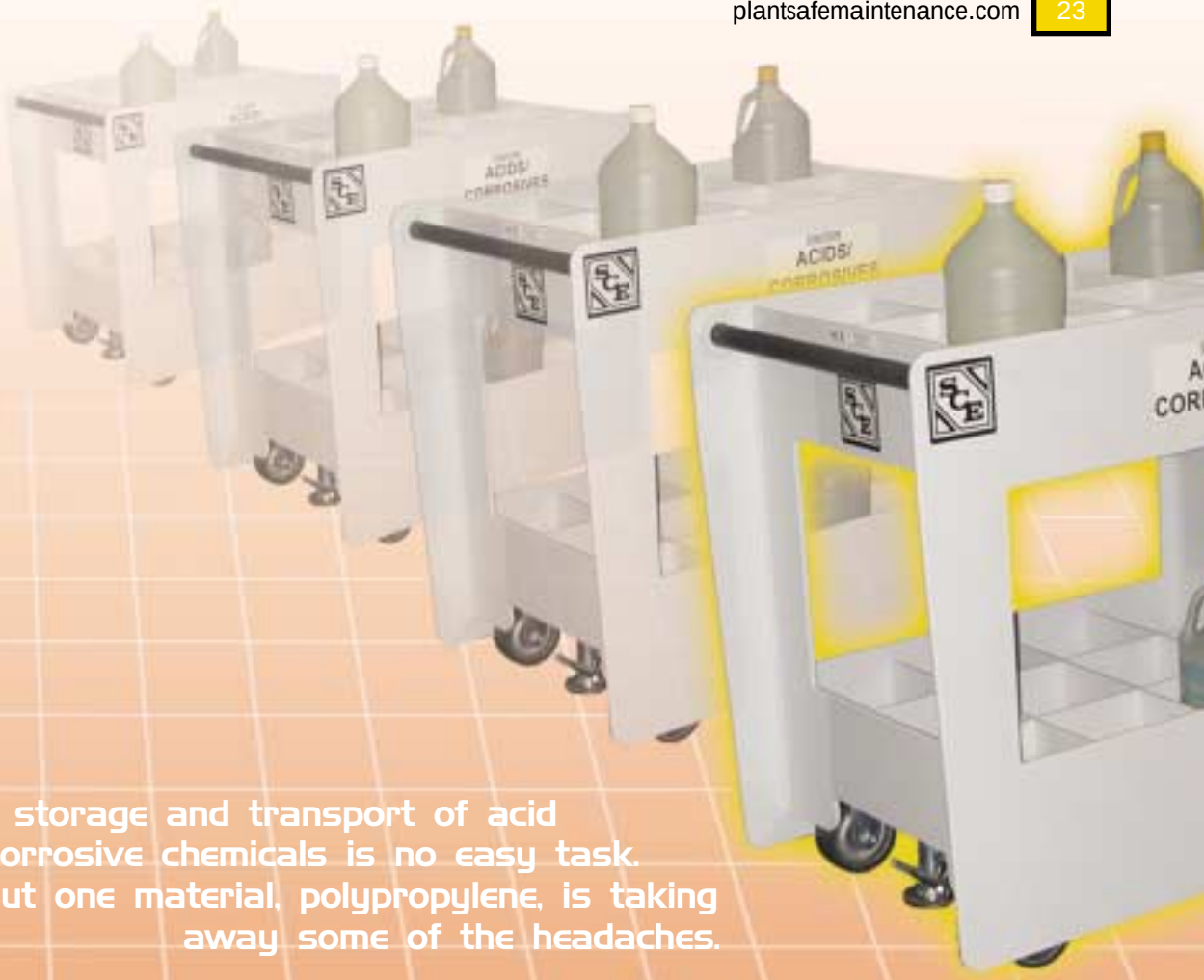
Beyond Flammable Chemicals: Solutions for ACID/CORROSIVE Chemical Storage & Transport

Marty Weiss, South Coast Enterprises



The safe storage and transport of acid and corrosive chemicals is no easy task. But one material, polypropylene, is taking away some of the headaches.

Chemical storage and transport of flammable chemicals and acid/corrosive chemicals is not a new subject, but it is one that all safety and plant managers continually address. But, while there is a broad selection of products for flammable chemicals — including painted steel, stainless steel and even wood core products — the opposite is true for acid/corrosive chemicals.

Most often, the products offered for acid/corrosives are basically the same as for flammables, but this often results in products that rust, rapidly deteriorate, produce contamination, or fail to offer optimum spill containment or fume control. For these problems to be eliminated, proper investigation of improved product design and chemical resistant material options is necessary.

Step One: Codes and Regulations in the United States

Codes and regulations in the United States — NFPA, OSHA, FM, UL Listing and UFC — all address the subject of chemical storage, and some address chemical transport.

The selection of products that meet these codes and regulations for flammable chemicals are easily found in the marketplace. For example, the codes and regulations generally require a double-wall, 18-gauge metal construction with a 1.5" air gap, spill containment, and spark arrestor on ventilation/exhaust connections and self-closing/latching doors make for a cabinet that will usually meet NFPA, OSHA and the UFC. Acid/corrosive chemical storage and transport, on the other hand, offers many new challenges. Here, the codes/regulations are less specific. Many end users have had unsatisfactory experiences with the traditionally-designed storage cabinets and carts, which has left the end user wanting for an optimum product design.

Five Criteria for Designing the Optimum Acid/Corrosive Chemical Cabinet or Cart

1. Material Selection

Proper material selection in the acid/corrosives category hinges on proper material selection. And, to the rescue comes a variety of "plastic" acid/corrosive chemical resistant materials: polypropylene and polyethylene. These materials offer excellent chemical resistance to nearly all acids/corrosives at room temperature storage.

Polypropylene has been the material of choice for the semiconductor and plating industries for the past 40 years. Few other industries utilize so many acid and corrosive chemicals into the process to manufacture the devices and circuit boards that make computers, televisions and most electronic devices function. We can learn from their experiences and apply them directly to the design of safe acid/corrosive chemical storage cabinets and carts.

Polypropylene is most widely used in the standard form that comes in sheets of various thickness. Using a welding technology, cut sheet material can be assembled to be liquid tight and extremely strong. The material can be sawed, drilled and routed similar to wood working using the properly designed tools, blades and bits.

Because of the wide use of polypropylene, Factory Mutual (FM) has encouraged the plastics industry to develop polypropylene materials that offer superior fire resistance and smoke generating properties. These are the FM4910 family of materials. Generally, this material is recommended when fire hazards and/or contamination due to smoke are a high risk to facilities and products. Often, the insurance carriers associated with FM recommend the use of this material.

2. Fume Control

Often ignored is fume control using well-designed fume exhaust systems. Acid and corrosive chemicals do not evaporate quickly as compared to flammable chemical solvents. Therefore, the fumes linger for days until even the smallest spill is cleaned away.

Well-designed chemical cabinets have fume exhaust ports that should be connected to the facility fume control system. Only a small volume of exhaust is required to safely sweep away the fumes when the doors are closed. Cabinets with rear plenum exhaust systems provide for optimum fume control at each storage level. With the doors closed, even a large 60"H x 48"W x 18"D cabinet can exhaust well with less than 10 CFM of exhaust air.

Also keep in mind that, since chemical transport carts are on the move, connecting exhaust systems are not practical. This is one of the reasons that chemical transport carts are not intended to be used as storage cabinets. That is, the chemicals should be unloaded immediately upon arrival at the destination.

There is a broad selection of storage products for flammable chemicals but the opposite is true for acid/corrosive chemicals.

3. Cabinet door hinge and latching systems

Door hinges and the latching system must be also chemically resistant and provide for safe latching of the doors. Correct choice of plastic hinges and the utililization of an all-polypropylene, three-point door latching system provides for the optimum design. Double doors should be overlapping to minimize the opportunity for liquids or fumes to leave the cabinet. Exhausting the cabinet will further limit any risk of fumes being emitted from around the door-to-door jam. A lock hasp provides for a level of security required by some users.

4. Ergonomic issues for cabinets and carts

Even a one-gallon bottle of acid will weigh at least 8 pounds. Larger volumes are, of course, even heavier. For cabinets, the upper storage area will not usually exceed 48 to 60 inches above the floor. For carts, the upper storage areas will not usually exceed 48 inches above the floor for one-gallon bottles. When designing cabinets or carts for larger containers, the lifting height is usually restricted to about 24 inches above the floor.

For carts, correct placement of push handle, wheel size and position, plus design of braking systems must include ergonomic considerations.

5. Special issues for chemical transport carts

Chemical transport offers other challenges. The UFC addresses spill containment, material selection, cart size restrictions, braking systems and more. For example, transporting into public corridors demands a fully enclosed cart to limit the hazardous exposure to the passer-by. A braking system, either manual or dead-man, is also required to limit the movement of the cart in an emergency. Carts are not to be used for long-term storage of chemicals.

As with cabinets, flammable chemical transport carts are to be of metal construction and acid/corrosive chemical transport carts are to be of material “appropriate” for this purpose. Again, polypropylene offers an ideal material that meets all the design criteria. Anything from small vials to 55-gallon drums can be safely transported. For the cleanroom, laboratory or general application, stainless steel for flammables and polypropylene for acid/corrosives offer a safe and clean material for this purpose.

Many special applications for chemical transport carts exist. Container sizes, mix, and quantity to be transported, cart space restrictions, and cleanroom use vs. general use all provide for a custom cart design. Therefore, the final cart design decision is made with consultation of the end user and often with the local fire department officer. Common sense application of the UFC has resulted in safe but creative designs of chemical transport carts for all kinds of applications.