Hands On



Mark Zahn, CEF • Mid-Atlantic Finishing, Inc. 4656 Addison Road • Capitol Heights, MD 20743

The Whys & Hows of Waste Treatment

I f you think experienced surface finishers have a lot of superstitions about their work, wait until you talk to a waste treatment operator! As big a deal as applying the finishes, waste treatment is a major component of any process. It is why we don't use cyanide plating baths when they can be avoided ... why we're more careful about what's in the cleaners we use ... and why hexavalent chromium is a nuisance.

This discussion will concentrate (No pun intended!) on the "whys" and "hows" of waste treatment. There are several methods for treating hazardous waste, and odds are that you use two or more types of treatment in your facility.

Types of Waste Treatment

The most prevalent type of waste treatment—and probably the easiest to figure out—is precipitation of metal hydroxides. Copper, zinc, nickel and trivalent chromium are not very soluble at a pH of about 9 or 10, unless they are "tied up" by some complexing agent to keep them in solution.

To take advantage of this fact, a system can be set up that adjusts the pH of used rinsewater to 9 or 10 before it goes into the sewer, and drops most of the metal out of solution. It's a cheap and relatively maintenance-free method, and is typically accomplished by directing all of the acid and alkaline wastewater into one big tank, where it will have time to sit for a while. Before it enters the sewer, the pH is adjusted with caustic soda (sodium hydroxide) or sulfuric acid (hydrochloric acid is also fine), until the pH is somewhere between 9 and 10. (It is possible, I know, to adjust the pH to 8 with no problem of excess metal in the water. Sometimes, however, the final pH required is different, depending on the relative amounts of the metals going into the system, among other things.)

As the pH approaches an acceptable level, the metal dissolved in the wastewater begins to come out of solution—usually as a hydroxide salt. The first clue that this is happening is that an otherwise clear solution begins to turn cloudy. Next, the microscopic particles of solids begin to aggregate, or huddle together, at which point you can see fine chunks of them in the water. Because these solids are more dense than the water around them, they start to settle-out to the bottom of the tank. Unfortunately, they don't settle that quickly, especially if the water is moving—even just a little. Unless you have a 50,000-gal tank dedicated to this, you are a potential customer for companies—both chemical and equipment—that manufacture other things used in this type of system.

Chemical Additives

Chemical additives used are predominantly two types. Most common are flocculants-technically known as "slimy white goo." If just a little bit is mixed in the wastewater ($\sim 6-12$ ppm), it helps the precipitating solids to form big chunks that will settle more easily. Instead of chunks the size of a pinhead, they will clump together in gobs (all these are technical terms) as big as a quarter. There are pitfalls, however. If a system isn't producing good "floc," there is a tendency to add more slimy white goo. That is, of course, the wrong thing to to, because a high concentration of this stuff will cause the precipitant to make smaller chunks again-a little like trying to correct a contamination problem by adding more brightener.

Another common chemical added to this type of system is ferrous sulfate. It is added either before or at the pHadjusting stage to help make more dense "floc," so that particles will settleout faster. It works, but it also adds great bulk to the sludge that must then be hauled away—at no small expense. In the long run, it is better to devote a little more care and a lot less ferrous sulfate to a waste treatment system.

Equipment Considerations

Another reason to avoid using ferrous sulfate is that sometimes its use can require additional equipment. If you add more solids, you make more sludge. There are mechanical means for the efficient settling of solids that do not require additional floor space. One such

device is a clarifier, which is simply a big tank used solely to help settle sludge out of solution. The "slant tube" or Lamella clarifier is filled with dividers that run from just below the surface of the water to a couple of feet off the bottom. They are inserted into the tank during construction and form chutes at a $5-10^{\circ}$ angle from the side wall of the tank, providing a lot of surface area for the newly precipitated metals to come to rest. In this way, the "bottom" of the tank is brought closer to the precipitation sites, so settling time is reduced. The surging action of the water, as it is intermittently pumped over the top of the clarifier, also helps wash the settled precipitant down the chutes.

Treated water is pumped into the bottom of the tank, and then travels up through the tubes, allowing the precipitant to settle onto them. The remaining, now clean, water at the top (called *supernatant*) is pumped to the sewer. Metal hydroxide sludge is collected at the bottom of the clarifier and pumped into a filter press, where it is "dewatered." What is left is a sludge that, if all went well, is about the consistency of wet wallboard. That sludge is approximately 20 percent solids, and is dry enough to ship to a treatment, storage and disposal (TSD) facility.

This all sounds good in theory, but in practice it is seldom simple. Waste streams from surface finishing operations often contain unpredictable mixtures of metals, surfactants, chelating agents, and a host of other things that make waste treatment operators crazy. It is difficult to predict what to expect during the course of any day, and if someone makes a mistake, the lives of your otherwise mildmannered environmental compliance people can get very exciting.

Each person involved in the production operation and waste treatment has a responsibility to the other. Don't make your coworker's job more difficult than it has to be. Waste treatment operators: Be good to the production workers ... maybe they'll confide in you when something goes wrong, and everyone will be able to go home on time.