# Reducing Air Pollution from Electroplating Operations

## Shops can lessen or eliminate burdens involved with APC systems.

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Air pollution control (APC) is the equipment that everyone loves to hate. It's mandated, a fact which business tends to dislike. It's not a revenue generator. It can slow down (or shut down) a lucrative production process. It has the reputation for being a maintenance headache. Often, there are chemicals or other consumables to buy. And, even when things go smoothly, the paperwork needed just to prove that happy truth can be confounding, tedious and redundant.

So, hate it we do. Some of us, anyway. In actuality, other than the bookend statements above — the parts about mandates and paperwork — there are choices shops can make to lessen or eliminate the burdens involved with each of the other four common complaints regarding APC systems.

For most finishing shops, regulated emissions emanate as fumes from chemical etching, pretreatment, anodizing or plating processes, or as particulate from mechanical processes such as brushing, buffing and blasting.

In any case, at its best, air pollution control produces four benefits — a compliant stack; an indoor environment that requires less housekeeping; a healthier and more productive workplace; and reduced wear and corrosion on equipment and facilities.

### Fumes

Fumes from finishing processes vary, but arguably the most challenging is the trifecta of $HNO_3$ droplets plus NO and $NO_2$ gas-phase contaminants that result when aluminum parts meet nitric acid. All bright-dip chemistries have a nitric component. Thanks to the $NO_2$, they all have the potential to create that nasty brown plume. (Sulfuric fumes may be as formidable, but they're water soluble and easier to manage.)

Where $NO_x$ is a primary contaminant, a packed tower (packed bed) scrubber is an efficient option. These systems, which have a long, strong track record in the metal finishing space, are well able to control inorganic fumes of all types, as well as vapors, gases and some volatile organic compounds (VOCs). Their efficiency range is north of 90% for these contaminants, and systems can be engineered to handle multiple contaminants as well as multiple gas streams.

The heart of a packed tower scrubber is a chamber-containing tower media that provides maximum surface contact between gas and the scrubbing liquid by facilitating continuous formation of droplets throughout the packed bed. This results in high scrubbing efficiency and minimizes the packing depth needed.

The distinctive shaping of ribs, struts and drip rods gives packing media excellent wetting characteristics, low pressure drop, and the ability to maintain uniform liquid distribution throughout the bed.

The design also prevents clogging because there are no flat surfaces or minute openings to harbor particulate. Well-engineered packing eliminates puddling as well because the design is free of corners and valleys and minimizes wasteful liquid flow down the wall surfaces.

During scrubber operation, exhausted gas is forced to the bottom of the scrubber's chamber and flows through the media; clean gas passes through an integral mist eliminator; and slurry falls to the lower part of the chamber for disposal.

Advantages of a packed tower system include relatively low pressure drop, high mass-transfer efficiency and low life cycle cost.

A second option common among metal finishers,

Tri-Mer technician performing hot air welding on a polypropylene vertical flow packed bed tower scrubber.

Tri-Mer packed tower scrubbers serve electroplating operations involving nitric acid, and are well suited for multiple-contaminant gas streams. Scrubber columns operate in series; these are preparing for final assembly and testing. Systems are built for capacities ranging from 100 cfm to 50,000 cfm per air stream.

Tri-Mer polypropylene exhaust fan, manufactured of polypropylene for high resistance to sodium hydroxide. Installation will be downstream of a crossflow scrubber serving an anodize line.

and particularly among those who process with sulfuric acid, is an all-mechanical system called a fan/separator. These 2-stage fume scrubbers first wet the contaminant with scrubbing liquid as it enters the fan, allowing it to be centrifugally spun out of the fan scroll through dynamic mixing. The centrifugal action, using the fan wheel as part of the scrubbing process, eliminates approximately 55% of airstream contaminants.

The impingement stage that follows causes the air to change direction as it passes across a section of rigid packing media, which does double-duty as a mist eliminator. The media is 99% efficient in removing 20 micron and larger liquid droplets under a continuous duty load.

## Particulate

Airborne particulate (PM) and hazardous air pollutants (HAP) in particulate form (PMHAP) can often be controlled by a wet scrubber simultaneously with fumes or gases, but, where particulate is the primary concern, a wet dust collector is most practical for finishing environments. Wet dust collectors work by mixing water and particles, most often using a fixed-position, dual-opposed blade system. Once the dust-laden airstream and liquid are fully combined, a tangential airstream is injected through the lower blade assembly to increase turbulence.

After rotation is accelerated, droplets in the airstream are processed through a downstream mist eliminator and particulate material is isolated for recovery or disposal.

Wet dust collectors are not new, but the best updated designs combine low power demand and low water use with high removal efficiency. Ideally, following original makeup, the only water needed should be that which is required to compensate for what is lost to the system's filter cake — and evaporation.

A well-engineered wet dust collector should also provide two other advantages. First, it should be incapable of clogging under any operating condition. This is important because agglomeration and sticky residues are common downsides of baghouse or pulse-jet style (dry) collectors and one of the main headache producers for maintenance personnel responsible for keeping them online.

Second, if the facility is substantial in size (or growing in that direction), the wet dust collector should be able to deliver true 24/7 operation. That is, it doesn't have to shut down to remove collected particulate or perform other maintenance. Whether your production volume calls for this flexibility or not, the ability to keep operating without declaring "time-outs" for maintenance is a valuable advantage that helps the facility to keep moving forward.