# Controlling VOCs in Paint Finishing

## Factors to review when considering a VOC abatement system . . .

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There is good news and bad news in the air for the paint finishing industry. The bad news: It is virtually certain that spray booths and drying ovens will require new equipment to control VOCs (Volatile Organic Compounds) under a number of new or impending federal and local clean air regulations.

The good news, however, is that one of the most effective systems for coping with these regulatory realities may actually provide a wide range of unexpected benefits in the long run, by minimizing the costs of operation and maintenance.

The first step in dealing with VOCs in industrial finishing operations is to realize that there are as many solutions to the problem as there are painting facilities.

One option for VOC destruction is regenerative thermal oxidation (RTO) systems. Although regenerative thermal oxidation systems do entail somewhat higher capital costs, these costs are typically offset by the system's lower fuel and maintenance requirements. In certain cases, a regenerative thermal oxidation system can convert what was once an undesirable pollutant into a usable energy source, helping minimize the operating costs.

**Inside Regenerative Thermal Oxidizer Technology.** In an RTO system, gases are oxidized in a combustion chamber. The gases exit through a porous heat-transfer section where 95 pct of the heat is recovered in a bed of inert ceramic elements. A system of valves directs incoming contaminated air to the heat-transfer section. Fumes are preheated to within five pct of oxidation temperature using the stored heat from the heat-transfer section. Gases then pass to the combustion chamber.

This continuous cycle of alternately storing and releasing heat in multiple heat-transfer sections allows an uninterrupted flow of process gas through the system at all times.

**Other VOC-Destruction Technologies** include carbon adsorption and recuperative thermal oxidation (metal heat exchangers).

Catalytic systems have not been historically a technology of choice due to particulate carryover, heavy metals and other factors. While some might argue that a fluid bed catalyst is acceptable, it would be wise to evaluate such equipment carefully and ensure that it will function properly in your specific situation.

Given today's higher operating temperatures (1,500F) and the demand for flexible production operation hours, recuperative heat exchangers tend to not have as long a service life as other technologies.

On the other hand, rotary concentrators using adsorbing materials such as carbon or zeolite have been, and continue to be, widely used in the industry. In many instances, the collected VOCs are oxidized after being stripped from the adsorption media. Capital costs are similar to those of RTO, and concentrator systems enjoy a slight edge in operational costs.

The downside of concentration systems is their relative complexity,

**FUEL usage costs**

making such systems more suitable for larger, potentially better-staffed facilities.

**Designing the Right System.** To make the most of the potential benefits of RTO technology, certain realities regarding the integration of the RTO with the paint finishing process must be considered. The following actions are advised:

• Careful evaluation of the upstream filtration system to minimize paint spray/particulate carryover.

• Inclusion of provisions to bake out (thermally decompose) any organic particulate build-up on the inlet side of the RTO system. As these compounds accumulate, they can lead to fire hazards; VOC bypassing into the atmosphere (due to valve-sealing); and a loss of VOC destruction efficiency.

• Inclusion of RTO start-up purge capability independent of the process lines and vice versa, as individual lines must be purged prior to the diversion to the RTO.

• Incorporation of an RTO heat-recovery bypass, allowing the system to accept wider swings in VOC loadings, as are typically encountered in job shops and similar facilities.

RTO is more than a simple add-on to an existing or planned paint line. It's an integral part of the larger system, and must be engineered with each specific situation taken into account.

Questions to ask yourself include: What kind of spray booth do you have — down draft or side draft, automated or manual? What filtering method are you using — dry or water wash? Are you spraying a low or high-solids coatings or water-bornes? Are you using a convection oven? Direct or indirect heat? Every one of these factors makes a difference when it comes to designing an abatement system that will effectively suit your needs.

Other system variables include such external factors as the facility's number of production hours; the number of formulations in use; future expansion plans; and regulatory requirements, such as capture/destruction efficiency, fire codes and insurance requirements.

Then there are regulatory factors: permits; degree of allowable emissions; abatement technology required; and other considerations. For example, in what ozone non-attainment area classification does the facility fit — marginal, serious, extreme? The answer to this question determines the allowable annual VOC emission levels. The type of process determines when the related deadlines for the Maximum Available Control Technology (MACT) standards pertaining to the coating industry are to be in place. Is the facility to be considered a major or a minor source? Are nitrous oxide, carbon monoxide and particulates a concern?

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Because of these and other considerations, bringing a facility into compliance with pollution laws can be a complex matter. The best way to begin is with the following four-stage process:

**1.** Optimize Process Efficiency. The more efficient a paint line, the less work the VOC-control system will have to do. This results in lower energy costs. It pays to evaluate and execute ways to minimize exhaust volume, maximize solvent volume, optimize entry velocities, eliminate leakage and, where possible, recirculate exhaust.

**2.** Quantify Final Process Characteristics. This involves establishing an accurate, quantitative measurement of what is in the stream: exhaust volume, exhaust temperature, solvent loadings, particulate loadings, operation hours, formulations, etc.

**3.** Quantify External Factors. These include the availability and cost of utilities in the area. Can the fuel supply be interrupted? Is there adequate electrical service capacity coming into the plant?

**4.** Evaluate Your Purchasing Criteria. Your near-term and long-range goals will be key deciding factors in determining which system is best suited for your paint line. For instance, are you looking to cut costs in the year ahead? Or can you afford to wait a few years and enjoy greater savings? Only by accurately assessing your real purchasing criteria can you ensure that the system you install will best serve your needs.

Facility managers should also be aware of the standards and codes of the National Fire Protection Association as they apply in various regions. Included in these regulations are those covering fire protection, flammable liquids, spray applications, dipping/coating processes, ovens and furnaces, blowers and exhausts. Also consider the National Electric Code, Uniform Fire Code — Flammable Finishes (West), Standard Fire Prevention Code — Flammable Finishes (South) and any number of other state and local government standards that may apply.

There are several methods for dealing with VOCs in the products finishing industry. By carefully assessing the various factors raised in this article, such as the operational characteristics of your facility, existing and pending fire and safety standards, your company's short- and long-term financial circumstances and a host of other considerations, you can ensure that the system you install will best serve your specific situation.

One final piece of advice, price is becoming an increasingly significant factor in the decision-making process. However, it would be extremely unwise to allow it to cloud your judgment. Bear in mind that if the abatement system you choose does not meet the regulatory permit requirements to which you must adhere, you have accomplished nothing. **PF**

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