Maximizing Heat Recovery From Your Oxidizer

By Mike Scholz,
Anguil Environmental Systems Inc.

More and more, companies operating air pollution control equipment realize that the initial capital cost of an oxidizer system can be rapidly eclipsed by continued operating expenses if careful attention is not periodically given to the system. Here are ten tips to ensure your oxidizer is operating at peak performance.

The first five tips focus on parameters end-users should know about their oxidizer systems, while the last five address energy-reduction projects to be considered.

A concentrator can take exhaust air at or near ambient temperature and concentrate it, providing a VOC-rich airstream to the oxidizer for processing.

Know Your Expected Operating Costs. It is surprising how many facilities cannot answer the following two questions:

- How much is operating our oxidizer expected to cost?
- How close is our oxidizer operating to that expected value?

The "out of sight, out of mind" approach is entirely too prevalent these days when it comes to air pollution control equipment. While that speaks highly for the reliability of systems installed today, it also hints at a blind spot around the day-to-day operating cost of oxidizer systems. With relatively minimal inputs, oxidizer vendors can run a performance model for you and give you the expected operating cost range for your oxidizer system.

Pay Attention to the Percentages. After five years of operation, a regenerative thermal oxidizer originally designed for 95 percent thermal energy recovery (TER) may have slipped to 93 percent TER. This might not sound like a big deal, and it may go unnoticed by even the most attentive maintenance department. However, an average-sized regenerative thermal oxidizer (25,000 scfm) operating for a full year at 93 percent TER vs. 95 percent TER could cost upward of an additional $65,000 a year. Percentage points do count over the course of a year. Get to know the critical parameters to watch as your system ages.

Know Your VOC Loads — Especially the Amplitude and Duration of Peaks. Often, it is peak volatile organic compound (VOC) loads that determine your oxidizer design, but average VOC loads determine your oxidizer operating cost.

When an oxidizer is specified, designed and installed, the anticipated VOC loading peaks are used to dictate the amount of heat recovery incorporated. Typically, estimates for a future "worst-case scenario" are made to ensure a conservative approach is taken.

After a couple years of operation, it may be time to examine whether the design was too conservative, and the peak solvent load is much lower than estimated originally. Operating an oxidizer designed to handle a theoretical peak loading — rather than the actual peak load — can cost you much more than necessary for your actual day-to-day production loading.

Find Out What You'd Buy Today. Finding out exactly what would be specified to treat your process exhaust today is a valuable exercise — especially if your existing equipment is in need of significant repairs or upgrades. Knowing what would be specified in today's energy-conscious market can serve to illuminate cost-effective upgrades to your existing equipment.

For instance, suppose that five to 10 years ago, a regenerative thermal oxidizer with 90 percent heat recovery was specified to treat your process exhaust. Today, oxidizer vendors may prescribe an oxidizer with 95 or 96 percent heat recovery and a hot-gas bypass damper to deal with high VOC-loading periods. If your existing oxidizer system is due for repairs, one can also determine whether it would be cost-effective to upgrade to today's standards at the same time.

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Alternatively, a completely different oxidation technology might be specified if you were installing that five- or 10-year-old system today. With today's control schemes, regenerative thermal oxidizers have expanded their applicability greatly over past years, while also dropping significantly in initial capital cost. Knowing exactly what would be specified today can save you from sinking too much money into an outdated oxidizer system.

Know What Grant Money Is Available to You. Energy-reduction upgrades to existing equipment will have an associated initial capital cost. This can be significantly reduced with grant money from local utility companies.

Across the country, money has been earmarked for the purpose of funding energy-reduction projects. Know what grant money is available to you, whom to contact, and when and how to apply. The main intent of these programs is to take upgrade projects that you (or your management) may be on the fence about and contribute the funds necessary to make them very attractive.

Concentrate High-Volume, Low-VOC Airstreams Prior to Oxidizer. If a significant portion of the air entering your oxidizer is at or near ambient temperature with low levels of VOC loading, using a VOC concentrator may reduce the heat input required by your oxidizer system.

As a result of recent regulations, many facilities around the country have been forced to improve localized VOC capture as well as prove high destruction efficiency in their oxidizer systems. In many cases, this has lead to the installation of additional capture hoods or enclosures and increased the amount of air to be treated by a given oxidizer system.

A concentrator can take exhaust air at or near ambient temperatures and concentrate it so that what is actually sent to the oxidizer system is reduced by a factor of eight to 15 times. This greatly reduced airflow typically is fuel-rich with VOCs, and the concentrated stream is much less of an operating cost burden on the oxidizer system.

Focus on Combustion Air. Combustion air, both in your oxidizer system or in your process burners, is often overlooked as a potential area for operating cost savings. Next to main oxidizer system fans, the smaller combustion fan supplying high-pressure air across the oxidizer burner can seem insignificant. However, these smaller fans, more often than not, are supplying fresh air — at outdoor temperatures — directly into the oxidation chamber, where it must be heated to full oxidation-chamber temperature. At a temperature difference usually more than 1,400°F (778°C), it does not take much airflow over the course of a year to add up to significant operating cost dollars.

Making sure burners are tuned properly and not firing on excess combustion air can make a big difference. With regenerative thermal oxidizers, there is the additional opportu-

10 TIPS: OXIDIZERS AND HEAT EXCHANGERS

1. Know how much your oxidizer is supposed to be costing you to operate — and how much it really is.

2. Pay attention to the percentages and understand the critical parameters to watch as your system ages.

3. Know your VOC loads, especially the amplitude and duration of peaks. Operating an oxidizer designed to handle a theoretical peak loading, rather than your process's actual peak load, can waste money.

4. Know what oxidizer system would be specified for your process today. Even if your system is only five or 10 years old, oxidizer technologies have advanced. Understanding what is state of the art can help you determine whether equipment upgrades, retrofits or even replacement will provide the best payback.

5. Know what grant money is available to you. Some utilities offer grants for equipment upgrades that reduce your energy consumption.

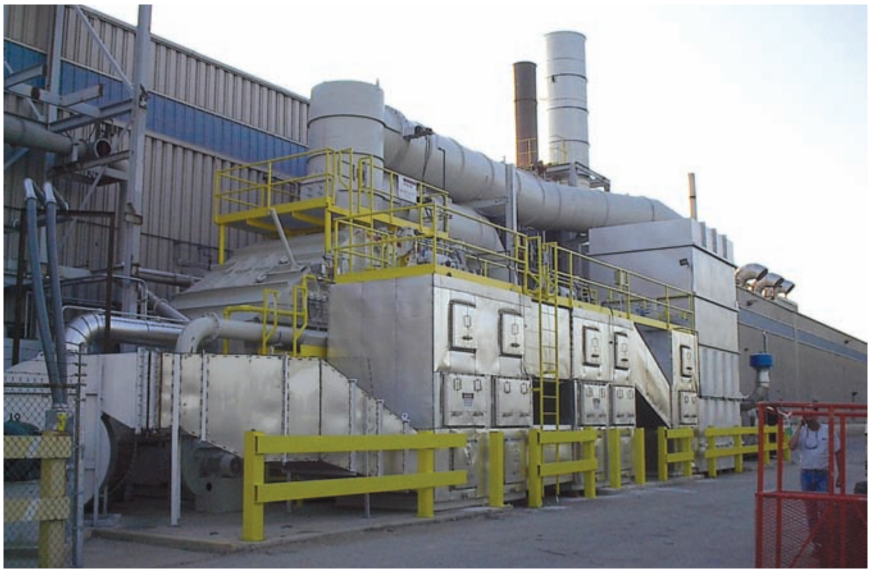
6. Concentrate high-volume, low VOC airstreams. Using a VOC concentrator may reduce the heat input required by your oxidizer system.

7. Focus on combustion air. Making sure burners are tuned properly and not firing on excess combustion air can make a big difference.

8. Improve primary heat recovery. Potential methods include adding passes to the internal air-to-air heat exchanger, changing the ceramic heat-recovery media, or changing the control scheme.

9. Consider secondary heat recovery. Heat exchangers can be added to the exhaust stack to capture excess stack heat.

10. Properly maintain existing systems. Small inefficiencies in system operation can lead to high operating costs.



New oxidizer designs can deliver 95 or 96 percent heat recovery and a hot-gas bypass damper to deal with high VOC-loading periods.

To improve primary heat recovery in regenerative thermal and regenerative catalytic oxidizers, consider increasing or changing the type of ceramic heat-recovery media.

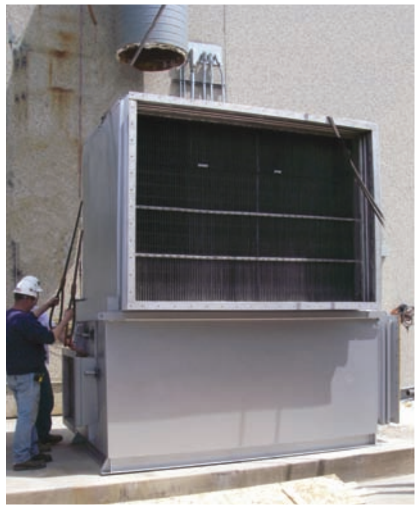
nity to install a flameless fuel-injection system where combustion air is not needed at all. Finally, even with a perfectly tuned burner, combustion air can be preheated using a heat exchanger or a blend with stack air.

Improve Primary Heat Recovery. Oxidizers typically are designed with some form of internal heat recovery. Usually, the hot purified gases leaving the combustion chamber are used to preheat the incoming solvent-laden airstream. This is referred to as the primary heat recovery of an oxidizer system.

Projects that improve the primary heat recovery of an oxidizer system often offer the quickest payback because they provide additional heat recovery at all times that the oxidizer is in service. For recuperative thermal and catalytic units, this typically consists of adding additional passes to the internal air-to-air heat exchanger. For regenerative thermal and regenerative catalytic oxidizers, this would be handled with increasing or changing the type of ceramic heat-recovery media, or changing the control scheme that dictates how often beds are switched from inlet to outlet.

Consider Secondary Heat Recovery. If improving primary heat recovery is not cost-effective — or if oxidizer operating conditions do not allow it — secondary heat recovery may be the best option for conserving the heat input to an oxidizer system. Heat exchangers can be added to the exhaust stack of an existing oxidizer to capture excess stack heat in air, water or even steam. A variety of low-backpressure heat exchanger designs can be added to an oxidizer's stack without requiring replacement of the oxidizer system fan.

Payback for these projects is greatly improved if the captured heat can be used back in the exhaust-generating process itself, because it is assumed that the process is operating at all times that the oxidizer is operating. For example, suppose fresh air is passed through a secondary heat exchanger in an oxidizer exhaust stack, and then it is supplied back as base loading for the oven zones that the oxidizer is treating. Every time the oxidizer is on, the oven zones also require heat, so this heat-recovery project pays back all year long. If the same fresh air was supplied back to the plant as tempered make-



If the captured heat can be used in the exhaust-generating process, the quick payback for secondary heat-recovery projects makes them attractive.

up air, this application may only provide payback during the heating season.

Following this logic, in the past, comfort heat applications may have been ignored. But considering today's unstable and rising fuel costs, coupled with the energy-recovery grants available to facilities, these projects deserve attention.

Properly Maintain Existing Systems. Finally, no matter how well an overall system is designed, it cannot continue to operate at a high efficiency level without proper maintenance. A handful of small inefficiencies in system operation can lead to a large operating cost over the course of a year. At today's energy prices, regular calibration of feedback instruments and control loops can pay for itself many times over.

All too often, production facilities take the "no news is good news" approach to their air pollution control equipment at the expense of higher operating costs and inefficiencies. Instead, minimize costs and maximize efficiency by chasing the benefits of the "company stays green and saves green" mindset. **PH**

Mike Scholz is a senior application engineer at Anguil Environmental Systems Inc., Milwaukee, Wis., a company that designs and installs new oxidizer systems, upgrades existing oxidizer systems and provides other air pollution and heat recovery systems. For more information from Anguil, call (414) 365-6400 or visit www.anguil.com. Contact Mike Scholz at mike.scholz@anguil.com.