

Thermal Oxidizer

Destroy VOCs efficiently and cost-effectively

Founded in 1949, Brown Printing of Waseca, Minnesota, is the fourth largest magazine printer in the country and the community's largest employer. Recognized nationally as a high quality, high volume printer, Brown Printing produces more than 300 titles for America's finest publishers.

Each hour, more than 30,000 pounds of paper and 900 pounds of ink are transformed on the company's 11 web offset presses and other hi-tech equipment into the fine magazines, catalogs and inserts on which the company has built its reputation.

Emission control equipment is a critical element in the 625,000 square foot facility. Without it, they could not operate. In August 2002, the company began the process of replacing their old Recuperative Thermal Oxidizers with new, high efficiency Regenerative Thermal Oxidizers (RTOs). In operation since September 2003, the results to date have been nothing short of phenomenal.



Dean Veldboom, facilities manager for Brown Printing, oversees the operation of two Regenerative Thermal Oxidizers (RTOs) for process emissions control. The impressive units are housed in a custom installation adjacent to the Waseca plant, shown in the background.

Recuperative vs. Regenerative technologies

Thermal oxidizers are designed to burn off Volatile Organic Compounds (VOCs) from process exhaust systems – in this case, varnishes from inks used in Brown's printing processes. An August 2002 inspection showed the company's four rooftop Recuperative Thermal Oxidizer units were at the end of their useful life and needed to be replaced.

Facilities Manager Dean Veldboom worked with Twin Cities engineering firm Sebesta Blomberg to consider equipment options and suppliers for both technologies. They found replacing the old recuperative units with newer units of the same type was not their best choice.

By spring of 2003, two Megtec CleanSwitch™ Regenerative Thermal Oxidizers (RTOs) had been selected. They were installed by September, just over a year from the time the review process had begun.

“Environmental impact and energy efficiency were critical factors in our selection,” Veldboom said. “Performance is the bottom line. Without this type of equipment, we can't operate. The regenerative technology offered dramatic energy savings and fast payback on the investment, so it was definitely the best solution for our operation.”

Installation and operation

Equipment specifications

Two Megtec CleanSwitch™
Regenerative Thermal Oxidizers
Model No. CS25095

- Maximum flow: 25,000 SCFM each (50,000 SCFM total capacity)
- Operating temperature: 1,600°F.
- Burner BTU/hr (maximum): 4,524,000 BTU/hr (4,524 SCFH natural gas) per unit
- VOC destruction efficiency: 99.3 percent of inlet solvent
- Fan HP (installed): 200 HP each
- Cycle time: 180 seconds

Benefits of Regenerative Thermal Oxidizers

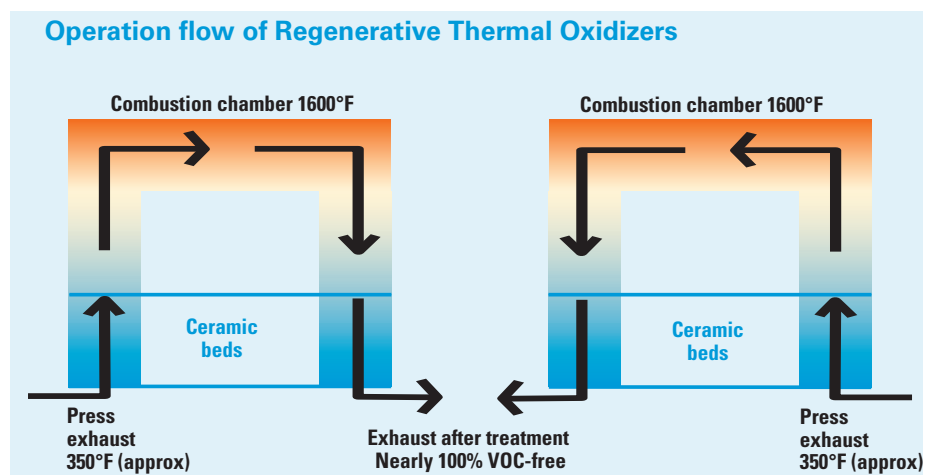
- Significantly lower emissions that exceed industry standards.
- Self-sustaining operation for extremely high energy efficiency.
- Substantial energy savings and fast equipment payback.
- Easy operation and minimal maintenance.

A smooth transition. The two RTOs at Brown Printing are impressive side-by-side, dual chamber units installed in a custom-made housing that blends into the adjacent plant. Ground-level installation of the units, which weigh 70 tons apiece, provides easier access and maintenance.

The greatest challenge Veldboom faced was coordinating the removal of the old units with the installation of the new systems to keep the plant operational. “Everything went well, and we were all pleased,” he said. “Downtime is costly and was kept to a minimum. We needed primarily to tie in duct work from the old to the new system. Because these kinds of projects affect your whole production line, everyone can get pretty nervous. Our start-up went uninterrupted, and we’ve never looked back.”

A simple, yet revolutionary concept. The two RTOs operate in tandem around the clock, adjusting to accommodate the number of presses operating and allowing the company to maintain continuous operation. They take exhaust air, which includes ink residue, off the presses at approximately 350°F. In each separate unit, the VOC-laden air flows into the bottom of one chamber and through the five-foot deep ceramic beds within, where it absorbs stored heat enroute to the top combustion chamber. There, a natural gas-fired burner adds additional heat to reach 1,600°F and incinerate the VOCs.

The hot, clean air then enters the second chamber and begins a downward flow and cooling process, leaving behind a heated ceramic bed to begin the next reciprocal cycle, after which it is exhausted to the atmosphere. This air exchange cycle continues in each dual chamber unit every three minutes.



Press exhaust enters a dual chamber unit, passing through a heated ceramic bed to the combustion chamber where the Volatile Organic Compounds (VOCs) are incinerated. The clean air flows downward through the second chamber, where the ceramic beds absorb the heat to begin the next reverse cycle. The air flow is reversed every three minutes through the dual chambers.

The advantage of Regenerative Thermal Oxidizers is that when running at capacity, they are self-generating and self-combusting. When more ink is used in the printing process, more VOCs are exhausted, which generates more heat in the RTOs. “The more ink on the page, the better these systems run,” Veldboom explained. “When you need them to work hardest, they actually run most efficiently.” When the process generates enough heat to reach 1,600°F in the combustion chamber, no extra natural gas is required. At Brown Printing, the RTOs operate in self-sustaining mode 25 percent of the time.



Programmable settings, fully-automated processes and minimal maintenance allow the thermal oxidizers to operate with minimum attention from Dean Veldboom and other Brown Printing staff.

Programmable controls. Programmable logic controllers (PLCs) control virtually every function on the RTOs: fan speed, temperature monitoring in the chambers and ceramic beds, air flow and volumes, natural gas flow, etc. There are two control panels – one for each unit – plus a main control panel in the plant that monitors the entire system. Built-in sensors, established settings and a fully-automated process allow the system to “pretty much run itself” according to Veldboom. A central operator can troubleshoot or make adjustments, but the RTOs require little hands-on attention.

Minimal maintenance. The dual units require minimal maintenance, and one can easily be taken down for the maximum two days required for a manufacturer’s representative to check for contaminants and adjust fans, valves, thermocouples and other components. Life expectancy for the ceramic beds is the same as for the units themselves – 20 to 25 years – as long as they are not contaminated. As added backup during maintenance periods, Brown Printing kept one of its four recuperative rooftop units.

The existing installation was designed to handle added plant capacity in an expansion. Heat recovery applications could also be considered to pre-heat air for space heating and makeup air, but there is no need at present.

Performance that exceeds expectations

Though Brown Printing’s new Regenerative Thermal Oxidizers have been in operation for just over one year, Veldboom and his colleagues are delighted with their performance.

Significantly lower emissions. “Our system was designed to eliminate a minimum of 99.5 percent of VOCs, which exceeds Minnesota Pollution Control Agency standards,” he explained. “They are actually doing 99.9 percent, which is outstanding. The results are even better than we expected.”

Dramatic energy savings. Natural gas savings are also much higher than anticipated. The RTOs are significantly more energy efficient than their predecessors, using just 700 dekatherms of natural gas a month compared to 6,000 previously. Veldboom offered this comparison: “We save enough energy annually to heat nearly 700 homes, which would be a large portion of Waseca.” Compared to the old Recuperative Thermal Oxidizers, the new equipment reduced natural gas consumption by 89 percent, which resulted in an overall plant reduction in natural gas consumption of 30 percent.

Swift payback. With energy savings higher than anticipated and the money-saving advantages of a CenterPoint Energy Custom Rebate, projected payback is now expected to be less than four years.



Brown Printing’s 1,000 employees produce more than 300 titles in the Waseca plant. The new Regenerative Thermal Oxidizers greatly reduce energy costs and contribute to the company’s ongoing success.

“Anytime you can get a four-year payback on a piece of support equipment, it’s just tremendous,” Veldboom emphasized. “The printing industry is under a lot of pressure today. We’re fortunate to have the capital to invest in a system like this that will help us remain competitive. It’s been a good investment for us.”

Brown Printing’s two other U.S. plants in Pennsylvania and Illinois also have RTO installations.

Industries that can benefit from this technology

Adhesive Coating
Asphalt Manufacturing
Bakery
Brewery
Coating
Combustion Turbines
Composite/Synthetic Materials
Chemical Processing
Electronics/Semiconductor
Ethanol
Food Processing
Industrial Boilers
Loading/Unloading
Metals Finishing
Odor Control
Paint Manufacturing/Paint Spray
Petroleum/Hydrocarbon
Pharmaceutical
Plant Process Heaters
Printing/Laminating/Converting
Roasters
Sheet Board Manufacturing
Sheet Coil Coating
Soil Remediation
Steel Mills
Tape Coating
Utility Boilers
Vinyl Products
Waste Heat Cogeneration Systems
Waste Treatment
Wood Furniture

For more information

To learn more about thermal oxidizer technologies and rebates for your business, contact your account manager today.

612-321-4330

Toll free 1-800-234-5800, ext. 4330

www.CenterPointEnergy.com

Options in thermal oxidizer technologies

A thermal oxidizer is an incineration device used to reduce or remove VOCs from process exhaust systems. Which type of thermal oxidizer is right for your operation? It depends on your industry. While the printing industry has been tending toward using regeneratives, “one size doesn’t fit all,” and many options are available. Your best choice will depend on:

- Level of control required
- Pollutant(s) to be removed
- Concentration of the pollutant(s) in the airstream
- Total volume/flow of the airstream
- Operating costs
- First costs of equipment

Types of thermal oxidizers

- **After Burner.** This system includes a burner, burner train, combustion blower and, if needed, a process fan. It is typically used when the concentration of organic pollutant is sufficiently elevated that it produces enough energy to heat combustion products to the required oxidation temperature. If the gas stream does not contain enough energy, the burner supplies the necessary heat. This system may not always be cost-effective due to high gas usage with lower concentrations of VOCs.
- **Recuperative.** This configuration operates much the same as the After Burner; however, it is more economical because much of the waste heat is captured for reuse. A metallic tube or plate-type heat exchanger is built into the exhaust end of the combustion chamber, typically used when the exhaust stream does not contain high levels of particulates and maximum heat recovery is desired. Recuperatives are typically smaller and lighter-weight than other systems.
- **Catalytic.** This option also works well with low concentrations of VOCs. Though similar in design to recuperatives, they use precious metals or metal oxide-based catalysts rather than open flames to burn off solvents. Catalytic oxidizers operate at about half the temperature of other thermal oxidizers and have smaller footprints and lower operating costs.
- **Regenerative.** Extremely high thermal energy recovery is the major advantage of this system. Incoming process gases pass through a ceramic heat recovery bed enroute to the combustion chamber, where they are heated to the desired temperature for incineration. They pass through another heat exchange bed where their energy is absorbed and stored to heat the next cycle. It is extremely cost-effective with up to 95 percent of heat energy recovered and low VOC concentrations processed in self-sustaining mode without adding combustion fuel.
- **Regenerative Catalytic.** The newest oxidation technology, this system operates much like the RTO, but with a layer of catalyst in the combustion chamber. Both precious metal and metal-oxide systems are currently available.