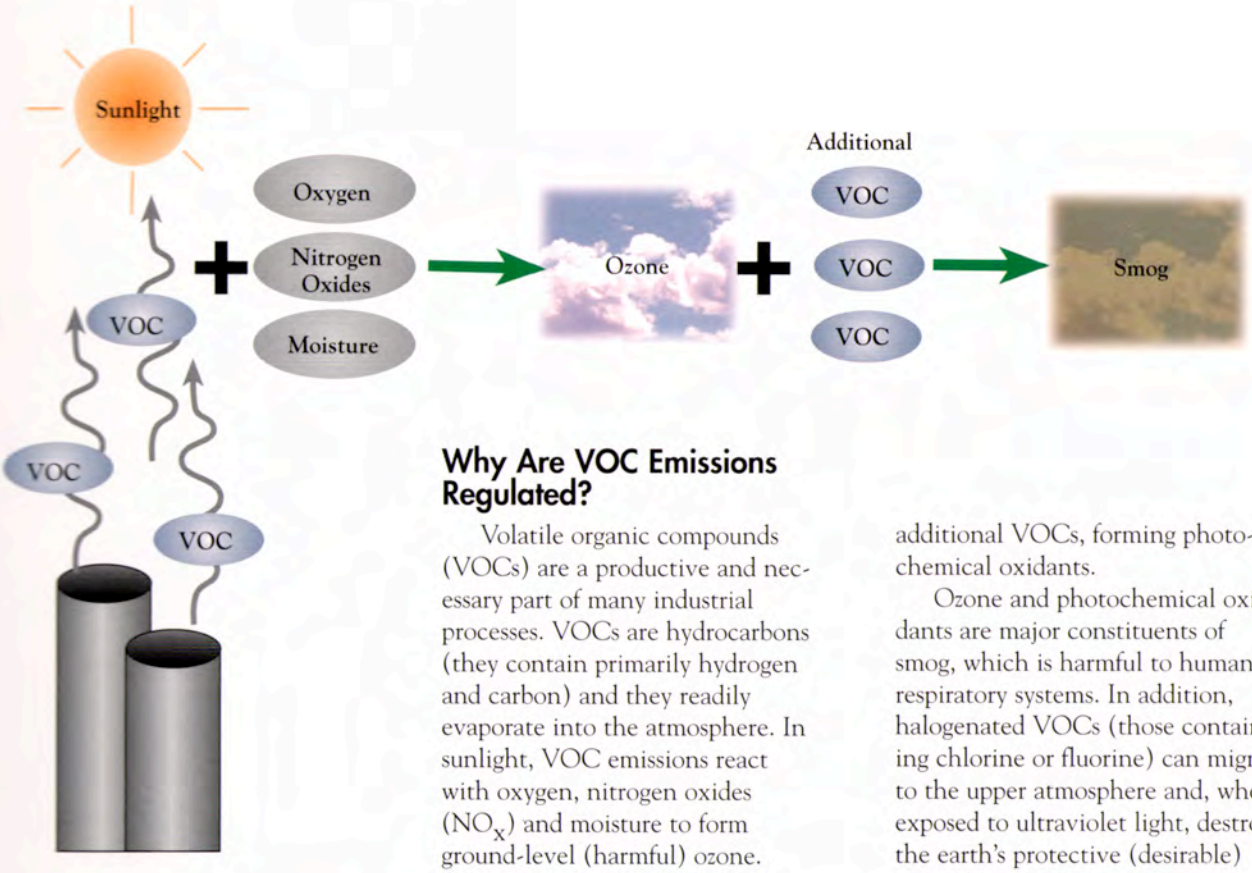
VOC Control Systems

WAHLCO

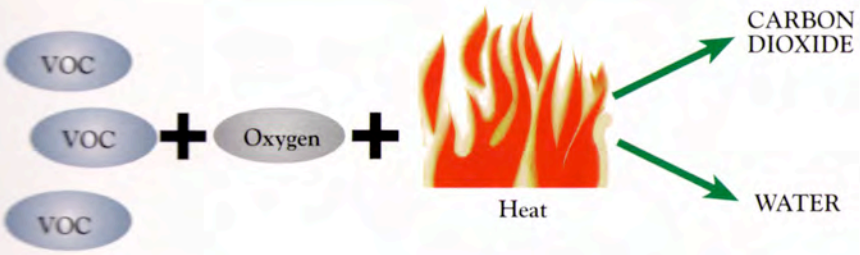
WAHLCO
VOC TECHNOLOGIES

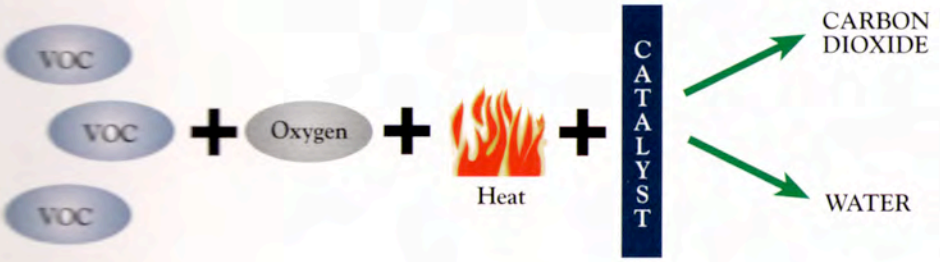


Why Are VOC Emissions Regulated?

Volatile organic compounds (VOCs) are a productive and necessary part of many industrial processes. VOCs are hydrocarbons (they contain primarily hydrogen and carbon) and they readily evaporate into the atmosphere. In sunlight, VOC emissions react with oxygen, nitrogen oxides (NO_X) and moisture to form ground-level (harmful) ozone. The ozone, in turn, reacts with additional VOCs, forming photochemical oxidants.

Ozone and photochemical oxidants are major constituents of smog, which is harmful to human respiratory systems. In addition, halogenated VOCs (those containing chlorine or fluorine) can migrate to the upper atmosphere and, when exposed to ultraviolet light, destroy the earth's protective (desirable) ozone layer.





Converting VOCs To Harmless By-Products

VOCs can be eliminated by a simple chemical reaction with oxygen at elevated temperature, a process known as oxidation. The oxidation process converts VOCs and oxygen into carbon dioxide and water vapor. These CO_2 and H_2O gases are considered harmless – they are the by-products of many natural processes, such as breathing. While virtually all VOCs become oxidized when heated to a temperature of 1400°F or higher, many VOCs can also be oxidized at much lower temperatures in the presence of a catalyst.

Oxidizers are extremely good at destroying VOCs; destruction/removal efficiencies (DREs) of 99% or higher are possible. Oxidizers can also be used to control various nuisance odors, smoke emissions, and air toxics.

Front Cover Photos: *Although VOCs themselves are frequently colorless, they are a major factor in the formation of smog.*

Five Goals For Every VOC Control System

#1 Minimize Energy Use

VOC control systems use two types of energy: fuel and electric power. Wahlco can provide VOC systems with up to 98% thermal efficiency, lowering fuel bills by 60% compared to other designs. Wahlco uses advanced, high surface area heat exchange media to reduce the pressure drop required to achieve high thermal efficiency. This, in turn, reduces fan electric power consumption.

#2 Maximize VOC Destruction

In many cases, regulatory authorities have a surprising amount of leeway when determining future pollution control guidelines for your company. They may consider your past and current pollution control efforts – and may even provide future pollution credits based on commendable current performance. In some situations, achieving high VOC destruction/removal efficiencies today may help you avoid more stringent regulation tomorrow.

As a result, it's often beneficial to achieve the highest possible oxidizer performance *today*. Achieving the first 95% DRE is relatively easy, but many plants require higher DREs. In fact, many industrial processes must achieve 99% DRE or better to meet the EPA's current Maximum Achievable Control Technology (MACT) requirement. Wahlco's unique VOC system designs have achieved destruction efficiencies of 99.99%.

#3 Conserve Valuable Plant Space

Your primary business is not VOC control...so you want your VOC system to use as little space as possible in your plant. Wahlco's super-compact designs fit into your plant as unobtrusively as possible, saving valuable square footage and leaving more room for productive machinery. Even our large systems are available in space-saving configurations, and use of advanced heat transfer media further reduces the overall space required for our equipment.

#4 Eliminate Downtime

A VOC oxidizer failure can cause catastrophic production losses. Wahlco's air pollution control systems have an unparalleled worldwide reputation for reliability.

#5 Minimize Routine Maintenance

Your maintenance crew doesn't need another machine to worry about. Wahlco's high-reliability components reduce maintenance procedures to a bare minimum. And we design our equipment for easy access to key areas.

This compact regenerative thermal oxidizer has three separate chambers inside a single canister and utilizes honeycomb heat exchange media for high energy efficiency. It is used here to purify VOC emissions from multiple sources in a paint and varnish manufacturing plant. This compact design, available up to 20,000 scfm, not only saves space, it costs less than multi-canister oxidizers.

Three-canister regenerative thermal oxidizer with fluorine removal system for a brick manufacturing facility. Multi-canister systems are particularly well suited for large gas volumes (20,000-150,000 scfm and larger).

Select From Wahlco's Wide Range of VOC Systems

Our Flexibility Guarantees Your Success

Because Wahlco designs and manufactures many types of VOC oxidation equipment, including custom systems for a broad cross-section of industries, you can select the VOC system best suited to your individual requirements.

Meeting Your Unique VOC Control Needs

Wahlco will assess your plant's VOC concentrations, exhaust rates, and types of VOCs. A complete emissions profile, including variations over time, identifies the "peaks and valleys" of your VOC loads – key parameters used to determine the type of system that is best suited for your process and to effectively engineer the system to achieve the lowest possible operating costs.

Anticipating Your Future Needs Today

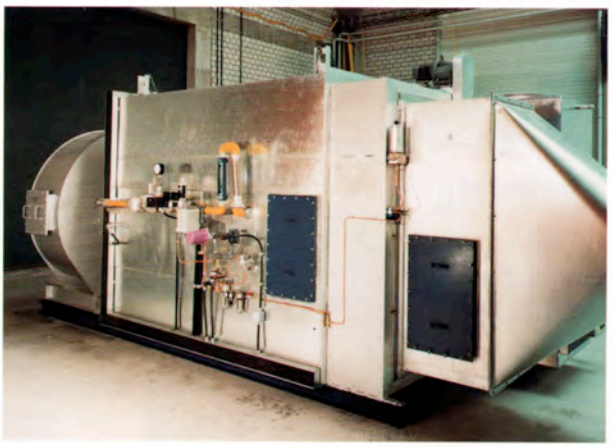
To ensure that we provide the appropriate upgrade path, we will discuss any changes you anticipate in production materials and air flows, including expansion plans.

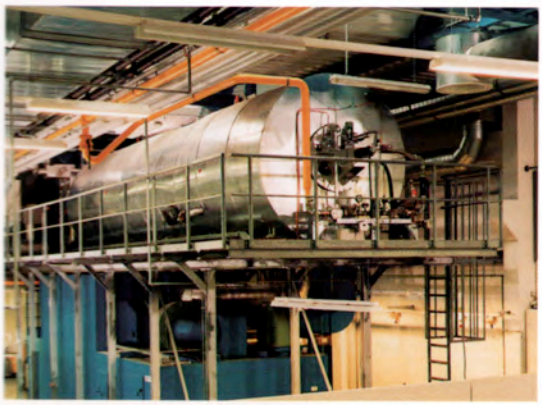
Many Wahlco oxidizers can be expanded without sacrificing VOC destruction or thermal efficiencies. In particular, our systems are designed to accommodate the next generation of burners, catalysts, and heat exchange media.

Custom designed regenerative thermal oxidizer for rotogravure printing. The unique star configuration optimizes space utilization.

Regenerative catalytic oxidizer at a food-processing plant.

Economical, pre-tested, skid-mounted regenerative catalytic oxidizer with rotary heat exchanger. This compact unit serves a sheet-fed gravure press.

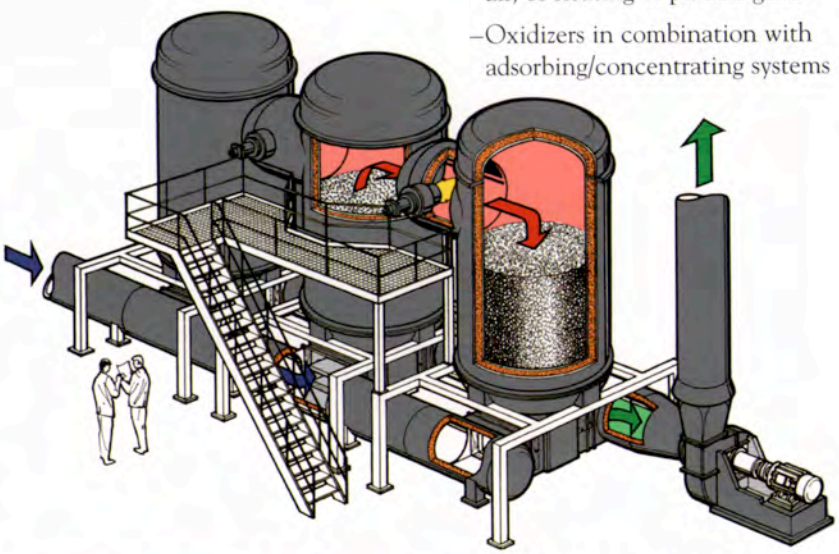




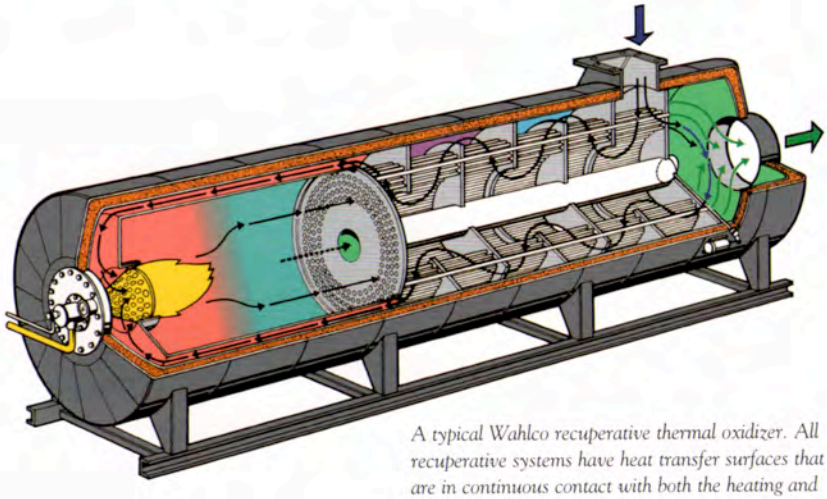
Phenol-laden gases from pleating machines and paper-drying kilns are cleaned by this recuperative thermal oxidizer. The system includes a secondary heat exchanger to provide hot water for plant use.

Wahlco's VOC Technologies At A Glance

- Recuperative Thermal Oxidation Systems
- Regenerative Thermal Oxidation Systems
- Recuperative Catalytic Systems
- Regenerative Catalytic Systems
- Solutions for Special Applications:
  - –Super-compact systems
  - –Pre-tested, skid-mounted units
  - –Modular installation/expansion systems
  - –Systems for aggressive or halogenated VOCs
  - –Low NO_x systems
  - –Heat recovery for process steam, hot-water, thermal-oil, cooling air, or heating of process gases
  - –Oxidizers in combination with adsorbing/concentrating systems



All regenerative systems contain heat exchange "media" to alternately heat incoming gases and then cool exhaust gases after oxidation. This illustration shows a typical three-canister system, one of many Wahlco regenerative configurations. The VOC-laden gas first absorbs heat from the media in one canister, undergoes oxidation, then releases heat to the media in a second canister before exhausting out the stack. The third canister, meanwhile, is used to purge any unpurified gases from the media bed. Every few minutes, the exhaust flow is redirected by opening and closing the dampers on the bottom of each canister, with each canister alternately performing the function of inlet, then purge, and then outlet.



A typical Wahlco recuperative thermal oxidizer. All recuperative systems have heat transfer surfaces that are in continuous contact with both the heating and cooling gases. Incoming VOC-laden gas absorbs heat from the outside of the heat transfer tubes, while oxidized gas gives up heat to the inside of the same tubes.

A Basic Question: Regenerative Or Recuperative Heat Exchangers?

To put it simply, VOC emissions levels and heat recovery requirements will help you to decide.

VOC oxidation requires relatively high temperatures. This translates into a substantial requirement for heat, especially when there are large amounts of exhaust gases to be treated. To minimize the need to add heat, most oxidizers include a heat exchanger, either recuperative or regenerative, to "recycle" heat back into the oxidizer system.

In addition, VOCs themselves release significant amounts of heat when oxidized. Wahlco's engineers design each oxidizer system to achieve a balance between the heat release of VOCs and the thermal efficiency of the heat exchanger. Ideally, "autothermal" operation is achieved.

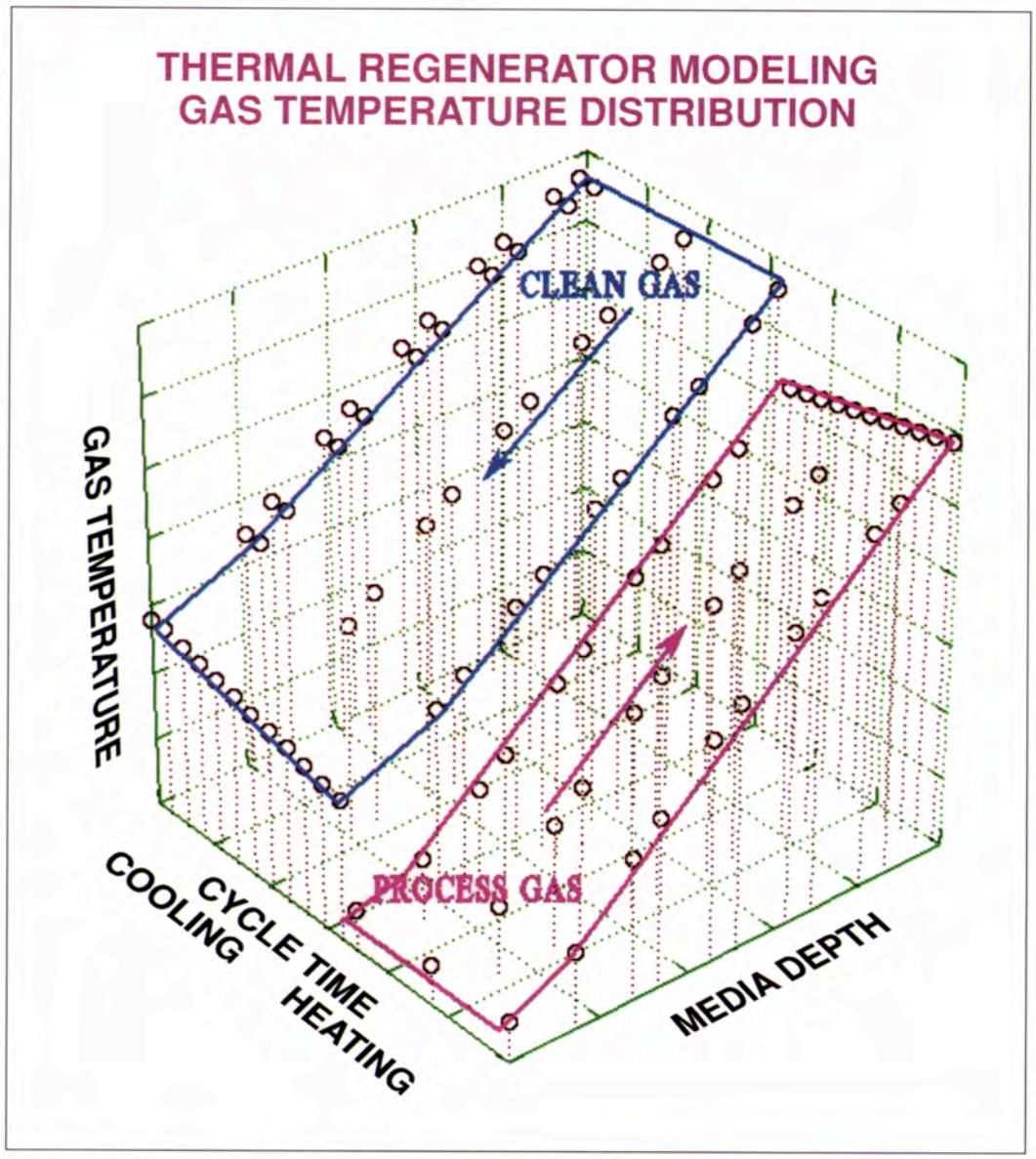
"Autothermal" operation means no supplemental fuel is needed to maintain oxidation temperature—the process is heated entirely by VOC-released energy. Exhaust gases with high VOC levels have lower heat recovery demands, while exhausts with low VOC levels need higher thermal efficiency to achieve autothermal operation.

Regenerative thermal oxidizers (RTOs) have the highest heat recovery rates, with Wahlco systems capable of 98% thermal efficiency. This makes regenerative oxidizers ideal for applications where energy recovery is crucial, such as high volume exhausts with low VOC concentrations.

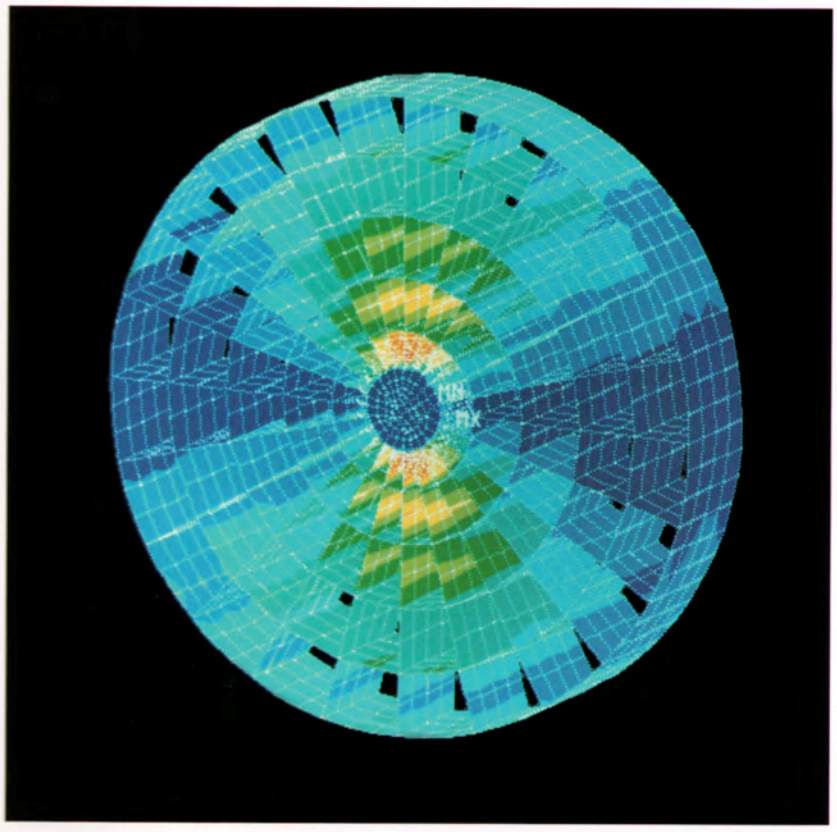
Recuperative thermal oxidizers, on the other hand, benefit from simplicity of operation and relatively low capital cost. Recuperative oxidizers, however, start to lose their cost advantage when the required thermal efficiency approaches 75%. So recuperative oxidizers are more commonly used in applications with high VOC concentrations where extremely high heat recovery is not essential.

At Your Service: Unrivaled Technological Expertise

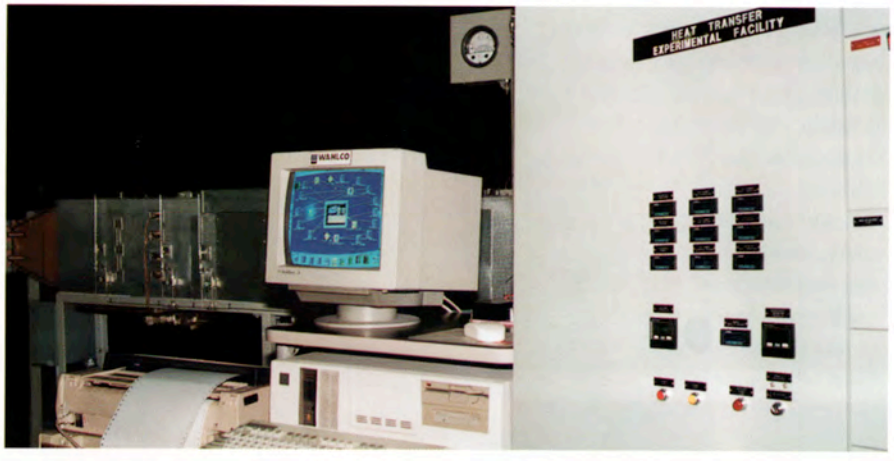
- Extensive experience with oxidation processes, heat transfer materials and catalytic media in air flows up to 2,000,000 scfm.
- Working knowledge of over 1,100 oxidation systems.
- Equipment installations in 75 countries.
- Computational Fluid Dynamics for determining flow and temperature distribution over varying VOC loads and air flows.
- Exclusive proprietary computer modeling to achieve the highest attainable destruction efficiencies and thermal performance.



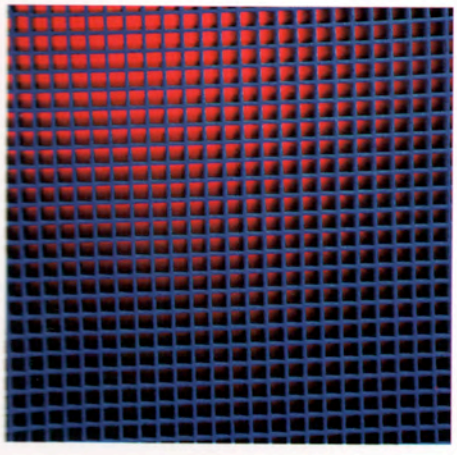
Heating and cooling profile in a regenerative catalytic oxidizer (RCO). A complete understanding of temperature and flow profiles, as shown here, helps Wahlco design RCO units to operate within temperature limits that optimize catalyst performance.



Finite element analysis helped Wahlco locate potential problem areas and devise solutions long before the first component was fabricated for this 40-foot diameter rotary regenerative air heater wheel.



Wahlco designed and operates one of the world's most sophisticated heat transfer testing facilities. We can accurately predict performance for a wide range of processes and heat exchange materials.



Wahlco uses several types of high efficiency heat exchange media, including ceramic honeycomb. Wahlco's experience includes pioneering work in developing new heat transfer media, including several patented designs.

The Economy of Excellence

Fully Guaranteed Performance From An Established Leader

Because of Wahlco's vast experience in air pollution control, and the knowledge we've gained from the more than 700 additional systems designed and manufactured by our technology licensor, LTG Lufttechnische GmbH, Wahlco can offer and meet performance guarantees with confidence.

Lowest Total Costs

Total costs include the expenses to purchase, operate, and maintain equipment over its life. Prices for VOC control systems can vary greatly. High prices do not guarantee better performance. Very low price may signal possible sacrifices in material selection and product life expectancy, or shortcomings in after-sale customer and technical support.

Wahlco offers technically superior systems, and we apply our production engineering expertise to make our products economical to manufacture. For example, computer controlled laser technology dramatically reduces labor costs, allowing us to provide superior stainless steel recuperative oxidizers at prices comparable to, or less than, carbon steel units from other suppliers.

Efficient Energy Use

As an end user, you may be more concerned about energy costs than any other factor. With thermal efficiencies up to 98%, Wahlco offers the world's most energy-efficient oxidizer designs. Many of our systems are "autothermal" at surprisingly low VOC loads. This means that no supplemental fuel is needed for combustion. Wahlco will analyze your VOC loads and local energy rates, and will provide comprehensive cost comparisons for various systems over a meaningful time period.

The Most Reliable System In Your Plant

VOC control system failure could shut down your plant. Wahlco understands the importance of system reliability. Wahlco's philosophy is to design our VOC control equipment to be the most reliable system in your plant. Our engineering experience has taught us that simple designs yield reliable systems.

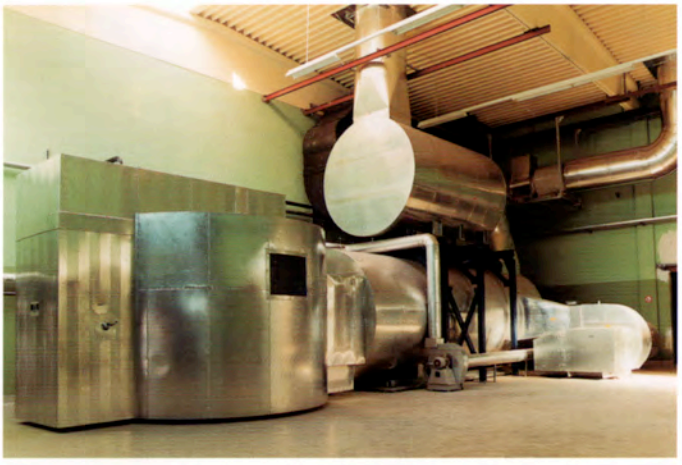
Reliable systems need absolutely dependable components. That's why Wahlco uses special designs for key components, including zero-leakage dampers, high-temperature thermocouples, media supports, flow distribution devices, and catalytic oxidation chambers.

Regenerative thermal oxidizer with honeycomb heat exchange media operates at 97% thermal efficiency at a tube coating and laminating plant.

Systems Built To Last

Wahlco has always built systems that are designed to last the life of the plant. And proper material selection is critical to achieve long system life. The materials selected must resist corrosion while withstanding thermal stress and thermal shock under the harshest operating conditions.

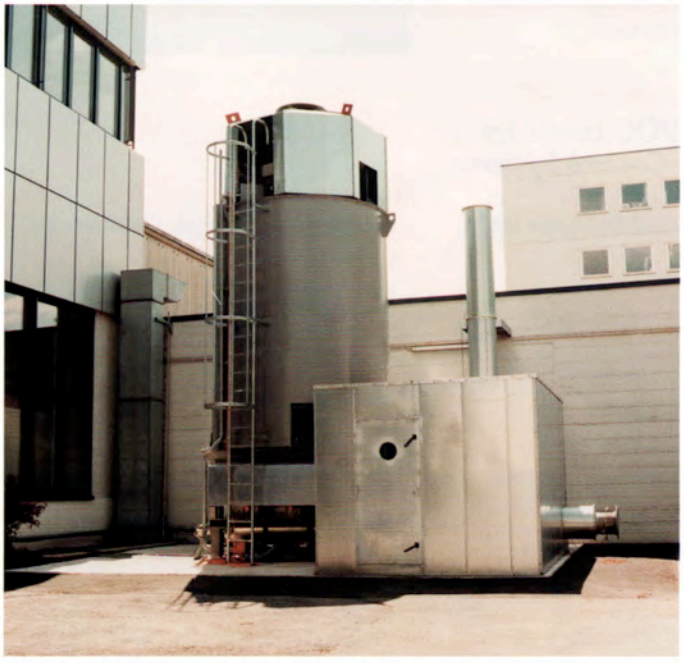
Wahlco uses special materials in critical areas to assure the longest possible oxidizer life. For example, many of Wahlco's recuperative thermal oxidizers have high-grade stainless steel shells and internal components to maximize service life.



Recuperative catalytic oxidizer used to purify exhaust gases from a laundering plant that cleans solvent-laden cloths.

Unsurpassed Damper Performance

Regenerative thermal oxidizers are dependent upon the flawless operation of flow control dampers. These critical subsystems direct the flow of exhaust gas and purified air streams between the various heat-exchanging canisters. The dampers must operate without leakage or malfunction every few minutes, up to as many as 350,000 cycles per year. Wahlco has extensive experience with zero-leakage dampers for fail-safe industrial and utility uses, including super-critical, high-temperature gas turbine installations. The use of our exclusive zero-leakage dampers on critical RTO applications has resulted in measured destruction efficiencies of 99.99%.



Full scale pilot regenerative oxidizer used for testing purposes. This three chamber, single canister oxidizer was used to verify the predicted performance of various types of ceramic heat exchange media.

Uncompromising Technical Support

Installation, Training, Maintenance, and Field Service

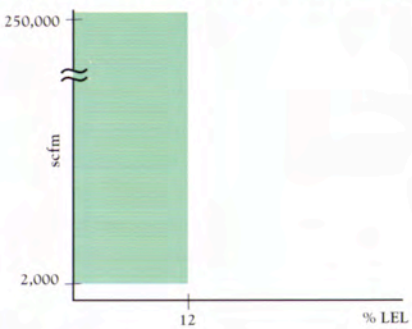
Wahlco will provide any level of field assistance you require, from supervising your installers to providing a complete turnkey installation. We will train your staff to operate the system, and will confirm that your oxidizer meets the performance guarantee. If you desire, we can even arrange a maintenance program so you can be certain that your Wahlco VOC system will always perform at optimum levels.

Flexible Financing

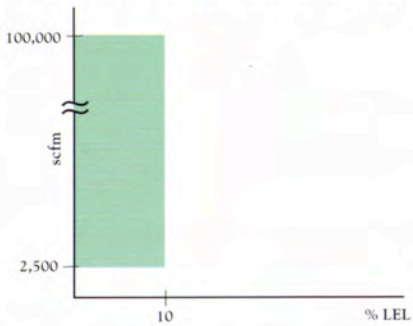
Consider your company's best financial interests, then talk to Wahlco. We can assist in providing innovative financing arrangements, including leasing and lease/purchase options.

Airflow and VOC Levels for Wahlco VOC Control Systems

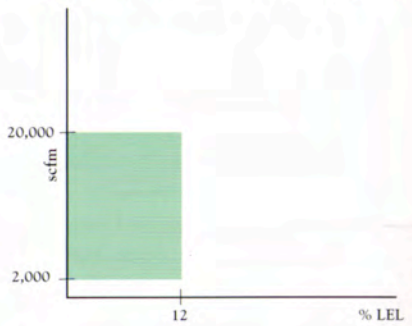
Regenerative Thermal Oxidizers (RTOs)



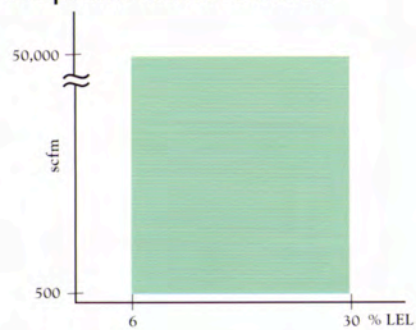
Regenerative Catalytic Oxidizers (RCOs)



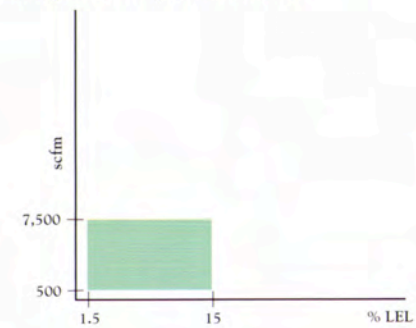
Compact Regenerative Thermal Oxidizers



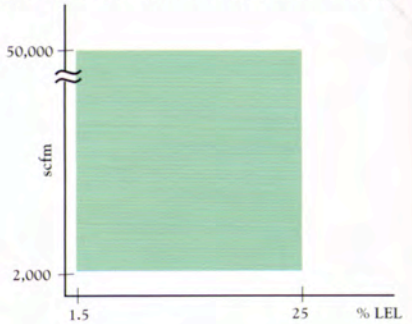
Recuperative Thermal Oxidizers



Compact Catalytic Oxidizers

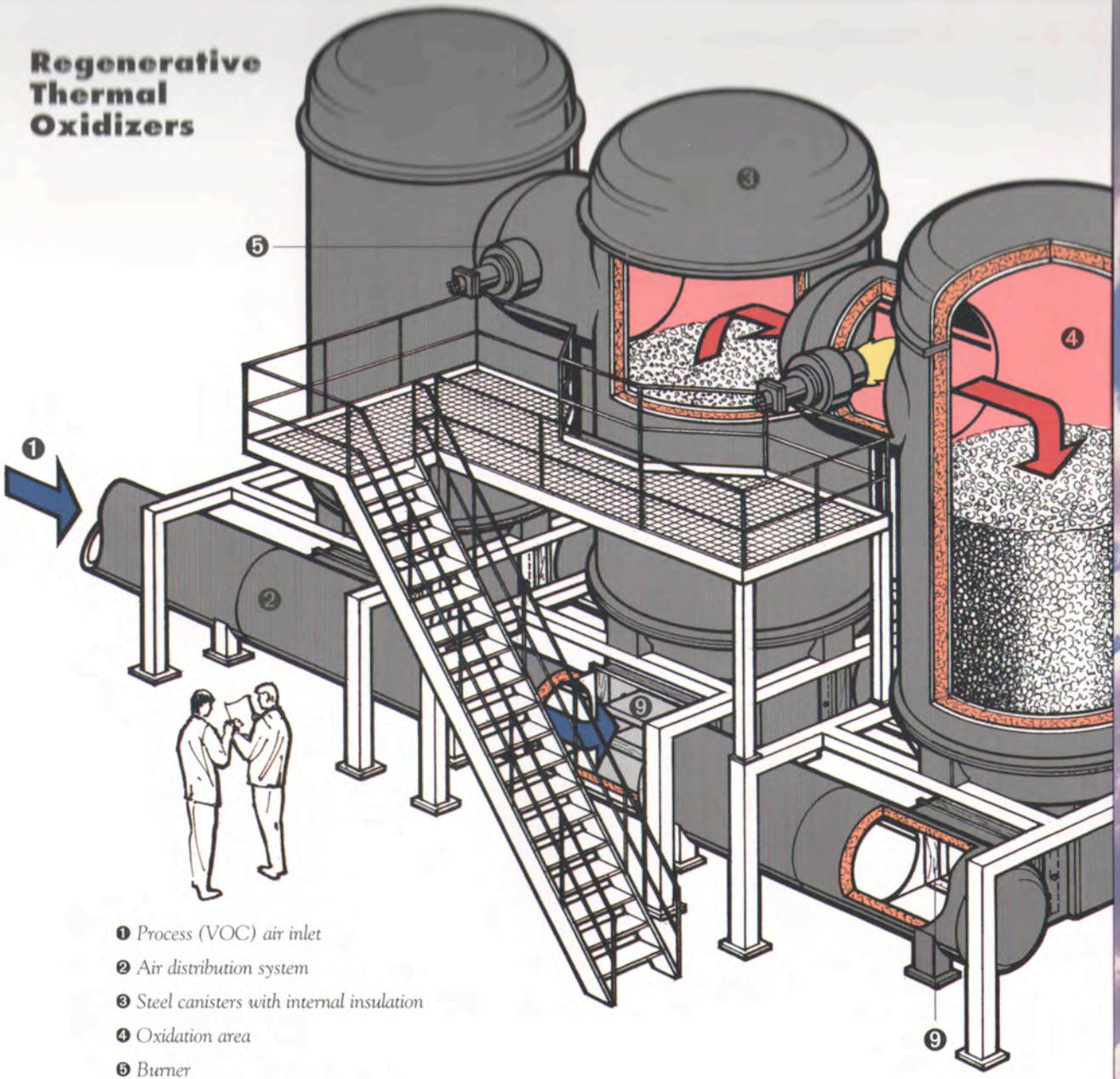


High VOC Catalytic Recuperative Oxidizers



%LEL (Lower Explosive Limit)

Regenerative Thermal Oxidizers

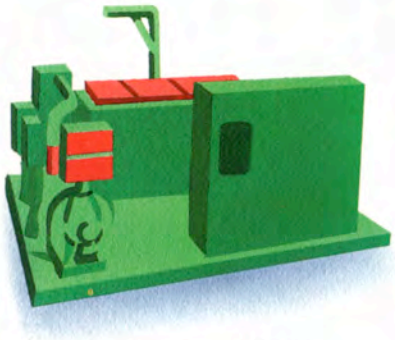


❶ *Process (VOC) air inlet*
❷ *Air distribution system*
❸ *Steel canisters with internal insulation*
❹ *Oxidation area*
❺ *Burner*
❻ *Ceramic material for heat exchange*
❼ *Purified air fan*
❽ *Purified air outlet*
❾ *Flow distribution dampers*

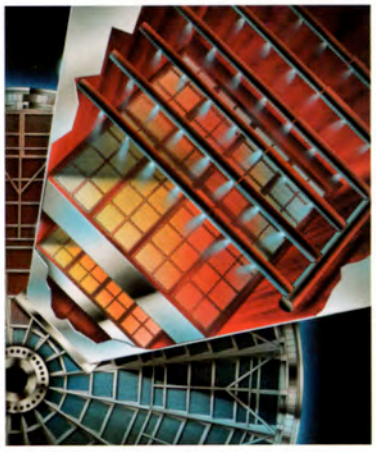
(Pocket folder with six inserts for specific VOC systems)

Specialists In Air Pollution Control

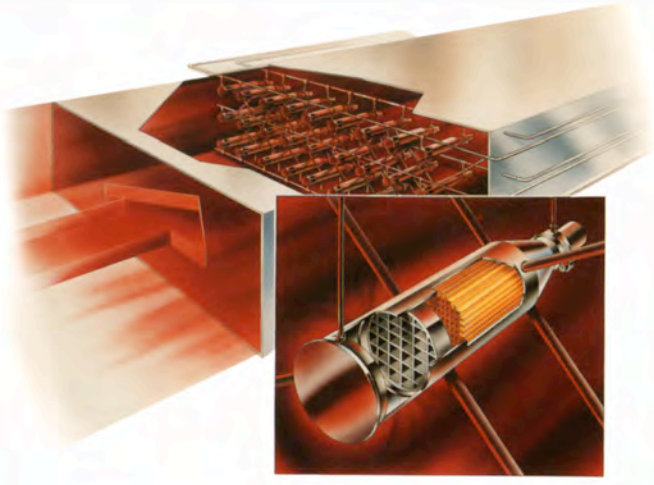
Wahlco, Inc., established in 1972 to design and manufacture specialized air pollution control systems, enjoys a preeminent worldwide market position, with installations in 75 countries. Wahlco was the first to commercialize flue gas conditioning technology for utilities and industrial applications, and continues to be the world leader in this technology. Today, we have refined our focus on air pollution control to include NO_x reduction and VOC control systems, while continuing to make advances in flue gas conditioning technology.



Wahlco's Flue Gas Conditioning (FGC) systems eliminate particulate emissions from coal-fired electric ulility boilers.



Wahlco's Staged NO_x Reduction Systems (SNRS) reduce nitrogen oxides in gas or coal-fired boilers.



Catalytic oxidation systems improve electrostatic precipitator performance. Wahlco's patented in-situ oxidation systems have several unique features, including designs for maximizing catalyst life, even in corrosive, abrasive exhaust flows.

High-temperature, long-life thermocouples and electric heaters for critical applications, including gas turbines, aerospace, flue gas conditioning, and VOC control systems.

WAHLCO
VOC TECHNOLOGIES

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