



Solutions

FOR YOUR POLLUTION CONTROL NEEDS

PROCESS COMBUSTION CORPORATION

300 Weyman Road, Suite 400 • Pittsburgh, PA 15236 • (412) 655-0955 • pcc@pcc-group.com



Our expertise and experience in the Thermal and Biological Oxidation of gaseous and liquid wastes, NOx abatement, VOC destruction, odor control, and acid gas systems is complemented by our knowledge, understanding and practical know-how specific to heat recovery boilers, heat exchangers, wet scrubbers, baghouses and electrostatic precipitators.

PCC integrates systems providing “Solutions” to your most challenging Pollution Control needs.

Since 1969, PCC has designed and provided systems for the chemical, petrochemical, refining, automobile, pharmaceutical, textile, rubber, converting, metals, food, sulfur, carbon, engineered wood products and the pulp/paper industries.



PCC's Quality Management System is certified in conformance with the ISO 9001:2015 standard.



PCCs' adherence to consistent and predictable systems is a cornerstone of our long term track record of success.

The PCC Advantage



Our Design Philosophy is a foundation within PCC's Technical Competencies. Safety is always a key concern, coupled with our conservative equipment design, ensuring performance guarantees and mechanical warranties are consistently achieved. All of PCC's Oxidation Systems are custom-designed in accordance with our expert knowledge and our customer's design specifications.

- ✓ **Engineering/Design**
 - **Process Engineering**
 - **Mechanical Design**
 - **Refractory Design**
 - **Electrical Design**
- ✓ **PCC's CORE Competencies include:**
 - **Project Management**
 - **Computer Aided Design (3D modeling)**
 - **System Automation & Control Technology**
 - **Construction Management**
 - **System Tuning and Troubleshooting**
- ✓ **System Integration**



Our SERVICES flow from our Core Competencies:

- ✓ **Waste Water Incinerators**
- ✓ **Thermal Oxidation of Process Gases**
- ✓ **Biological Oxidation of Process Gases**
- ✓ **Process Air Heaters**
- ✓ **Project Specification Development**
- ✓ **Engineering Studies**
- ✓ **System Modifications and Retrofits**
- ✓ **Field Start Up Training & Troubleshooting**



Aspen and 3D Modeling bring the power of process simulation and optimization to the engineering desktop, and deliver a unique combination of modeling technology, process simulations and overall enhanced process/equipment design.



All projects, large and small, are based on high engineering standards, strict quality control, firm delivery schedules, compliance with stringent environmental regulations and the selection of pre-qualified suppliers and fabricators.



Broad Experience - PCC designs, manufactures and supplies thermal and biological oxidation technologies for a wide range of pollution control applications. Our designs promote the chemical reaction (thermal/biological oxidation) between the pollutant compound and oxygen (O_2) in air. Our system designs range from highly technical to pre-engineered projects.

NOx Reduction - Our technically advanced Low NOx burners, multi-stage low NOx combustion systems either minimize or totally eliminate NOx emissions. We can meet the most stringent control requirements technically and economically.



PCC Supplies a range of SOLUTIONS to meet your air pollution control needs. Our technical offering includes:

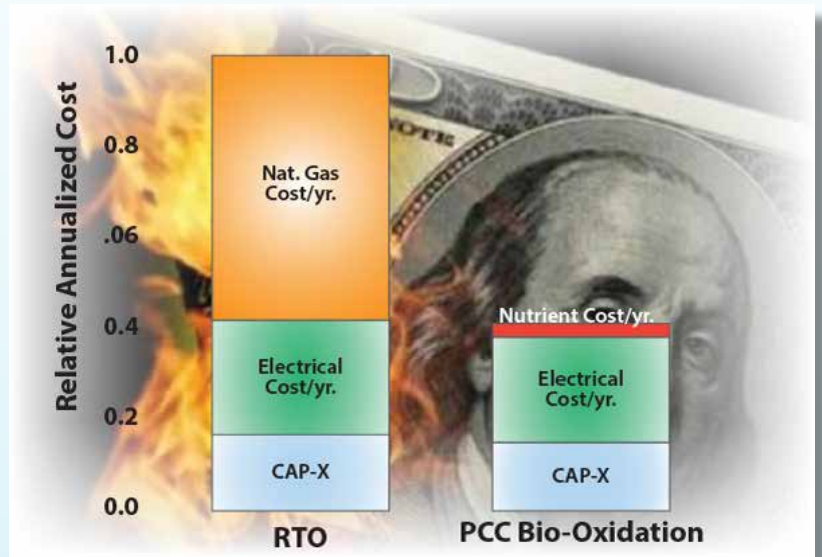
- ✓ Direct fired Thermal Oxidizers
- ✓ Multi-stage Thermal Oxidizers
- ✓ Recuperative Thermal Oxidizers
- ✓ Regenerative Thermal Oxidizers
- ✓ Flameless Thermal Oxidizers
- ✓ Biological Oxidation

All systems are engineered by PCC and are guaranteed to meet the end user's specification and performance requirements.

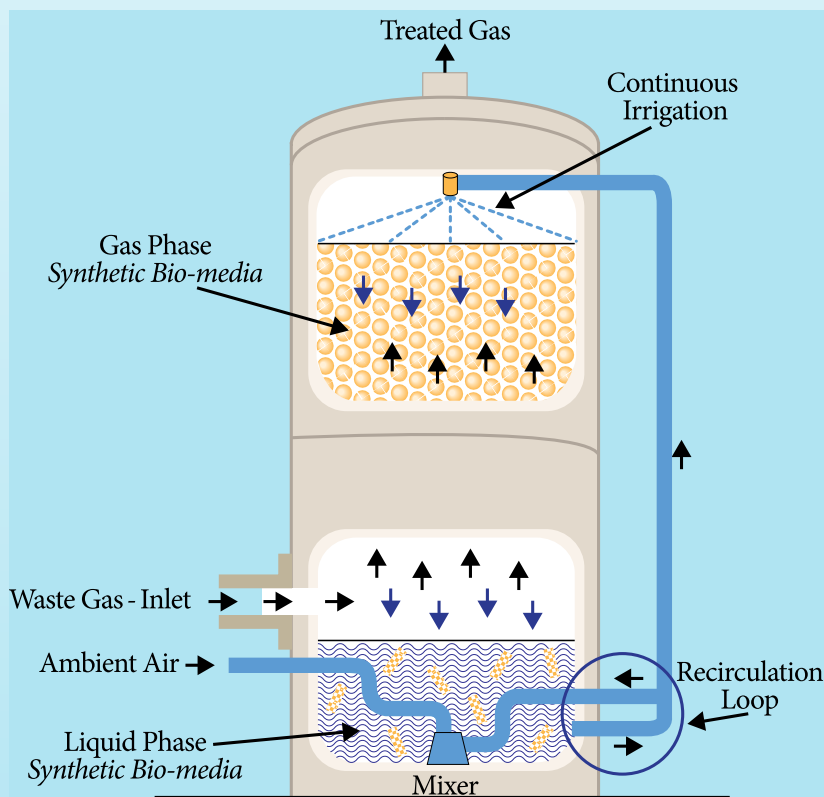


PCC's Dual-BioPhase™ Bio-Oxidation Technology, provides an economical and environmentally friendly method of treatment for a wide range of organic and inorganic air emissions. PCC's Dual-BioPhase™ systems are fully automated and custom-engineered to meet the performance requirements for most odor or VOC applications.

The PCC Dual-BioPhase™ System is engineered to provide an innovative bio-oxidation process that achieves an entirely new level of performance when compared to other biological air treatment systems. Pollutant compounds that dissolve in water are treated in the water phase, while compounds that remain in air are treated in the gas phase. Bio-oxidation generates 20x less CO₂ than thermal oxidation.



The replacement of Regenerative Thermal Oxidizers (RTO's) with PCC's Dual-BioPhase™ Bio-Oxidation Technology is becoming more common. There are numerous applications that lend themselves to the replacement of the RTO with Dual-BioPhase™ technology. A minimum of a 60% operating cost reduction can be realized as well as an 80% - 90% reduction in Green House Gases, along with the elimination of NOx.



Customer Service



To better serve our global customers, PCC has operations in Beijing, China and London, England. Their mission is to support the Pittsburgh headquarters in the execution of projects in Europe and Asia by developing supply chains, provide Project Management support, start-up services, inspection services, local contract and banking services, assist with Sales and Marketing activities and help our customers communicate effectively with PCC worldwide.

PCC's Aftermarket Team can help provide comprehensive parts and technical service for all makes, brands and configurations of thermal oxidizers and ancillary equipment. We offer spare and replacement parts, a full range of technical services, equipment training, maintenance programs, retrofits, control system upgrades and diagnostic analysis to address your technical service needs. Let PCC assist you in improving the efficiency of your existing equipment.



PCC's staff travels worldwide to support our new existing customers equipment needs. We will work with your plant staff to formulate preventive maintenance plans, establish critical spare parts inventories and provide overall operational support aimed at keeping your systems fully operational.

Spare Parts: Whether you need a spark plug or new transmitter, PCC has the technical experience and staff to meet your needs. We offer comprehensive solutions with emphasis on system control and burner management components.

- ✓ Replacement Instrumentation, Sensors and Probes
- ✓ Mechanical Parts and Components
- ✓ Bio-Oxidizer Mechanical Parts, Controls, Media and Nutrients

Aftermarket Service: When you need a burner tuning or site supervision, PCC has the professional resources to complete the job. We offer innovative solutions and competitive pricing for the following:

- ✓ Erection Supervision & Support
- ✓ Refractory Repairs and Replacement
- ✓ On-site assessment of existing equipment
- ✓ Repair and Maintenance Program
- ✓ Construction and Erection Services



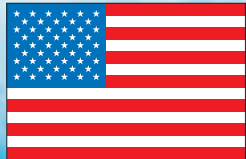
Aftermarket Engineering: Whether you need an on-site audit or technical evaluation, PCC has the professional resources to complete the job. We offer innovative solutions and competitive pricing for capacity upgrades.

- ✓ Additional waste streams
- ✓ Engineering studies
- ✓ Technical field support for installation of systems and components.

CALL US @ 412.655.0955



Representatives are located in major US Cities, Canada, Asia, and selected countries, visit www.pcc-group.com to find your local agent.



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FLAMELESS OXIDATION SYSTEMS

"REDEFINING ULTRA LOW NOx"



Untouchable DRE > 99.9999%



Ultra Low NOx < 1 ppmv



Self-sustaining for Waste Gas > 10 BTU/scf



100% Waste Gas Turndown Capability



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Process Combustion Corporation's Flameless Thermal Oxidizer (FTO) systems are the best solution for applications that require the highest Destruction Removal Efficiencies (DRE) and lowest NOx emissions.

Each FTO is fully automated and engineered to accept the full range of waste gas compositions and flow rates generated by our customer's manufacturing processes.

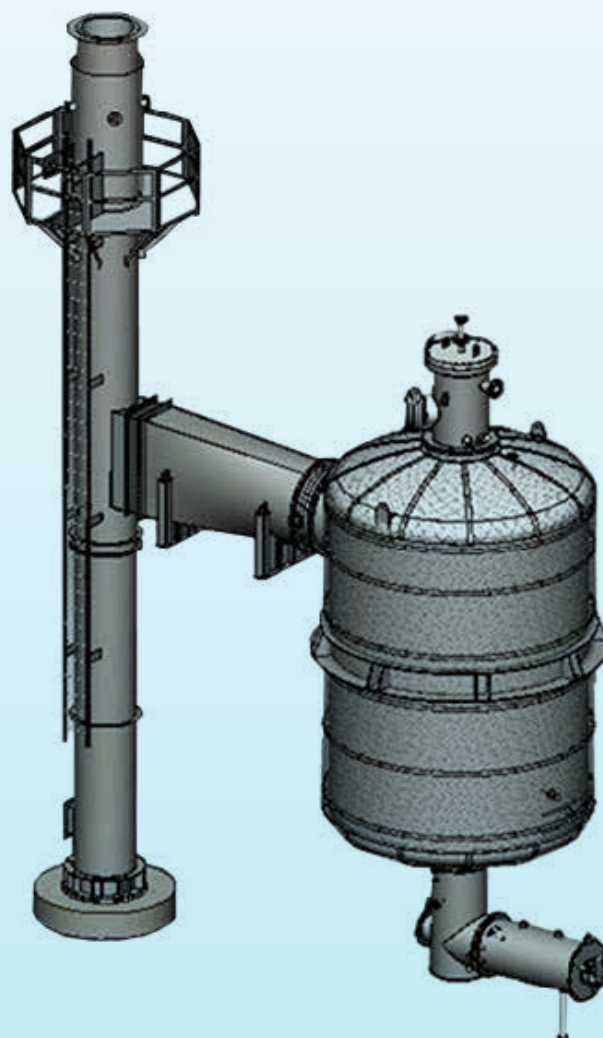
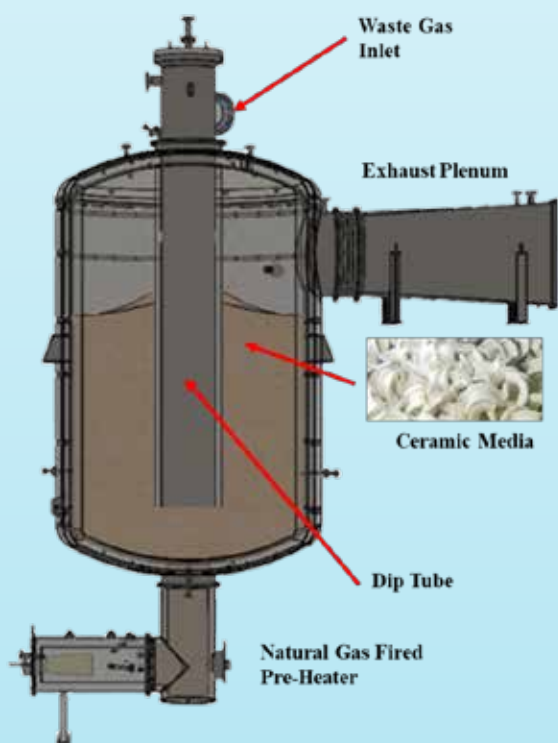
What is Flameless Oxidation?

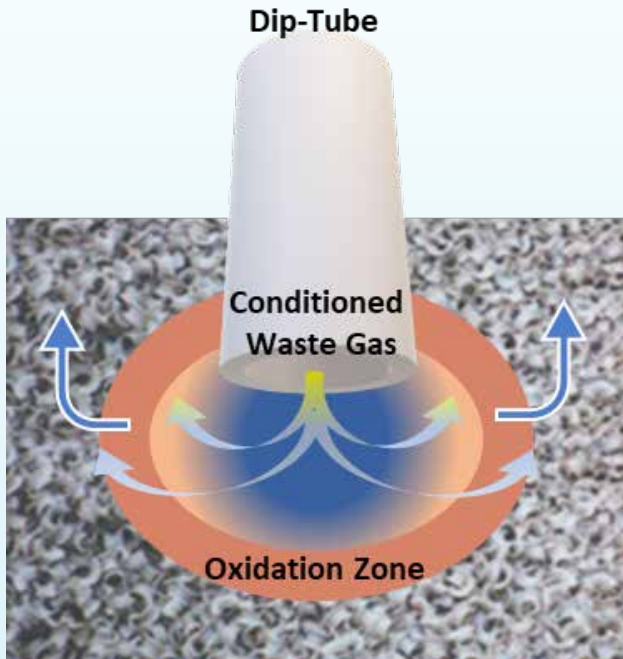
Flameless oxidation is a thermal treatment that premixes waste gas, ambient air, and auxiliary fuel prior to passing the gaseous mixture through a preheated inert ceramic media bed. Through the transfer of heat from the media to the gaseous mixture the organic compounds in the gas are oxidized to innocuous by-products, i.e., carbon dioxide (CO_2) and water vapor (H_2O) while also releasing heat into the ceramic media bed.

The reason why a flame is not generated in the media bed is because the gas mixture is kept below the lower flammability limit based on the percentages of each organic species present.

PCC's Flameless Thermal Oxidizers are designed to operate safely and reliably below the composite LFL while also maintaining a constant system flow and enthalpy (temperature).

Waste gas streams experience multiple seconds of residence time at high temperatures leading to measured destruction removal efficiencies that exceed 99.9999%. Premixing all of the gases prior to treatment eliminates localized high temperatures which leads to thermal NOx as low as 1 ppmv.





PCC's "Feed Forward" control technology, pre-mixes the Mixture of air, fume and fuel before being sent down the dip tube with a constant enthalpy and flow rate. The reaction zone is held in a fixed location as the waste gas composition/flow changes by adjusting fuel (constant enthalpy) and air (constant flow rate) flow rates and monitoring strategically located thermocouples.

PCC's FLAMELESS THERMAL OXIDIZER PERFORMANCE:

Destruction Removal Efficiencies (DRE) greater than 99.9999% are attainable. Thermal NO_x emissions of less than 1 ppmv are achievable. The system is self-sustaining for fume streams as low as 10 BTU/scf. Waste stream feed forward control ensures stability and prevents nuisance shutdowns.

The Technology behind PCC's FTO Performance:

In any Oxidation System, destruction is determined by the Three T's:

Time:	Residence Time
Temperature:	Temperature at which the oxidation reaction occurs.
Turbulence:	Premixing/Mixing (waste gas, air and supplemental fuel).

PCC's Flameless Thermal Oxidizer achieves all three of these metrics by design.

Time

The flow through a PCC Flameless Thermal Oxidizer involves multiple seconds of residence time at high temperatures. Because perfect mixing has already been achieved, high gas velocities are not required. As a result, the flow through each unit can be slower leading to longer retention times for oxidation reactions to reach completion.

Temperature

Each PCC Flameless Thermal Oxidizer operates with a completely uniform temperature profile that means the entire gas flow passes through a bed with a constant temperature profile to ensure that optimum destruction is achieved.

Turbulence

A PCC Flameless Thermal Oxidizer pre-mixes waste gas, air and fuel gas through the integration of PCC's "Feed Forward" control technology. Thorough and complete mixture of the waste components is completed before they enter the reaction vessel.

Extremely low Thermal NO_x levels are a result of a consistent, uniform operating temperature within the PCC FTO system. In a typical thermal oxidizer, the burner has hot spots within its flame, yielding temperatures in excess of 3000°F. PCC's FTO does not utilize a flame as the heat source. Maximum bed temperature of 1800°F - 1900°F ensures the minimization of thermal NO_x creation.

PCC's Flameless Thermal Oxidizer (FTO) Models

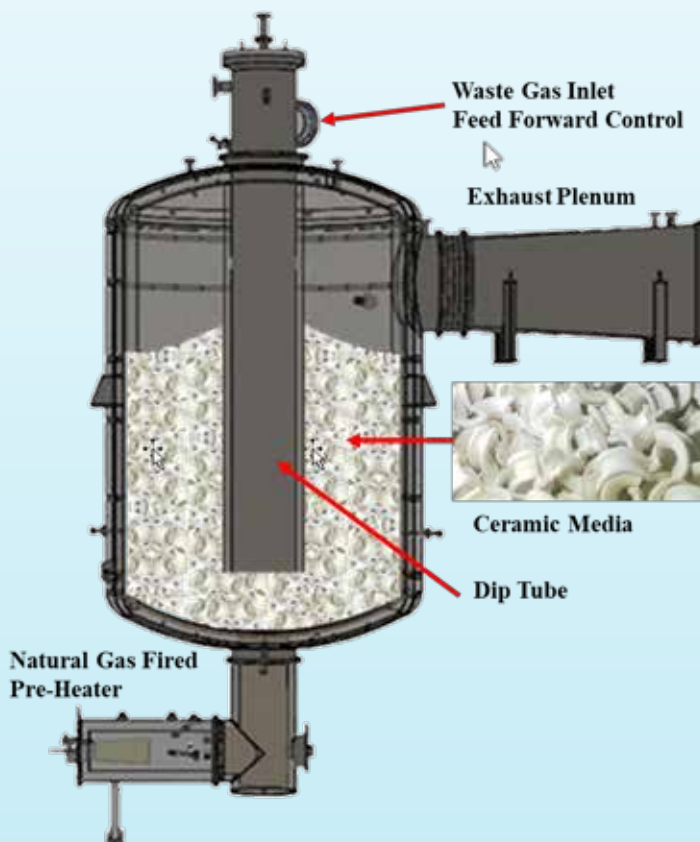
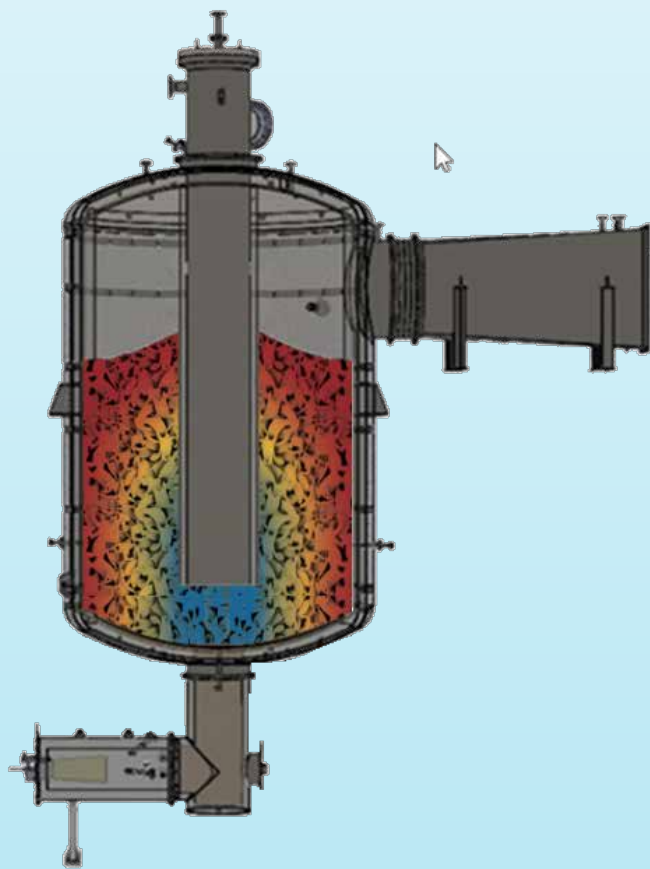
PCC offers three different types of Flameless Thermal Oxidizer models based on the volume of waste gas being treated:

Model	Treatment Capacity (scfm)
Electric FTO	0 to 100
Planar FTO	100 to ~5,000
Elliptical FTO	750 to 100,000+

Elliptical FTO

The Elliptical model is a refractory-lined cylindrical vessel partially filled with ceramic media. A natural gas burner is located at the bottom of the vessel and is used to preheat the ceramic media bed.

A dip tube is located in the center of the vessel and is used to direct the flow of the waste gas into the reaction vessel.



Utilizing PCC's "Feed Forward" technology, waste gas, ambient air, and natural gas are premixed based on a specified BTU value and delivered to media bed through use of the central dip-tube.

A reaction zone is established based on several factors. The waste gas is oxidized and then passes through the remainder of the media bed prior to exiting through the exhaust plenum.-

The PCC Planar FTO is a refractory-lined, inverted cone vessel filled with ceramic media. The media is preheated through the use of a small auxiliary natural gas burner.



The burner is only used to preheat the system during the initial start-up phase or at times the media temperature falls below the lower operating limit.

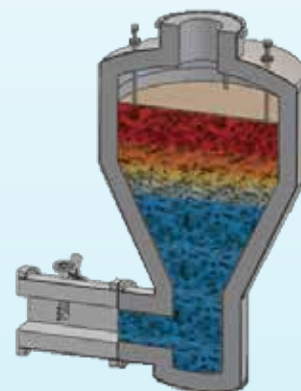
Waste gas, ambient air and natural gas enter the bottom of the vessel through a gas distribution plate.

The waste stream is forced up through the bed. An initial cooling effect occurs within the media bed, due to the ambient temperature of the waste stream.

As the waste gas is heated, as a result of its interdispersion with the heated ceramic media, it reaches the temperature at which oxidation occurs. This is known as the Reaction Wave. The waste stream is fully oxidized and then continues up through the remaining bed. It then exhausts through the exhaust port located on the top of the unit.

The PCC Electric FTO consistently treats Volatile Organic Compounds (VOCs) in waste gas streams yielding removal efficiencies of 99.9999%. The thermal oxidation is accomplished at 1800°F to avoid production of thermal NO_x and to minimize operating costs. Thermal NO_x levels are < 1 ppmv. High Destruction Efficiency, Low NO_x, Electrically Heated.

The PCC Electric FTO consists of a carbon steel, refractory-lined oxidation vessel. The vessel contains three spiral-wound electric resistance heater elements in 310SS protection tubes surrounded by a bed of randomly packed inert ceramic saddles. The PCC Electric FTO is fully automatic and there are no moving parts in the oxidizer. Alternate materials of construction are available as required based on the waste gas composition. A typical system requires 480V 3 phase 100 amp, 120V 1 phase 20 amp, and 5 scfm of instrument air at 80 psig.-----



How the PCC Electric FTO Works

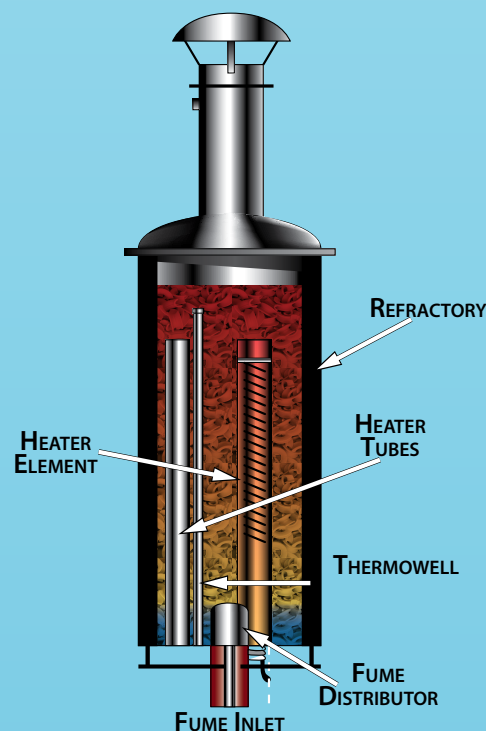
The PCC Electric FTO consists of a vertical, refractory-lined vessel filled with ceramic media. The ceramic media is pre-heated to a calculated temperature through the use of an electric resistance heater. Electrical energy is only required as a supplement to the heat content of the fume and to preheat the ceramic bed during start-up.

The waste gas and air are pre-mixed at the bottom of the vessel and introduced into the unit. The organic compounds found in the waste gas are oxidized and discharged into the atmosphere via a stack extension on the top of the unit.

The PCC Electric FTO operates well below the Lower Flammable Limit (LFL) eliminating the possibility of a flame within the system. The fume oxidizes as it passes through the oxidation zone releasing heat, which is transferred into the surrounding ceramic matrix thus maintaining the operating temperature of the bed without the need for supplemental heat via the electric heaters.

Simplicity of Design






The PCC Electric FTO's simplicity of design and portability made it a multipurpose piece of equipment for multiple low volume waste gas treatment applications. The PCC Electric FTO's standardized design requires minimal customization. The modular configuration makes it simple to install.

















MISSION STATEMENT...PCC's mission is to apply our know-how with confidence to design, supply and service high-tech, energy-efficient, dependable combustion and pollution control systems that provide cost effective environmental solutions for our global customers.

We will work hard together to achieve mutually rewarding, long-term relationships with our clients and suppliers, and we will continuously develop new technologies to meet emerging market needs.

Our Core Values

-  **Know-How** - Experienced, Knowledgeable & Competent - PCC's #1 Core Value
-  **Hardworking** - Working Hard Together to Get the Job Done
-  **Confidence** - Our Confidence in Our Abilities = Customer Confidence
-  **Customer Focus** - Custom Design with a Friendly, Willing Spirit
-  **Dependable** - Meeting Commitments to Our Customers & Owners

For over 50 years, Process Combustion Corporation (PCC) has designed, supplied & serviced combustion, heat transfer & pollution control systems worldwide. Headquartered in Pittsburgh, PA, USA; with offices in Beijing, China; and London, England; PCC is recognized as a global leader in pollution control systems. Our creative designs minimize system costs, especially energy consumption, while meeting environmental regulations. Our capabilities include:

-  **Thermal Oxidizer Systems**
-  **Regenerative Thermal Oxidizers**
-  **Flameless Thermal Oxidizers**
-  **Bio-Oxidation Systems**
-  **Wet Scrubbers**
-  **Activated Carbon Adsorption**
-  **Air Heaters**
-  **Specialty Burners**
-  **Specialized Combustion Systems**
-  **Low NOx, SCR/SNCR Systems**
-  **Landfill Gas Thermal Oxidizers**
-  **Service & Installation**
-  **Engineering Studies**
-  **Turnkey Projects**



Located in the South Hills of Pittsburgh, PA, PCC's Administration, Sales, Engineering, Manufacturing and Research & Development are housed in one location.

PCC's CUSTOMERS



PCC has enjoyed successes working with the following companies (partial list) over the years. Our goal is always to be sure our customers are satisfied with quality, custom-designed and engineered, reliable products and services.



3M
Air Products & Chemicals
AK Steel
Albemarle
Albemarle Catalyst
Amsterdam
Aker Kvaerner
ALCOA
AOC
Arcadis Giffels
Arizona Chemical
Arkema, Inc.
Ashland Polyester
Atlas Roofing Corp.
Barrick Goldstrike Mines,
Inc.
BASF Corporation,
BC Seneca
Bayer
BE&K Construction Co., LLC
BlueStar Silicones
BP Chemical
British Gypsum
C.A.G.
Cabot Corporation
Calgon Carbon Corporation
Catalyst Recovery
of LA, LLC

CertainTeed Corporation
Codelco Devision El
Teniente
Chinook Sciences
CDI Engineering
Cyanco
Cytec Carbon
Fibers LLC
Cytec Industries Malaysia
Sdn Bhd
Daikin America
Dow Chemical
E.I. DuPont de Nemours
& Co.
Eastman Chemical
Elysium Energy
Engelhard
Fabrica Carioca de
Catalisadores
Firestone
Polymers, LLC
Ford Motor Company
Gas Technology Institute
Grace Davison
GraTech
GSF Energy LLC
Harper International
Henry F. Teichmann
Honda R&D Americas, Inc.

Honda Transmission Mfg. of
America, Inc.
Horsehead Corp.
Huber Engineered Wood
Hyundai Motor
Manufacturing
IES Ltd.
Ineos
Ineos Nitriles (UK) Ltd.
Iron Dynamics
Flat Roll Division
Israel Military Industries
Ltd. (IMI)
JM Huber
KiOR Inc.
Koppers
Kunshan Eastern Rainbow
Environmental Equipment
Co.
Kureha Advanced Materials,
Inc.
Lanzhou Design Institute
LES Renewable
NG, LLC
Lipten Company
Louisiana Pigment
Company, L.P.
Lucite
International, Inc.
Meadwestvaco Papers
Group

Metropolitan Biosolids
Management, LLC
Millennium
Inorganic Chemicals
Monsanto
Montauk Energy
Morgan AM&T
National Electrical Carbon
Niro, Inc.
Noble Energy
Norit Americas
Omnova Solutions
Omya, Inc.
OPTI Canada
Orion Carbon
Owens Corning Asphalt
Plants
PetroChina Jilin
PetroChemical Company
Polychemie, Inc.
PPG Industries, Inc.
Propak Systems Ltd.
Puralube
Rubicon/Huntsman
Rudolph/Libbe, Inc.
Seadrift Coke, LP
Seneca Landfill Gas
to Energy Plant
Shanghai SECCO
Petrochemical Co.

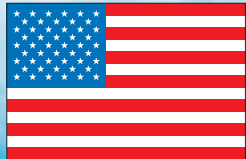
Sinopec Anqing
Solid Waste Authority of
Central Ohio (SWACO)
Solutia
Sterling
Chemicals, Inc.
Swindell-Dressler
International Co.
Technical
Chemical Co.
Tembec Industries
Toray Carbon
Fibers America, Inc.
URS Corp.
Valspar
Waak engineering
Waste
Management Renewable
Energy, LLC
Weyerhaeuser
Yantai Wanhua
Polyurethanes
Co. Ltd.



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REGENERATIVE THERMAL OXIDIZERS

-  Energy-Efficient
-  Low Total Cost of Ownership
-  Modular configurations
-  Customized designs

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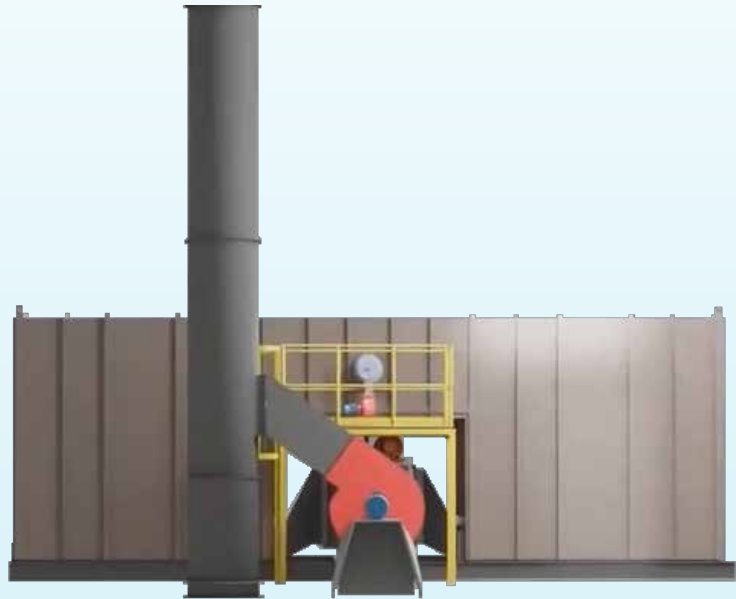
Process Combustion has been engineering and providing the Industrial Sector with Combustion Technologies since 1969. PCC is committed to offering a SOLUTIONS option to meet most air pollution control requirements.






REGENERATIVE THERMAL OXIDIZERS

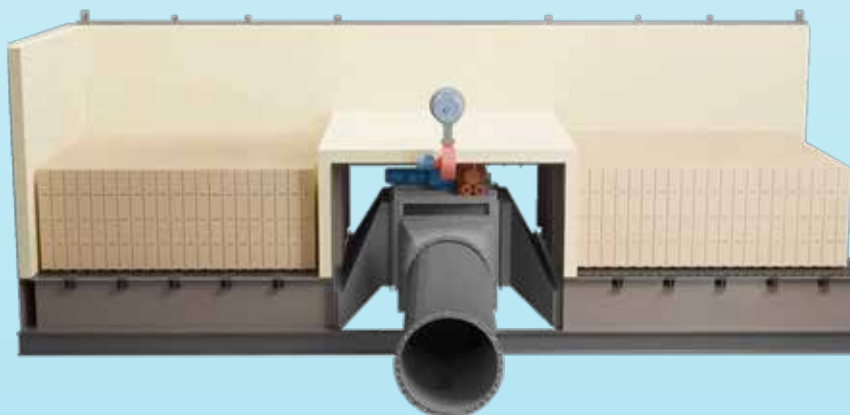
PCC's goal is to assist industrial customers in meeting the toughest control demands faced today. We design solutions for industrial and commercial manufacturing processes designed to minimize waste and remove pollutants.

PCC's RTO ADVANTAGE

PCC offers a range of RTO designs and configurations to meet your needs and provide the best solution for your application.



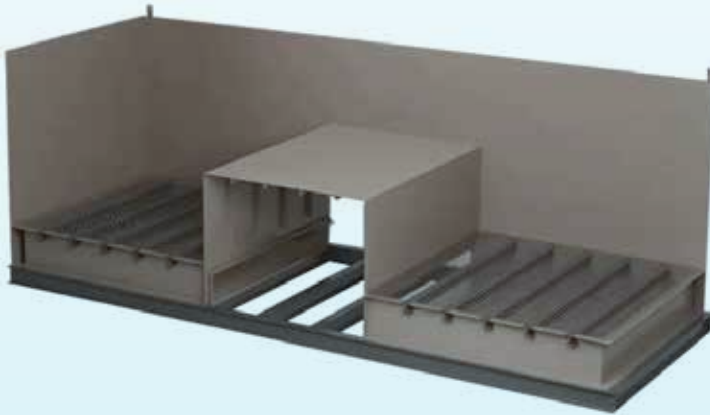
-  Engineered Designs to meet the end user's requirements
 - ✓ Modular configurations for quick installation
 - ✓ Customized designs to meet unique application requirements
-  Proven Quick Switch Rotary Valve
 - ✓ Minimum maintenance, smooth, quiet, zero-leakage operation
 - ✓ Superior reliability of any RTO
-  Low "Total Cost of Ownership"
 - ✓ Energy, Maintenance & Life Cycle Capital Cost
-  Energy-Efficient.
 - ✓ Up to 97% thermal efficiency resulting in low energy expenditures
-  Up to 99% VOC destruction efficiency



PCC's RTO's are designed for low to high volume (1,000 to 300,000 scfm) air flows with high thermal and VOC destruction efficiencies. In many applications, the system will run in a self-sustaining mode whereby no additional fuel is required to destroy VOCs.

THE ENGINEERING BEHIND PCC's RTOs

PCC's systems achieve emission destruction through the process of high temperature thermal oxidation, utilizing the 3 T's of Destruction: Time, Temperature and Turbulence, at the proper oxygen level to convert the pollutants into carbon dioxide and water vapor.



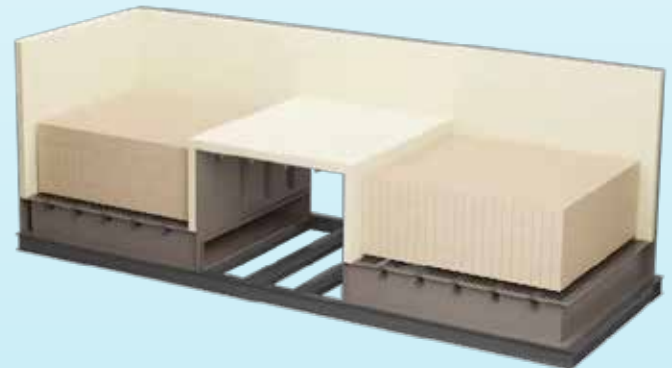
PCC's RTOs are designed to repurpose the thermal energy generated during operation, reducing the energy consumption and operating costs.

Rigid, steel support beams are used to ensure the system is fully supported and will maintain structural rigidity over many years of service.

The Waste Gas plenums are fabricated from heavy gauge, sheet steel to ensure the integrity of the plenum.

Structural steel cross members are used to provide the foundation for the steel media bed supports. An open grid, bar grating and steel mesh support make up the media support platform. PCC's design facilitates ease of cleaning if the process contains condensables.

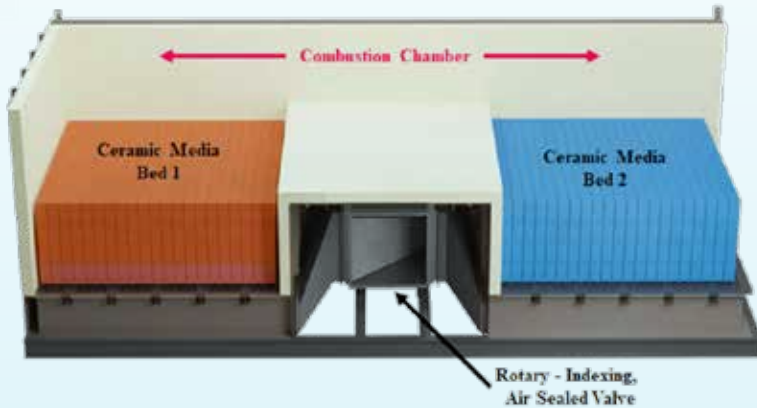
Heat capture and transfer is facilitated via either a Ceramic "Structured" Block Media or a ceramic saddle media. The design of the system, coupled with the media choice, yield up to 97% thermal efficiency at full flow. PCC utilizes a lightweight, ceramic fiber refractory module refractory lining.



PCC's unique Rotary-Indexing Air Sealed Valve is used to control the directional flow of the waste gas stream. The valve is designed utilizing a hollow plenum, air sealed design configuration. This eliminates high wear areas while reducing the leakage to zero.

The valve employs an extremely "fast switch" (<0.3 seconds direction flow to directional flow) design that includes a "Kiss-Close" software to minimize maintenance requirement while maximizing the performance of the valve. Virtually zero leakage, results in a significant volume reduction associated with "Puff" (untreated air).

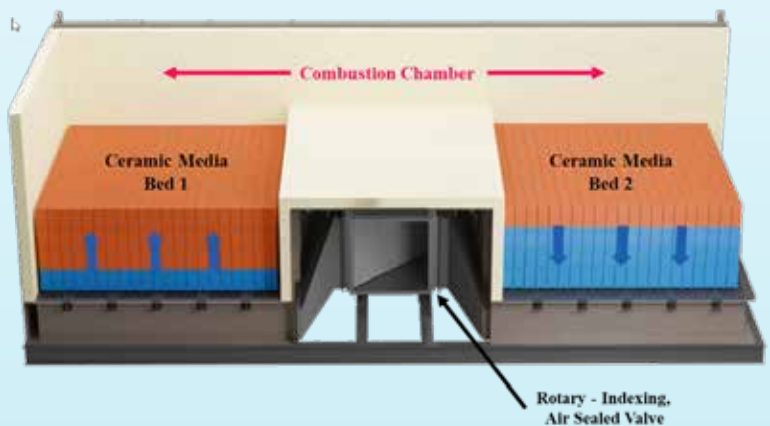
How PCC's RTO Works



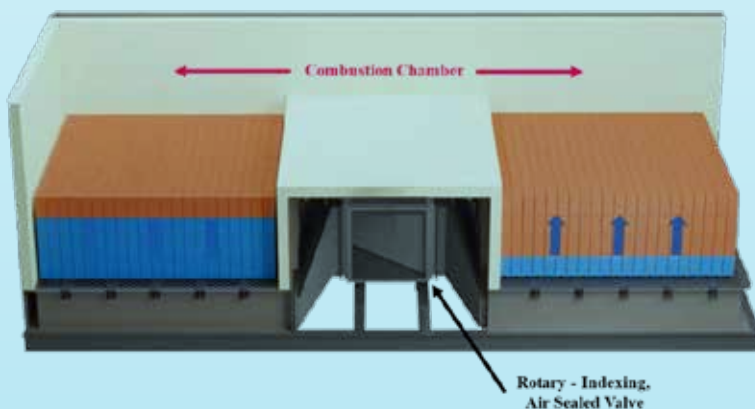
1. The ceramic, heat recovery bed 1 is preheated prior to the introduction of the waste stream into the system.

2. The waste gas enters bed 1, through the plenum located at the bottom of the bed. The waste stream passes "up through bed 1 and is preheated due to the thermal transfer of heat from the bed into the waste gas.

3. The waste stream then passes through the combustion chamber, where it is heated to the appropriate temperature to fully combust and destroy the waste stream compounds and then passes down through the ceramic media bed 2.
4. Heat is then transferred from the waste gas into the ceramic, heat recovery media in bed 2. Bed 2 is then heated to a predetermined temperature. The treated waste gas is then exhausted through the stack to the atmosphere.



5. The indexing valve engages diverting the direction of flow of the untreated waste stream. The waste stream now enters bed 2, is preheated, transfers through the combustion chamber and then exits through ceramic bed 1. Bed 1 is re-heated and the stream is then exhausted to the atmosphere through the stack.



6. The cycle repeats throughout the operation of the system.

PCC's current RTO is the genesis of more than 30 years of experience and discovery in RTO technology. With seven RTO related patents and hundreds of worldwide installations, chances are we've installed a system in an application just like yours.

We put our experience to work for you by thoroughly understanding your process, helping to select the right equipment and optimizing the system's performance to maximize your investment.

With pollution of all types at the forefront of everyone's minds these days, we are more committed than ever to supplying a low emission, simple, reliable, energy-efficient and cost-effective means of cleaning tomorrow's air today.

RTO Benefits

- Global emission regulatory compliance – now and in the future.
- Lowest operating cost and lower CO2 emissions
- Greatest reliability, lowest maintenance cost of any RTO
- Quick, 3-day installation
- Lowest pressure drop, highest thermal efficiency
- Operator friendly
- Proven leader in pollution equipment technology

RTO Features

- Up to 99% VOC destruction efficiency
- Up to 97% heat transfer efficiency
- PCC's Rotary-Indexing Air Sealed Valve
- Completely modular
- Exclusive, light weight ceramic media
- State of the art controls



MISSION STATEMENT...PCC's mission is to apply our know-how with confidence to design, supply and service high-tech, energy-efficient, dependable combustion and pollution control systems that provide cost effective environmental solutions for our global customers.

We will work hard together to achieve mutually rewarding, long-term relationships with our clients and suppliers, and we will continuously develop new technologies to meet emerging market needs.

Our Core Values

- **Know-How** - Experienced, Knowledgeable & Competent - PCC's #1 Core Value
- **Hardworking** - Working Hard Together to Get the Job Done
- **Confidence** - Our Confidence in Our Abilities = Customer Confidence
- **Customer Focus** - Custom Design with a Friendly, Willing Spirit
- **Dependable** - Meeting Commitments to Our Customers & Owners

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- **Thermal Oxidizer Systems**
- **Regenerative Thermal Oxidizers**
- **Flameless Thermal Oxidizers**
- **Bio-Oxidation Systems**
- **Wet Scrubbers**
- **Activated Carbon Adsorption**
- **Air Heaters**
- **Specialty Burners**
- **Specialized Combustion Systems**
- **Low NOx, SCR/SNCR Systems**
- **Landfill Gas Thermal Oxidizers**
- **Service & Installation**
- **Engineering Studies**
- **Turnkey Projects**



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3M
Air Products & Chemicals
AK Steel
Albemarle
Albemarle Catalyst
Amsterdam
Aker Kvaerner
ALCOA
AOC
Arcadis Giffels
Arizona Chemical
Arkema, Inc.
Ashland Polyester
Atlas Roofing Corp.
Barrick Goldstrike Mines,
Inc.
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BC Seneca
Bayer
BE&K Construction Co., LLC
BlueStar Silicones
BP Chemical
British Gypsum
C.A.G.
Cabot Corporation
Calgon Carbon Corporation
Catalyst Recovery
of LA, LLC

CertainTeed Corporation
Codelco Devision El
Teniente
Chinook Sciences
CDI Engineering
Cyanco
Cytec Carbon
Fibers LLC
Cytec Industries Malaysia
Sdn Bhd
Daikin America
Dow Chemical
E.I. DuPont de Nemours
& Co.
Eastman Chemical
Elysium Energy
Engelhard
Fabrica Carioca de
Catalisadores
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Polymers, LLC
Ford Motor Company
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Grace Davison
GraTech
GSF Energy LLC
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Honda R&D Americas, Inc.

Honda Transmission Mfg. of
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Huber Engineered Wood
Hyundai Motor
Manufacturing
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Ineos
Ineos Nitriles (UK) Ltd.
Iron Dynamics
Flat Roll Division
Israel Military Industries
Ltd. (IMI)
JM Huber
KiOR Inc.
Koppers
Kunshan Eastern Rainbow
Environmental Equipment
Co.
Kureha Advanced Materials,
Inc.
Lanzhou Design Institute
LES Renewable
NG, LLC
Lipten Company
Louisiana Pigment
Company, L.P.
Lucite
International, Inc.
Meadwestvaco Papers
Group

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Millennium
Inorganic Chemicals
Monsanto
Montauk Energy
Morgan AM&T
National Electrical Carbon
Niro, Inc.
Noble Energy
Norit Americas
Omnova Solutions
Omya, Inc.
OPTI Canada
Orion Carbon
Owens Corning Asphalt
Plants
PetroChina Jilin
PetroChemical Company
Polychemie, Inc.
PPG Industries, Inc.
Propak Systems Ltd.
Puralube
Rubicon/Huntsman
Rudolph/Libbe, Inc.
Seadrift Coke, LP
Seneca Landfill Gas
to Energy Plant
Shanghai SECCO
Petrochemical Co.

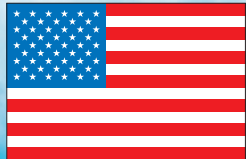
Sinopec Anqing
Solid Waste Authority of
Central Ohio (SWACO)
Solutia
Sterling
Chemicals, Inc.
Swindell-Dressler
International Co.
Technical
Chemical Co.
Tembec Industries
Toray Carbon
Fibers America, Inc.
URS Corp.
Valspar
Waak engineering
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Yantai Wanhua
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DUAL-BioPHASETM OXIDATION TECHNOLOGY

CLEAN AND "GREEN" TECHNOLOGY

-  *Ultra low CO₂*
-  *Does not produce NOx, CO, SOx*
-  *Operates at ambient temperature*

Solutions

FOR YOUR **AIR** POLLUTION CONTROL NEEDS



PROCESS COMBUSTION CORPORATION

300 Weyman Road, Suite 400 • Pittsburgh, PA 15236 • (412) 655-0955 • pcc@pcc-group.com

ADVANCED VOC AND ODOR CONTROL TECHNOLOGY



Process Combustion Corporation's Dual-BioPhase™ Systems, provide an economical and environmentally friendly method of treatment for a wide range of organic and inorganic air emissions. PCC's Dual-BioPhase™ Systems are fully automated and custom engineered to meet or exceed the performance requirements for odor or VOC applications.

What is Bio-Filtration?

Bio-filtration is a biological process that uses micro-organisms to convert Volatile Organic Compounds (VOCs), Hazardous Air Pollutants (HAPs), and Odor causing compounds into harmless by-products, i.e., carbon dioxide (CO_2) and water (H_2O).

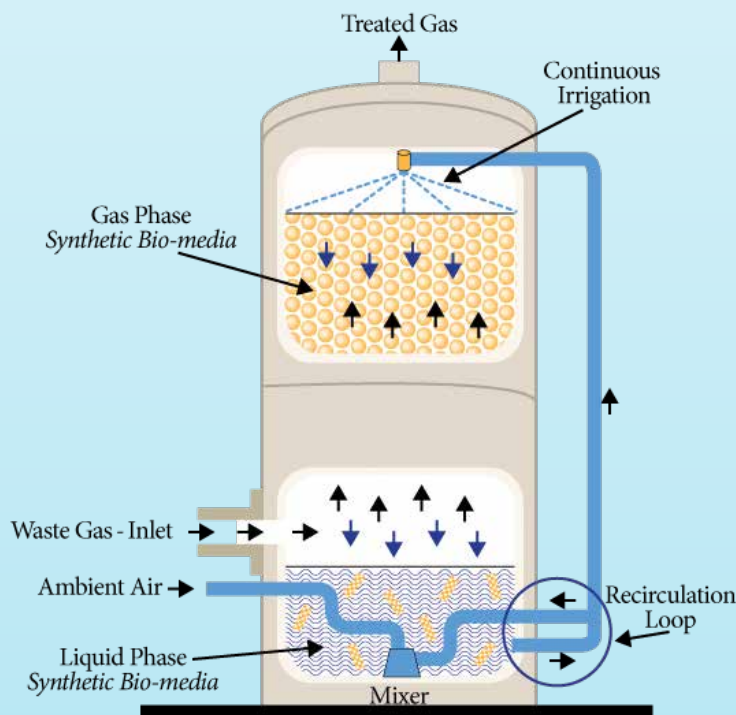
Since the introduction of the technology in the 1960's, most bio-filters have used naturally bioactive media such as peat, compost, soil or wood chips to biologically degrade odors and VOC's. Recognizing the limitation associated with these organic media systems and other conventional odor control technologies, the PCC Dual-BioPhase™ System offers innovative bio-oxidation process that achieves an entirely new level of performance for biological air treatment systems.

What is a PCC Dual-BioPhase™ Bio-Oxidation System?

Pollutant compounds that dissolve in water are treated in the water phase while compounds that remain in air are treated in the gas phase. The Dual-BioPhase™ Technology utilizes synthetic media on which contaminant degrading bacteria are immobilized as biofilm on the surface of the media. As air flows through the bed of media, the contaminant comes in contact with the active biofilm that degrade the pollutant compounds. At the same time, a continuous stream of water flows down through the media to keep the biofilms moist and biologically active.

The system achieves maximum treatment efficiency by adding a nutrient biocatalyst to the water that circulates through the Gas Phase Biological Oxidation Section so that the airborne contaminants are adsorbed into the water where they are biodegraded by the aqueous culture.

Thus, with the PCC Dual-BioPhase™ System, contaminant compounds in the air are biodegraded by the active cultures in the liquid phase as well as by the active biofilms on the surface of the synthetic gas phase media.



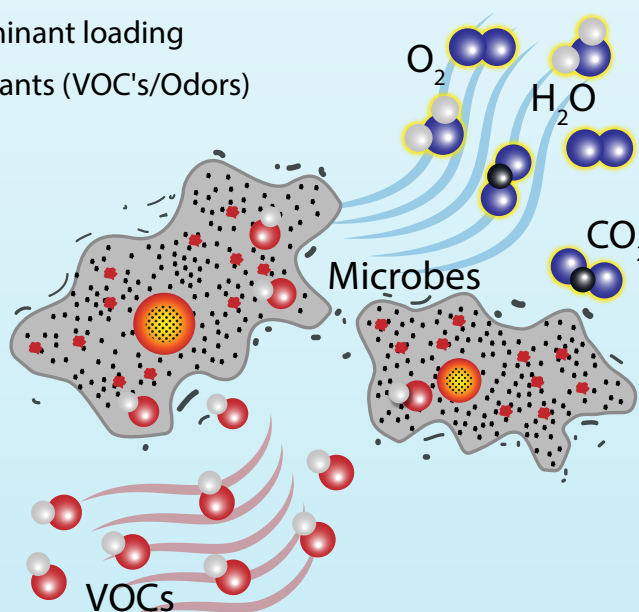
Synthetic Media

Dual-BioPhase™ technology offers important state-of-the-art improvements that translate into tangible performance and economic benefits. Foremost is the unique synthetic media specifically for the Dual-BioPhase™ Bio-Oxidation Process. PCC's synthetic media is designed for low pressure drop and allows ample room for biofilm growth without clogging due to excessive microbial growth. It achieves hydrophilic properties to retain water and support the growth of biofilms on the media surface.

Advantages of PCC Dual-BioPhase™ System vs. Traditional Biofilters

Superior performance of synthetic media allows for:

- Higher gas velocity - reduced size of biofilter
- Shorter gas residence time
- Quicker response to fluctuations in contaminant loading
- Handle higher concentrations of contaminants (VOC's/Odors)
- No fouling/clogging



Evaluation Category	Traditional Biofilter	Dual-BioPhase™ BioOxidation Process
Microorganisms and Nutrients are Restrained within Media	Yes	No
Media Replacement is Required to Replenish Nutrients	Yes	No
Media needs Continually Fluffed to Obtain Porosity	Yes	No
Biomass Growth Causes Media Settling	Yes	No
Continually Increasing ΔP	Yes	No
Maintaining Optimal Water Content is Crucial	Yes	No
Media Height Limited to Maintaining Proper Moisture Content	Yes	No
Capacity for Contaminants - ppmv	< 50	< 5,000
Limited Capacity to Neutralize Acids	Yes	No

Application

- Wood Products - OSB, MDF, Pellets, etc.
- Bioenergy, Biofuel, Biomass Energy Plants
- Pharmaceutical
- Tank Farms, etc.
- Food Manufacturing

Competing Technology

- Traditional Biofilters
- Regenerative Thermal Oxidizers (RTO/RCO)

PCC's Dual-BioPhase™ Technology and RTO/RCO technologies typically compete in applications where HAP and VOC concentrations are low (<5000 ppmv). Typical VOC's treated are; Aromatic Hydrocarbons, Alcohols, Aldehydes, Esters, Ethers, and Ketones.



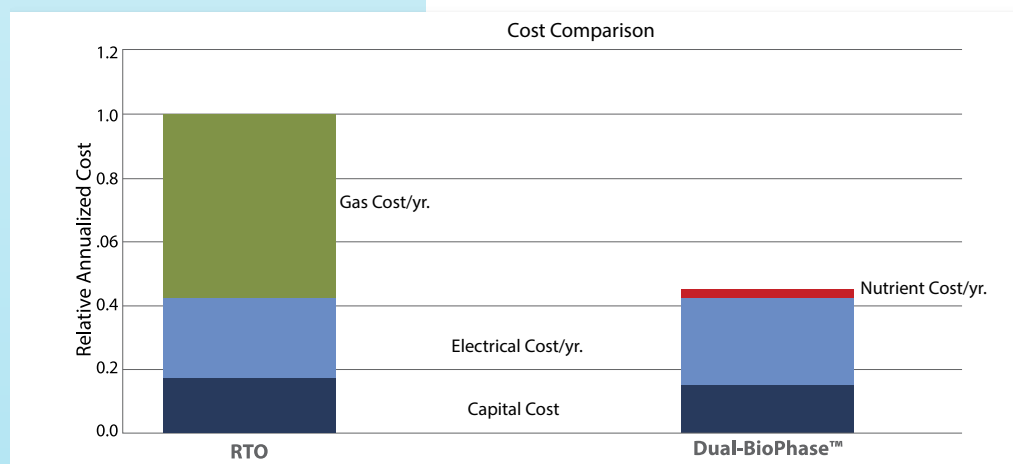
Green House Gas

RTO/RCO's use high temperature to oxidize the chemicals to carbon dioxide (CO₂) and water. Typically, natural gas is used to effectively maintain the destruction temperature required to prevent emission of unreacted hydrocarbons. One drawback to burning natural gas is that it creates Green House Gases (GHGs) and unfavorable by-products CO, CO₂, NO_x and SO_x, etc. PCC's Dual-BioPhase™ Systems use micro-organisms to biologically convert the organics to carbon dioxide and water thereby producing significantly less CO₂ vs. thermal oxidation. Because there is no flame involved with biofilters, there is no CO, NO_x or SO_x produced.

Evaluation Category	RTO	Dual-BioPhase™
Burns Natural Gas - Additional Operating Cost	Yes	No
Valve Maintenance - Wear & Tear	Yes	No
Potential Fouling of Ceramic Media	Yes	No
Strict Thermal Safety Requirements (1500°F)	Yes	No
CO Emission	Yes	No
CO ₂ Emission	Yes	~95% Less
NO _x Emission	Yes	No
SO _x Emission	Potential	No
Particulate Removal Required with Wet-ESP	Yes	No
Potential Treatment of Waste Gases	Yes	No

Economics

Typically, capital cost is similar, however, the operating cost of a PCC Dual-BioPhase™ system is considerably less than an RTO. Environmental impact is also a significant factor to consider.





Application

- Industrial Processes
- Waste Water Treatment Plants
- Solids Handling
- Lift Stations
- Unidentified Odors

Competing Technology

- Traditional Biofilters
- Carbon Adsorption
- Chemical Scrubbing
- Water Scrubbing

PCC's Dual-BioPhase™ System - This uniquely designed process overcomes the inherent drawbacks of its competing technology including maintaining proper pH balance. This is especially significant when treating Hydrogen Sulfide (H_2S). It is well known that H_2S can be biodegraded under acidic conditions. However, at low pH many organic sulfur compounds, such as mercaptans and disulfides, which are typically responsible for most wastewater odors, do not biodegrade. PCC's Dual-BioPhase™ Bio-Oxidation System does it all.

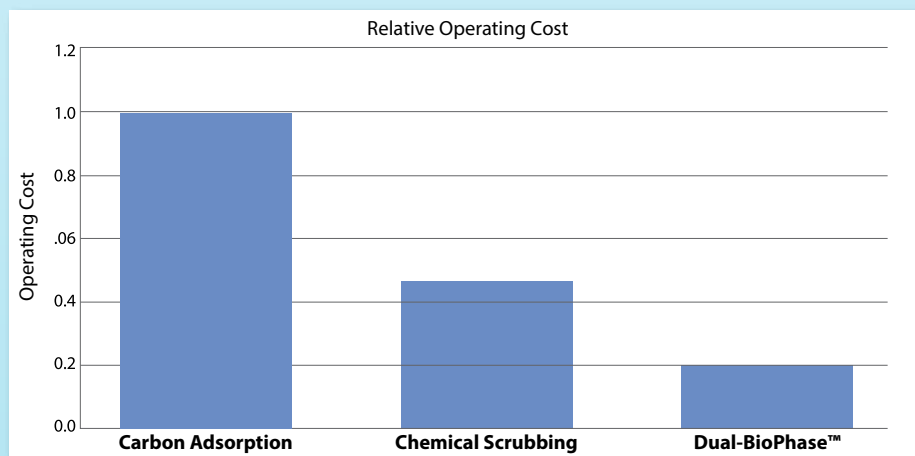
Adsorption - Adsorbents (i.e. Activated carbon, zeolites, etc.) are costly without regeneration and when inlet concentrations are greater than 5 ppmv. Compounds such as hydrocarbons can also pose a fire hazard.

Chemical Oxidation - Using chemicals such as ozone, hydrogen peroxide, chlorine, and potassium permanganate are costly and produce by-products to be treated e.g. halocarbons, peroxide, etc.

Water Scrubbing - Can be used for water soluble compounds. However, the contaminant is simply removed from the gas and transferred into the liquid which must still be oxidized. Particulates in the gas may clog the packing media.

Economics

As can be seen in the graph (below) a PCC Dual-BioPhase™ system offers significantly lower operating cost compared to competing odor control technology.



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A Message from the President...

"Through the use of our engineering and application expertise, PCC will design and supply a quality system, delivered on time, that will meet all of your project requirements."

Our Core Values

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Aker Kvaerner
ALCOA
AOC
Arcadis Giffels
Arizona Chemical
Arkema, Inc.
Ashland Polyester
Atlas Roofing Corp.
Barrick Goldstrike Mines,
Inc.
BASF Corporation,
BC Seneca
Bayer
BE&K Construction Co., LLC
BlueStar Silicones
BP Chemical
British Gypsum
C.A.G.
Cabot Corporation
Calgon Carbon Corporation
Catalyst Recovery
of LA, LLC

CertainTeed Corporation
Codelco Devison El
Teniente
Chinook Sciences
CDI Engineering
Cyanco
Cytec Carbon
Fibers LLC
Cytec Industries Malaysia
Sdn Bhd
Daikin America
Dow Chemical
E.I. DuPont de Nemours
& Co.
Eastman Chemical
Elysium Energy
Engelhard
Fabrica Carioca de
Catalisadores
Firestone
Polymers, LLC
Ford Motor Company
Gas Technology Institute
Grace Davison
GrafTech
GSF Energy LLC
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Honda R&D Americas, Inc.

Honda Transmission Mfg. of
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Horsehead Corp.
Huber Engineered Wood
Hyundai Motor
Manufacturing
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Ineos
Ineos Nitriles (UK) Ltd.
Iron Dynamics
Flat Roll Division
Israel Military Industries
Ltd. (IMI)
JM Huber
KiOR Inc.
Koppers
Kunshan Eastern Rainbow
Environmental Equipment
Co.
Kureha Advanced Materials,
Inc.
Lanzhou Design Institute
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Louisiana Pigment
Company, L.P.
Lucite
International, Inc.
Meadwestvaco Papers
Group

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Millennium
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Monsanto
Montauk Energy
Morgan AM&T
National Electrical Carbon
NexLube Tampa, LLC
Niro, Inc.
Noble Energy
Norit Americas
Omnova Solutions
Omya, Inc.
OPTI Canada
Orion Carbon
Owens Corning Asphalt
Plants
PetroChina Jilin
PetroChemical Company
Polychemie, Inc.
PPG Industries, Inc.
Propak Systems Ltd.
Puralube
Rubicon/Huntsman
Rudolph/Libbe, Inc.
Seadrift Coke, LP
Seneca Landfill Gas
to Energy Plant

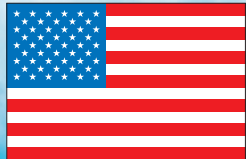
Shanghai SECCO
Petrochemical Co.
Sinopec Anqing
Solid Waste Authority of
Central Ohio (SWACO)
Solutia
Sterling
Chemicals, Inc.
Swindell-Dressler
International Co.
Technical
Chemical Co.
Tembec Industries
Toray Carbon
Fibers America, Inc.
URS Corp.
Valspar
Waak engineering
Waste
Management Renewable
Energy, LLC
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Yantai Wanhua
Polyurethanes
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THERMAL OXIDIZER SYSTEMS

PCC is the market leader in the design and supply of advanced, custom-designed Thermal Oxidizer Systems for the destruction of industrial waste gases and liquids. Our expertise includes advanced low emission systems, multi-staged low NO_x incineration, low BTU gas burning, thermal destruction of nitrogen bearing compounds, waste heat recovery and hundreds of engineered projects to meet customers unique requirements.

PCC provides you with cost effective oxidation equipment for your liquid and gaseous waste disposal project. From the skid-mounted oxidizer to the massive fully integrated systems utilizing acid gas scrubbers, heat recovery and steam generation, we do it all.



The Right Equipment for the Job

Whether the application requires a standard "off-the-shelf" oxidizer or a custom designed system, PCC performs for you.

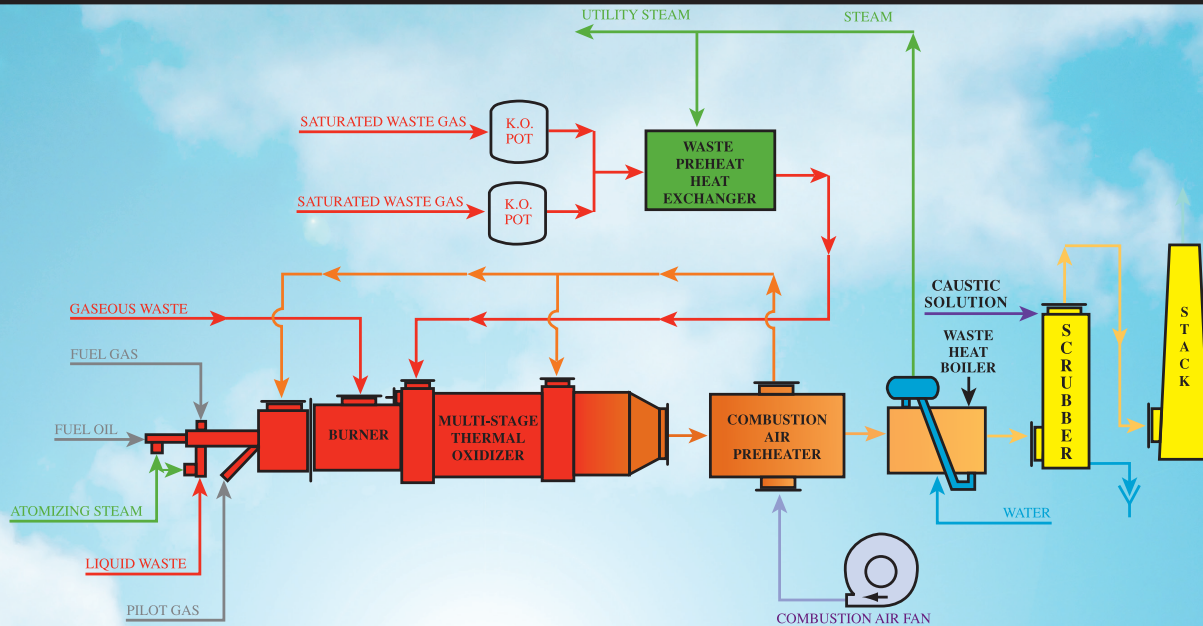
Our team of application and design engineers understands the need for integration of equipment and accessories from the customer's perspective. Our personnel bring a wide range of experience in global industries such as petrochemical, pharmaceutical, pulp and paper, mining and minerals, organic and inorganic chemicals and automotive, just to name a few.

Bringing projects to fruition within the initial time schedule and budget has become a hallmark of the PCC organization.

PROCESS COMBUSTION CORPORATION

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Oxidizers from people who know and care about providing environmental compliance with reliability



TYPICAL FULLY INTEGRATED THERMAL OXIDATION SYSTEM

Typical Wastes

- Acrylonitrile
- Terephthalic Acid
- Butanediol
- Mercaptanes
- Low BTU Gases
- VOC's
- Waste Oils
- Butyl Chloride
- Phosphine
- Hydrogen Cyanide
- Toluene
- Benzene
- Halogenated Hydrocarbons
- Trichloropropene
- Maleic Anhydride
- Dibutyl Phthalate
- Trifluoroacetic Acid
- Chlorinated Hydrocarbons

Industries Served

- Petrochemical
- Man-made Fibers
- Petroleum
- Pulp & Paper
- Automotive
- Energy
- General Manufacturing
- Pharmaceuticals
- Animal rendering



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China Office



India Office



United Kingdom Office

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ELECTRIC FTO

FLAMELESS THERMAL OXIDIZER



**High
Destruction
Efficiency,
Low NO_x,
Electrically
Heated**

The *PCC Electric FTO (EFTO)* consistently treats Volatile Organic Compounds (VOCs) in waste gas streams yielding removal efficiencies of 99.9999%. The thermal oxidation is accomplished at 1800°F to avoid production of thermal NO_x and to minimize operating costs. Thermal NO_x levels are <1 ppmv.

The *PCC Electric FTO* consists of a carbon steel, refractory-lined oxidation vessel. The vessel contains three spiral-wound electric resistance heater elements in 310SS protection tubes surrounded by a bed of randomly packed inert ceramic saddles. The *PCC Electric FTO* is fully automatic and there are no moving parts in the oxidizer. Alternate materials of construction are available as required based on the waste gas composition. A typical system requires 480V 3phase 100 amp, 120V 1 phase 20 amp, and 5 scfm of instrument air at 80 psig.

**How the PCC
Electric FTO
Works**

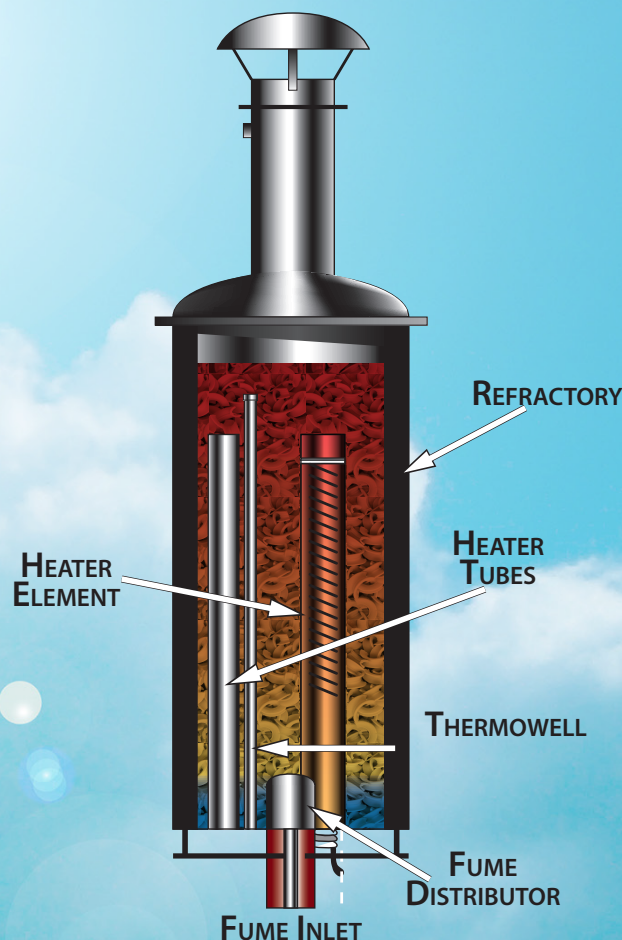
The *PCC EFTO* consists of a vertical, refractory-lined vessel filled with ceramic media. The ceramic media is pre-heated to a calculated temperature through the use of an electric resistance heater. Electrical energy is only required as a supplement to the heat content of the fume and to preheat the ceramic bed during start-up.

The waste gas and air are pre-mixed at the bottom of the vessel and introduced into the unit. The organic compounds found in the waste gas are oxidized and discharged into the atmosphere via a stack extension on the top of the unit.

The *PCC Electric FTO* operates well below the Lower Flammable Limit (LFL), eliminating the possibility of a flame within the system. The fume oxidizes as it passes through the oxidation zone releasing heat, which is transferred into the surrounding ceramic matrix thus maintaining the operating temperature of the bed without the need for supplemental heat via the electric heaters.

**Simplicity of
Design**

The *PCC EFTO's* simplicity of design and portability make it a multi-purpose piece of equipment for multiple low volume gas treatment applications. The *PCC EFTO's* standardized design requires minimal customization. The modular configuration makes it simple to install.



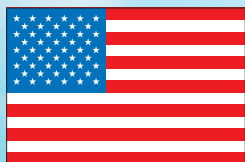
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Call now for a competitive proposal!



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SCRUBBERS & SUPPORT SYSTEMS

 Vertical Countercurrent Packed Tower

 Horizontal Crossflow Packed Bed

 Vertical Tray Scrubber

 Venturi Scrubbers

 Eductor Venturi Scrubber

 Quench Systems







PROCESS COMBUSTION CORPORATION

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Scrubbers and Support Systems

For 50 years, PCC has been providing "solutions" that ensure our customers are in compliance with local, state and federal requirements. .

PCC's SCRUBBER SYSTEM PORTFOLIO INCLUDES THE FOLLOWING SOLUTIONS:

- | | |
|---|--|
|  Vertical Countercurrent Packed Tower |  Venturi Scrubbers |
|  Horizontal Crossflow Packed Bed |  Eductor Venturi Scrubber |
|  Vertical Tray Scrubber |  Quench Systems |

PCC designs systems utilizing materials of construction that are compatible with the process and offer a long service life at a reasonable cost. Typical systems utilize Fiberglass Reinforced Plastic (FRP), Thermoplastics (HDPE, PP, PVC, CPVC) and Alloy Steel (304/316 Stainless, Alloy 20, Hastelloy C-276).

PCC Engineered Systems:

- Chemical Processing
- Petrochemicals
- Food processing
- Electronic Components & Semi-Conductor
- Odor Control Nitrous Oxide and Sulfur Oxide
- Pharmaceuticals
- Pulp & Paper



Wet Scrubber Selection Guide:

Scrubber Type	Gas Absorption		Mists <10 Micron	Mist >10 Micron	Solids/Dusts >5 Microns	
	High Sol.	Low Sol.			Low	High
Packed Tower	E	E	G	E	NR	NR
Crossflow	E	G	G	E	NR	NR
Tray Tower	E	E	G	E	G	NR
Venturi (High Energy)	F	NR	G	E	E	E
Venturi (Low Energy)	F	NR	F	G	E	E
Eductor Venturi	F	NR	F	E	E	G

E: Excellent; G: Good; F: Fair; NR: Not Recommended

As with all of PCC's APC equipment, we are happy to provide a quote for a stand-alone unit or a completely integrated system custom-designed for your process. Call us for a proposal today!



DESIGN CRITERIA

Vertical Packed Tower Designs

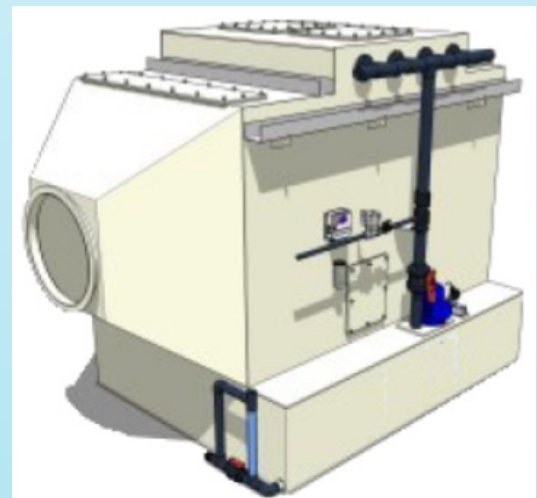
- Gas Rates: 20 to 100,000 cfm
- (200 to 600 fpm)
- Liquid Rates: 8-12 gpm/1000 cfm
- Pressure Drop: <1" to 8" w.c.
- Packing Depths: 3 to 20 feet
- Mist Eliminators: Packing, Chevrons, Mesh Pad



Quench

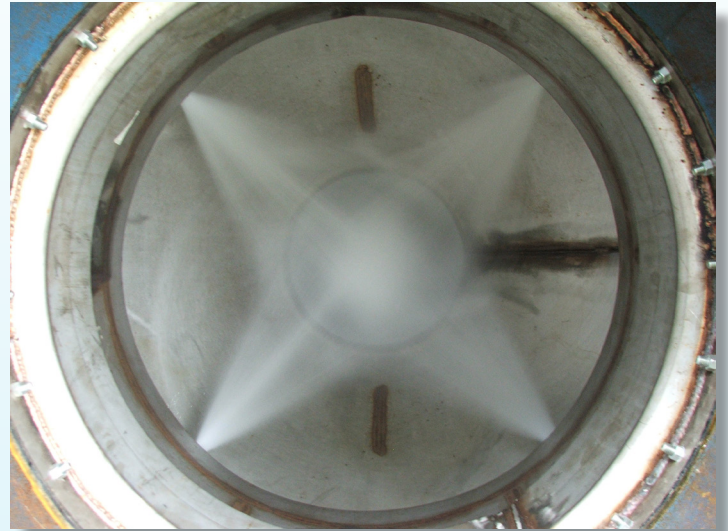
Horizontal Packed Crossflow Designs

- Gas Rates: 1,000 to 100,000 cfm)
- Liquid Rates: 12-24 gpm/1000 cfm
- Pressure Drop: <1" to 6" w.c.
- Packing Depths: 2 to 10 feet
- Mist Eliminators: Chevron Blades

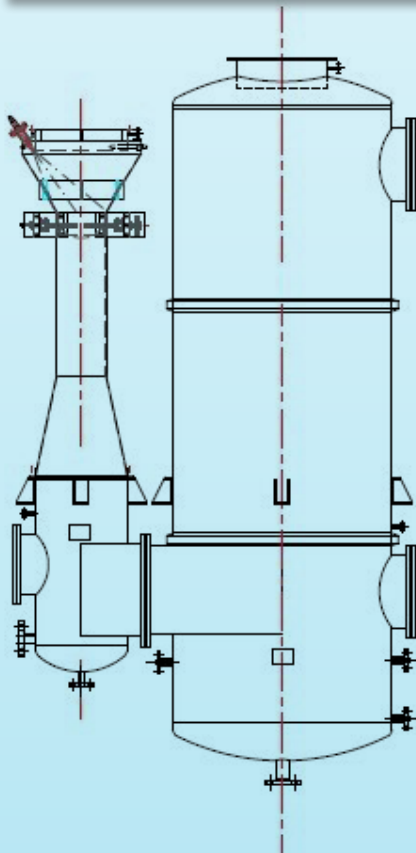


High to Medium Energy Venturis

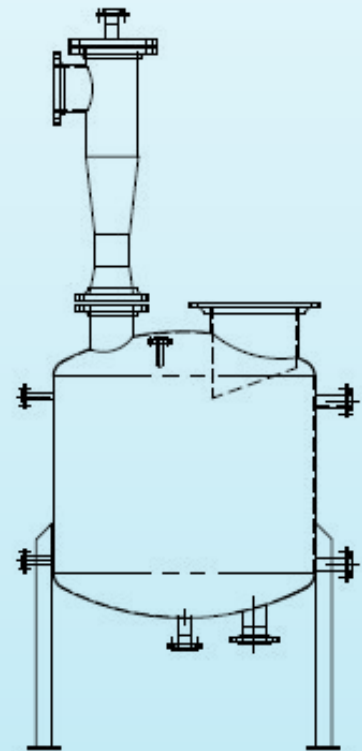
- Small dust applications $>.4$ micron
- Can be coupled to gas absorption equipment to handle mixed particulate/gas applications
- Condensing moisture or particulate that coats or plugs dry collectors.
- Flammable or explosive particulate/gas mixtures



Horizontal Crossflow Packed Bed



Variable Throat Venturi



Eductor Venturi

- Low flow 50-3000 cfm applications.
- Mixed particulate/gas scrubber applications.
- Mixed steam, particulate/condenser/scrubber applications.
- Particulate 3-5 micron and larger.
- Hygroscopic dusts that plug dry collectors.
- Hot corrosive oven exhausts.
- Flammable or explosive particulate/gas mixtures

MISSION STATEMENT...PCC's mission is to apply our know-how with confidence to design, supply and service high-tech, energy-efficient, dependable combustion and pollution control systems that provide cost effective environmental solutions for our global customers.

We will work hard together to achieve mutually rewarding, long-term relationships with our clients and suppliers, and we will continuously develop new technologies to meet emerging market needs.

Our Core Values

- **Know-How** - Experienced, Knowledgeable & Competent - PCC's #1 Core Value
- **Hardworking** - Working Hard Together to Get the Job Done
- **Confidence** - Our Confidence in Our Abilities = Customer Confidence
- **Customer Focus** - Custom Design with a Friendly, Willing Spirit
- **Dependable** - Meeting Commitments to Our Customers & Owners

For over 50 years, Process Combustion Corporation (PCC) has designed, supplied & serviced combustion, heat transfer & pollution control systems worldwide. Headquartered in Pittsburgh, PA, USA; with offices in Beijing, China; and London, England; PCC is recognized as a global leader in pollution control systems. Our creative designs minimize system costs, especially energy consumption, while meeting environmental regulations. Our capabilities include:

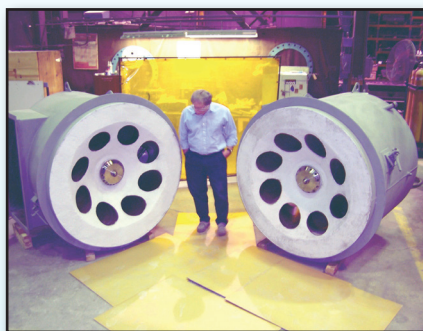


- **Thermal Oxidizer Systems**
- **Regenerative Thermal Oxidizers**
- **Flameless Thermal Oxidizers**
- **Bio-Oxidation Systems**
- **Wet Scrubbers**
- **Activated Carbon Adsorption**
- **Air Heaters**
- **Specialty Burners**
- **Specialized Combustion Systems**
- **Low NOx, SCR/SNCR Systems**
- **Landfill Gas Thermal Oxidizers**
- **Service & Installation**
- **Engineering Studies**
- **Turnkey Projects**



Located in the South Hills of Pittsburgh, PA, PCC's Administration, Sales and Engineering are housed in one location.

PCC has enjoyed successes working with the following companies (partial list) over the years. Our goal is always to be sure our customers are satisfied with quality, custom-designed and engineered, reliable products and services.



3M
Air Products & Chemicals
AK Steel
Albemarle
Albemarle Catalyst
Amsterdam
Aker Kvaerner
ALCOA
AOC
Arcadis Giffels
Arizona Chemical
Arkema, Inc.
Ashland Polyester
Atlas Roofing Corp.
Barrick Goldstrike Mines,
Inc.
BASF Corporation,
BC Seneca
Bayer
BE&K Construction Co., LLC
BlueStar Silicones
BP Chemical
British Gypsum
C.A.G.
Cabot Corporation
Calgon Carbon Corporation
Catalyst Recovery
of LA, LLC

CertainTeed Corporation
Codelco Devision El
Teniente
Chinook Sciences
CDI Engineering
Cyanco
Cytec Carbon
Fibers LLC
Cytec Industries Malaysia
Sdn Bhd
Daikin America
Dow Chemical
E.I. DuPont de Nemours
& Co.
Eastman Chemical
Elysium Energy
Engelhard
Fabrica Carioca de
Catalisadores
Firestone
Polymers, LLC
Ford Motor Company
Gas Technology Institute
Grace Davison
GraTech
GSF Energy LLC
Harper International
Henry F. Teichmann
Honda R&D Americas, Inc.

Honda Transmission Mfg. of
America, Inc.
Horsehead Corp.
Huber Engineered Wood
Hyundai Motor
Manufacturing
IES Ltd.
Ineos
Ineos Nitriles (UK) Ltd.
Iron Dynamics
Flat Roll Division
Israel Military Industries
Ltd. (IMI)
JM Huber
KiOR Inc.
Koppers
Kunshan Eastern Rainbow
Environmental Equipment
Co.
Kureha Advanced Materials,
Inc.
Lanzhou Design Institute
LES Renewable
NG, LLC
Lipten Company
Louisiana Pigment
Company, L.P.
Lucite
International, Inc.
Meadwestvaco Papers
Group

Metropolitan Biosolids
Management, LLC
Millennium
Inorganic Chemicals
Monsanto
Montauk Energy
Morgan AM&T
National Electrical Carbon
Niro, Inc.
Noble Energy
Norit Americas
Omnova Solutions
Omya, Inc.
OPTI Canada
Orion Carbon
Owens Corning Asphalt
Plants
PetroChina Jilin
Petrochemical Company
Polychemie, Inc.
PPG Industries, Inc.
Propak Systems Ltd.
Puralube
Rubicon/Huntsman
Rudolph/Libbe, Inc.
Seadrift Coke, LP
Seneca Landfill Gas
to Energy Plant
Shanghai SECCO
Petrochemical Co.

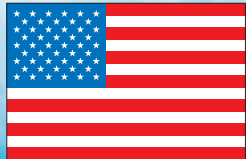
Sinopec Anqing
Solid Waste Authority of
Central Ohio (SWACO)
Solutia
Sterling
Chemicals, Inc.
Swindell-Dressler
International Co.
Technical
Chemical Co.
Tembec Industries
Toray Carbon
Fibers America, Inc.
URS Corp.
Valspar
Waak engineering
Waste
Management Renewable
Energy, LLC
Weyerhaeuser
Yantai Wanhua
Polyurethanes
Co. Ltd.



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SULFUR RECOVERY UNIT TAIL GAS INCINERATION

At a time when crude oil and natural gas contains greater quantities of sulphur, and sulphur containing contaminants, the demand for 'cleaner' low sulphur fuels driven by environmental legislation is putting further pressure on the operation of sulphur recovery units (SRUs).

Commercially developed in the 1930s the Claus process, or modern day variations, is the industry standard for sulphur recovery. The standard present day process consists of a reaction furnace, a waste heat boiler for steam production, two or three catalytic reaction stages and a tail gas incinerator. See fig.1.

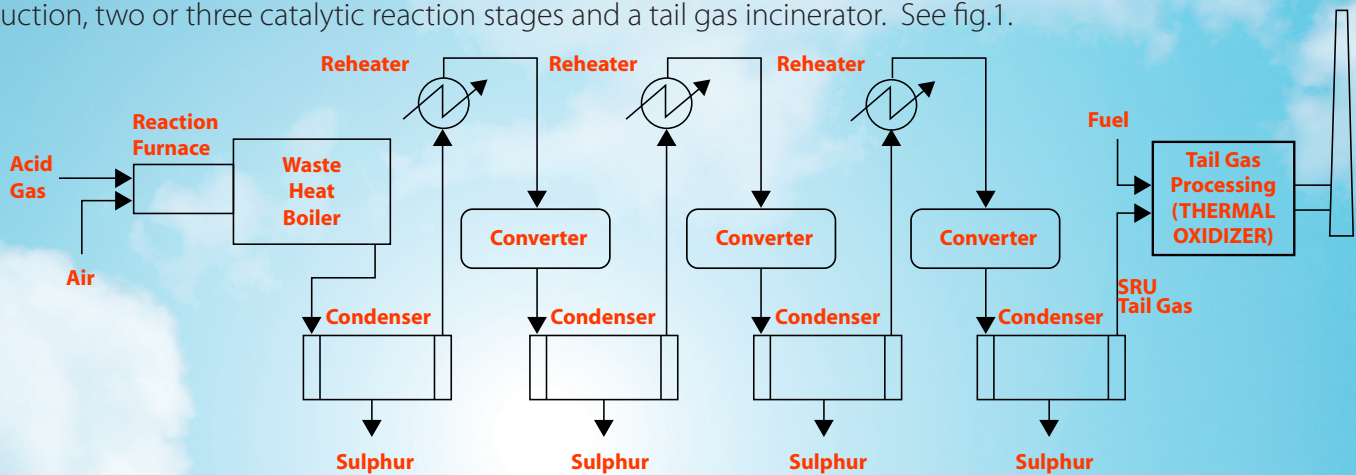


Fig.1. Straight through three bed modified Claus unit.

With over 70 years experience in combustion technology, PCC has particular expertise in the design, engineering and manufacture of tail gas incinerators complete with the associated control skids and burner management systems. The tail gas from a Claus unit typically contains N_2 , CO_2 , H_2O , CO , H_2 , unconverted H_2S and SO_2 , COS , CS_2 , sulphur vapour and entrained liquid sulphur. Due to environmental regulations, venting of this tail gas stream

without further processing is seldom permitted. The minimum requirement is usually incineration, for which the primary purpose is the destruction of the remaining H_2S (<10ppm). Waste heat removal and additional flue gas treatment can be incorporated into the design where further steam production or emissions legislation demands.

As the combustibles present in the Claus unit tail gas are so dilute (<3%) and therefore will not burn unsupported, oxidation of all the sulphur components to SO_2 requires the addition of external fuel and air. In the presence of excess oxygen, the thermal oxidation of the tail gas is carried out at temperatures of 650 - 800°C. Typically sized for a residence time of 1.0 second

(minimum of 0.5 seconds), most tail gas thermal oxidizers are natural draught. However, forced draft designs are often preferred when downstream equipment such as boilers or steam superheaters are included. The excess oxygen level is generally designed for 4-5%, which equates to 20-25% excess air and ensures that all sulphur compounds are oxidized to SO_2 .



Sulphur Recovery Tail Gas Incinerator

PROCESS COMBUSTION CORPORATION

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Oxidizers from people who know and care about providing environmental compliance with reliability

Both the thermal oxidizer and stack of a typical tail gas incinerator are refractory lined to protect the steel from the high temperatures. A high stack temperature has to be maintained in order to ensure the gases remain above the dewpoint, thus avoiding the potential corrosion caused by the condensation of H_2SO_4 . Normally one layer of refractory is sufficient as the temperatures are not as high as those in the reaction furnace of the Claus Unit.

Insulating castables, rated at 1200°C and 1500°C are commonly used for the chamber and burner area respectively. The stacks can be designed as free-standing, derrick-supported or guyed structures, where selection is governed by process design (height and diameter required), climate (wind-load, seismic activity etc.), and site area availability.

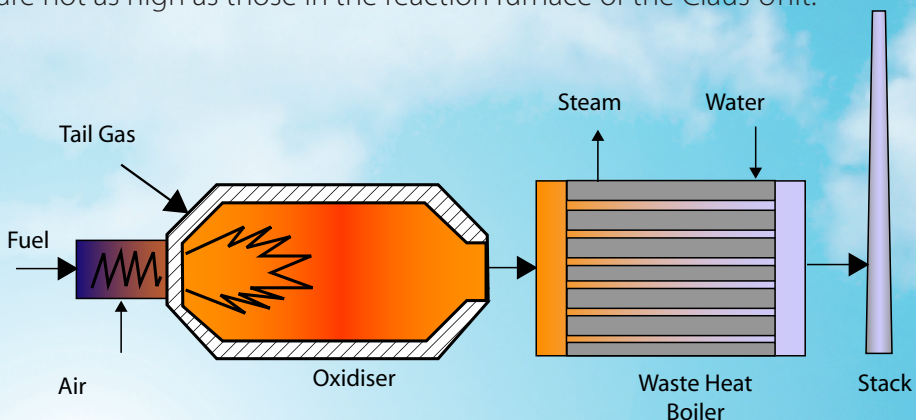
If the tail gas incinerator is required to handle nitrogenous streams (eg: amines or ammonia), as can be the case where waste

streams from the acid gas/amine treatment units are present, PCC can provide a specialist two stage low NO_x thermal oxidation system to handle the additional streams without breaching stringent NO_x emission levels. See PCC's Two Stage Low NO_x Thermal Oxidation brochure.

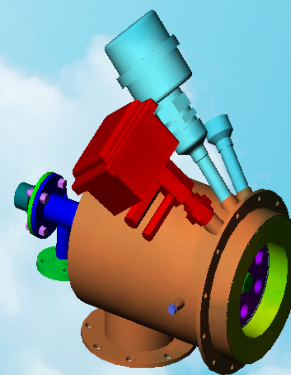
With PCC's knowledge and expertise in the field of burner design, we are also able to offer a proven sub-stoichiometric burner for use in the reaction furnace of the Claus unit. The PCC Baffle Burner has been installed in hundreds of commercial applications and can operate below 50% of stoichiometry, an important requirement for reaction control in the furnace. The construction of this high intensity burner also provides excellent fuel-air mixing at much lower noise and vibration levels than other high intensity burners. The full capability of the PCC baffle burner can be clearly demonstrated on our burner test facility.

Where direct fired methods of reheating are specified for each of the catalytic beds in the Claus train, PCC can also offer direct fired reheaters based on the same burner technology. The burner can be fired using a side stream of acid gas or fuel gas and work under the sub-stoichiometric conditions required to prevent oxygen breakthrough thus avoiding catalyst poisoning. By opting for this reheating method, the process gases can be heated to any desired temperature level whilst minimizing pressure drop.

Whether you require a burner retrofit for your existing plant or a complete turnkey tail-gas incineration unit with associated control and burner management systems, PCC's experienced sales and engineering staff will be pleased to discuss your application.



Tail Gas Thermal Oxidiser with Optional Waste Heat Boiler



PCC Limited Baffle Burner

US Headquarters



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PROCESS COMBUSTION

C O R P O R A T I O N

ULTIMATE AFTERMARKET

Single-Source for all your APC Equipment Needs



www.pcc-group.com

AFTERMARKET - MISSION STATEMENT

PCC's Aftermarket mission is to continue to supply the same high-level service, spares, rebuilds and retrofits for the existing equipment. PCC will use our know-how to design, supply and service high-tech, energy-efficient, dependable combustion and pollution control systems that provide cost effective environmental solutions for our global customers.

We will work hard together to achieve mutually rewarding, long-term relationships with our clients and suppliers, and we will continuously develop new technologies to meet emerging market needs.

Process Combustion Corporation provides the following Aftermarket services for your Air Pollution Control Equipment needs:

Spares

- ⚙️ **Prevent** shutdowns due to long lead times
- ⚙️ Intimate **knowledge** of your system
- ⚙️ Can set up **recurring orders** to ensure system is always fully stocked
- ⚙️ Increase overall **reliability**

Service

- ⚙️ Stop problems **before they start**
- ⚙️ Equipment and component life **enhanced**
- ⚙️ System operation and performance is **optimized**
- ⚙️ Have your system running as **safely** as possible

Rebuild/Retrofits

- ⚙️ Complete **overhaul** of existing units
- ⚙️ Can be a **replacement-in-kind** or completely **new**
- ⚙️ Can modify fuel type from **oil to gas**
- ⚙️ Give **new life** to an old, existing unit

AFTERMARKET SERVICE



✓ **Safety** ✓ **Efficiency** ✓ **Compliance** ✓ **Reliability**

We've all been there...something's wrong at the plant. Production has come to a halt. It's an all-hands on deck effort to fix a problem that never should have happened in the first place. Sometimes the smallest things cause the biggest challenges. Nobody thinks about the Air Pollution Control equipment - until there's a problem.

- Reduce the risk to your operations by having your PCC equipment serviced by the experts who built it!
- Maintain a safe work environment
- Prevent costly nuisance shutdowns
- Reduce the Regulatory risk of exceeding permitted emissions
- Control operating costs by minimizing fuel consumption

PCC's services include the following:

- Checking all safety interlocks. Adjusting as necessary and verifying First Out annunciation
- Calibrating all transmitters/high temperature limits
- Checking all pressure/position/level switches and adjust as necessary
- Checking the stroke of all control valves
- Verifying and adjusting air to fuel ratios
- Inspecting internal refractory (if required).
- Leak testing all fuel safety shut off valves
- Addressing any problems/questions by plant operations.
- Checking fuel or water nozzles.
- Replacing any faulty components if spares are available at the plant.
- Checking the pilot burner setup and verify lighting reliability.
- Reporting results of checkout to include recommending replacement parts and unit upgrades

Customers with Service Plans receive **Priority Scheduling** and save 25% on PCC's standard service labor rates.

Contact Matthew Valancius, PCC's Aftermarket Manager, (412) 655-0955 x3177 or mvalancius@pcc-group.com for more info.

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ENCLOSED GROUND FLARES

FOR LANDFILLS, DIGESTERS AND BIOGAS APPLICATIONS

For decades, Enclosed Ground Flares (EGFs) have proven to be a logical and economical choice for many applications. They are simple, cost effective, and typically achieve 98% DRE for most VOCs. EGFs are commonly used as a thermal destruction device for waste streams that have a heating value. The required combustion air is obtained through natural draft rather than a forced draft fan. The controls and instrumentation are typically minimal and the control panel will have limited function in most cases.

Design Advantages

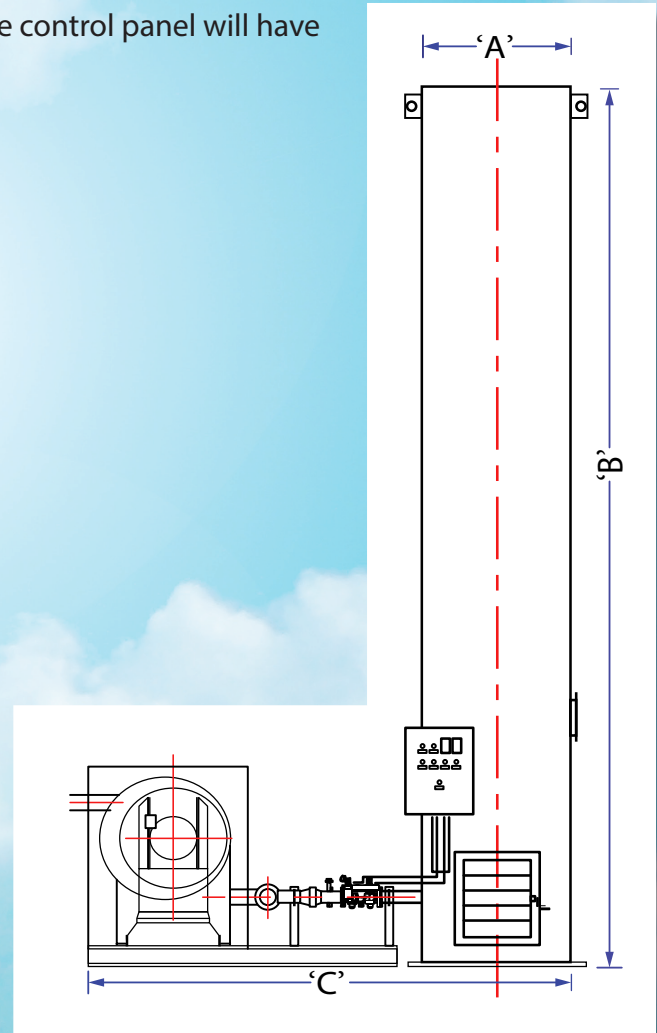
- Concealed flame
- Operating Temperature: 1400°F-1800°F
- Residence Time: 0.5 sec. min.
- Minimal Plot Space
- Modular Design for flexibility
- Easy Installation
- Economical

Safety Features

- Flame Detection
- Multiple thermocouples
- Block valves
- Purge cycle

Options

- Hard or Soft Refractory
- Control upgrades
- Skid Mounting
- Ladders & platforms



TYPICAL SIZING DATA								
Larger sizes available upon request								
Waste Flow Rate, (scfm)	Total Unit Capacity (MMBtu/hr)	Dimensions, in ft.			Fuel Consumption, @ %CH ₄ , MMBtu/hr			
		"A"	"B"	"C"	3%	5%	8%	12%
500	5	4'-0"	25	16	4.3	3.63	2.62	1.27
1000	10.4	5'-0"	30	18	8.6	7.3	5.23	2.53
2000	22	5'-9"	32	20	17.2	14.5	10.5	5.0
3000	31	6'-6"	35	22	25.8	21.8	15.7	7.6

*Note: Above dimensions are based on waste stream composition of 8% CH₄, 98% DRE and other assumptions.

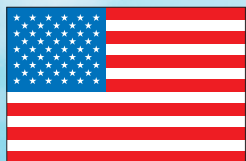
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FORCED DRAFT FLARE

FOR LANDFILLS, DIGESTERS AND BIOGAS APPLICATIONS

Some applications require a reasonable but effective alternative to a thermal oxidizer or an enclosed ground flare. PCC's Forced Draft Flare incorporates the best features of both to produce a cost-effective, fuel-efficient, combustion-based pollution control device. PCC utilizes our 50 years of experience with combustion related systems to optimize the performance of these units. Our modular design also allows for simple and quick modifications to increase residence time or incorporate heat recovery in the future.

Design Advantages

- Improved management of combustion air for performance benefits
- Significantly less fuel consumption vs. EGFs (*see table below*)
- Lower emissions
- Burner access at grade
- Not draft dependent
- Adaptable to varying operating cases
- Minimum 0.5 seconds residence time
- Operating temperature 1400°F to 1800°F
- 98%+ Destruction Removal Efficiency (DRE)
- Flanged sections can be added to increase residence time
- Greater turndown



Safety Features

- No open dampers at grade that could expose errant fumes and personnel to flame
- Flame detection, block valves, and purge
- Not impacted by wind

Options

- Skid mounting
- Control upgrades
- Heat recovery
- Higher DRE



TYPICAL SIZING DATA								
Larger sizes available upon request								
Waste Flow Rate (scfm)	Total Unit Capacity (MMBtu/hr)	Dimensions, in ft.			Fuel Consumption, @ %CH ₄ , MMBtu/hr			
		"A"	"B"	"C"	3%	5%	8%	12%
500	3	3'-6"	25	8	2.11	1.46	0.47	Pilot only
1000	6	4'-0"	25	10	4.22	2.91	0.94	Pilot only
2000	12	5'-0"	30	13	8.45	5.82	1.88	Pilot only
3000	17.5	5'-6"	35	15	12.7	8.73	2.81	Pilot only

**Note: Above dimensions are based on waste stream composition of 8% CH₄, 98% DRE and other assumptions.*

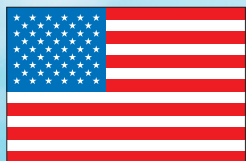
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LANDFILL OXIDIZERS FOR AIR QUALITY COMPLIANCE

✓ **Reliability** ✓ **Simplicity** ✓ **Compliance** ✓ **Maximum ROI**

PCC initially began supplying systems for landfill gas applications in the mid 1990s and have several successful operating Landfill Gas Thermal Oxidizer systems. Our thermal oxidizers can use "street grade" natural gas, raw landfill gas, and/or some of the partially processed high Btu gases derived from the customer's process as fuel for the burner. In some cases, heat recovery in the form of a heat exchanger is essential to provide heated streams to regenerate the media beds used in the landfill gas processing plants. Heat recovery is also added to the Thermal Oxidizer for preheating the combustion air to the burner to minimize fuel consumption.

- DRE (Destruction Rate Efficiency) up to 99.99%
- Control simplicity equals reliability
- Dual burner means reliable on-line service
- Refractory selection means long service life
- Permeate waste stream injected
- Multi Fuel options

Partial Customer List

- Aria Energy (IES/LES)
- GSF Montauk
- Waste Management
- Allegheny Energy



Call now for a competitive proposal!

Representatives located throughout the US. Find yours at www.pcc-sterling.com

Thermal Oxidizer Advantages

- Controlled Combustion
- Lower emissions
- Heat recovery option (boiler, HX)
- Adaptable to stream variations
- Durable, low maintenance
- Fuel options - NG, LFG, waste, high BTU
- High turndown with multiple burners

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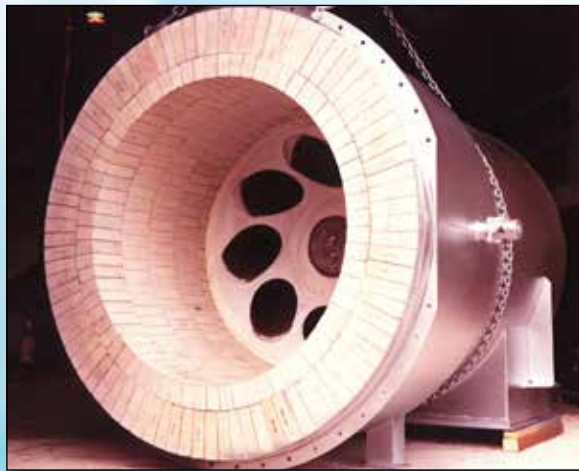


BURNERS AND COMBUSTORS

PCC high intensity, multi-fuel, low NOx burners and combustors have set the standard for quality and reliability. They are available in a wide range of standard sizes, or custom-engineered to meet your special needs.

OGH burners and combustors burn both heavy and light fuel oils and high BTU gases separately or in combination. They can be fired horizontally or vertically, and upwards or downwards. Complete, stable combustion is achieved using minimal energy combined with the "staged air" principle. Low discharge of solids and low CO are essential features of both burners and combustors. Turndown up to 10:1 is available for most gaseous fuels and up to 4:1 for most liquid fuels.

The PCC burner and combustor employs an oil atomizer when firing a liquid. The atomizer produces a well-defined cone of finely atomized oil using moderate oil pressure combined with compressed air or steam. A gas distribution ring feeds the jets, which injects gas through the port block. When gas is the only fuel, a central gas gun replaces the combination oil atomizer and gas gun assembly.



PCC Low NOx Burners, Multi-fuel Burners, and OGH Burners and Combustors are suitable for a variety of industrial applications:

- Air Heaters
- Dryers
- Ovens
- Fluid Bed Start Up
- Furnaces
- Kilns
- Incinerators

PROCESS COMBUSTION CORPORATION

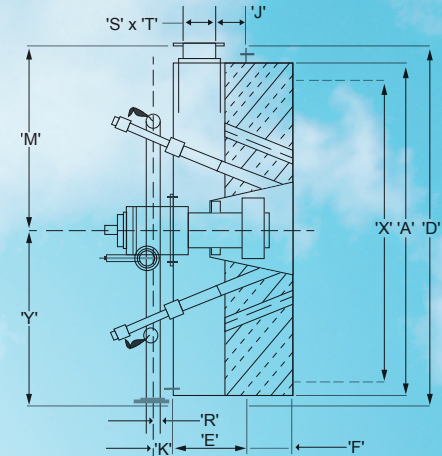
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Oxidizers from people who know and care about providing environmental compliance with reliability

OGH Burner

The OGH burner provides the means for atomizing liquid fuel(s), their introduction and distribution, together with gaseous fuel(s), into the combustion zone. There, two stages of combustion air are also admitted and distributed through the burner port block to produce rapid and efficient mixing of the fuel and air. Stable ignition of the flame is well managed. The burner also provides locations for a pilot burner, flame scanner and other associated ancillary items. The use of staged air gives the OGH burner greater stability and higher turndown capability over a wider range of excess air than most conventional forced draft burners.

The standard burner accepts preheated combustion air up to 575°F (300°C). Higher temperatures, up to 850°F (450°C), can be used on burners with a heat resistant steel plenum. An insulating inner lining may be added to the plenum if required for safety or economy.



BURNER SIZE AND TYPE	HEAT RELEASE Btu/Hr x 10 ⁶	AIR FLOW (scfm)	FLAME LENGTH AT 70% EXCESS AIR (ft)		DIMENSIONS - INCHES													
			OIL	GAS	A	D	E	F	J	K	M	R	S	T	X	Y		
OGH 1	4	1260	6.5	3.5	27	30	7	22	4	5	16	3	3	22	20	15		
OGH 2	7	2200	6.5	4.0	32	36	9	2	4	7	20	3	4	26	26	17		
OGH 3	12	3780	6.5	4.0	40	44	12	2	6	9	24	5	5	34	34	22		
OGH 4	16	5040	6.5	4.0	46	52	13	3	6	9	27	5	6	38	39	25		
OGH 5	24	7560	8.0	4.5	53	59	16	3	8	11	31	6	8	45	44	32		
OGH 6	32	10080	8.0	4.5	60	66	19	4	9	14	34	8	9	51	51	36		
OGH 7	50	15750	8.0	4.5	73	79	22	4	9	14	40	8	12	62	63	43		
OGH 8	75	23600	8.0	4.5	88	94	26	4	11	14	48	10	14	75	79	52		
OGH 9	100	31500	8.25	5.0	102	108	31	4	13	16	51	12	17	85	90	59		

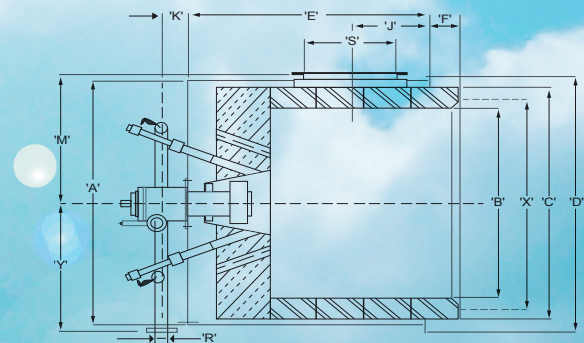
OGH Combustor

The OGH combustor combines PCC's burner with a short refractory-lined air-cooled fire tube to mix fuel and air, initiate a stable flame front and provide a high temperature environment where combustion air is preheated and mixed.

This design provides a controlled environment promoting a short and well-defined flame from the combustor resulting in reduced space requirement for completion of combustion.

OGH combustor designs are available for various heat release and preheated air.

COMBUSTOR SIZE AND TYPE	HEAT RELEASE Btu/Hr x 10 ⁶	AIR FLOW (scfm)	FLAME LENGTH AT 70% EXCESS AIR (ft)	DIMENSIONS - INCHES													
				A	B	C	D	E	F	J	K	M	R	S	X	Y	
OGH 1	4	1260	3	25	14	20	28	21.5	6	12	5	15	3	10	17	15	
OGH 2	7	2200	3	28	19	26	33	38.4	6	14	7	19	3	14	22	17	
OGH 3	12	3780	3	37	27	34	42	42.0	8	16	9	22	5	16	30	22	
OGH 4	16	5040	1.5	44	33	40	50.2	49	10	17	9	26	5	17	37	25	
OGH 5	24	7560	1.5	57	44	53	63.0	53	10	20	11	33	6	20	49	32	
OGH 6	32	10080	1.5	65	51	60	70.5	61	10	22	14	36	8	24	55	36	
OGH 7	50	15750	1.5	78	63	73	84.3	77	10	25	14	43	8	30	69	43	
OGH 8	75	23600	1.5	95	79	88	100.8	97	10	29	14	52	10	36	83	52	
OGH 9	100	31500	1.5	110	90	102	115.8	112	10	32	16	60	12	42	97	59	



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AIR HEATERS



Industrial heating, drying and calcining applications benefit from the energy efficiency, reliability and robust construction of Process Combustion Corporation's (PCC's) air heaters. Our custom designs are well proven in hundreds of successful installations worldwide.

PCC air heaters and gas reheaters provide heat releases from 4 to 100 MM Btu/hr (1-30 MW). Their high intensity burners are staged to give ultra clean combustion, whether firing oils or gas fuels. The burners feature wide turndown and low emissions, and their short, well-defined flames result in a compact design.



Custom Design

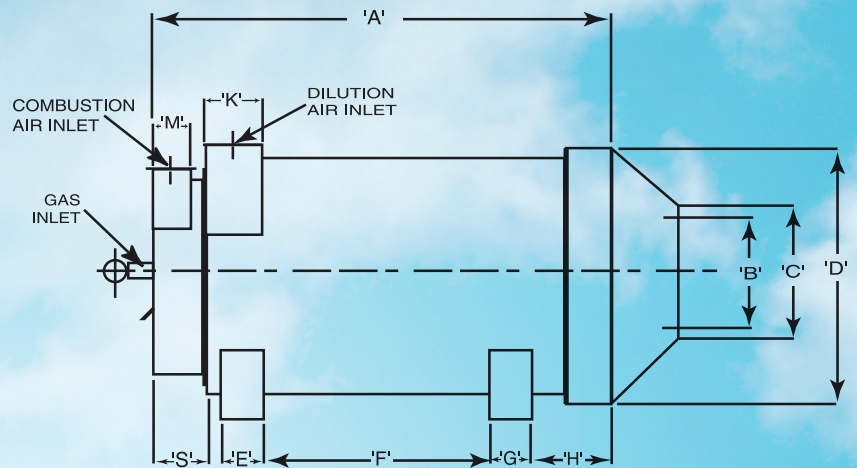
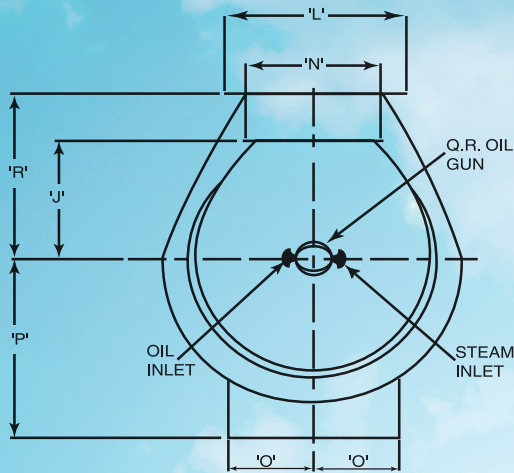
Many variations and special features are available to meet the specific requirements of your air heater application. Call PCC to discuss unique solutions to your combustion challenges.

- Induced draft dilution air
- Vertical firing positions
- Side discharge or radiation free hot air outlet
- Prepiped and prewired
- Fully packaged auxiliaries
- High pressure design, constructed to ASME code
- Skid mounting
- Close temperature mixing
- Metallic firetubes
- Hot or vitiated combustion air
- State of the art controls

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OGH BURNER SIZES	HEAT RELEASE MM	A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	R	S	APPROX. SHIPPING WT (LBS)
2	7	86"	24"	36"	45"	6"	40"	6"	18"	20"	18"	24"	6"	18"	14"	26"	28"	13"	5500
3	12	96"	30"	42"	52"	6"	46"	6"	20"	24"	21"	30"	6"	24"	18"	30"	32"	15"	8000
4	16	108"	36"	51"	64"	6"	50"	6"	28"	28"	24"	48"	6"	24"	20"	34"	36"	15"	10000
5	24	120"	42"	58"	70"	12"	50"	12"	28"	32"	26"	48"	10"	36"	24"	38"	39"	15"	12000
6	32	132"	50"	68"	82"	12"	55"	12"	30"	34"	30"	54"	12"	36"	24"	44"	41"	20"	15000
7	50	144"	58"	74"	90"	12"	65"	12"	30"	36"	30"	60"	18"	36"	27"	48"	46"	22"	24000
8	75	168"	64"	80"	99"	15"	66"	15"	39"	42"	36"	60"	24"	54"	33"	56"	52"	30"	32000
9	100	180"	68"	84"	108"	15"	77"	15"	40"	44"	36"	66"	30"	60"	36"	60"	55"	30"	40000

Air Heater Product Applications

Bagasse	Fibers	Make-up	Preheating
Bricks	Flue Gases	Minerals	Refractories
Catalysts	Fodder	Moldings	Salt
Chemicals	Food	Ores	Sand
Coal	Fumes	Oxides	Simulation
Coffee	Grain	Pulps	Slags
Concentrates	Gypsum	Papers	Slurries
Cores	Herbicides	Pellets	Test
Detergents	Hops	Pigments	Tissue
Exhausts	Kaolin	Plasterboard	Vapors

Air Heater System Applications

Boilers	Fluid bed dryers	Pulverizers	Spray dryers
Calciners	Furnaces	Ribbon dryers	Stoves
Distillers	Grinders	Rotary dryers	Tunnel dryers
Drum dryers	Jet engines	Shaft dryers	Vaporizers
Exhaust systems	Mills	Shelf dryers	Web dryers
Flue stacks	Ovens	Shredders	

Benefits

Space Saving
 Energy Efficient
 Reliable
 Long Lasting
 Simple to Operate
 Low CO/HC Emissions

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TURNKEY PROJECTS

From conceptual design to start up, and all project phases in between, PCC has the expertise and resources to execute projects on a turnkey basis.

Process Combustion Corporation handles all construction engineering, installation, commissioning and operator training through our office staff. We subcontract equipment installation to carefully selected, high-quality, erection contractors and we provide a PCC representative to supervise all facets of the equipment installation process.



After installation is complete, a PCC site representative provides supervision and guidance during the critical commissioning and start-up phases of the project. Finally, PCC provides training for operating personnel, which includes safe operation, maintenance and troubleshooting of the system and its components.

All of PCC's projects, large and small, are executed using proven engineering standards, experienced project managers, strict quality control practices, and carefully selected suppliers and contractors. This professional approach ensures safe, reliable, long-lasting equipment, and an installation that is completed on schedule and within budget.

Working closely with our E&C's, end users, suppliers, contractors and internal project team, PCC's project management makes us the preferred vendor for turnkey projects.

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Services and Offerings

Technology

With the technology, expertise and experience of the staff at PCC, we are able to offer our customers custom-engineered systems for maximum efficiency. Using Aspen, a sophisticated simulator of processes and Computational Fluid Dynamics (CFD's), a numerical model of combustion devices used to predict various scenarios and optimize the design of the system, PCC is able to deliver a high-quality, highly effective pollution control system.

Using AutoCAD and 3-D modeling, each system provided to our customers has been custom-designed for optimum efficiency.

There is no "off-the-shelf" at PCC, we work with our customers to suit their exact needs.



Parts & Service



PCC's Spare Parts and Service Department is striving to become our customer's one-call source for repairs, maintenance and replacement components.

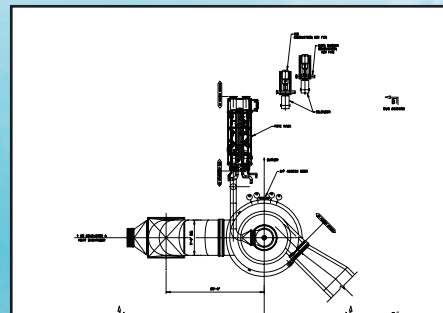
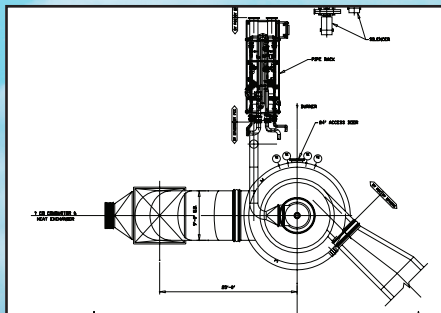
We have detailed project files that accurately track all modifications, upgrades, repairs and services associated with our previous supply of thermal oxidizers, air heaters, burners and combustors back to 1970.

PCC has constant inventory of common replacement parts. However, most other parts can be delivered in less than 4 weeks.

Process Combustion's service personnel have the full support of our staff and access to the project history. We also offer reduced-rate service contracts for periodic maintenance.

Engineering Studies

PCC prides itself on the ability to meet a customer's ever-changing needs. We are available to conduct Engineering Studies to existing PCC equipment or non-PCC equipment when the need arises. We are able to analyze existing conditions and, in some cases, provide modification recommendations that will allow the customer's system to operate more efficiently, thus providing cost savings and/or reduced emissions.



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