

CALLIDUS TECHNOLOGIES

Thermal Oxidizers

Industry Leader / Compliance Driven / Certification Assured



LOW NO_x



FUME



HALOGENATED
ORGANIC



DOWN FIRED



TAIL GAS



CALLIDUS
TECHNOLOGIES, L.L.C.
The Environmental & Combustion Experts.



Three train rotary kiln closed loop gasification system for wood products plant in the U.S.



8 MM BTU/hr brominated waste unit on site in the U.S.

Callidus-Experts In Thermal Oxidizers

Callidus Technologies Inc. is proud to be the industry leader in environmental and combustion technology.

All products - **Burners, Flares, Vapor Control Systems, Rotary Kilns, and Thermal Oxidizers** - are engineered and designed by combustion experts who are focused on customer satisfaction and emission compliance.

This dedication to our customers is proven by the performance of our thermal oxidizer group. The engineers in this group are second to none in oxidizer experience and technical capabilities and have been involved in the successful design, fabrication, and startup of over 1000 thermal oxidizers worldwide.

Rest assured. Callidus will provide the best possible solution to your thermal oxidizer requirements.

We Pride Ourselves On [Quality]

Our manufacturing facility employs the highest standards in the industry. Like many companies, our manufacturing techniques use state-of-the-art equipment, but what truly sets Callidus apart is our people. We take great care to ensure that highly trained individuals are used in performing our special requirements. Ongoing and regularly scheduled training through our research and development group assures that a high level of quality is maintained.

Callidus quality assurance personnel thoroughly inspect each assembly prior to shipment, thus reducing installation time. Callidus fabrication and manufacturing is certified to ISO 9002.

Callidus [Leads] The Way With Engineering Excellence

Callidus focuses on meeting each customer's individual requirements, resulting in a custom-designed solution for every project. In fact, on average, each engineer has 15 years experience designing thermal oxidizers.

[Advanced] Manufacturing and Fabrication Capabilities

Upgrading our manufacturing and fabrication facilities is an ongoing process at Callidus. Our fabrication facilities employ the latest manufacturing practices and equipment. As a global leader in the thermal oxidizer market, much of our fabrication occurs in strategic locations around the world. Proprietary items are fabricated in our own shop. This approach makes good economic sense, and provides our customers the best value for their combustion system.



Soil remediation rotary kiln on site in U.S.

At Callidus We Don't Just Follow The Standards - We Set The Standards

- *Burners*
- *Flares*
- *Vapor Control Systems*
- *Rotary Kilns*
- *Thermal Oxidizers*

[Fume] Thermal Oxidizer

Callidus Fume Thermal Oxidizers thermally treat organic fumes in air or inert gas streams at temperatures between 1400°F and 1600°F. Destruction efficiencies typically range from 95 to 99.99 percent.

Callidus Catalytic Oxidizers can be used in cases where the organic level is low and the fume stream is free from dust or substances potentially poisonous to the catalyst. Catalytic oxidation is generally carried out at 550°F to 850°F and requires substantially less fuel than thermal systems.

Destruction efficiencies greater than 99.99 percent may be required for some organic wastes. This is achieved by operating the oxidizer at a higher temperature with minimal auxiliary fuel. Waste heat boilers or hot oil heaters can be used downstream to recover heat for other plant operations.



15 MM BTU/hr fume incinerator on site in Europe



9.5 MM BTU/hr fume incinerator on site in the U.S.

[Tail Gas] Thermal Oxidizer

Tail gas from Sulfur Recovery Units contain a variety of sulfur compounds destroyed in Callidus' Tail Gas Thermal Oxidizer. Typical oxidizing temperatures vary from 1200°F to 1500°F, with residence times of 0.6 to 1.0 second. System designs for both natural or forced draft are available.

Generally, regulations require H₂S in the flue gas to be 10 ppmv or less; but in certain cases, levels as low as 2 ppmv are required.



22 MM BTU/hr tail gas unit on site in the U.S.

Tail Gas Thermal Oxidizer

Typical Equipment

- Low emission burner
- Castable or brick refractory
- Natural draft/forced draft
- Heat recovery optional
- Startup burner
- Stack

Typical Waste Streams

- Sulfur plant tail gas
- Carbon black tail gas

Representative Installation

- Refinery in Texas
- 20 MM BTU/hr burner
- 60,000 lbs/hr flow
- 1 second residence time
- 1400°F operating temperature



20 MM BTU/hr sulfur plant tail gas incinerator on site in U.S.

Fume Thermal Oxidizer

Typical Equipment

- Low emission burner
- Ceramic fiber refractory
- Forced draft
- Heat recovery equipment
- Burner management system
- stack

Typical Waste Streams

- VOC streams
- Process vents
- Pharmaceutical vents
- Dryer exhausts

Representative Installation

- Chemical company in Ohio
- 100 MM BTU/hr burner
- 135,000 lbs/hr flow
- 1 second residence time
- 1500°F operating temperature

10 MM BTU/hr fume incinerator with flue gas conditioning and baghouse on site in U.S.



Low NO_x Thermal Oxidizer

Typical Equipment

- High intensity burner
- Brick lined furnace
- Forced draft
- Heat recovery equipment
- Burner management system
- 3-stage process

Typical Waste Streams

- Ammonia vents
- Acrylonitrile vents
- Nitrogen bound organic wastes

Representative Installation

- Petrochemical plant in India
- 20 MM BTU/hr
- 850 Kg/hr waste flow
- 1 second residence time
- 2200°F/1600°F operating temperatures

Downfired Thermal Oxidizer

Typical Equipment

- Low emission burner
- Low porosity brick refractory
- Forced draft
- Adiabatic quench
- Particulate removal

Typical Waste Stream

- Ethylene plant blowdown
- Caustic water streams

Representative Installation

- Chemical plant in Taiwan
- 23 MM BTU/hr burner
- 1573 Kg/hr waste flow
- 2 second residence time
- 1800°F operating temperature



80 MM BTU/hr low NO_x
system on site in Europe.



35 MM BTU/hr
downfired system on
site in the Middle East.

Halogenated Waste Thermal Oxidizer

Typical Equipment

- Medium intensity burner
- Forced draft
- High alumina brick refractory
- Heat recovery equipment
- HCl recovery/scrubber

Typical Waste Stream

- PVC plant vents
- VCM waste liquids
- Pharmaceutical vents
- Bromine liquid wastes

Representative Installation

- Chemical plant in Thailand
- 20 MM BTU/hr burner
- 40,000 Kg/hr waste flow
- 2 second residence time
- 2200°F operating temperature

[Downfired] Thermal Oxidizer Systems

Thermal destruction of aqueous or organic waste streams containing inorganic or organic alkali metal salts requires that the thermal oxidizer be downfired to prevent accumulation of molten salts in the oxidizer furnace. Because molten salts tend to destroy refractory, the Callidus design minimizes salt contact which improves refractory life.

Particulates entrained in the flue gas are removed by either a wet or dry flue gas clean up system depending on the required emissions rate. In the Callidus wet system, salt or ash-laden flue gas from the oxidizer first enters the quench system located directly below the thermal oxidizer. Here the hot gas is quenched to its adiabatic saturation temperature by water injection or by a Callidus high efficiency submerged quench system (patent pending). Then, the saturated flue gas goes through a wet venturi scrubber before being sent to a packed column scrubber, if required, or vented to the atmosphere through a stack.

In the Callidus dry system design, flue gas from the oxidizer is typically cooled to 300° to 600°F by air and/or water injection before being sent to a baghouse or an electrostatic precipitator for particulate removal.

Destruction efficiencies greater than 99.99 percent are routinely achieved for most organic waste components at temperatures of approximately 1800°F. Particle matter emission rates may vary from as low as 0.005 to 0.08 grains/DSCF, depending on the particle removal equipment selected to meet the customer's requirements.

[Halogenated Waste] Thermal Oxidizer Systems

Callidus has extensive experience in halogenated organic waste oxidation, the most common halogen being chlorine. Thermal oxidation of chlorinated hydrocarbons produces hydrogen chloride gas (HCl) and some free chlorine, which must be removed. The quantity of HCl in the flue gas determines whether a

single or two-stage HCl removal system is used. Either an HCl absorber or a caustic scrubber is used when a small quantity of HCl is present. A two-stage system is often used to reduce caustic usage when the flue gas contains a significantly large quantity of HCl.

Callidus Halogenated Waste Thermal Oxidizer Systems are capable of destruction efficiencies up to 99.9999 percent. Operating temperatures can range from 1500°F to 2200°F with residence times of 1.0 to 2.0 seconds depending on the destruction efficiency required.

[Low NO_x] deNO_x Systems

Thermal oxidation of nitrogen-bearing wastes require a specialized combustion approach. Single-stage combustion of these wastes can produce NO_x emissions in excess of those allowed by most regulatory agencies. To maintain NO_x emissions within acceptable limits, Callidus uses a three-stage combustion process to destroy these wastes.

The waste is burned in the first stage under substoichiometric, or reducing conditions. The high temperatures and lack of oxygen in the first stage cause the nitrogen-bearing compounds to form elemental nitrogen rather than NO_x.

In the second stage, flue gas from the first stage is cooled to approximately 1400°F by injection of water, steam, or cooled recycled flue gas.

The combustion process is completed in stage three where the flue gas is oxidized at a temperature of 1700°F to 2000°F with excess oxygen present. NO_x in the final flue gas typically ranges from 80 to 200 ppm, depending on the waste composition. A destruction efficiency of 99.99 percent can be achieved for most compounds.



deNO_xidizer/tail gas unit on site in India.

At Callidus Technologies We [Exceed] The Expected

At Callidus, quality assurance and customer satisfaction are our top priorities. Each step of a project is reviewed to meet or exceed our customers' requirements and standards. Where applicable, equipment is pre-assembled and tested. Fabrication is accomplished either in-house or by certified, experienced suppliers. Our rigorous quality inspection program is evidenced by our ISO 9002 certification.

[Unequaled] Research and Development

Our industrial scale Thermal Oxidizer R & D Facility is fully instrumented and utilizes process control and data logging systems. The facility is devoted to research and development of new products, new combustion processes, improvement of existing equipment processes, and problem-solving efforts. The center also serves as a research facility for regulatory agencies as well as private clients.

The Thermal Oxidizer R & D Facility currently consists of two major combustion systems: a vertical, downfired salt type unit with complete wet quench system and a three-stage, low NO_x horizontal Callidus deNO_x oxidizer system. Both units are designed to be easily reconfigured to allow numerous process configurations. The computer control system and its leading edge data acquisition system also enhance the capabilities of the test facility. A separate pad, complete with stack, utility hook-ups, and flue gas

sampling equipment, is also available for equipment checkout and specialty combustion testing for our customers.

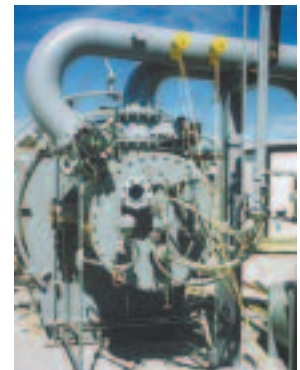
Our research and development facility investment and capabilities, along with our dedication to quality and continually improved incinerator school, underscores Callidus' commitment to being the leader in the worldwide environmental and combustion industry. We don't just follow the standards - we set them.



Thermal oxidizer research and development center



Industrial scale thermal oxidizer and data acquisition center



Thermal oxidizer burner - research and development center



USA, Corporate Headquarters;

7130 South Lewis, Suite 335 • Tulsa*, OK 74136

Phone: +1 918 496 7599

Fax: +1 918 488 9450

E-mail: thermaloxidizer@callidus.com

Web: www.callidus.com

London, UK:

Phone: +44 14 8327 0360

Fax: +44 14 8327 0361

Mumbai, India:

Phone: +91 22 2582 2639

Fax: +91 22 2582 3345

Shanghai, China:

Phone: +86 21 6875 7533

Fax: +86 21 6875 7560

