

Topsoe CATOX™ catalytic VOC oxidation technology

Catalytic VOC – compliance without compromise

The cost-effective, dependable way to remove VOCs from your off-gasses

Catalytic oxidation technology from Topsoe, makes VOC compliance a whole lot more affordable

We provide the process engineering and the specialist catalysts required, with the “big picture” perspective that ensures you an affordable, hassle-free path to VOC compliance

VOC removal

There are now global regulatory restrictions on emissions of volatile organic compounds (VOCs) – and standards are only going to get more stringent.

Catalytic oxidation

Catalytic oxidation removes the hazardous VOCs from virtually any off-gasses at relatively low temperatures. This reduces the energy consumption and environmental impact of your operations.

Our catalytic oxidation solutions enable you to get rid of 99+% of the unwanted VOCs – and with no secondary pollutant issues.

Take the hassle out of compliance chasing

VOCs are often odorless and invisible, making them difficult to combat. However, other VOCs are very visible and smelly.

Your current VOC abatement solutions may be ineffective, causing unscheduled downtime and revenue-denting interruptions to your operations, and you may even be facing challenges from your neighbors.

Emissions restrictions are constantly changing as well as getting more stringent.

You know best what your problem is.

We know best how to tackle it.

VOCs are also referred to as:

- Odors
- Solvents
- Organics
- Combustibles





Compliance is compulsory ...

VOCs are everywhere

Huge numbers of different VOCs are emitted as gases from products and materials used in countless different industrial and commercial processes. Unfortunately, they are responsible for a very wide range of health, economic and environmental problems.

That's why VOC emissions are now heavily regulated. Compliance with the relevant legislation is no longer an option – nowadays it is usually a prerequisite for even being allowed to operate.

But such compliance is costly. It often requires substantial investments in new abatement technologies to deal with standards and requirements that are constantly changing.

Ways to remove VOCs

The two technologies currently most often used to deal with VOCs from manufacturing processes are:

- **Thermal oxidation**
For many years, thermal oxidation has been the most widely used way to deal with such VOCs. However, traditional thermal oxidation using direct heat is often both inefficient and expensive, and has a substantial environmental impact.
- **Catalytic oxidation**
Catalytic oxidation systems are very different from thermal oxidizers because they rely on catalytic activity rather than extreme heat to oxidize the pollutant concentrations and remove them from exhaust streams.

This catalyst activity makes it possible to operate at temperatures as low as 150°C.

The catalytic oxidation process provides air pollutant destruction efficiencies in excess of 99%, with thermal recovery efficiencies of 50–80%. This technology is best suited for exhaust gas streams with low-to-moderate pollutant concentrations (normally 2–15 g/Nm³).

The big advantage of catalytic oxidation lies in low operating costs, easy installation and operation, and a relatively low-tech, cost-effective path to VOC compliance, because of the way advanced catalytic technology makes the incineration easier.

Each approach has its own particular history and advantages – and for practical reasons they are often combined in order to tackle specific VOC abatement requirements and operational contexts.

Total Cost of Ownership

Looking at new equipment, the price can cause confusion because it reflects only one part of the total investment. Initial cost may represent less than 10% of the total costs spent over lifetime. Energy and operation costs may have 4-5 times more relevance than the initial cost.

You need to evaluate the total cost of ownership (TCO), as an estimation of all the expenses associated with purchasing and operating a piece of equipment. TCO will provide a way to compare equipment and can be calculated as:

$$TCO = I + O + M + D + P - R$$

I = Initial costs

O = Operating costs

M = Maintenance costs

D = Downtime costs

P = Performance costs

R = Residual value

Initial costs is the price for acquire the equipment, CAPEX.

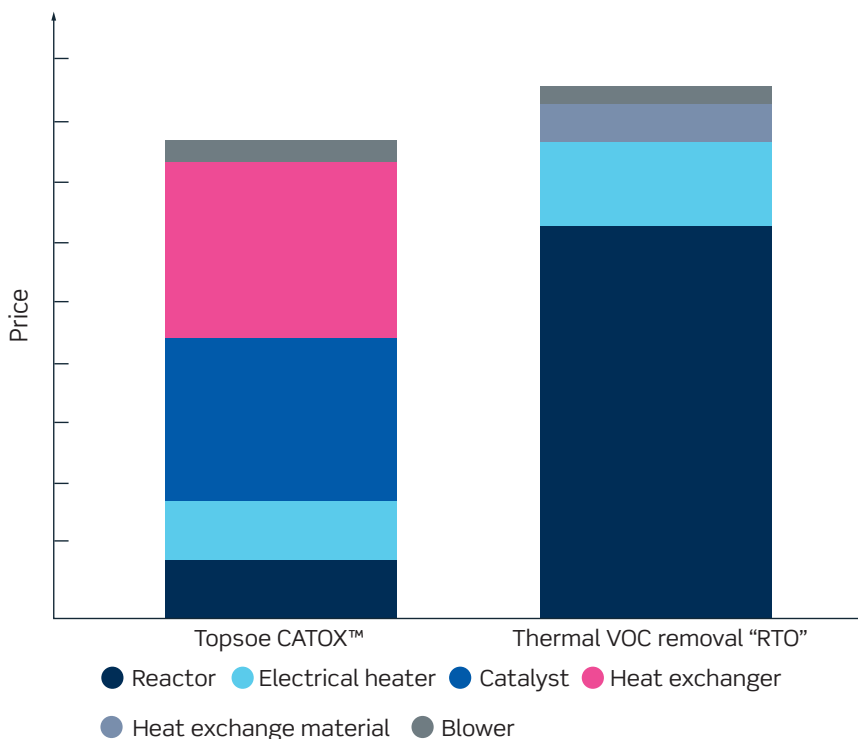
Operation costs is the annual operation (OPEX), incl. training of employees and energy to operate the installation.

Maintenance costs includes regular repairs as cleaning, inspecting, lubricating and adjusting the installation. This also includes reactive maintenance when the equipment breaks down unexpectedly.

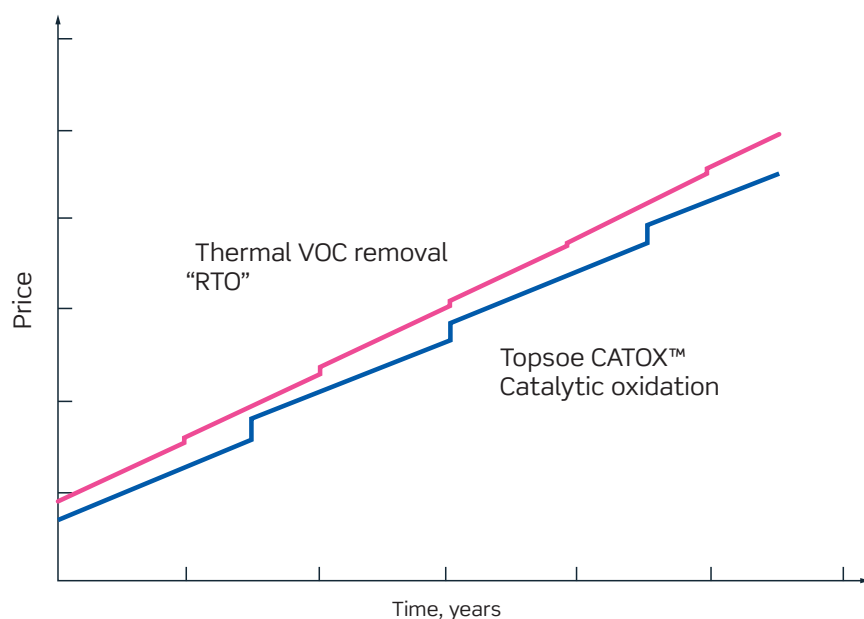
Downtime costs involves the labor costs of employees whose work is delayed, lost production, etc.

Performance costs. Installations have different levels of output, reduces various quantities of VOCs and hence different environmental implications etc.

Residual value has to do with the installation's longevity and your accounting principles. How much will the installation be worth in 5 years or 20 years?



Comparison of lump sum investment, CAPEX



Comparison of operating costs, OPEX



... it's **your choice** how to do it

How to decide what's best for you

Every industrial process that results in the formation of VOCs is unique. And the exact mixture of VOCs in your operation's flue gases will be like no other.

The combination of technology and engineering needed to incinerate and oxidize these pollutants has to be tailored to each particular industry, process and operating configuration. The main considerations when ensuring cost-effective VOC removal are:

- **How much:**
The exact pollutant profile and concentrations of VOCs in each exhaust stream you want to clean up and make compliant.
- **How long:**
The time it takes to completely break down any VOC specific pollutant into water and carbon dioxide.
- **How hot:**
The ignition temperatures required to eliminate each VOC you're having to deal with. Thermal oxidation normally incinerates them at 800-1100°C. In catalyst oxidation, special catalysts significantly reduce the temperatures needed for the problematic carbon compounds to ignite, making it possible to eliminate VOCs at temperatures as low as 150°C. Decisions about temperature requirements have to be balanced against your current energy costs, of course.
- **How the inputs burn:**
The composition of the exhaust gas has a big impact on the oxidation of the pollutants you're targeting.
- **How long-term:**
Restrictions – whether local, national or international – on VOC emissions are only going to get more stringent. You get most value out of any setup if it's compatible with foreseeable future compliance requirements.



Our take on catalytic oxidation – Topsoe CATOX™

At Topsoe, we hear companies calling for reliable, versatile off-gas cleaning solutions that make VOC compliance affordable. That's what our catalytic oxidation capabilities are all about – applying a unique combination of advanced catalyst technology and practical engineering capabilities.

Catalytic oxidation removes the hazardous VOCs from virtually any off-gas outputs by passing the gas flow through a bed of specially configured catalyst inside the combustion chamber. This works at relatively low temperatures, and therefore reduces the energy consumption and environmental impact of your operations.

Catalytic oxidation normally requires significantly less energy than thermal oxidation to operate because the chemical reactions take place at lower temperatures, thanks to the presence of the catalysts.

The process normally uses high-efficiency indirect heat exchangers to pre-heat the gas flow using thermal inputs from other processes or the exhaust from the Topsoe CATOX™.

This has big advantages:

- Lower fuel consumption and OPEX, with round-the-clock automatic operation if required
- Lower CAPEX costs, because normal carbon steel can be used and less insulation is needed
- Rapid startup supports greater operating flexibility
- Lower carbon dioxide emissions and hence reduced carbon footprint
- Negligible secondary pollutants (such as nitrogen oxides and carbon monoxide)

Clear responsibility, effective implementation

Affordable compliance with Topsoe CATOX™

Our CATOX™ technology gives you easy access to the VOC compliance essential for a “license to operate”. Getting this capability in place quickly and affordably helps you get ahead of the competition.

Topsoe CATOX™ provides

A comprehensive range of tried-and-tested catalytic oxidation solutions – ranging from simple/standardized to state-of-the art/customized.

A full spectrum of equipment/engineering services from one single reputable supplier, helping ensure effective integration, reliability, etc.

State-of-the-art, high-quality catalysts that engage as effectively as possible with the VOCs in the flue gas flow so you get the highest efficiency.

Specialist know-how about all the systems involved. Our customers benefit from comparative data and tried-and-tested configurations operating all over the world.

Solutions that are easy to upgrade, extend and reconfigure – so your

operations can comply with changing legislative specifications, market requirements and customer preferences.

Our catalyst engine

Topsoe is one of the few catalyst companies with the know-how to manufacture its own catalyst products and integrate the catalyst layout with in-house engineering and design of the entire solution. We can also draw on a huge body of comparative process data and practical experience with catalytic oxidation of individual VOCs using different catalysts and under different operating conditions.

Our CATOX™ oxidation catalysts feature proprietary formulas in which intensively researched active metals are carefully dispersed over a carrier material. These designs make sure the catalyst engages as effectively as possible with the VOCs in the off-gas flow.

Know-how benefits

We are able to draw on a huge amount of process data and practical experience with catalytic oxidation of individual VOCs using different catalysts and under different operating conditions, to help you identify and install the engineering setup best suited to your operating requirements and CAPEX/OPEX constraints, and the most effective oxidation catalysts for making it run cost-effectively and reliably.

Frameworks that suit you

We can provide project frameworks that meet your particular operating profile, compliance targets and energy/results mix.

Easy to use

With skilled engineering staff often in short supply, it's important to install equipment that's easy to use and to maintain, and requires as little human intervention as possible.

Topsoe CATOX™ systems are available with the exact degree of control system integration and automation you require.



The catalytic oxidation advantage

Removes > 99% of VOCs in any waste gas stream

No resulting NOx or other secondary pollutants

Extremely low/negligible energy consumption

Expected equipment service life >20 years

Lower-temperature oxidation keeps cost of equipment and materials down

The Topsoe CATOX™ advantage

Integrated design, configuration, engineering, manufacturing, catalyst production and system service from single source

Topsoe CATOX™ catalysts available for almost any operating setup and compliance requirement

Catalyst operating life normally approx. 20-30,000 hours – in some documented installations as much as 160,000 hours

All CATOX™ catalysts manufactured in Topsoe's own plants under ISO 9001: 2015-certified conditions, with full documentation

All CATOX™ catalysts configured on the basis of world-class scientific research, and benefiting from continuous examination of real-world operating data

Documented efficacy and reliability from catalytic oxidation installations all over the world

Configurations can be customized to individual operating requirements, with round-the-clock automatic operation if required

Topsoe CK specialist catalysts are exceptionally cost-effective, extremely resistant to VOC poisons and perform well with halogenated and sulfurous compounds

Related technologies

Discover the full range of Topsoe catalysts and technologies for optimizing performance



Filter

Particulate filtration TopFrax™ and CataFlex™

In certain industries, dust, soot and other particulates in off-gases are a problem that needs special consideration. Our solutions enable you to integrate catalytic emissions management in particulate filtration and reduce complexity and total cost of ownership. High-efficiency catalytic filters offer new flexibility in meeting existing and future emission requirements.



Catalytic incineration with SMC™ technology

The conventional way to process lean H_2S gases with low fuel value is through thermal oxidation, which consumes a considerable amount of fuel. Our SMC™ (Sulfur Monolith Catalyst) technology offers a smarter way to incinerate Claus tail gas, treating off-gas with valuable fuel savings. Up to 99.99% H_2S is converted to SO_2 with only a minimum of oxidation to SO_3 .



Nitrous oxide removal

Nitrous oxide - N_2O - is a powerful greenhouse gas with a global warming potential of 298 CO_2 equivalents. Our catalysts for N_2O decomposition enable you to achieve abatement costs that are significantly lower than normal CO_2 prices. The unique monolith structure ensures low pressure drop combined with high efficiency. The catalyst is active for both N_2O and NO_x abatement, offering a low cost solution for your overall solution.



Why **partner** with Topsoe?

The Topsoe advantage lies not just in individual solutions, but in how our solutions work together

When you partner with Topsoe, you partner not only with the world's leading technology licensor and supplier of sulfuric acid catalysts. You also partner with a company that takes a uniquely holistic approach to your plant and your business.

We look at your plant from a “big picture” perspective – and then apply the full breadth of our expertise to deliver a thoroughly tailored solution, where individual components work together to maximize your plant's performance and your business success.



Haldor Topsoe is a world leader in catalysis and surface science, committed to helping our customers achieve optimal performance. We enable companies to get the most out of their processes and products, using the least possible energy and resources, in the most responsible way. We are headquartered in Denmark and do project development, R&D, engineering, production, and sales & service across the globe.



Get in touch today
www.topsoe.com/catox

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