



# Extraction and filtration solutions for laser fume and laser dust

Air purification for industrial laser processes

# Laser processes and applications

The use of laser technology has become standard in many industrial manufacturing processes, but also in other areas such as medical technology or R&D. Cutting and joining processes, surface processing, marking or modern production technologies such as additive manufacturing benefit from the extensive advantages of this technology.

There is not "the" laser, because the range of possible technologies is also increasing.

## Laser wavelengths in the electromagnetic spectrum

### Invisible spectrum (ultra violet)

100 nm – 380 nm

### Visible spectrum

380 nm – 780 nm

### Invisible spectrum (near infrared)

780 nm – 2,500 nm

### Invisible spectrum (infrared)

2,500 nm – 1 mm

### UV laser

- 193 nm: Applications in medical technology, e.g. eye treatments
- 355 nm: Laser marking, cutting, structuring of e.g. copper, glass, ceramics
- 450 nm: UV laser for laser marking, cutting of plastics, wood

### Visual Laser

- 532 nm: High-precision turning or cutting of a wide variety of materials, e.g. sapphire, glass, and metal
- Melting, welding of copper and gold

### Near infrared Laser

- 1,064 nm: Laser marking, cutting, welding, melting of all possible materials
- Available in different power classes up to >100 kW as well as ultrashort pulse lasers (ns, ps, fs)

### Infrared Laser (Co2)

- 10.6 µm: Laser engraving and cutting of various materials, e.g. plastics, wood, rubber, leather, metals, textiles and many more

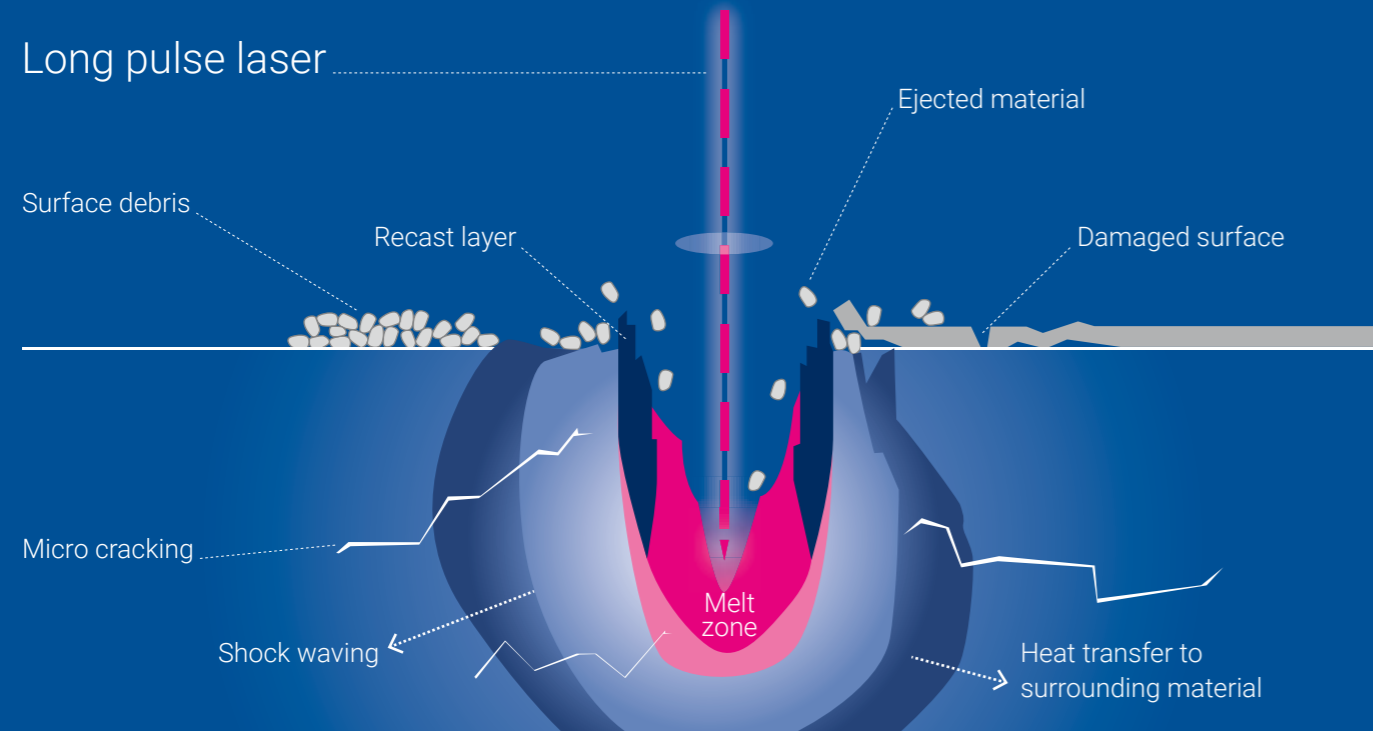
## Application fields

- Laser cutting
- Laser sintering
- Laser welding
- Laser marking
- Laser structuring
- Laser ablation
- Medical laser
- Laser printing
- Laser cleaning
- Laser melting
- Micro processing
- and more

## Processes materials

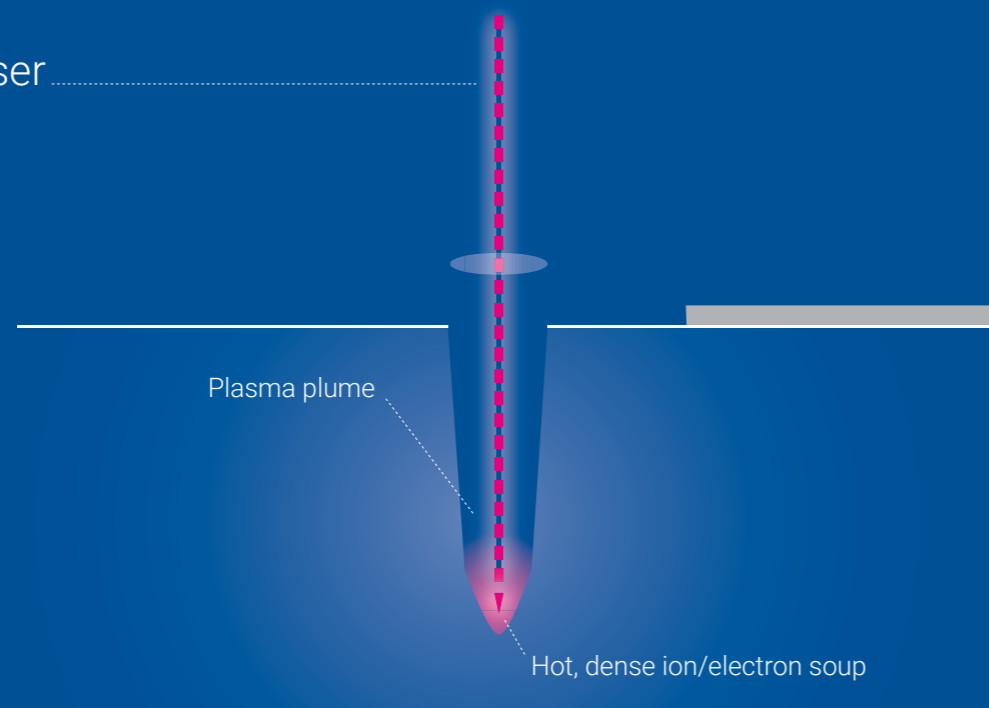
- All metals
- Plastics and composite material
- Organic materials/ textiles
- Paper
- Wood
- Ceramics
- Rubber
- Glass

# Technologies and emissions



## Ultra short pulse laser

- No damaged surface
- No debris
- No recast layer



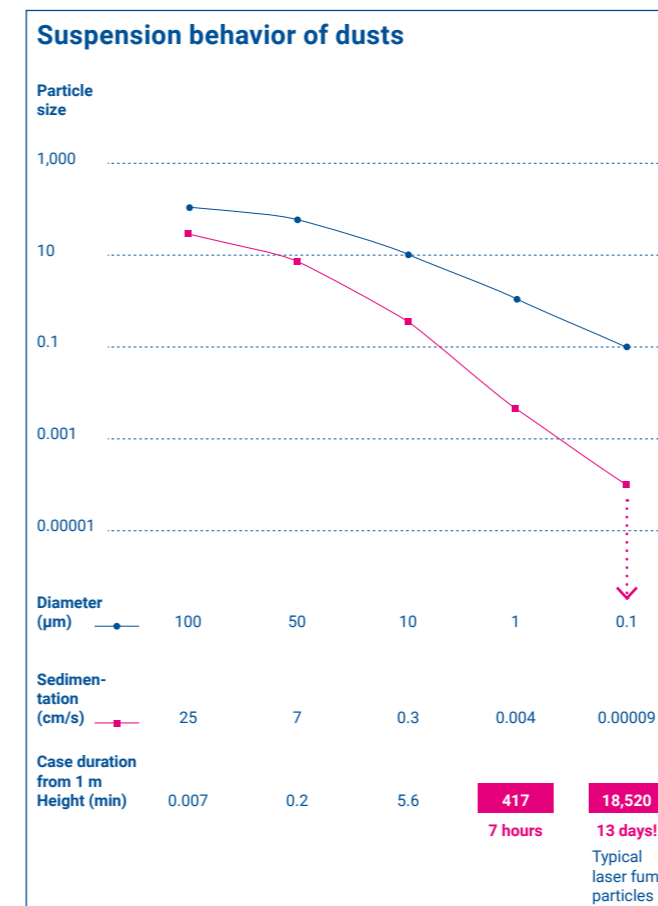
- No micro cracking
- No shock waving
- No melt zone

Depending on the laser technology, all applications produce airborne pollutants, classically referred to as laser fume, laser dust or laser vapor. These emissions consist of particles of different sizes and compositions. They may have impacts on the human organism, the manufacturing equipment, and the product quality.

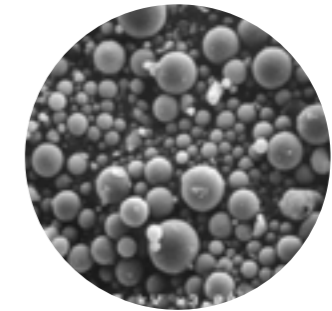
The type of contaminant emission depends on the respective laser process.

## Sedimentation behavior of airborne particles

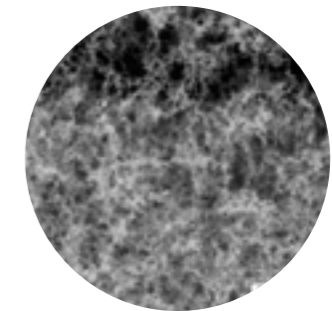
The finer the laser dust, i.e. the smaller the particles produced, the longer it takes for them to completely sink out of the ambient air – possible air movements and thermal influences are excluded. That's why it is highly important to capture and remove pollutant directly at the source to prevent it from entering the ambient air.



Particle shapes after processing with different laser techniques.



Continuous wave laser (cw)  
Nanosecond pulse (ns)



Picosecond pulse (ps)

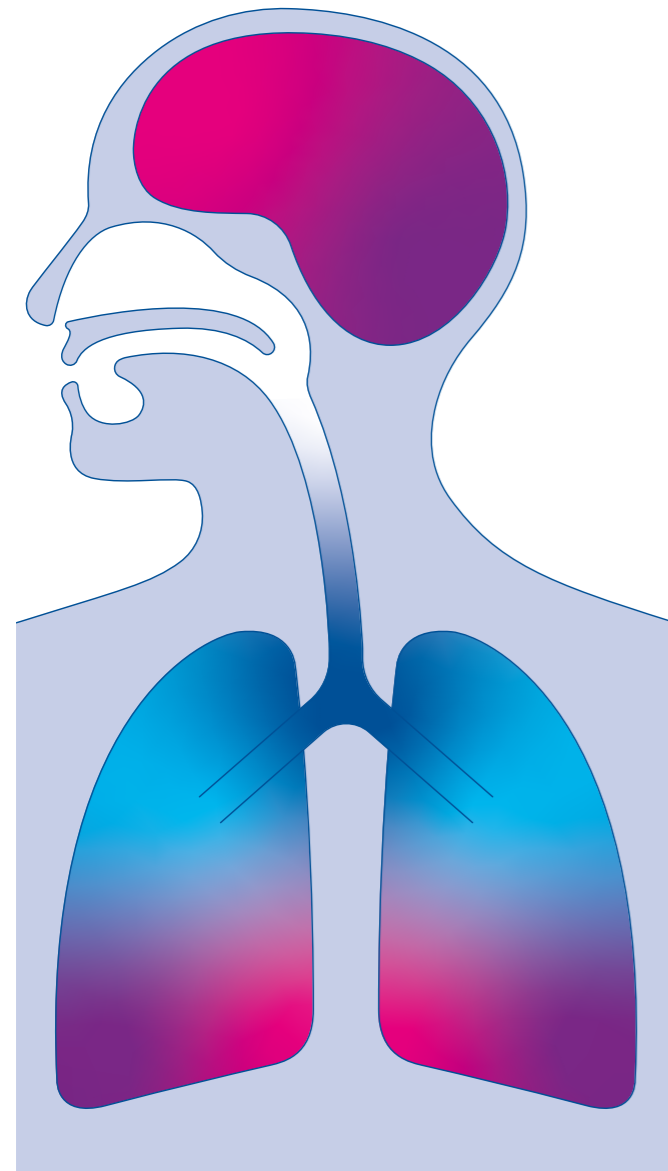


Femtosecond pulse (fs)

Particles can be highly combustible or even pyrophoric (self-igniting).

# Health risks and legal basis

In many countries there is a number of legal regulations that prescribe how airborne pollutants in the process air must be removed. A distinction is made as to whether the substances are harmful to the brain, nerves or respiratory tract, or whether they are inhalable or alveolar.



## Material processing releases pollutants



*Some compositions of laser fume, e.g. chromium-nickel compounds, must be considered separately, as special occupational safety regulations apply to them.*

The use of professional extraction and filtration technology is therefore imperative. Due to the different compositions of laser fume, a comprehensive analysis and implementation process is required to define the ideal collection, separation and exhaust solution.

# Pollutant collection

## The filtration process begins with the capture

Air pollutants are collected before filtration, because only what is captured can be filtered. The degree of capture forms the basis for the subsequent optimal filtration. Consequently, this results in the efficiency of the entire system and therefore the pollutant residues in the recirculated exhaust air.

The greatest proximity to the pollutant source is crucial here.

The selection of the best-suited collection element is also of great importance. ULT is at the customer's side to provide advice.

Further information on the capturing of airborne pollutants:

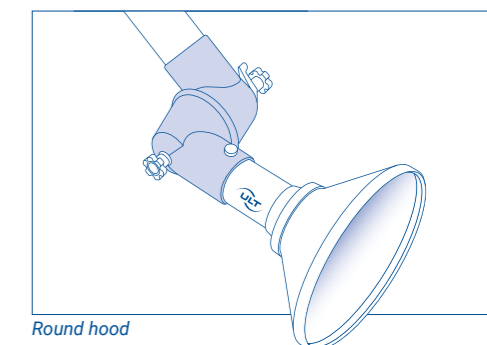
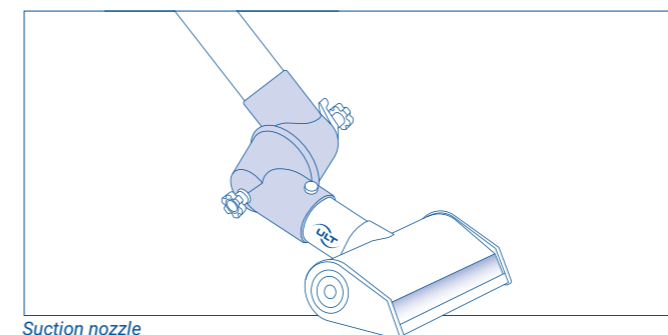
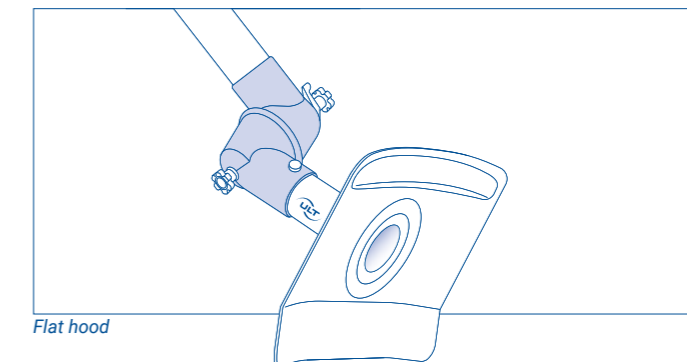
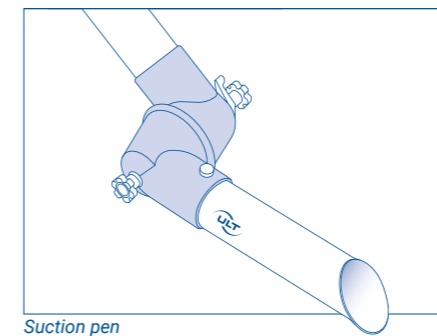


**COMPETENCE BROCHURE ON POLLUTANT CAPTURING FROM ULT**

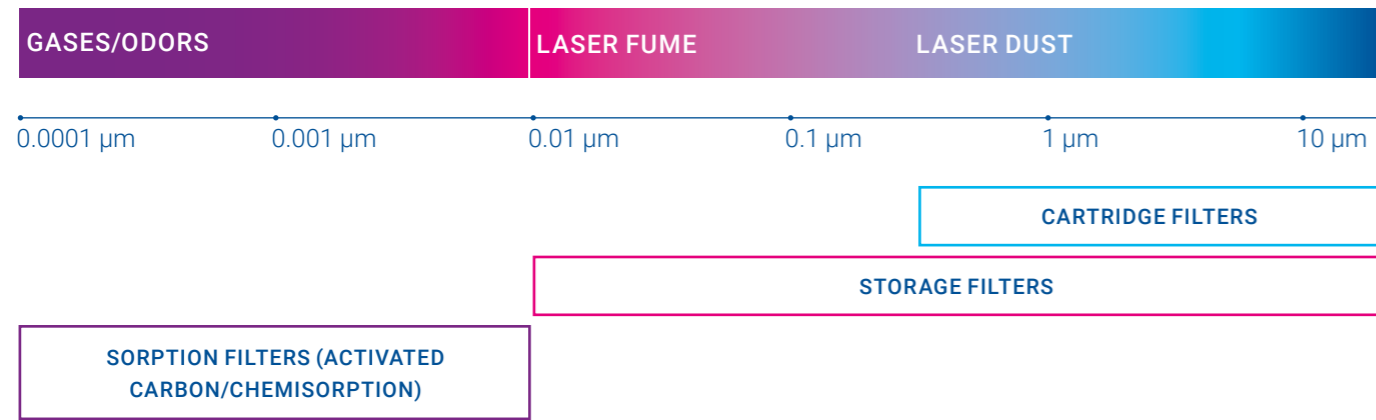


**BROCHURE BY THE GERMAN PROFESSIONAL ASSOCIATION VDMA**

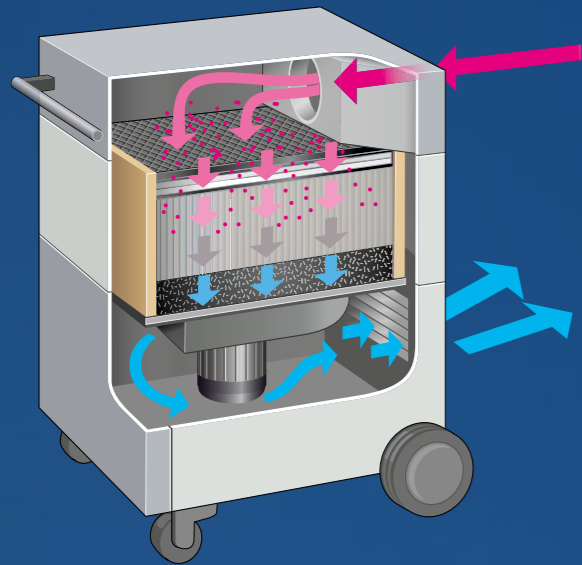
## Typical capturing elements



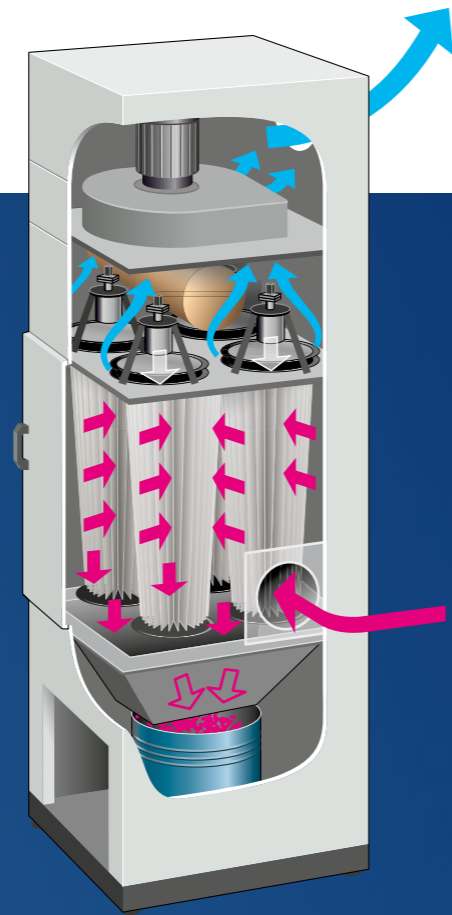
# Filter types and particle sizes



## Filtration principles



- Storage filter**
- For low laser fume concentration and sporadic use
  - Low investment costs
  - High flexibility

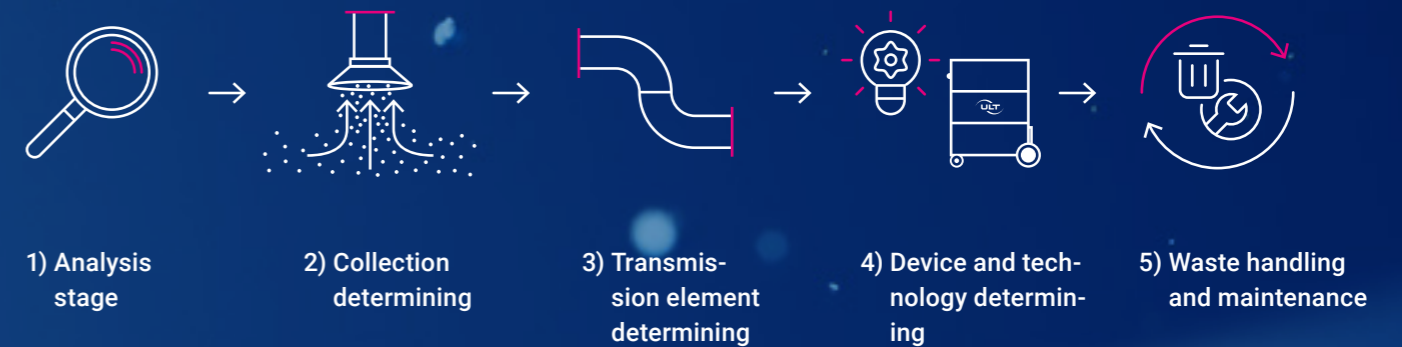


- Cartridge filter**
- For higher laser dust concentrations and continuous use
  - Low maintenance requirement
  - High operating point stability



## The right plant design for optimum air pollution control

The dimensioning of the plant technology is derived from a fundamental analysis of the production and pollutant situation. This should be prepared by experts together with the users



# Use of additional technology

In certain cases, a "simple" extraction and filter system is no longer sufficient.

For example, in the case of moist laser dust from plastics or organic materials such as paper or wood, a filter aid additive is necessary in almost all cases. This supports and optimizes the separating process of the occurring particles and, hence, extends the filter life considerably.

In addition, laser processes almost always generate odors or gases, which can be removed by appropriate sorption processes (use of activated carbon or chemisorption).

*Particularly in terms of ultrashort pulse laser, there are major challenges as filters clog up quickly.*



FILTER AID FOR PARTICLE SEPARATION



EXTRACTION AND FILTRATION OF STICKY LASER DUST

# Undesirable dangers – what should be considered?

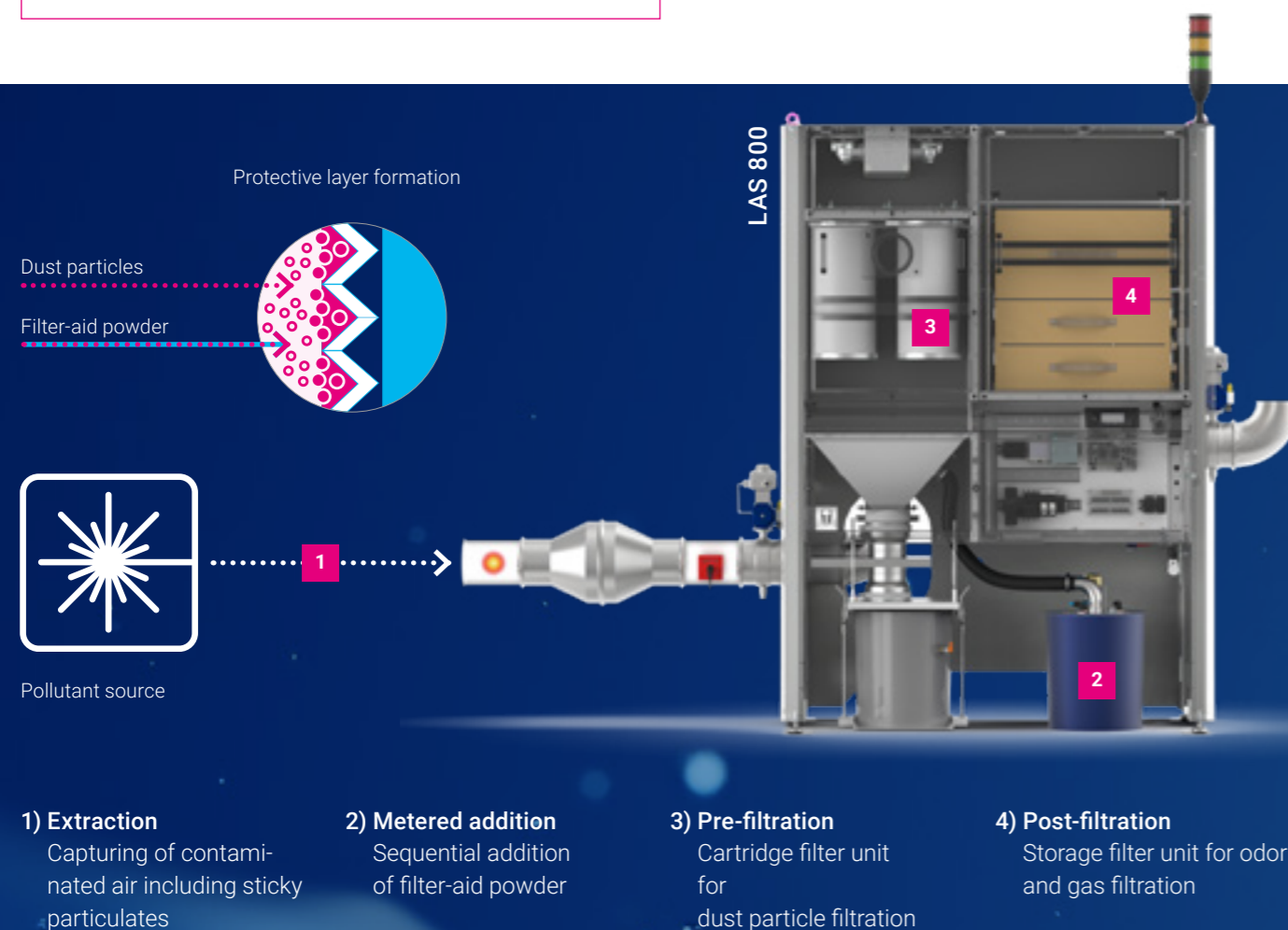
## Question:

What pollutants are produced? The Gestis database of the DGUV provides necessary information.

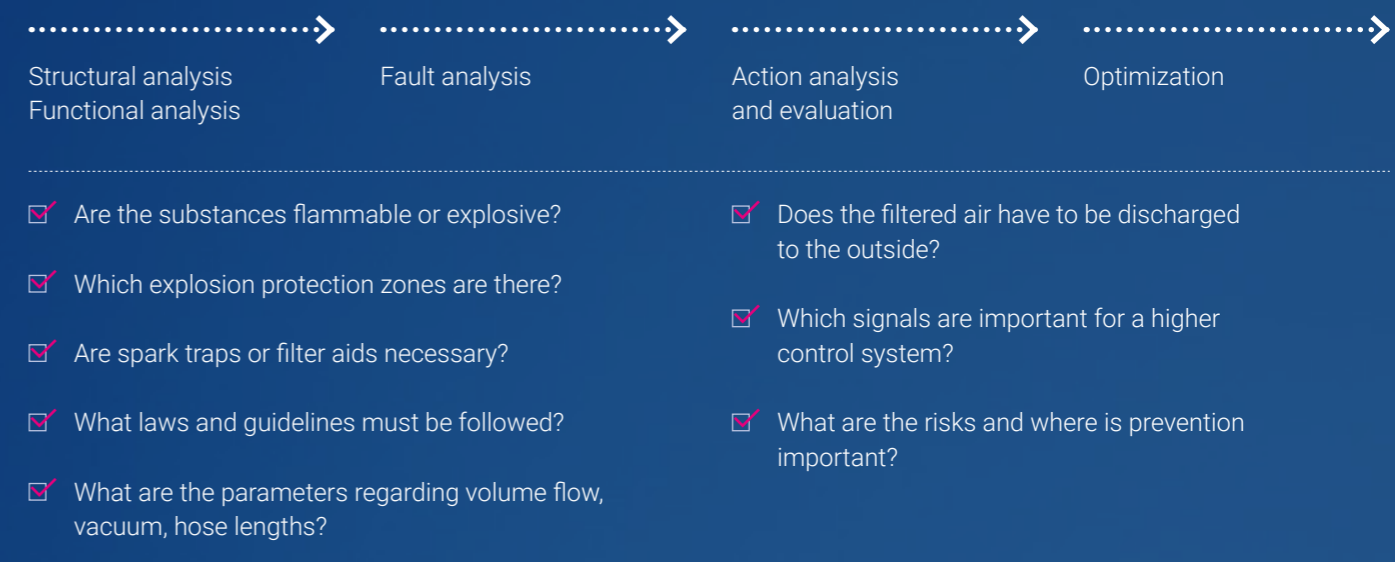


DGUV GESTIS DATABASE

*Based on hazardous material checklists and risk assessments, we develop a comprehensive concept for your ideal extraction and filtration solution.*



## Analysis stage and questions



These and other questions need to be answered. ULT supports users in hazard analysis and elimination, and offers individual solutions if required.

# ULT systems and their typical fields of application

## Storage filter systems



Device type	LAS 160.1
Max. air flow in m³/h	190
Max. vacuum in Pa	3,200
Dimensions in mm (W×D×H)	405 × 355 × 545
Volume in dB(A)	49



Device type	LAS 200.1
Max. air flow in m³/h	320
Max. vacuum in Pa	9,000
Dimensions in mm (W×D×H)	390 × 400 × 620
Volume in dB(A)	47



ULT offers a wide range of mobile and stationary laser fume extractors. Depending on the application, the modular extraction systems of the LAS series can be expanded or customized. Safety aspects also play a significant role.

Based on our many years of experience, we know that each process must be specifically analyzed to determine the optimal filtration system. ULT provides its customers with advice and support in this matter.

## Cartiridge filter systems



Device type	LAS 300
Max. air flow in m³/h	400–900
Max. vacuum in Pa	3,650–12,000
Dimensions in mm (W×D×H)	475 × 625 × 1,010
Volume in dB(A)	<65



Device type	LAS 500
Max. air flow in m³/h	400
Max. vacuum in Pa	20,200
Dimensions in mm (W×D×H)	670 × 590 × 2,050
Volume in dB(A)	70



Device type	LAS 800
Max. air flow in m³/h	1,620
Max. vacuum in Pa	8,500
Dimensions in mm (W×D×H)	1,430 × 790 × 2,020
Volume in dB(A)	65



Device type	LAS 260.1 ProSight
Max. air flow in m³/h	360–635
Max. vacuum in Pa	3,200–9,500
Dimensions in mm (W×D×H)	440 × 508 × 958
Volume in dB(A)	<60



Device type	LAS 400.1
Max. air flow in m³/h	600–1,000
Max. vacuum in Pa	2,600–9,800
Dimensions in mm (W×D×H)	652 × 600 × 867 / 1,140
Volume in dB(A)	55



Device type	LAS 1200
Max. air flow in m³/h	1,500
Max. vacuum in Pa	3,250
Dimensions in mm (W×D×H)	790 × 820 × 1,040
Volume in dB(A)	55



Device type	LAS 1500
Max. air flow in m³/h	2,160–3,240
Max. vacuum in Pa	3,200–3,450
Dimensions in mm (W×D×H)	680 × 750 × 2,920
Volume in dB(A)	75



Device type	LAS 2000
Max. air flow in m³/h	3,300–4,000
Max. vacuum in Pa	3,550–4,630
Dimensions in mm (W×D×H)	1,350 × 855 × 2,500
Volume in dB(A)	73



Device type	ULT 2500.1
Max. air flow in m³/h	4,300–6,800
Max. vacuum in Pa	4,200–16,000
Dimensions in mm (W×D×H)	900 × 1,645 × 3,250
Volume in dB(A)	75



# Intelligent solutions for best air quality

## ULT – air quality

Since the air quality is of fundamental importance for work and production processes, ULT, as a full-service provider, develops air purification solutions for the highest demands – to protect employees, equipment, products, and the environment.

The reliability of our products ensures manufacturing processes and the profitability of our customers.

The proximity of the ULT experts to the processes and requirements of our customers enables the development of tailor-made and needs-oriented solutions – from the standard product to the individual system.

Our own research and development department as well as numerous cooperations with professional associations, education institutions and industry form the basis for the permanent further development of our ventilation systems and solutions for the best air quality of tomorrow.



ULT AG



Utilization of an LAS 800 laser fume extractor for laser cutting

ULT headquarters in Löbau/  
Germany



## Solutions – unique and customer-oriented

### What makes our solutions for laser fume extraction so special:

- Complete system solutions: filter types, safety technology, accessories
- Low-noise operation
- Low operating costs

### What distinguishes a solution from ULT:

- One-stop shop for products, system solutions, installation
- Individual system configuration on basis of a modular device concept
- High professional competence in consulting



EXTRACTION AND FILTRATION SOLUTIONS FOR LASER FUME AND DUST



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