

A WIRTGEN GROUP COMPANY



**BENNINGHOVEN**

# **BENNINGHOVEN REVOC SYSTEM**





Feed rates compliant with the emission limits  $\text{VOC} < 50 \text{ mg/m}^3$  \*

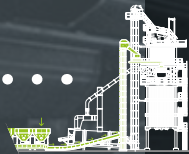
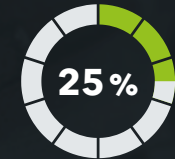


**Dosing system  
into the mixer**

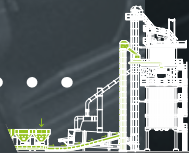
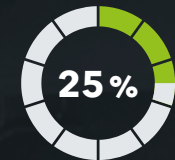
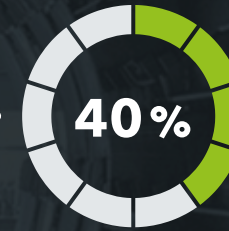
with REVOC-System



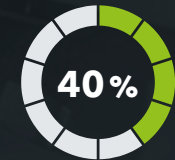
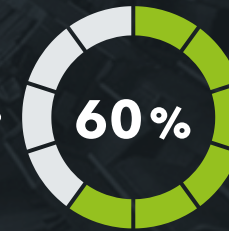
without REVOC-System



**Variable dosing system  
(only cold RAP)  
Multivariable dosing system  
(cold RAP and bulk materials)**



**Variable dosing system /  
multivariable dosing  
system + parallel drum**



\* depending on the quality of the recycling material

# CATALYST IN ASPHALT PRODUCTION.

BENNINGHOVEN REVOC SYSTEM

## Pioneering technology

The BENNINGHOVEN REVOC system is a patented technology for reducing the output of greenhouse gases from asphalt mixing plants. In addition to reducing CO<sub>2</sub>, the total carbon emissions can also be reduced by as much as 50 %. This technology can be used to make asphalt production more efficient and more environmentally friendly. The innovative process can keep the recycling content per ton of finished asphalt at a high level while complying with the emissions limits. BENNINGHOVEN therefore offers a technical solution for a longstanding target conflict: higher recycling content and lower emissions.

- > The energy that is generated for drying and heating the virgin mineral (primary function) is used by the REVOC system for the thermal post-treatment of the overall carbon (secondary function).
- > First, the exhaust gases are actively extracted directly where they are generated, primarily from the mixer.
- > The vapours with high VOC concentrations are then moved to the REVOC system for thermal post-treatment.



## Long-term and reliable

### 01 Complying with limits

The permissible emissions limits are being tightened up in many regions worldwide. When producing asphalt with recycling materials, complying with these is a challenge that the manufacturers have to face.

As soon as recycling material has to be added to the mixing process, complying with the permissible limits for total carbon (C<sub>tot</sub>/VOC) from the volatile organic compounds becomes a complex task. VOC has a higher greenhouse potential than CO<sub>2</sub> and is hazardous to health in higher concentrations. In future, these emissions have to be reduced as much as possible with the objective of securing both the future of the plant site and the operating license for existing asphalt mixing plants.

### 02 Crucial contribution to securing the future of the site

The key advantage of the REVOC system is that it can help to secure the future of asphalt mixing plants. These benefits in terms of efficiency, added recycling material and emission behaviour allow plant owners to maintain their core business in the future. In particular in light of the ever more restrictive requirements from government authorities, the REVOC system is the economical option for worry-free operation.

BENNINGHOVEN REVOC-SYSTEM

### 03 Outlook for Germany: TA-Luft

- > The revised German "Technical Instructions on Air Quality Control" (TA-Luft) came into effect in Germany in December 2021.
- > It is representative of the stricter emissions regulations that put the further operation especially of older asphalt mixing plants at risk.
- > As per the TA-Luft, total carbon (VOC) is "representative of the organic substances in the exhaust gas, with the exception of particulate organic substances".
- > Total carbons in the exhaust gas are therefore highly volatile organic compounds, i.e. compounds containing carbon
- > The TA-Luft defines the limit for this as < 50 mg/Nm<sup>3</sup>
- > To comply with the TA-Luft and to prepare existing asphalt mixing plants for the future, VOC emissions need to be reduced.
- > **The BENNINGHOVEN REVOC system meets all these requirements.** Plant owners can optionally monitor and verify compliance with the VOC limits with continuous emissions measurements.





# USING SYNERGIES

## Perfectly coordinated system

The BENNINGHOVEN REVOC system is a complete process system. To reduce emissions and comply with standards and administrative regulations such as the TA-Luft, the entire process has to be considered: burner, fuel, recycling feed systems, dust collection system, dimension of the dryer drum and the REVOC system.

The emissions can meet or fall below the required limits only if these factors are perfectly coordinated technically and the plant is run expertly and with the targets in mind.



## 04 Components of the REVOC overall system

- > REVOC system with the primary function of drying and heating the virgin mineral and the secondary function of thermal post-treatment of the VOC emissions
- > Dust collection system
- > Burner
- > Fans
- > Piping

# PRINCIPLE

## Cleverly designed process

### 05 Efficient multi-use of thermal energy

- > Extraction of the bituminous vapours from the mixer
- > Extraction of the bituminous vapours from the skip track
- > Thermal post-treatment of bituminous vapours from the above sources in the REVOC system
- > Introduction of the bituminous vapours from the parallel drum into the dust collection system
- > Reduction of emissions, of the total carbon concentration generated during the mixing process with recycling material in an asphalt mixing plant



## 06 A look into the REVOC system



First, the exhaust gases are actively extracted directly where they are generated, primarily from the mixer in the asphalt mixing plant - where heated mineral, the recycling material and the bitumen come together to be mixed into fresh asphalt. The vapours with high VOC concentrations are moved to the REVOC system for thermal post-treatment.

The energy that is generated for drying and heating the virgin mineral (primary function) is used by the REVOC system to also burn off the overall carbon (secondary function), making operation of this innovation highly energy efficient.

The exhaust gases flow into the REVOC zone. The size of the system allows enough space for the flame without being affected from the outside, to ensure clean and complete burning. This is an optimum prerequisite for not allowing any carbon monoxide (CO) to be generated, which in turn depends on the combustion chamber, the fuel and the material to be heated.



# ADVANTAGES

## The path to more sustainability

### 07 Innovative process solution

- > **Reducing** the total carbon emissions generated during the process of mixing in the recycling material
- > **Maintaining the output** of the mixing plant with high recycling content while complying with the emissions limits
- > **Up to 60 % recycling content** with emissions limits of  $> 50 \text{ mg/m}^3$
- > Available as a **retrofit solution** for existing plants and new plants

### 08 Environmentally friendly asphalt production - energy efficient and resource friendly

- > Lowering VOC by 50 % to  $< 50 \text{ mg/m}^3$
- > Use of recycling materials is in line with the German Waste Management Regulation (KrWG)
- > Saving up to 33 % or 1.5 t of  $\text{CO}_2$  per hour simply by increasing the recycling content from 40 % to 60 %



### 09 Great user benefit

- > Existing plants can be upgraded to the latest state of the art.
- > Small structural changes during retrofitting with relatively low investment costs
- > Employees and the environment benefit from reducing the volatile organic substances (VOC).

### 10 Fuels of the future

- > Using alternative fuels such as biomass-to-liquid, wood dust, HVO, etc. improves the environmental footprint of the virgin mineral drying process.







## BENNINGHOVEN SUSTAINABILITY

### Use of recycling material

**The processing of recycled asphalt is a high priority when it comes to conserving natural resources. This fundamental drive for reusing materials is only one of many.**

Asphalt is one of the few products that can be fully re-used. Recycling does not generate any waste. Country-specific requirements, the reduction of emissions and increased economic efficiency are points in favour of recycling and environmentally friendly asphalt production, because green asphalt is possible only with the use of recycling material. Reducing the greenhouse gas CO<sub>2</sub> with the concept of the hot-gas generator is a fundamental step in the overall balance of road construction technology.

### Advantages of using recycling material

- > Conserving natural resources (mineral/bitumen)
- > Highest possible reuse based on the recycling concept
- > Reducing CO<sub>2</sub> emissions in the entire process chain: Use of RAP material from the environment of the plant, short travel distances, production of mineral (quarrying/breaking) and bitumen (refinery) are no longer required.
- > Proactive reaction to bitumen availability
- > Increased economic efficiency





**BENNINGHOVEN**  
**Branch of Wirtgen Mineral**  
**Technologies GmbH**

Benninghovenstraße 1  
54516 Wittlich  
Germany

T: +49 6571 6978 0  
M: [info@benninghoven.com](mailto:info@benninghoven.com)

 [www.benninghoven.com](http://www.benninghoven.com)