

Combined NO_x/SO_x Abatement by Modular Design

Flue Gas Purification for Heavy Fuel Oil (HFO) Fired Engines

Complete Solutions, Complete Systems, One Supplier

Flue Gas Purification Systems: Environmental Technologies based on Steuler Know-How

Steuler flue gas purification systems have been proven in many different fields of application. Our vast experience has confirmed us to be the market leaders in this type of technology, with operational experience over many years. The research and development undertaken by Steuler will ensure you can meet all current and future emission limits. Steuler provide high efficiency systems with low investment, operating and maintenance costs, with the emphasis being placed upon the safety of operation and ease of maintenance.

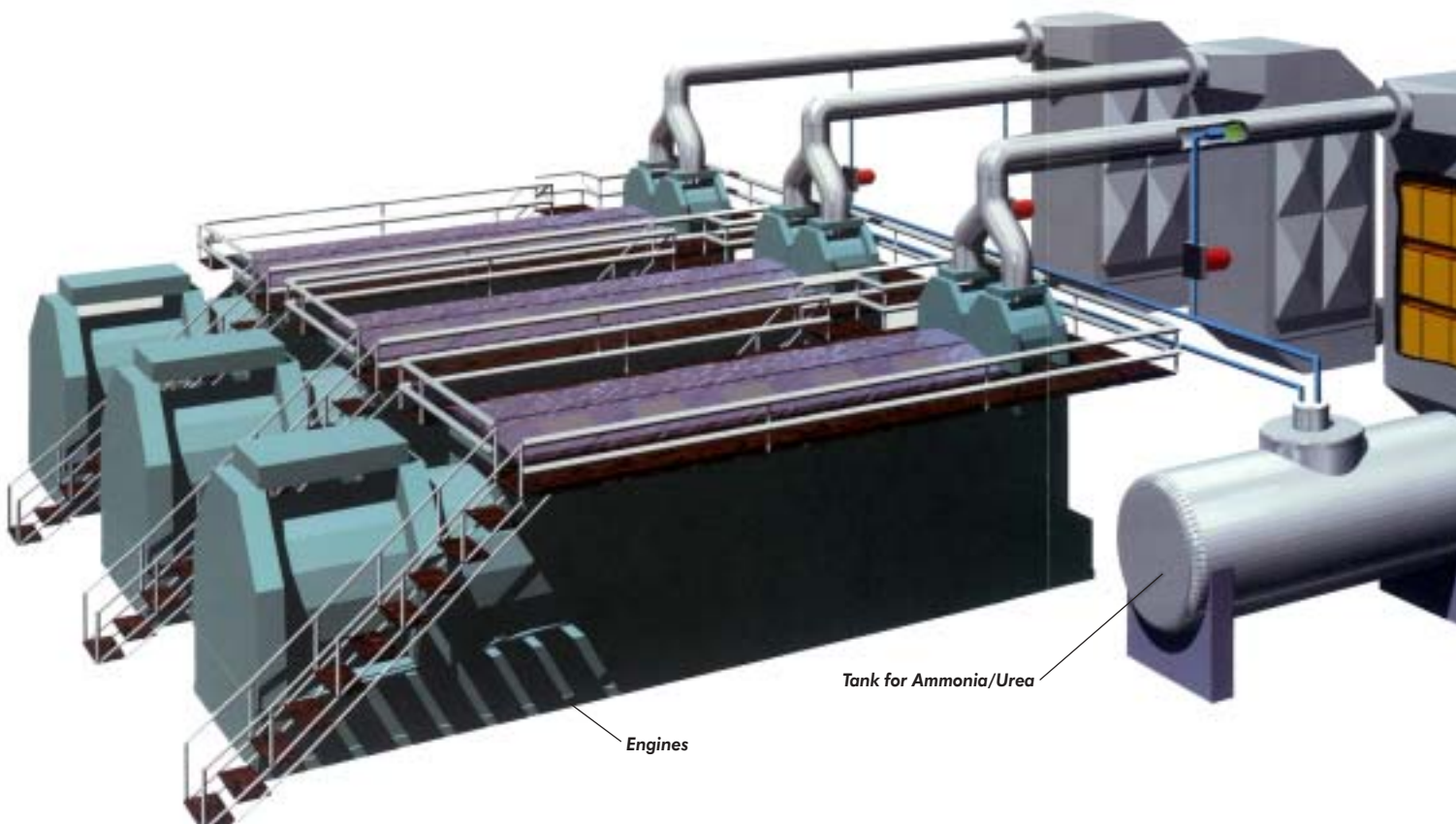
Local authorities and environmental groups are forcing the industry to reduce emissions from flue gas, especially in heavy fuel oil fired engine applications for power and heat generation.

Flue gases containing NO, NO₂, SO₂, SO₃, Particulate Matter, Heavy Metals and Volatile Organic Compounds (VOC) in various concentration are known as being harmful substances.

Steuler offers the solution for emission problems Modular Steuler Systems for emission abatement are based on well known process and plant components that have been well tested in practice for many years. The Steuler modular flue gas treatment systems can be designed to meet customers needs and demands.

Steuler can provide a full turnkey facility, consisting of all the engineering required, installation and inspection, commissioning with operator training and with full service back-up.

Steuler Modular Systems provide a unique opportunity to upgrade or retrofit the facility should stricter emission levels be required in the future.



Catalytic Abatement of NO_x, CO and VOC

NO_x Abatement: For the Selective Catalytic Reduction (SCR) of nitrous oxides (NO_x), the CER-NO_x Catalyst has been developed by Steuler.

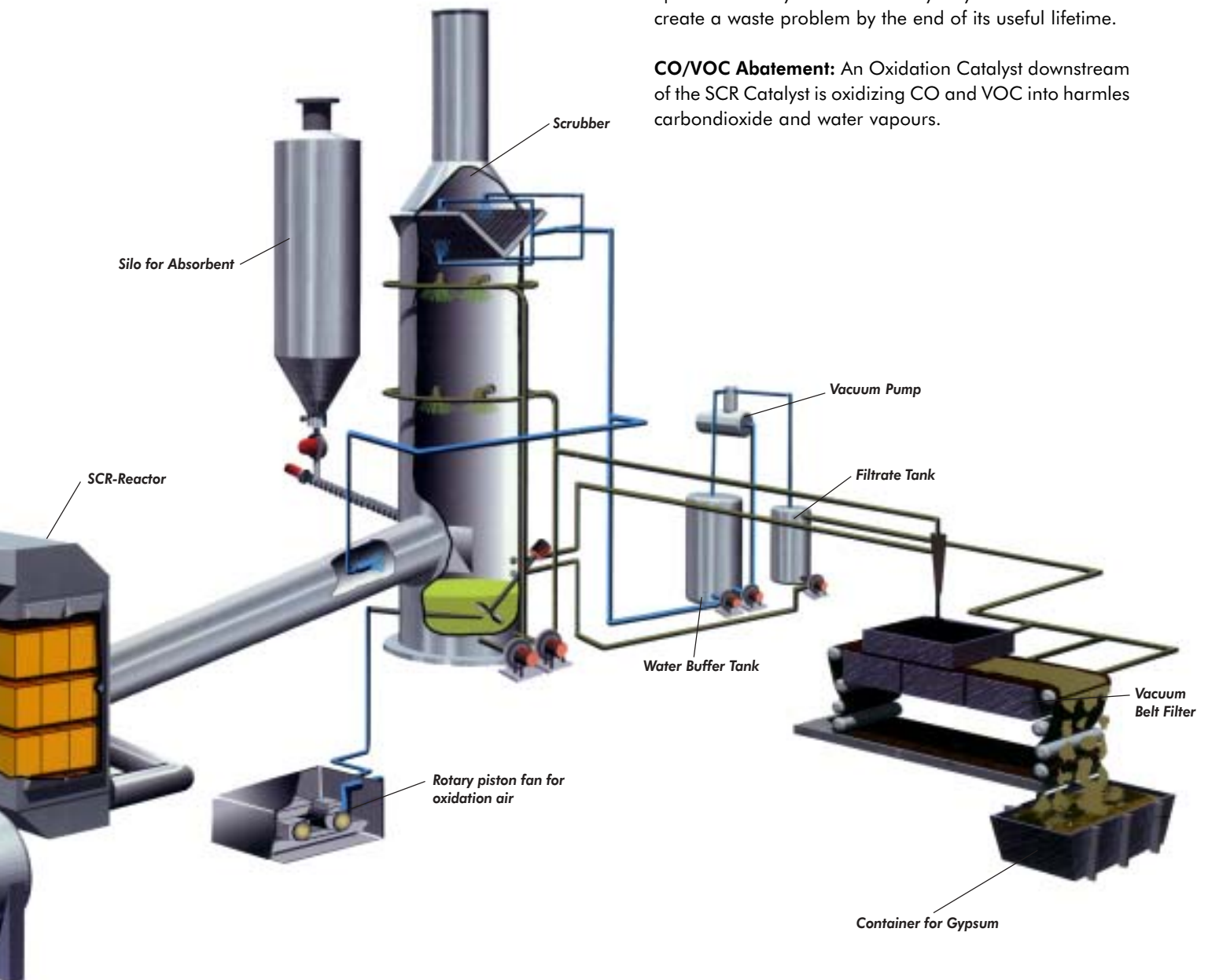
This is a zeolite/ceramic molecular sieve honeycomb catalyst, virtually resistant to poisoning, masking and plugging due to its special properties and structures.

Therefore, the right product for „Dirty Fuels“ like Heavy Fuel Oil.

With urea or ammonia as a reducing agent, NO_x is reduced across this catalyst the natural compounds nitrogen and water vapours. NO_x abatement efficiency is up to 95%.

Spent SCR catalyst material is fully recyclable and does not create a waste problem by the end of its useful lifetime.

CO/VOC Abatement: An Oxidation Catalyst downstream of the SCR Catalyst is oxidizing CO and VOC into harmless carbon dioxide and water vapours.



Wet Scrubbing Absorption Technology for SO₂ and SO₃ Abatement

Steuler is well experienced with Wet Scrubbing Absorption Technology to reduce SO₂ and SO₃ (SO_x) from flue gas while recovering gypsum as a reusable matter from the process, avoiding waste water or any other effluents.

Steuler has developed very compact wet scrubbing systems with well selected components and materials, resulting in a current state of the art technology.

The process employs a scrubbing liquid containing Calcium-carbonate (Limestone) to absorb SO_x from the flue gas. By oxidation with oxygen from the atmosphere gypsum is produced. (CaSO₄ x 2 H₂O).

A vacuum belt filter separates the gypsum from the process. Heavy metal impurities can be separated from the scrubbing liquid as a separate process.

This means no Nickel or Vanadia will be contained in the gypsum and high purity of the gypsum guarantees unrestricted use in the building industry.

DeSO_x-System: Features and Benefits

- Very high reduction for SO_x
- Almost 100% efficiency of absorbent
- Recovery of gypsum as reusable material
- Closed liquid loops inside the plant
- No corrosion due the use of non-metallic components
- Very high system availability
- Simple operation of the system
- Very compact system design
- ➔ Emissions are well below admissible limits
- ➔ Minimizing utility costs
- ➔ No waste products (low costs)
- ➔ No waste effluent to dispose of
- ➔ long lifetime, low maintenance
- ➔ Minimum downtime, higher production
- ➔ Skilled labour not required
- ➔ Minimum space required

DeNO_x-System: Features and Benefits

- Successful experience in pollution control equipment
- Low operating and maintenance cost
- Broad temperature range of 285 - 510 °C
- CER-NO_x works well on contaminated liquid and gas fuels with up to 3,5% sulphur
- CER-NO_x is non metallic and does not promote SO₂ - SO₃ conversion
- CER-NO_x does not react with exhaust gas contaminants (As, P, Cl, Pb, Zn)
- Catalyst design does not trap soot
- Integrated CEM-PLC-DA control system
- ➔ Experience and process guarantees
- ➔ Very long catalyst life
- ➔ System flexibility
- ➔ Application flexibility
- ➔ No masking
- ➔ No poisoning
- ➔ No plugging
- ➔ Virtually 100 % availability and automatic EPA reporting

Steuler Flue Gas Purification Systems have a proven track record with the following fuels:

- Heavy Fuel Oil/Crude Oil
- Distilled Fuel Oil
- Kerosene
- Natural Gas
- Mining Gas
- Digester Gas
- Landfill Gas
- Solvents
- Pyrolysis Gas



SCR catalyst system to reduce NO_x from a 7MW_{el} Diesel engine at a cogen site



SCR/Oxidation catalyst systems to reduce $\text{NO}_x/\text{CO}/\text{CH}_x$ from engines at a compressor station



Vacuum belt filter for gypsum recovery



DESO_x scrubber with absorbent silo and machine hall for pumps and vacuum belt filter

Steuler – your system partner with the right connections and know-how

- **Surface treatment facilities** with integrated environmental protection to improve quality, increase throughput and lower operating costs.
- **Single and multiple wire lines** for galvanic and electrolytic coating offering high throughput, requiring little space and maintenance.
- **Regeneration plants** using membrane technology to recover water, acids, alkalis and metals from rinse water, spent acids, waste and treatment solutions.
- **Waste water treatment facilities for industrial water** with complete water recycling and disposal concepts for the residual materials.
- **Catalytic exhaust gas treatment facilities** for the conversion of NO_x , CO_2 , CH_x , NH_3 dioxins and furanes into their natural components N_2 , CO , and H_2O using fully recyclable zeolite catalyzers.
- **Absorption facilities** to separate and break down the hazardous substances HCl , HF , SO_x , aerosols, sublimates and heavy metals into raw materials.
- **Waste-water-free flue gas purification facilities** conforming to the German Clean Air Act and all pertinent regulations (17. BImSchV. and TA-Luft) for power stations, combustion engines, waste and hazardous waste incineration plants, process gases, etc. with recycling of residual materials.



STEULER

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Flexibled solutions through modular designs

