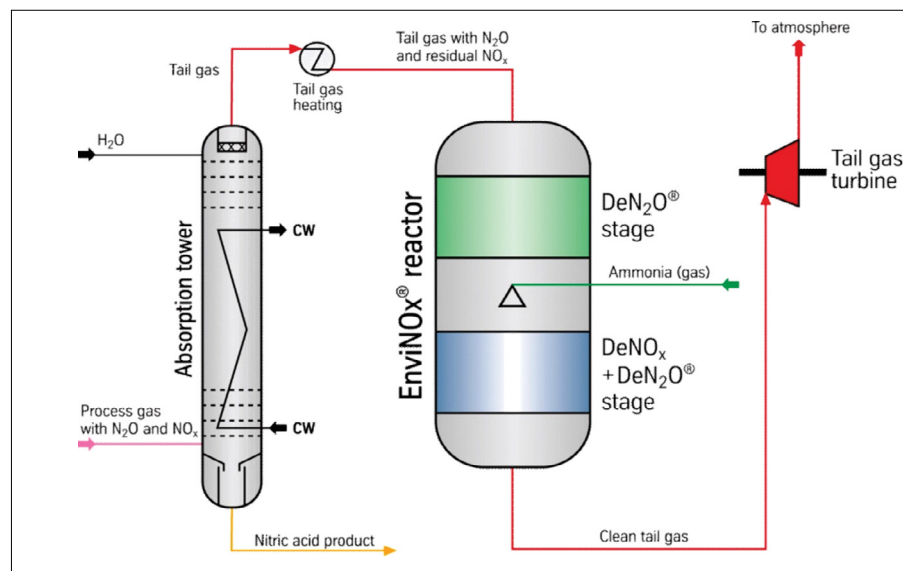
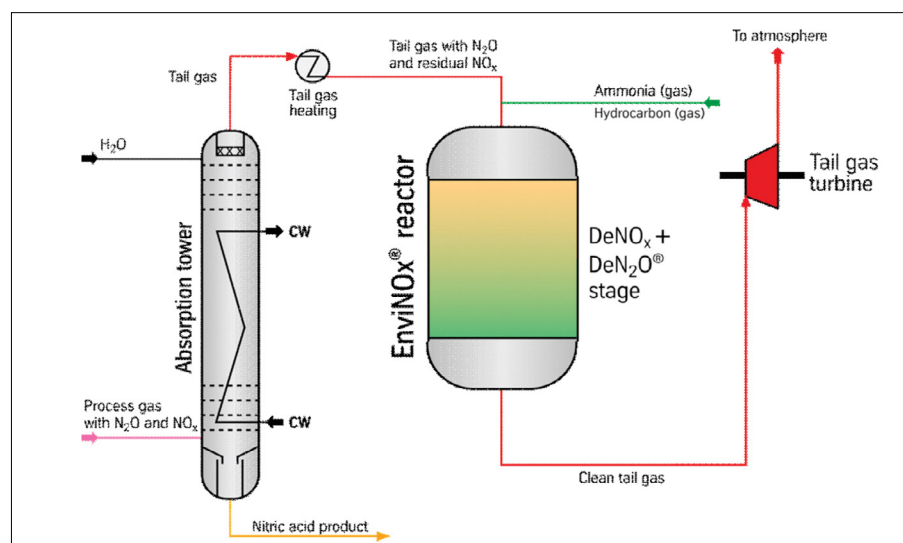


# Leading N<sub>2</sub>O and NO<sub>x</sub> abatement

New South African legislation decrees that existing plants must comply with the Minimum Emission Standards (MES) in compliance to NO<sub>x</sub> (Nitrogen Oxides) levels of less than 350 mg/Nm<sup>3</sup>. Rajend Govender CEO of thyssenkrupp Uhde SA, and Nithesh Mohun, highlight the role of thyssenkrupp EnviNOx® process in achieving this.



**thyssenkrupp Uhde's EnviNOx Variant 1 involves catalytic reduction of gases with NO<sub>x</sub>, ammonia and N<sub>2</sub>O with hydrocarbons over zeolite catalysts. It is especially applicable for tail gas temperatures higher than about 425 °C. In this variant, ammonia is introduced into the centre of the reactor vessel between two separate beds of catalytic material.**



**EnviNOx Variant 2 is suitable for temperatures of between 300 °C and 550 °C and involves the catalytic reduction of NO<sub>x</sub>, ammonia and N<sub>2</sub>O with hydrocarbons gases over zeolite catalysts. In this simpler variant, ammonia is introduced above the reactor vessel.**

In chemistry, NO<sub>x</sub> is a generic term used for the nitrogen oxides that contribute to air pollution and the destruction of the ozone layer. Nitrous oxide (N<sub>2</sub>O), commonly known as laughing gas, is produced as a by-product in the manufacture of nitric acid, an important raw material used in the production of fertilisers, amongst others.

Operators are under increasing pressure to produce more efficiently, both from an operational cost and environmental point of view," notes Rajend Govender CEO of thyssenkrupp

Uhde South Africa "To meet the challenge of managing emissions to minimum levels and still be up on production requires proven technologies that allow cost-effective set-up and operation, while at the same time making a significant contribution to environmental protection."

The EnviNOx® process from thyssenkrupp Uhde is capable of almost completely removing NO<sub>x</sub> gases – and, if required, the greenhouse gas N<sub>2</sub>O – turning it into harmless nitrogen and water. The technology has been proven on an industrial scale with around 55 plants

using the EnviNOx® process worldwide.

Four EnviNOx® systems have been sold in South Africa. thyssenkrupp Uhde is also the licensor of the nitric acid process for five of the six nitric acid plants in South Africa. The earliest EnviNOx® unit has been in operation in a 1 000 tpd nitric acid plant in Linz, Austria, since 2003. The first unit on the African continent came on stream three years later in a 1 830 tpd nitric acid plant in Egypt.

The EnviNOx® process removes NO<sub>x</sub> through a process not dissimilar to what is used to reduce emissions in modern vehicles, namely selective catalytic reduction (SCR), which uses a catalyst and a small amount of ammonia in the reaction process.

While SCR technology is already used by a number of suppliers, thyssenkrupp stands out as having successfully developed a reactor and catalysts specifically for the abatement of both N<sub>2</sub>O and NO<sub>x</sub> in nitric acid plant tail gas. "The N<sub>2</sub>O and NO<sub>x</sub> removal rates of our EnviNOx® technology, which was developed in Germany in the early 2000s, have been proven commercially to be very high, achieving N<sub>2</sub>O removal of up to 99%, and NO<sub>x</sub> emissions to nearly zero," states Nithesh Mohun, Business Development Manager at thyssenkrupp Uhde South Africa.

The central component of the EnviNOx® system is the reactor. It contains a special catalyst developed and optimised by thyssenkrupp and its partners and is typically located between the final tail gas heater and the tail gas turbine.

thyssenkrupp offers two EnviNOx® process variants. Variant 1 is especially applicable for tail gas temperatures higher than approx. 425 °C while Variant 2 is suitable for temperatures of between 300 °C and 550 °C.

The combination of N<sub>2</sub>O and NO<sub>x</sub> emissions reduction in a single reactor vessel renders EnviNOx® extremely flexible as it provides end-users the option of initially investing in NO<sub>x</sub> reduction only leaving open the option to upgrade to N<sub>2</sub>O abatement at a later stage.

thyssenkrupp Uhde recently completed a contract for engineering and procurement to retrofit its EnviNOx® technology at two of South Africa's nitric acid plants. "As the customer initially only required NO<sub>x</sub> emission reduction, we supplied the EnviNOx® ready solution to treat the tail gas stream from their nitric acid plant. When more stringent South African legislation on the abatement of N<sub>2</sub>O comes into effect, we can simply add a second catalyst to the customer's reactor," notes Mohun.

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