Factsheet

PiT Navigator SNCR

Selective Non-Catalytic Reduction (SNCR)

SNCR is a well-known process for flue gas denitrification. It is successfully used in cement industry for many decades. The basic working principle is to inject a reducing agent like ammonia or urea solution into the flue gas stream at suitable temperatures. The reducing agent reacts with nitrogen monoxide and nitrogen dioxide. The result is nitrogen and water.

PiT Navigator SNCR is a modular SNCR system which can be applied as initial installation or to optimize and partly replace existing SNCR systems. The necessary hardware components like distribution unit or injectors are supplied by Lechler GmbH. This ensures superior hardware quality and is the basis for consistent optimization results.

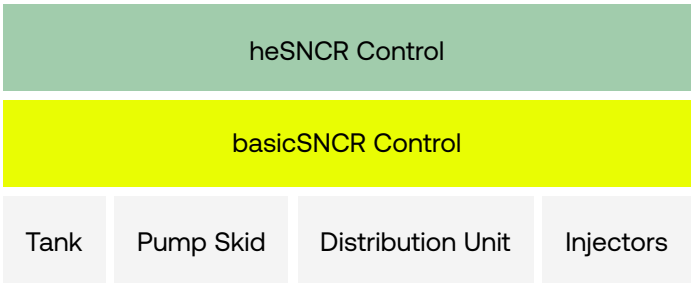


Figure 1: Overview basicSNCR and heSNCR

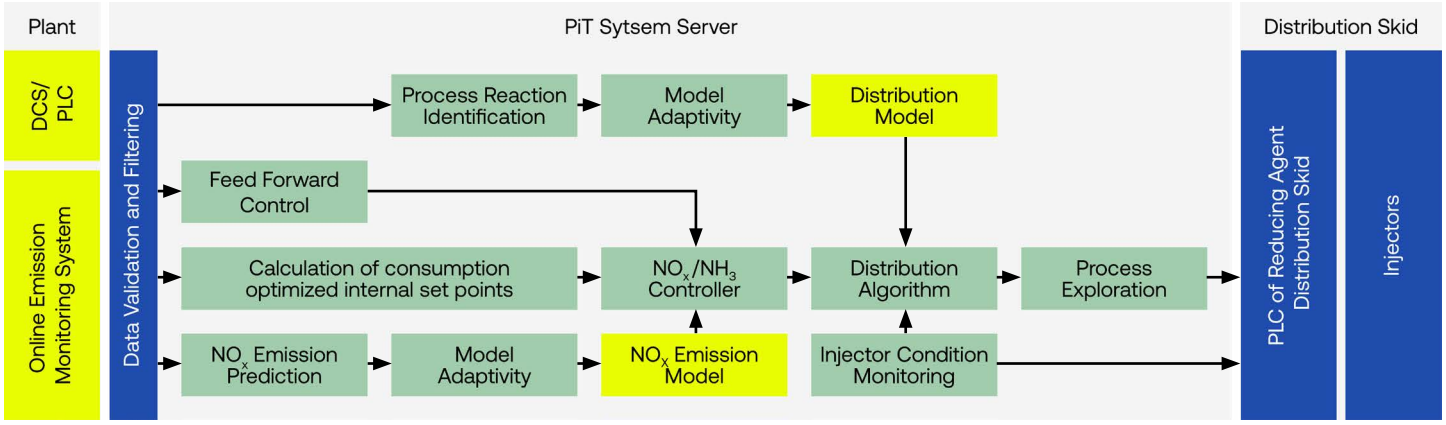
Based on the requirements for the SNCR system, e.g. reduction rate or nitrogen dioxide limit, as well as certain plantspecific conditions the better suited control module basicSNCR or heSNCR (highly efficient SNCR) as well as the corresponding hardware set-up have to be chosen.

Motivation: Despite the fact that SNCR has been used in the cement industry for a long period of time the performances of these installations vary significantly. Many SNCR systems consume substantially more than the theoretical minimum of reducing agent to achieve the desired reduction. In cases where a very low nitrogen dioxide emission level must be maintained consumption increases almost exponentially. Additionally, this often leads to high NH_3 emissions and odor nuisance.
There are basically three main reasons why simple SNCR systems perform suboptimal:

1. Insufficient quality of the injection system.
2. Insufficient coverage of the suitable injection area by mounted injectors.
3. Equal distribution of reducing agent to all injectors.
4. Insufficient consideration of the real flue gas temperature in the injection area.

PiT Navigator heSNCR addresses and solves these issues. This leads ultimately to

- compliance with applicable nitrogen dioxide limits
- significantly reduced consumption of reducing agent



Application

PiT Navigator heSNCR has been installed in many different plants all over Germany. The systems comply with the latest legal regulations for NO_x (< 200 mg daily average, < 400 mg/Nm³ half hourly average) and NH_3 (< 30 mg/Nm³ daily average, < 60 mg/Nm³ half hourly average). Besides this the total consumption of reducing agent has been reduced by up to 35 % compared to the previously installed SNCR under comparable working conditions.

Technical Details

The basicSNCR can be used as a reliable PLC based standalone control solution. However, since basicSNCR also provides the communication with the Lechler hardware, it is included in the heSNCR. There is an upgrade path from basicSNCR to heSNCR.

basicSNCR

The basic task of basicSNCR is communicating with the actuators of the distribution unit and controlling them. On this level all necessary safety requirements are addressed. Using a reliable interface like Profibus DP or Modbus the required concentration measurements are transmitted from the online emission monitoring system.

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The implementation of a simple PID control makes sure that the NO_x emissions remain in check in case the heSNCR is not available. This control may also be implemented by the customer within the plants DCS. The actual status can be made available through a web interface. It allows to manipulate every aspect of the control too.

heSNCR

The highly efficient SNCR control system is a new approach to solve the most demanding problems of SNCR control:

1. How much reducing agent should be injected in total?
2. How should the total amount of reducing agent be distributed among all or a subset of the available injectors?

Both questions are nontrivial, because the answers depend on a multitude of influencing factors that may change over time, like emission limits (NO_x, NH_3) and their individual timescales (half hourly, daily, yearly, ...) as well as the status of production (flue gas flow, fuel properties, temperature levels, built NO_x, interconnected mill operation, ...). While the first releases of heSNCR used an adaptive first principle model to estimate the flue gas temperature distribution in the injection area (onlineCFD), the latest major release uses a completely data driven approach to address also kilns with pre-calciner. This concept does not model the temperature distribution in the injection area, but the effect of specific process conditions on the effectivity of available SNCR injectors.

Upgrade options

Figure 1 illustrates the available extensions to SNCR systems.