NOX REDUCTION BY APPLYING SNCR PROCESS TO CTE ROVINARI

Adriana Foanene, *Ph.D.*,
Constantin Brâncuși University of Târgu Jiu, Romania
Adina Milena Tătar, *Ph.D.*,
Constantin Brâncuși University of Târgu Jiu, Romania

Abstract: *NOx emission reduction remains a problem to be solved in CTE Rovinari . In this regard were tested several methods for reducing NOx emissions from CTE Rovinari including SNCR process (selective non-catalytic reduction), which is described theoretically and experimentally in this paper.*

Key words : *emission, reduction, coal, methods, burning .*

INTRODUCTION

After burning fossil fuels result in large amounts of emissions.
Reducing emissions can be achieved through improved efficiency ; reduce NOx emissions ; reduce SO_2 emissions ; reduce dust emissions. Neutralization technologies are very complex, especially due to the specific behavior of nitrogen oxides as they result from thermal processes .
Neutralization processes gaseous emissions from industrial thermal processes can be catalytic or non-catalytic, based on the phenomen of absorption, adsorption, thermal decomposition or chemical reduction. These processes are dry or wet system but all contain a number of different phases in terms of complexity .
Neutralizing Installations for gas emissions from combustion processes are generally known as plant denoxare (DeNOx) - in the case of oxides of nitrogen and, respectively, the desulfurization plants (DeSO2) - sulfur dioxide.
Thus was established a number of ways to reduce emissions.

SECONDARY MEASURES TO REDUCE NOx EMISSIONS

Secondary measures are measures of " end of pipe" which tries to eliminate oxides already formed. They can be implemented independently or together with primary measures to reduce NOx .
Most technologies rely on the injection of ammonia, urea or other components that react with NOx to form molecular nitrogen. Secondary measures fall in two categories:
• Selective Catalytic Reduction (SCR) ;
• Selective non-catalytic reduction (SNCR) .

SELECTIVE NON-CATALYTIC REDUCTION (SNCR)

SNCR process is another secondary measure to reduce nitrogen oxides already formed. Operates without a catalyst at temperatures between 850 and 1100^0 C, type of reactor used (ammonia, urea, sodium hydroxide) .
Using ammonia as the reagent the following chemical reactions take place more or less simultaneously :

$4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$ (oxidation)

$4NO + 4NH_3 + O_2 \rightarrow 4N_2 + 6H_2O$ (reduction)

An SNCR unit type has two business units :

♣ Unit Storage: stored, cooled and evaporated reagent

♣ The unit itself SNCR: makes injection into flue gas flow reagent occurs when nitrogen oxides resulting reaction with nitrogen and water. The temperature range is particularly important because ammonia is oxidized over this and in this way produces more nitrogen oxide, and under this conversion rate is too low and eliminate ammonia in the atmosphere. To adjust the temperature required several levels of injection (Figure 1).

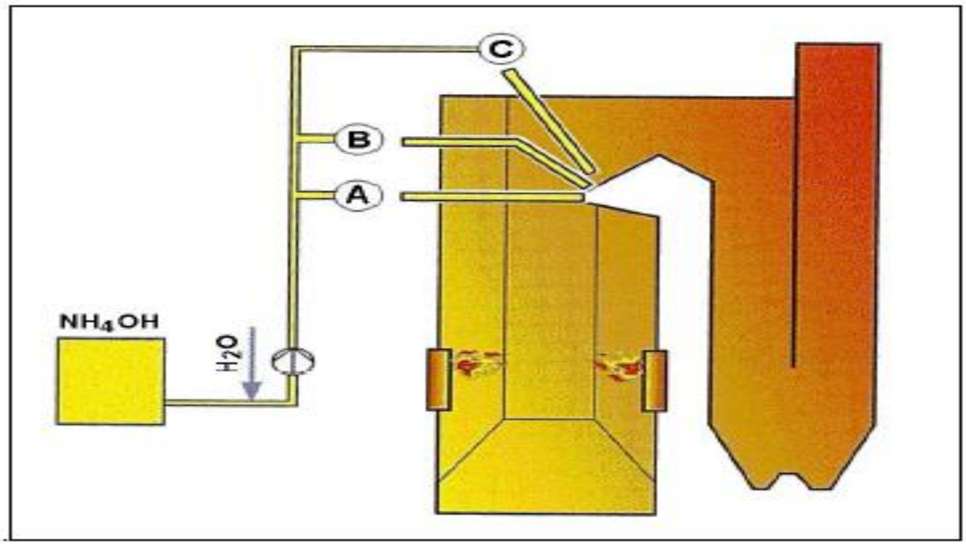

Figure 1 The selective non-catalytic reduction (SNCR)

The use of ammonia and ammonium hydroxide nitrogen in negligible quantities. Larger quantities are obtained from urea injection directly into the boiler. Moreover, the use of urea as an additive can lead to corrosion problems outweigh the use of ammonia or ammonium hydroxide, therefore SNCR reactor materials must be carefully selected .
The reaction between the nitrogen oxides and ammonia / urea to form nitrogen and water depends on the temperature and residence time. In the case of the use of ammonia and ammonium hydroxide, the temperature is from 850 to 1000^0C, with the optimum optimal temperature 1000^0C .
The retention time in the temperature range of between 0.2 and 0.5 seconds. Mixing ratio of ammonia to NOx to be rather rich in NH_3 than stoichiometric. This favors a corresponding reduction of nitrogen oxides, but favors the emission of ammonia in the atmosphere.
Appropriate equipment SNCR process is easy to install and does not require much space, even if every time need more levels of injection. SNCR technique fails to load variations boilers .
Current construction costs depend on the boiler and operating profile . For a 250 MW

temperature from 870^0C. The temperature when urea is used for 800 to 1100^0C, with the approximately 2500 EURO / ton NOx retained .
Given that after modification of all operating parameters NOx percentage falls below the prescribed values is necessary to introduce SNCR reduction plant type .
Based on documentation from other facilities where work has revealed that the level of 41.80 m is great for introducing the facility SNCR injection wells , keeping the air ducts to reduce NOx at this rate because the blast to help cool the solution introduced into the furnace boiler installation and therefore reduce the effect would be better .
For NOx reduction in the furnace is recirculated part of the flue gases taken at the end of the furnace thus reducing furnace temperature . The degree of recirculation does not need to be greater than 10 % because at higher values of the stability problems of the flame (flame can break) .
Since fractionation percentage NOx combustion air falls below limit of regulations is necessary to use other methods for reducing NOx emission .

APPLICATION SNCR PROCESS TO CTE ROVINARI

During the period from 9 to 19 March 2013 s CTE Rovinari tests were carried out in the boiler 6 for the reduction of NOx by applying the SNCR process (selective non-catalytic reduction) . To this reagent was used ERC GmbH carbamide 5722 of the company based on the aqueous urea solution enriched with various additives.
Selective non-catalytic reduction of NOx reducing agents is the reaction of generating ammonia (carbamide reagent ERC 5722) and nitric oxide (NO) and nitrogen dioxide (NO_2) at a temperature between 850^0C and 1100^0C, overall reaction is expressed by :
$$\text{carbamin5722} + NO + O_2 \rightarrow N_2 + H_2O + CO_2$$
The high efficiency of this reaction is strongly dependent on the temperature at coal boiler - spray and a running time of 4000 hours / year is estimated to cost
subject to treatment.
In the flue gas with high oxygen content of the reaction optimal temperature is much lower than in the flue gas with a reduced concentration of oxygen.
Similarly influence the NOx decomposition of carbon monoxide, hydrogen and water vapor .
The reaction rate is strongly influenced by temperature. For example , at temperatures above 1000^0C the reaction balance is reached in less than 0.1 seconds. At 850^0C residence time required increases to 0.5 sec .
NOx reducing agent as an aqueous solution , is distributed in the flue gas upstream of the reaction zone. Reducing agent droplets are produced and distributed uniformly over the flow section of the reaction zone using for this purpose injectors and injection systems .
To be proper reaction of the medium injected and oxides of nitrogen , prior to its water evaporates and the solids composition of the reducing agent decomposes . Injection system is designed so that the reactions always occur within the optimum temperature.

CONCLUSION

Based on tests conducted the following conclusions can be drawn :
When operating at high power block over
(200-240) MW, NOx was decreased to approx. 200 mg / Nm3 in the conditions under which the initial NOx concentration was around (350-370) mg / Nm^3 .
When operating at low power block under 200 MW , there were decreases in NOx limit (300-350)mg /Nm^3 while the initial concentration was approx . (400-500) mg / Nm^3 . The fact that this task could not achieve NOx limit values 200 mg / Nm3 (ie denoxare yields greater than 40 %) also contributed to the large amount of air introduced into the die temperature control agent in separating . Unable to act to reduce this quantity as maintaining a temperature at preset limits reduced separator made of the

which the reaction occurs. On the other hand, the optimal reaction temperature depends on the composition of the combustion gases

injectors for carbamide 5722. How the outbreak is strongly temperature dependent sarina boiler at low loads temperature in the injection level was suboptimal reaction required reduction . In this regard it is stated that for large steam boilers using two or more floors injection so depending on how temperature is distributed in the furnace can be appropriately activated injectors floor .

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safety of operation.

To these must be added the fact that the test was performed using only one floor reagent

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