

NOx emission below 70 mg/Nm³ when firing fuel gas containing high H₂ % at NEREFCO (Netherlands)

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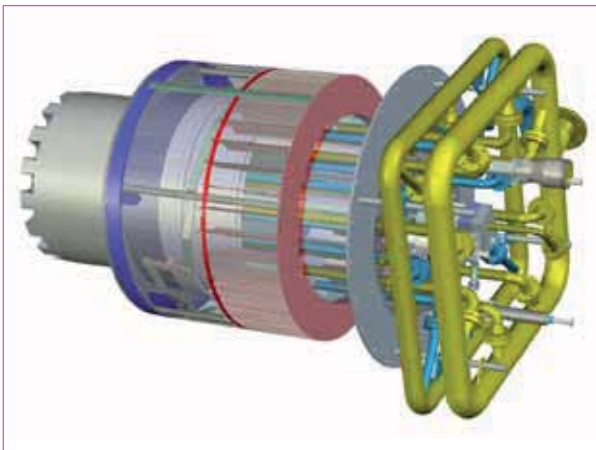
CONTEXT

In 2007, NEREFCO, formerly British Petroleum (BP), Europort refinery (NL), decided to increase their steam production with a new water tube steam boiler (130 t/h, 29.5 barg superheated steam).

They decided to install the best available techniques for Low Nox burners firing fuel gas containing a high H₂ % (up to 58 %vol.) including the following targets:

- NOx emission when firing fuel gas: < 70 mg/Nm³, @ 3% O₂ dry basis.
- CO emission when firing fuel gas: < 50 mg/Nm³, @ 3% O₂ dry basis.
- Maximum boiler availability.

NEREFCO entrusted CMI, Seraing (B), associated with Fives Pillard, Marseille (F) to meet this challenge, using the Fives Pillard LONoxFLAM® G2 gas burners (patent N° FR 94/04136).



GRC LONoxFLAM® G2 gas burners

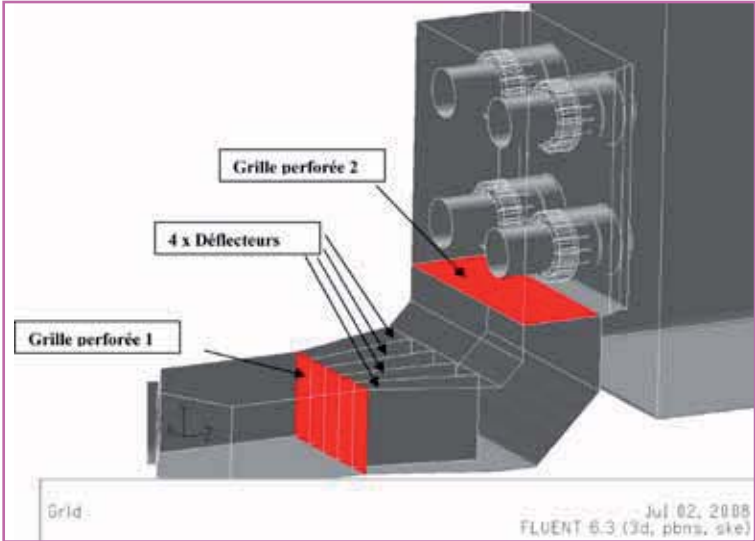
TESTS

In order to reach such a target, tests were carried out in the Fives Pillard's Research Center over a two month period, to check emissions with various H₂ % in fuel gas, as well as the flame stability from min. to max. load.

These tests allowed to precisely determine the rate of external flue gas recirculation (FGR) in order to meet the guaranteed NOx / CO emissions.

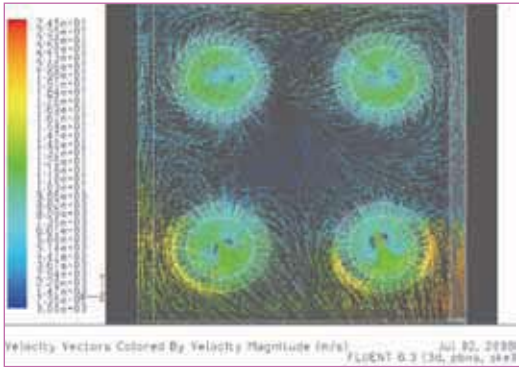
IMPROVEMENT OF THE BOILER AIR DISTRIBUTION

The combustion air windbox had to be improved further to CFD modeling (Fluent® software)

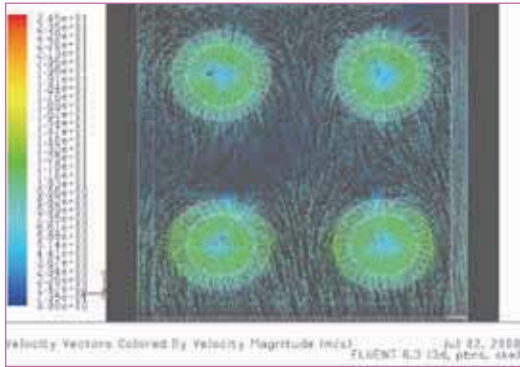


Modeling the distribution of air in the combustion air windbox

It has been therefore necessary to correct the combustion air distribution in order to obtain a velocity distribution as uniform as possible.



Result before correction



Result after correction

EMISSION MEASUREMENTS

The combustion air windbox had to be improved further to CFD modeling (Fluent® software)

LOAD (%)	CONTRACTUAL VALUES Firing fuel gas with H2 < 58% vol.		MEASURED VALUES Firing fuel gas with H2 ≈ 50% vol.		In mg/Nm3 @ 3% O2 dry basis
	NOx	CO	NOx	CO	
100%	70	50	67	36	

CONCLUSION

Following the results obtained at NEREFECO, the Kuwait Petroleum company (KPE), (located also in Europort (NL)) decided to install the same boiler but with more stringent operating conditions, since the Refinery gas to be fired for such a new steam boiler (120 t/h, 45 barg superheated steam) contains a higher hydrogen content (up to 90 % vol.). This new boiler will be commissioned in 2010.