

Reducing NO_x and CO₂ Emissions in a 100 t/hr Five Cail Babcock Water Tube Steam Boiler by replacing 2 Pillard fuel Gas/H₂/HFO burners with 2 Fives-Pillard GRC G2 Lonoxflam[®] fuel Gas/H₂/DO burners without using external flue gas recirculation

By : Jean Louis GROS, Process Engineer, Rhodia Le-Pont-de-Claix (38)

The power house of the Rhodia CEVCO chemical plant at Pont-de-Claix, comprises 5 gas turbines with heat recovery boilers and a Fives Cail Babcock water tube steam boiler (100t/hr, 30 bars superheated steam).

For environmental reasons, Rhodia CEVCO decided to replace the 2 GRC fuel gas/H₂/FO₂ burners fitted to the water tube steam boiler, with the following targets :

* Reduce NO_x emissions in gas firing and in a natural gas/H₂ mix firing, from around 400 (previous value) to 225 mg/Nm³ 3%dry O₂, in order to comply with the 2003 July 30th French regulation applicable from January 1st 2008.

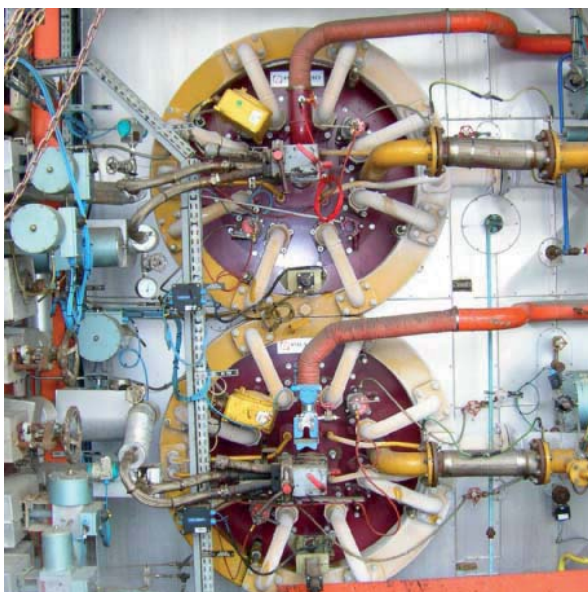
* Increase max H₂ flow rate firing in order to reduce fuel gas consumption costs, and decrease CO₂ emissions.

* Decrease the fuel gas flow rate at low boiler load in mixed firing in order to reduce fuel gas consumption costs.

* Replace HFO, recently classified as a potential carcinogen, by Diesel Oil (DO).

Rhodia Operations entrusted Fives Pillard to meet this challenge, using the best available technique in NO_x reduction without external flue gas recirculation: the Fives Pillard GRC G2 Lonoxflam[®] gas burners (patent n°FR 94/04136).

Burners before upgrading :



Burners after upgrading :





Works have been limited to the modification of 4 water tubes on the front part of the boiler and replacing the burner, avoiding a flue gas recirculation pipe and fan, which would have been more costly.

CONTRACTUAL VALUES AND ACTUAL MEASURED VALUES

NOx and CO values expressed in mg/Nm³ 3% dry O₂.

LOAD (%)	CONTRACTUAL VALUES Firing 100% fuel gas and H ₂ /fuel gas mix		ACTUAL VALUES (April 2008) Firing fuel gas		ACTUAL VALUES (April 2008) Firing H ₂ /fuel gas mix	
	NOx	CO	NOx	CO	NOx	CO
100	≤ 225	≤ 100	109	< 100	156	< 15
60 - 70	≤ 225	≤ 100	97	< 100	156	< 15
20 - 30	≤ 225	≤ 100	83	< 100	129	< 5

CONCLUSION

Fives Pillard confirmed that its GRC G2 Lonoxflam[®] burner technology allows to reduce NOx emissions without flue gas recirculation, with a quite simple solution (changing only the burners) with results which are better than expected :

- NOx pollution due to fuel gas firing have decreased by about 70% (400 to 109 mg/Nm³)
- NOx pollution due to firing a fuel gas/H₂ mix have decreased by about 60% (380 to 156 mg/Nm³)
- Max H₂ flow rate firing a gas/H₂ mix have increased by about 60%
- Fuel gas consumption at minimum boiler load in mixed firing have decreased by 23% and by 4% at 70% boiler load, which represents from 700 to 400 kg CO₂/hr savings in CO₂ quotas.

Rhodia is totally satisfied with the level of emissions achieved with this investment. It's a masterpiece in the policy of reducing atmospheric emissions which was started several years ago on the power house.

Reducing NOx Emissions in a 45 t/hr Duquenne Water Tube Steam Boiler by replacing 4 old Gas burners with Fives-Pillard GRC G2 Lonoxflam® Gas burner without using external flue gas recirculation

By : Terry CHAMBERLAIN Rhodia Process Engineer, Saint Fons Site (69)

Rhodia Operations Saint Fons Site is a part of the Rhodia Diphenols chain. Process Steam is generated by the site boiler house, fitted with two functioning DUQUENNE water tube steam boilers (45 t/hr, 45 bars saturated steam).

For environmental reasons, Rhodia Operations decided to replace its 4 old GTV gas burners, 43 MW operating at 140°C combustion air. NOx emissions of the old burners were about 390 mg/Nm³ @ 3% dry O₂.

The NOx emission target for the new burners was defined as 225 mg/Nm³ @ 3% dry O₂, in order to comply with the 2003 July 30th French regulation applicable from January 1st 2008.

Rhodia Operations entrusted Fives Pillard to meet this challenge, using the best available technique in NOx reduction without external flue gas recirculation : the Fives Pillard GRC G2 Lonoxflam® gas burners (patent n° FR 94/04136)

Furthermore, Rhodia Operations imposed the following criteria:

1°) Conserving:

- Existing gas train
- Existing fan
- Existing diameter of boiler tube bends
- Existing Burner Management System

2°) Scheduling the boiler works over a period of 5 days in order to minimise the duration of boiler shut-down.

Burners before upgrading :





Burners after upgrading :

Inside view of the boiler

Outside view of the boiler



Thanks to Fives Pillard's Lonoxflam burner technology, works have only been limited to replacing the burner, avoiding a flue gas recirculation pipe and fan which would have been more costly.

CONTRACTUAL VALUES AND ACTUAL MEASURED VALUES

NOx and CO values expressed in mg/Nm³ 3%dry O₂

LOAD (%)	CONTRACTUAL VALUES		ACTUAL VALUES (MARCH 2008)		COMBUSTION AIR TEMPERATURE
	NOx	CO	NOx	CO	
100	≤ 180	≤ 100	≤ 114	≤ 10	≤ 140°C
50	≤ 180	≤ 100	≤ 75	≤ 10	≤ 140°C
30	≤ 180	≤ 100	≤ 79	≤ 10	≤ 140°C

CONCLUSION

Upgrading the burners has been successfully managed by the Rhodia and Fives Pillard teams whilst minimising the non availability of its Boiler.

With regard to boiler operation, the Fives Pillard GRC G2 Lonoxflam[®] gas burners, started up in March 2008, allow an adequate turn-down and have retained reliability and boiler efficiency (Res O₂: 1,8%)

Furthermore, Fives Pillard confirmed that its GRC G2 Lonoxflam[®] burner technology allows to reduce NOx emissions without flue gas recirculation and with results better than expected. The retained efficiencies assist Rhodia in its efforts to meet tight CO₂ quotas and the coming European Regulation applicable from January 1st 2013.