PRECISION ICEBLAST CORP

CASE STUDY

Heat Recovery Steam Generators

Clean fouled HRSG tubes, Increase Reliability

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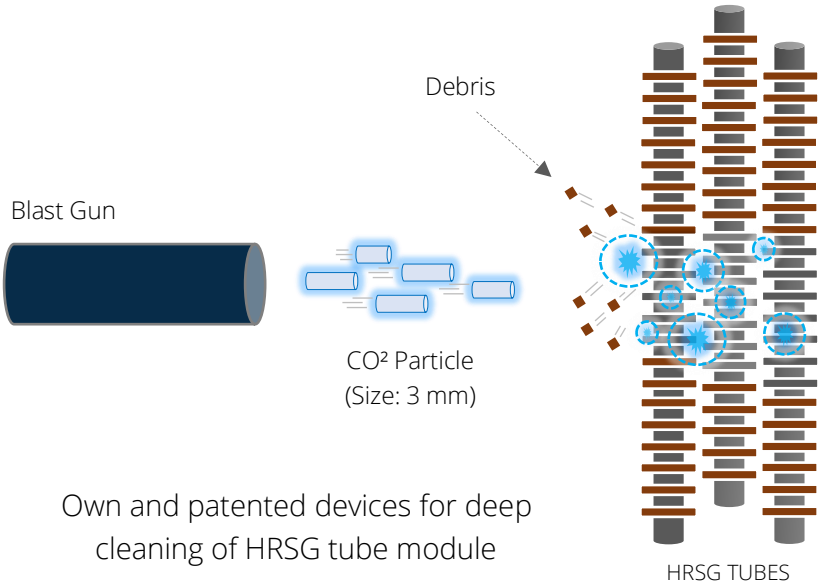
Deposits on the gas side and corrosion of the HRSG heat transfer surfaces are inevitable and are a common cause of reduced steam production, low steam temperatures and degraded gas turbine performance. These effects contribute to the reduction of electricity production and loss of revenue.

Many factors contribute to deposit formation on HRSG tubes—including fuel sulfur content, tube leaks, insulation failures, ammonia injection in excess of that required for NOx control, and condensation caused by low stack temperature. Corrosion also is problematic at plants operating in locations with high humidity, particularly those facilities designed for base-load service and required to cycle. Additionally, HRSGs equipped with oil supplemental firing experience an increased rate of tube fouling than when burning only natural gas.

Over time, fouling can bridge the gap between adjacent tube fins or other heat-transfer surfaces, further disrupting heat transfer and increasing gas-side pressure drop. Recall that gas-turbine (GT) and combined-cycle efficiency decrease with increasing delta p. In cases where HRSG performance is severely compromised, the entire plant may require an extended forced outage to repair corrosion-induced tube leaks, remove deposits from heat-transfer surfaces, or even replace an entire module.

Dry Ice Technology and Deep Cleaning Method

Cleaning with dry grain
CO2 pellets
(rice grain 3mm)



Own and patented devices for deep cleaning of HRSG tube module

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Plant Information

BRAZIL	
2x GAS TURBINE	GE 7FA.04 - 168,872 MW
1x STEAM TURBINE	GE D11A – 184,091 MW
2x HRSG BOILER	VOGT / 2012
START DATE: 05/17/2019	END DATE: 05/28/2019

Problem Presented

High concentration of sulfur deposits on the external heating surface of the fin tubes of the HRSG # 51 and HRSG # 52 boiler preheating module. Oxidation and partial corrosion principle.

Image of HRSG#51 water preheater tubes with sulfur deposits.

Image of HRSG#52 water preheater tubes with sulfur deposits.

Images of HRSG#51 water preheater tubes with oxidation and corrosion principle.

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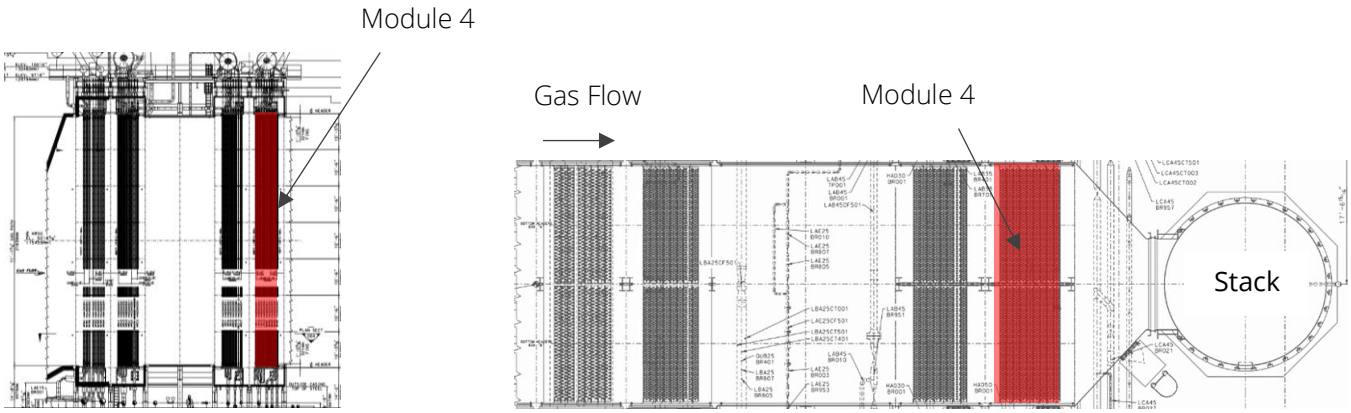
Scope of Work

Cleaning the boiler water preheating module HRSG # 51 and HRSG # 52. Each module with a total square area of 2207 ft².



Side and aerial view of the water pre-heater module that was cleaned in both HRSG's.

Conclusion

The cleaning project for the tube module for water pre-heaters of the HRSG # 51 boiler and the HRSG # 52 boiler of the ENEVA Combined Cycle Plant, located in the city of Santo Antonio dos Lopes, state of Maranhão, Brazil, was concluded with 11 calendar days of work with a team of 4 iceblasters technicians and 1 Iceblast supervisor. The work was completed without any history of accidents involving people and equipment.

Access on both sides of each module was made with tubular scaffolding towers installed in the vertical section. Being a tower between module 3 and 4 (upstream face) and another tower between module 4 and stack (downstream face).

The cleaning process was carried out with 3mm pellets of dry ice (CO^2), used as an impact agent against the outer walls of the encrusted tubes accelerated by ultra-high pressure compressed air (350PSI / 24bar). The entire process was also carried out with blasting equipment and deep cleaning devices developed and patented by Precision Iceblast itself

Cleaning started at the top of the face between (module 4 and stack) of HRSG # 51, blasting from top to bottom. Once completed, the same procedure was applied to the face between (modules 3 and 4) of HRSG # 51. After cleaning both sides of module 4 of the HRSG # 51 boiler, the 2 scaffolding towers were uninstalled, and all dirt was removed from the boiler floor.

For cleaning the HRSG # 52 boiler, the same procedure applied in HRSG # 51 was adopted.

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Results

The deep cleaning service performed at HRSG's provided greater reliability and better operational performance for the combined cycle plant. Main gains observed with the customer after cleaning the HRSG's:

Tubes Before Cleaning

Tubes After Cleaning

1400 kg / 3086 lbs of deposits removed.

Boiler / stack floor completely clean

Gains

- Reliability obtained for the operation.
- Backpressure reduction potential: 4 in wc
- Reduction in stack outlet temperature: 3°C / 37, 4°F
- Gain potential in Mega Watt: 1MW/h
- MW/h Cost = USD 14,63 | Total Installed Power: 519 MW
- Hours worked per year by HRSG: 4320 hours.

ANNUAL SAVINGS: 1.783.801,96 USD