Advanced Cyclone Systems

EMISSION CONTROL

CASE STUDY

BREMER | Rio Grande do Sul, Brasil | 2016

Hurricane RE System to Reduce Particulate Matter from a 15t/h steam boiler to under 65mg/Nm^3

FOREWORD

ACS supplied a dedusting equipment for boiler manufacturer BREMER who integrates the equipment in the boiler package. The end customer is COOPERATIVA SANTA CLARA LTDA.

On October 19, 1967, H. BREMER & FILHOS LTDA was established under a rational management and advanced technology from Germany within modern, administrative principles. Since then, BREMER sold more than 1800 boilers in Brazil and 50 in foreign countries.

The final client, COOPERATIVA SANTA CLARA LTDA, is the oldest dairy cooperative in operation in Brazil and is also the first to achieve ISO certification in Rio Grande do Sul, producing 750 thousand liters of milk per day, resulting in a line of more than 140 products, between milk, cheese, dairy drinks, Temper Cheese, curd and other derivatives.

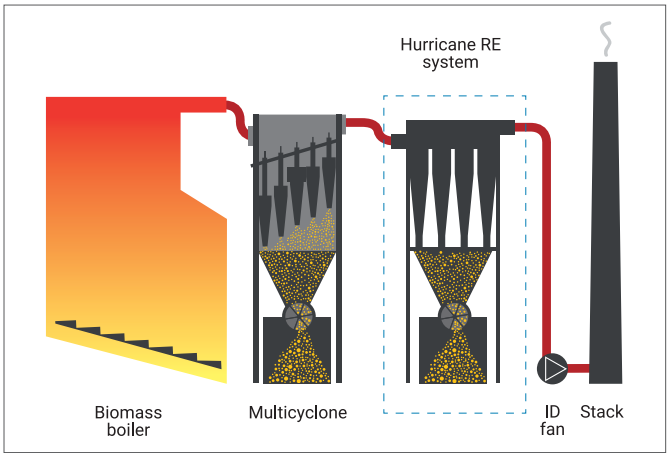

Fig. 1 – Process flow diagram from existing installation

IDENTIFYING THE PROBLEM AND SOLUTION

As many other dairy companies, COOPERATIVA SANTA CLARA has wide needs for steam for several processes.

To produce steam, the plant acquired a BREMER 15t/h steam boiler which burns wood chips, mainly of eucalyptus wood.

ACS challenge was to reduce particle emissions from an inlet concentration of ≅400mg/Nm$^3_{dry}$ at 8% O_2 (after the Multicyclone pre-separator) to less than 65 mg/Nm$^3_{dry}$ at 8% O_2, thus exempting the use of a bag filter with the associated problems and operating costs (changing of filter elements and related downtime costs, costs with compressed air, etc.).

After confirming the particle size distribution (see Fig.3) and other relevant operating conditions, ACS designed a system composed of 16 Hurricane RE type cyclones, arranged in 4 batteries of 4 cyclones each, operating in parallel.

The results achieved were within the expected values (≅50mg/Nm$^3_{dry}$ at 8% O_2).

ABOUT HURRICANE CYCLONES

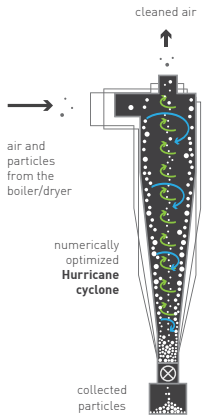

Fig. 2 – Hurricane Cyclone

Hurricane cyclones are patented numerically optimized cyclones. **Hurricane** geometries maximize powder collection for each different application, while minimizing reentrainment and keeping pressure drop at reasonable levels. Hurricane cyclones demonstrate impressive efficiencies in capturing very fine powders with a Volume Median Diameter (VMD) of less than 5µm.

These cyclones are the output of nonconvex nonlinear problems formulated and solved after years of work in partnership with the Faculty of Engineering of Porto and incorporate the most recent findings of the impact of agglomeration in the cyclone collection efficiency (Chemical Engineering Journal 162 (2010) 861–876).

A single Hurricane is more efficient than any other known cyclone available in the market for the same pressure drop.

DESIGN BASIS

- Solids **[Biomass*]**
- Particle size distribution **[Fig.3]**
- Temperature (ºC) **[170]**
- Actual flow rate (m^3/h) **[34 960]**
- Normalized flow rate (Nm^3/h_{dry}) **[19 038]**
- Inlet Concentration (mg/Nm^3 at 8% O_2) **[400]**

*wood chips

SYSTEM SPECIFICATIONS | EMISSIONS

- Expected total pressure drop (kPa) **[1.7]**
- Expected emissions (mg/Nm^3_{dry} at 8% O_2) **[36-55]**
- Guaranteed emissions (mg/Nm^3_{dry} at 8% O_2) **[<65]**
- Verified emissions (mg/Nm^3_{dry} at 8% O_2) **[<50]**

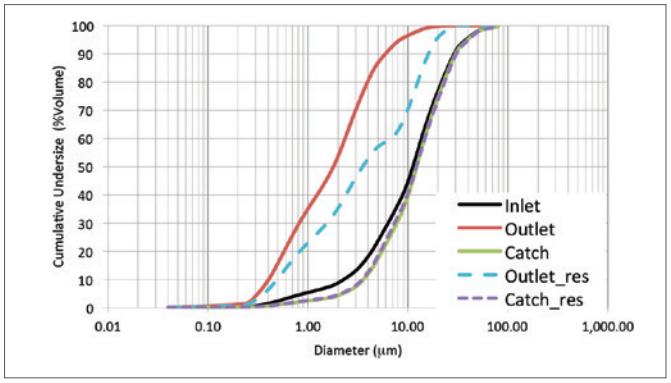

Fig. 3 – Particle size distribution used in simulation

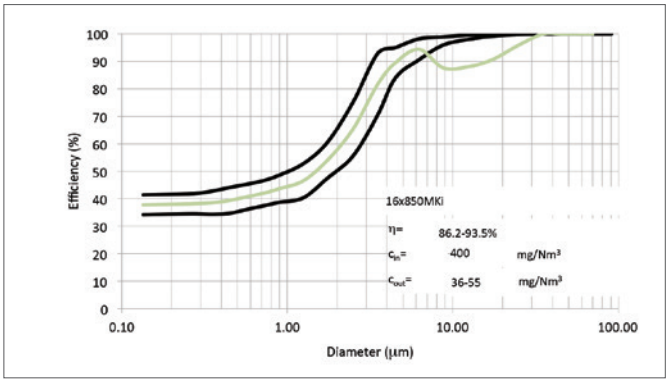

Fig. 4 – Predicted maximum and minimum grade efficiency curves with corresponding global efficiency values

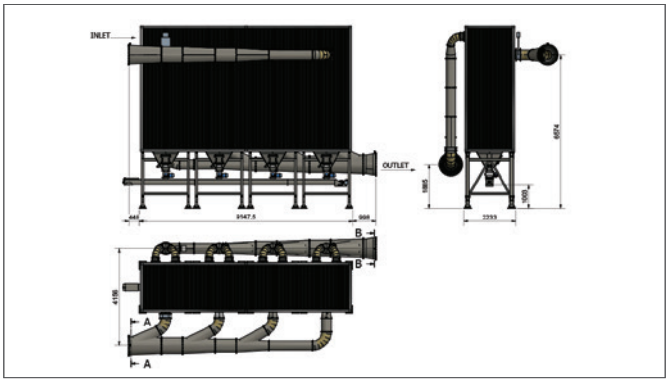

Fig.5 – ACS solution [16RE ø850mm]

CONCLUSIONS

Efficiency verified results (averaged under $50mg/Nm^3$) confirm that the Hurricane System successfully achieves PM emissions under $65mg/Nm^3$ corrected to 8% of O_2 for inlet concentrations of fine particulates (escaping a multicyclone) of more than $400mg/Nm^3$, thus achieving imposed emission standards with an equipment which has lower investment costs, when compared with ESPs, and much lower maintenance and operating costs when compared to Bag Filters and Wet Scrubbers.