**FOREWORD**

Advanced Cyclone Systems, S.A. (ACS) designed and supplied a Hurricane Cyclone System for KMW Energy, an engineering consulting company and equipment manufacturer of biomass energy solutions from Ontario, Canada.

The system was installed at Les Produits Forestiers D&G in Quebec, Canada. Les Produits Forestiers D&G runs a softwood lumber processing plant that is one of the most technologically sophisticated in all of Northeastern America.

ACS was requested to reduce the particulate matter (PM) emissions from a 600HP biomass boiler burning bark to under 150mg/Rm³ at 7%O₂ (Reference conditions “R” => 25°C & 101.3kPa).

Identifying the Problem and Solution

The current emission legislation in Quebec, Canada made it mandatory for biomass boilers <3MW to curb emissions below 100 or 150mg/Rm³ at 7%O₂. Until recently, most of the smaller biomass boilers were able to meet emission limits with just multicyclones (MC). The new emissions limit value left a lot of end users in need of a compact, efficient and economical system to reach the new mandatory values.

ACS was contacted by KMW Energy to design a system for Les Produits Forestiers D&G bark biomass boiler to guaranteed emission below 150mg/Nm³ at 7%O₂.

ACS analyzed the operating conditions and designed a system comprised of eight Hurricane HR cyclones disposed in two batteries of four cyclones to reduce the particulate matter from a maximum of 281mg/Nm³ at 7%O₂ after the MC to below 150mg/Nm³ at 7%O₂.

**Hurricane HR System** To Reduce Particulate Matter Emissions From A 600HP Biomass Boiler Burning Bark
ABOUT HURRICANE CYCLONES

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

- Fuel [Bark Wood]
- Particle size distribution* [Fig.3]
- Temperature (°C | °F) [254 | 490]
- Actual flow rate (m³/h | acfm) [27 959 | 16 456]
- Normalized flow rate (Rm³dry/h) [10 153]
- Max. inlet concentration after MC (mg/Rm³dry at 7% O₂)** [≤281]
- Moisture content in the gases (%) [27.6]
- Site location [Indoors]

SYSTEM SPECIFICATIONS | EMISSIONS

- Guaranteed emissions (mg/Rm³dry at 7% O₂) [≤150]
- Expected emissions (mg/m³ | mg/Rm³dry at 7% O₂) [36 | 108]
- Expected pressure drop (kPa | in H₂O)* [1.2 | 4.8]

* This pressure drop is only for the system, does not include ducts.
** Reference conditions "R" => 25ºC, 101.3kPa

CONCLUSIONS

Consulair, an emission testing company from Quebec, Canada, confirmed that “…all tests meet the standard of Article 75 of the CEOS of 150mg/m² at 7% oxygen” performed on January 31st and February 1st, 2017. The results ensure PM emission compliance for the D&G plant with an ACS cyclone system with lower investment, lower maintenance and lower operating cost than the alternative bag filter.