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# Start-Up of the Ozeos Gas Treatment Center (GTC) for RTA AP60

Philippe Martineau[1], Jean-nicolas Maltais[2], Vincent Vérin[3], Mathieu Frainais[1]
[1]Fives Solios Inc.; 625 Président Kennedy; Montréal, Québec, J3V 6A9, Canada
[2]Rio Tinto Alcan - ARDC – 1955 Bd Mellon – CP1250 Jonquiere – Canada
[3]Fives Solios SA: 25-27 boul. De la paix - 78100 St-Germain-en-Laye - France

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## Abstract

The GTC of the AP60 potline has reached full operation at the end of 2013, treating gases from 38 pots. This paper will overview Fives most advanced and eco-designed scrubbing technology built around the Ozeos scrubbing modules with integrated reactors. The AP60 GTC has five modules: four are equipped with conventional bags and one equipped with extended surface bags. The GTC is also provided with state of the art fresh alumina distribution system allowing overfeed into a module that handles more gas flow (ex: module with extended surface bags) and capability to operate in Cascade feed mode during the summer time. Great care was given to the ID fan selection and noise abatement to meet very stringent requirements (the smelter being located amid a residential area). The paper will finally present the scrubbing performance obtained during the first year of operation and the comparison in performance of the modules equipped with extended surface bags versus conventional bags.

## Introduction

In 2013, RTA and Fives specialists teamed up to start up and bring to normal operation a new dry scrubber technology. The close cooperation of both teams during the start-up and operation was an important contribution in the achievement of these state of the art performance results.

**Figure 1. Ozeos - the state-of-the art dry scrubbing technology for modern smelters. (Photo: RTA AP60)**

This new generation of GTC process filter modules has been developed by Fives over the last few years. It is called Ozeos and has been tested since 2005 in RTA's LRF Research Center in Saint-Jean-de-Maurienne, France. Furthermore, the Ozeos technology is part of Rio Tinto Alcan new AP60 potline at their Jonquiere site in Québec. It features a more compact design that best suits the large gas volume treated by centralized GTCs for modern high amperage pots and includes a low velocity reactor that reduces the potential of scaling, abrasion and alumina attrition. It is provided with bags that have a length up to 8 m and made from micro-denier polyester for best particulate filtration. The filter modules can be equipped with either conventional filter bags or with the extended surface type filter bags.

This advanced dry scrubbing module also includes a series of features to facilitate improved control and easier maintenance, but also means to improve fluoride scrubbing. For example:

- Bag leak detection at each module with automatic detection of the leaking row.
- Continuous monitoring of gaseous fluoride (HF) at each module outlet to allow improve tracking of the GTC performance and to help trouble shooting.
- Control of the gas volume treated by each module through continuous gas flow measurement combined with a modulating filter outlet damper. This is particularly useful when the plant start changing bags one module at a time as news bags offer lesser resistance to flow.
- Finally, best in class fresh alumina distribution system with a unique offering of three modes of operation aimed at providing the lowest GTC fluoride emission.

## Alumina distribution box configuration options

The classic mode is using a distribution box with calibration system and individual air conveyors that ensures an equal distribution of fresh alumina to each reactor/scrubber module.

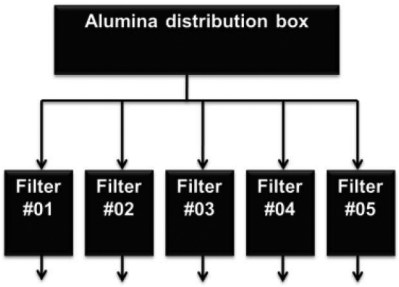


**Figure 2. Classic mode distribution box configuration**

The second mode is the fully automated Cascade feed mode (patent US7731924 B2) where fresh alumina cascades from one module to the next, enriching itself in fluoride progressively, which provides improved HF scrubbing.

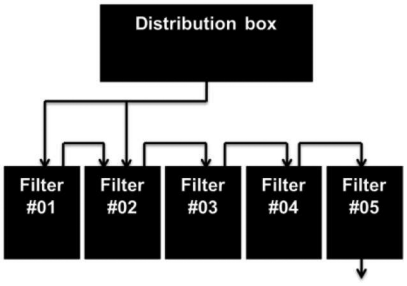


**Figure 3. Automated cascade feed mode configuration**

The distribution box is also provided with dual outlets allowing for the increase of fresh alumina injection at one reactor based on the feedback from the HF monitoring at each module outlet.

**Figure 4. Ozeos: an eco-designed process filter module for GTCs**

## Eco-Design [1]

A complete sustainability assessment of the GTC technology has been performed in order to:

- Check that design improvements did not generate a transfer of impacts, i.e. that Ozeos scores better than other benchmark filter modules on all sustainability indicators. The assessment was made through a comparative Life Cycle Assessment (LCA) combined with additional calculations.
- Quantify Ozeos environmental performance by analyzing site data from the Saint-Jean-de-Maurienne pilot unit and the Jonquiere commercial scale plant.

After performing this entire LCA, the comparison of Ozeos and TGT-RI assessments led to the conclusion that no transfer of impact occurred while designing Ozeos, as shown on the graph below.

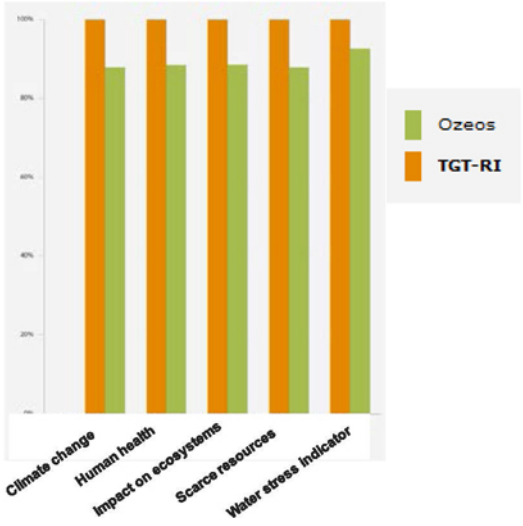


**Figure 5 – Life Cycle Assessment of TGT-RI versus Ozeos, performed with Quantis SUITE 2.0**

By combining the results of the LCA and of the other analyses performed, several areas have been listed that improve the environmental footprint of a GTC, including:

- Reduction in HF emissions
- Reduced pressure drop in filter modules, including reactor
- Reduced power consumption of the fan
- Reduced compressed air consumption
- Reduced footprint and weight
- Bags lifetime

The lower overall environmental impact of Ozeos can be explained by multiple design improvements. First, the amount of materials (plastic, polyester, steel) has been reduced leading to a lower filter module weight and a reduction of indirect impacts (transportation and erection costs, etc.). Another benefit from this is an optimized ground footprint, as the Ozeos is 55% more compact in volume than Fives former benchmark for an equivalent filtering surface. An optimum balance has now been reached between compact design and performance.

Also, the electric power consumption has been decreased as a result of the introduction of a low speed gas gradient in the new design of the reactor-filter combination. The reduced pressure drop generates 5% savings on a GTC electrical consumption when compared to the benchmark, corresponding to a projected annual $300,000 electricity savings for a 740,000 TPA aluminium smelter.

In terms of environmental performance, analysis of various site data led to the conclusion that Ozeos reduces HF emissions by at least 20% compared to the formers state-of-the-art technologies, but also that HF emission performance is less sensitive to gas temperatures. This outstanding performance is principally the result of an improved mixing of alumina and gas, and an optimum gas velocity gradient in the filter module.

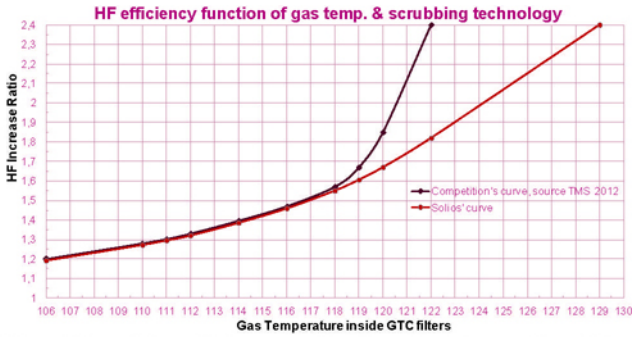


**Figure 6. Scrubbing efficiency as a function of gas temperatures [2]**

Thanks to all these benefits, Ozeos is now one of the designated Fives Engineered Sustainability® brands, which means it classifies as a best-in-class product in terms of environmental performance.

## Operation performance results for the first year of operation

The Ozeos GTC was put into operation on the August 28th 2013 and the first AP60 pot was started on the August 29th. The total flow was accurately controlled during the startup of the subsequent pots so that it was possible to maintain a pot flow slightly above the design criteria. By doing so, the design flow of 162 $Nm^3/sec$ was reached during the month of December when

the last pot was started. For the first year of operation, the Ozeos total flow was at the design flow, within a ± 7.5 % variation.

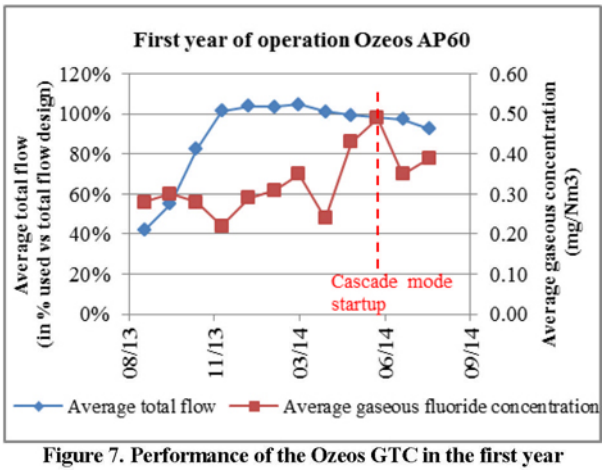


**Figure 7. Performance of the Ozeos GTC in the first year**

After this ramp up period, it is important to point out that for the first 5 months of 2014, the filter module equipped with extended surface bags operated with 10-15 % more flow than the four other modules equipped with conventional bags. For the following three months, all filter modules were operated each at the same flow. Also, in July and August of 2014 the cascade mode alumina distribution was used to test and verify its performance.

Noticeably, during that period the monthly average of the gaseous fluoride concentration in the stack stayed well under the design criteria of 0.65 mg HF/Nm$^3$. This performance established a new benchmark by staying below 0.02 kg TF/ton of aluminium produced for the whole period from January to August 2014.

For the last 6 months, the operational team has been progressively reducing the total flow. This projected to provide significant savings in terms of energy consumption, while keeping the stack and potroom roof vent emissions stable.

### Operation performance between normal and cascade mode

A test campaign was conducted during the summer of 2014. The results confirm that operating the scrubber in cascade mode significantly reduced the HF stack emissions. By cascading the fresh alumina through all modules, the gain in reduction of emissions in the first modules is more significant than the increase of emission in the last module.

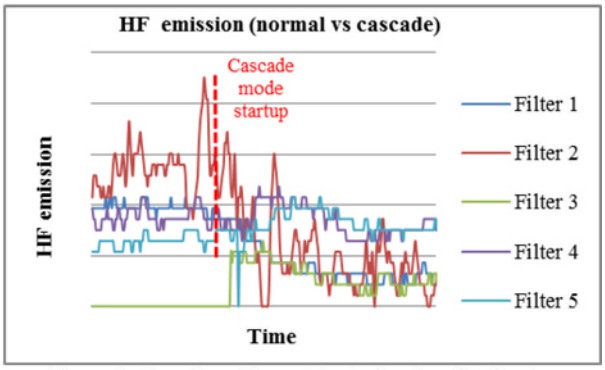


**Figure 8. Cascade vs Normal fresh alumina distribution**

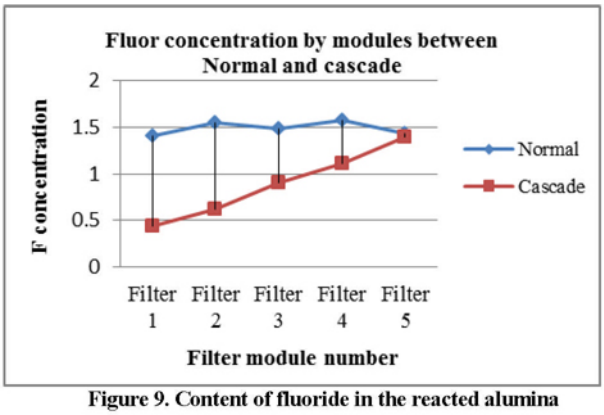


**Figure 9. Content of fluoride in the reacted alumina**

### Conclusion

Following a continuous improvement program that has lasted at least 10 years, the Ozeos technology is created with innovative features to bring a new level of performance. A unique fact is the use of LCA analysis to produce a truly sustainable technology with real contributions to the environment.

The first Ozeos is now demonstrated on pilot and commercial scales. The features have been tried and tested and the results are better or in line with the expectations of lower emissions while specific cost savings have been achieved from its new design.

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