

## Management of Fluoride Emissions during Amperage Increase in Potlines

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### Abstract



Management of fluoride emissions has always been a challenge during amperage increase in any smelter. In general fluoride emission increases with increase in potline current. This adds up to challenges posed in terms of ecological balance and carbon footprints which is already a chronic problem for aluminium business around the world. Ma'aden Aluminium increased its amperage from 370 kA to 410 kA over a span of 5 years. During these years, the potline process has evolved over various phases of different parameters changes to align with higher amperage. This paper intends to share our experience on the impact on fluoride emissions at GTCs and scrubbing efficiency of GTCs before and after the amperage increase.

**Keywords:** Fluoride emissions, Scrubbing efficiency, Gas temperature, Amperage increase, Online analyzers.

### 1. Introduction

The Ma'aden Aluminium smelter is provided with 4 gas treatment centers (GTCs) supplied by Fives Solios. Each GTC is connected to 180 pots collecting hot gases and supplying reacted alumina to the associated pots. Like all other aluminium smelters around the world, Ma'aden Aluminium operates under strict limits of fluoride emissions that are regulated by the Royal Commission of Saudi Arabia. Ma'aden Aluminium aspired to increase its production capacity by increasing its operating current in both potlines which is a common practice among the aluminium smelters. Over the years the line current in the potlines has been increased gradually from 370 kA to 410 kA, which was achieved in December 2020. In the journey to increase line current, the process has experienced several changes and adopted accordingly to meet the production and efficiency targets.

### 2. HF Emissions at Different Ambient Conditions

In Figure 1, there is an historical trend of increase in potline current in Maaden Aluminium since January of 2016. With the increase in potline operating current by 40 kA usually there is an increase in gas temperatures as well as an increase in fluoride concentrations at GTC inlet. Figure 2 shows the historical trend of Ambient temperatures and Fume temperatures recorded at the GTC inlet together with HF emissions recorded in the stack by online analyzers. Looking at the data, which is average of four GTCs, there are no significant changes in gas temperatures recorded at the inlet of GTC during or after the increase in line amperage. However, there is observed a very gradual reduction in average HF emissions (in secondary axis) recorded at stack by online analyzers.

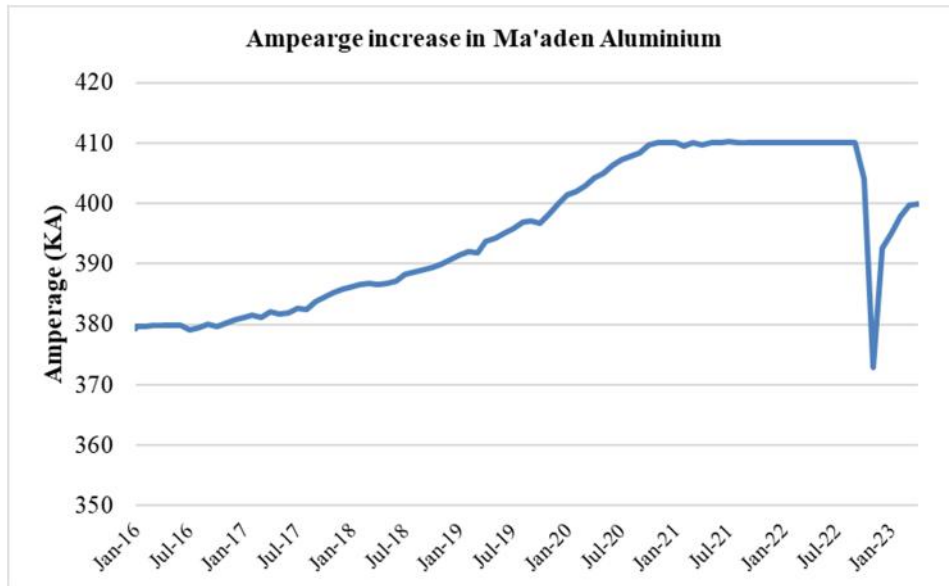


Figure 1. Increase in potline operating current.

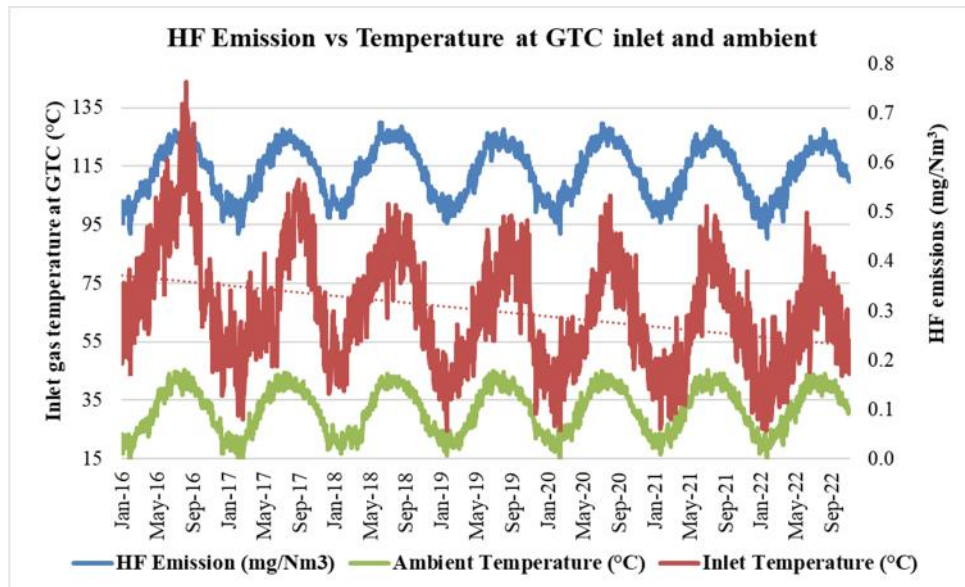


Figure 2. The scrubbing efficiency of GTC with temperature.

Going forward we will discuss the behavior of GTC scrubbing efficiency at different gas temperatures at the GTC inlet and will analyze the behavior separately under different weather conditions as well.

The relation between fluoride emissions and gas temperatures was established long back and published in various journals earlier. Here we intend to interpolate our own data to complement those findings with reference to Figure 3 [1]. Figure 4 shows the variation of HF emissions with respect to gas temperatures at GTC inlet across the year where the gas temperature varies from 90 to 130 °C while the HF emission varies from 0.1 to 0.6 mg/Nm<sup>3</sup> throughout the year. Further, the data was split in two different ambient temperature zones of the year when the weather is hot during April to September and when the weather is cold from October to March which is more relevant to identical weather conditions shared by middle eastern countries like Saudi Arabia, Oman, Bahrain, Qatar, UAE etc.

## 6. Conclusion

The journey of amperage increase along with all the challenges has brought us immense learnings. Though the concept is not new, every journey is unique and brings around loads of experience. Though we have managed to maintain and reduce our stack emissions, the roof emissions remain a challenge and there is a long way to go to meet the benchmark. Going forth we strive to meet our goals aligned to commitments made on the way to net-zero and make a healthier and better environment together.

## 7. References

1. Hugues Vendette et al., Alumina dry-scrubbing technology: development of a cascade feeding system for improved capture efficiencies, *Light Metals* 2007, 187-191.