



FLUORIDE EMISSIONS MANAGEMENT GUIDE (FEMG)

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1.0 Introduction & Theory

Generation of unwanted fluoride by-products from the aluminium smelting process is unfortunately unavoidable with today's state of technology. However, the release of fluorides into the surrounding environment can be reduced.

With careful management and control of both operations and maintenance practises around the plant, smelters are able to reduce the amount of fluorides they release into the environment, achieving levels demonstrated by the world's best practise.

1.1 Purpose of the Guide



Why has this guide been written?



The Fluoride Emission Management Guide (FEMG) has been written for all smelters in China, and for managers, engineers and operators alike, to:

- 1) Increase understanding of the factors that control fluoride evolution and emissions, and
- 2) Detail what operating, control and maintenance practises are required in order for smelters to control and reduce their fluoride emissions.

The guide focuses mainly on improvements to work and maintenance practises, as these are typically low cost and allow a smelter to maximise its environmental performance with its existing technology. Less emphasis is placed on technology improvements, which require higher capital investment.

Recommendations have been proven by world-class smelters and are based upon world's current best practises – if adopted; smelters stand to achieve significant improvement in their environmental performance.

The ultimate aim of the guide is to provide practical and technical information to help all smelters in China achieve significant reductions in fluoride emissions, reducing the overall environmental impact of the smelting industry in China.

The guide has been prepared by the Light Metals Research Centre (LMRC), the University of Auckland, on the invitation of the Australian Aluminium Council (AAC), under the Asia-Pacific Partnership (APP) on Clean Development and Climate.

1.2 Scope of the Guide



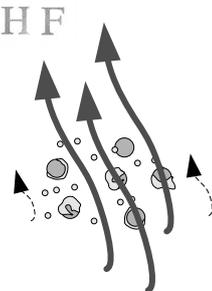
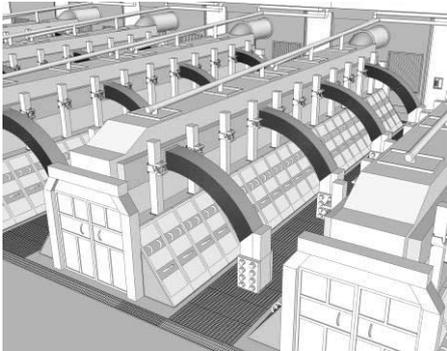
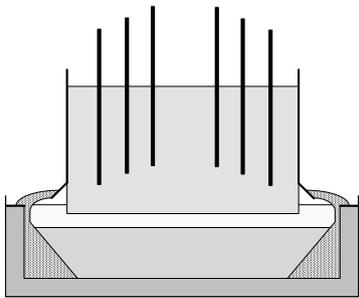
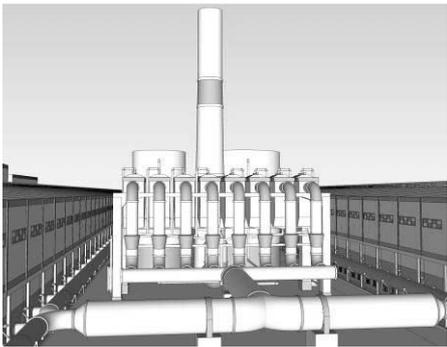
What emissions & types of smelters are covered by the guide?



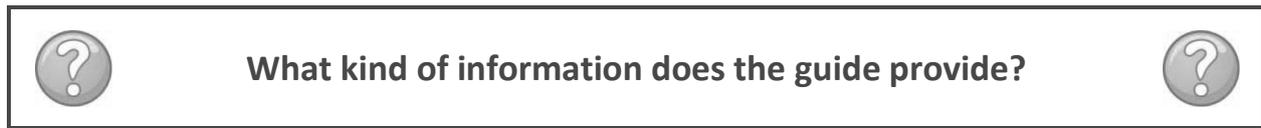
The FEMG covers fluoride emissions from primary aluminium smelters, concentrating on the potroom and gas treatment centre, as well as audits required and overall smelter systems that contribute to emissions.

The guide focuses on pre-bake, point-fed pot technologies and injection-type dry scrubbing technologies, which cover over 90% of all Chinese aluminium smelters. The full scope of the FEMG is illustrated in Table 1.1.

Table 1.1 - Scope of the FEMG.

Elements in the FEMG	What IS COVERED In the FEMG? 	What's NOT covered in the FEMG? 
Environmental Emission Type	Fluoride emissions only , including: <ul style="list-style-type: none"> • Gaseous fluorides, HF • Particulate fluorides 	Non-fluoride emissions , including: <ul style="list-style-type: none"> • SO₂, CO, CO₂ • Polycyclic Aromatic Hydrocarbons (PAH's) • Perfluorocarbons (PFC's), CF₄, C₂F₆
Potroom / Pot Design	<ul style="list-style-type: none"> • Pre-bake pot design • Point-fed 	<ul style="list-style-type: none"> • Söderberg pot design • Bar-break / side-work designs 
Gas Treatment Centre / Scrubber Design	<ul style="list-style-type: none"> • Dry scrubbers, with an injection-type reactor and bag-house 	<ul style="list-style-type: none"> • Wet scrubbers • Dry scrubbers, with alternate technology like Torroidal or fluidised bed

1.3 Structure of the Guide



The FEMG covers 6 main sections for understanding and controlling fluoride emissions:

1. **Introduction & Theory** – Drivers behind reducing fluoride emissions, and background into how fluoride emissions are generated.
2. **Overall Fluoride Emission Management System** – Overall concept and approach for controlling and managing smelter fluoride emissions.
3. **Potroom Systems for Reducing Fluoride** – Key Process Indicators (KPI) and control points for operations/control & maintenance practises in the potroom.
4. **Gas Treatment Centre for Reducing Fluoride** – Key Process Indicators (KPI) and control points for operations/control & maintenance practises for the gas treatment centre.
5. **Smelter Systems Outside the Potroom and Gas Treatment Centre** – Key Process Indicators (KPI) and control points for other areas in the smelter that affect fluoride emissions.
6. **Fluoride Emission Measurements** – Standard and recommended smelter fluoride measurement methods.

Where possible in the guide, improvements to practises will be focused on over technology improvements, with recommendations ranked from requiring little/no capital investment to significant capital investment.

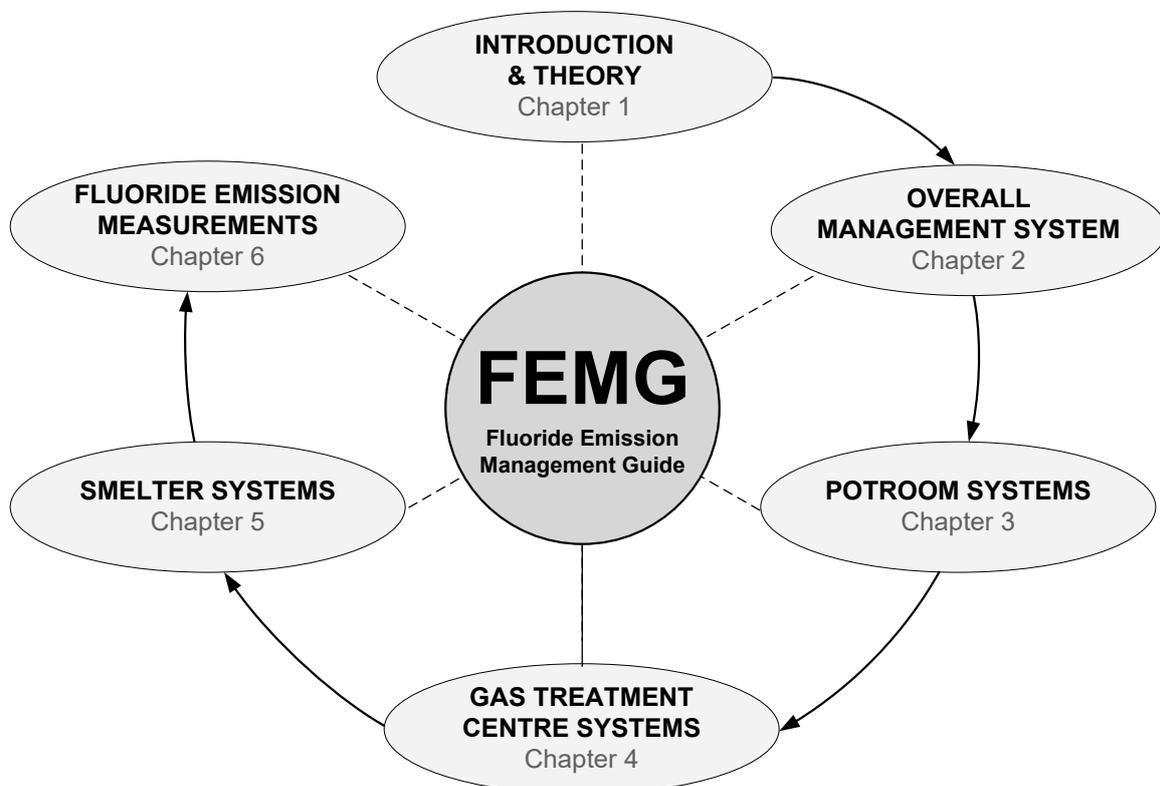


Figure 1.1 – Structure of the FEMG.

1.4 Drivers Behind Fluoride Emission Control

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Why is controlling & reducing fluoride emissions important?

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All aluminium smelters in the world, including those in China, are driven by the same factors for reducing the amount of fluorides they release into the environment. These factors are legal, health and environment, as well as operations or performance as illustrated by the chart below.

It is important to note that by implementing the best practices in this FEMG, each smelter has the potential to not only make significant improvements in environmental performance, but also significant improvements in the smelter’s key operating performance measures, e.g. reductions in specific energy consumption, higher current efficiency, reductions in material losses, and so on.

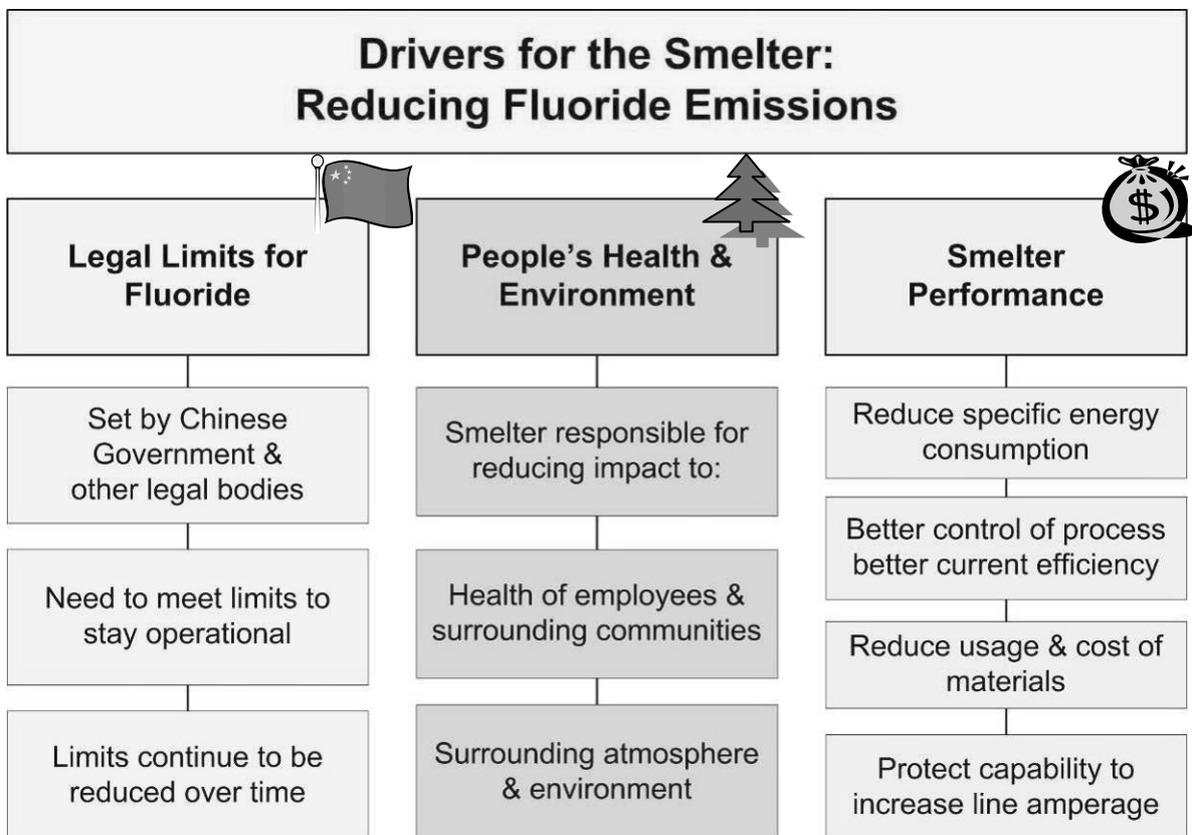


Figure 1.2 – Chart showing why smelters need to make practical steps to reduce its fluoride emissions.