

SO₂ reduction solutions



Full spectrum of effective solutions

Key benefits

- **Reliable SO₂ reduction of up to 97%**
- **Full spectrum of solutions for an ideal match**
- **Expertise to help plants weigh costs and benefits**
- **Solutions with guaranteed performance**

Primary methods

- **Selective quarrying**
- **Increase SO₂ absorption in the raw mill**
- **Improve burning process**
- **Install D-SO_x system**

Secondary methods

- **Install Hydrated Lime Injection (HLI) system**
- **Install Gas Suspension Absorber (FLS-GSA)**

Finding the right approach for your cement plant

Reducing sulphur dioxide (SO₂) successfully requires more than 'just' buying a particular product, or injecting hydrated lime into the pyro system. It is first and foremost a matter of process optimisation. This requires evaluating your present system to explore a range of potential reduction methods. It also requires weighing costs and benefits to find the correct solutions for your specific requirements. In other words, it's not just about installing new equipment.

FLSmidth offers a wide range of SO₂ reduction alternatives, since there can be a variety of ways to achieve the results you're looking for. And we have the expertise to recommend exactly the right solution for your cement plant.

Our primary approach to SO₂ reduction is to ensure that your pyro system is correctly designed and operated. We strive to optimise your system by utilising its existing SO₂ reduction potential. Only if further reduction is necessary do we recommend modifying your process by installing an FLSmidth D-SO_xTM system or by secondary measures like Hydrated Lime Injection (HLI) or a Gas Suspension Absorber (FLS-GSA[®]).



Professional compliance solutions

Increasingly stringent regulations mean it's more important than ever to be sure that your plant is always in compliance. Whether your SO₂ reduction challenges require a primary or secondary reduction method, you can be sure the solution will be developed with the professionalism the industry expects from FLSmidth.

Process audit for optimal SO₂ reduction

Therefore, the first step in virtually any SO₂ reduction project is the process audit, which reviews your cement plant operation for possible process optimisation to ensure the lowest possible SO₂ emissions. A process audit investigates the system through a review of plant measurements, operational stability, chemical study, burner optimisation and preheater design.

Once the process audit is complete, the plant and FLSmidth agree on a course of action – including minor or major design changes – by weighing the costs and benefits of the different alternatives.



Primary SO₂ reduction – optimise your system

Fine-tuning the process

When SO₂ is released from the raw materials in the top cyclone stages of the preheater, it typically enters the main gas handling system and the raw mill. A raw mill is capable of absorbing 40-70% of the SO₂ in the gas that enters the mill and CaSO₃ and CaSO₄ is formed. Therefore, the amount of gases going to a raw mill can be increased to reduce the overall SO₂ in the main stack. This is done by conditioning the gas from the preheater properly or by adjustments of the mill operating conditions.

During certain kiln operating conditions SO₂ can be released in the rotary kiln. FLSmidth's leading pyro process design includes a pre-calciner system that functions as a perfect scrubber, which removes 100% of SO₂ from fuels and raw materials entering the calciner. SO₂ can, however, escape through a kiln bypass. This can to some extent be controlled by optimisation of oxygen in the kiln, burner settings and temperature and quality of fuel. Correct feeding of the pyro system and the type and grade of the raw materials also affect SO₂ production. FLSmidth can help your plant control all of these factors through good operation and maintenance procedures.

In short, the primary approach to controlling SO₂ emission is to avoid SO₂ creation through correct system design and operation.

FLSmidth D-SOX™ system – Up to 30% SO₂ reduction

SO₂ formed in the upper cyclone stages of the preheater can be reduced by reaction with the naturally occurring CaO present in the pyro system. CaO is formed in the calciner, and gas and dust containing high amounts of CaO can be directed to the upper stages for SO₂ reduction by a minor calciner modification called the FLSmidth D-SO_x system. Since the gas moving through the FLSmidth D-SO_x system has an easier path than the gas that goes through the intermediate cyclone stages, the natural draft of the preheater can be used to pull the gas through the D-SO_x system.

Exclusively developed by FLSmidth, the FLSmidth D-SO_x system is a proven and simple primary reduction method that employs a calciner slip stream to reduce SO₂ emissions, without addition of reagents.

Typical steps

1. Conduct process optimisation, including audit
2. Decide course of action, weighing costs and benefits
3. Make necessary operational and design changes





Secondary SO₂ reduction – a cost-effective solution

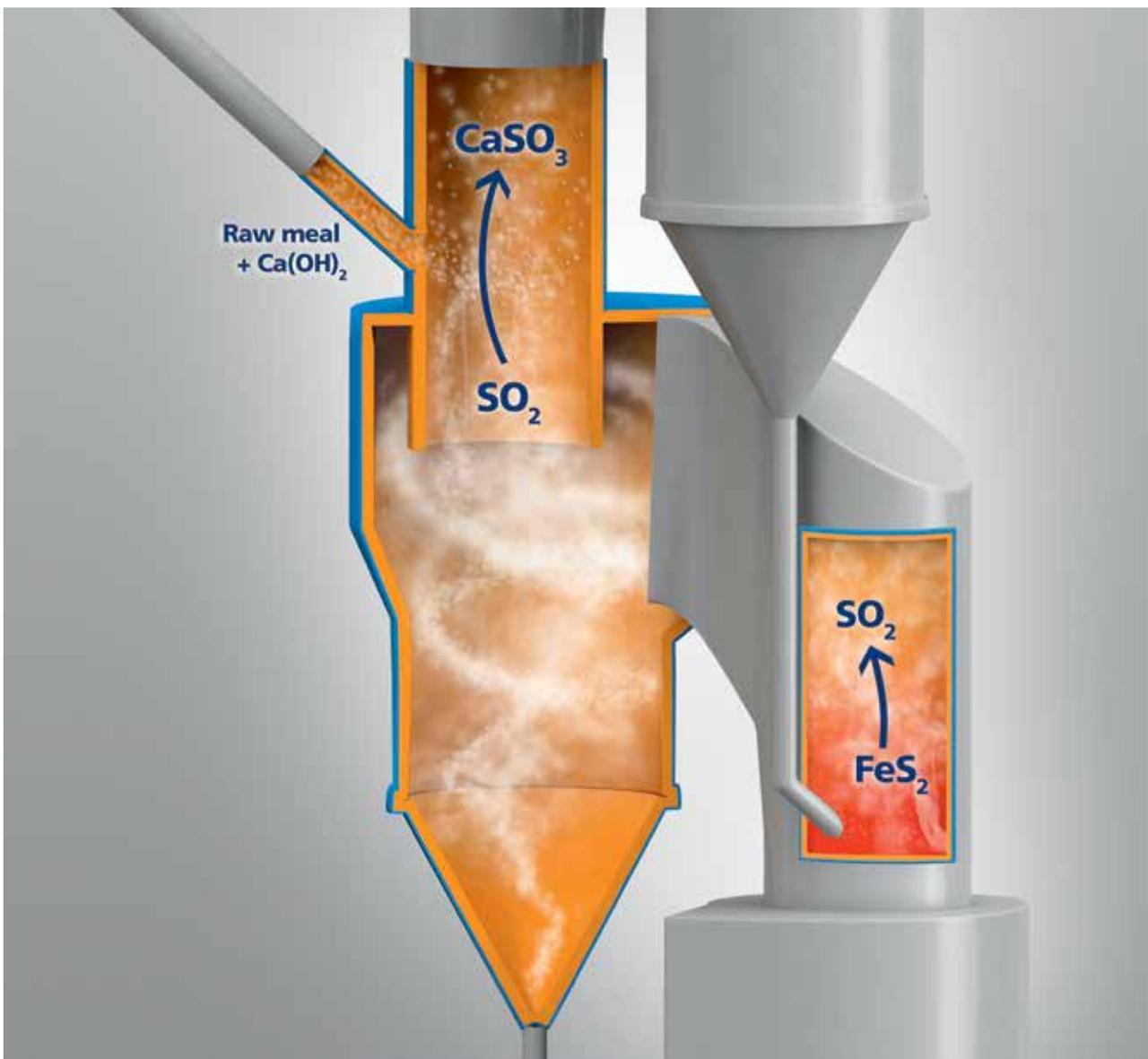
Hydrated Lime Injection (HLI) – up to 60% SO₂ reduction

If there is a need to further reduce emissions by removing SO₂ from exhaust gases coming from the preheater or kiln bypass, we offer proven technologies to meet the specific needs of your plant.

FLSmidth's HLI system reduces SO₂ emissions up to 60% by injecting hydrated lime powder – which absorbs SO₂ – into the preheater kiln feed. The system injects the hydrated lime powder either pneumatically into the preheater or via a mechanical bin that

measures the powder into the preheater kiln feed system. The HLI system is a highly reliable, cost-effective solution for handling periodic fluctuations in SO₂ emission levels and remaining within legal compliance limits.

The oxidation of pyrite (FeS₂) takes place at 300-600°C. Ca(OH)₂ enters the preheater with the feed and reacts with the SO₂.



Gas Suspension Absorber – up to 97% SO₂ reduction

Our SO₂ reduction technology with the highest reduction efficiency is FLSmidth's Gas Suspension Absorber, FLS-GSA®. The FLS-GSA provides up to 97% reduction of SO₂ (and HCl).

A hydrated lime slurry and water (for temperature control) is injected through a pressurised air-atomising nozzle. The sorbent is re-circulated to a large extent, keeping the degree of lime utilisation high, and operating costs low.

Versatile, efficient control

The FLS-GSA is an efficient, versatile multi-pollutant control device. Its modular design enables fast, flexible installation at low initial cost, with very little

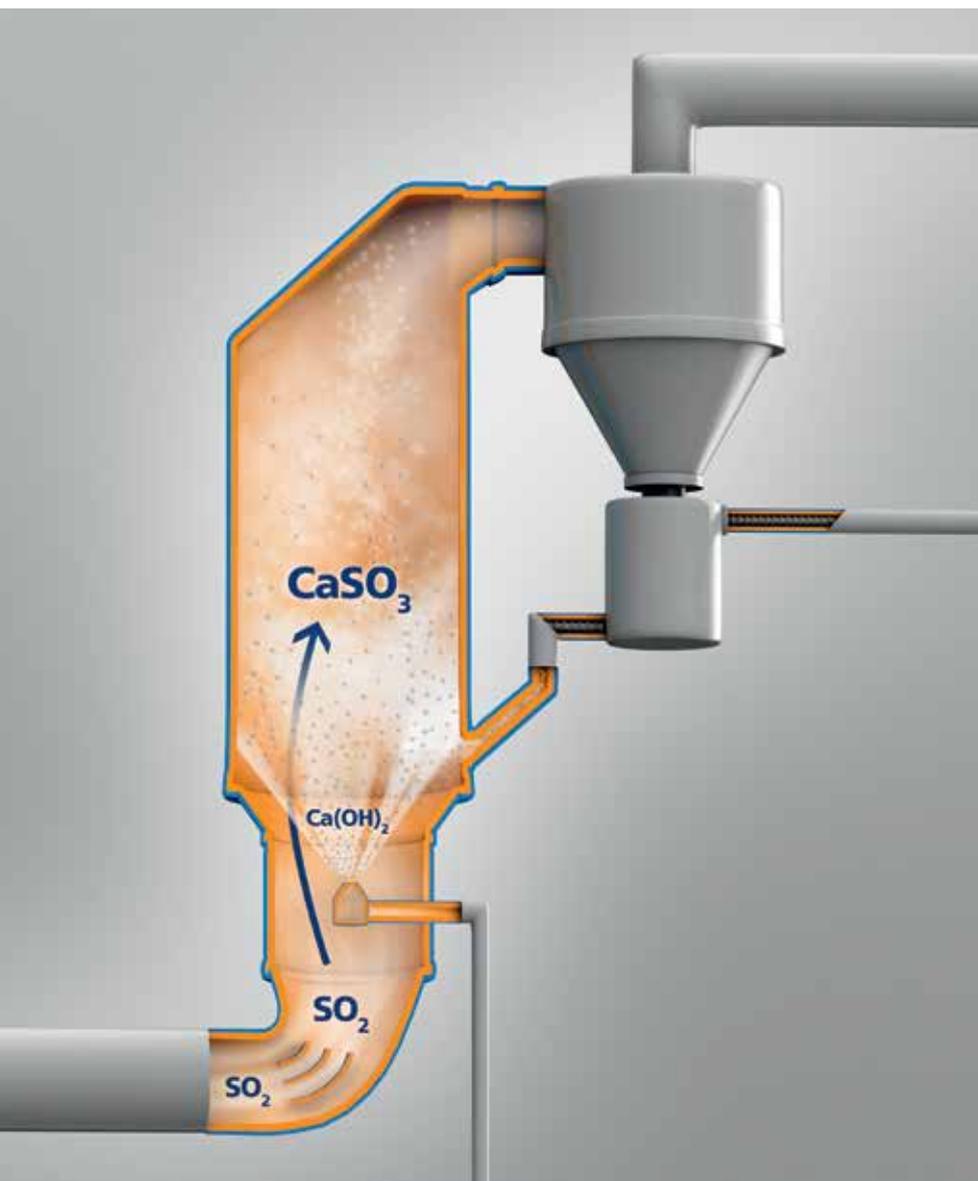
disruption to plant operation. Because it recirculates the absorbent to such a high degree, absorbent utilisation is optimised, which keeps operating cost at a minimum. The reactor volume is small and requires limited ground space.

Easy to maintain

Compared to alternative solutions, the FLS-GSA is easy to maintain. It uses a minimum of wear parts – a key factor in controlling costs and keeping availability high. For instance, nozzle replacement (the only part that requires regular maintenance) can be performed without disrupting plant operation. The replacement process is a one-person job that takes just a few minutes and follows a simple procedure prompted by the control system – while flue gas cleaning continues uninterrupted.

Long-term compliance

The FLS-GSA is designed to comply with extremely low emissions standards. It can help you meet increasingly stringent environmental regulations well into the future.



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