CARMEUSE™
NATURAL CHEMICALS

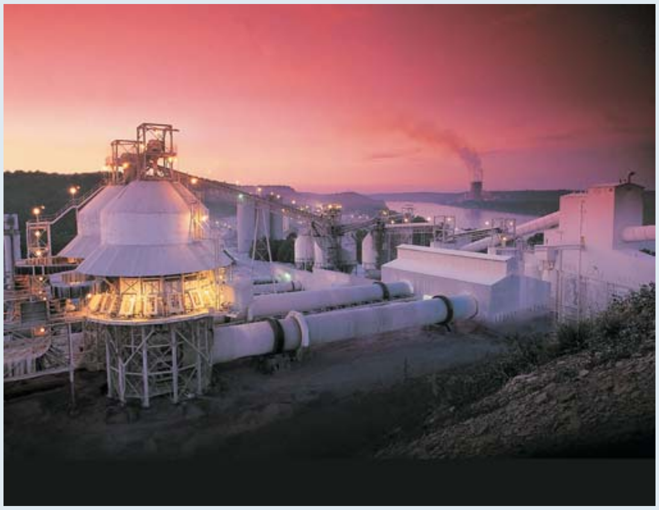
Lime
The Proven Solution for Cleaner Air

LIME

Dry Scrubbing

Plume Abatement

High (up to 99.9%) SO_2 Removal Efficiency



Carmeuse, the LARGEST SUPPLIER of reagent and ADVANCED technology, for the HIGHEST PROVEN removal efficiency of SO_2

Lime, the Proven Solution!

CARMEUSE NATURAL CHEMICALS

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Dry Scrubbing

Dry Flue Gas Desulfurization Technology

Dry flue gas scrubbing with lime is widely used for control of sulfur dioxide (SO_2) emissions from power plants that burn low-sulfur coal. Lime spray dryers are the most common type of dry FGD used in power plants. A dry FGD system is located after the air preheater and before a baghouse or electrostatic precipitator. In combination with a baghouse, a dry FGD system can achieve sulfur dioxide SO_2 reduction up to 94% on low-sulfur coal with low lime reagent use. Byproduct from the capture of SO_2 is collected in either a baghouse or electrostatic precipitator. A dry FGD system produces no waste water unlike wet FGD.

Along with its use in power generating facilities, dry FGD is widely applied for control of acid gases (SO_2, HCl, HF, SO_3) from other industrial facilities such as incinerators and aluminum plants. A common industrial application for dry FGD is injection of hydrated lime powder ahead of a baghouse. Lime-based control provides the maximum achievable control technology (MACT) for hazardous air pollutant (HAP) reductions from flue gas streams. As with the wet scrubbing system, lime used in dry scrubbing systems provides a cost effective means for simultaneous control of acid gases, mercury, fine particulates, and other hazardous air pollutants in a single vessel. This technology has been successfully demonstrated in power plants and industrial applications since the mid-1970's.

Dry Lime FGD Processes

Typically, there are a number of dry lime processes, either used or suitable for SO_2 capture in coal fired power plants including: 1) Lime Spray Dryer, 2) Flash Dryer Absorber, 3) Circulating Fluidized bed, and 4) In-duct Injection.

Benefits of Dry Lime FGD

- Proven technology
- Lowest capital cost
- Low operating cost
- Multi-pollutant capture including mercury
- No liquid waste stream

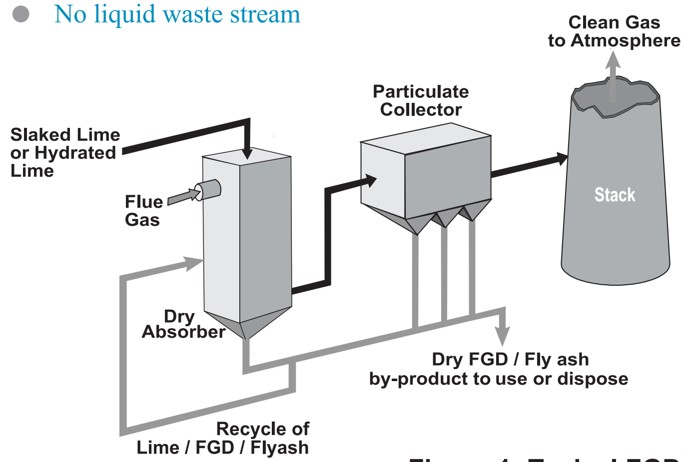


Figure 1: Typical FGD Design for Dry Scrubbing

Plume Abatement

Alkali Injection for SO_3 Control

Combustion of high-sulfur coal combined with control of nitrogen oxide emissions via selective catalytic reduction (SCR) produces high concentrations of sulfur trioxide (SO_3) in flue gas, which increases visible plume opacity and is a source of fine particulate. The system of using byproduct magnesium hydroxide from a Thiosorbic® (magnesium-enhanced lime) wet flue gas desulfurization process is highly efficient for controlling SO_3 and plume opacity. Furnace injection of byproduct magnesium hydroxide became part of an SCR installation at a 1300MW Midwestern station. Leading methods for maximum plume abatement include:

Calcium Hydroxide Injection: Hydrated lime has proven potential for control of SO_3 via dry injection into flue gas ahead of an ESP, or ahead of a wet scrubber.

- Low capital and operating costs
- Ease of use and widespread availability
- The ability to be used with other technologies to trim SO_3 emissions after the SCR.

Magnesium Hydroxide Injection: Magnesium hydroxide that is a byproduct of a magnesium-enhanced (Thiosorbic®) lime wet flue gas desulfurization (FGD) process is equally effective as commercially-available magnesium hydroxide for furnace injection for removal of SO_3. Since the byproduct is produced on-site, transportation costs are eliminated. After injection, $Mg(OH)_2$ loses water of hydration to become MgO at a temperature above662° F (350°C). MgO reacts with SO_3 to form magnesium sulfate particles that are removed in a downstream particulate control device.

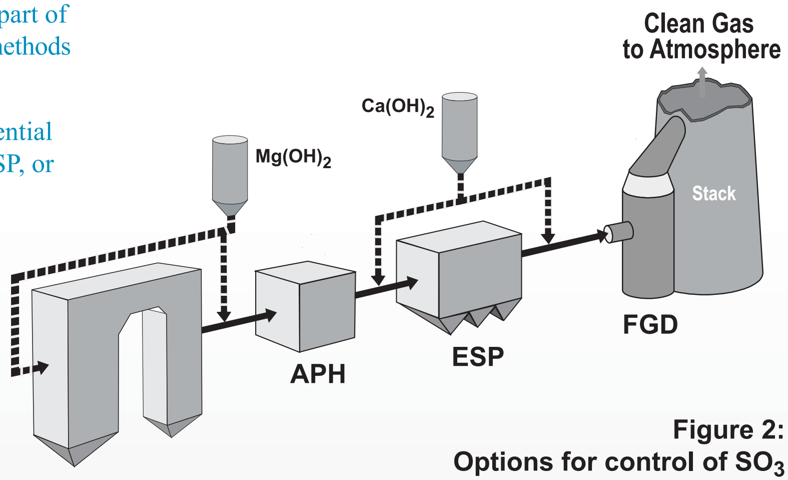


Figure 2:
Options for control of SO_3

Wet Scrubbing

Wet Flue Gas Desulfurization Technology

First developed in 1970's, Carmeuse's Thiosorbic magnesium-enhanced lime process has evolved into a leading wet scrubbing process for control of sulfur dioxide (SO_2) and sulfur trioxide (SO_3) emissions from coal-fired boilers used in power generating plants, while also providing byproduct gypsum and magnesium hydroxide.

Table 1: 4 yr. average of SO_2 emissions and removal efficiency for 1,800 MW plant (3 units at 600 MW each)

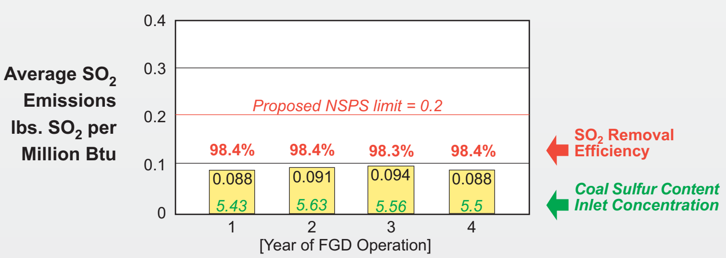
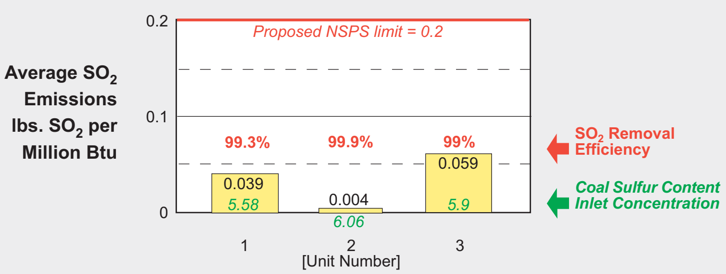


Table 2: SO_2 emission test per unit--1,800 MW plant



Benefits of MEL Process

- Lower capital cost for emissions control than LSFO
- Higher SO_2 removal efficiency to above 99% on high sulfur fuel.
- The production of byproduct magnesium hydroxide to use as a reagent for the efficient control of SO_3
- Decreased plume opacity.
- The production of byproduct gypsum to use for the manufacturing of wall board and cement
- Increased availability.

Thiosorbic® absorbers are much smaller and cost less than those used in LSFO FGD processes.

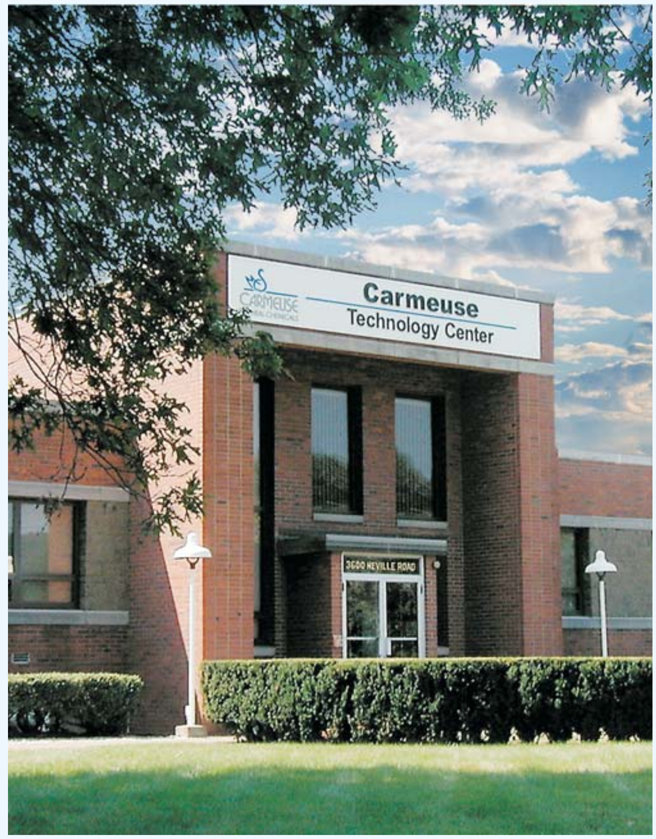
Technical Support

The Carmeuse Technology Center

Located in Pittsburgh, Pennsylvania, the Carmeuse North America Technology Center has more than a half-century tradition of technological excellence. Its innovators developed the Thiosorbic FGD process, with performance far superior to conventional FGD technology. Staffed with experts in the field of air pollution control, the Technology Center strives to provide solutions to air pollution control problems in coal-fired power plants that are efficient, reliable, and easy to operate. Equipped with analytical equipment specifically for analysis of FGD samples, it provides extensive technical support to users of the Thiosorbic process in seven states and contract analysis and support to others.

To provide the superior service, Carmeuse's Technology Center has state of the art analytical and research equipment including:

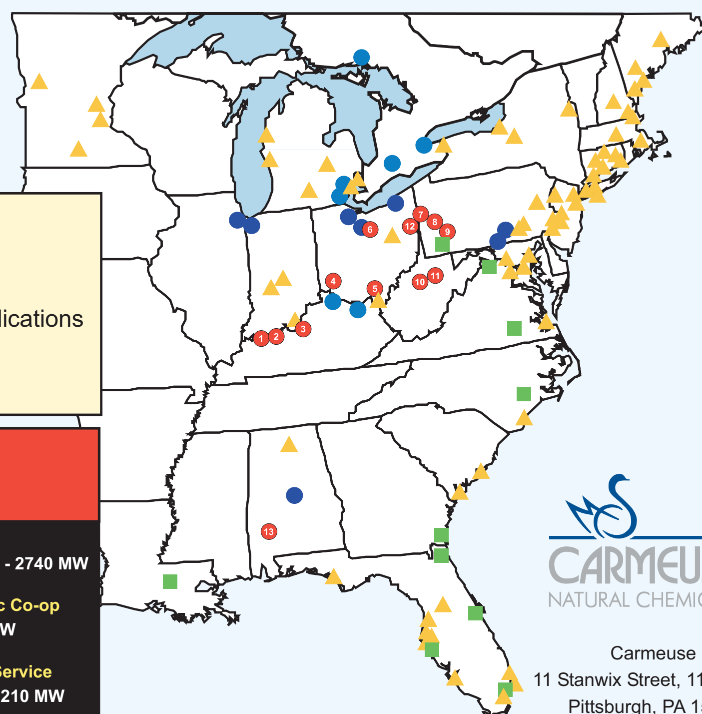
- Scanning Electronic Microscope with X-Ray Analysis
- Inductively-Coupled Plasma Spectrometry
- X-Ray Spectometry
- Particle Characterization Laboratory (Size, Surface Area, etc.)
- A full array of complementary chemical and physical analytical techniques.



Carmeuse Lime Plant Locations -- Eastern and Central NA and Canada

For more information about a Carmeuse Lime plant near you call:

866-243-0965
866-780-0974



- ● Carmeuse Lime Plants
- ■ Terminals
- ● Thiosorbic Lime FGD Applications (Details below)
- ▲ Dry Lime FGD

Thiosorbic® Lime FGD Applications
15 Stations, 33 Units, 17,140 MW

LG&E (E.ON)
1. Green - 490 MW
2. Henderson - 365 MW

Cinergy
3. East Bend - 670 MW
4. Zimmer - 1300 MW

American Electric Power
5. Gavin - 2600 MW
6. Conesville - 890 MW

AES
7. Beaver Valley - 125 MW

Reliant Resources
8. Elrama - 510 MW

Allegheny Energy
9. Mitchell - 290 MW
10. Pleasants - 1370 MW
11. Harrison - 2050 MW

First Energy
12. Bruce Mansfield - 2740 MW

Alabama Electric Co-op
13. Lowman - 520 MW

Arizona Public Service
14. Four Corners - 2210 MW

Great River Energy
15. Coal Creek - 1010 MW

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