**Process gas analysis**
for flue gas desulfurization plants

Components to be measured
– SO₂, O₂

ABB Solution
– ACX

Measurement made easy

**Introduction**
When burning coal or petroleum products for energy production or other reasons (e.g. steam production in petrochemical plants) pollutants are created, that are emitted with flue gas. Sulfur, contained in the fuel is burned to SO₂ and SO₃ which are one of the main pollutants factors. For these reasons almost, all industrialized countries have adopted laws to restrict sulfur dioxide emissions.

Typically affected plants
• power plants
• sulfuric acid plants
• pulp & paper plants
• sintering furnace
• coke oven
Process gas analysis

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SO\textsubscript{2} Reduction - Primary measures
- low sulphur fuel usage
- co-incineration of low sulphur and a high alkaline ash; desulphurization rate ≤ 75 %
- use of adsorbents in fluidized bed combustion systems (combustion temperature ≤ 850 °C); desulphurization rate ≤ 75 %

SO\textsubscript{2} Reduction - Secondary measures
A “Flue Gas Desulphurization (FGD)” plant removes sulfur dioxide from the flue gas before it is released into the atmosphere and hence reduces the impact on the environment. In general flue gas desulfurization can be subdivided into regenerative and non-regenerative technologies. These technologies can then be subdivided into a wet process or a semi-dry process or a dry process. The most commonly employed flue gas desulfurization technologies are:
- Lime or limestone scrubbing (wet process, most commonly employed technology)
- Spray-dryer absorption (semi-dry process)

**Lime or limestone scrubbing (wet process)**
After leaving the dust removal plant, the flue gas enters a tower where it is sprayed with a calcium-based slurry (scrubbing liquid) that is fed from a tank. The gaseous pollutants such as SO\textsubscript{2} are solved in the liquid and react with the liquid to form calcium sulfite or sulfate which are removed by dewatering and settling into a thickener. Alternatively, calcium sulfite is oxidized to form gypsum by bubbling compressed air through the sulfite slurry. The desulphurization rate ≤ 92 t 98 %. The by-products calcium sulfate dihydrate (gypsum) can be sold which reduces operating costs.

**Spray-dryer absorption (semi-dry process)**
The desulphurization rate ≤ 85 to 92 %. The by-product (mixture of fly ash, unreacted additive and CaSO\textsubscript{3}) needs to be special conditioned by mixing water and fly ash to produce a disposable fixed product (→ landfills)

Dry sorbent injection (dry process)
The by-products are disposed of, for example, as landfill, although careful control is needed because they include active lime and calcium sulfite.
The Flue Gas Desulfurization by-product applications include:
- raw material for wallboard
- fill material for structural applications and embankments
- feedstock in the production of cement
- raw material in concrete products and grout
- ingredient in waste stabilization and/or solidification

Motivation
Optimum scrubber plant control with maximum efficiency to comply with environmental regulations (minimal use of reagent and plant condition monitoring). Additionally, produce by-product (gypsum) that can be sold because it fulfills the required quality.

Task: FGD Control Process
Two parameters are required for FGD control
- SO\textsubscript{2} before FGD plant to control the treatment process
- SO\textsubscript{2} after FGD plant (typically values from the stack’s CEM measurement are used)
The reagent dosage is derived from these two values. Additionally, oxygen is measured to detect leakages.

Typical measuring ranges
before FGD  SO\textsubscript{2}: 0 to 400 / 4000 mg/m\textsuperscript{3}  
O\textsubscript{2}: 0 to 25 Vol%  

ABB Solution
ACX is a complete system for extractive continuous gas analysis. The system can be fully operated from the outside. Inside, the well-established reliable analyzers of the Advance Optima series work with the proven components for sample conditioning. The ACX system is particularly easy to maintain as a result of the standardized design. Comprehensive digital communication allows global remote maintenance and control with Analyze\textsuperscript{IT} Explorer.

ACX can be equipped with a back-purge option to prevent clogging of the sample probe due to the dust load. Other options:
dual sampling for simultaneous measurement at two different sampling locations
dual switching for measurement at two sampling locations or for uninterrupted measurement at one sample location during the back-purge phases

Customer benefits
- improved efficiency
- secured economics