# AIR PROTECTION FROM POWER INDUSTRY EMISSIONS

## 1.3. Sulfur oxide emission reduction

### 1.3.2. Technologies of sulfur oxide emission reduction

#### 1.3.2.2. Dry limestone technology

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In dry limestone technology finely crushed lime – calk CaO or burnt lime $Ca(OH)_2$ is used. It's injected into the boiler convective shaft at a temperature range of about 850°C. The reagent binds sulfur dioxide:

$$CaO + SO_2 + {}^1/_2O_2 = CaSO_4;$$
$$Ca(OH)_2 + SO_2 = CaSO_4 \cdot {}^1/_2H_2O + {}^1/_2H_2O.$$

Depending on the lime used, anhydrous or semi-aquatic plaster stone is formed. The scheme of this technology is not practically different from the considered dry limestone desulfurization scheme, but the reagent is supplied before the convective shaft. Lime has the same effect as limestone on collecting of sulfur trioxide, operation of electrostatic precipitators and scrubbers.

#### 1.3.2.3. Dry soda technology

Soda is a very active, but an expensive reagent. It is applied just as well as lime, but the $SO_2$ catching effect achieved is higher in comparison with lime. At the same time reagent consumption is greater as the molar weight, for example, of sodium carbonate is equal to 106 against of 56 for CaO and against of 74 for $Ca(OH)_2$. $SO_2$ is bound according to the chemical formula:

$$Na_2CO_3 + SO_2 + {}^1/_2O_2 = Na_2SO_4 + CO_2\uparrow.$$

As in all dry technologies, the indicated reaction takes place only on the surface of solid substance, therefore fineness of the crushed reagent is also important.

Except for $SO_2$, soda neutralizes other acidic components of flue gases - hydrogen chloride HCl and fluoride HF. The first one may be presented in combustion products of salty coal (or coal with rather high chloride content). Then

$$Na_2CO_3 + 2HCl = 2NaCl + CO_2\uparrow + H_2O.$$

Now soda is mainly used for purification of combustion products of municipal solid wastes (MSW) in municipal incineration plants. Municipal solid wastes contain a large number of organic matters based on chlorine and fluorine compounds, so that hydrogen chlorides and fluorides are present in flue gases in amounts often exceeding $SO_2$ concentration. At purification of combustion products of MSW in addition to two equations mention above, the third one is also added:

$$Na_2CO_3 + 2HF = 2NaF + CO_2\uparrow + H_2O.$$

Gas purification wastes received in a form of the mixture of $Na_2SO_4$, NaCl and NaF with the remains of the unreacted soda, are soluble, therefore for their storage special non-draining slurry disposal areas are needed.

Installation of the gas purification system consists of a dry absorber, installed before the bag collector. Soda, injected into the gas, binds their acid components, after which waste mixed with ash and residues of the unreacted soda precipitate on the filter material of the bag collector. The layer formed has a certain gas permeability, which provides a further contact of gases with the reagent. Since regeneration of bags (removal of the excessive dust layer) is fulfilled at regular intervals, the unreacted soda continues to bind acidic components of combustion products in time between regenerations, which increases their absolute collection degree by 10 ... 15%.