REDUCE SO_2 EMISSIONS BY FLUIDIZED BED COMBUSTION TECHNOLOGY

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Abstract: *This paper presents the possibility of fluidized bed combustion technology for steam boilers from Romania. Are two methods which can be applied: the stationary fluidized bed and the circulating fluidized bed combustion. Finally, there are shown the results of measurements of the exhaust steam in a boiler equipped with the fluidized bed combustion technology.*

Key words: *SO_2, pollution, sediment particles, fluidized bed.*

1. INTRODUCTION

Burning coal in power boilers from Romania leads to environmental pollution with SO2, NOx, CO2, CO and ash dust. Oltenia Energy Complex consists of power plants with 330 MW power units. 330 MW power units running on lignite extracted from surface mines. To reduce SO2 emissions currently apply wet flue gas desulfurization. There is possibility of fluidized bed combustion technology boilers and power units in Romania.

In the fluidized bed with a height of 2,5-3,8 m, the coal particles are entrained in a movement of the coal disorderly. Particles collide with each other and strike the pipes of the heat exchange surfaces of the boiler. As a result of these collisions is removed layer formed on the surface of the ash particles from the combustion . In this way, it facilitates the access of oxygen to the surface of the reaction, favoring the growth rate of combustion of the coal particles but also to improve exchange heat from the flue gases and heat exchanger of the boiler.

Figure 1 presents the fluidized bed combustion plants.

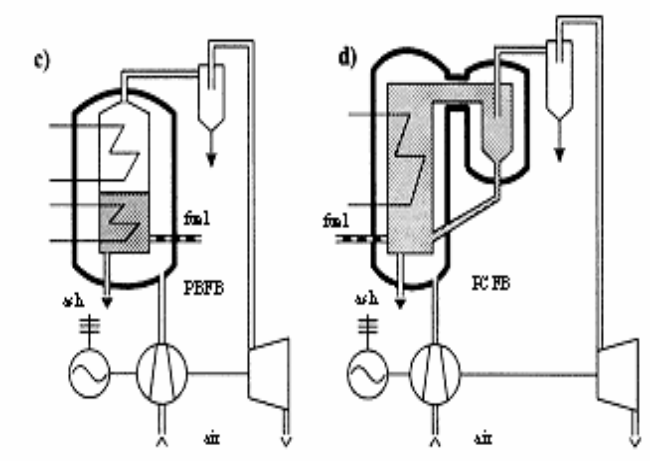

Figure 1. Fluidized bed combustion plants

National Strategy on atmosphere protection, approved by Government Decision no. 731/2004 aims to create the necessary framework for the development and implementation of an integrated air quality management, efficient economically. The overall objective of the strategy is to protect human health and the environment.

The key objectives are:

• maintain ambient air quality in zones and agglomerations where it falls within the limits set by current regulations for quality indicators;

• improving ambient air quality where it does not fall within the limits of the rules;

• take the necessary measures in order to limit adverse impacts on the environment, including transboundary context;

• fulfilling the obligations assumed under international treaties and agreements to which Romania is part of, and participation in international cooperation in this field.

SO_2 is a colorless gas, bitterness, nonflammable, with a pungent odor that irritates the eyes and respiratory system. The presence of sulfur dioxide in the atmosphere over certain limits negative effects on plants, animals and man. SO_2 affects many species of plants visible negative effect on the structure and their tissues being noticeable to the naked eye. In humans and animals in low concentrations cause respiratory irritation, and higher concentrations cause bronchospasm.

It affects the upper respiratory tract, and in the case of an action more intense irritation and inferior airways, causing bronchiolitis, bronchopneumonia, and in severe cases - pulmonary edema. Odor perception limit is at a concentration of 6,5 mg / m3. 68 mg / m3 is the support for 30 min without causing pathological phenomena, and the concentration of 124 mg / m3 can be supported by more than 3 min. Also produce sulfur dioxide disorders of carbohydrate metabolism and enzymatic processes. Estimates show that the SO2 emissions into the atmosphere may reach the figure of 180 million tons annually, which amount includes amounts due to the combustion of coal (75%) and other fuels (19%) remaining percentages being provided by industrial activities that involve metal or synthesis of breath derivatives such as sulfuric acid (H2SO4). SO2 concentrations in the atmosphere industrialized cities varies from case to case, but with an average value of 0.19 ppm, but can reach and values above 2,8 ppm, which must be worrying, because long-term exposure of warm-blooded organisms, including humans at concentrations greater than 0.16 ppm of carbon dioxide in the air can cause serious damage.

Depending on the concentration and exposure time sulfur dioxide has different effects on human health. Exposure to a high concentration of sulfur dioxide in a short period of time, can cause serious breathing difficulties.

Are particularly affected people with asthma, children, the elderly and people with chronic diseases of the airways.

Exposure to a low concentration of SO_2 in the long term can lead to respiratory tract infections. SO_2 can cause dangerous effects of ozone.

2. EXPERIMENTAL

Figure 2 is a schematic diagram of pilot plant circulating fluidized bed combustion boiler having a coal operated.

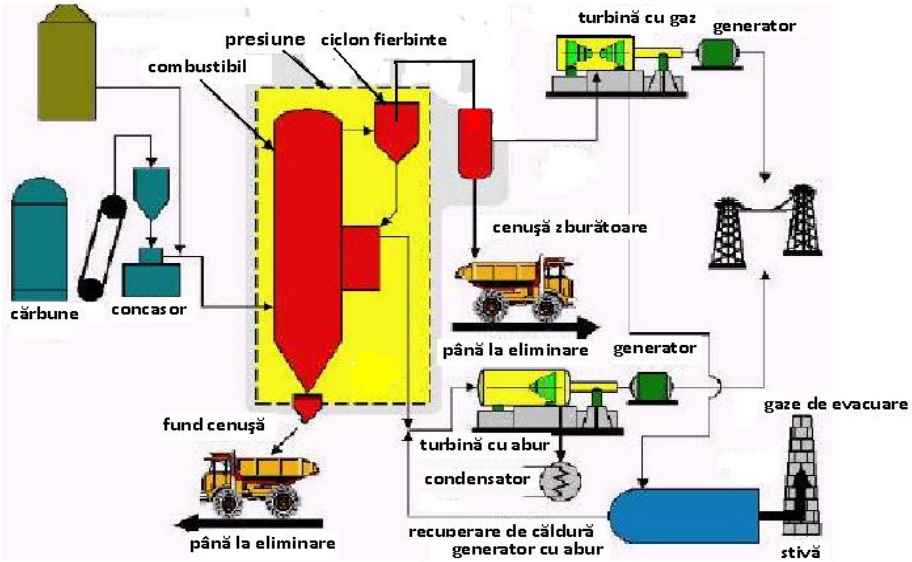

Figure 2. Experimental installation

Necessary for the fluidization air is introduced by means of an air blower. 96% of the ash resulting from the combustion of coal is separated in a cyclone placed at the outlet of the combustion gas in the combustion chamber. Ash is discharged from the cyclone to an external heat exchanger where it is cooled, the cooled ash is then reintroduced into the combustion chamber.

Keep circulating fluidized combustion is less hard in terms of the quality and composition of fuels. All types of solid fuels (coal, lignite, peat, biomass, solid waste, etc.) can be used in this type of installation, without changing the fuel system, which allows great flexibility in the supply plant. The same flexibility is manifested in terms of the mode of boiler, it can operate at partial loads of up to 40% of nominal capacity.

The best performance is obtained when the mixture of the outbreak is intensive, significant recycling and particle residence time in the furnace is long. Fluidized bed boiler efficiency (92%) is generally slightly higher than that of a classic boiler (86%), helping to improve overall efficiency of the unit.

Burning coal in a fluidized bed is favorable in terms of environmental impact. environment. For justification stated the following:

- The temperature inside the furnace is maintained in the range of 760 - 950 ° C. This range is favorable reaction between limestone CaCO4 and SO2, SO3 generated during combustion. Limestone injection into the furnace with fuel, it provides a reduction in the concentration of SO2. Performed inside the furnace desulfurization efficiency can exceed 92%.
- Low temperatures inside the furnace does not favor the occurrence of oxides of nitrogen. Allowable concentrations of NOx in the flue gases discharged into the atmosphere can be met only by applying primary measures being required installation of special filters.
- The use of high-sulfur lignite SO2 emissions fall below 210 mg / Nm3, and the NOX below 150 mg / Nm3.
- Application of this technology generates a high amount of dust, mainly due to the products resulting from the reaction of desulfurization. For this reason, it is necessary particulate filter particularly efficient evacuation of combustion gases from the boiler.

At present there are in the world a large number of small units equipped capacity CFB, used mainly in industrial applications. Switching to power units to be used in the power plants involved a large volume of research. Technology currently circulating fluidized bed combustion can be applied to uniform power 200-330 MW in the near future following the 700 MW threshold is reached.

Desulphurization yield is generally in the range of 35-42%.

Technology circulating fluidized bed combustion has proven an extremely useful for rehabilitation of existing power plants. In these cases the existing boiler is replaced by a boiler equipped with this technology.

The technical problems that must be solved so that the technology can be applied extensively are:

- Addressing the effects of erosion due to contact between the particles in the fluidized bed boiler and pipes;
- High consumption of reagents used in the desulphurisation: CaCO4 or MgCO4
- N2O emissions increased more than the traditional combustion systems
- Generating large amounts of solid waste.

Table 1 presents the results of experimental measurements of SO2 emission from experimental facility, during January-September 2014.

Table 1. SO_2 emission measurements

Month	**O_2 (%)**	**SO_2 (mg/m^3_N)**	**Air excess λ**	**Flue-gas temperature (^{0} C)**
January	12,2	388,8	5,4	129
March	11,6	392,3	4,8	132
June	10,4	379,4	3,6	130
September	10,8	386,7	3,1	131

3. CONCLUSION

Application technology of circulating fluidized bed combustion boilers Romanian energy can be an inferior Options when firing coal. It is important to solve the main problems arising from the operation of this technology, namely:

- Unwanted increase nitrous oxide emissions, which leads to destruction of the ozone layer;
- Unwanted increase in the amount of solid waste;
- Increased production costs due to electricity costs additives used; limestone or dolomite;
- Solve problems related to erosion of boiler tubes due to contact with the fluidized bed particles.

Despite these shortcomings, the technology of circulating fluidized bed combustion can substantially contribute to reducing emissions of SO2 for lower coal combustion boilers that have not been applied to other technologies for flue gas

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