

BACKGROUND

Mercury emission from coal combustion and coking technologies is one of the global problems of recent interest. Poland is ranked among top coal and coke producers in global scale. Polish steam coals and coking coals contain trace amounts of mercury but there is still quite small database and essentially no regular monitoring. Based on the published data one may estimate that the content of mercury ranges from 20 even up to several hundred ppb.

GOAL OF THE PROJECT

The aim of this project is to:

- identify mercury emission levels from hard coal-fired power plants
- develop database of mercury contents in steam coals
- selection of sorbents for the mercury removal from process gases
- elaborate of an optimal system for its monitoring
- design and optimize the process concept for the installation of mercury removal from coal processing gases

TOXICITY OF MERCURY

Mercury is the most toxic and dangerous element contained in the hard coal and emitted to the environment. Extremely dangerous are organomercury compounds (dimethylmercury, diethylmercury), which are created in the environment by biomethylation process. Metal and its compounds damage central nervous system, kidneys and other organs. Heavy or long exposure to mercury vapor may result in brain damage and ultimately death. Sources of the mercury emission can be divided into natural and anthropogenic.

The circulation of mercury in the environment was schematically shown in the Fig. 1.

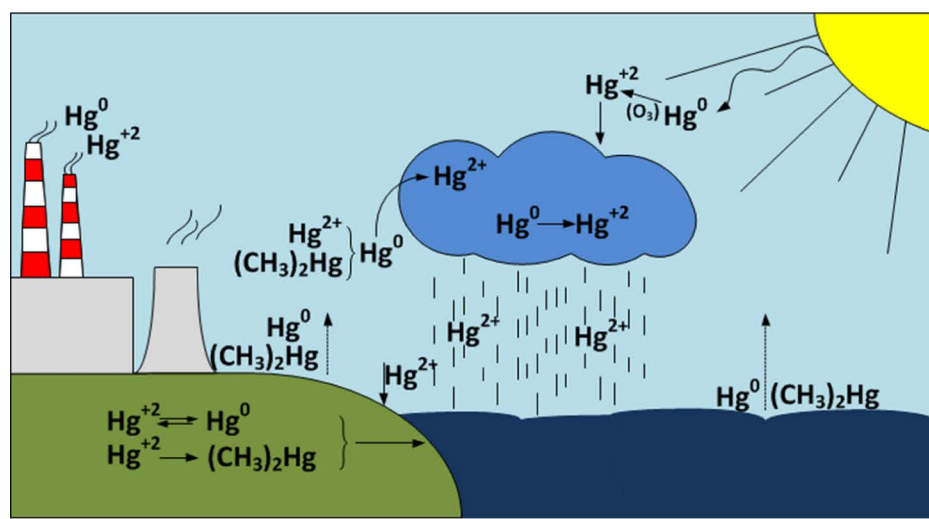


Fig. 1 Circulation of mercury in the environment

MERCURY IN COAL

Mercury may be present in coal in both organic and inorganic forms, however usually occurs as a cinnabar (HgS) often together with sulfide minerals such as pyrite. After combustion Hg is transformed into three species: particle-bound mercury, vapour-phase elemental mercury and vapour-phase oxidized mercury, the most reactive form. The average content of mercury in Polish coals was estimated at 141 ppb and may be compared with mercury content in global coals, e.g. Brazilian 130-310 ppb, USA 30-330 ppb, Chinese 30-490 ppb.

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MERCURY CONTROL AND REMOVAL TECHNOLOGIES

Technologies of control mercury emissions from coal-fired power plants are relatively new when compared to technologies control SO_x and NO_x emissions that are commercially available for at least 20 years. Technologies to reduce mercury emissions exist and are used in various countries for each of the sectors examined.

Pre-combustion: operations (e.g. coal washing, coal blending) can reduce mercury emissions by up to around 70 per cent, with an average of 30 per cent.

Pre-combustion: addition of halogens (especially bromine) has the potential to improve mercury removal by increasing oxidation of mercury in the flue gas (especially in the presence of an SCR system).

Post-combustion: Activated Carbon Injection.

- Currently, sorbent injection is considered to be the most feasible available technology for control of mercury in flue gas.
- Injecting a sorbent into the flue gas represents one of the simplest and most mature approaches to controlling mercury emissions from coal-fired boilers.

This technology is ideally suited for retrofitting onto existing power plants for several reasons:

- minimal capital cost of equipment due to the simplicity of the system,
- can be retrofit with little or no downtime of the operating unit,
- significantly shorter installation time compared to SCR and FGD technologies,
- effective for bituminous, subbituminous and lignite coals,
- can achieve 80 to 90 % removal when used with a fabric filter and 90 % removal on an ESP,
- the sorbent injection can be integrated to enhance mercury capture with virtually every configuration of air pollution control equipment including ESPs, fabric filters, wet and dry.

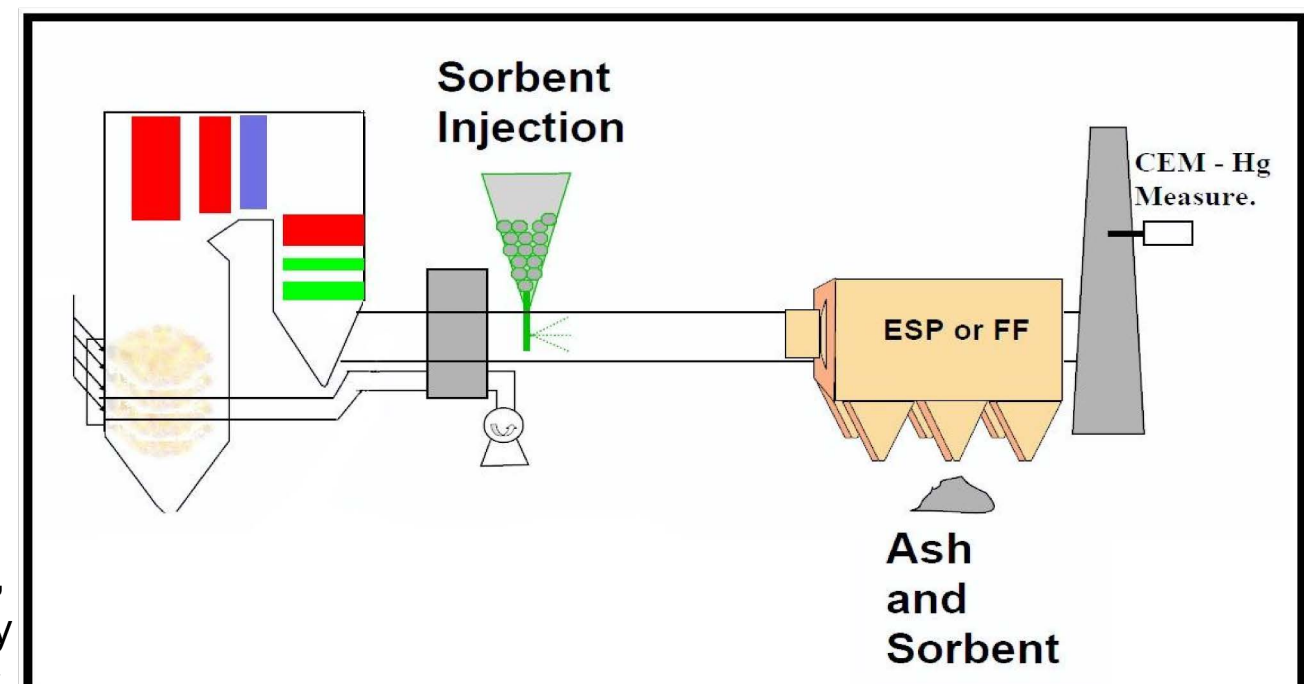


Fig. 3 Scheme of ACI technology

SUMMARY

At present there is no legal regulation in Poland and in Europe as well concerning mercury emission from coal combustion and coking industry but a country wide inventory of mercury content in coals is planned in the nearest future due to expected legal regulations in Europe and in global scale also. This action is on going now. According to this fact, it is necessary to develop analytical methods and technology for mercury removal from flue gases.

*Presented subject is a part of a specific project planned for three years and named "Development of a Coal Gasification Technology of High Efficiency Fuel Power Production (CoalGas)" is coordinated and managed by prof. Janusz Gołaś (in WORK PACKAGE No 4 - "Monitoring and reduction of mercury emission in gasification and combustion processes", coordinated by prof. Leszek Czepirski).

PARTNERS OF THE PROJECT: