Mercury removal in semi-dry flue gas desulphurization installations equipped with bag filters

E. Głowacki[1], P. Żupa-Marczuk[1]

[1] *Power Research and Testing Co., ENERGOMEASUREMENT" Sp. z o.o., ul. gen. J. Sowińskiego 3, 44-100 Gliwice, Poland*
Corresponding author: *eglowacki@energoMeasurement.com.pl, pzupa@energoMeasurement.com.pl*

Keywords: Bag Filter, Gas Cleaning, Mercury (Hg) Removal

In view of the actual requirements which are consequences of the introduction of the IED Directive and also future environmental conditions resulting from the BAT Conclusions, an essential criterion for the selection of flue gas cleaning equipment is not only possible reduction of primary pollutants like SO_2, NO_x or dust but also possible removal of mercury, HCl and HF. The paper focuses on possible reduction of mercury in semi-dry flue gas desulphurization installations equipped with bag filters.

Mercury emissions from coal-fired power plants depend on such factors as the mercury content in coal, the content of chlorine and sulfur in coal and their interaction with mercury, mercury speciation in flue gas, the distribution of mercury between the solid and gaseous phases or the content of unburnt coal in ash. The above factors are however connected with the type of the boiler and coal combustion conditions, ash distribution between slag and fly ash, interactions between fly ash particles and mercury, the type and efficiency of flue gas treatment equipment (SCR, ESP, FGD) and conditions of its operation.

The BAT Conclusions specify that for hard coal-fired plants of total rated thermal input in fuel ≥ 300 MW_t, Hg level in flue gas should not exceed 4 $\mu g/Nm^3$, whereas for hard coal-fired plants of total rated thermal input in fuel < 300 MWt, Hg level in flue gas cannot exceed 9 $\mu g/Nm^3$. For lignite the values are 7 $\mu g/Nm^3$ and 10 $\mu g/Nm^3$, respectively.

Semi-dry flue gas desulphurization installations equipped with bag filters present a very high efficiency of mercury removal. Inside the bag filter, along with dust removal, mercury is naturally reduced by absorption and adsorption, in particular its oxidized form Hg^{2+} and partially metallic form, as a result of reactions on the surface of the filter cake. Long retention time of particles, slow filtration rate and a direct contact with oxidizing agents in flue gas and dust enable mercury reduction without introducing any additional sorbents, at a much higher level than in electrostatic precipitators.

In the years 2010-2016, „Energopomiar" Sp. z o.o. carried out a number of measurements of Hg emissions from semi-dry FGD installations equipped with bag filters. The tests of „Energopomiar" Sp. z o.o. indicated the possibility of achieving much lower levels than the ones determined in the BAT Conclusions. Table 1 below presents measurement results obtained at four hard coal-fired plants at different operating conditions, equipped with a semi-dry FGD installation with a bag filter.

Table 1. Hg emission at the FGD outlet

Measurement no.	Hg content in flue gas at the FGD inlet, $\mu g/Nm^3$	Hg content in flue gas at the FGD outlet, $\mu g/Nm^3$	Hg content in fuel burnt, mg/kg
Plant A			
Measurement 1	8.13	3.72	0.052
Measurement 2	9.52	2.34	0.086
Measurement 3	2.47	0.58	0.058
Measurement 4	2.47	0.46	0.058
Plant B			
Measurement 1	6.41	2.43	N/D
Measurement 2	N/D	0.85	0.101
Measurement 3	N/D	0.46	0.064
Measurement 4	N/D	1.28	N/D
Measurement 5	N/D	1.19	N/D
Measurement 6	N/D	1.16	0.075
Measurement 7	N/D	1.24	0.215
Measurement 8	N/D	2.29	0.081
Plant C			
Measurement 1	N/D	3.42	0.089
Measurement 2	N/D	2.64	N/D
Measurement 3	N/D	2.77	0.089
Measurement 4	N/D	3.68	0.081
Plant D			
Measurement 1	6.30	2.23	0.089
Measurement 2	N/D	1.95	0.082
Measurement 3	N/D	3.52	0.083
Measurement 4	N/D	3.58	0.05
Measurement 5	N/D	3.76	0.205