

REDUCING OF CARBON DIOXIDE EMISSIONS AT OIL SHALE ASH DEPOSITION

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Nearly 6 million tons of oil shale ash is deposited annually in Estonian oil shale power plants. The ash handling system is hydraulic, with ash and slag transportation to the ash field. Total area of settling ponds and open return flow channels of the ash handling systems are 1,312,000 m² (Balti PP) and 3,014,000 m² (Eesti PP).

Due to high alkalinity of ash and ash transportation water the continuous absorbance of CO₂ contained in the air take place and this process is independent from load of the power plant. The dynamics and extent of CO₂ from atmosphere by oil shale ashes formed in PF and CFBC boilers have been studied at first in laboratory experiments, modeling the conditions of different seasons. The effect of different kinds of ashes as well as transportation and depositing conditions, namely conventional hydro separation or dense slurry technology, on formation and properties of ash stone was also estimated. Finally, the total quantity of CO₂ bind in the ash fields and sediment bonds of Estonian oil shale power plants were determined and generalized on the bases of the results of field samples analyses and calculations.

The baseline data for calculations are taken from the sampling and determination of CO₂ content in ash field material. The chemical analysis results of drilling samples are reduced to the water- and CO₂-free ash matter. The difference (gap) between CO₂ content (Δ CO₂) in ash field material and in the total boiler ash shows the quantity of CO₂ bind from surrounding air.

Emitted quantities of CO₂ from PF and CFB boilers were estimated based on the average calorific value of energetic oil shale 8.45 MJ/kg (years 2003-2007). The CO₂ absorption coefficients in ash field in the case of CFB technology have been calculated to be 0.084 t and in the case of PF technology 0.030 t per ton of fuel. The ash of CFB boiler bounds on ash field 9.7% and PF boiler ash 3.2% from emitted CO₂. The tests of CO₂ absorption by alkali water show that the total surface of settling bonds can absorb up to 50 thousand ton of CO₂ annually. In view of share of the PF and CFB firing technologies used in the Estonian oil shale power plants and taking into account the sediment bonds total surface, the quantity of CO₂ could be absorbed is about 5-6% from emitted CO₂.