

Quartz and coal-fired power plants Approach and experiences in the Netherlands

Extensive research to quartz in coal and fly ash was performed in the Netherlands.

The quartz content in the imported coal from all over the world is measured (50 samples, with a range of 0,3–7,0%, average value $2,6 \pm 1,4\%$).

The quartz content in coal fly ash (PFA ash from the ESP with a range of 3–14% average value $9 \pm 3\%$) and in some samples of furnace bottom ash (FBA) was measured. Besides the relation between coal and ash was established by means of their RE-factor. It appears that during combustion a part of the quartz disappeared, about 50%. In However, the amount of quartz in the respirable fraction is only of importance. To get an indication from that fraction also the relation between quartz in coal and the finest fraction of the PFA, collected in the last part of the ESP, was studied. It appeared that the concentrations in the finest fraction were much lower (4-5 times lower than in the total fraction).

An in house developed CCSEM method was used in order to establish the amount of quartz quantitatively (see paper MEIJ, R., NAGENGAST, S. and WINKEL, B.H. te, 2000. The occurrence of quartz in coal fly ash. *Inhalation Toxicology*, 12 (supplement 3), pp.109-116.). It appears that only a very small portion of quartz is present in the respirable fraction (quartz contents $<1\%$), besides the major part is embedded and has not toxic properties. The amount of free respirable quartz is less than 0,1%. This means that the Dutch occupational quartz standard of $0,075 \text{ mg} \cdot \text{m}^{-3}$ (respirable) will never be exceeded.

In addition a lot of toxicological work has been done with coal fly ash. No effects of quartz in coal fly ash could be detected (see references in the paper). Besides the low concentration in the respirable fraction the high temperature regime during combustion could be the explanation (prof Fubini, Italy).

Real exposures were measured under the ESP, by sampling suspended coal fly ash in the air by cyclones. The respirable fraction was sampled on cellulose-ester filters of Millipore, type AAWP, diameter 47 mm, pore size $0,8 \mu\text{m}$. They were analyzed by XRD with

silver layer to enhanced the sensitivity. The cyclones collected only the respirable fraction. The results were published in the following report:

Amount of α -quartz in suspended respirable coal fly ash (in Dutch

Gehaltes aan α -kwarts in zwevend respirabel poederkoolvliegias)

Authors: Dr. R. Meij en J.H.M. Overbeek

Kema report number 65033.300-KST/MAT 97-6538.

The main table and summary of this report is given below:

Table 1 Results of measurement of suspended respirable dust under the ESP

	respirable dust			quartz (in respirable dust)			
	Amount of dust on filter	concentration in air		Amount on filter ¹⁾	content	Air concentration	
	in mg	in $\text{mg}\cdot\text{m}^{-3}$		in mg	in %	$\text{mg}\cdot\text{m}^{-3}$	
Number of measurments (duplo included)	19	19	$10^{2)}$	19	19	19	$10^{2)}$
Geometrical mean			0,06				0,0005
Arithmetical mean	2,3	0,08		0,03	1,0	0,001	
standard deviation	1,5	0,06		0,05	0,8	0,002	
variation coefficient (in %)	63	75		144	79	147	
Minimum value	0,9	0,02	0,02	0,003	0,3	0,00005	0,00008
Maximum value	6,3	0,21	0,18	0,19	3,0	0,0065	0,0052

¹⁾ blanc value filter < 3 μg

²⁾ in this column for the in duplo measurements mean geometrical values are used

Summary

A measuring program is performed at power station Gelderland unit 13, Amer Power station unit 8 and Maasvlakte Power station unit 2 in the months June and July. Under the hoppers of the ESP suspended respirable dust is collected. Three samplings per unit in duplo between 8 o'clock and 20 o'clock were performed.

Sampling of respirable dust was the purpose of this program in order to measure the quartz content. Besides, an impression of respirable dust concentrations and quartz concentrations under stationary conditions.

It appears that the concentrations respirable quartz under the hoppers of the ESP lie between 0,00008 en 0,005 $\text{mg}\cdot\text{m}^{-3}$ with a geometrical mean value of 0,0005 $\text{mg}\cdot\text{m}^{-3}$. These values lie

considerable under the Dutch TLV-value of $0,075 \text{ mg}\cdot\text{m}^{-3}$. (threshold limited value for personal exposure)

In addition it appears the α -quartz concentrations in the dust samples lie about $1,0\pm 0,8\%$

Finally it appears that the concentrations suspended dust below the hoppers of the ESP lie between $0,02$ en $0,18 \text{ mg}\cdot\text{m}^{-3}$ met een geometrisch gemiddelde van $0,06 \text{ mg}\cdot\text{m}^{-3}$. These concentrations lie well below the TLV value for respirable dust of $5 \text{ mg}\cdot\text{m}^{-3}$.