

**International Workshop on
Environmental Aspects of Coal Ash Utilization**

Tel Aviv, Israel
December 15th – 16th 2009

Discussion platform:

The status of coal ash in occupational and environmental health in Israel

Background

- Fly ash¹ is defined in Israel as “hazardous dust” due to its free crystalline silica (appearing only in the form of quartz) content. This definition applies to any weight percentage of quartz in the fly ash (even if it is less than 1 percent). One of the repercussions of this definition is that fly ash must be related to as siliceous “hazardous dust” regardless of its actual crystalline silica content. This is not in agreement with the convention in many countries that coal ash dust and dust containing less than 1% silica (and no other hazardous material) should not be classified as hazardous dust. Moreover, in Israel, unlike in many other countries, the crystalline silica regulations hold not only for the respirable fraction, which may cause silicosis or other chronic lung diseases, but for the inhalable fraction of the dust as well.²
- Worldwide, fly ash is defined as nuisance dust: United States (OSHA, NIOSH and ACGIH), UK (COSHH-HSE), Germany (TRGS 900-Federal Ministry of Labor and Social Affairs) and Holland.³
- The respirable fraction of particulate matter in bottom ash amounts to only 0.4% (w/w), and part of it never becomes airborne because it is trapped among very coarse particles. The concentration of respirable free silica in bottom ash is very low (0.002%)⁴.
- It was found in analysis of Israeli fly ash dust that the concentration of quartz in the inhalable fraction (under 200µm aerodynamic diameter) and the respirable fraction (under 10µm aerodynamic diameter), is 2.3%-4.3%, and 2.5%-2.9%, respectively.⁵
- Due to chemical reactions that occur at the combustion temperature in the boilers (1500°C), most of the quartz is coated with aluminosilicates, so that

¹ The technical committee for hazardous dust recently recommended to exclude bottom ash from the regulations corresponding to mineral hazardous dust.

² The category of silica in the mineral hazardous dust regulations in Israel is defined as: “Crystalline silica dioxide” – a natural mineral including quartz [...] and coal, coal ash and basalt”.

³ Survey of world wide dust [standards](#), with [references and notes](#).

⁴ [Professional report](#) written by A. Pardo and based on literature review including hygiene and health aspects of pulverized coal ash. Current issue is based on Y. Nathan and Y. Deutsch [examination of crystalline silica in bottom ash](#).

⁵ Results of environmental monitoring at Orot Rabin Power Station, 2008, in Nathan et al., 2009. [Occupational health aspects of quartz in pulverized coal fly ash in Israel](#), paper in print.

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the percentage of free quartz in the respirable fraction does not exceed 1%.⁶ The percentage of aluminosilicates in the ash is 60%-80%⁷.

- The concentrations of heavy metals in fly ash represent trace amounts, and upon becoming airborne, based on estimates in studies, are lower by three orders of magnitude than the maximum permitted occupational level for exposure.⁸
- The level of ionizing radiation emanating from radionuclides of uranium, thorium (and their daughter products) and potassium, which are found naturally in coal, is very low despite the enrichment effect in the transition from coal to ash. The measured levels point to an addition of 1%-5% above the background radiation in their natural environment and similar to those emitted from various types of soil and rocks⁹. In any case, these are annual radiation dosages three orders of magnitude lower than the occupational standards (hundredths of millisieverts [mSv] as opposed to a permitted level of 20mSv) and much lower than the annual limit dosages for the general population.¹⁰
- Research data and medical history do not indicate that exposure to coal ash in various processes causes lung disease, and no compelling evidence has been offered for pneumoconiotic or fibrinogenic potential (unlike the documentation of morbidity among coal miners in the past)¹¹.

Existing hygienic conditions

Coal ash is included in the "Mineral Hazardous Dust" regulations [Occupational safety regulations (Occupational Hygiene and public health in hazardous dust), 1984] because of its free crystalline silica content.

⁶ According to Y. Nathan: SEM observations of 25 South African and 36 Indonesian fly ash particles did not indicate any presence of free (uncoated) quartz.

⁷ [Borm, P. J. A., 1997](http://annhyg.oxfordjournals.org/cgi/reprint/41/6/659.pdf). Toxicity and occupational health hazards of coal fly ash (CFA). A review of data and comparison to coal mine dust. *Annals of Occupational Hygiene*, v. 41;6, p. 659-676. In: <http://annhyg.oxfordjournals.org/cgi/reprint/41/6/659.pdf>

⁸ Presswood, W. G., Huyser, J., Whitaker, C. G., 1980. Monitoring airborne fly ash by the membrane filter counting procedure. *American Industrial Hygiene Association Journal*, 41, p. 33-39. Taken from A. Pardo's review (see footnote 4).

⁹ United State Geological Survey (USGS), 1997. Radioactive elements in coal and fly ash: Abundance, forms and environmental significance. USGS fact sheet ES-163-97. In: http://health.state.tn.us/Downloads/TVA_USGS-radio-flyash.pdf. Taken from A. Pardo's review (see footnote 4)

¹⁰ Y. Grof et al., Radiation Safety Division, Soreq NRC, 2004. [Survey of risks of workers exposure to ionizing radiation](#) in industrial plants processing phosphates and coal ash regarding their classification examination as radiation workers.

¹¹ Taken from A. Pardo's review (see footnote 4).

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Subjects for discussion

- Coal ash is not considered hazardous ash despite the connotation given to it in the Israeli regulations.
- The classification of coal ash in the regulations as opposed to its classification in other countries.

Recommended classification of coal ash

- The classification of coal ash dust (fly and bottom) as “nuisance dust,” the common practice in Europe and the United States (in one of the various definitions for nuisance dust).