Survey of risks of workers exposure to ionizing radiation in industrial plants processing phosphates and coal ash regarding their classification examination as radiation workers.

Radiation Safety Division, Soreq NRC

Yair Grof
Gustavo Haquin
Sigalit Haruz-Veshitz
Tal Rimer

August 2004

Abstract

Survey of occupational radiation hazards in the phosphate industry and in facilities processing fly ash with regard to classification of the workers as radiation workers.

In Israel extraction, mining, processing and conveying of phosphate and is conducted on a wide scale, as well as the utilization of these minerals in the fertilizers industry. The conveying of coal ash and its use in the building industry and as landfill is also being conducted in Israel.

Exposure to these two materials (phosphate and coal ash) presents a potential radiological hazard. Previous investigations indicated that the workers in some non-nuclear industries involving Naturally Occurring Radioactive Materials (NORMs) are potentially exposed to ionizing radiation. The measurements and calculations led to the conclusion that classification of these workers as "radiation workers" should be considered, according to the "Safety at Work Regulations (workers engaged in work with ionizing radiation)". These regulations are to be revised soon, according to the recommendations of the International Commission on Radiological Protection to reduce the annual dose limit of workers from 50 mSv to 20 mSv (averaged over 5 years) and to classify a worker as radiation worker if his exposure is above 1 mSv per year (instead of 5 mSv per year nowadays). Since these recommendations were adopted by the European Union and will serve as a basis for the new regulations in Israel, there is a need to estimate the exposure of workers in industries processing or conveying phosphate and coal ash.

An extensive survey was performed in plants/facilities in Israel that convey and process phosphate and in plants that process coal ash, in order to estimate the exposure of the workers to ionizing radiation. The survey included the use of TLD dosimeters to estimate external exposure, radon detectors (CR-39) and personal air
samplers to estimate internal exposure. The uranium content of inhaled dust was measured by Delayed Neutron Analysis.

The measurements took place over a period of 16 months. The radon detectors and the TLDs were replaced every 2-3 months and personal air samplers were carried by the staff that performed the measurements. The survey was carried out at seven sites. Calculations of the expected dose were performed for a worker staying during one hour per day at the most exposed location on each site. Worst-case estimates of the dose expected from all exposure modes for one-hour exposure each day over a year (300 hours per year) are shown below for the practices that were investigated:

- Coal ash use and storage: $0.060 \text{ mSv}$ (average of three sites).
- Coal ash processing: $0.032 \text{ mSv}$ (average of two sites).
- Storage and conveying of phosphate: $0.800 \text{ mSv}$ at one site and $2.175 \text{ mSv}$ at the other one.

These results indicate that there is no potential for a radiological hazard in practices involving coal ash in the conditions that were measured. There is therefore no justification to limit exposure in these practices. The values that were calculated for storage and conveying of phosphate are higher by one to two orders of magnitude than those for coal ash. There are even scenarios for which phosphate might cause a radiological hazard: the annual exposure will be higher than $1 \text{ mSv}$, if a worker stays at the most exposed location on the first site for more than 1 hour and 15 minutes per day, or on the second site for about 30 minutes per day.

It may be summarized that even though some radiological concerns were raised with regards to coal ash use in workplaces, this study, which includes a large number of replicate measurements shows that there is no need to limit staying in the coal ash surroundings. In the surroundings of storage areas and conveying of phosphate, the exposure values were higher by one to two orders of magnitude than those of coal ash and there are even two extreme scenarios that request exposure limitation.