April 2012

International Workshop on Environment, Health and Occupational Hygiene Issues in Coal Ash Utilization - 2012

Introduction

The Israeli National Coal Ash Board (NCAB) is currently organizing the third meeting of a professional-scientific workshop exploring various perspectives of the environmental aspects of the uses of coal ash, with the participation of leading experts in relevant fields from Israel, Europe and the United States. The workshop is assembled periodically over the years, in line with progress made in NCAB's research program. NCAB has held two meetings thus far – in November 2005 and December 2009. The third workshop is slated for December 2012.
The aim of the workshop is to establish and maintain a knowledge base required for the determination of:

- Environmental criteria and testing and control methods for the use of coal ash.
- Occupational hygiene requirements for work with coal ash.
- Environmental standardization of coal as utilization.

The two previous meetings of the workshop focused on the following areas:

- Leaching of pollutants from ash applied to soil for paving, infrastructures and agriculture.
- The contribution of coal ash to exposure to radiation in dwellings.
- Occupational and environmental hygiene as related to exposure to coal ash in its various uses.
- Standardization and legislation of the environmental conditions for the uses of coal ash.

Based on the conclusions derived from the discussions and in the previous meetings of the workshop, an action plan for further research needed in each of the aforementioned areas has been carried out to provide a base for the upgrading of the environmental requirements for coal ash use.
In two areas the basic work has been completed, recommendations were consolidated and ensuing standardization processes begun:

- The definition of coal ash as free crystalline silica in the Hazardous Dust Standards was removed in the framework of the new legislation by the Ministry of Environmental Protection and the Supervision of Work Division in the Ministry of Industry, Trade and Labor, so that coal ash is included in the normative category of nuisance dust.
- The environmental standards for the uses of coal ash are being adapted by the professional cadre of Ministry of Environmental Protection as a reference and action framework for the purpose of environmental licensing of coal ash uses.

Research is continuing in the areas of the leaching of pollutants and radiation exposure, and the recommendations that emerge from the research will be discussed at the planned meeting of the workshop.

The Knowledge Base created by the laboratory and field research program of NCAB, is summarized below:

Leaching of pollutants in soil applications

Pollutants in application of ash in infrastructures

- Dependence of changes in the solubility of oxyanions from fly ash in an aqueous alkaline environment on exposure time of the material to the environment.
- Examination of changes in the permeability to water in road embankments made of coal ash over time.
- Monitoring of chemical and mineral changes in the Jisr-el-Zarka embankment, constructed of fly ash, in the ten years since it was built.
- Monitoring of runoff plots in the Jisr-el-Zarka fly ash-made embankment ten years after it was built, as a follow up to the monitoring carried out in the first two years after construction.

Pollutants in agriculture

- Measurement of the contribution of fly ash to the concentrations of pollutants in the soil and in irrigated crops when the ash is used to improve soil and to stabilize sewage sludge applied to agricultural soils.
- Development of a method to estimate the release of selenium, vanadium and boron from fly ash contained in soil.

Based on the findings of the research, fly ash can be characterized as an inert monolith in paving applications, based on the European regulations and as a negligible contributor of pollutants to soil and crops in agricultural applications.
Based on the findings of the above studies and the conclusions drawn in the discussions held at the 2009 workshop, NCAB's Professional-Scientific Team – PST (pollutants) has drafted a proposal for environmental requirements for the applications of coal ash in infrastructures and agriculture that includes the following chapters:

i. Environmental requirements for coal ash applications in paving and infrastructures;
ii. Environmental requirements for coal ash applications in agriculture;
iii. Procedures for monitoring pollutants in fly ash;
iv. Application dependent maximum allowed values for trace element concentrations in coal ash.

The team has begun to develop a method to monitor the suitability of a given fly ash for use in paving, based on an assessment of the anticipated pollutant leachability. This determination is to be performed by extracting representative transfer coefficients from the pollutant concentrations obtained in leaching measurements with powdered ash to their concentrations in leachates from ash used as structural filler (monolith) in infrastructures. The team recently decided to wait for the completion of the process of developing leaching measurement procedures for powdered and

for compacted granular material conducted by the USEPA so as to use these procedures as analytical tools to determine the desired transfer coefficients.

Exposure to radiation in construction and other applications

- Assessment of the contribution of coal ash in its different uses to radiation doses of exposed populations.
- Creating an infrastructure to monitor the exposure to radiation in the uses of ash.
- Survey of the international professional literature on radiation standards in construction.
- Radiation survey of common concretes, with and without coal ash, according to Israeli Standard 5098 – Content of Natural Radioactive Elements in Building Products.
- Refining of the model to assess the exposure to radiation from building products, including external exposure (gamma rays) and internal exposure (radon and its daughters).
- The effect of coal ash on the exhalation of radon from concrete.
- Assessment of the justification of ash in concrete on the basis of the preventive cautionary rules determined by the Israel National Radiation Protection Policy Committee.

From the findings and based on the various assessments, it can be determined that the contribution of ash to radiation in its various uses, and specifically in construction, is low to very low. The findings of the study and its conclusions were taken into consideration in the standardization for the exposure to radiation from building products in general.

Program for the workshop to be conducted in December 2012

The upcoming workshop will be two days long and, as noted, will focus on the environmental requirements for the uses of coal ash in two areas – soil applications and building products.
The workshop will begin with a plenary session, continue with two parallel sessions and conclude with a final plenary session as follows:

- Opening session – The opening session will be devoted to a presentation of the aims of the workshop, a forecast for the coal ash sector in view of the development plans of the electricity production and a discussion of the environmental policy for the promotion of coal ash uses.
- Session on pollutants – This session will be devoted to assessment of the leaching of pollutants from ash in soil applications, analytical methods to assess the anticipated leaching of pollutants for each application and a proposal for an advanced version of the environmental requirements drafted by the PST (pollutants) to limit and regulate these applications.
- Session on radiation – This session will be devoted to an assessment of the exposure to radiation in ash uses, the methods to measure the exhalation of radon from building products including implications on the assessment of the contribution of ash to radiation from concrete

and the parameters in the standards for radiation from building products, in accordance with the most up-to-date guidelines of the international bodies for radiation safety.

- Concluding session – This session will be devoted to consolidating a work plan for completing the drafting of the necessary environmental requirements and the construction of monitoring tools.

Day	Session	
I	Opening - Introduction	
	Pollutants – Environmental aspects	Radiation – Measurement methods
II	Pollutants – Measurement methods	Radiation – Environmental aspects
	Concluding session – Future work	

Main contents of the workshop

General

Promotion and application of coal ash uses

A global outlook of the uses of coal ash – A survey of developments in the past two decades, which have been characterized by increased efforts to make beneficial use of coal ash instead of disposing of it as waste, in response to economic and environmental needs and based on the principles of sustainable development.

Update of the national coal ash master plan – To put the plan both in regard to uses and to storage infrastructures, in line with the transfer of emphasis in electricity generation from coal to natural gas.

Environmental monitoring of the uses of coal ash

Environmental monitoring of ash from the point of view of both manufacturers and users – The philosophy of the ash organizations in the United States and Europe regarding the necessary conditions to make the most of the beneficial potential of coal ash in its various uses.

Environmental standards for the use of coal ash in Israel – The main points of the most up-to-date proposal for the standards that was constructed in line with developments in professional knowledge and in hands-on experience in application and in licensing procedures.

Leaching of pollutants

Regulation of the uses of coal ash

The recent revision in the legislative principles for the control of coal ash and its uses in the United States – An examination of changing the present designation based classification of coal ash in the waste standards: when disposed of as waste, the ash will be defined as “hazardous waste” and handled under federal supervision; and when the ash is put to a beneficial use it will be defined as “reusable waste” subject to environmental requirements, and put under state supervision.

The uses of coal ash under the European waste standards and environmental control mechanisms – Maximum utilization of coal ash, both as a byproduct and through retrieval from landfill and storage sites, in accordance with the principles of sustainable development and subject to environmental controls provided by the existing tools in the waste related regulations.

Monitoring pollutants in the various uses of coal ash

Development of new methods to analyze leachates by the USEPA – these methods incorporate the principles set in the European standards and better reflect the actual environmental conditions to which the ash is exposed to in its various uses.
Concentrations of trace elements in Israeli ashes – findings of multiannual analyses.
Characterization of Israeli ashes using the pHDT method – the plotting of trace element concentration in leachates vs pH as a basic tool to assess environmentally dependent pollution risks.

Environmental requirements for the uses of coal ash in soil

Proposals for improved environmental requirements.
Monitoring procedures that conform to the proposed updated requirements – application-dependent monitoring procedures and maximum allowed levels of pollutant concentrations in leachates.

Future plans

Proposals for future research and definition of the tests that need to be performed to further expand of our knowledge base.

<u>Radiation exposure</u>

Monitoring radiation exposure

International guidelines for monitoring of radiation exposure – A survey of the up-to-date guidelines published in 2011, including doubling of the dose coefficient associated with exposure to radon and its daughters.
European standards for controlling radiation exposure – A survey of the up-to-date 2011 version that requires the establishment of procedures to control radiation exposure by member states, including exposure to radiation from building products.

Radiation exposure in coal ash uses

Assessment of the exposure of the Israeli public to ionizing radiation from natural sources – a comprehensive survey that was recently carried out as a supplement to the UNSCEAR report of 2000, of the natural radiation levels from environmental and man-modified sources, including those due to more recent building products that contain coal ash, the ash being relatively enriched with radioactive elements. A calculation of the average radiation dose received by members of the public is included.
Utilization of coal ash in the Israeli concrete industry – The ash is a partial substitute for sand and cement in concrete mixes regulated by the most up-to-date standards for cement and concrete and practiced in the current and anticipated building techniques.
Control of the exposure to radiation caused by coal ash in its different uses – A survey of the contribution of coal ash to radiation exposure in its various uses and the existing and required control mechanisms; comparison of the Israeli case to the accepted situation around the world.

Radon exhalation from building products

The Dutch method for measuring radon exhalation and assessing exposure to radon – A description of the method used to determine radon exhalation and of the model to assess the exposure, underlying the Dutch standard to control radiation exposure from building products.

The Israeli method for measuring exhalation and assessing exposure to radon – A description of the method and assessment model underlying Israeli Standard 5098 – Content of Natural Radioactive Elements in Building Products.

The contribution of coal ash to radiation from building products

The findings of the research conducted in Israel – The accumulated findings of tests and measurements were performed to assess the influence of coal ash on radiation from concrete, including its influence on radon exhalation; a calculation of the contribution of coal ash to radiation exposure according to the updated dose coefficient attributed to radon exposure.

Data from the Dutch measurement – Comparative findings of corresponding radiation tests on Israeli concrete samples that were performed in the NRG labs in Holland; calculation according to the updated value assigned to radon.

Future plans

Expansion of the knowledge base through further research and characterization of the array of tests.

Update of recommendations to improve the standard for radiation from building products.