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**Environmental Assessment of Coal Ash Leaching Properties and
Beneficial Use with the Help of LEAF**
International Academic Cooperation

As part of overall research into the environmental aspects of coal ash usage, a proposal has been made regarding environmental aspects of fly ash utilisation including significant improvements to analytical characterisation and data processing. This research makes use of the framework developed by a number of groups headed by Dr. David Kosson, who is also a partner to this proposal.

**Environmental Assessment of Coal Ash Leaching Properties and
Beneficial Use**
**Applications using the Leaching Environmental Assessment Framework
(LEAF)**
Joint Research Program

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Introduction

Ever since the National Coal Ash Board (NCAB) began operating, side by side with research into environmental aspects of coal ash and its uses, the Professional - Scientific Committee and later, the Professional - Scientific Team (Pollutants) has focused special attention on characterisation methods. The characterisation is conducted in order to assess the potential environmental effects of the trace elements it contains as a function of their level of availability in the environment. The leachability properties of the fly ash concerns both the licensing of its use and the ongoing monitoring of the coal ash produced at the power stations.

In 1997, based on the findings and conclusions reached by the Professional - Scientific Committee, NCAB recommended a leaching procedure for the environmental monitoring of coal ash. The Ministry of Environmental Protection adopted the recommended USEPA Procedure 1311 - TCLP (Toxicity Characteristic Leaching Procedure) and the risk criteria (the D-List)



integral to that procedure as the preferred testing method. According to this method, Israeli coal ash is defined as “non hazardous”. Using the risk criteria derived from the TCLP method, the Chief Scientist at the Ministry defined the application criteria for “usable ash”, which serves as the ongoing monitoring tool for ash produced at power stations. Monitoring is conducted by the Israel Electricity Corporation, using a representative half year mixture for all the power stations and by NCAB, which takes an annual, representative sample from the principle sources. The criteria values for “usable ash” are significantly lower than the threshold for each element in the D-List, which ensures that there is little likelihood of any exceptions to the “non-hazardous” criteria given in the TCLP in any random shipment of coal from any one source or another.

Originally, the TCLP method (testing of the leachings received after the material is exposed to strong acid) was designed for the assessment of environmental hazards when dumping acidic industrial wastes. As it was developed for acidic conditions, international debate persists regarding the method’s suitability for monitoring coal ash exposed in natural (neutral) environment. Nevertheless, the method was preferred because it includes maximum value criteria for the “non-hazardous” category. As recommended by the Professional - Scientific Team, NCAB instigated research investigating the behavior of coal ash exposed to an aqueous environment. The European Method EN 12457-2, executed with exposure to distilled water, which is a better simulation of the natural environment was examined. In accordance with the Team’s recommendation, parallel comparative testing of both ash leachings procedures (European EN method and TCLP method) have been conducted for the past several years. It is important to note that in contrast with the TCLP method, which is limited to a dust like material, the European method, developed as part of the CEN European standards system by a group of researchers at the ECN Institute in Holland, headed by Dr. Van der Sloot, also includes a range of sluicing methods. The EN method is designed to simulate the exposure of different materials (granular and monolithic - soil, wastes, sludge, construction materials and industrial by-products) in a range of different environments.

The LEAF framework is based on four procedures simulating exposure of a range of materials used for different purposes. It constitutes the development, refinement and institutionalization of the European method. LEAF was developed at the invitation of the USEPA and with its active involvement and was a cooperative effort between the American development group based at the VU in Nashville, Tennessee, headed by David Kosson and an European group of researchers. Recently, the four methods have received official recognition from the USEPA as an assessment tool of environmental risks for handling a range of materials.



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At the joint initiative of NCAB, Nadya Teutsch from the GSI and the VU research group, together with researchers at Volcani Center and the Technion, along with backing and support from the USEPA, a comprehensive research framework was formulated. The advanced testing methods and the LEAF environmental assessment structure will be incorporated into the environmental research and monitoring array for coal ash in Israel.

The work program is essentially an infrastructure investment with a view of the long term, which includes the following four principal tasks.

1. Assimilation of LEAF and up to date USEPA test methods into the environmental testing and assessment array for coal ash in Israel, which has been conducted for many years by the GSI.
2. The definition of environmental limitations of coal ash usage in concrete and cement products for infrastructures.
3. Environmental testing for agricultural applications of coal ash.
4. Development of a structured framework for environmental decision making regarding the uses of coal ash in Israel's unique conditions.

The framework proposal drawn up jointly by David Kosson, Nadya Teutsch and Hans Van der Sloot was presented at a workshop conducted by NCAB on May 13, 2013. Following the workshop, a preliminary proposal was drawn up and included a general definition of the research objectives, the tasks to be completed and an initial budget estimate. The entire project has a very broad scope and will extend over a number of years. Proper preparations for the execution of this project require the creation of a knowledge and information infrastructure with two main centers: (1) database at NCAB and (2) research and testing array at the GSI. The extensive infrastructure available at the GSI enables the execution of the tasks proposed in this research.

In consultation with the Professional - Scientific Team (pollutants) and the proposal writers, it was recommended that at the first stage, the focus will be on the first task and will include three roles.

- I. Studying the new USEPA testing methods and the environmental impact of their findings as part of LEAF and establishment of a data management and assessment array - LeachXS. To expedite this purpose, NCAB shall purchase one license for LeachXS Pro for use in the GSI (on two computers) and obtain free copies of LeachXS Lite for NCAB's requirements. Training shall be provided by David Kosson through internet communications. It must be noted that training in the initial understanding of the program was provided by David Kosson and Hans van der Sloot at no cost as part of the workshop that was held in December 2102. Another thorough second meeting followed with the participation of Nadya Teutsch and Olga Berlin from GSI and Dan Shriki from NCAB.



- II. Existing and new NCAB's data shall be entered into the LeachXS system (already partially entered during the aforementioned training). VU shall create a database including the Israeli data and other relevant data - from the USEPA and other sources around the world (to be provided by Hans Van der Sloot). This database shall enable the preparation of a report comparing the data from the various sources.
- III. In addition, David Kosson and Hans van der Sloot will provide training on the operation of the quality control tools required for the ongoing monitoring of element content and the characterization of the ash from the different sources. They will also provide an example of the printout and an operating guide for the convenience of the users. Training will take place mainly through internet conferencing, with some training in Israel, which will mean hosting them in Israel for about two days. For accomplishing the implementation of LEAF for Israeli coal ash purposes, Nadya Teutsch will spend a week at David Kossons labs at VU.

Enclosed: [Research Proposal](#)