

## E. Concepts and policies

### Sustainable use of the subsurface

#### The ENFO knowledge base to support efficient management of waste utilization on soil

Vaszita, Emese; Gruiz, Katalin; Siki, Zoltán, Feigl, Viktória; Klebercz, Orsolya;  
Ujaczki, Éva; Fekete-Kertész, Ildikó

Waste utilization for remediation of deteriorated and contaminated soil is a complex management task involving high uncertainties in decision making. Decisions in environmental management in general are aided by guidelines, experts' systems, various forms of information, databases, and other decision-support tools in addition to regulatory framework and environmental monitoring data.

Further to several international efforts in planning and establishing management systems or other IT (information technology) tools to support environmental management, a comprehensive Hungarian knowledge base, the ENFO = ENvironmental iNformation, ([www.enfo.hu](http://www.enfo.hu)) has been developed and designed combining the accessible IT tools and the up-to-date scientific and engineering knowledge on risk management of chemicals and contaminated sites. ENFO provides legal, scientific and engineering tools and embraces an expert system arranging the information in versatile forms, such as glossary, relational databases, picture galleries, e-courses, maps, etc. for a large variety of end-users, common people and professionals. The data are arranged according to the management levels and tasks in combination with the impacted elements of the environment such as chemical substances, environmental compartments and the exposed receptors. The informatics background of the ENFO knowledge base and web portal is a three-tiered architecture client–server design including a data tier, a logic tier and a presentation tier. The ENFO WEB portal integrates the Drupal content management system (CMS) and the MOKKA database, using MySQL (relational database management system based on Structured Query Language).

This paper introduces two key topics of the knowledge base: *soil and waste*. These topics were developed within the SOILUTIL project = SOIL amelioration by innovative waste UTILisation technologies ([www.soilutil.hu](http://www.soilutil.hu)). The information on soil and waste are arranged in two-dimensional matrices. Within the two-dimensional matrices the soil and waste topics are combined with risk management, risk assessment and monitoring as well as risk reduction/remediation methodologies.

The core of the expert system is the waste database and the soil amelioration/remediation technology database. Both databases contain information presented on purposefully prepared datasheets and are provided with search engines. The waste characterization data sheet includes information on the location and availability of the wastes, the value and hazard, as well as their potential usage and the associated risks at generic or producer-specific levels. The soil remediation technology database demonstrates via case studies the applicability/suitability of the wastes for soil remediation.

Within the expert system there is an interaction between the Soil and Waste topics: a “matching” software is being developed to support the preliminary decision on efficient waste utilization on soil. The software matches the utilizable characteristics and/or components of the *waste* (waste value) to the amendable characteristics, parameters and/or missing components of the deteriorated *soil* to produce an efficiently remedied/amended soil. Matching is done in two steps: 1) identifying the missing parameters of the deteriorated soil and finding the optimal (theoretical) additive type to it, 2) finding the matching waste or waste combinations (the closest to the optimal) to amend the soil. The matching components/parameters are arranged according to a priority sequence. The software works both at generic and site specific levels in terms of the soil and waste. The experts system, the search engines and the matching software can accommodate the requirements of various users including developers, researchers, degraded and polluted land owners, waste producers and disposers.