

## **Landfilling in Europe: Research needs from the perspective of implementation of the EU Landfill Directive**

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### **Background**

Landfilling has the lowest priority within the framework of the European waste policy hierarchy (1: minimisation of waste production, hazard potential and energy consumption through substitution and cleaner technology measures; 2: recycling or utilisation; 3: incineration with energy recovery (and subsequent utilisation or landfilling of the residues) and 4: controlled landfilling). This hierarchy constitutes the basic philosophy behind waste management in the European Union (EU) and many other industrialised countries. Despite its low ranking, landfilling remains a very important and indispensable part of the waste management system in all countries in Europe and elsewhere. However, the low priority of landfilling as a waste management solution is probably an important contributing cause of the fact that the funding situation for landfill research has been less than optimal during recent years, particularly at EU level. Landfill research was not very prominent in the Fifth framework programme of the European Community for research, technological development and demonstration activities (1998 - 2002) and it is even less visible in the Sixth framework programme (2002 – 2006). Most of the research carried out on various aspects of landfilling in Europe during the past 5 years has been based on national programmes, in some cases involving both public agencies and private companies.

The changes in characteristics and behaviour of the waste to be landfilled and the trend towards fewer and larger landfills (and more serious consequences of failures) combined with the increased concern about the potential impacts of the landfills on the environment, both in the short and long term, call for a substantial increase of landfill research in Europe. The research needs should be viewed in the perspective of the EU Landfill Directive, which was adopted on July 16, 1999, and of the pending EU Commission Decision, which will lay down the criteria for acceptance of waste at the various classes of landfills defined in the Landfill Directive.

With particular reference to the implementation of the EU Landfill Directive, research needs may be identified within the following areas:

- Performance of studies of waste/waste interaction to obtain a better understanding of integral waste behaviour and to identify control parameters for waste acceptance;
- Development of models for the description of the release of contaminants from monolithic waste to form the basis for development of acceptance criteria corresponding to those set for granular waste;
- Performance of studies of the effects of external impacts on landfilled waste in the short and long term (e.g. oxidation of reduced materials, carbonation of alkaline materials);
- Development of models for description of the biodegradation of mixed organic waste aimed at the development of acceptance criteria;

- Performance of further studies of the behaviour of organic components in landfills aimed at the development of acceptance criteria for specific organic compounds;
- Performance of studies of the effects of various methods of pre-treatment of waste prior to landfilling;
- Performance of studies of the effects of various operational and design measures intended to improve the performance of the landfill, i.e. to shorten the time period needed to reach “final storage quality”. This could include the development of new landfill concepts and designs, and should include a thorough discussion of the definition of “final storage quality”;
- Development of methods and technologies that can ensure a controlled and uniform distribution of the flow of water through landfills.
- Development of landfill designs and operational measures that will allow the transformation of the landfill operation from initial phase with active environmental protection systems to a final phase without or with passive environmental protection systems;
- Performance of studies aimed at assessing and if necessary improving the durability and long term reliability of active and passive environmental protection systems at landfills. This would include studies aimed at the prediction of long term liner performance and the nature and effects of liner failures in terms of release of leachate;

The advantages of concerted and co-ordinated efforts are obvious, and it is particularly recommended, that European-wide databases on waste characteristics and landfill leachate characteristics are established. In view of the difficulties experienced in getting EU funding for such activities, it is recommended that such databases are set up in co-operation between interested parties in the individual European countries, including the environmental authorities.