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ScienceDirect
Waste Management 28 (2008) 489–501
wasteWmanagement
www.elsevier.com/locate/wasman

Developing environmental legislation to promote recycling of industrial by-products – An endless story?

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Accepted 14 December 2006
Available online 30 April 2007

Abstract

In Finland during the last few decades, mineral industrial residues (by-products) have been used in earthworks, but only to a limited extent relative to their total volume. The most important barrier to efficient recycling of by-products has been the need for a site-specific environmental permit, since the permit process tends to be time-consuming and laborious. In 2000 a working group was set up to prepare national legislation, i.e., a Government decree, in order to promote the use of by-products in earth construction. The aim was to exempt certain residues from the environmental permit obligation. At the first stage, the working group determined specific decision criteria for the selection of the by-products to be included. For the selected residues, the acceptable construction applications and material-specific environmental standards were defined. Various difficulties were encountered during the preparation of the decree. These were mainly caused by the lack of data and by some ongoing changes in environmental regulations. Furthermore, the draft decree received several critical and partly contradictory comments and proposals for amendments. This resulted in considerable delay in implementation.

1. Introduction

In Finland, the annual use of natural mineral aggregates, i.e., gravel, sand and crushed stone, totals approximately 90 million tons (Mtons) (Rintala, 2003). The exploitation of natural raw materials is associated with environmental impacts, such as aesthetic harm, loss of biodiversity and an increased risk of groundwater pollution (Kosola and Kemppi, 2002). At the same time, industrial and mining activities generate approximately 25 Mtons of industrial wastes (by-products[1]), which are potential substitutes for natural resources (Mroueh et al., 2000; Statistics Finland, 2003). Additionally, construction works generate about 40 Mtons of excess soil, the quality of which varies (Mäenpää and Rintala, 2000). Residues such as fly ash from coal combustion (CCFA), blast-furnace slag (BFS), and crushed concrete have frequently been employed in earthworks during the last few decades. The use of other by-products is far more limited. Exact data on present recycling rates are lacking, but some studies indicate that, overall, around one-third of the volume of potential secondary aggregates is reused (Mroueh et al., 2000). The limited utilization of by-products may be due to high transportation costs, need for processing or pretreatment, and inadequate data on their geotechnical and environmental properties. However, the official granting practices have often been considered as the main barrier to recycling activities.

The Finnish environmental legislation does not recognize the concept of "by-product" and, thus, all residues excluding those treated as products are considered as wastes. Consequently, an environmental permit is normally required for full-scale recycling activities. The case-by-case permit process has been regarded as time-consuming, laborious and problematic, particularly in the case of small-scale construction and reconditioning projects, in which the constructor expects fast and easy availability of building materials. Furthermore, earthen structures are often planned without specifying the materials in detail.

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[1] Here the term by-product is used as a synonym for mineral industrial wastes (residues) which are potential substitutes for primary aggregates in earthworks.

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doi:10.1016/j.wasman.2006.12.021

Therefore, the use of alternative aggregates depends on their availability and price at the time of the realization of a construction project. Due to the problems caused by the environmental permit process, in Finland some associations and companies representing, e.g., metal, energy, forest and waste processing industry, have lobbied strongly for the facilitation of recycling activities.

At the EU level, the Landfill Directive and the principle of producer responsibility can be considered as the main drivers to the efforts to promote recycling of by-products. The Finnish Waste Act (1072/93) issued pursuant to the Waste Directives includes a provision which imposes the Ministry of the Environment to prepare National Waste Plans (NWP). In the first NWP extending from July 1998 to January 2005, the low recycling rate of some wastes was mentioned as one of the main concerns (Ministry of the Environment, 1998). Moreover, the main principles of the EU waste policy, e.g., sustainable use of natural resources and objectives of utilization and recycling of wastes, were considered as important factors. Therefore, to promote the realization of these principles a general average target to recycle 70% of all industrial wastes by 2005 was laid. The same goal applied to wastes generated in metal industry. The recycling target was expected to be reached partly by adopting economic instruments (subsidies and financing) and partly by issuing statutes, regulations and guidelines. The development of legislation promoting the use of waste materials in earth construction was mentioned as one of the six major actions. Therefore, the Ministry of the Environment set up a working group whose task was to prepare a Government decree to exempt certain industrial residues from environmental permit obligation. The working group[2] comprised representatives from the Ministry, from a regional environment centre, and from the Finnish Environment Institute.

The project for the preparation of the decree started in 2000 as a continuation of the national Ecogeo Technology Programme financed by the National Technology Agency[3] (TEKES). This programme was run between 1994 and 1999 and it included a project consortium aiming at development of a code of practice for the definition of environmental compliance of by-products used in earth construction (documented in Mroueh et al., 2000, 2001). In this project entity, there were separate projects dealing with risk assessment, life cycle analysis, long-term technical durability, sorption and migration of contaminants in soil, legislative background, landfill disposal, quality control, and environmental criteria. The information produced in these projects and the environmental criteria in particular, formed the foundations of the decree.

[2] The author of this paper was a member of the working group and responsible specifically for the definition of environmental criteria and the requirements for sampling and analysis.

[3] The name has been changed to "the Finnish Funding Agency for Technology and Innovation".

2. Preparation of the government decree

2.1. Starting point

At the time of starting the preparation of the Government decree, only the Netherlands and Denmark in Europe had specific regulatory environmental standards related to the use of by-products in earthworks. Some other countries had issued technical standards and guidelines. On the other hand, in the USA, many states had separate regulations for by-products (Sorvari, 2003).

The outcomes of the projects carried out within the previous national Ecogeo Technology Programme included guidelines for testing the environmental properties of by-products, a description of the restrictions for the environments and construction applications, and generic composition and solubility standards. The principles and criteria for the selection of the methodology adopted in the definition of the generic environmental standards have been described elsewhere (Sorvari, 2003).

The generic solubility standards (Maximum Permissible Emissions, MPEs) are based on the Finnish lower soil guideline values and the permissible discharge to soil beneath an earthen construction (Sorvari and Tenhunen, 2001). The derivation of the MPEs followed the Dutch methodology described in Aalbers et al. (1996). The generic composition standards are based on higher soil guideline values, i.e., the limit values. Since the most recent soil guideline values for metals were rather low, the use of the Dutch methodology led to low MPEs. Even though a simple multicriteria decision aid method was used to consider the benefits of waste utilization, such as saving of landfill space and preservation of natural resources, the calculations resulted in relatively low solubility standards, which would be exceeded by most of the by-products already in frequent use. Therefore, we needed a more detailed examination of environmental risks in order to determine the environmental suitability of potential secondary aggregates.

In order to exempt any residue from the permit obligation, we have to be able to specify it unambiguously. This was interpreted as a requirement for accurate data of the chemical composition of the residues. The secondary premise for the consideration of any by-product for inclusion in the decree was its technical suitability. At the time of starting of our work, several by-products had been tested for technical applicability. Some materials also had technical directions for use (Table 1).

2.2. Selection of by-products

2.2.1. Methodology

Originally, more than 20 industrial residues were identified as potential secondary aggregates (Table 1).

We used three main decision criteria to select the by-products to be included in the decree: market potential, existence of practices of use, and environmental suitability. Each criterion was assessed qualitatively or semi-quantita-