

INTERNATIONAL SOCIETY FOR SOIL MECHANICS AND GEOTECHNICAL ENGINEERING



This paper was downloaded from the Online Library of the International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE). The library is available here:

<https://www.issmge.org/publications/online-library>

This is an open-access database that archives thousands of papers published under the Auspices of the ISSMGE and maintained by the Innovation and Development Committee of ISSMGE.

Panel discussion: Barrier emplacement quality assurance on landfills

Débat de spécialistes: Contrôle de qualité concernant l'installation des barrières dans les décharges

J. Rappert & F. Ihle – IGB, Geotechnical and Environmental Engineering, Hamburg, Germany

ABSTRACT: Landfill barriers require special procedures with respect to installation technology and quality control and assurance. Therefore, the more general regulations have to be transferred into a concise quality assurance plan for the individual barrier construction project by the consulting engineer: Standard procedures and regulations will not do the job.

RESUME: Les barrières de décharges exigent des procédures concernant la technologie d'installation ainsi que le control et l'assurance de la qualité. Pour l'ingénieur de consulting il est nécessaire de transférer les règles plus générales dans un plan de contrôle de qualité concernant des constructions de barrières individuelles. Les procédures et les règles standardisées ne sont pas suffisantes.

1. INTRODUCTION

Containment technology is used to avoid the emission of contaminants from landfills. Modern landfills usually are equipped with bottom barriers and surface barriers. These barriers generally are multilayered systems. A landfill cover for example may include from top to bottom:

- the topsoil with the vegetation,
- the drainage layer,
- the composite liner with a geomembrane above a compacted mineral liner and
- the gas ventilation layer on the subgrade.

Landfill barriers require special procedures with respect to installation technology and quality control and assurance. Only if the functionality of each individual element is guaranteed the sealing system can function as a whole over the required service life.

2. OVERVIEW

In Germany, the requirements for landfill barriers are:

- the Technische Anleitung Sonderabfall (TASo) for Hazardous Waste Landfills,
- the Technische Anleitung Siedlungsabfall (TASi) for landfills of the categories I and II. The categories I and II more or less correspond to the former categories „landfills for construction debris“ and „landfills for domestic waste“.

Additionally the recommendations of the comitee „Geotechnik der Deponien und Altlasten“ of the Deutsche Gesellschaft für Geotechnik, the „GDA-Empfehlungen“ have to be mentioned.

3. QUALITY ASSURANCE PLANS

The technical directives and the GDA-Empfehlungen mentioned above are in need of interpretation, especially with regard to the requirements in the construction of barriers.

Therefore, the more general regulations have to be transferred into a concise quality assurance plan for the individual barrier construction project by the consulting engineer. Quality assurance plans have to be adapted to the specific technology and the materials used as well as the site-specific conditions. In that respect, the consulting engineer has to proceed in each case according to his experience. To the author's experience, the following aspects and regulations generally should be part of quality assurance plans:

- legal frame work,
- bodies involved, authorities to issue directives,
- presence of the responsible persons at the construction site,
- required material properties,

- construction process of the individual barrier elements,
- strategy and extent of sampling,
- acceptance and clearance,
- documentation.

4. CASE EXAMPLE

It was intended to construct the drainage layer for a surface barrier with broken glass as recycling material, see Figure 1. This resulted in two requirements for quality assurance: Proof of environmental compatibility and proof of material identity and composition.

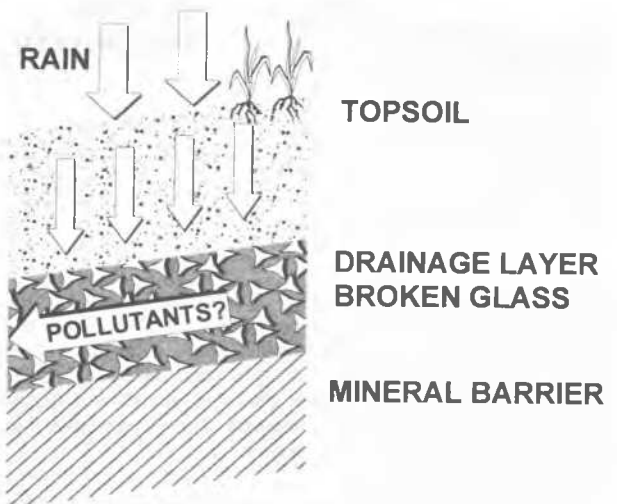


Figure 1. Proof of environmental compatibility.

4.1 Proof of environmental compatibility

Chemical analyses had to be carried out to confirm that the recycling material was not chemically contaminated. However, it was not appropriate just to analyse the total content of contaminations in the material. Instead, the task was to determine the amount of ions dissolved in water under test conditions which are representative for the conditions in the field. Therefore it was necessary to produce an artificial elution medium with similar properties to rainwater that has passed the topsoil and luters the drainage layer of the barrier. The test procedure was as follows, see Figure 2.

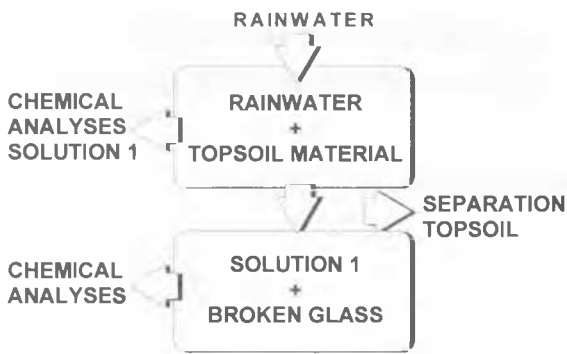


Figure 2. Laboratory test procedure.

Production of „rainwater“ by first adjusting the elution medium, in this case tap water, to a pH value of 5.5. In the second step the elution medium was mixed with the material of the topsoil in order to simulate a solution which has percolated through the topsoil layer. The solution was then chemically analysed. Finally the solution was separated from the topsoil material and mixed with the broken glass which should be used as material to construct the drainage layer. This solution was also chemically analysed. It was regarded to be representative for rainwater which had seeped through the topsoil and then passed the drainage layer. The results of the study were: see Figure 3:

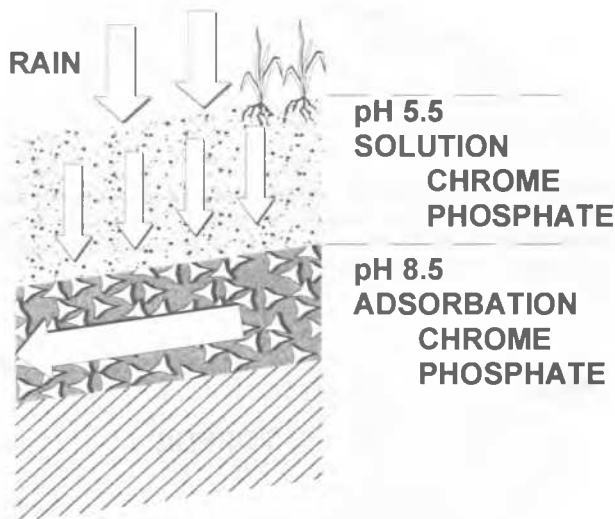


Figure 3. Results of the laboratory test procedure.

The water showed increased contents of chrome and phosphate after the contact with the topsoil material. The increased contents had to be due to an solution of these constituents from the topsoil. An increase of pH from 5.5 to 8.5 was also observed. After separating the water from the topsoil and mixing it with the broken glass the water showed significant lower chrome and phosphate contents. These constituents had obviously been adsorbed at the broken glass.

In conclusion:

- The topsoil material, which was not originally the subject of the examinations, showed increased chrome and phosphate contents with a mobile fraction which has been dissolved in the persolate.
- The broken glass was not only chemically uncontaminated, instead, it was able to adsorb chrome and phosphate.

4.2 Proof of material identity and composition

The recycling material provided by the supplier for the chemical examinations was free of any other admixes such as corks, bottle labels etc. However, an on-site evaluation of the supplier of the material revealed that the delivery batch had a substantial proportion of the above mentioned admixes and therefore was unsuitable for installation. Upon

request, the supplier was able to guarantee the purity required of the recycling material, but only at a clearly increased supply price, compared with the original offer. This price was in the same range as the supply price for gravel. Thus, the use of broken glass for the construction of the drainage layer was out of the question from an economic viewpoint, although the requirements regarding the environmental compatibility had been kept.

5. FINAL REMARKS

Quality assurance is only a part of the strategy. Modern regulations should present an integral approach starting with appropriate material testing and suitability studies before construction, quality control and quality assurance during construction as well as post-construction and post-closure monitoring programmes. Standard procedures and regulations above will not do the job. State-of-the-art concepts are individual programs taking into account the site-specific conditions as well as the chances and risks of the use of the available local materials.