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Redevelopment of Old Sludge Reservoirs

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Abstract

Because of environmental and societal constraints Tessenderlo Chemie at Ham is reorganizing its sludge deposit sites, covering more than 200 ha in the area. Due to changing production and organization, some of the deposits are being closed and the sites redeveloped, whereas other deposits are reorganized. This paper deals with the problems, occurring at the treatment and reuse of the specific industrial sludge as a construction material for dikes.

The geotechnical characteristics of the sludge were investigated, and a test dike with a height of 18 m above original ground level was constructed. The applicability of naturally dried sludge, of sludge with forced natural drying, and of sludge dried by filter pressing was tested. The appropriate construction pace and maximum elevation were determined, based on hydrostatic settlement measurements, oedometer tests, vane and direct shear tests as well as borehole shear tests. Computer simulations were calibrated with the field measurements, and used to evaluate the stability and safety of newly constructed sludge embankments.

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1. Introduction

Tessenderlo Chemie (Tessenderlo Group) was established in 1892, and over the years several sludge deposits were installed, covering about 200 ha in the area. Due to internal reorganization a redevelopment of

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the sludge deposits is at issue.

A basic element in the reorganization is the dry storage of old wet sludge, by using the dried sludge as building material for dikes and embankments. The sludge is a byproduct of the production of phosphates and is composed of calcium fluoride (CaF_2) and silicon dioxide (SiO_2) [1]. The wet residue is pumped into settling basins where it undergoes a natural drying, or it is dredged and dried by filterpressing. The dried sludge is comparable to clay with a high natural water content of 70 to 120% and a permeability between 10^{-9} and 10^{-11} m/s. Using the dried sludge in embankments at the same sites significantly increases the storage capacity of the deposit sites. The aim is to restore part of the covered area as industrial ground.

A geotechnical investigation was conducted to evaluate the problems and possibilities of using the industrial sludge as building material for dikes and embankments. The investigation uses laboratory tests on small samples as well as real size excavations and embankments on the site.

2. Reorganization

The reorganization comprised three deposits: Old Deposit (7,5 ha), Veldhoven (75 ha) and Kepkensberg (30 ha). The Old Deposit will be closed, and the area will be turned into a new industrial zone. For that, the 300 000 m³ of sludge in the deposit are being removed to the Veldhoven deposit. This project is being executed in 2012-2014, and in September 2013 half of the sludge volume has already been removed.

The Old Deposit was inactive for the last 30 years. In this period the sludge was naturally dewatered and consolidated. However, the unknown characteristics of the material presented a risk during the removal works, and therefore, a test excavation was made inside the deposit area to evaluate the sludge conditions and the stability of the sludge slopes during excavation. The test pit measured 27 x 20 m², with a depth of 8 m. Two slopes were profiled, one with an angle of 36°, the other with an angle of 53° (Fig. 1). After one month there were no indications of slope instability or sliding. A computer model confirmed the stability of the test pit both for short-term and long-term safety. Therefrom, it was concluded that an excavation under a gradient of 53° could be executed safely.



Fig. 1. Test excavation at Old Deposit

The sludge deposit at Kepkensberg, covering an area of 30 ha, is being reorganized. Part of the site is now becoming a new deposit, instrumented according to actual environmental regulations. The remaining part is

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