# Threshold densities for microbial sulphate reduction in bentonite

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Anaerobic groundwaters host a number of various microbes including the sulphate reducing bacteria (SRB) that use sulphate as an electron acceptor and thus form corrosive sulphide. This can have an impact on the safety function of a repository for spent nuclear fuel (SNF) where copper canisters are planned to be used. In this study three different clays considered to be used as buffer or backfill in a repository for SNF, were inoculated with SRB at various densities. The objective of the project was to identify if there is a threshold density for the buffer above which, microbial sulphate-reducing activity is practically inhibited. For this purpose, the radiotracer $^{35}SO_4^{2-}$ was used for detection of microbial sulphate reduction to $H_2S$ [1]. This is the most sensitive method available due to the short half-life of this isotope (87.4 days). Microbial activity has been demonstrated to decrease with increasing density and decreasing water activity of swelling clays [2, 3, 4]. Previous work with bentonite suggests that microbial activity and cultivability ceases somewhere in the range of 1900 – 2100 kg/m$^3$ wet density but the exact cut-off density remained to be determined [5, 6]. The results show that the cut-off process is not gradual, i.e. either the microbes work at full speed or they are inactive. The cut off density where the microbial activity ceased turned out to be slightly different for the clays.

[1]Bengtsson et al. 2015. *SKB R-15-05*. [2]Motamedi et al. 1996. *FEMS Microbiol Lett* **141** 83-87. [3]Stroes-Gascoyne et al. 1997. *Can J Microbiol*. **43** 1133-1146. [4]Motamedi 1999, *Thesis*, **1** 1-45.Göteborg Univ, Göteborg. [5]Pedersen et al. 2000. *Engineer Geol* **58** 149-161. [6]Masurat et al. 2010. *Appl Clay Sci*, 47 58-64.