Microbial degradation of low-level radioactive waste in repository conditions

M. VIKMAN[1*], K. MARJAMAA[1], M.ITÄVAARA[1], M.NYKYRI[2], J.SMALL[3], N. PAASO[4]

[1]VTT Technical Research Centre of Finland, Tietotie 2, P.O.Box 1000, FI-02044 VTT, Finland (*correspondence: minna.vikman@vtt.fi).

[2] Safram Oy, Metsätie 24, 02300, Finland

[3] National Nuclear Laboratory, Birchwood Park, Warrington WA3 6AE, UK

[4]Teollisuuden Voima Oyj, Olkiluoto, 27160 Eurajoki, Finland

In Finland low-level radioactive waste (LLW), arising from the operation of nuclear power plants, includes in addition to scrap metals considerable amounts of paper sheets, cardboard, cotton gloves and plastics. The microbiological degradation of cellulosic materials in anoxic conditions can result in gas generation and can also accelerate corrosion, deteriorate the performance of multi-barrier systems, and enhance the mobility of radionuclides from the repository to the surrounding environment.

The Gas Generation Experiment (GGE) has been established in 1997 to examine gas generation from LLW in TVO's final disposal repository for operational LLW and ILW in Olkiluoto, Finland [1]. The GGE has been monitored for generated gas, water chemistry and microbiology. The aim of our study was to examine microbial communities in the GGE using molecular technologies including quantitative PCR and high-throughput sequencing.

Heterogeneous chemical conditions in the GGE created optimal niches for microbial action and gas generation, which started approximately after one year of operation. Our results demonstrate that LLW is converted methane and carbon dioxide as a successive action of complex microbial consortia. The function of most relevant microbial groups influencing the gas generation will be discussed.

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[1] J. Small *et al*. 2008. Appl. Geochem. **23**, 1383-1418.