In order to investigate the reduction of greenhouse gases by novel and ecological bio-process, three passive methane oxidation biocovers (PMOB) were installed in St-Nicephore landfill in Quebec, Canada. The aim of the present paper is to estimate surface fluxes of volatile organic compounds (VOC) using two different direct measurement methods. Rectangular and circular flux chambers were used to collect the emitted biogas at the surface of PMOB. The sampling period took place from June to September 2012. An analytical method was developed to analyse the landfill biogas. Gas chromatography-mass spectrometry (GC/MS) and solid-phase micro-extraction (SPME) fibre were used to identify and quantify VOC. A number of VOC compounds were identified and quantified in landfill biogas. During the present study, more attention was given to benzene, toluene, ethyl-benzene, and xylene (known in the literature as BTEX) surface fluxes. The surface emission fluxes varied from 182.5 µg/m^2/year to 3.8 mg/m^2/year.