IE- 4 Landfill Gas Flux in a Closed Semi-Aerobic Landfill

Xi Bingyu, Hideki Yoshida, Vu Quang Huy Muroran Institute of Technology, Hokkaido, JAPAN

Background

Many closed landfills in Japan has been managed with operation of onsite leachate treatment plant though landfilling already completed. The end of aftercare of those closed landfills is regulated with the standards of leachate quality, landfill gas flux, temperature, etc. In order to reduce the required time for the end of aftercare, in situ passive aeration has been applied to a closed sanitary landfill after closure.

Introduction

This landfill is located in Hokkaido, the northern Japan. Ambient temperature is 6.4℃ and annual precipitation is 1090 mm. This landfill was operated from 1977 to 2003 and mainly accepted municipal wastes without incineration until 1996. Biodegradable wastes were landfilled. After closure, 5 monitoring wells were installed (B-M-1, B-3-3, B-3-7, B-6-4, B-11-5) in 2004. Then more than 90 landfill gas wells were installed from 2004 to 2008. **Figure 1** shows the observations of landfill gas components (CH_4, CO_2, O_2, N_2) in 3 monitoring wells and the landfill gas wells in August 2019.

Survey of gas components and gas flux at monitoring gas well

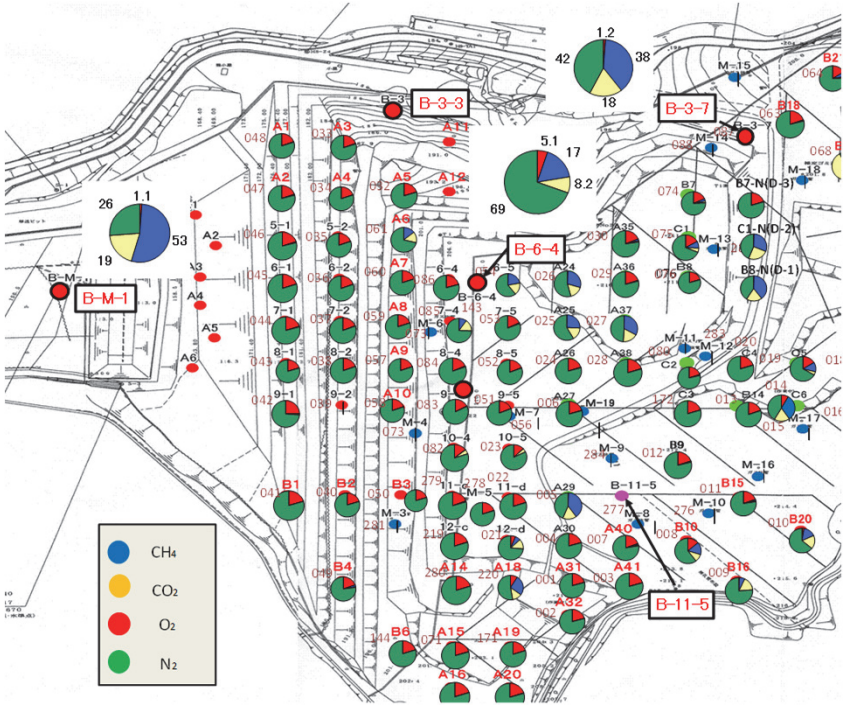

Figure 1. Gas compositions at gas wells and 3 monitoring wells

Results and discussion

At surveyed 86 gas wells maximum CH_4 concentration (**Figure 1**) was 54.3% and average CH_4 concentration was 5.9% (explosive level). As 15 years passed after closure, CH_4 and CO_2 concentrations were reduced. **Figure 2** shows monitoring data of landfill gas components, gas flux and temperature from 2004 to 2019 in 2 monitoring wells (B-M-1,B-6-4) . At B-M-1 the gas temperature fluctuated with the air temperature around 10-30 ℃ without no significant temperature rise and anaerobic conditions were dominant. At B-6-4 the gas temperature rose up to 40 ℃ due to aerobic biodegradation. The critical value of gas flux is 1000 ml/min because of the accuracy of gas velocity measurement. The observed fluxes were nearly below this criteria, however, CH_4 concentrations were always high more than 5%.

The relationships between gas flux and CH_4 concentration or gas temperature are shown on **Figure 3** and **4**. When CH_4 concentration increased, gas flux increased. On the other hand, there is no correlation between gas flux and temperature. The gas fluxes at B-6-4 were lower than B-M-1. Stabilization of the waste layers at B-6-4 resulted from active aerobic biodegradation and resulted in low CH_4 concentrations. So gas fluxes were small.

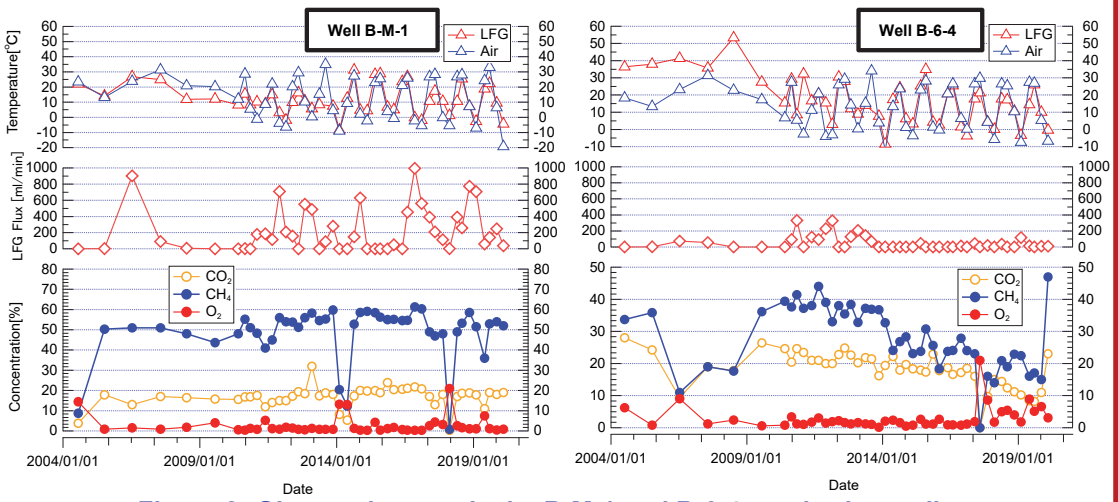

Figure 2 Observation results in B-M-1 and B-6-4 monitoring wells

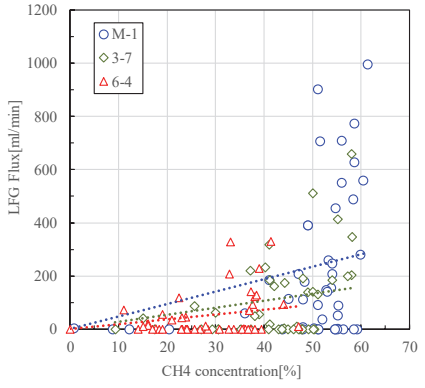

Figure 3 Gas flux vs CH4 concentration

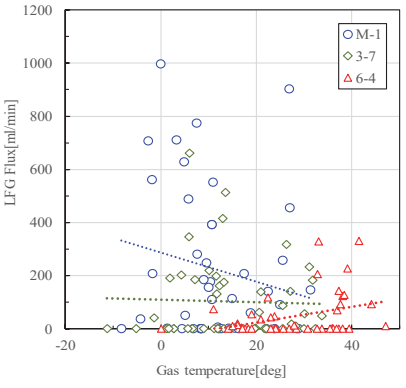

Figure 4 Gas flux vs gas temperature