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ScienceDirect

Procedia Environmental Sciences 35 (2016) 377 – 380

Procedia Environmental Sciences

International Conference on Solid Waste Management, 5IconSWM 2015

# Establishment of Energy Potential of Norio Landfill of Municipal Solid Waste of Tbilisi

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**Abstract**

In November 2010 the new landfill has been put into service in Tbilisi, the territory of which equals to 94 ha and is divided by inner roads into several areas, on which the waste disposal cells (area 5ha) are installed. The goal of our project was the determination (elaboration of energetic scenarios) of economically profitable ways of utilization/application of basic greenhouse gas $CH_4$, on the basis of inventory of methane emission from Norio landfill of municipal solid waste of Tbilisi city by IPCC methodology, and prevention from global climate changes caused by greenhouse gases with the use of methane in the energy sphere. The share of the landfill of municipal solid waste in the greenhouse gases emission in Georgia equals to 7% of the total emission of $CH_4$ and $CO_2$ that is very high rate. Our goal was the determination of amount of greenhouse gases ($CH_4$ and $CO_2$) emerged on the Norio landfill and forecasting of gases emission for the subsequent period. According to inventory data the whole potential of methane emission from Norio landfills equals to 930 mln. $m^3$.



Peer-review under responsibility of the organizing committee of 5IconSWM 2015

*Keywords:Greenhouse Gases, landfill, Energy Potential;*

## Introduction

The new landfill has been put into servicing of Tbilisi since November 2010, which territory equals 94 ha and is divided by inner roads into several areas, on which the waste disposal cells (sectors) (area 5ha) are installed. The first sector operation started in November 2010 and closed in January 2014.The depth of the sector are 30 meters and is equipped with 39 plastic tubes for gas collecting. Nowadays, landfill gas are emitting to the atmospheric air and as a result: locally -in surrounding areas occurs the air pollution and globally - climate change.

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Peer-review under responsibility of the organizing committee of 5IconSWM 2015
doi:10.1016/j.proenv.2016.07.017

## Literature review

After waste disposal in the cells and its covering with the ground are rapidly developed anaerobic conditions, in which under the influence of methanogenic microorganisms occurs the process of organic substances' bioconversion. As a result of this process is emerged the biogas, i.e., so-called "landfill gas" (LG), which microcomponents are methane and carbon dioxide. Percentage distribution of microcomponents fluctuates from 40-70% to 30-60%. Besides the above mentioned, the "landfill gas" contains nitrogen, oxygen and hydrogen in much less concentrations. In the form of microorganisms dozens of various organic compounds can be the part of LG that define its features and among them the toxicity. Proceeding from its content and the nature of environmental influence the "landfill gas" ranks among so-called "greenhouse gases" that stipulates the global value of its utilization (recycling).

Emission of gases from the every ton of waste disposed at the landfill will last during 45 years in average, while for the landfill this period, by taking into account the filling time, will last during 75 years. Full time of "landfill gases" emission is divided into 4 periods, in the course of which the process of gases emission passes with various intensity and has a different duration (Table 1) (N. Dvalishvili, et al, 2014; SazonovE.V, 2010).

Table 1: Theoretical amount of biogases emission during operation of MSW (municipal solid waste) landfill

| Name of the period | Duration of the period, years | Amount of gas emitted, % |
|---|---|---|
| Initial | 5 | 8 |
| Peak | 2 | 4 |
| Stable | 20 | 83 |
| Descendant | 18 | 5 |
| The whole period | 45 | 100 |

**Figure 1**

$$\boldsymbol{CH_4}\ Emission = \left[\sum_{x} CH_4 generated_{x,T} - R_T\right] \bullet (1 - OX_T)$$

Where:
$CH_4$ Emissions = $CH_4$ emitted in year *T*, Gg
T = inventory year
x = waste category or type/material
$R_T$ = recovered $CH_4$ in year *T*, Gg
$OX_T$ = oxidation factor in year *T*, (fraction)

The received results were compared with experimental results, which were conducted by Scientists of Institute of Hydrometeorology at Georgian Technical University in 2014 (S. Mdivani, et al, 2014).

## Results and discussion

The results of theoretical inventory and the experimental evaluation of emitted methane from a landfill body are shown in Table 2 (2.1 and 2.2). The findings show that the accuracy theoretical inventory is about 25%. According to experimental observations, the quantity of carbon dioxide in the landfill gases is half times less than quantity of methane.

Table 2-(2.1):Theoretical inventory (1.1 and 1.2) and the experimental evaluation (1.2) of emitted methane from landfill in Tbilisi (Norio)