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Estimation and modeling of gas emissions in municipal landfill (Case study: Landfill of Jiroft City)

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ABSTRACT: One of the major factors, contributing to the emission of greenhouse gases in the environment is generation of pollutant gases in municipal landfills. As for the design and building of a gas collecting system, it is necessary to properly estimate the amount and type of the landfill emissions. By means of LandGEM model, this study predicts the amount and type of the landfill gases, produced for 30 years (from 2016 to 2045) in Jiroft. Results show that in 2045, 3, 324, 274 tons of waste will be disposed in municipal landfills of Jiroft and the total amount of produced gas, methane, carbon dioxide, and non-methane organic compounds will be 32, 994, 8813, 24,181, and 378.8 tons/year, respectively. Furthermore, the rate of landfill gas emissions from 2016 to 2045 has been achieved. Maximum concentrations of methane, carbon dioxide and non-methane organic compounds in 2045, in 700 meters from landfill, will be 40, 590, 112, 700, and 1765 tons/m^3 respectively. Based on the results, obtained from this article, landfill pollutants such as CH_4, CO_2, and NMOC's can reach up to 15 kilometers from landfill, thus social places should be located farther than 15 kilometers from the landfill site of Jiroft. The results, obtained in this paper, can be used to identify the effect of Jiroft landfill in global emission of greenhouse gases and proper management of the landfill gas not only reduces greenhouse gas emissions, diminishing their effects on public health, but can be also used as a sustainable energy source.

Keywords: carbon dioxide, gas emissions, landGEM model, methane, municipal landfill.

INTRODUCTION

Urban landfill gas has always been produced from biological activities of biodegradable waste (Couth et al., 2011; Kalantarifard & Yang, 2012). Methane and carbon dioxide, known as greenhouse gases, are the main components of this type of gas, having strong adverse impacts on the atmosphere (Abdoli & Pazoki, 2014; Chiriac et al., 2007). Although sanitary landfills are usually covered with a 10-15 cm layer of clay, gas leakage to the atmosphere can be seen in these landfills.

Produced gas in landfills usually contains 45-60% methane (CH_4), 40-60% carbon dioxide (CO_2), and small amounts of nitrogen (N_2), oxygen (O_2), ammonia (NH_3), hydrogen sulfide (H_2S), hydrogen (H_2), sulfide (S_2), carbon monoxide (CO) as well as non-methane organic compounds (NMOCs) such as trichlorethylene, benzene, and vinyl chloride (Aydi, 2012; Saral et al., 2009, Pazoki et al., 2015).

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In 2000, developing countries were responsible for the emission of 29% of greenhouse gases in the world. This amount is estimated to reach 64% and 76% in 2030 and 2050, respectively. Greenhouse gas emission from landfills is considered one of the main reasons for such a growth rate (Pazoki et al., 2015; Tian et al., 2013), which poses a major problem not only in developing countries but in developed ones. It is predicted that 3.8% of global warming potential in the United States of America is associated with the methane, produced in landfills of the country (Chalvatzaki & Lazaridis, 2010). In percentage terms, methane gas is placed second among greenhouse gases with 18% and, in terms of the damage it can inflict; it is 25-30 times more potential than carbon dioxide to cause global warming (Nolasco et al., 2008; Aydi, 2012). Also, in Europe, 30% of methane production human resources is dedicated to landfills (Georgaki et al., 2008). Higher concentrations of methane also reduce the concentration of hydroxyl radicals (OH) and increase tropospheric ozone (Gardner et al., 1993). Other problems in urban waste analysis are landfill and methane oxidation which are the product of volatile organic compounds.

Heating value of methane is also high and can be important in terms of energy supply and economy. When combined with atmospheric air with a ratio of 5% to 15%, it becomes explosive. Thus, not collecting it properly is accompanied with a risk of explosion in landfills. Methane production usually begins from the second month after the start of landfill and may continue for years (Pazoki et al., 2015; Kalantarifard & Yang, 2012).

As a result, the issue of predicting the amount of gases, produced by landfill, is very important. Many studies have been conducted to estimate the amount of produced gases. One of the most known models to estimate the amount and composition of produced gas in landfill is Landfill Gas Emission Model (LandGem), which is based on the first order equation of decomposition rate to quantify the amount of gaseous emissions from decomposition of urban wastes in landfills and has been developed by United States Environmental Protection Agency (USEPA) (EPA, 2005).

This paper aims to estimate the amount of generated gases, such as methane, during the years after waste burial (waste disposal lasts for 30 years) in landfills of Jiroft by estimating future waste production, using a LandGEM simulation model. Also, in what follows, the emission rates of every pollutant gas of the landfills are estimated in their surrounding areas, by means of Screen View software.

MATERIAL AND METHODS

Jiroft is surrounded by Kerman in North, Baft in West and North west, Kahnooj in South, and Bam in East and North East. It is located at 56°45’ to 58°31’ longitude and 28°10’ to 29°20’ latitude (Fig. 1). With an area of 13,798.619 km^2, Jiroft spans over a plain and mountainous area.

Annual rainfall in Jiroft is equal to 82 mm with an average annual temperature of 23.5 °C. Thus, in climatic categorization, Jiroft belongs to arid and semi-arid regions (Waste Management Master Plan of Jiroft, 2013). According to the latest census, Jiroft's population was 111,034 in 2013. According to Waste Management Organization of Jiroft, in average 131 tons of waste were produced and transported to the landfills in 2013. Given the predicted population of Jiroft (according to equation 1 or exponential growth function) in 2013, being 120,746, per capita waste generation of Jiroft was 1.08 kg/day person.

$$P_n = P_0 \left(1+r\right)^n \quad (1)$$

where P_n is population in the target year, P_0 is population in the beginning year, r is annual population growth rate, and n is number of years between the first year and the target year.

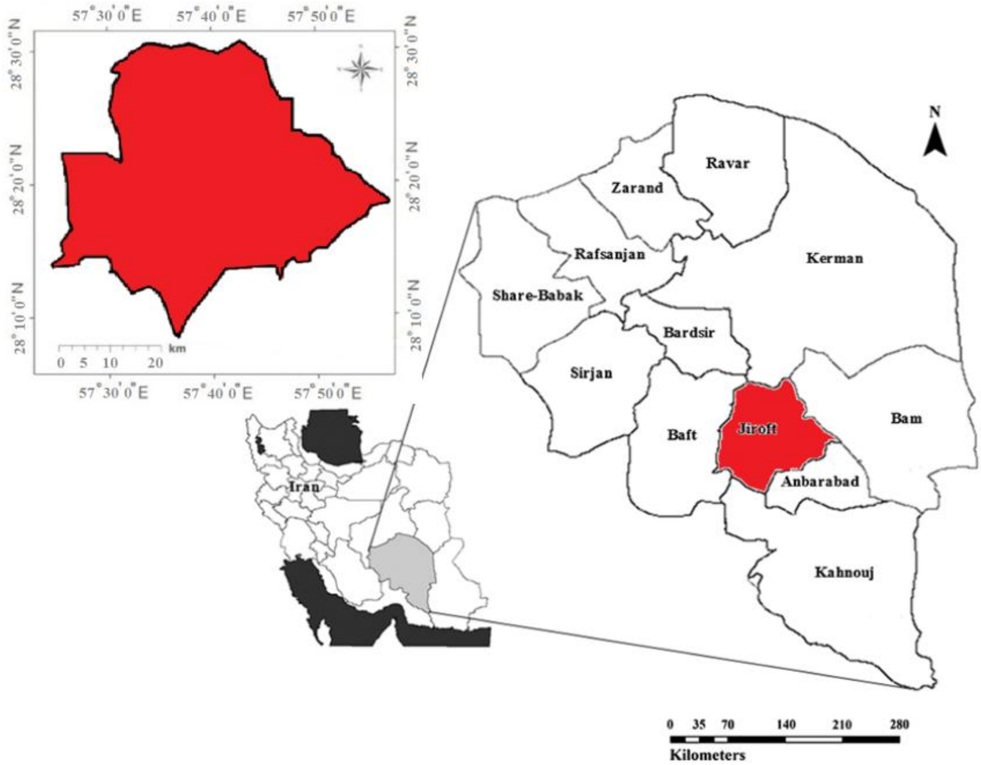

Fig. 1. Geographic map and location of Jiroft in Kerman Province

Table 1 shows the physical analysis of Jiroft waste. About 80.65% of total waste of Jiroft is putrescible. Food wastes are highly decomposable, with other urban wastes not easily decomposed, the small rate of paper wastes being an exception. In Table 1, all decomposable urban wastes are divided into three categories: high-speed decomposition rate (69.31%), average-speed decomposition rate (2.16%), and low-speed decomposition rate (9.18%).

LandGEM is a tool, based on Microsoft Excel, which is used to estimate the rates of landfill gases as well as their associated emissions. One of the advantages of this model is that it can predict the amount of produced gases under certain circumstances of landfill and in the absence of information about a specific landfill, its database contains series of default information that can help. Default LandGEM information is based on two sets of landfill criteria: Clean Air Act (CAA) is one of the landfills requirement, including New Source Performance Standards/Emission Guidelines (NSPS/EG) and National Emission Standards for Hazardous Air Pollutants (NESHAP); the other criterion is based on Agency's Compilation of Air Pollutant Emission Factors (AP-42), called EPA.

This study has used the latest LandGEM version (3.02). LandGEM is a first order equation (EPA, 2005).

$$Q_{CH_4} = \sum_{i=1}^{n} \sum_{j=0.1}^{1} k L_0 \left(\frac{M_i}{10} \right) e^{-k t_{ij}} \qquad (2)$$

where Q_{CH4} is the anticipated annual production of methane, i is the increase within the studied years, n is difference between the predicted and first year of waste disposal, j is 0.1 (increase within the studied years), k is methane production rate (year^{-1}), L_0 is methane production potential (m^3/Mg), M_i is waste mass in the ith year (Mg or ton), and t_{ij} is the jth section's age of M_i waste mass in the ith year (decimal year, for example 2.3 years)

The model is in the form of an Excel workbook with several sheets. The input, required from the user, are design capacity of landfill, annual rate of waste disposal to landfills, methane generation rate (k), potential methane generation capacity (L_0), and number of years for the wastes to get accepted at landfills.

Methane generation rate (k) indicates methane production rate, thus speeding up biodegradation of the organic matter. As the rate increases, decomposition occurs in a shorter time. Landfill gas generation rate depends on four parameters: moisture content of waste, ability of microorganisms to decompose wastes to methane and carbon dioxide, waste pH, and waste temperature. Considering the arid and semiarid climate of the study area, CAA and LandGEM (version 3.02) generally approximated landfill gas generation rate as equal to 0.02. But according to the World Bank recommendations, this rate is obtained more accurately as indicated in Table 1. The obtained k value is equal to 0.027 1/year. This amount is determined based on moisture (rain) and decomposition rate of waste components and is probably more accurate than the proposed CAA (Rezaee., 2014). Methane production potential (L_0) depends only on the type and composition of landfills' waste, e.g., the more the amount of cellulose in the waste, the greater the potentiality for methane production. Depending on the type of the climate, proposed by CAA, for arid and semi-arid regions, methane production potential equals to 170 m^3/ton. As mentioned above, this is an approximate value, because, due to the type and composition of waste, we cannot consider a fixed value for all regions. Thus, the rate is calculated considering the type of waste and World Bank instruction (Table 2). The lowest rate of L_0 equals 198 m^3/ton, while the highest rate is not taken into consideration due to lack of credibility (Rezaee, 2014).

NMOC concentration of landfill gas depends on the type of waste in landfill along with the reactions of different combinations of anaerobic decomposition wastes. NMOC concentration is measured by parts per million volume (ppmv) unit. According to CAA, its default value equals 4000 ppmv, like hexane. Based on LandGEM (version 3.02) instruction, if it is in compliance with CAA, the amount of methane, produced at landfill, should be 50% (equal to the amount of carbon dioxide). By having the amount of produced methane (Q_{CH4}) and methane rate (P_{CH4}), the amount of produced carbon dioxide (Q_{Co4}) can be obtained, using Equation (3).

$$Q_{CO_2} = Q_{CH_4} \times \left\{ \left[1 / P_{CH_4} / 100 \right] - 1 \right\} \quad (3)$$

Table 1. Estimated rates of urban landfill gas production in Jiroft based on physical analysis of waste and rainfall (82 mm/year) (Rezaee, 2014)

Waste components	%	Low speed decomposition	Average speed decomposition	High speed decomposition
Organic matters	69.31	-	-	69.31
Paper & Cardboard	6.98	4.82	2.16	-
Textiles	2.86	2.86		
Wood	1.5	1.50		
Plastic and PET	5.90	-		
Rubber	1.25	-		
Glass	4.68	-		
Metal	3.77	-		
Dust, ash etc.	3.75	-		
Total	100	9.18	2.16	69.31
Gas production rates for each group according to the annual rainfall (1/year)	-	0.01	0.02	0.03
Final gas production rate (1/year)	-		0.027	

Table 2. Estimation of methane production potential (L_0) based on Jiroft waste decomposition

Decomposition rate	Lowest rate (L_0)	Highest rate (L_0)
Low speed decomposition (m^3/ton)	5	25
Average speed decomposition (m^3/ton)	140	200
High speed decomposition (m^3/ton)	225	300
The lowest estimated rate of L_0 at Jiroft landfill (m^3/ton)	198	

Table 3. Parameters and specifications of the landfills studied in LandGEM model

Beginning year of waste disposal	2016	
Year of landfill closure	2045	
Does the year of landfill closure require a computing model?	No	
Landfill capacity	Not available	ton
Methane production rate (*k*)	0.027	1/year
Methane production potential (L_0)	198	m^3/ton
Concentration of non-methane organic compounds *(NMOC)*	4000	ppmv
Methane content	50	Volume rate (%)

Table 4. Screen view input data

Gas	Methane	CO_2	NMOC's
Type of emission	Surface	Surface	Surface
Emission rate ($g/s.m^3$)	0.000013	0.000721	0.000263
Emission height (m)	0	0	0
Landfill length (m)	1250	1250	1250
Landfill width (m)	850	850	850
Landfill area type	Rural	Rural	Rural

Screen View software, developed by USEPA, has been also used in this study to determine the concentrations of landfill gases, produced around Jiroft. Using Screen View software, the concentrations of methane gas, carbon dioxide, and NOMC'S are estimated according to the information, obtained from LandGEM, the assumptions, related to landfill, and the data input, requested in accordance with Table 4 in the final disposal year (2045). Given that the gases arise from the landfill, surface diffusion is taken into consideration. Hypothetical length and width of the landfill, based on waste production in the next 30 years, are considered 1250 m and 850 m, respectively. Also, given that the landfill is outside the city, the considered area is assumed to be rural.

RESULTS AND DISCUSSION

According to the United Nations' report, per capita waste production in developing countries is 500-900 g/day.person, whereas, in Iran, its average is 850 g/day.person. (Rezaee, 2014), suggesting that per capita waste generation in Jiroft (1.08 kg per day) is higher than Iran and other developing countries. It is 27% more than the average per capita waste generation in Iran. In Table 5, Jiroft population has been estimated for 30 years, between 2016 and 2045, using Equation (1). According to the estimations, the city's population in 2016 is 142,788 and, with its current population growth rate in place, the city's population in 2045 will be 481,551. The amounts of waste produced in 2016 and 2045 are 565, 44 and 190,692 tons per year, respectively. Total waste, produced during these 30 years will be equal to 3,324,274 tons.

Table 5. Population growth and estimated urban waste, produced in Jiroft from 2016 to 2045

Year	Population	Waste production (ton)	Waste in landfill (ton)	Year	Population	Waste production (ton)	Waste in landfill (ton)
2016	142,788	56,544	56,544	2031	267,775	106,038	1,262,173
2017	148,901	58,964	115,508	2032	279,238	110,577	1,372,750
2018	155,275	61,488	176,996	2033	291,192	115,311	1,488,061
2019	161,922	64,121	241,117	2034	303,658	120,247	1,608,308
2020	168,854	66,865	307,982	2035	316,658	125,395	1,733,703
2021	176,083	69,728	377,710	2036	330,214	130,763	1,864,466
2022	183,621	72,713	450,423	2037	344,350	136,361	2,000,827
2023	191,482	75,826	526,249	2038	359,092	142,199	2,143,026
2024	199,679	79,072	605,321	2039	374,465	148,287	2,291,313
2025	208,227	82,457	687,778	2040	390,496	154,635	2,445,948
2026	217,141	85,987	773,765	2041	407,213	161,255	2,607,203
2027	226,437	89,668	863,433	2042	424,646	168,158	2,775,361
2028	236,131	93,507	956,940	2043	442,825	175,357	2,950,718
2029	246,240	97,510	1,054,450	2044	461,782	182,864	3,133,582
2030	256,782	101,685	1,156,135	2045	481,551	190,692	3,324,274

The amounts of urban waste in landfill (the last column in Table 5) are considered as inputs to LandGEM model. Based on the outputs of this model, the highest rate of landfill emissions belongs to 2045, i.e. one year after the last year of waste disposal in Jiroft landfill. Total amounts, obtained for produced gas, methane, carbon dioxide, and NMOCs in 2045 will be 32,994, 8813, 24,181, and 378.8 ton/year respectively; while these amounts for Jiroft landfill in 2045 will be 26,420,149, 13,210,075, 13,210,075, and 105,680.6 m^3/year, respectively. According to LandGEM model assumptions, demonstrated in Table 3, volumes of methane and carbon dioxide will be equal. Since 69.31% of the gases, produced at landfills, are organic matters, the amount of landfill gases is very large, signifying that it is an essential issue to collect landfill gases, given the type of waste produced at Jiroft.

Figure 2 shows the volumetric production rates of emissions, during 140 years, since the onset of waste disposal, having considered the LandGEM output. As the gradient of the amount of waste, buried in the landfill graph, is increased, gas production gradient rises until the closure of landfill. The maximum amount of gas production is witnessed in the years after the landfill is closed. Since 2045, as no waste is going to be disposed in the landfill and the food for decomposition will be decreased each year, gas production rate will also decline. Such a decreasing trend in Figure 2 will be continued until 2156. As indicated, since the assumed amount of the volume of methane in LandGEM is 50%, the volume of methane and carbon dioxide produced are equal and their charts, similar. Yet, according to Figure 3, the mass of carbon dioxide is greater than methane. Mass of production carbon dioxide in 2045 will be 2.74 times more than methane mass in the same year. In other words, in the landfill, methane is higher in place than carbon dioxide, so it is more volatile.

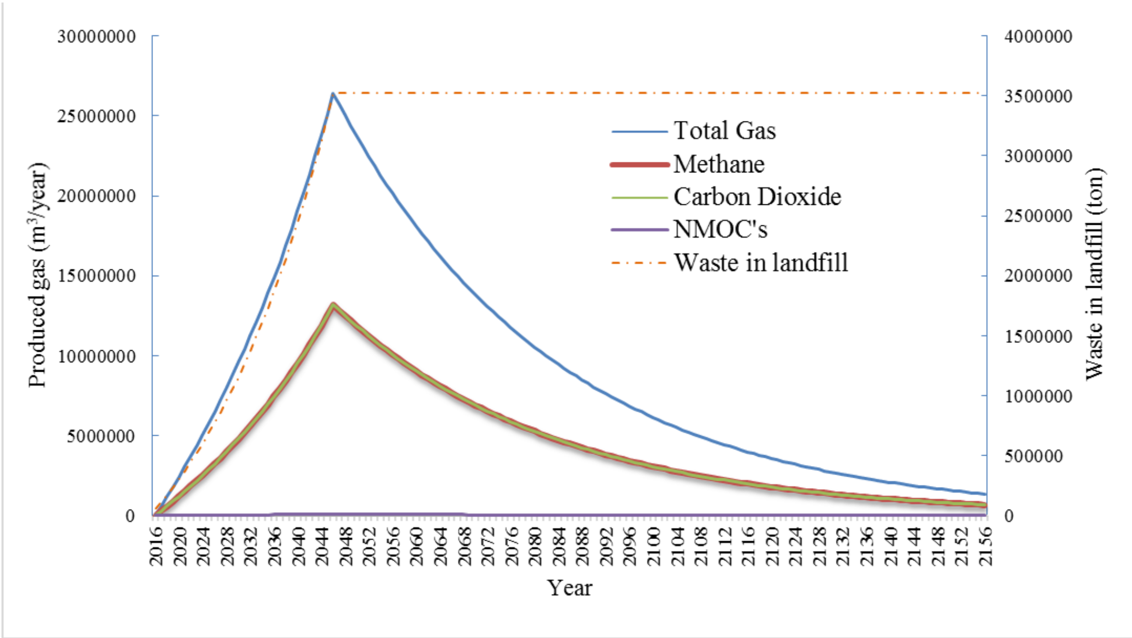

Fig. 2. Volume of produced gas emissions in Jiroft landfill from 2016 to 2156 (LandGEM estimation)

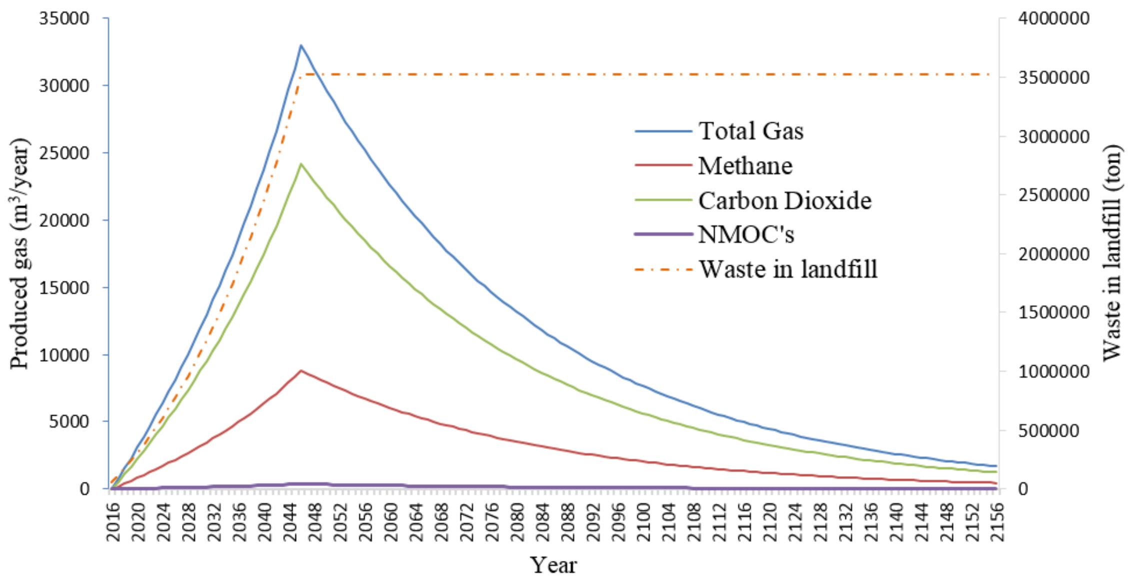

Fig. 3. Mass of produced gas emissions in Jiroft landfill from 2016 to 2156 (LandGEM estimation)

NMOC gases are chemical compounds with similar behavior in the atmosphere but different chemical structures. They also contribute to the production of tropospheric ozone. Figure 2 and 3 show the amounts of produced NMOC gases, though the total amount of these gases is much less than methane and carbon dioxide (about 1%). Thus, Figure 4 illustrates the chart of annual NMOC production in Jiroft landfill, separately. The importance of non-methane organic gases is that although they are lower, they leave more adverse effect on human health. A number of these compounds are known as the main causes of cancer. About 46 non-methane organic compounds, produced in Jiroft landfill and estimated by LandGEM, are shown in Table 6.

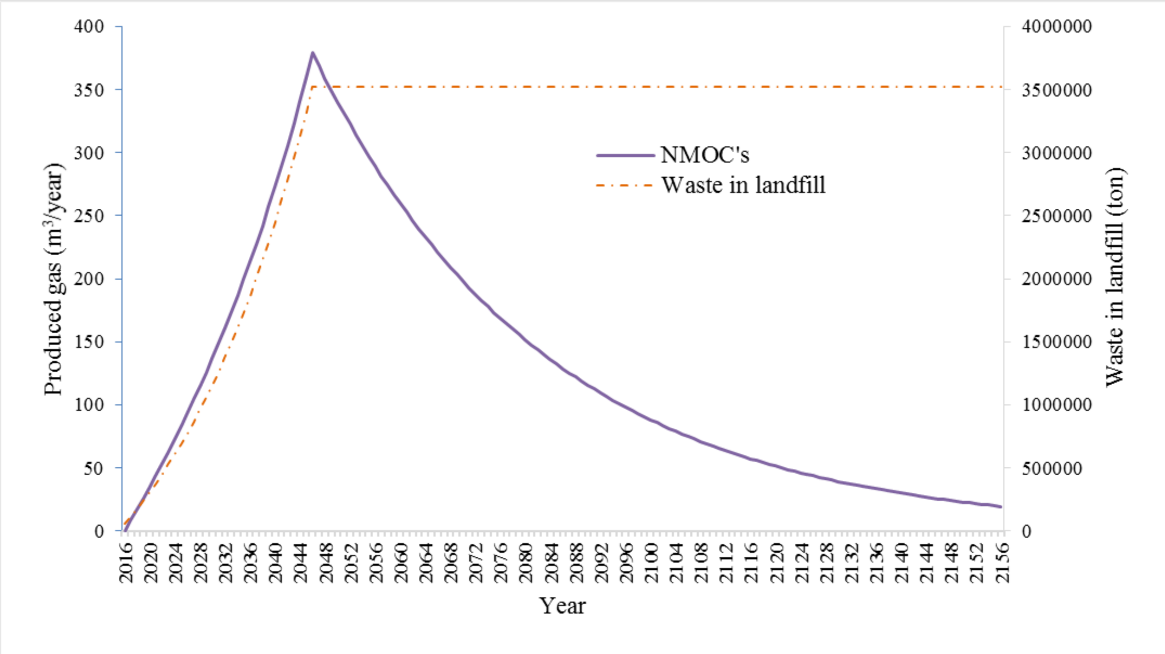

Fig. 4. Mass of produced NMOC's in Jiroft landfill from 2016 to 2156

Table 6. NMOC gases produced at Jiroft landfill in 2045 (LandGEM estimation)

Gas/emission	Emission rate	
	(m^3/year)	ton/year
Total amount of gases produced at landfill	26,420,149	32,994.11
Methane	13,210,075	8813.08
CO2	13,210,075	24,181.03
NMOC's	105,680.6	378.8086
1,1,1-Trichloroethane (methyl chloroform) – HAP	12.68167	0.070369
1,1,2,2-Tetrachloroethane - HAP/VOC	29.06216	0.202893
1,1-Dichloroethane (ethylidene dichloride) - HAP/VOC	63.40836	0.261017
1,1-Dichloroethene (vinylidene chloride) - HAP/VOC	5.28403	0.021305
1,2-Dichloroethane (ethylene dichloride) - HAP/VOC	10.83226	0.044586
1,2-Dichloropropane (propylene dichloride) - HAP/VOC	4.755627	0.022349
2-Propanol (isopropyl alcohol) – VOC	1321.007	3.302707
Acetone	184.941	0.446764
Acrylonitrile - HAP/VOC	166.4469	0.367334
Benzene - No or Unknown Co-disposal - HAP/VOC	50.19828	0.163085
Benzene - Co-disposal - HAP/VOC	290.6216	0.944175
Bromodichloromethane - VOC	81.90246	0.558095
Butane – VOC	132.1007	0.319337
Carbon disulfide - HAP/VOC	15.32369	0.048522
Carbon monoxide	3698.821	4.309179
Carbon tetrachloride - HAP/VOC	0.105681	0.000676
Carbonyl sulfide - HAP/VOC	12.94587	0.032345
Chlorobenzene - HAP/VOC	6.605037	0.030923
Chlorodifluoromethane	34.34619	0.123527
Chloroethane (ethyl chloride) - HAP/VOC	34.34619	0.09217
Chloroform - HAP/VOC	0.792604	0.003936
Chloromethane - VOC	31.70418	0.066579
Dichlorobenzene - (HAP for para isomer/VOC)	5.548231	0.033923
Dichlorodifluoromethane	422.7224	2.125864
Dichlorofluoromethane - VOC	68.69239	0.294054
Dichloromethane (methylene chloride) - HAP	369.8821	1.306753

next page →

(Continue) Table 6. NMOC gases produced at Jiroft landfill in 2045 (LandGEM estimation)

Gas/emission	Emission rate (m^3/year)	Emission rate ton/year
Dimethyl sulfide (methyl sulfide) - VOC	206.0772	0.532536
Ethane	23513.93	29.40876
Ethanol – VOC	713.344	1.367192
Ethyl mercaptan (ethanethiol) - VOC	60.76634	0.15703
Ethylbenzene - HAP/VOC	121.5327	0.536626
Ethylene dibromide - HAP/VOC	0.02642	0.000206
Fluorotrichloromethane - VOC	20.07931	0.114734
Hexane - HAP/VOC	174.373	0.625034
Hydrogen sulfide	951.1254	1.348203
Mercury (total) - HAP	0.007662	6.39E-05
Methyl ethyl ketone - HAP/VOC	187.5831	0.56261
Methyl isobutyl ketone - HAP/VOC	50.19828	0.209123
Methyl mercaptan - VOC	66.05037	0.132169
Pentane - VOC	87.18649	0.26164
Perchloroethylene (tetrachloroethylene) - HAP	97.75455	0.674246
Propane - VOC	290.6216	0.53295
t-1,2-Dichloroethene - VOC	73.97642	0.298273
Toluene - No or Unknown Co-disposal - HAP/VOC	1030.386	3.948381
Toluene - Co-disposal - HAP/VOC	4491.425	17.21089
Trichloroethylene (trichloroethene) - HAP/VOC	73.97642	0.404303
Vinyl chloride - HAP/VOC	192.8671	0.501368
Xylenes - HAP/VOC	317.0418	1.399895

This study has modeled the emissions around Jiroft landfill, using Screen View software. In order to model the concentration of emissions, produced by Jiroft landfill, data from Table 6 (LandGEM output) were required, based on which, emission rates of methane, carbon dioxide, and NMOC are 0.000263 g/s.m^3, 0.000721 g/s.m^3, and 0.0000113 g/s.m^3, respectively. The type of the landfill region is rural and the emission rate in the direction of the wind has been considered for 2045. Figure 5 shows the concentrations of each of the emissions with respect to their distance from Jiroft landfill. As shown in this figure, the concentration of methane at a distance of 10 m from the landfill is 30,940 ton/m^3, which increases up to 700 m, where it reaches 40,590 ton/m^3. From there on, proportionate to its distance from the landfill, the concentration plummets; however, there are still some emissions even at 15 km from the landfill, meaning that if you do not properly locate a landfill, its emissions can even reach the city, affecting its air. The same goes for concentrations of carbon dioxide and NMOCs, whose maximum concentrations reach to 112,700 and 1765 ton/m^3, respectively.

In a study, conducted in 2013 in the city of Sanandaj, LandGem software was used to estimate the amount of landfill gas. There 50% content of methane, the methane production rate constant of 0.045 1/year, and gas production potential constant of 200 m^3/ton were taken into consideration. The calculated amount of landfill gases such as methane, carbon dioxide, and NMOC over 20 years, were 23,150, 6184, 16,970, and 266 tons/year, respectively (Rezaee., 2014).

Rezaee (2014) also concluded that the maximum gas production of landfill reaches its maximum rate one year after the closure of the landfill. The time of landfill gas production, is similar to this study. The methane generation rate (k), likewise the decay rate, is within the range of 1/year 0.02-0.7 and the amount is 0.02 and 0.7 for dry areas and wet areas respectively.

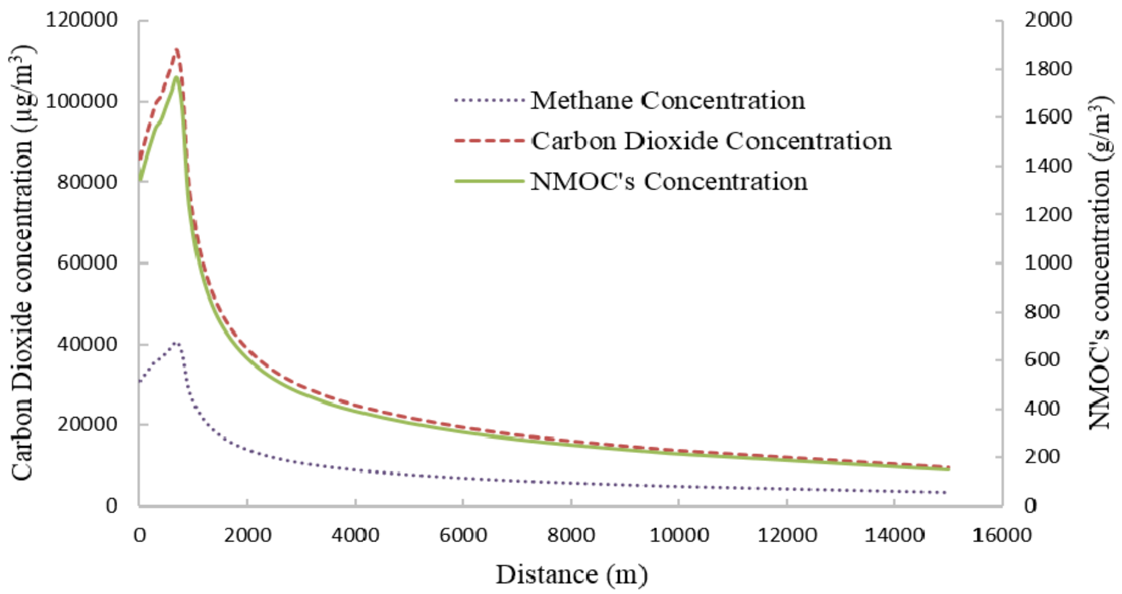

Fig. 5. Relationship between methane, carbon dioxide and NMOC's concentrations with distance from the landfill

As the numerical amount of k increases, the rate of methane production will increase, too. Potentiality of gas production, suggested by USEPA and used in a number of papers, is 170 m^3/ton, but in this respect the waste in this study has a higher percentage of corruptive waste, with the gas production potentiality, obtained as 198 m^3/ton, close to other studies (Rezaee, 2014). The gas production potentiality is estimated in a number of other studies and reported to be 100 m^3/ton (Chalvatzaki & Lazaridis, 2010; Aydi, 2012; Alexander et al., 2005; Tchobanoglous, 1993).

In most previous studies the proposed USEPA was used for methane production rate and potential gas production and the results were obtained on the basis of these parameters (Talaiekhozani & Nasiri, 2016; Kalantarifard & Yang, 2012; Talaiekhozani et al., 2016). It should be noted that the numbers, intended for these parameters, are estimated for the conditions of the location and type of waste, produced in the USA. Hence, for accurate estimation of the required parameters (k and L_0) for the purpose of calculating the amount of gas production of landfill, other methods such as the World Bank must be used.

Due to the growing population and the consequent increase in waste production in future, along with global warming, caused by increasing greenhouse gases, high levels of emissions around the landfill of Jiroft, risk of explosion of methane produced in landfills, and economic feasibility of using methane, measures have to be taken to collect produced gases around Jiroft landfill, in near future. These emissions can also be carried by the wind miles away and leave adverse effects on the environment as well as human health.

CONCLUSION

The main reason behind the formation of landfill gas is biological activity. The main landfill gases are CO_2 and CH_4, both of them, among the greenhouse gases. In addition the risk of explosion in landfill is very high, due to the presence of methane gas. High heating value of methane gas could attract national interest, as a result of energy management, particularly in the developing countries. Thus, it is very important to predict landfill gases and model their release. LandGem model, which is based on first-rate equation analysis, has been used to quantify the amount of emissions from urban waste landfills. In this paper, the production rate of landfill gas (methane generation rate) (k) with respect to the decomposition rate of the waste components and water content was 0.027 1/year and lowest potentiality for methane production (minimum potential methane generation rate) (L_0), depending on the type and composition of waste buried in the landfill of Jiroft, was 198 m^3/ton. NMOC concentration was 4000 ppmv such as hexane; and the waste production per capita in the city of Jiroft is intended 1.08 kg/day. This study estimated the amount of gases, produced in Jiroft landfill from 2016 to 2045, using LandGEM model. It also modeled concentrations of produced emissions at various distances, using Screen View, concluding that with the current rate of waste production, in 30 years, Jiroft landfill will be potential of producing gases such as methane, carbon dioxide, and NMOCs, up to 8813, 24,181, and 378.8 tons/year, which will be emitted to long distances, even farther than 15 km. Thus, in case of constructing a landfill at Jiroft, it is necessary to collect its emissions in order to prevent it from polluting the environment and also overcome the risk of explosion. Also, due to high heating value of methane, its trade will be profitable. It is evident that all data output generated by the software can be related to other factors, as well.

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