Journal of Life Sciences 10 (2016) 198-202
doi: 10.17265/1934-7391/2016.04.005

A Selection Study for Sanitary Landfill Site at Basra City, South of Iraq

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Abstract: The selection study for a sanitary landfill site at Basra city (south of Iraq) indicated to choose Al-Barjesia region at chwabedian area which belong to Al-Zubair directorate, using global positioning system (GPS). The measured latitude and longitude axes of this area are 30° 25.4′ north and 47° 29′ west. It is located at a distance of about 25 km straight line from the city center. The calculated elevation range of the chwabedian site was obtained to be 5-10 m above sea level, while the depth of plutonic water in the landfill site is range from 15-25 m. The measured permeability for this site was about 0.75-0.84 mm^3/min. The evaluation of soil components percentage in the suggested site was listed in table 1, as examined by the international constructional laboratory, at Basra/Iraq. A primarily modern design for chwabedian sanitary landfill was projected and sketched in figure 3.

Key words: Landfill site, solid waste management, leachate.

1. Introduction

Rapid generation of solid waste (SW) resulting from economic development and population growth had become one of the most important environmental issues of our time. Massive solid waste (MSW) can be processed in one of three ways [1]: 1—Thermal treatment 2—Biological treatment and 3—Landfilling [2, 3]. The solid waste is defined as it is a solid material which is a result of different industrial processes and continuous human residual. The applied method for the protection of waste during the healthy sanitary landfill process is a complicated process which is belonged to the solid waste services process [4]. Currently a large number of methods, approaches and modeling have been developed to support decision-making in solid waste management. With the large number of methods available, however, it is becoming increasingly difficult for practitioners and decision makers to understand [5, 6].

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The solute transport is the most complex subject in the soil physics. It involves water and chemical movement, chemical interaction and microbial transformation. The solute conservation equation that predicts the process considers three different transport processes, advective, diffusive and hydrodynamic dispersive flux.

The mechanism underlying adverse reproductive effect due to leachate exposure is not fully known [7-10]. Choosing the exact scientific methods for differential survey at an area for sanitary landfill site and applying it on the selection region to build this important public utility is attributed as a health environmental public service which protect the humanity from possible environmental calamities.

The sanitary landfill site can be considered as a specialized unit for accumulation for different solid waste which is convenient to the region for sanitary landfill through the geotechnical design and acceptance for the human population. The presence of some measurements (or tests) must be included for the selection of a sanitary landfill [11] such that: 1—The

distance from city center must be indicated on the city map which including the presence of other conditions in addition to know the petroleum and archeological maps to avoid these regions. 2—Avoiding obviation the regions located in the winds direction. The breezing up of wind will affect on the city through the transportation of smell stinking. 3—The selected region must be far away at least ~370 m from any water source or agricultural regions or artesian wells. 4—It is better to select a region with little transmittance for a sanitary landfill. 5—The regions which are much less average rain full quantities per year can be chosen to avoid residing of the leachate which contain massive material. A typical section for sanitary landfills is shown in figure 1.

During the past decade, solid waste (SW) has increased drastically in the state of Iraq, especially after the war of 2003. Most ends up in landfill with only a minor percentage being recycled [2, 3, 12]. The aim of this study is to indicate a suitable location for a sanitary landfill site at Basra city (south of Iraq) fixed/or restricted on a scientific, environmental, and healthful bases. A modern landfill design for this location is projected. It will be mention that it is till now there is no expert sanitary landfill site at Basra governorate.

2. Instrumentation and Measurements

Global positioning system (GPS)—Garmin's enhanced eTrex Vista Cx elevates GPS includes 64 MB micro SD card for Map source data, has been applied according to Basra governorate map. Direction and velocity of wind in addition to the altitude of water plutonic (underground) from earth's surface were calculated using GPS connected to the satellites, after choosing of a sanitary landfill site. The longitudes and widths of this site were also indicated. Soil samples were collected from this landfill site by

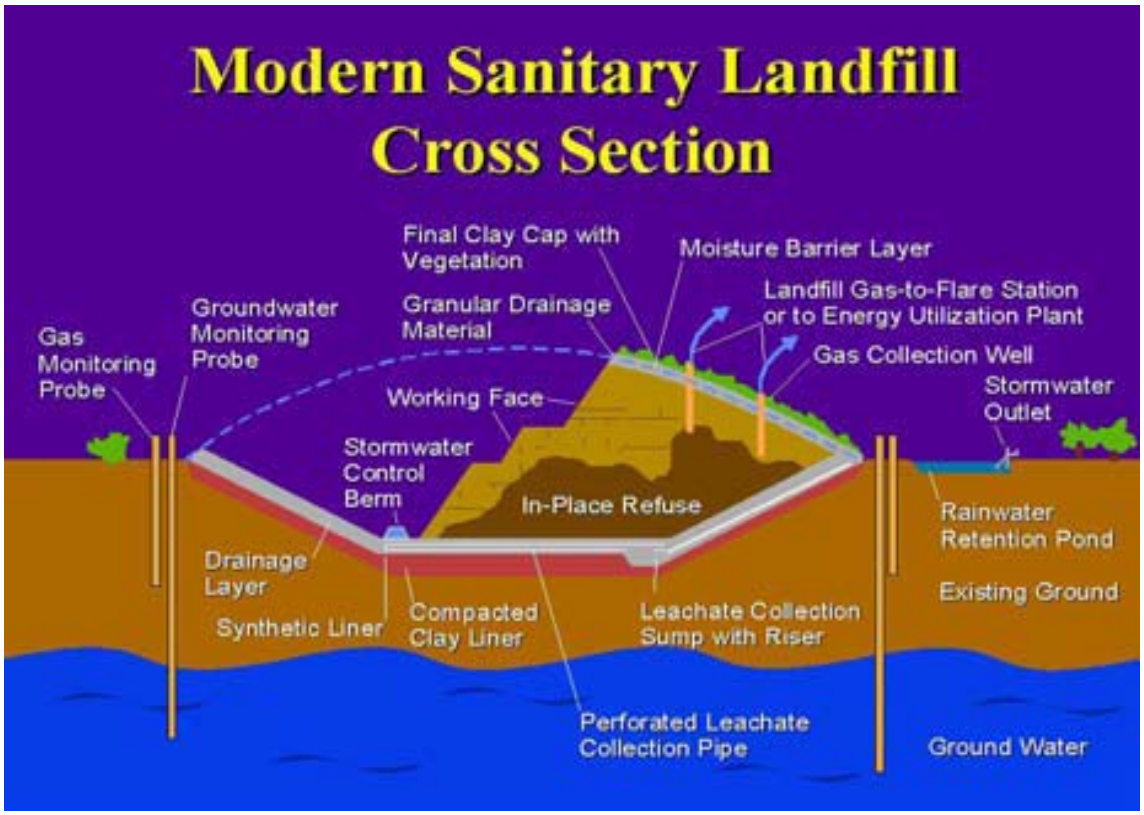

Fig. 1 A typical section for a sanitary landfill (www.nswma.org).

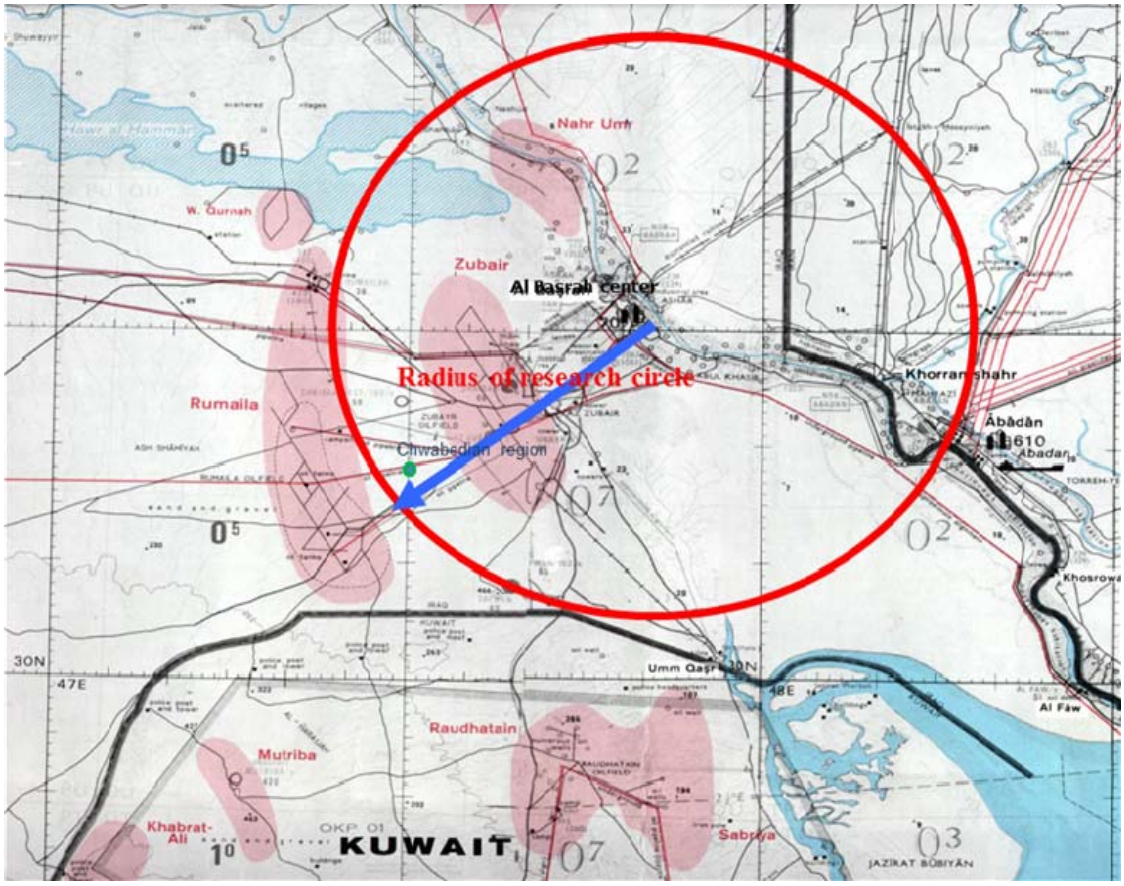

Fig. 2 A sketch of the radius of the research circle at Basra City/Iraq.

sand samples system and examined through the international constructional laboratory to know the sand percent institutions. Old Basra city was chosen as a center for the research circle Fig. 2.

3. Results and Discussion

According to the primarily study done by our unit (Environmental Pollution Research Unit—Southern Technical University) predicated that about 0.75 Million ton (M_t) per year of massive solid material (MSW) were generated at Basra city in the period 1990-2003 which is belong to about 1.8 million people.

It is increased to about 1.65 M_t per year after the war in the period 2003-2013 due to the increasing of waste generation especially metal waste and plastics. While it is projected to increase to about 2.75 M_t per year belong to about 5 million people in the period 2020-2030 due to the increasing of local consumption especially the organic waste (food waste) which accounts for approximately 55% of the total. The calculated amount will need land filling space of about 465.000 m^2 according to Al-Salem 2009.

Our results suggest that a landfill, if well-designed and managed, can be a good neighbor and have no statistically measurable negative impact on surrounding [13].

Chwabedian area at AL-Berjesia has been chosen as a sanitary landfill site (belong to AL-Zubair directorate) using GPS. This area was about 25 km straight line distance from city center (position of creating solid dross). The measured width and longitude axes of the chwabedian area are 30° 25.4′ north and 47° 29′ west, respectively. Velocity of the wind in this site is about 23 km/h north-west. Plutonic water is in the range (15-25) m from the earth's surface in this site, which is appropriate to establish the landfill site in order to allow residing of leachate of the landfill material.

Table 1 Soil contents percent ratio at chwabedian site.

Depth (cm)	Sand %	Silt %	Clay %
0-30	~87	~8	~5
30-60	~86.5	~5.5	~8

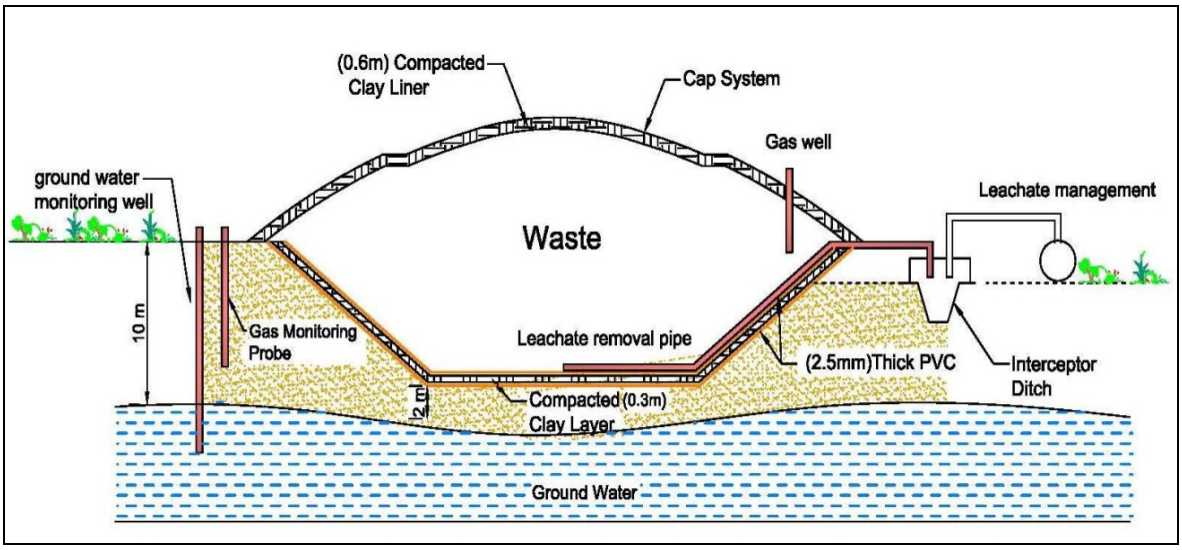

Fig. 3 A primarily modern design for chwabedian sanitary landfill.

Soil contents percent ratio as examined by International constructional laboratory is found as in Table 1.

The average transmittance was about (0.75-0.84) mm^3/min.

Table 1 indicates that this area can be considered as sandy then the transmittance is high which simply allow residing of leachate to the plutonic water [14].

In order to prevent the liquid leachate infiltration (slip) from the sand, we suggest that this region can be coated with 1—compacted clay layers of about 0.6 m pressed by ~70% with a forced arrangement which allow it to be a little permeability. And 2—using two layers of an impermeable polyvinyl chloride (PVC) cover put on the landfill base, each with about 2.5 mm thick, as in Fig. 3.

It is important here to follow some practice steps for the solid waste during the embedding period.

- Putting a layer of the solid dross and distributed over all the area of a sanitary landfill.
- Finally the sanitary landfill will be close and compress with a clay layer considering going out of gases from the bottom of the site to the surface by soil pipes, as in Fig. 3.

A periodic examination (each 1 month at least) must be carried out in order to evaluate the environmental action. Also we suggest using this landfill site as a Greenland region. It must be mention that this sanitary landfill is established for embedding the house waste and non-danger waste, while the danger waste must be treated at the created position and will be disposition by suitable methods.

4. Conclusions

Through this study to choose a sanitary landfill at Basra/south of Iraq, we can conclude the following points:

(1) Chwabedian region at AL-Berjesia (about 25 km straight line distance from Basra city center) has been chosen as a sanitary landfill site, using global positioning system (GPS).

(2) Velocity of the wind in this region was about 23 km/h north-west as average.

(3) Plutonic water is in the range (15-25) m from

the earth's surface in this site which is appropriate to establish the sanitary landfill site.

(4) Chwabedian region can be considered as a sandy site (about 87% sand) with high permeability (about 0.8 mm^3/h), as examined by International constructional laboratory at Basra.

(5) It is very important to follow some practice steps for the solid waste during the embedding period in order to prevent contamination infiltration into the soil by coated this sanitary landfill with compacted clay layers and by using an impermeable cover put on the landfill base, such as polyethylene (HDPE) or polyvinyle chloride (PVC) (7).

(6) A primarily modern design for chwobedian sanitary landfill was projected and sketched in Fig. 3.

(7) A periodic examination (each 1 month at least) must be carried out in order to evaluate the environmental action.

Acknowledgments

The authors would like to thank Mr. Ali A. Amara Iraqi Ph.D. student in Australia for his support in this work.

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