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Management and Evaluation of the Geological and Environmental Effects in Maragheh Landfill (North West of Iran)

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INFORMATION

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ABSTRACT

Urban development and increasing population have led to the production of various wastes. The geological and environmental effects of landfill are significant, pose a serious threat to human, animal, and plant health. Lack of proper management to dispose of and dispose of very hazardous wastes will result in irreversible environmental and geomedical consequences. The present article evaluates the environmental effects of the landfill in Maragheh City located in northwestern Iran by conducting field and library studies. About 150 tons of garbage is transferred daily to this landfill, which is located two kilometers from the city, which is not acceptable in terms of international standards and criteria, and more importantly, this landfill is located near the tourist area of Chakan. Improper disposal of waste, neglect to isolate the landfill and leachate leakage, have led to irreparable environmental pollution in the area. On the other hand, the emission of gas due to waste corruption has led to the spread of pollutants and pathogens in the region. Therefore, the main cause of environmental problems in the region is the lack of hygienic landfilling and lack of control over the production and distribution of leachate, which must be planned to prevent it.

1. Introduction

Waste disposal in the environment is one of the most important problems of human society, the rate of which is increasing gradually due to population growth (EPA, 1993). The generated waste can be in the form of solid, sludge, liquid or gas or a combination of all of these substances that pose a threat to human life. The way we dispose of waste is troublesome because it causes water and soil pollution, disease outbreak, spoilage of landscapes and increase in environmental clean-up costs (Ghazban, 2011).

The entry of large volumes of urban waste along with thousands of tons of hazardous toxic waste beside industrial and hospital waste into the environment creates many problems and its negative, harmful effects in relation to other existing urban systems, including the environmental system, are examined.

Maragheh Landfill is one of the environmental problems in the region that despite conducting studies on environmental impact assessment, due to lack of technical and scientific controls, has now caused health and environmental hazards in the region. The present study examines the weaknesses of Maragheh Landfill from EIA's viewpoint.

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2. Location and Geology of the Region

Maragheh City with a surface area of 2185.65 square kilometers occupies 4.8% of the total area of East Azerbaijan Province. This city falls at 37°23'21"N, 46°14'15"E. The Maragheh City had a population of 175.255 in 2016 and is the second city after Tabriz in terms of size and population in the province (Fig. 1).

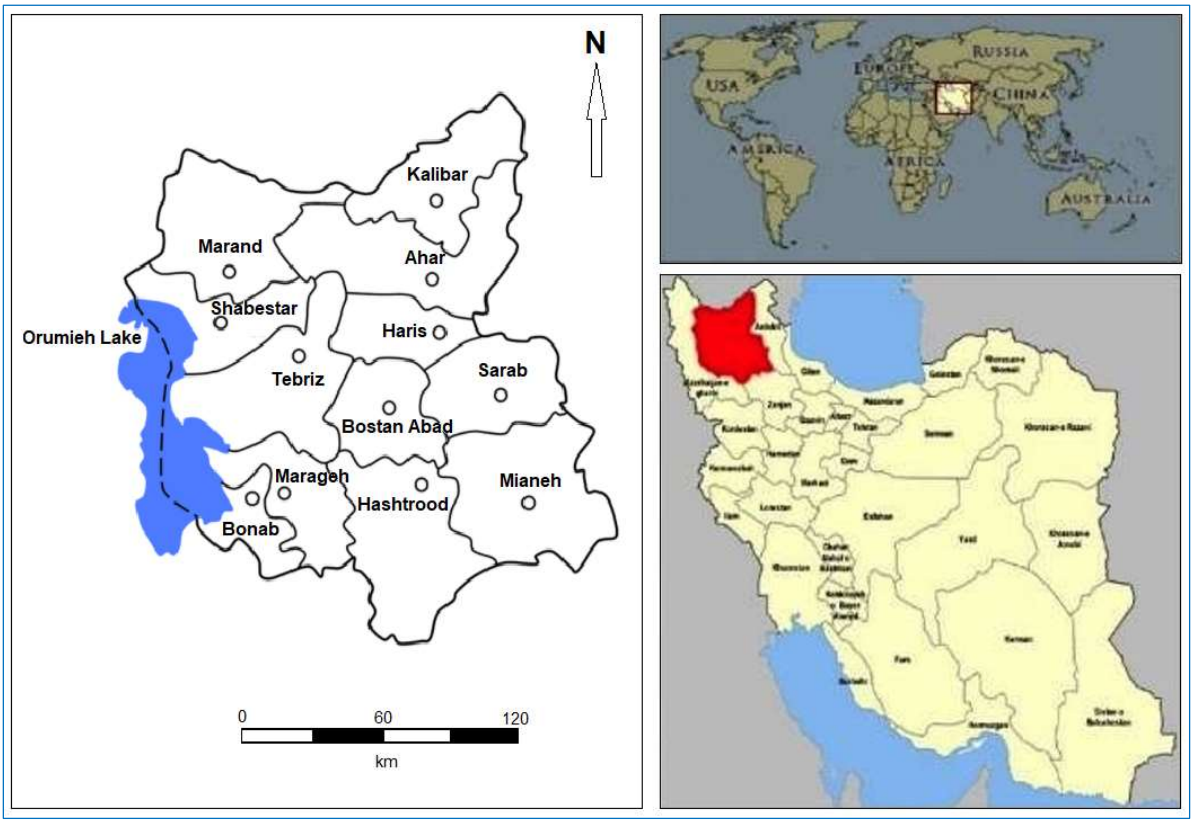

Fig. 1. Location and specification of Maragheh city in the East Azerbaijan Province in Iran

For a long time, the garbage produced in the city of Maragheh has been dumped and buried in a place located in the southeast of the city, near the tourist area of Chekap (Fig. 2).

Fig. 2. Location of Maragheh Landfill on satellite photo

According to the existing geological maps of the region, this landfill contains permeable geological formations of young and periodic alluvial barracks of sandstone and lime (Fig. 3).

Maragheh City is located on young alluvial formations, lake sediments of evaporate deposits from Urmia lake to volcanic and igneous masses of rocky outcrops of Sahand Mountain activity. In terms of geomorphology, Maragheh metropolitan is located on an alluvial fan and on the bank of Sofi-chay River. From the north and northeast parts, it is limited by Sahand Mountain and it has caused the establishment of Maragheh tuff in these sectors.

This city is limited to the Bonab and Urmia Lake basin from the west (Aga-Nabati, 2015; Bahrani et al., 2016; Ghazifard et al., 2016). The Maragheh region, due to certain geological conditions and being on the Sahand alluvial fan, is considered as drainage path for Maragheh-Bonab plain and Urmia Lake basin. Drainages with erosion-sedimentation cycles in lapse of time have caused changes in the morphology of region (Chandra, 2015; Ghazifard et al., 2016).

3. Findings and Discussion

Proper and correct landfill locating is the most effective step in creating urban development and is one of the most important principles of environmental hazards (Lohani et al., 1997). To investigate the destructive effects of landfill, environmental factors including physical, biological and social factors have been studied as follows.

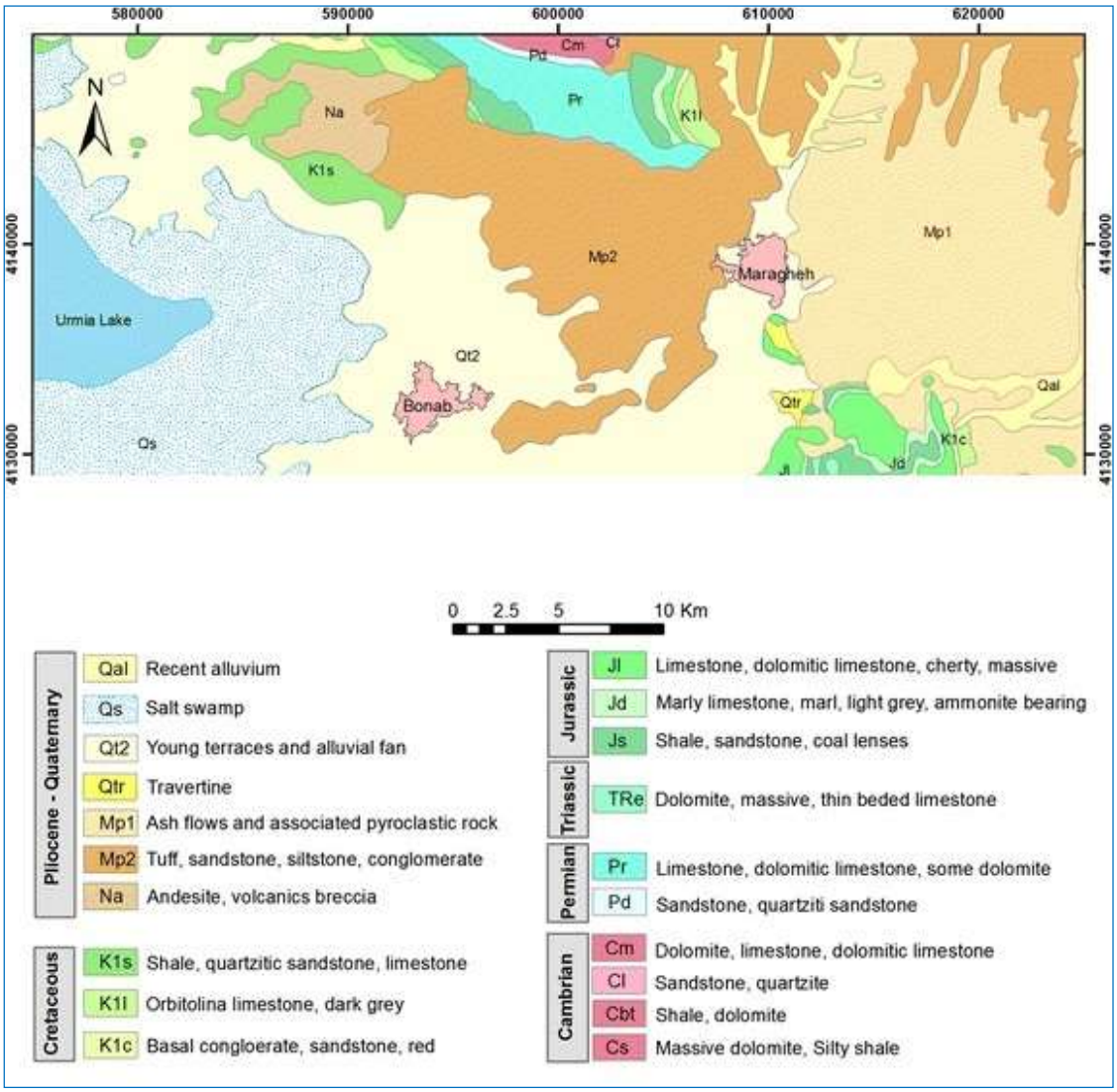

Fig. 3. Lithology in the study area based on existing geological maps

3.1. Physical factors

Physical factors refer to the effects that landfills have on the soil, water, air, and etc. of the environment.

3.1.1. Soil

One of the environments that is in direct contact with the landfill is soil. Soil is considered as a fertile and purifying layer. This concept states that not only soil provides nutrient but also it has a purifying property. This property is due to its physical properties (water penetration through pores), chemical properties (surface adsorption and evaporation) and its biological properties (decomposition and putrefaction of organic matter). However, its capacity is limited and many toxic substances and pollutants may be gathered in it, and eventually it can be considered as a serious threat to the environment.

In other words, a large volume of area loses its physical and biological quality due to landfill and becomes unusable. In addition, due to poor burial conditions and leaching of pollutants in the landfill because of rainfall, soil contamination spreads.

3.1.2. Surface water and groundwater

The most important cause of surface water and groundwater pollution in landfills is landfill leachate. Leachate is a liquid that passes through waste and leaks out of solid waste and contains soluble, suspended solids or particles of the same waste. Leachate occurs when the amount of waste moisture exceeds the soil moisture and this process is intensified by rainfalls. This problem is multiplied several times in the presence of surface water and groundwater in the landfill area and causes the growth of environmental pollution to the point of crisis (Fig. 2). When the surface and underground waters flow towards residential areas and the permeability of the garbage bed layers is high, the pollution problem will become much more severe.

3.1.3. Air

Atmosphere is a very good environment through which pollutants can be transferred. Landfills cause air pollution in two ways, direct and indirect.

Direct way: causing health problems such as respiratory problems such as asthma, health effects due to unpleasant

odor and the effects of deposition of acidic dust on plants resulting from direct contact with chemicals.

Fig. 2. Contamination of surface water in waste landfill

Indirect way: In this case, chemicals are deposited on soil, water or plants and due to the use of this type of food that is affected by atmospheric sediments, diseases are caused. Unlike other contaminants, this type of contaminant cannot be remedied by collection or clean-up operations. Decomposition of household waste and perishable food at landfills has produced gases, the most important of which are methane and lesser carbon dioxide and volatile organic acids. Inappropriate accumulation of waste produces gas caused by waste corruption, which causes the fire of waste and doubles its destructive effects on the environment (Fig 3). It should be noted that the direction of the prevailing winds at the waste accumulation site is very important for the transfer of these air pollutants to residential areas.

Fig. 3. Air pollution caused by burning waste

3.2. Biological factors

Biological factors refer to the effects of landfills on the plant and animal habitats around the landfill. Plants and animals that are exposed to pollutants and wastes through mechanisms such as digestion, swallowing, skin contact, adsorption, membrane adsorption processes in microorganisms, dust deposition on leaves, direct absorption through roots and leaves can absorb dangerous elements and transmit them to humans. Leachate infiltration into groundwater, the presence of birds and animals are major factors in the transmission of pollutants that endanger the health of people in the area.

According to the studies, about 630 types of chemicals (pharmaceuticals) are consumed in hospitals and approximately 300 of them are toxic and dangerous (Fig 4). These toxic substances exist in hospital waste that their recycling is prohibited and proper disposal requires certain laws and methods (Ebrahimi, A., 2008).

Fig. 4. Toxic and hazardous hospital waste for the environment

3.3. Social factors

The most important social factors are the problems caused by transportation and the problems of landscapes and aesthetic phenomena:

3.3.1. Transportation

One of the adverse effects of construction and operation of landfills is the increase in the volume of vehicle traffic, especially the percentage of heavy vehicle traffic. Tabriz landfill is located at a good distance from residential areas, but due to the increase in traffic load, there is a possibility of traffic accidents endangering the lives and property of the people.

3.3.2. Landscapes and aesthetic phenomena

In general, the quality of landscapes is relative and depends on the combination of components of different physical landscapes such as topography, trees, shrubs, water bodies and land use. The construction of landfills has specifically affected the quality of landscapes and the quality of aesthetic phenomena in the region.

4. Conclusion

150 tons of waste produced in Maragheh is daily transferred to the main landfill of the city. According to studies, a large volume of soil in the region has lost its biological quality because of landfilling and has become unusable for agricultural and industrial purposes. In addition, due to the leaching of pollutants in the landfill by rainfall, the soil contamination of the area by pollutants has spread.

Improper accumulation of waste, lack of leachate control, the presence of permeable bed are the most important factors that have turned Maragheh Landfill into an environmental problem. Regarding the high volume of waste produced, the

project of separating waste at the source, recycling waste and using them to produce compost and biogas are among the most basic solutions to control it.

This will also control hazardous waste such as hospital waste. One of the most important actions would be having a suitable insulating cover to prevent the waste from coming into contact with surface water and atmosphere in order to prevent the production and penetration of leachate and the contact of birds and animals.

There are several methods to prevent the migration and movement of gas, including the use of impermeable dams (such as clay, bentonite, earth membrane or cement), ventilation and exit of gases from the site and the collection of these gases.

In recent years, noticing the environmental problems caused by improper landfilling and disposal of waste at Maragheh Landfill, the municipality has constructed a place for sanitary landfilling that can control leachate and gas produced by waste decomposition and decay.

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