

# Analysis & Measurement of Air Pollution & Local Ecological Action Plan (LEAP) in Mashhad – Iran

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## Abstract

In this research the analysis and measurement of air pollution and Local ecological action plan (LEAP) in Mashhad will be studied. We will study the air pollution factors in order to determine the most effective element of air pollution, the diseases caused by air pollution and the ways of managing and controlling local air pollution.

This study shows that afforestation is the best way to deal with air pollution. Considering the results of this study, in order to reduce the high levels of pollution and making the air clean, increasing green areas is the most important option.

**Keywords:** Air pollution, Local ecological action plan, Air pollution factors, S.W.O.T.

## 1. Introduction

### 1.1. The history of air pollution

Air pollution means the existence of one or more pollutant agents like: dust, fumes, gas, mists, smells and moisture in the air. These pollutant agents have their own quantities, characteristics and special time of staying in the air which are very dangerous for human, plants and animals' lives. These factors will affect strongly on human being's way of life and make living difficult for them.

The history of air pollution and the discussions related to it comes back to the middle ages and even more previous times. So air pollution and the determined rules related to it are not new issues. For example, in 1307 Edward the First, stopped using coal in brick factories because such use polluted the air of London. These kinds of rules were run in past in different parts of the world. Nowadays, there are different consequences of air pollution and these consequences make the society to have major plans for controlling air quality and this issue is considered as an important national issue.

In 1952, more than four thousand persons died in London because of photo chemical dusty fog; and this is one of the most horrible happenings caused by air pollution during the history. In 1948 in the United States, air pollution and its existence in Denver, Pennsylvania for 4 days, was the agent of killing 20 persons and making more than six thousand persons out of 14/000 persons, ill.

These happenings were the consequences of extremely polluted air caused by factory fumes and acids. Currently, the fog may be caused by burning fossils especially oil and coal in the air. This fog is one of the main elements of polluting air especially around the factories.

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Besides, in most cities of the world, carbon monoxide, nitrogen, oxides and hydro carbon are combined together in the presence of sun light and cause the photo chemical dusty fog be formed.

Although the role of fixed polluting sources is considerable in making this dusty fog and this role has been more effective than the polluting role of using vehicles and motorcycles, nowadays the vehicles play more important role in polluting the air of big industrial cities.

Air pollution and air quality has always, from past time to now, been one of the most interesting and essential issues analyzed by scientists and researchers, but the majority of these studies have been done during recent decades.

## 1.2. Air pollution in Mashhad

Air pollution is an important risk factor for multiple health conditions which consists of respiratory infections, lung cancer, and heart disease, according to the WHO. The health effects caused by air pollution may include difficulty in wheezing, breathing, aggravation of existing respiratory and coughing and cardiac conditions. Respiratory and the cardiovascular systems of human body are being affected by poor air quality. These effects can result in increased doctor or emergency room visits, increased medication use and premature death. Individual reactions to air pollutants rely on the kind of pollutant an individual faces, the degree of exposure, the individual's genetics and health status.

Considering prevailing winds, inappropriate location of plants and the existence of brick factories would generate increasing air pollution.

According to the statistics of daily air pollution different types of vehicles pollute the air; patrol enters 8691.7 ton, Gasoline 376.62 ton, Gas 4642.8 ton into the air every day.

## 2. Location

Mashhad is located at 59.35° East longitude and 36.20° North latitude, in the valley of the Kashaf River near Turkmenistan, between the two mountain ranges of Hezar-masjed and Binalood.

The measured population in 2010

- City 3,069,941 (Metropolitan)

2,772,287 (City itself)

(2,011 Census)

- Population Rank in Iran 2<sup>nd</sup>

Over 20 million pilgrims and tourists per year



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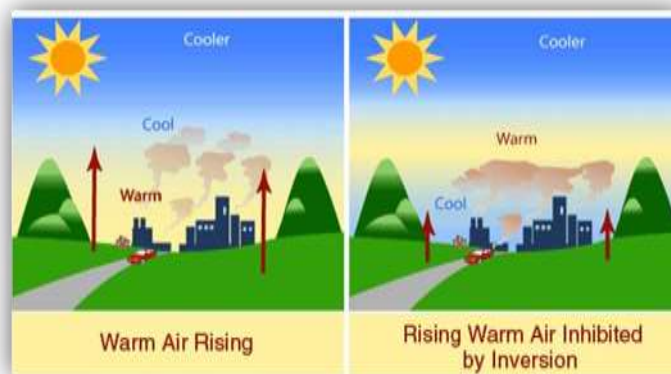
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In the summer of 2010 was more than 13 million pilgrims in Mashhad. Statistics show that the shrine of Imam Reza in Mashhad makes every Iranian almost every three years to travel to Mashhad.

Mashhad has variable winds in the south-east to north-west. Maximum temperatures in the summer is 43 degrees and lowest in winter to is – 23 degrees.

The city is located between Damavand mountain (Southwest) and Hezar masjid (North and Northeast). During the night the heavy mass of the air crosses to this area and the warmer mass of air goes up this layer, and it would make the heat inversion.

So this would make an inflexible mass of air which wouldn't let the air move vertically and it would concentrate the pollution caused by the motoric vehicles inside the atmosphere.



This concentration of pollution inside the atmosphere would make breathing harder for citizens and it would cause several different types of illnesses.

Also heat inversion would cause the smoke fog which would stay in the air for several hours.



### 3. Air Pollution Factors

Mashhad has 270-300 days of heat inversion every year. Beside all these, some bus drivers turn on their vehicles early in the morning to warm up their engines and this will cause a black layer of air that would stay whole day in the atmosphere. Also radiation heat inversion and massive and dynamic inversions would increase pollution in cold season during the years.

The temperature difference which occurs through the mountains of north, south and south western parts of Mashhad during the day and night, causes a breeze which comes from the mountains and also the valleys closed to Mashhad; and which enters this city during the night and is the element of transferring dirty weather from the city atmosphere to out of it and exchange this weather with clean and healthy one. So the valleys close to Mashhad are considered as the lungs of this city and they should be kept empty and no building is allowed there.

This protection should be done in order to help the exchange of clean weather among the city and mountains, occur habitually. The other important agent is the wind which breezes from west to east or from southeastern to northwestern parts of the city. They are considered very important as the agents of transferring dirty weather out of the city and bringing in the pure and clean weather.

Also, as soon as the sun rises, the polluting sources start working from early morning. The fog of dust made of photo chemistry materials starts forming gradually and finally at noon reaches its highest point because at noon there is the maximum amount of sun shining. But, during afternoon and evening, most of the factories stop working and sun shine is also reduced.

We can conclude based on the above explanations that this photo chemical dusty fog will be formed more during the hot period of a year, especially in summer.

We may classify the air pollution sources into two main categories:

#### 3.1. Portable or mobile pollution sources

- Autos
- Heavy vehicles
- Light vehicles
- Motorcycles
- Public transportations (public transportation)
- Aircrafts
- Trains

Autos have the greatest role in air pollution. Also public transportations such as buses due to being worn have a significant role in air pollution. In this paper, the ways to deal with these sources of pollution will be studied.

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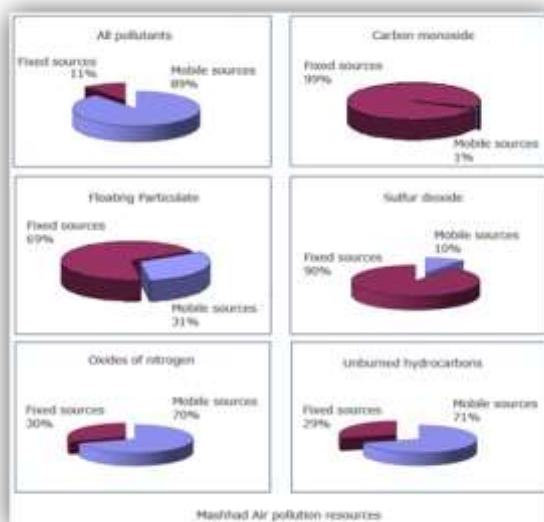
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### 3.2. Fixed pollution sources

- Household sources
- Commercial sources (like: restaurants, hotels, etc.)
- Industrial sources (like: metal, foods, medicines, chemical, leather, electricity , etc.)
- Pumps : Patrol , Gasoline , LPG , CNG
- Natural sources (like: Storms of dust, pollens, anther plant)

Factories in Mashhad have the significant role in air pollution. The construction of these factories goes back to pre-development period. Currently, the population growth and constructions make most of these areas located in residential areas which result in adverse effects on citizens' health.

Table 1. Mashhad air pollution sources



### 4. The Effects of Air Pollution in Mashhad

Based on the results of several researches which were done by random sampling on 286 family members in Mashhad, we find out that more than 94 % of Mashhad citizens suffer from bad smelling, 85% report the raining of black dust, around 77% get weak vision and 88% experience the effects of air pollution in their living region.

**Table 2. The number of days which Mashhad has air pollution**

Number of days in Mashhad	Not at all	Less than 1	1 - 3	4 - 6	7 - 10	More than 10	Everyday
Days with bad smell in the air	6.6	7.6	28.4	27.3	13.1	8.7	8.3
Days with black debris in the air	15.2	6.4	20.1	20.5	13.1	10.6	14.1
Days with weak vision for citizens	23.2	8.8	33.3	13.3	9.1	9.1	3.2
Days with having harmful effects on the health of citizens	12.3	8.8	27.1	20.4	16.5	11.3	3.5

As shown in above table, for most of days in Mashhad, there is black debris in the air. This is followed by the number of days belong to bad smelling in the air and the least number of days relate to the days with harmful effects on the health of Mashhad citizens.

**Table 3. The percent of diseases caused by air pollution**

Diseases caused by air pollution in Mashhad	% Of patients
Asthma	9.7
Ocular allergy	29.1
Skin allergy	27.3
Other allergies (sore throat , etc.)	38.1
Heart disease	5.5
Angina	7.3
Emphysema and chronic bronchitis	8.3

As the above table reveals, the highest percent of diseases caused by air pollution belongs to allergies which is 38.1 % and the lowest percent of patients related to air pollution belongs to the category of heart diseases, which is 5.5% .

## **5. Suggestions**

Studies have shown that the best way to fight against air pollution is to plant trees. Thus by considering the results of these studies which aimed to decrease the high level of pollutions and make the air clean, we conclude that increasing green areas is the most important option for this goal.

1. Mashhad green belt, green belt of trees and shrubs, which refers to the surrounding green belt, green arc or green axis within or outside the boundaries of the city will also work as a cathartic factor to clean the air.
2. Constant insistence on the use of public transport.
3. Setting up manufacturing plants outside the city.

## **6. Different Elements to be Engaged in this Project**

In this project different kinds of elements such as the following should be involved:

### **6.1. Cooperator**

Mashhad natural environmental protection organization has the responsibility of guiding this ecological plan.

### **6.2. Participants**

- The mayor of Mashhad
- The agriculture organization of Mashhad
- The traffic police of Mashhad
- The organization of Public Transport of Mashhad

Among these participants, the mayor of Mashhad has the most major role in connecting the other participants together and lead them to reach the primary goals. Besides, the traffic police of Mashhad has a considerable role in organizing the public transport and ordering the traffic. Agriculture organization organizes the restoration of green space and green belt with the help of agricultural department of Mashhad. Public transport organization encourages people to use public transport through better services, lower prices and faster travelling. Despite the problems that exist in the public transport system of Mashhad, with the integrated management of mayor desired goals can be reached.

### **6.3. Media**

- Mashhad local TV network
- Local radio Payam
- Local Khorasan newspaper
- Iranian mobile network (provide information to citizens via SMS)

These medias give enough information to Mashhad citizens in order to be aware of the project plans. So if there would be any change to the headquarters' plan the people would immediately be informed of it. Mashhad local TV network has almost one million viewers. Payam radio also has lots of listeners. A substantial majority of the listeners are taxi drivers who play an important role in informing the public. Nevertheless, there are TV and radio, Khorasan newspaper which represent a broad spectrum of readers, and therefore these have a significant role in informing the public. Also Iranian mobile network can provide information to citizens via SMS and giving a brief description of the project and their role as citizens.

### **7. Future Vision**

- Improving air quality
- Improving the quality of life in the health field
- Reducing the anxiety of people
- Reducing the noise pollution
- Increasing green areas for people's welfare
- Making traffic easier and faster
- Reducing the use of gasoline
- Making the city nicer and cleaner

The things mentioned above are the future goals of this project which can be reached easily by an organized and managed plan. The success of the project depends on the coherent and consistent cooperation of all relevant organs. Lack of cooperation in Iran is the main problem in achieving these goals.

### **8. S.W.O.T**

S.W.O.T is the analysis of the strength and the weakness points of a project and estimating the opportunities and the threats one can face during operating a project.

#### **8.1. The strength points of this project**

- The diversity and relative preservation of Mashhad landscapes (urban or rural areas).
- Different characteristics of these areas, which are reflected both in natural and cultural landscapes.



- Academic participation in international workshops and educational networks at the local level.

### **8.2. The weakness points of this project**

- Uncontrolled and unplanned construction, as settlements and infrastructure and recreational facilities in all types of landscapes, leads to vanishing of the character of the landscape (natural and cultural).
- Unplanned deforestation leading to erosion, extinction of biodiversity at all levels, the disappearance of valuable landscape elements of the structure which lead to a loss of landscape identity.
- Non-functioning mechanism of negative effects of sanctions (illegal construction and illegal dumps).
- The low level of underdevelopment and forms of participation in the planning process residents and organization.
- The low level of awareness about the quality of the landscape in which they live.

### **8.3. The opportunities for this project**

- Involved in the programs and projects of international and interregional cooperation based on the preservation, promotion and presentation of common landscape resources and landscape values.
- New trends in tourism (ecotourism, rural tourism ...), which are based on respect for the landscape (landscape) and environmental values, especially in the area of Damavand and Hezar Masjed mountains.
- NGOs interested in issues of environmental quality can be used in the function of educating and activating local communities in the planning processes.

### **8.4. The threats to this project**

- Country's economic underdevelopment and lack of financial resources for the implementation of programs and projects in the field of protection.
- Lack of education and systematic actions to activate residents in the planning and organization.
- The complexity of the process of increasing the level of awareness of the value of landscapes in which they live.

## **9. Conclusion**

In Iran, the amount of air polluting elements and their scattering reach a dangerous high level, especially in big cities. Among the cities of this country, Mashhad is different from others. Mashhad is located among Binalood mountains from one side and Hezar masjed mountains from the other side. It has 270 to 300 days of heating inversion in a year and during some periods of a year, it would be one of the dirtiest cities of Iran.

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Besides, Mashhad is considered as the second major religious city of the Muslim world. Because Imam Reza holy shrine is located there, yearly around 20 million people from different cities of Iran and other countries come to visit this holy city. So the scientific analysis and searching of air pollution status in Mashhad is a very important and unavoidable issue, in order to provide a healthy, beautiful and enjoying place for the people of Mashhad and all the others who come to visit this city from all around the world.

Based on these explanations, in this study the air polluting sources of this city was studied to analyze and measure the air pollution scattered by vehicles such as motorcycles and also applying the LEAP ( local ecological action plan) in order to reduce air pollution.

This analysis has shown that based on the direction of main winds, the main sources of air pollution are located all around the city. Besides, although the usual oil consuming for domestic and industrial usage is natural gas and the air pollution caused by natural gas is considerably less than gasoline, mazut and coil, the distribution of these sources in the center and inside Mashhad is more than the number sources out of the city. The role of these sources in Mashhad air pollution is so high especially during the cold seasons of a year that heating inversion occurs.

According to the location of Mashhad, the type of air pollution, the type of oil consuming and the direction of wind breezing are the main sources of polluting air.

Besides, the results come from air pollution measurements show that oil consuming, gasoline consuming and gas consuming vehicles, transfer in turn 8691/70, 376/62, 4642/59 tons of different kinds of polluting elements to Mashhad atmosphere.

Studies have shown that afforestation is the best way to cope with the pollution. Considering the results of this study, in order to reduce the high levels of pollution and making the air clean, increasing green areas is the most important option.

The government in cooperation with the police, decided to make a division of the cars, according to their registration number: even and odd. Cars with even numbers are permitted to move around on even days and the cars with odd numbers are permitted to move around on odd days.

Setting up manufacturing plants outside the city.

Constant insistence on the use of public transport.

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