

# Air Pollution Control In Industrialized Cities of the I.R. Iran

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Recently, some researches related to air pollution problems in large cities of the Islamic Republic of Iran have been done. Famous institutes and research centers in countries like Japan, Sweden and Germany have been in cooperation with Iranian institutes in implementing the results. Due to quick increase in the population because of peoples' migration from countryside to cities, and rate of growth in the early years after the revolution, air pollution was an important problem in I.R.Iran. Therefore, air pollution control is one of the main issues in major cities of I.R. Iran. It is the purpose of this study to investigate the control mechanisms for air pollution problems in the major industrial cities. The necessary action plans that were taken in recent years in some of the cities, which were also suggested to be taken in the other ones, are the other purpose of this study.

From the results of studies it was obtained in Iran, lots of researches are important to mention. Amongst the main activities that are done in recent years are: establishing of the meteorological research centers and atmosphere sciences; three applicator meteorological research centers and more than 40 new stations in the country; installation of newest computer systems in metrological information, using of wall map and continuous radio-traffic to announce traffic news; completing of subway construction in Tehran; forbidding of industrial activities in a definite distance away from Tehran and transferring them to suitable places; building of highways and freeways; improving of public transportation and gasifying them; developing of fuels quality and removing lead from them; and gasifying of the heating systems in houses and buildings.

Key words: Air Pollution, Control, Households, Industry, Transportation

## 1. Introduction

Islamic Republic of Iran (I.R. Iran) is located in the center of the Middle East. Because of its location, it is one of the important countries in the region. The population of I.R. Iran is over 60 millions in a surface land area of 1'648'195 kilometer squares. Seven cities of Tehran (The Capital City), Tabriz, Isfahan, Meshed, Kerman, Ahvaz and Shiraz with populations from two to twelve millions are the major industrialized ones. In recent years, these cities have faced to air pollution problems.

Population growth, rapid urbanization, growing energy needs and fossil fuel consumption, industrial development, and traffic increase are the main reasons for the air pollution problem.

Tehran as one of the metropolitan cities of I.R.Iran with populations of over twelve millions people have faced to serious air pollution problem. In addition to the mentioned factors, the geographical condition in which mountains from north to east and wind direction from west to east surround it, the pollutants are concentrated in the city and cannot naturally removed. Presence of high buildings has limited circulation of air too. So, the inversion happens especially in fall and winter seasons.

Some of the air pollutant emissions in capital cities of important Asian countries are given in figures 1 to 3. These figures indicate that total suspended particulate (TSM); SO<sub>2</sub> and NO<sub>2</sub> are

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high in most cities. It is interesting to mention that  $SO_2$  is almost two times in Tehran as compared to other capital cities <sup>6)</sup>.

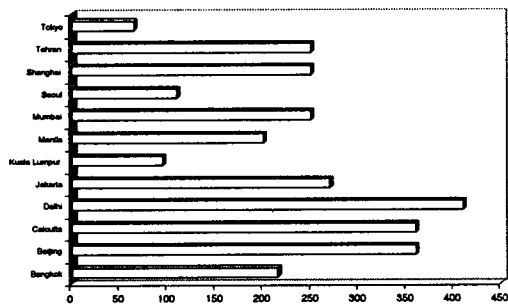


Fig. 1. TSP Concentration in the Capital Cities

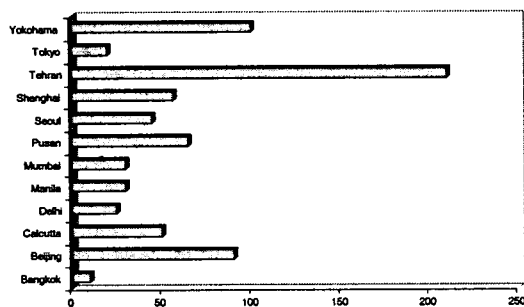


Fig. 2.  $SO_2$  Concentration in the Capital Cities

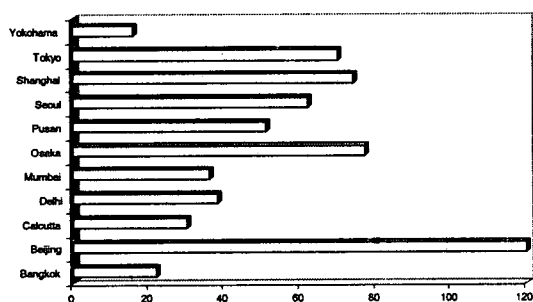


Fig. 3.  $NO_2$  Concentration in the Capital Cities

## 2. Sources of Air Pollution

The main reasons of air pollution in I.R.Iran are three polluting factors that can be divided into three categories:

- Transportation
- Industry
- Heating system of buildings and houses

The effect of each polluting source in the air pollution of Tehran is given in Table 1 <sup>1)</sup>.

Table 1 – Effect of Polluting Source in Tehran (%)

Source	Transportati	Industry	Refinery and Power Plant	Buildings and Public Services
PM-10	87.3	8.8	1.4	2.5
CO	94	4.9	0.2	0.4
NO <sub>x</sub>	29.3	41.9	17.7	11.1
SO <sub>x</sub>	3.2	64	18.1	14.7
HC	70.2	18.2	14.1	13.2
Total	71.3	2.5	5.9	4.4

### 2.1 Transportation

Transportation in I.R.Iran is divided into:

- Public
- Private
- Government and cooperative

As statistics shows, the age of automobiles in Tehran are from 10 to 22 years (average age is 15.9 years) that have an important role on air pollution. Unfortunately, the amount of fuel consumption in private cars is very high as 26 percent of them are old and consume 50 percent of total fuel. Annually, more than 15 milliard liters petrol and 6 milliard gasoline is consummated by different kinds of transport means in the country. The number of different transport means and the amount of various pollutants produced in Tehran are illustrated in Tables 2 and 3, respectively.

Table 2 – Number of Transport Means in Tehran (1996)

Kind	Number	Percent
Active automobiles	700000	59.56
Motorcycles	350000	29.78
Active and inactive buses	44260	3.77
Minibuses	4643	0.395
Taxis	23354	1.99
Other*	53000	4.5
Electric buses	66	0.006
Total	1175323	100

\*Private cars that are used as taxis

Table 3 – Produced Pollutants in Tehran (1997)

Pollutant	Tons
CO	280000
SO <sub>2</sub>	17500
PM	21000
NO <sub>x</sub>	105000
All kinds of HC	115000
Pb	More than 2000

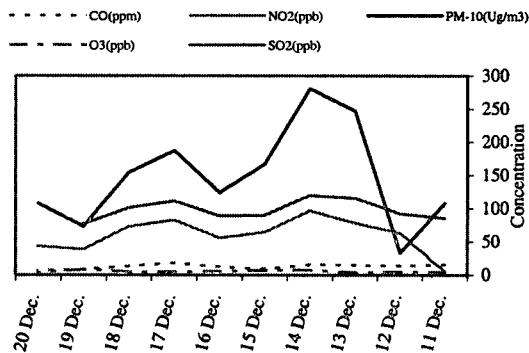


Fig. 4. Pollutants Concentration in one Station

Figure 4 indicates the pollutants concentration from 11 to 20 December in 1998 in one of the analysis station<sup>2)</sup>. Although, these results are not sufficient to show a correct view of Tehran's air pollution condition but it indicates the importance of the problems<sup>4)</sup>.

It is important to mention that since last year, lead has been removed from all petrol and all of automobiles are now using unleaded gasoline. Therefore, the amount of lead in the air is decreased tremendously. In addition, according to new governmental rules, all vehicles older than 15 years must be substituted to new ones.

## 2.2 Industry

Industries are stationary polluting sources that have less environmental effect than cars. It does not mean that they can be disregarded. Table 4 compares amount of NO<sub>x</sub> and SO<sub>x</sub> production in different industries.

In general, 30 percent of I.R.Iran industries are located in Tehran that is about 6500 units. Most of them are in west although wind direction is from west to east. So, in new management plan, establishment of industries is forbidden within the area of 120 kilometers around the city of Tehran

unless in defined industry sites. Some polluting units should be move to another suitable site, too. Sometimes, numbers of polluting industries are prevented from activities but it doesn't seem to be an effective way. It is preferred to change and improve the industrial emission to reach the acceptable air quality standards.

Table 4– NO<sub>x</sub> and SO<sub>x</sub> Production from Industries

Kind of Industry	NO <sub>x</sub>	SO <sub>x</sub>
Non metal	11.4	31.8
Wood and Paper	1.3	1.8
Food	6.1	8.1
Textile	2.3	3.1
Iron	9.9	7.3
Chemical	4.5	4.7
Others	6.4	7.2
Total	41.9	64

## 2.3 Heating systems of buildings & houses

Heating systems are another stationary polluting sources. One of the actions in recent years is installation of natural gas piping in houses especially in main and great cities that has an important role in pollutant reduction.

## 3. Present and Future Air Quality Control Action Plan

The activities which have been studied and some were completed by now are considered as present action plan. The future action plans are the ones that are studied in recent years and are expected to be completed by the year 2015:

### 3.1 Present action plan

General activities can be summarized as:

- Building of highways, bridges and sidewalks.
- Researching and cooperating with different institutes, centers and countries like Japan, Germany and Sweden.
- Implementing of more than 240 studying and researching plans in meteorology and dependent courses.
- Establishing of the first meteorological research center and atmosphere sciences, four applicator meteorological research

centers and 36 new stations in the country.

- Installation of newest computer systems in metrological information canterers.
- Using of wall map and radio-traffic to announce traffic news, continuously.
- Using of alternative fuels especially in improved engines.
- Analysis of air pollutants in different points in the main cities.
- Increasing of air pollution analysis stations for daily, weekly, seasonally and annually reports.
- Completion of subways construction in Tehran and starting its construction in the main cities like Mashad and Tabriz
- Substituting new buses to the old ones and starting to change their fuel system to use natural gas instead of gasoline <sup>3)</sup>
- Implementing limited traffic places and times in the center of Tehran that cars can't be entered from 6 am to 17 pm every day except on Thursdays and Fridays which are national weekend holidays.
- Implementing more limitation for vehicles to enter the downtown areas in pick air pollution days in Tehran.
- Implementation of different times for starting and ending of work hours in most of governmental and private administration, organizations, offices ... in different times.
- Announcing 18<sup>th</sup> of January as "Clean Air Day".
- Encouraging people to use public transportation rather than private cars.

### 3.2 Future action plan

Producing of integrated program organized based on 7 important main parts as following is another activity that must be implemented from 1997 to 2015 in Tehran. It is important to mention that these action plans are also considered to be implemented in other industrial cities.

- New transport means for major cities
- Advancing old cars with new ones
- Increasing and advancing public transportation

- Changing the fuel to the least pollution emission one
- More Technical car inspection
- Implementation of better Traffic management
- Organizing of training courses and workshops at different levels in the city

### 4. Suggestions

Solving of air pollution problem will be more important in future. Due to population increased in industrial cities in I.R.Iran<sup>5)</sup> proper management, harmony among different organization and ministries should be applied. In addition, more public participation is necessary. Finally, more educational and training programs by any means will help to overcome the air pollution problems in the major cities.

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