Influencing factors on air pollution in Ahwaz

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Abstract

The city of Ahwaz is one of the biggest cities in Iran, capital of Khuzestan province, situated on both sides of Karoon river, with a population of one million. The climate of this city, during most seasons, particularly summer, is very hot and humid reaching 50-55 degrees centigrade. According to environmental studies, the climate is very polluted, so much so that Ahwaz is among the high-risk cities.

A number of factors affect the pollution. In this study an attempt has been made to identify and to some extent, determine the range of some of these factors.

In fact, unusual development and growth of the city, undesired placement of heavy industries, such as iron and steel plants, airport, and exploration of Oil wells in a nearby city, in addition to heavy traffic and number of small polluting factories operating inside the city, have made the city like an island of heat and pollution. Fuel is the other important factor, which is to be considered.

It seems, studies on transportation phenomena suffer from lack of continuity and enough mutual understanding.

In this study some practical and scientific solutions, are suggested, in order to reduce the pollution in this city.

1 Introduction

Effects on human health and an increase in mortality levels caused by air pollution have been described extensively in international literature. In fact, pollutant levels are very often influenced from local variables (composition and maintenance level of vehicles running in the town, driver behavior, particular weather conditions of the town) and difficult to be estimated or modeled by analytical formulas.
2 Problem dimensions

Combustion of transportation fuels releases several contaminants into the atmosphere, including carbon monoxide, hydrocarbons, oxides of nitrogen, and lead and other particulate matter. Hydrocarbons, of which more than 200 have been detected in exhaust emissions, are the result of incomplete combustion of fuel.

Particulate are minute solid or liquid particles that are suspended in the atmosphere; they are aerosols, smoke, and dust particles. Photochemical smog is the result of complex chemical reactions of oxides of nitrogen and hydrocarbons in the presence of sunlight. [1]

3 Background of the air pollution by traffic

Atmospheric pollution is a major problem facing all nations of the world. Rapid urban and industrial growth has resulted in vast quantities of potentially harmful waste being released into the atmosphere. [2]

In fact, pollutant levels are very often influenced by local variables (composition and maintenance level of vehicles running in the town, driver behavior, particular weather condition of the town) difficult to be estimated or modeled by analytical formulas. [3]

It is evident that cross roads represent critical one for car traffic, in fact there are a lot of concomitant situations that contribute in significant raising of polluting emissions, that is: condition of engine deceleration rate when car is arriving near cross roads, condition of engine bottom gear for stops originated by queues or “red” phase of traffic lights, condition of engine pick-up rate during start again phases. [4]

4 Ahwaz city

Khuzistan province (64,664 km²) is located in the southwest part of Iran. This province contains 13 townships, 24 cites and 30 towns and 113 villages.

Ahwaz City is fifth largest city in the Iran in terms of population, populations growth of Ahwaz city and khuzistan province is very high. [5]

<table>
<thead>
<tr>
<th>Year</th>
<th>Ahwaz</th>
<th>Kh – Province</th>
</tr>
</thead>
<tbody>
<tr>
<td>1956</td>
<td>120000</td>
<td>1278000</td>
</tr>
<tr>
<td>1966</td>
<td>200375</td>
<td>1707000</td>
</tr>
<tr>
<td>1976</td>
<td>334399</td>
<td>2187118</td>
</tr>
<tr>
<td>1986</td>
<td>619966</td>
<td>2681978</td>
</tr>
<tr>
<td>2000</td>
<td>1000000</td>
<td>3242519</td>
</tr>
</tbody>
</table>

Ahwaz city (220 km² in area), owing to its characteristics was designated as the center of agricultural and industrial poles. The establishment of heavy industry, power plants, oil and gas industries and agri-industrial company of sugar can have brought back its former importance.
The maximum temperature in summer (Apr-Oct), reaches 52 degree of centigrade. Industrial activities dominated the economy of the region until now. A usual practice was the installation of industrial plants close to residential areas, so neighborhood complaints were very frequent and, in several cases, there were situations of health risks.

Still there is much work to do, especially in relation to transportation related sources. Another important point is that in the city of Ahwaz there is a strong heat island effect, an increase of air temperature in the most dense urban area of about 12 degrees centigrade in relation to neighboring rural areas. The heat island is strongly related to areas where pollution levels are higher.

Ahwaz size and layout have also created environmental problems such as traffic congestion, air and noise pollution. Many government departments are located in the center of the city.

Wind direction and velocity is considered as decisive factors on pollution spreading.

5 Transportation systems and study trips

The investigation of origin-destination studies shows that nearly 28% of the total urban movement (trips) were carried by bus. Transportation system. Bus system is regarded as the main system of the city transportation.

According to the origin-destination results, the total daily trips made are equal to 1,800,000 trips. Table (1) show the rate of trip generation and trip attraction of different traffic areas.

Table 1: No of trips

<table>
<thead>
<tr>
<th>Type of system</th>
<th>P.Car</th>
<th>Taxi</th>
<th>M.Bus</th>
<th>Bus</th>
<th>Motor-bic</th>
<th>bicycle</th>
<th>Walk and others</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of trips</td>
<td>265646</td>
<td>324323</td>
<td>111380</td>
<td>531454</td>
<td>69248</td>
<td>56945</td>
<td>573385</td>
<td>1,800,000</td>
</tr>
<tr>
<td>Percen tags</td>
<td>13.75</td>
<td>16.78</td>
<td>5.76</td>
<td>27.5</td>
<td>3.58</td>
<td>2.95</td>
<td>29.64</td>
<td>100%</td>
</tr>
</tbody>
</table>

6 Air pollution in Ahwaz city

Still there is much work to do especially in relation to transportation related and others sources. Air quality management in Ahwaz started-based upon air quality standards and in emission standards for stationary sources, present day standards are shown in table (2)
Table 2: Iranian national air quality standards (μg / m^3)

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Primary standard</th>
<th>Secondary standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon monoxide</td>
<td>20,000 (1-hour average) 10,000 (8-hours)</td>
<td>same as primary</td>
</tr>
<tr>
<td>Nitrogen dioxide</td>
<td>100 (annual mean)</td>
<td>100 (annual mean)</td>
</tr>
<tr>
<td>Sulfur dioxide</td>
<td>365 (24 hours average) 80 (annual mean)</td>
<td>260 (24 hours average) 40 (annual mean)</td>
</tr>
<tr>
<td>Hydro carbon</td>
<td>160 (3 hours max) (6-9 A.M)</td>
<td>Same as primary</td>
</tr>
<tr>
<td>Suspended particles</td>
<td>75 (annual mean) 260 (24 hours max)</td>
<td>60 (annual mean) 150 (24 hours max)</td>
</tr>
<tr>
<td>Photochemical Dioxide</td>
<td>160 (1 hours max)</td>
<td>Same as primary</td>
</tr>
</tbody>
</table>

Table (3) show the inventory of emissions from mobile and industries sources in Ahwaz in 2000.

Table 3: Emissions in Ahwaz City kg/day

<table>
<thead>
<tr>
<th>Source Type</th>
<th>CO</th>
<th>HC</th>
<th>NOX</th>
<th>SOX</th>
<th>Particles</th>
</tr>
</thead>
<tbody>
<tr>
<td>P.Car</td>
<td>464877</td>
<td>1993</td>
<td>17931</td>
<td>8367</td>
<td>1593</td>
</tr>
<tr>
<td>Taxi</td>
<td>23625</td>
<td>102</td>
<td>912</td>
<td>4253</td>
<td>87</td>
</tr>
<tr>
<td>M.Bus</td>
<td>260</td>
<td>605</td>
<td>972</td>
<td>792</td>
<td>476</td>
</tr>
<tr>
<td>Bus</td>
<td>333</td>
<td>565</td>
<td>908</td>
<td>739</td>
<td>444</td>
</tr>
<tr>
<td>Motor. Bic</td>
<td>60550</td>
<td>259</td>
<td>2335</td>
<td>10899</td>
<td>225</td>
</tr>
<tr>
<td>Total</td>
<td>551945</td>
<td>3524</td>
<td>23058</td>
<td>100360</td>
<td>3616</td>
</tr>
</tbody>
</table>

Table 4: Emissions in Ahwaz City due to industries kg/year

<table>
<thead>
<tr>
<th>Process of production</th>
<th>CO</th>
<th>HC</th>
<th>NOX</th>
<th>SOX</th>
<th>Particles</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>121.8×106</td>
<td></td>
<td></td>
<td></td>
<td>10309124</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Combustion of fuel</th>
<th>CO</th>
<th>HC</th>
<th>NOX</th>
<th>SOX</th>
<th>Particles</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>330451</td>
<td>2281987</td>
<td>2956854</td>
<td>4695633</td>
<td>275906</td>
</tr>
</tbody>
</table>

Parameter includes CO, HC, NOX, SOX and particles can be compared to the national standards of air quality in order to define control strategies. Other factors that influence the air pollution of Ahwaz city are as follows: 1- Existence of much oil wells in the vicinity of the city.
2- Existence of two black carbon factories in addition to the pipe factory of the Iranian national oil company inside the city.

3- High temperatures in warm seasons

4- Consumption of fuels such as gas oil and oil at major workshops inside the city.

5- In correct utilization of landuse that leads to increase of travel concentrations at particular regions of the city.

6- Passage of khorrampshahr and Bandere-emam trains through the city

7- Location of steel industries in the vicinity of the city.

8- Severe lack of grasses and trees inside the city.

9- Oldness and wear of the main transportation vehicles in the city.

10- Low speed of the traffic flow in the city.

7 Recommendations

1- Changing land utilization, by a long-term plan.

2- Imposing a controlled traffic area, a few hours of each day over C.B.D

3- Inavgurtion of light rail transit system

4- Regular technical examination of cars.

5- Reinforcement of public transportation systems.

6- Increasing traffic flow speed by imposing provisions.

7- Father studies on bicycle and pedestrian transportation.

8- Teaching driving provisions along with appropriate law imposing mechanisms.

9-

10- Increasing green areas up to the standard level.

11- Omittion of lead from gasoline.

12- Using gas-consuming engines.

8 Conclusions

The evaluation of air quality in Ahwaz area is very important and related to human and economic activities, as well as to meteorological conditions. Data above-mentioned show that air pollution control programs were not effective.

Unfortunately there are not surveys about disease due to air pollution in Ahwaz. Still there is much work to do far this problem.

The variation of the traffic management structure, the increase of the general transportation vehicles and the study and execution of light rail transit.

References


[3] S.Amoroso and M.Migliove, Neural networks to estimate pollutant levels in canyon roads, seventh international conference on urban transportation and the


[5] Population and housing censuses selected years plan and budget organization, Iran. 1998