

## *Analysis of Pollutions Resulted from Jobs in Isfahan*

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### **Introduction**

Mankind is increasingly being submitted to an unnatural life style in an environment harmful to his health. The result is not only illness and stress but also socio-economic problems. Urban areas, by their nature as centers of population and economic activity are subject to a wide range of pollutants. The health effects of these pollutants among which are carcinogens include respiratory diseases and eye and skin irritation. In addition, they erode man-made environments and damage natural environments. Most air pollutants stem from three sources: industry, motor vehicles and the burning fossil fuels for heat or electricity generation. The contribution of industrial sources to air pollution varies considerably from one town to another, depending on the accumulation and type of industries in an area.

60% of the world's population lives in urban environments. As cities are the centers producing the greatest pollution, residents of these cities are in fact the first victims. Urban environmental problems are related to two factors: first the uncontrolled pressure put on the environment by many of the activities concentrated in the cities; second the spatial arrangement of our urban areas.

Environmental health problems need to be treated not only in a regional level but also in an international integrating level, as in many cases their effects create imbalances elsewhere. Some chemicals can be seen in the air or have a smell; others can harm people without any odor or visible sign. Often, workers get used to the smell of chemicals and can not detect them even at high levels. Direct chemical contamination can occur from badly designed hazardous waste sites or from industrial sites. We need to find out what chemicals are being used in our workplaces and become familiar with their potential hazards.

Major urban air pollutants can also give rise to significant respiratory morbidity. Air pollutants are usually classified into suspended particular matter (dusts, mists and smokes); gaseous pollutant (gases and vapors); and odors. Outdoor air pollution is caused mainly by the combustion of petroleum products or coal by motor vehicles, industry and power stations. Workplace is another important source of air pollution exposure. Emissions and disposal of pollutants have local, regional and global effects on ecosystems, from roadside lead pollution to regional acid rain and global climate change.

In this paper, various inconveniences and pollutions -including: air pollution, disturbing noise, causing tremble, refuse aggregation, and chemical contamination- resulted from jobs in Isfahan city has been analyzed. The jobs or workplaces which have been surveyed are as follows: carwash, smithy, tableau making, ironware store, dairy shop, aluminum workshop, motorcycle service station, engraving workshop, electric repair shop, car body rebuild shop, bag & shoes manufacture, metal manufactures, dry cleaners, confectionery, welding workshop, clinic, fowl & fish shop, furniture repair shop, door & window manufactures, butchery, foundry, fruit & vegetable market, battery cell manufacture, carpenter's workshop, car oil replacement, cabinet & canal making, and car repair shop.

### **Materials & Methods**

The method of this research is analytic-causal. Required data has been gathered by field work. Arranging the priorities of the jobs has been determined through Analytic Hierarchy Process (AHP).

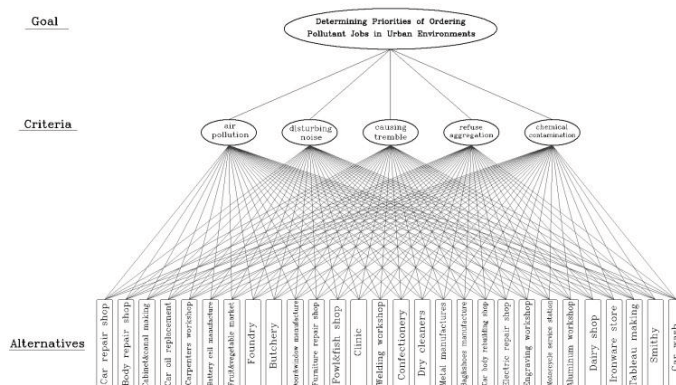
The Analytic Hierarchy Process (AHP) is a theory of measurement through pair wise comparisons and relies on the judgments of experts to derive priority scales. It is these scales that measure intangibles in relative terms. The comparisons are made using a scale of absolute judgments that represents “how much more” one element dominates another with respect to a given attribute. The derived priority scales are synthesized by multiplying them by the priority of their parent nodes and adding for all such nodes.

**Discussion of Results**

To make a decision in an organized way to generate priorities we decomposed the decision into the following steps:

Defining the problem and determining the kind of knowledge sought: in this study the defined problem is the pollution and inconveniences resulted from various jobs in Isfahan city, and our aim is to compare these jobs with respect to each and all kinds of pollutions and inconveniences. Subsequently, we want to find out what jobs or workplaces are in a worse condition so as to determine ordering priorities.

Structuring the decision hierarchy from the top with the goal of decision, then the objectives from a broad perspective, through the intermediate levels (criteria on which subsequent elements depend) to the lowest level (which usually is a set of alternatives): in this hierarchy structure, our goal is to determine the priorities of arranging pollutant jobs in urban environments. In the next level, criteria are pollutions and inconveniences including air pollution, disturbing noises, tremble making, refuse aggregation and chemical contamination; various jobs and workplaces –as previously mentioned- shape the lowest level of the hierarchy structure. (Fig. 1)



**Fig. 1: Hierarchy structure of determining ordering priorities of pollutant jobs in Isfahan city**

Ranking and ratings of the criteria: This ranking method is used when the number of alternatives is sizable. To make comparisons, we need a scale of numbers that indicates how many times the importance or dominance of one element is more than the other one with respect to the criterion compared. Table 1 exhibits the scale, and Table 2 shows the pair wise comparison matrix of the criteria with respect to the goal.

**Table 1: The fundamental scale of absolute numbers**

| Intensity of Importance | Definition                             |
|-------------------------|--|
| 1                       | Equal Importance                       |
| 2                       | Weak or slight                         |
| 3                       | Moderate importance                    |
| 4                       | Moderate plus                          |
| 5                       | Strong importance                      |
| 6                       | Strong plus                            |
| 7                       | Very strong or demonstrated importance |
| 8                       | Very, very strong                      |
| 9                       | Extreme importance                     |

**Table 2: Pair wise comparison matrix of the criteria with respect to the goal**

|                        | <b>chemical contamination</b> | <b>refuse aggregation</b> | <b>causing tremble</b> | <b>disturbing noise</b> | <b>air pollution</b> | <b>Priorities</b> |
|------------------------|-------------------------------|---------------------------|------------------------|-------------------------|----------------------|-------------------|
| chemical contamination | 1                             | 7                         | 5                      | 3                       | 2                    | 0.442             |
| refuse aggregation     | 1/7                           | 1                         | 1/2                    | 1/4                     | 1/5                  | 0.049             |
| causing tremble        | 1/5                           | 2                         | 1                      | 1/2                     | 1/3                  | 0.088             |
| disturbing noise       | 1/3                           | 4                         | 2                      | 1                       | 1/2                  | 0.161             |
| air pollution          | 1/2                           | 5                         | 3                      | 2                       | 1                    | 0.260             |

Rating categories of criteria was established; then, these categories were prioritized by pair-wise comparing. Alternatives were evaluated by selecting the appropriate rating category on each criterion. The rating categories for all criteria and their priorities are given in table 3.

**Table 3: Deriving priorities for ratings**

| <b>N (Number of pollutant jobs)</b> | <b>Priorities</b> |
|-------------------------------------|-------------------|
| $300 \leq N$                        | 0.344             |
| $200 \leq N < 300$                  | 0.233             |
| $100 \leq N < 200$                  | 0.160             |
| $80 \leq N < 100$                   | 0.096             |
| $60 \leq N < 80$                    | 0.071             |
| $40 \leq N < 60$                    | 0.050             |
| $20 \leq N < 40$                    | 0.034             |
| $N < 20$                            | 0.022             |

Calculating final weight of jobs with respect to all kinds of studied pollutions and inconveniences:

**Conclusions**

Final scores of jobs have been calculated through synthesizing the preference value of the criteria and ratings of the jobs. These final scores are given in table 4.

The result of this study considering all studied kinds of pollutant activities has shown that activities such as car repair shop, body repair shop, cabinet and canal making, replacement of car oil, carpentry, making battery, fruit and vegetable market, and grinding are of worse condition among all; so, they are proposed as the first priorities for pollution control planning in Isfahan city.

**Table 4: Final weigh of jobs in respect of all kinds of studied pollutions and inconveniences**

|                            |              |                            |              |
|----------------------------|--------------|----------------------------|--------------|
| <b>car repair shop</b>     | <b>0.230</b> | <b>confectionery</b>       | <b>0.075</b> |
| body repair shop           | 0.162        | dry cleaners               | 0.075        |
| Cabinet & canal making     | 0.162        | metal manufactures         | 0.073        |
| car oil replacement        | 0.138        | bag & shoes manufacture    | 0.073        |
| carpenter's workshop       | 0.132        | car body rebuild shop      | 0.072        |
| Battery cell manufacture   | 0.131        | Electric repair shop       | 0.072        |
| fruit & vegetable market   | 0.112        | engraving workshop         | 0.072        |
| foundry                    | 0.107        | motorcycle service station | 0.072        |
| butchery                   | 0.092        | aluminum workshop          | 0.072        |
| door & window manufactures | 0.090        | dairy shop                 | 0.066        |
| furniture repair shop      | 0.090        | ironware store             | 0.066        |
| fowl & fish shop           | 0.087        | Tableau making             | 0.066        |
| Clinic                     | 0.086        | Smithy                     | 0.066        |
| welding workshop           | 0.081        | carwash                    | 0.066        |

**Key words**

Pollution, Pollutant jobs and workplaces, Order, Analytic Hierarchy Process (AHP)