ASSESSMENT OF ENVIRONMENTAL IMPACT WITH REFERENCE TO AIR POLLUTION OF SIPCOT INDUSTRIAL REGION, TAMIL NADU, INDIA.

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Abstract
This study attempts to examine the nature and causes of environmental degradation on account of developmental programmes specially industrial activities. The SIPCOT Industrial Complex viz Narasingapuram, Navalpur and Puliyankannu of Ranipet, Vellore district have been selected for the present study of Air pollution and its impact on environment and to the residents of that region. The identified reasons, causes, effects and consequences of environmental degradation are correlated with the socio-economic status of the respondents and thereby an analytical orientation to this study is attempted. Thus this study is partly exploratory in nature and partly analytical in nature. The survey of 10 per cent households from each village are selected for the present study. In total 524 households are surveyed from the three villages. The data collection was done in the month of December 2008. The collected data are classified and tabulated with the help of computer programming, and cross tabulation on the basis of putting socio-economic variables with dependent variables. Chi-square test is applied to test the hypothesis particularly to study the difference between socio-economic status and respondents’ views, perceptions, realization to air pollution with reference to environmental degradation. The suitable simple statistical techniques was adopted to illustrate the results of analysis and suitable recommendations are given according to the findings.

Keywords: Environmental degradation, SIPCOT, Air pollution and Ranipet.

INTRODUCTION

The word “environment” refers to surroundings – the context within which we exist. For humankind, the term 'environment' means, on a broad scale the biosphere (Koji, Tsunokawa & Christopher Hobanj 1997). Every day, earth becomes more and more polluted. Air pollution fills our lungs with harmful substances that deteriorate our health and longevity. Water pollution is rapidly delimiting what little freshwater we have left. Over land pollution is changing the once-fertile lands to turn deserts.

This study attempts to examine the nature and causes of environmental degradation due to the developmental activities of the various agents. Industrial development leads to multiplier effects, such as displacement, relocation and changes in population density and the resultant socio-economic consequences. Environmental degradation however depends on the nature of the industrial development projects and the technology which involved its size, location and the time taken to implement them. All industrial projects need not be taken as producers of equal beneficial or negative results. Some industries produce only beneficial results only with limited adverse impact. In contrast some produce adverse living conditions but benefits economically also. The negative impact of industrial activity is mainly in the form of environmental degradation which adversely affect the health and welfare of the people. Environmental impact can be either short term or on long term. The impact on construction noise, dust, traffic disruption, air pollution, water pollution, deforestation, trees, displacement of people, shifting of business is short term in nature. The impact of pollution caused by poor drainage infrastructural facilities, overcrowding, disruption of social cohesion, changes in cultural values, changes in economic structure and changes in climatic conditions will be prolonged in long run.

Industrialization and urbanization have resulted in the deterioration of India’s air quality. Of the 3 million premature deaths that occur every year in the world due to outdoor and indoor...
air pollution, the highest number is in India. According to the World Health Organization (1996), New Delhi is one of the top ten most polluted cities in the world. Surveys indicate that in New Delhi the incidents of respiratory diseases due to air pollution is about 12 times the national average. According to another study, while India’s gross domestic product has increased 2.5 times over the past two decades; vehicular pollution has increased eight times, while pollution from industries has quadrupled.

**Profile of SIPCOT industry in Ranipet**

In Ranipet State Industries Promotion Corporations of Tamil Nadu (SIPCOT) Limited was established in the year 1972. These industries are fully government owned premier institutions. SIPCOT Industry catalyses development of small, medium and large scale industries in Tamil Nadu. The study area is situated in Ranipet town of Vellore district.

There are 16 industrial complexes in overall Tamil Nadu at Bargur, Cheyyar, Cuddalore, Gangai kondan, Gummidipoondi, Hosur, Irungattukottai, Manamadurai, Nilakkottai, Oragadam, Perundurai, Pudukkottai, Ranipet, Siruseri, Sriperumputthur, and Thothukudi. In Ranipet majority of the industries are leather and chemical industries. These industries are highly polluting the villages where they are located.

The Industrial complex / park in Ranipet is in three phases. SIPCOT Complex is spread over viz., 730, 133.13 and 496 acres. Over all scalable area is 578, 112 and 380 acres. There is no free land available for allotment as on 2007. The cost of land is Rs. 7 lakhs / per acre.

This industrial complex is connected by Chennai – Bangalore Highway (NH-4). The nearest Railway station is Mukundarayapuram. The nearest Airport is Chennai. Ranipet, one of the fastest growing areas in Vellore district, Tamil Nadu, was selected as the study area for this research. Ranipet is well known for its Leather and Chemical Industries and as a center for export for leather products. In Ranipet there are 155 industrial complexes in SIPCOT industrial area.

**Table 1** Detailed Information of SIPCOT Industrial Region

<table>
<thead>
<tr>
<th>SI. No</th>
<th>Particulars</th>
<th>No of Industries</th>
<th>No of Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Leather Industries</td>
<td>64</td>
<td>97.799</td>
</tr>
<tr>
<td>2</td>
<td>Chemical Industries</td>
<td>32</td>
<td>206.086</td>
</tr>
<tr>
<td>3</td>
<td>Steel Industries</td>
<td>14</td>
<td>66.086</td>
</tr>
<tr>
<td>4</td>
<td>Oil Industries</td>
<td>5</td>
<td>9.075</td>
</tr>
<tr>
<td>5</td>
<td>Fabrication Industries</td>
<td>5</td>
<td>17.073</td>
</tr>
<tr>
<td>6</td>
<td>Automobile Industries</td>
<td>4</td>
<td>6.074</td>
</tr>
<tr>
<td>7</td>
<td>Wood Industries</td>
<td>2</td>
<td>1.000</td>
</tr>
<tr>
<td>8</td>
<td>Paper Industries</td>
<td>2</td>
<td>5.026</td>
</tr>
<tr>
<td>9</td>
<td>Dispensary</td>
<td>3</td>
<td>9.086</td>
</tr>
<tr>
<td>10</td>
<td>Veterinary and Preventive Institution</td>
<td>1</td>
<td>2.011</td>
</tr>
<tr>
<td>11</td>
<td>Effluent Treatment Plant</td>
<td>3</td>
<td>2.052</td>
</tr>
<tr>
<td>12</td>
<td>Effluent Pump House</td>
<td>1</td>
<td>0.006</td>
</tr>
<tr>
<td>13</td>
<td>Others</td>
<td>16</td>
<td>303.593</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>155</strong></td>
<td><strong>724.247</strong></td>
</tr>
</tbody>
</table>

Source: Computed

**Statement of the problem**

This study aims at analyzing the status of environmental degradation and its consequence on group conflict by making an experiment of three villages viz Narasingapuram, Navalpur and Puliyankannu around the Vellore SIPCOT region. The rationale behind the undertaking the present study is a lift from the following facts.

There are a number of polluting industries in SIPCOT Vellore region and study villages are included under the range of the industries. Hence, one may notice a number of impacts of these industries on various aspects of life of the indigenous people and local community. Usually development of industries leads to both positive effects as well as negative effects. The positive effects may
be in the form of employment generation, increase in income in the hands of local people, activity diversification, business diversification, increase in overall condition of living, development of subsidiary occupation and so on. The analysis of respondents’ views on measure to solve conflicts between local people and factory management and between local people and government with respect to prevention and control of pollution is one of the aspects of the present study.

The occurrence of air pollution is a common problem in any industry. Anyone can realize the effects of air pollution in SIPCOT industrial area when they cross over the area by bus. The air pollution may have various adverse effects on local people. Hence, the researchers decided to take up the study on “Assessment of environmental impact with reference to air pollution of SIPCOT industrial region, Tamilnadu, India”.

Objectives of the study

Based on the research issues, the following objectives were drawn:

1) To assess the impact of SIPCOT industrial pollution in the surveyed regions.
2) To analyse the air pollution by SIPCOT industries and the effects of the air pollution in the surveyed region.
3) To study the health hazards faced by the respondents due to air pollution in the study region.
4) To suggest remedial measures (strategies)

Hypothesis

The few hypotheses were drawn to test with the help of appropriate statistical tools. The hypotheses are as follows

1) Air pollution has affected the surveyed population significantly and the severity of the pollution differs according to the nearness of the people to the SIPCOT in the surveyed region.
2) The socio economic characteristics of the respondent in the SIPCOT area differ in the intensity of effect of the diseases with reference to the impact of air pollution.

Limitations of the study

In this study environmental pollution is assessed from the point of view of social sciences are not in the way of physical sciences in testing the extent of pollution in land, water and in air since it does not fall under the purview of social sciences. This study is conducted only in Vellore SIPCOT region and it is not conducted in the remaining SIPCOT industrial areas throughout the state of Tamilnadu because the study of all areas are not possible at the level of an individual researcher, due to constraints of money, time, energy and efforts.

REVIEW OF LITERATURE

The researchers have analyzed different relevant study to apply the need of the study area, which gave an idea to select a method and approach for the chosen study area.

The study conducted in China, Based on satellite observations and chemical transport models reveals the fact that the Eastern China has the highest concentrations of airborne fine particulate matter (PM2.5) (Van Donkelaar et al., 2010) and vertical column densities (VCD) of tropo10 spheric NO2 (Richter et al., 2005) in the world. Serious air pollution has caused huge public health hazards particularly in mega cities (Parrish and Zhu, 2009) and has also threatened ecosystems. The highest acidity of precipitation in the world has been observed in South and Southwest China (Larssen et al., 2006).

Researchers are currently investigating the importance of the size and chemical composition of particles as a causal factor for cardio respiratory effects (Brunekreef and Holgate, 2002). The focus is now on the very small particles; PM2.5 and PM1 (i.e., particles smaller than 2.5 μm or 1 μm, respectively). As very small particles penetrate further into lungs than larger particles, they are believed to be more strongly associated with adverse health effects. Diesel engine emissions contribute disproportionately to the very-small-particle fraction of urban air pollution (WHO, 1996).

The recent documentation of lung cancer as an effect of long-term exposure to urban air pollution (Pope et al., 2002) highlights carcinogenic chemicals in the smallest air particles and in carcinogenic gases (e.g., benzene; benz [a] pyrene) as possible causal agents. Carbon dioxide (CO2), another air pollutant created by fuel combustion, has no direct health effects at the concentrations occurring in the ambient environment. However, it is the main ‘greenhouse gas’ causing global climate change (McMichael et al., 1996) and, as such, indirectly contributes to the global health impact of such change. Efforts to reduce urban air pollution by reducing the use of Automobiles would have the added benefit of reducing CO2 emissions.
There is an increasing concern about the hazardous effects of atmospheric pollutants on humans and other living organisms in populated areas (Freitas et al., 2010; Garcia et al., 2011). However, recently epidemiological studies have pointed out that airborne particulates containing toxic components, such as heavy metals, are of special concern due to numerous health effects (Mavroidis and Chaloulakou, 2010).

The urban population is exposed to the airborne toxic metals that often are well above natural background levels (Shridhar et al., 2010). Many monitoring programs on atmospheric particulate matter have been conducted in several parts of the world which showed diverse fluctuations and disparities among the trace element constituents (Gupta et al., 2007; Ayrault et al., 2010).

**RESERACH DESIGN**

The three villages around the SIPCOT industrial complex viz Narasingapuram, Navalpur and Puliyankannu have been selected for the present study. To identify reasons, causes, effects and consequences of environmental degradation are correlated with the socio-economic status of the respondents and thereby it gives analytical orientation to this study. Thus this study is partly exploratory in nature and partly analytical in nature.

For the survey, 10 per cent households from each village are selected for the present study. The household represents sampling unit where 182 households from Narasingapuram village, 167 households from Navalpur village and 175 household from Puliyankannu village. In total 524 households are surveyed from the three villages.

**Sampling Design**

![Sampling Design Diagram]

The relevant data are collected from the respondents by employing a well structured interview schedule. The researcher has visited each household in their village and thereby collected relevant data from them by establishing a good rapport with them. The data collection was done in the month of December 2008.

The collected data are classified and tabulated with the help of computer programming, cross tabulation is also made on the basis of putting socio-economic variables with dependent variables. Chi-square test is applied to test the hypothesis particularly to study the difference between socio-economic status and respondents’ views, perceptions, realization and so on various aspects of environmental degradation.

It is written as

\[ \chi^2 = \sum \frac{(O - E)^2}{E} \]

Where

- \( O \) = observed frequencies
- \( E \) = expected frequencies

The general data interpretation takes place with the help of percentage analysis. Diagrammatic and graphical representation is also made depending on the requirement of the situation.

**ANALYSIS OF THE STUDY**

The socio economic profile of the respondent in the SIPCOT area in Vellore District. The impact of air pollution was analyzed and it is shown in the following.
Data presented in table (2) indicate the Caste-wise respondents’ ways of realization air pollution on consequence of SIPCOT industrial activities. It could be noted that out of the total 524 respondents 17.4 per cent of them realize the presence of air pollution in the form of bad odour and 36.3 per cent of them observe it in the form of fatigue and headache. Out of the total 524 respondents 24.6 per cent of them feel eye itching on consequence of air pollution and the rest of them realize it is air forms such as bad odour, Fatigue, headache and eye itching. The case-wise analysis reveals the following facts. A more than half of the most backward caste respondents (56.9%) realize the air pollution in terms of fatigue and head ache and a considerable level of backward caste (36.2%) and scheduled caste (33.5%) respondents realize it eye itching. A more than two-third of the forward caste respondents realizes it in terms of bad odour, fatigue, headache and eye itching.

It could be seen clearly from this discussion that the occurrence of fatigue and headache on consequence of air pollution takes first in order of reporting in the study notably among the most backward caste respondents, eye itching second and bad odour the last. In general forward caste respondents suffer of all problems of air pollution in the study area.

### Table (3) Occupation-wise Respondents’ Views on Air Pollution

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Bad Odour</th>
<th>Fatigue and Headache</th>
<th>Eye Itching</th>
<th>All</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>55 (41.7)</td>
<td>34 (25.8)</td>
<td>14 (10.6)</td>
<td>29  (21.9)</td>
<td>132 (100)</td>
</tr>
<tr>
<td>Business</td>
<td>6 (15.4)</td>
<td>7 (17.9)</td>
<td>5 (12.8)</td>
<td>21  (53.9)</td>
<td>39  (100)</td>
</tr>
<tr>
<td>Govt. Employees</td>
<td>5 (11.4)</td>
<td>6 (13.6)</td>
<td>8 (18.3)</td>
<td>25  (56.8)</td>
<td>44  (100)</td>
</tr>
<tr>
<td>Industrial Employees</td>
<td>8 (5.6)</td>
<td>41 (28.7)</td>
<td>76 (53.1)</td>
<td>18  (12.6)</td>
<td>143 (100)</td>
</tr>
<tr>
<td>Wage Labour</td>
<td>17 (10.2)</td>
<td>162 (61.4)</td>
<td>26 (15.7)</td>
<td>21  (12.7)</td>
<td>166 (100)</td>
</tr>
<tr>
<td><strong>Total(%)</strong></td>
<td><strong>17.4</strong></td>
<td><strong>36.6</strong></td>
<td><strong>24.6</strong></td>
<td><strong>21.7</strong></td>
<td><strong>(100)</strong></td>
</tr>
</tbody>
</table>

Source: Computed : Figures in parentheses denote percentage to row total
The above table (3) presents data on the occupation-wise respondent’s realization of air pollution. A agriculturists (41.7%) realize the problem of air pollution in terms of bad odour. A vast majority of the wage labourers (61.4%) visualize it is the form fatigue and headache and eye itching as per the views a more than half of (53.1%) the industrial employees. A more than half of the business group (53.8%) and government employee group (56.8%) respondents realize the air pollution in the form of bad odour, fatigue headache and eye itching.

It could be seen clearly from this discussion that the respondents of business group and government employee group suffer in various ways on consequence of air pollution. Eye itching is a common problem among the industrial employees and it is fatigue and headache among the wage labourers.

**Table (4) Education level-wise Respondents’ Views on Air Pollution**

<table>
<thead>
<tr>
<th>Education Level</th>
<th>Bad Odour</th>
<th>Fatigue and Headache</th>
<th>Eye Itching</th>
<th>All</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illiterate</td>
<td>16 (21.0)</td>
<td>44 (57.9)</td>
<td>10 (13.2)</td>
<td>6 (7.9)</td>
<td>76 (100)</td>
</tr>
<tr>
<td>Primary</td>
<td>18 (9.8)</td>
<td>96 (52.5)</td>
<td>57 (31.1)</td>
<td>12 (6.6)</td>
<td>183 (100)</td>
</tr>
<tr>
<td>Secondary</td>
<td>39 (24.8)</td>
<td>28 (17.8)</td>
<td>40 (25.5)</td>
<td>50 (31.9)</td>
<td>157 (100)</td>
</tr>
<tr>
<td>Undergraduate</td>
<td>10 (15.1)</td>
<td>12 (18.2)</td>
<td>10 (15.2)</td>
<td>34 (51.5)</td>
<td>66 (100)</td>
</tr>
<tr>
<td>Technical</td>
<td>8 (19.0)</td>
<td>10 (23.8)</td>
<td>12 (28.6)</td>
<td>12 (28.6)</td>
<td>42 (100)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>91 (17.4)</td>
<td>190 (36.3)</td>
<td>129 (24.2)</td>
<td>114 (21.7)</td>
<td>524 (100)</td>
</tr>
</tbody>
</table>

*Source: Computed: Figures in parentheses denote percentage to row total*

The above table (4) presents data on the education level-wise respondents realization of air pollution. It could be noted that more than half of the respondents of illiterate group (57.9%) and primary level educated (52.5%) realize the problem of air pollution in the form of occurrence of fatigue and headache. The majority of the undergraduate level educated (51.8%) realize it in various forms viz. bad odour, fatigue, headache and eye itching and it is considerable among the respondents of secondary level educated (31.8%) and respondents with technical education (28.6%).

It could be seen clearly from this discussion that illiterate and primary level educated mainly realize the problem of air pollution in terms of occurrence of fatigue and headache.
Table (5) Income-wise Respondents’ Views on Air Pollution

<table>
<thead>
<tr>
<th>Income Level (Rs.)</th>
<th>Bad Odour</th>
<th>Fatigue and Headache</th>
<th>Eye Itching</th>
<th>All</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upto 1500</td>
<td>21 (12.6)</td>
<td>92 (55.4)</td>
<td>41 (24.7)</td>
<td>12 (7.3)</td>
<td>166 (100)</td>
</tr>
<tr>
<td>1500-3000</td>
<td>15 (17.8)</td>
<td>13 (15.5)</td>
<td>46 (54.8)</td>
<td>10 (11.9)</td>
<td>84 (100)</td>
</tr>
<tr>
<td>3000-4500</td>
<td>18 (18.6)</td>
<td>41 (42.3)</td>
<td>16 (16.5)</td>
<td>22 (22.6)</td>
<td>97 (100)</td>
</tr>
<tr>
<td>4500-6000</td>
<td>23 (22.8)</td>
<td>32 (31.7)</td>
<td>7 (6.9)</td>
<td>39 (38.6)</td>
<td>101 (100)</td>
</tr>
<tr>
<td>6000 and above</td>
<td>14 (18.4)</td>
<td>12 (15.8)</td>
<td>19 (25.0)</td>
<td>31 (40.8)</td>
<td>76 (100)</td>
</tr>
<tr>
<td>Total(%)</td>
<td>91 (17.4)</td>
<td>190 (36.3)</td>
<td>129 (24.6)</td>
<td>114 (21.7)</td>
<td>524 (100)</td>
</tr>
</tbody>
</table>

Source: Computed : Figures in parentheses denote percentage to row total

The data presented in table (5) indicate the income-wise respondents views on air pollution. It could be noted that more than a half of the respondents of the lowest income group (55.4%) realize the effects of air pollution in terms of fatigue and headache and considerable level of respondents of the third income group (42.3%) realize these problems. The majority of the respondents of second income group Rs.1500-3000 (54.8%) suffer due to eye itching as a consequence of air pollution. A little majority of the respondents of the fourth income group Rs.4500-6000 (38.6%) and highest income group realize the effects of air pollution in terms of bad odour, fatigue, headache and eye itching.

It could be seen clearly from the aforesaid discussion that the respondents of high income group realize mainly various effects of air pollution rather than individual effects as realized by low income respondents.

FINDINGS, CONCLUSION AND RECOMMENDATIONS

Major findings of the study

1) The results of caste-wise analysis indicate that the occurrence of fatigue and headache on consequence of air pollution takes first in order of reporting in the study notably among the most backward caste respondents, eye itching second and bad odour the last. In general forward caste respondents suffer with all problems of air pollution in the study area.

2) The results of occupation-wise analysis indicate that the respondents from business group and government employee group suffer in various ways on consequence of air pollution. Eye itching is a common problem among the industrial employees and it is fatigue and headache among the respondents wage labourers.

3) The results of education level-wise analysis indicate that illiterate and primary level educated mainly realize the problem of air pollution in terms of occurrence of fatigue and headache.

4) The results of income-wise analysis indicate that the respondents of high income group realize mainly various effects of air pollution rather an individual effects as realized in the case of low income respondents.

5) The results of income-wise analysis indicate that the respondents of high income group realize mainly various effects of air pollution rather an individual effects as realized in case of low income respondents.

Conclusion

The modern industrial society faces many environmental hazards, issues and degrades the living qualities and conditions of
human being. Several countries already have measures to standards for many of the chemicals of concern. It is in deploying the implementation and enforcement regime that India needs to pay particular attention to communities around SIPCOT industrial regions.

The air pollution is rated as a very serious environmental problem in the SIPCOT industrial regions. The Stationary emissions depend on industrial activities, solid waste burning and other types of smoke is mostly found in the SIPCOT region. The air pollution of the SIPCOT industries adversely affect the health status of the persons of adjoining villages of the industrial regions. Further, the air pollution leads to serious respiratory diseases in the industrial regions. In total, the industrial pollution of the SIPCOT industrial complex undermines the livelihood and cause health hazards of the people in the adjoining regions. In this context, it underlines the necessity of assessing the type, and extent of impact of the environment pollution in the SIPCOT regions.

Recommmdations

The following are the important recommendations that follow from the result and discussion of the present study. The suggestions are helpful to the policy makers in industrial pollution control activities in the SIPCOT area.

1) Government should take initiative to control environmental degradation caused by the industrial pollution.

2) Government and SIPCOT industrial authorities should take necessary steps to extend the common effluent treatment plant in the industrial area.

3) Factory owners should arrange for compensation to the affected population, working staff and to the contractors.

4) Industries polluting the environment severely should be forbidden from their production. Government should take proper initiatives to shutdown the polluted industries immediately.

5) Industrial authorities are expected to give compensation to farmers who lost their agricultural land and production due to the industrial pollution that caused devastation.

6) The Pollution Control Board should take various measures to control and for disposal of gases and liquid, wastes from the chemical of industries of the whole industrial region.

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