Effect of air pollution on human health problems residents living around the cement plant, Chandrapur, Maharashtra, India

Shefali Kesarwani and Abhishek James

Abstract
Cement industry is the backbone of India’s economy and one of the leaders in detrioating the environment and health of the human. The emissions from cement plant like particulate matter (respirable and nonrespirable) and gaseous pollutant (SOx, NOx, CO2). Cement dust not only deteriorate the quality of air but also human health, animal health and vegetation. The effect of cement dust mostly seen between 2-4 km radius. Data for human health was collected through questionnaire. About 35 people from each site have been surveyed for prevalence of air pollution oriented diseases among the people. Results indicated higher incidence of respiratory diseases among the affected people followed by eye irritation and other diseases among the affected people residing around the cement plant. The effect on human health is due to long period exposure of air generated in the study area.

Keywords: air pollution, human health problems, cement plant

1. Introduction
Cement industry is responsible for contributing a variety of pollutants to atmosphere such as Particulate matter (PM2.5 & PM10), Sulfur oxide (SO2), Nitrogen oxide (NO2) (Worrell et al., 2001; Quiros and Webb, 2005) [29, 17]. PM10 is particulate matter with an aerodynamic diameter up to 10µm, i.e., fine and coarse fraction combined. The diameter of dust particles of PM10 is larger than PM 2.5 i.e. fine dust particles. Globally cement industry contributes almost 5% of total carbon dioxide to atmosphere, which enhanced global warming (Qudais, 2011; Lei et al., 2011) [16, 8].

210 large cement plants account for a cumulative installed capacity of over 350 million tonnes, while over 350 mini cement plants have an estimated production capacity of nearly 11.10 million tonnes, as of 2016. Every industry has both positive and negative impact on environment and living beings associated with it positive, in terms of socio-economic development and negative in terms of associated harmful emissions (Ggeorghe and Ion, 2011; Srivastava and Singh, 2012; Yousefi, 2013) [6, 23, 30].

WHO estimates that worldwide, at least two million people every year die prematurely due to health effects caused by lack of clean air around them. Air is the basic element necessary for human life but the quality of air is deteriorating day by day and it is being constantly polluted from different sources of pollution. One of the major sources of air pollution is industries and automobiles, as per estimation 20- 30% of air are contaminated by different industries in India (Sivasamy and Srinivasan, 1997) [22].

Different activities in industries deterioate various environmental components like air, soil, water and vegetation (Dolgener et al., 1983; Sai et al., 1987; Mishra, 1991; Murugesan et al., 2004; Kumar et al., 2008) [5, 19, 12, 13, 2]. According to Central Pollution Control Board of India cement industry is one of the 17 most polluting industry. Cement dust contains heavy metals like chromium, nickel, cobalt, lead and mercury which is hazardous to the environment with impact on living beings. (Baby et al., 2008) [2]

Exposure to cement dust can cause serious health problems through contact with skin, eyes, or breathing passages and might result in hospitalization (Anderson et al., 2003; Ballester et al., 2001) [1, 3].

The emissions from cement industry degrade the air quality in areas within 3-4 km radius periphery of the factory. Such emissions can contribute to a wide range of health effects, especially respiratory diseases, brain damage, lung cancer, heart diseases, skin irritations, fatigue, headache, and nausea (World Development Indicators, 2004) [28]. Failing eyesight due fumes is also common in the different working processes of cement area of the factory.
According to the World Health Organization (WHO), long-term exposure to the above emissions can result in many diseases in human beings. Several studies result showed that these emissions from cement industry are adversely affecting human health in many ways, like itchy eyes, respiratory diseases like tuberculosis, chest discomfort, chronic bronchitis, asthma attacks, cardiovascular diseases and even premature death. (Pollution Prevention and Abatement Handbook 1998, Mehraj, Bhat and Balkhi; 2013) [11].

Materials and Methods
Chandrapur district is located in the eastern edge of Maharashtra in Nagpur division. It is located between 19.30’N and 20.45’N latitude and 78.46’E longitude. The district is known for its Super Thermal Power Plant, one of the biggest in Asia, and its vast reserves of coal in Wardha Valley Coalfield and Large reservoirs of limestone supply many cement factories also known as a geological museum because a multitude of rocks and fossils found here. Chandrapur is known for its hot and dry climate Humidity is very low in this region. Temperature starts decreasing in october with December being the coldest month, with a minimum average temperature of 9 ºC and maximum of 23.2 ºC. Temperature begins to rise in February. May is the hottest month, with a mean maximum temperature of 43 ºC and minimum of 28.2 ºC.

For the present study four villages have been selected namely Awarpur, Palgaon, Nanda and Naokari which are located around the cement plant within 5 km radius. Awarpur is a village which is situated at 19.78’N and 79.13’E which is 1.9km away from cement plant. Palgaon is a village which is situated at 19.78’N and 79.15’E which is 300m away from cement plant. Nanda is a village which is situated at 19.77’N and 79.12’E which is 3.9km away from cement plant. Naokari is a village which is situated at 19.79’N and 79.14’E which is 850m away from cement plant.

Study of Health Status was carried out by selecting 35 people from each sampling site. Their background information was collected through personal interview. Criteria for selection participant was based on random selection at the site those aged from 20 and 45. Care should be taken that the person having exposure to that area at least from 5 years.

Results and Discussions

Human health diseases: The most common route for pollutants to enter the human body is by inhalation, the most common effect of air pollution is damage to the respiratory system. Exposure to air pollutants can cause headache, eye irritation, skin allergies, chest pain, respiratory problems (such as, asthma, shortness of breath, allergic reaction that interference with breathing, cough and wheezing) and lung problems (such as, chronic bronchitis, emphysema, tuberculosis and pneumonia) when the air is polluted. Study of Health Status was carried out by selecting 35 people from each sampling site. Their background information was collected through personal interview. Criteria for selection participant was based on random selection at the site those aged from 20 and 45. Care should be taken that the person having exposure to that area at least from 5 years.

From figure no.1 it was concluded that 14.3% people having headache, chest pain and respiratory problems 11.4% people having eye irritation, 8.6% people having skin allergies and lung problems at Awarpur.

20.0% people having respiratory problems, 17.1% people having eye irritation and chest pain, 8.6% people having headache and skin allergies, 5.7% people having lung problems at Palgaon.

20.0% people having respiratory problems, 14.3% people having eye irritation, 11.4% people having headache and skin allergies, and 5.7% people having chest pain lung problems at Nanda.

22.9% people having eye irritation, 17.1% people having respiratory problems, 11.4% people having headache and lung problems and 8.6% people having skin allergies and chest pain at Naokari. Similar results was also reported by Rai P., Mishra R.M. and Parihar S. 2013 [13].

![Fig 1: Occupational health diseases among the people due to air pollution of sampling sites](image)

Table 1: Percentage of air pollution oriented diseases among the people of four sampling sites

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Diseases</th>
<th>Awarpur</th>
<th>Palgaon</th>
<th>Nanda</th>
<th>Naokari</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Headache</td>
<td>14.3</td>
<td>8.6</td>
<td>11.4</td>
<td>11.4</td>
</tr>
<tr>
<td>2.</td>
<td>Eye irritation</td>
<td>11.4</td>
<td>17.1</td>
<td>14.3</td>
<td>22.9</td>
</tr>
<tr>
<td>3.</td>
<td>Skin allergies</td>
<td>8.6</td>
<td>8.6</td>
<td>11.4</td>
<td>8.6</td>
</tr>
<tr>
<td>4.</td>
<td>Chest pain</td>
<td>14.3</td>
<td>17.1</td>
<td>5.7</td>
<td>8.6</td>
</tr>
<tr>
<td>5.</td>
<td>Respiratory problems</td>
<td>14.3</td>
<td>20.0</td>
<td>20.0</td>
<td>17.1</td>
</tr>
<tr>
<td>6.</td>
<td>Lung Problems</td>
<td>8.6</td>
<td>5.7</td>
<td>5.7</td>
<td>11.4</td>
</tr>
</tbody>
</table>

Table 2: Average percentage of air pollution oriented diseases among the people of all four sites

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Diseases</th>
<th>Average percentage of air pollution oriented diseases among the people of all four sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Headache</td>
<td>11.4</td>
</tr>
<tr>
<td>2.</td>
<td>Eye irritation</td>
<td>16.4</td>
</tr>
<tr>
<td>3.</td>
<td>Skin allergies</td>
<td>9.3</td>
</tr>
<tr>
<td>4.</td>
<td>Chest pain</td>
<td>11.4</td>
</tr>
<tr>
<td>5.</td>
<td>Respiratory problems</td>
<td>17.9</td>
</tr>
<tr>
<td>6.</td>
<td>Lung Problems</td>
<td>7.6</td>
</tr>
</tbody>
</table>
After completing the cohort health sampling it was concluded that most of the people having problem related to headache, eye irritation, skin allergies, chest pain, respiratory problems (like asthma, shortness of breath, cough, wheezing, allergic reaction that interference in breathing) and lung problems (like bronchitis infection, pneumonia, tuberculosis, emphysema).

Site 1 (Awarpur) total 71.5% persons are affected at site 1 due to air pollutants.
Site 2 (Palgaon) total 77.1% persons are affected at site 2 due to air pollutants.
Site 3 (Nanda) total 68.5% persons are affected at site 3 due to air pollutants.
Site 4 (Naokari) total 80.0% persons are affected at site 4 due to air pollutants.
Site 4 > Site 2 > Site 1 > Site 3

Association between air pollution and lung function parameters has already been well documented (Schwela 2000; pope 2000a; WHO 2000b) [26, 15]. Under long term exposure, there is correlation between particle concentrations and mortality from lung disease (WHO 2000a) [26]. Particulate matter in the ambient air have been found to cause acute effects such as increased daily mortality, increase rate of hospital admissions for exacerbation of respiratory disease etc. (WHO 2000a, 2000b) [26]. However, health effects of SPM in humans depend on particle site, concentrations and exposure time.

Conclusion
As per human health status at site 3 (Nanda) shows less affected number of people with 68.5% as compared to Site 4 (Naokari) shows highly affected number of People with 80.0%. The problems which are found in people is due to long exposure of dust generated in the study area.

References


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