International Journal of Academic Research and Development
ISSN: 2455-4197
Impact Factor: RJIF 5.22
www.academicsjournal.com
Volume 2; Issue 6; November 2017; Page No. 353-357

Assessment of cement emissions and its environmental impact: A study in the Pulwama district of J&K state, India

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Abstract
Environmental change is considered as a major challenge for both the developed and developing countries in the world. It is a growing threat for human and environmental degradation. Cement industrial emissions are one of the major contributors in global environmental changes. Cement manufacturing is a highly major source of many harmful emissions such as nitrogen oxides, sulphur oxides, carbon dioxide and huge amount of noise, dust and smoke. The study aims to investigate the impact of cement industrial emissions on environmental components like air, water, soil in the Pulwama district of Jammu and Kashmir state. In this study, the researcher has deliberately selected all the three cement industries located at three different industrial sites in the study area. In this study, the investigator has selected 113 respondents from all the three cement industrial sites with the help of stratified random sampling method. All the respondents in this study were selected on the basis of distance i.e. those respondents were selected who are living within the half km from their respective cement plants. The study concludes that the surrounding environment has been affected in a number of ways due to the constant exposure of cement emissions.

Keywords: cement emissions, environmental pollution, atmospheric changes, human health

Introduction
It is inevitable to conceit modern life without the material of cement production. Cement is an important and essential constructive material for all kinds of infrastructural developments. It plays a key role in the economic growth and development of a country**.** Despite its economic developments, the cement industries have created many challenges in the form of environmental hazardous issues and problems. The cement industry is a highly energetic intensive process and contributed vital role in the climatic alterations. The major environmental hazardous issues are related to health and safety to all living things, because it is directly associated with certain kinds of toxic pollutants. Cement manufacturing requires huge amount of non-renewable resources like raw material of limestone and huge fossil fuel consumption. Therefore, it constantly exerts a huge pressure to the natural resources (Mishra, G. P., 1991) [1].

Industrial pollution has threatened our bio-diversity and eco-system through the continuous release of several harmful gases which includes carbon monoxide, chlorofluorocarbons and oxides of sulphur and nitrogen. These hazardous products of industrialisation have created unbalancing alterations in our natural environment which results loss of soil fertility, reduction of crop production, global warming, acid rains and disturbance of social life in the form of disintegration. Therefore, due to these unbalancing modifications occurred in our natural environment, human health has been affected tremendously. Our water resource bodies such as rivers, oceans, ponds and lakes have been polluted due to constant misuse of this component of nature. The forests, plains, grassland, wet lands have also been affected and they are fighting for their survival (Prakash, J. and R. M. Mishra, 2003) [2].

Cement industry is one among the most important industries involved in creating environmental pollution. The aerial discharge of cement industries consist of Particulate matter and certain harmful substances producing continuous visible clouds which ultimately settle on the nearby agricultural and vegetative fields and harmfully affects whole biotic life around its jurisdictional areas, which results the whole atmospheric conditions around it subjected to extraordinary stress, strain and abuse. As whole, cement manufacturing process involves release of enormous pollutants, need is to strictly and sustainably regulate its manufacturing, distribution and consumption especially in the residential and biodiversity rich areas, so that human lives may not be lost for the sake of development (Sai *et al.*, 1987) [3].

Review of existed literature
Adak *et al.* (2007) [4] analyzed Mandiakudar is a rural area near Rourkela, the cement and steel city of Orissa. A large number of cement plants are in operation in and around Rourkela. The particulate matters of the dust exhausted from the cement plants are released to the air and it creates considerable environmental pollution. In order to monitor the ambient air quality of Mandiakudar based on suspended particulate, sulphur dioxide (SO2) and oxides of nitrogen (NOx) a fact-finding survey was conducted for a period of three years from 2001 to 2003. The amount of different pollutants are compared with the standard limits recommended by Central Pollution Control Board (CPCB) and air quality parameters and/or air quality indices (AQI) are

also worked out on that basis. The study concludes that the environment of whole area is harmfully affected due to continuous exposure of cement emissions.

Statement of the problem

The study aims to analyze the impact of cement emissions on environmental components by making a descriptive study in the Pulwama district of the Jammu and Kashmir State. In the study area, there are three cement industrial plants located at different three industrial zones. Hence, it is very important to the researcher to investigate the harmful impacts created by these industries on the natural environment in the form of various kinds of pollutrions. Therefore, in order to reach the focussed objectives of the study, it is essential to the investigator to investigate the factors relating to the exposure of cement emissions on environment in terms of Loss of Biodiversity, water pollution, Loss of Aquatic Life, Reduction of Crop Productivity, Occurrence of Smog, Land Pollution, Air Pollution, Noise Pollution, Deposition of cement dust and Diseased crops.

Research Methodology

The present research study is undertaken in the Pulwama District of Jammu and Kashmir state with the following:

Objectives

1. To analyze the variation of environmental impacts by cement emissions with respect to the different cement industrial sites in the study area.
2. To study the variations of environmental impacts by cement emissions with respect to different age groups.

Hypothesis

To prove the study objectives, the investigator has framed two alternative null hypotheses:

1. There is no significant variation of environmental impacts by cement emissions with respect to the different cement industrial sites in the study area.
2. There is no significant variation of environmental impacts by cement emissions with respect to the different cement industrial sites.

Sampling

The present study aims to investigate the environmental impacts of cement emissions caused by the three cement industrial plants in the Pulwama district of the Jammu and Kashmir State. In order to achieve the focussed objectives, the investigator has purposively selected all the three cement industrial plants located in the three different industrial zones in the study area. These cement plants includes JK Cements Industry Ltd in the zone of Khrew, Mehboob Cement Industry Ltd in the industrial zone of Wuyan and Cemtac Cement Industry Ltd in the zone of Pampore. In this study, the investigator has selected 113 respondents from all the three cement industrial plants with the help of stratified random sampling method. The researcher have selected all the respondents on the basis of distance i,e those respondents have been selected who are living within the half kilometre around their respective cement plants.

In the Khrew cement industrial zone, the total population within the half km were 225 and among them the researcher has selected 45 respondents which equals to 20% population with the help of stratified random sampling method. In this way, same procedures were also applied both for Mehboob and Cemtac Cement industrial plants. Therefore, In the Wuyan industrial zone, the total population were 185 and among them the researcher has selected 37 respondents and in the Pampore industrial zone, the total population were 155 and among them the researcher has selected 31 respondents. Therefore, the total population of universe is 565, and among them, the researcher has selected overall 20% population which equals to 113 respondents.

Tools of Data Collection

The primary data were collected with the help of structured interview schedule. Apart from the primary data, the secondary data were collected from the internet, books, and pollution control board.

Data Analysis and Interpretation

The collected data were classified and analysed by using the Statistical tools like simple percentage and Two-way ANOVA model.

Table 1: Industrial site wise Distribution of the Selected 113 Respondents

Industrial Site Name	No. of Respondents	Percentage
JK Cements Ltd	45	39.82
Mahboob Cement Ltd	37	32.74
Cemtac Cement Ltd	31	27.43
Total	113	100.00

Table 1 presents the data on industrial site wise distribution of the respondents. It could be found that out of the total 113 respondents, 39.82 percent of the respondents belongs to the JK Cements Ltd, 32.74 percent of them belongs to the Mahboob Cement Ltd and 27.43 belongs to Cemtac Cement Ltd. It could be seen that maximum respondents belongs to the JK Cements Ltd.

Table 2: Age wise Distribution of the selected 113 Respondents

Age Group	NO. of Respondents	Percentage
20-30	32	28.31
31-40	38	33.62
Above 40	43	38.05
Total	113	100.00

Table 2 shows data on the age wise distribution of the total respondents. It could be found that out of the total 113 respondents, 38.05 percent of the respondents belong to the age group of above 40 years, 33.62 percent belongs to the age group of 31-40 and 28.31 percent belongs to the 20-30 years age group. It is clear from the above table that the majority of the respondents belong to the above 40 years age group.

Table 3: Industrial Site Wise Respondents' Rating to the Impact of Cement Emissions on Environmental Components

Variables	JK Cements Khrew	Mehboob Cements Wuyan	Cemtac Cement Pompore	Mean
Loss of Biodiversity	2.26	2.44	2.79	2.56
Water Pollution	2.76	3.04	3.39	3.16
Loss of Aquatic Life	2.14	2.32	2.67	2.82
Reduction of Crop Productivity	3.06	3.28	3.69	3.48
Occurrence of Smog	3.70	4.00	4.19	3.98
Land Pollution	1.79	1.88	2.17	2.90
Air Pollution	3.90	4.03	4.16	4.03
Noise Pollution	2.64	2.82	3.17	2.94
Deposition of cement dust	3.52	3.69	4.21	3.84
Diseased crops	1.85	1.98	2.27	2.88
Average	3.48	3.13	2.85	3.27

***Source*:** Computed from primary data

Anova

Source of variation	SS	DF	MS	F	F CRIT
Variation of impacts of cement emissions on environment	27.64822	19	1.455169	211.6232	1.867332
Variation due to cement industrial sites	2.826503	2	1.413252	205.5272	3.244818
Error	0.261297	38	0.006876		
Total	30.73602	59			

The data presented in the table 3 indicates the industrial site wise respondents' rating to the impact of cement emissions on environment components. It could be noted that out of the 10 impacts of cement emissions on environment, the respondents' have rated the Air pollution as their first level observed environmental impact caused by cement emissions and it is evident from their secured mean score of 4.03 on a 5 point rating scale. Occurrence of Smog is rated at second level environmental impact caused by cement emissions and it is estimated from the respondents' secured mean score of 3.98 on a 5 point rating scale. The respondents observe the Deposition of cement dust as their third level observed environmental impact caused by cement emissions and it is evident from their secured mean score of 3.84 on a 5 point rating scale. Reduction of Crop Productivity is the fourth level environmental impact caused by cement emissions and it is observed from the respondents' secured mean score of 3.48 on a 5 point rating scale. Water Pollution is rated at fifth level environmental impact caused by cement emissions and it could be known from the respondents' secured mean score of 3.16 on a 5 point rating scale.

The respondents rated Noise Pollution as their realized sixth level impact of environmental impact caused by cement emissions and it is revealed from their secured mean score of 2.94 on a 5 point rating scale. Land Pollution is rated at seventh level environmental impact caused by cement emissions and it observed from the respondents' secured mean score of 2.90 on a 5 point rating scale. Diseased crops is rated as their observed eighth level environmental impact caused by cement emissions and it is evident from their secured mean score of 2.88 on a 5 point rating scale. Loss of Aquatic Life is rated at ninth level environmental impact caused by cement emissions and it is evident from the respondents' secured mean score of 2.82 on a 5 point rating scale. Loss of Biodiversity is rated at tenth level environmental impact caused by cement emissions and it is evident from the respondents' secured mean score of 2.56 on a 5 point rating scale.

The respondents of the JK Cements Ltd in the Khrew Industrial site ranked the first position in their overall rated impact of cement emissions on environmental components and it is reflected from their secured overall mean score of 3.48 on a 5 point rating scale. The respondents of Mehboob Cement Ltd in the Wuyan industrial site records the second position in their overall rated impacts of cement emissions on environmental components and it is reflected from their secured mean score of 3.13 on a 5 point rating scale. The respondents of Cemtac Cement Ltd in the Pompore industrial site ranked the last position in their overall rated impact of cement emissions on environment and it could be seen from their secured overall mean score 2.85 on a 5 point rating scale.

The ANOVA two ways model is applied for further discussion. The computed ANOVA value 211.62 is greater than its tabulated value at 5 percent level significance. Hence, the variation among the overall observed impacts of cement emissions on environment is statistically identified as significant. In another point, the computed ANOVA value 205.52 is greater than its tabulated value at 5 percent level significance. Hence, the variation among the three cement industrial sites is statistically identified as significant as per the respondents rating on the impacts of cement emissions on environmental. Hence, the framed null hypothesis number 1 is rejected and the alternative hypothesis is accepted.

Table 4: Age Wise Respondents' Rating to the Impact of Cement Emissions on Environmental Components

Variables	20-30 years	31-40 Years	Above 40 Years	Mean
Loss of Biodiversity	2.30	2.69	2.55	2.56
Water Pollution	2.90	3.29	3.15	3.16
Loss of Aquatic Life	2.18	2.57	2.43	2.44
Reduction of Crop Productivity	3.14	3.59	3.45	3.48
Occurrence of Smog	3.86	4.17	4.06	3.98
Land Pollution	1.74	2.12	1.93	1.98
Air Pollution	3.97	4.18	4.14	4.03
Noise Pollution	2.68	3.07	2.93	2.94
Deposition of cement dust	3.55	3.98	3.97	3.84
Diseased Crops	1.84	2.22	2.03	2.08
Average	2.99	3.38	3.24	3.27

***Source*:** Computed from primary data

Anova

Source of Variation	SS	Df	MS	F	F Crit
Variation of impacts of cement emissions on environment	28.85501	19	1.518685	552.6544	1.867332
Variation due to age groups	1.49511	2	0.747555	272.0378	3.244818
Error	0.104423	38	0.002748		
Total	30.45454	59			

Table 4 presents data on the age wise respondents' rating to the impact of cement emissions on environmental components. The 31-40 years age group respondents' ranked the first position in their overall rated impact of cement emissions on environment as per their secured mean score of 3.38 on a 5 point rating scale. The above 40 years age group respondents records the second position in their overall rated impact of cement emissions on environment and it is known from their secured mean score of 3.24 on a 5 point rating scale. The 20-30 years age group respondents' come down to the last position in their overall rated impact of cement emissions on environment and it is estimated from their secured mean score of 2.99 on a 5 point rating scale.

The ANOVA two ways model is applied for further discussion. The computed ANOVA value 552.65 is greater than its tabulated value at 5 percent level significance. Hence, the variation among the overall rated impacts of cement emissions on environment is statistically identified as significant. In another point, the computed ANOVA value 272.03 is greater than its tabulated value at 5 percent level significance. Hence, the variation among the age wise group respondents is statistically identified as significant as per their rating on the impacts of cement emissions on environment. Therefore, the formulated null hypothesis number 2 is rejected and the alternative hypothesis is accepted.

Findings and Conclusion

The study reveals that there exists a significant variation between three cement industrial site wise respondents' realization to the impact of cement emissions on environmental components. However, the majority of the JK Cements Ltd industrial site respondents realize the high impact of cement emissions on environmental components in terms of Air Pollution and Occurrence of Smog. In addition, the study has also shown that the majority of overall respondents views to the impact of cement emissions on environmental components in the form of Air Pollution. (Table 4)

The study has found that there exists a significant variation between the age wise respondents' views to the impact of cement emissions on environmental components. Moreover, majority of the 31-40 years respondents realize the high impacts of cement emissions on environmental components in terms of Air Pollution and Occurrence of Smog. In addition, it has also been found that the majority of overall respondents views to the impacts of cement emissions on environmental parts in terms of Air Pollution. (Table 3)

Conclusion

The study concludes that the cement emissions have put several harmful impacts on the natural environmental components in and around the whole cement industrial sites in the study area. On the one hand, these industries has increased the economic and business profile of several industrialists, but on the other hand, it has brought number of hazardous consequences on the beauties and bounties of our natural environment by giving the birth of several types of harmful substances, which in turn has created number of environmental pollutions like air, water, land, noise, and thus has created a worldwide serious threat for the protection and maintenance of natural environment. However, such types of pollutions not only affected environmental parts, but it has also affected human and other living creatures' health status.

Suggestions

1. Government should take necessary steps to curb the environmental pollution.
2. Use of eco-friendly technology.
3. Proper dumping of industrial waste products.

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