

Changing Environmental Ecology of Rajban, Muglanwala and Kishan Kot Villages of Sirmour in Himachal Pradesh

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Abstract: Men, environment and development remained disintegrated issues of discussions in academic circles after the advent of industrialization. Cement industry pushed this debate further. The present study takes into consideration the impact of the oldest cement plant in Himachal Pradesh, Rajban in Sirmour district into consideration. The main objectives of the present research are: 1. effects of cement plant on the health of the people, 2. influence on human settlements, 3. impact on nearby vegetation. For the purpose of this study, stratified samples of population were collected from three nearby villages during 2021-2023. Also, official websites of government and cement plant were taken into consideration. For few quarries, RTI was also sought from the respective agencies. Information regarding health status and diseases was collected through house to house interviews and medical receipts of various hospitals and dispensaries. Photographs of deserted houses and dusty trees and shrubs were taken during field survey only. The present research derived following conclusions: 1. Exposure to cement dust increased human health risks, 2. Human settlements were affected due to the dust and pollution, 3. Thick layer of dust on plants had resulted into stunted growth of vegetation.

Key-words: Air Pollution, Human Health, Environment, Human settlement, Sirmour

I. Introduction

Whether the environment is clean or polluted, it has a deep impact on everyone. The Annual Report of Ministry of Environment and Forest 2005-6 suggested that the problem of environmental pollution is caused by harmful substances emitted from industries and improper consumption of natural resources by human (MEF Annual Report 2005-06, 145). Cement industry is one of the seventeen most polluting industries listed by Central Pollution Control Board (CPCB) recently in its report (CPCB Report, 2025, 81). Cement dust contains many dangerous pollution particles and the smoke coming out of the cement plant also causes pollution, which affects vegetation, human health and the ecosystem in some way or the other. Recent studies and researches have also acknowledged cement industry as one of the polluting industries. This industry is the root source of several dangerous human diseases. Farmer (1993, 65); Shukla et al. (2008, 34 and 2013, 337); Ramesh et al. (2014, 155); Rawat & Katiya (2015, 41); and Mishra et al. (2021, 109) in different studies done on various cement plants at Pan-India level found in their study that cement dust is potentially harmful to the environment and it directly affects vegetation and human population. Richard et al. in their research has shown that long term exposure to cement dust affects the functioning of lungs and liver in humans (2016, 6). Common diseases occurred by cement are such as asthma, BP, lung cancer, itching, TB, ischemic heart disease, eye irritation etc. (Attri & Kalia, 2017, 15). Also, fine particulate matter poses health risks to adults and children (Mallongi et al., 2023, 52). According to Mudgal and Chelsami, cement production releases a range of dangerous pollutants, which affects human health and ecosystem in some way or the other (2024, 44). Air pollution, particularly fine particulate matter, is a severe environmental and public health threat (Chamchalam et al., 2025, 5331). These studies conducted on various cement plants underline the fact that cement industries are affecting human health and vegetation. Present study strengthens the claims made in previous studies.

The present study takes into consideration the impact of the oldest cement plant in Himachal Pradesh, Rajban in Sirmour district. This cement plant was established in 1980 and today running successfully with its present nomenclature CCI (Cement Corporation of India). For almost half a century of establishment, its impact on human population could be measured in generations. The main objectives of the present research remained: a) to notice and register the effects of cement plant on the health of the people, b. to check the influence on human settlements in and around two km radius of the cement plant, c. to check the impact on nearby vegetation. For the purpose of this study, stratified samples of population were collected from three nearby villages falling within two km vicinity of the cement plant during 2021-2023. Also official websites of government and cement plant were taken into consideration. For few quarries, RTI was also sought from company and various government agencies. Under the field survey an attempt was made to collect information about the environmental and residents' condition of mainly three villages namely Rajban, Muglanwala and Kishan Kot. For the better understanding of the issue, several previously done studies in various parts of the country were also taken into consideration. As a research gap it was found that no concrete study of this oldest cement plant in Himachal Pradesh was conducted considering its impact on vegetation and population, hence it remained a case of observation for the present study.

Distance of Selected Villages from Cement Plant

Three villages around cement plant have been selected for analysis in the study, namely Rajban, Muglanwala and Kishan Kot. These are located at different distances from the plant as shown in table 1 below.

Table 1. Distance of selected villages from cement plant

Selected Cement Plant	Selected Villages		Selected Population			Distance (In km)	Area (hectares)
			Male	Female	Total		
Cement Corporation of India, Rajban-Sirmour (H.P.)	Rajban	Sikh Colony	24	23	47	0.200	47.00
		Aadarsh Colony	26	25	51	0.100	''
		Slum (Jhuggi Basti)	57	35	92	0.100	''
	Muglanwala		30	23	53	1.000	195.00
	Kishan Kot		29	25	54	1.500	86.00
	Total		166	131	297		

The nearest village to CCI Cement Plant is Rajban. Sikh Colony, Adarsh Colony and Slum Colony are situated in Rajban village itself. The total area of the Rajban village (Sikh Colony, Adarsh Colony & Slum Colony) is 47.00 hectares, Muglanwala is 195.00 hectares and Kishan Kot is 86.00 hectares on the basis of the 2011 census(142).The movement of the mine trolleys is through Sikh colony. The distance of Muglanwala village is one kilometer and of Kishan Kot village is 1.500 kilometers from the cement plant.Thus these villages become the most vulnerable to its dust and smoke. Sikh basti, Muglanwala and Kishan Kot villages have a significant impact due to vehicle movement as they are located on the same road of the cement plant.The areas and the vegetation near the cement plant and around the highway are greatly affected by its dust and smoke. Chaturvedi has conducted similar survey on Chunar Mirzapur industrial area that include cement plant as well. Its impact on two adjoining areas, Banaras Hindu University and Chunar Mirzapur carries the similar observation (Chaturvedi et al. 2013, 389) as present study on Rajban (Sikh settlement, Aadarsh Colony and Jhuggi basti), Muglanwala and Kishan Kot villages.

Amount of Particulate Matter in Ambient Air and its Effect on Human Health

Cement dust contains very fine particles. These microscopic particles easily mix in the air. The amount of polluted particles in the air is assessed by the National Air Quality Index (NAQI). The Central Pollution Control Board (CPCB) itself has entrusted in with the responsibility of daily monitoring of air quality in various cities. The National Air Quality Index (NAQI) measures how human health is affected by polluted particles in the air (CPCB Report 2019,83). Brief description related to the amount of particulate matter in ambient air and its effect on health is given in table 2.

Table 2. Particulate matter in ambient air and its effect on health

Air Quality Index	Particulate Matter (PM 2.5) ug/m ³	Particulate Matter (PM 10) ug/m ³	Health Impact
Good (0-50)	0-30	0-50	Minimal
Satisfactory (51-100)	31-60	51-100	Minor breathing discomfort to sensitive people
Moderately polluted (101-200)	61-90	101-250	Breathing discomfort to asthma patient, elderly & children
Poor (201-300)	91-120	251-350	Breathing discomfort to all
Very poor (301-400)	121-250	351-430	Respiratory illness on prolonged exposure

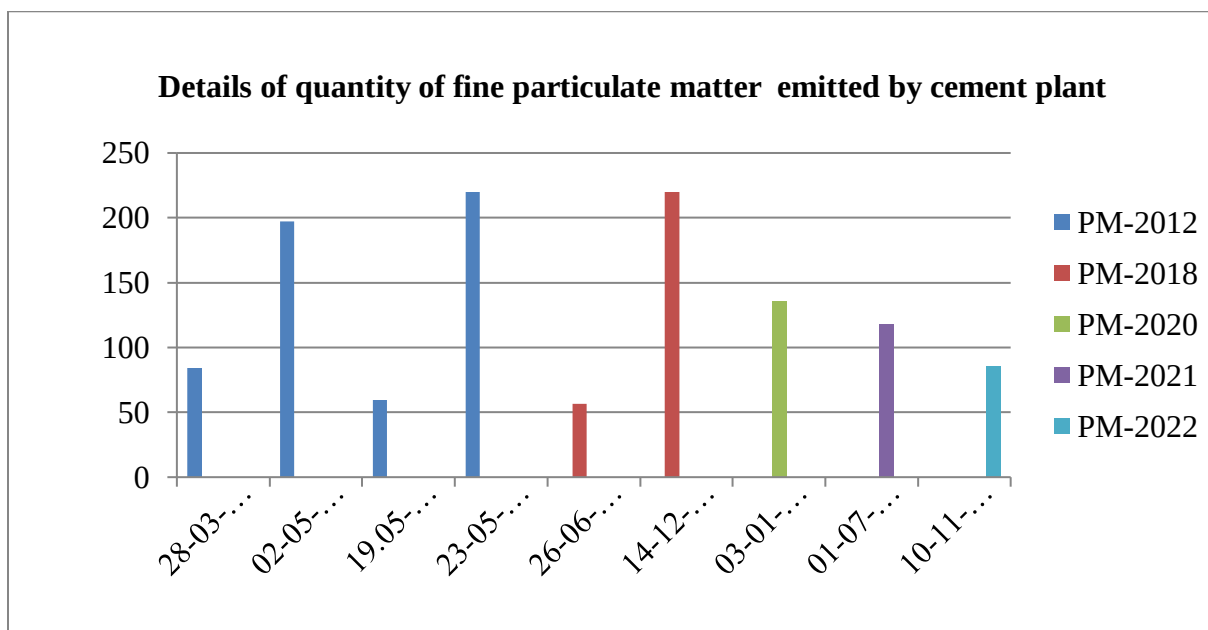
Extremely Bad (401-500)	250+	430+	Serious impact on people with heart & lung disease
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Source: CPCB, National Ambient Air Quality Monitoring Statistics and Trends 2019, Central Pollution Control Board, Ministry of Environment, Forest & Climate Change, Government of India

Description of spatial distribution of particulate matter level around residential areas of cement plant

CCI Cement Plant Rajban was the first cement plant of Himachal Pradesh. Later with the mission to achieve self-sufficiency, it became one of the Cement Corporation of India's units. Presently, CCI cement plant is engaged in cement production since 1980 till date. Like other cement plants in India, the smoke and dust coming out of this cement plant contain microscopic particles. The data related to the amount of particulate matter emitted by the selected cement plant is further explained in the study through column chart 1 below.

Column chart 1: Details of quantity of fine particulate matter emitted by cement plant



Source: Himachal Pradesh State Pollution Control Board data from 2012-2022 sought through RTI

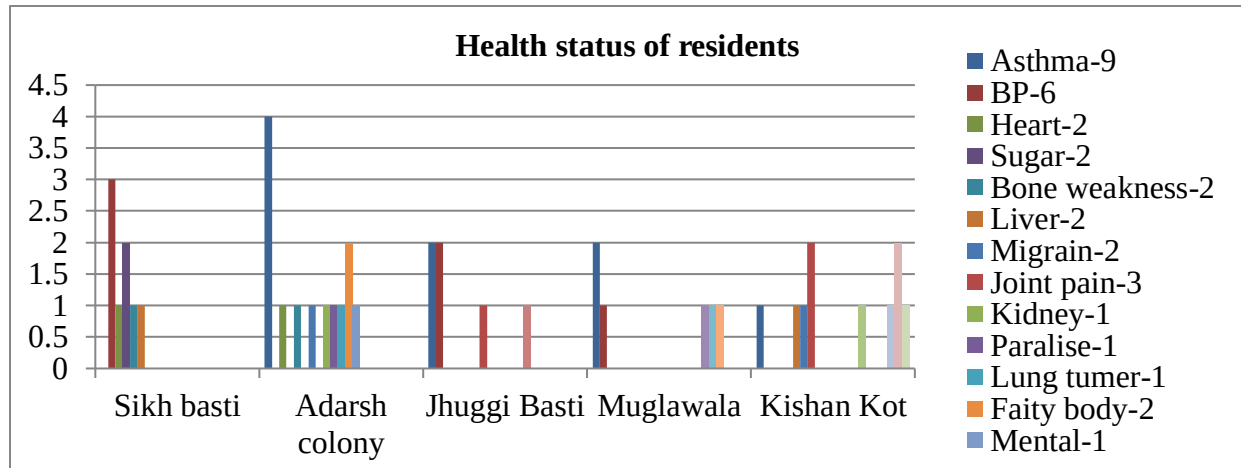
The data regarding the quantity of particulate matter emitted into the atmosphere of the surrounding areas by cement plant on different dates of different months of year has been collected from Himachal Pradesh State Pollution Control Board Regional Office Paonta Sahib through website, officials and RTIs, the details of which are given in the above Column chart 1. Looking at the data shown in Column chart 1 above, the amount of fine particles PM 2.5 ug/m³ and PM 10 ug/m³ emitted by CCI cement plant in areas was 84.29 ug/m³ on 28-03-2012 (HPSPCB, RTI-101. 9), 197.0 ug/m³ on 02-05-2012 (HPSPCB, RTI-101. 10), 59.56 ug/m³ on 19-05-2012 (HPSPCB, RTI-101. 12), 220.05 ug/m³ on 23-05-2012 (HPSPCB, RTI-101. 16), 56.64 ug/m³ on 26-06-2018 (HPSPCB, RTI-101. 35), 220.05 ug/m³ on 14-12-2018 (HPSPCB, RTI-101. 39), 135.58 ug/m³ on 03-01-2020 (HPSPCB, RTI-101. 48), 117.99 ug/m³ on 01-07-2021 (HPSPCB, RTI-101. 62). The whole ratio is more than the standards set in the National Ambient Air Quality Monitoring Status and Trends 2019 Report.

Mallongi has shown in his study that the chronic exposure to fine particulate matter may cause adverse health impact on humans (2023, 52). Richard & Chinyere's research has shown that long term exposure to cement dust affects the lung and liver function (2016, 6). Attri & Kalia in their study highlighted the environmental health status in the vicinity of ACC cement plant Barmana. In all these studies, the common diseases caused by cement pollutants are lung cancer, eye irritation, cough, TB, dental problems, skin diseases, asthma, high blood pressure, diabetes, heart diseases etc (2017, 12). Also, these studies clearly indicated that if the amount of Particulate matter exceeds the set standard in the atmosphere, it will affect the surrounding environment and human health in some way or the other. Referring to table 2, if the amount of particulate matter (PM 2.5) ug/m³ in the atmosphere is above 30 and the amount of particulate matter (PM 10) ug/m³ in the atmosphere is above 50 ug/m³, then it affects the sensitive people in breathing. If the amount of particulate matter (PM 2.5) ug/m³ in the atmosphere is above 60 and the amount of particulate matter (PM 10) ug/m³ in the atmosphere is above 100, then it is dangerous for asthma patients, adults and children. The amount of particulate matter (PM 2.5) ug/m³ is above 90 in the atmosphere and the amount of particulate matter (PM 10) ug/m³ in the atmosphere is above 250 then it causes trouble in breathing to everyone.

Health Status of Local Residents

Based upon the previously done studies and data referred thereof in reports, the information related to the health status and diseases of local residents was collected through house to house interviews during the survey.

Column chart 2: Health status of residents



Source: Related data has been collected from local respondents under the field survey (2021-2023)

The pollution particles emitted from the cement plant are continuously spreading into the atmosphere which is described in column chart 1. If people suffering from diseases live in a polluted environment, then their health will deteriorate further. On analysis of the 297 people selected for interview, data collected during field survey as mentioned in column chart 2, it was found that 48 local residents were suffering from some disease or the other which is 16 percent of the selected data. On the other hand, local residents spent almost their entire life in their community, and hence they are exposed to polluted particles on a daily basis, so local residents are susceptible to such diseases. Various studies prove that living in a polluted environment is harmful to health (Beig et al, 2010, 2, Richard el al, 6, Al-Dousari, 2023, 1), hence present study further corroborate the research done on other cement plants by researchers.

Impact of cement plant on the Environment and Local Respondents

Under the field survey, an attempt was made to enquire from the local residents what changes took place in the local environment after establishment of a cement plant in the selected area and how the surrounding environment was affected. Questions posed to interviewers has been tabulated in table 3 along with related data that has been collected.

Table 3. Impact on environment due to cement plant among respondents

Questions asked from the respondents	Total respondents	Yes	No	Don't know	Good	Bad	Good-Bad Both	Healthy	Unhealthy
what do you think about this plant	297	-	-	25	-	143	129	-	-
Impact of dust & smoke emitted by cement plant	297	233	-	64	-	-	-	-	-
Depletion of cultivable	297	156	-	141	-	-	-	-	-
Crops are being adversely affected	297	65	-	232	-	-	-	-	-
Forests are being destroyed	297	55	-	242	-	-	-	-	-
Are there any trees & plants that are dry & dying out	297	47	-	250	-	-	-	-	-
Problems increased due to increase in traffic	297	225	-	72	-	-	-	-	-
Impacted human health	297	171	-	126	-	-	-	-	-

Dirtiness increased around this plant	297	175	-	122	-	-	-	-	-
You are doing something towards environmental protection	297	266	-	31	-	-	-	-	-
Any effective steps taken by the plant towards environmental protection	297	-	53	244	-	-	-	-	-
Your health condition	297	-	-	-	-	-	-	249	48
Does any member of your family have any disease	297	244	28	25	-	-	-	-	-

Source: Field survey (2021-2023)

Present data has been collected from 297 local respondents from the three selected villages Rajban (Sikh Basti, Aadarsh Colony & Jhuggi Basti), Muglanwala and surrounding areas of Kishan kot during 2021-2023. The responses show that CCI plant has badly affected the crops, forest cover and environment. In addition to this, even human health is at risk. Referring to Column chart 1, the concentration of particulate matter was recorded highest in the year 2018 i.e., 220.25 ug/m³. If the amount of particulate matter exceeds the set standard in the atmosphere, it will affect the surrounding environment and human health, as mentioned in the above table 2. According to local residents, cement dust and smoke settles on the crops. At the time of harvesting, it causes burning sensation in the eyes and itching on the hands. Studies show that cement dust is potentially harmful to the environment and it directly affects crops through deposition of dust on crops and plants (Farmer, 1993, 65).

Local residents made it clear that patients suffering from asthma, lung cancer and TB etc. have difficulty in breathing due to cement dust and smoke. Previous studies done on Uttar Pradesh cement plants have shown that patients suffering from BP, itching and eye diseases are also affected by the noise, smoke and dust, since the cement industry is associated with high dust emissions causing ischemic heart disease, respiratory diseases and other diseases (Attri & Kalia, 2017, 15). Present study supplants the previous observation, though done on different cement plant. Residents of Rajban (Sikh Basti, Aadarsh Colony & Jhuggi Basti), Muglanwala and surrounding areas of Kishan kot also regretted that no effective steps were taken by the cement plant towards environmental protection. Contrary to it, the documents and official records received from CCI office show that new technologies are being used in the plant to prevent environmental pollution. Although efforts have been made by the cement plant to reduce its harmful effects on the environment, the amount of particulate matter pollution in the air has still been found to be higher than prescribed standard (shown in column chart1), confirming that their efforts to curb environmental pollution are ineffective. Also, no new plantation was observed in these areas to reduce pollution through better tree-cover. It could also have reduced cement dust entry into natural soil.

Status of human settlement around the Cement Plant

When Rajban Cement plant was established, local population did not leave the vicinity in the hope of getting jobs in the plant. Also migrant population arrived for job opportunities. Slowly, few of members were taken for menial tasks into the company, few took to driving small and heavy vehicles for the transportation of cement. But slowly, pollution increased which affected health and people shifted from close vicinity. During the field survey, several photographs were taken from various locations around the cement plant in which we found that the buildings were in dilapidated condition and dusty. Areas and houses in Aadarsh Colony and Slum (Jhuggi basti) were covered with dust.

Figure. 1: Views showing the surroundings environment of the cement plant (continued)



Figure. 1.a: Building in dilapidated condition near Aadarsh Colony

A building in deserted condition (Figure 1.a) had been found near Aadarsh Colony near cement plant, it was earlier a post office building. Today the condition of the building is very bad due to lack of repair and maintenance, it can collapse any time. This can cause loss of life and property to the people living around it.



Figure.1. b: Aadarsh Colony and other buildings



Figure.1.c: Dust keeps falling on the houses of Slum (Jhuggi Basti)

Aadarsh Colony and Slum (Figure. 1.b) are located near the cement plant. Dust keeps falling on the houses of Aadarsh Colony and Slum, as seen in the above figure 1.c. During the field survey, residents from Rajban (Sikh Basti, Aadarsh Colony & Jhuggi Basti) told that the dust and smoke emanating from the cement plant keeps accumulating on the houses.

Impact of Cement dust on Vegetation

Shukla (2008, 34, and 2013, 337); Ramesh (2014, 155); Rawat (2015, 41); found in their studies that dust and other pollution particles gradually settle on the surrounding trees and their leaves and hinder their growth in some way or the other. The stunted growth of shrubs and plants is clearly visible in and around Rajban (Sikh Basti, Aadarsh Colony & Jhuggi Basti) area. The effect of smoke and limestone dust emitted from cement plant on the lateral growth of vegetation is shown in figure 1 d & e below.

Fig. 1.d



Fig. 1.e



Figure. 1.d & e: dust accumulated on the plants

These figure 1, d and e are taken from inside the courtyard of Kirtik house in Aadarsh Colony. It is clear from the dust settled on the plants that the dust penetrates deep into the house. If there is so much dust on the plants inside the houses, then there must be even more dust on the plants outside. During field survey, dust covered trees were observed throughout.

II. Conclusion

The present research concludes that the exposure to cement dust increased human health risks. Secondly, human settlements were affected due to the dust and pollution. Thirdly, thick layer of dust on plants had resulted into stunted growth of vegetation. Life of people cannot be the cost of development. Perhaps extensive plantation could reduce the effect of dust up to certain level. For development, we need better policies based upon symbiotic relations.

Abbreviations

ug/m ³	Microgram per meter cubic
AQI	Air Quality Index
BP	Blood pressure
CCI	Cement Corporation of India
CPCB	Central Pollution Control Board
HPSPCB	Himachal Pradesh State Pollution Control Board
KM	Kilometer
MEFCC	Ministry of Environment, Forest & Climate Change
NAQI	National Air Quality Index
PCB	Pollution Control Board
PM	Particulate matter
PM 2.5	Particles with a size of < 2.5 microns
PM 10	Particles with a size of < 10 microns
RO	Regional Office
RTI	Right to Information
TB	Tuberculosis

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24. Primary information regarding health status and diseases is based on field survey (2021-2023), taken by the researcher from the villages Rajban (Sikh Colony, Aadarsh Colony & Slum Colony), Muglanwala and Kishan Kot, Teh, Paonta Sahib, District Sirmaur, H.P.
25. Primary data has been collected from the field through the discussion and interviews with 297 local residents (2021-2023) of the villages Rajban (Sikh Colony, Aadarsh Colony & Slum Colony), Muglanwala and Kishan Kot, Teh, Paonta Sahib, District Sirmaur, H.P.
26. Data based on documents received from CCI Rajban office. The interview of the officer was conducted in the month of April, 2023.

Conflict of Interest Statement

The authors whose names are listed immediately below certify that they have NO affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), in the subject matter or materials discussed in this manuscript.

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