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Research Article

Cement Production, Environmental Quality And Health: A Descriptive Study Of Khrew-Khonmoh Area In Jammu & Kashmir

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Abstract

India like other developing countries has policy priority for regional development through industrialization. Industrialization as a development strategy has been advocated in The Jammu and Kashmir (J&K), India, under various policies which led to the increase in the cement manufacturing plants in Khrew-Khonmoh area of Kashmir division. However, sustainable development needs to maintain an optimal trade-off between industrialization and environment. The present paper using secondary data, tries to describe the status of cement production in Khrew-Khonmoh industrial area of Kashmir division and its impact on quality of environment and health. The air pollution in Khrew-Khonmoh cement manufacturing belt in Jammu and Kashmir is above the national ambient air quality standards. Acute Respiratory Illness (ARI) cases are showing positive trend with air pollution in Khrew town of J&K. There is need to reconsider the environmental sitting criteria of cement plants and devising of new regulatory policies for conservation of fragile environment.

Key Words: Cement Production, Acute Respiratory Illness, Air Pollution, Environment, Conservation.

1. Introduction

In recent years much attention has been increasingly drawn to environmental problems associated with industrial production and consumption activities as rapid industrialization is causing serious threats to sustainable development of both developed and developing countries. In the process of economic development with increasing industrialization, the demand for scarce environmental resources is increasing considerably. With large scale emissions from industrial activities above the assimilative capacity of environment, the resultant damage on environment and consequently on: human health, productivity, biodiversity, agriculture and key stone functions of environment have assumed alarming proportions.

Deteriorating quality of environment is a major determinant of poor health and quality of life. One of the critical and major public health and environmental concerns is the problem of air pollution. The adverse health outcomes associated with air pollution include the reduced life expectancy, increase in the incidence of: mortality, chronic diseases like Asthma, chronic bronchitis, lung cancer, hospital admissions associated with heart and lung diseases, low birth weight, acute illness which induce respiratory infections such as influenza, acute bronchitis, pneumonia, sinusitis etc, restricted activity days (RAD), respiratory symptom days etc (Dockery 2001, Dockery et al. 1992, Dockery et al. 1993, Lave and Seskin 1973, Lipfert 1997, Neil et al. 1962, Ostro 1983, 1994,1999, Parker et al. 2005, Patterson and Eatough 2000, Pope et al. 2002, Pope et al. 2009, Pope and Dockery 1995, and many more). Most of these studies are confined to developed regions. In India

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the rural areas are designated for industrial activities to achieve the objective regional development. These fragile zones of environment need to be studied which have been affected by industrial activities. The present descriptive study tries to analyze the status of cement production in Khrew-Khonmoh industrial area in Jammu and Kashmir and its effect on environmental and health. Secondary data from different sources has been used to describe the status of cement production and its environmental impact. The association between air quality (PM_{10}) and Acute Respiratory Illness has been shown with the help of ordinary least square method for determining trend.

2. Khrew-Khonmoh Cement Manufacturing belt in J&K

Jammu & Kashmir (J & K) is northern state of Indian sub-continent located in north-western Himalayas covering an area of 2, 22,236 square Kilometres with population of 125.49 lakh persons (2011). Administratively, the state has been divided into two divisions - the Kashmir division (which includes the Kashmir valley and Ladakh region) and the Jammu division. The Jammu and Kashmir state accounts for 3.2% of the total geographical area and 1% of the total population of the country. Jammu and Kashmir state economy has some unique characteristics like remoteness and isolation, limited capacity in terms of: diversification in production sector, infrastructure and institutional set-up. These factors pose severe challenges in the process and planning of economic growth and development. The economy of Jammu and Kashmir is predominantly agrarian in nature with 70% of its population deriving its income directly or indirectly from the primary sector (Qureshi and Ahmad 2008). Nearly 75.19 % per cent of the population of the state lives in the rural areas. Major share of the labour force is employed in the primary sector.

The conventional proposition is that Industries accelerate the development of an economy. J&K is an industrially backward state and does not have a strong industrial base. Keeping in view the state's topography and fragile environment the Government has long stance of boosting the identified key industries on priority like handicrafts, tourism, cottage and small scale industries. Besides that, the state has set its agenda to speed up the pace of industrialization. The Government has created an environment conducive for setting up of industrial units or to attract investments via various policy and institutional measures keeping in view the growing employment demands and needs to accelerate the industrial activities in the state. These measures included setting up of promotional agencies for infrastructure development, financial assistance and coming up with the incentive bound industrial policy. New Industrial Policy (2004-2015), aims to accelerate the economic development by promoting rapid industrialization. Recognising the need to revive the industrial scenario in the state, provision of double-edged incentives both from centre and state were key attractions in the new industrial policy. The fiscal and tax incentives/exemptions from state and centre governments to boast the private investment in J&K include: interest subsidies on working capital, land power at concessional rates, insurance cover to industrial units, transport subsidy, exemption of toll tax for imports, value added tax, stamp duty, income tax exemption, etc. Besides, financial assistance, infrastructural facilities, official registration and permissions under single window systems were made investor friendly to attract investors.

Many small and medium-scale industries came up in the traditional sector and some new potential areas have also been identified like food processing, agro-based units and metallic and non-metallic products and others. As on 31st March, 2009, 139 industrial units of large and medium scale industries have been set up generating an employment for 27,236 persons. The permanently registered small scale industrial units at the end of March 2009 were 51,443 providing employment to 2,35,918 persons. Out of these Small Scale Industries (SSI's), 23,908 units were functioning in the state employing

The state of Jammu and Kashmir had established some public sector undertakings (PSU) operating in some potential areas which required heavy investments. There are twenty Public Sector Units in the state operational in areas like tourism, handicrafts, handloom, forests, horticulture, industries, agro-industries, minerals, cement etc. These PSU's are running into loss with few exceptions. Seven

of the PSU's are on budgetary support from state Government to meet their wage bills and day-to-day expenditures. Some of the PSU like J & K Cements, J & K Minerals Ltd. are profits making enterprises.

Cement industry is the vital industry for infrastructure development of the country. India emerged as second largest cement producing country in the world after China. Post-decentralization cement industry witnessed exponential growth (CMA, 2009)[1]. There are two sub-sectors in the cement industry - one consisting of large plants and other consisting of mini plants[2]. As on 31st March, 2011, there were 139 large cement plants and about 365 mini cement plants in the country. The present annual installed capacity of large plants is 234.30 million tonnes & for mini cement plants it is 11.10 million tonnes. The total annual production of cement during 2009-2010 by large cement plants was 168.30 million tonnes and by mini cement plants was 6 million tonnes (CMA, 2011)[3]. The southern region is the leading producer of cement followed by northern, eastern, western and central regions. While the top five cement producing states are: Rajasthan, Andhra Pradesh, Madhya Pradesh, Tamil Nadu, Gujarat and Maharashtra which together produce nearly 70 % of the total production of the country. The lowest cement producing states are Haryana, Assam, Jammu and Kashmir, Uttarakhand, Bihar and Kerala.

Jammu and Kashmir is third lowest cement producing state of India. The annual installed capacity of the state was 0.20 million tonnes up to 2008-09 as the only cement plant accounted in the national statistics till 2008-09 was that of 'J&K Cements Ltd. With the inclusion of Khyber Industries Ltd. in the cement manufacturers association, the total installed capacity of the state during the year 2009-10 was 0.53 million tonnes which is 0.24 % of the all India total. The annual production during 2009-10 was 0.16 million tonnes with 0.53 million tonnes of consumption. The annual cement production, consumption and installed capacity of J&K state as per Cement Manufacturers' Association (CMA) data is shown in Table No. 1.

Source: Cement Manufacturers Association, New Delhi (2009-10) *(Figures rounded off)*

Table No. 1: Cement production, Consumption and Installed Capacity of Jammu & Kashmir (Million Tonnes)

Year	Annual Installed Capacity	Annual Cement Production	Cement Consumption
2009-10	0.53 (0.24)#	0.16	0.53
2008-09	0.53 (0.24)	0.14	1.08
2007-08	0.20 (0.10)	0.16	1.26
2006-07	0.20 (0.12)	0.15	1.24
2005-06	0.20 (0.13)	0.16	1.01

Source: Cement Manufactures' Association[4], New Delhi (2010)

 # Figures in parenthesis are percentage of state production to all India total.

The cement industry is heavily reliable on limestone. For manufacturing one tonne of cement, 1.5 tonnes of limestone are required. The state of J&K is having 5000 Million Metric Tonnes of Limestone reserves. These reserves have become an attraction for the producers to set up their plants in this state. Though State is among the low producers of cement, few things are worth mentioning regarding the state's cement production. The above mentioned data are based on cement plants which are members of CMA particularly the large scale plants. However, J&K state possesses mini cement plants whose production is unaccounted in the national data sources. The majority of such production units are confined to the Khrew-Khonmoh area which is emerging as the cement hub and is designated as the cement capital of Kashmir.

Khrew-Khonmoh cement manufacturing belt is a prominent cement producing area of the Kashmir valley. Geographically, it is a plateau sharing same geology. This cement manufacturing belt lies in-between the foothills of mountain range locally known as Zewan Series and the Karewas of Pampore and is famous for saffron cultivation. The mountain range carries the finest developed sequence of limestones of Paleozoic and Mesozoic eras. The series is represented by compact and

partly crystallized, dark coloured limestone. Rocks of this system are composed of shale, dark arnacious-shales and limestone. Limestone is the principle rock of this mountain range, dolomite at places and thinly bedded in the upper part (Samee and Kanth 2005).

Administratively, this area falls in two Districts - Srinagar and Pulwama of Kashmir division. The cement belt lies on the south-eastern outskirts of Srinagar city and northern boundary of district Pulwama. This belt stretches from Pantha Chowk to Lethpora covering the adjoining vicinities of Zewan, Khonmoh, Wuyan, Khrew, Shar-Shali and Ladhu and the adjoining villages. From Pantha Chowk to Khonmoh the region falls under Srinagar Municipality (Ward No. 34) and rest of the area from Khonmoh onwards falls under sub-district (Tehsil) Pampore of District Pulwama.

The major pollution affected areas consist of Khonmoh, Khrew and other adjoining villages which together constitute the population of 32845 from 4586 households lying within 5 KM's from cement plant.

Cement Plants at Khrew-Khonmoh

Cement is freight intensive commodity. Therefore the raw material availability within regional markets is one of the prime requirements for establishing cement plants. Khrew-Khonmoh area is a promising location for cement plants. Many investors have located their cement plants in this belt. This in turn has resulted in the formation of a cluster. Apart from large number of stone quarries, stone crushers, almost 12 cement plants had been localized in this belt out of which nine are functional and many others waiting for commissioning. Locational specialization in terms of limestone availability, comparatively soft terrain, convenient transportation and its location at the centre of the Kashmir valley is the major cause of the congestion of cement manufacturing plants in this belt. The trend started in early 60's with the setting up of first 60 Tonnes per Day (TPD) cement factory by JK Minerals at Wuyan (recently closed). The second plant 'J&K Cements Ltd.- a Government undertaking' was setup in 1980 which started functioning from April 1982. This was followed by setting up of as many as 10 Cement factories having total capacity more than 5000 TPD. These plants are producing both the cement and clinker and most of them have been commissioned in the past decade. The majority of the cement plants are congested around Khrew followed by Khonmoh and Wuyan. In the immediate vicinity of Khrew lies the J&K Cements plant- which is a PSU and considered the most polluting cement plant in the area and nearer to the residential settlements. Other cement plants around Khrew are scattered in the upper reaches. At Khonmoh, there are currently three cement plants functional surrounding the northern side of settlements. In between Khrew and Khonmoh at Wuyan currently there is only one cement plant and the other PSU has been closed. This whole cement manufacturing belt is not a planned industrial zone/estate but emerged and developed outside the industrial estate though there might had some spill-over effects from the industrial estate at Khonmoh. The total numbers of cement plants with location production and installed capacities (tons per day) are listed in Table No. 2.

Table No. 2: Cement Plants and their Production at Khrew, Khonmoh and Wuyan (2009-10)

S.No	Name of Cement Plant	Location	Capacity Tonnes per Day (TPD)	Size**	Production Metric Tonnes/Annum
A	**Cement Plants at Khonmoh and adjoining Areas**				
1.	*Khyber Industries (P) Ltd.*	Tulpow, Khonmoh, Srinagar	1200	Large	318996
2.	*Saifco Cements Pvt. Ltd*	Saman, Khonmoh, Srinagar	600 (+300)*	Large	175788
3.	*Trumboo Cement Industry (TCI)*	Khonmoh, Srinagar	400	Large	120000
B	**Cement Plants at Khrew and adjoining Areas**				
3.	*J & K Cements Ltd*	Khrew, Pulwama	600 (+600)	Large	198000
4.	*M/S Kashmir Cements*	Bhatyar Khrew, Pulwama	NA	Medium	24000
5.	*M/S Valley Cement Industry*	Kutnerg, Khrew, Pulwama	50	Medium	15000
6.	*M/S Cemtac Cements*	Sulnar, Khrew,	200	Medium	33000

	Pvt. Ltd.	Pulwama			
7.	*M/S Dawar Cements*	Khrew, Pulwama	400	Medium	NA
8.	*M/S Itifaq Cements*	Khrew, Pulwama	200	Medium	NA
9.	*TCI-Max*	Khrew, Pulwama	1000	Large	600000
10.	*Jhelum Cements*	Khrew, Pulwama	600	Large	NA
C.	**Cement Plants at Wuyan**				
11.	*M/S Greenland Cements Pvt. Ltd*	Wuyan Pulwama	100	Medium	30000
12.	*J&K Minerals Ltd*	Wuyan Pulwama	60	Small	Closed

Source: Jammu and Kashmir State Pollution Control Board, Srinagar, 2009-2010.
Official websites: www.tcimax.com, www.khybercements.com
**figure in parenthesis denotes additional proposed expansion.*
*** Size as classified by J & K State Pollution Control Board.*
NA=Not Available.

Besides these existing cement plants, there are many others which are in pipeline for environmental clearance and other operational requirements and are yet to be commissioned. The cement plants are engaged in the production of clinker and cement like Ordinary Portland Cement (OPC), Pozzoland Portland Cement (PPC) of various grades and fly ash blended cement. For producing one metric tonne (MT) of cement the raw material consumption required is limestone (1.0 MT), clay (0.202MT), iron ore (0.023 MT), coal/coke/lignite (0.311 MT), gypsum (0.050 MT), and fly ash (0.300 MT)[5]. The total cement production in this area is more than 1.5 million tonnes per annum[6]. The cement plants collectively provide many economic benefits to the local population in terms of employment and other indirect benefits like increase in trade and commerce, increase in the transportation, civic facilities as a part of corporate responsibility etc. However, the emissions of the cement plants pollute the atmosphere which in turn affects the welfare of the people. There are direct and indirect costs borne by the local inhabitants by facing the negative externalities of these cement plants. These costs are the damages to the environmental services and goods- reversible and irreversible, explicit, implicit monetary and non-monetary. Establishing further large scale industries in this sector is fraught with many disadvantages. The State Development Report (2003) acknowledges that the fragile ecology of the state inhibits setting up of large industries based on minerals. The social costs involved, in the form of environmental degradation, pollution, soil erosion, would be much higher than the benefits which would accrue to the people.

3. Environmental Impacts of Cement Plants

Cement industry has been identified by Ministry of Environment & Forests (Govt. of India)[7] among the seventeen heavily polluting industries. The J&K State Pollution Control Board had categorised the cement industry into red category as it is highly polluting in nature. Generally the preparation of cement includes mining; crushing and grinding of raw materials principally limestone and clay; calcifying the materials in a rotary kiln; cooling the resulting clinker; mixing the clinker with gypsum; and milling, storing and packing the finished cement. The cement production by its nature is polluting the environment as dust besides primary and secondary pollutants are emitted almost at every stage of the manufacturing process starting from limestone mixing and raw material handling to cement mill and packing plant. The cement industry is an energy intensive industry by virtue of high temperature reactions and various physical operations involved in its manufacturing. The industry uses both coal and power as energy inputs. The uses of coal as energy adds to the air pollution. The fugitive emissions from raw material storage, loading and unloading operations, vehicular movement on unpaved roads add up to the total plant emissions. The emitted pollutants from stacks and fugitive dust are dispersed into the atmosphere. The small size particulate matters having low settling velocity are capable of reaching far-off places while the heavy dust particles settle down in the close vicinity of cement plants. These emissions affect the surrounding populations and environment. Worldwide researchers have documented the adverse environmental impacts of cement plants like: occupational exposure among cement workers and respiratory illness

(Al. Neami et al. 2001, Alveor-Galindo 1999, Dietz et al. 2004, Mwaiselage and Bratveit 2006, Zeleke et al. 2010); cement dust and its impact on health of surrounding community (Schuhmacher et al. 2004, Vestbo and Rasmussen 1990, Adak et al. 2007, Yhedego 1992); impact on surrounding vegetation, tress, agricultural crops (Kumar 2008,, Murugesan et al. 2004, Baby et al. 2008); and impact on water quality (Misra 1991).

As one of the goals of national environment policy is to sustain the environment, the producers are required to maintain the pollution emissions on the norms prescribed by the Central Pollution Control Board (CPCB). The CPCB's particulate emission standards from the stacks for a cement plant having capacity of 200 TPD or less is 250 mg/Nm^3 for the protected area and 400 mg/Nm^3 for all other area. For the cement plants having capacity of 200 TPD and above, the protected area norm is 150 mg/Nm^3 and for other area it is 250 mg/Nm^3. The J&K SPCB had followed a stringent policy regarding the emissions because of the sensitiveness of the area and had set these limits from 50-100 mg/Nm^3 depending upon the area of location and size of plant. Most of the cement plants in the case area do not possess continuous S*tack Monitoring Kits*; therefore, reliable information about the stack emissions is not available. To comply with these emission norms producers require controlling pollution emissions by utilizing different devices, methods, and techniques of pollution abatement. Though some of the cement plants have installed pollution control devices, yet many are defaulters. The residents claim that the pollution devices are not made operational during the night and tonnes of dust are emitted and gets dispersed into the atmosphere with heavy deposition in the residential area which becomes visible in the mornings.

The emissions from the cluster of cement plants in the case area and their impact on the local environment can be assessed by analysing the air quality indicators. The Total Suspended Particulate Matter (TSPM) limit for 24 hours for residential and rural areas as set by state pollution control board is 200. In the revised national ambient air quality standards[8] 2009, PM_{10} limit for 24 hours has been set at 100 μg/m^3 and annual limit is 60 μg/m^3. These limits are same for industrial, residential, rural and ecologically sensitive areas. However, growing evidence that there is no threshold limit for air pollutants has made many developed countries to lower down the maximum permissible limits. The World Health Organisation's recommended annual limit for PM_{10} is 50 μg/m^3. This gap between the developed or WHO recommended PM_{10} and developing nations clearly depicts the development-environment trade-off which is heavily biased towards the development.

To check the trends of air quality of this sensitive area two ambient monitoring stations have been installed under National Ambient Air Quality Monitoring Programme and are functional since from April 2009. The J&K State Pollution Control Board (J&KSPCB) is measuring the air quality at two ambient monitoring stations located at the residential areas of Khrew and Khonmoh which are 1-2 Km away from the nearest cement plant. These two places have more population with respect to the other affected villages which are scattered in the surrounding vicinity. The Respirable Dust Sampler (Envirotech AMP 460 NL CSIR/NEERI) is being used to monitor the Particulate Matter of aerodynamic diameter of less than 10μm or PM_{10} μg/m^3 and Total Suspended Particulate Matter (TSPM) on alternate days. The monthly Ambient PM_{10} and TSPM at the two stations of Khrew and Khonmoh for the year 2009-2010 is shown in Table No. 3.

Table No. 3: Monthly PM_{10} and TSP levels at Khrew - Khonmoh: 2009-10

Month	Khrew station		Khonmoh Station		Average	
	PM_{10}	TSPM	PM_{10}	TSPM	PM_{10}	TSPM
April 2009	85.75	252.29	96.92	246.32	91.335	249.305
May 2009	63.71	202.52	80.02	324.13	71.865	263.325
June 2009	76.78	290.31	102.8	227.33	89.79	258.82
July 2009	65.79	258.78	90.06	313.62	77.925	286.2
August 2009	90.69	159.75	97.24	193.69	93.965	176.72
September 2009	78.98	185.09	142.26	314.59	110.62	249.84
October 2009	136.82	422.56	106.03	224.3	121.425	323.43

November 2009	170.31	358.54	199.62	408.54	184.965	383.54
December 2009	105.46	222.32	148.23	322.98	126.845	272.65
January 2010	107.27	190.57	152.87	342.58	130.07	266.575
February 2010	108.37	208.92	130.85	276.22	119.61	242.57
March 2010	88.62	192.89	92.28	234.49	90.45	213.69
Av. Annual**	**98.22**	**245.38**	**119.93**	**285.73**	**109.07**	**265.55**

Source: Air Monitoring Lab., J & K SPCB, Srinagar, 2009-2010.
***Annual Ambient Air Quality Standards for residential areas is 60 μg/m^3 for PM$_{10}$.*

As shown in the table No 3, the annual PM_{10} at Khrew is 98.22 μg/m^3 and the TSPM is 245.38 μg/m^3 both are above the annual permissible limit of 60 μg/m^3 and 200 μg/m^3 respectively. Similarly at Khonmoh, the annual PM_{10} is 119.93 μg/m^3 and the TSPM is 285.73 μg/m^3 and both above the annual permissible limit of 60 μg/m^3 and 200 μg/m^3 respectively.
The average of the two stations represents the same with the annual PM_{10} as 109.07 μg/m^3 and the TSPM is 265.73 μg/m^3. The data shows that average air quality of the area is polluted with the pollutants above the permissible limits. The air quality of Khonmoh is worse than Khrew and its reason might be the closeness of the monitoring station to cement plants[9]. The air quality at both the stations is low during summer and high during winter which is attributed to the changes in the atmospheric conditions. The other pollutants like carbon dioxide, carbon monoxide, sulphur dioxide, nitrogen oxide are not being monitored in the case area.
The Cement factories primary and secondary pollutants added to the local atmosphere per day are increasing consistently with the increase in production capacity and emergence of new cement plants in this area. The emissions from factories to the local atmosphere are much more than the pollution bearing or carrying capacity of local atmosphere. Resultantly, ecological imbalance, decrease in agricultural production, soiling damages and Health loss are the potential threats. Samee and Kanth (2005) while analyzing the environmental impact of Khrew Cement factory (J&K Cements Ltd), which is being considered the most polluting cement plant and is nearer to the Khrew town, showed that the cement plant has not only influenced the land use and cropping pattern but has also reduced the productivity of different crops besides deteriorating the human health. Various representations and complaints had been submitted in the J&K SPCB against the growing number of cement plants and the associated impacts in the area by the local residents/farmers.
The deteriorating environment in this area effects natural and pristine natural endowments. The ecological sensitiveness of the case area makes it more susceptible to pollution and the potential loss and ecological imbalance is of national concern. The sensitiveness & national importance of the case area can be best explained in terms of its location, resources, biodiversity, ecology and climate. It is endowed with rare biodiversity and scenic beauty, the physiographic diversity, climate, habitat and natural vegetation provides the required habitat to a variety of flora & fauna. The area is in close proximity of Dachigam National Park which harbours endemic species. The upper reaches of Khrew and Khonmoh have been notified as "Reserve" areas. The mediterranean climate supports rich species. The fauna biodiversity of the state is rich with unique species both in the forest zones and above the tree line. About 16% of the mammals, birds, reptiles and butterflies found in India are found in the state. The ecological significance gives the region more importance and a comparative edge in terms of potential for tourism development which contributes considerably to the economy. The existing case area is in close proximity of these core zones of biosphere and fragile eco-zones. These rare species are more prone to pollution. The possible environmental impact of the cement manufacturing plants in the region are on the- topography, soil & land use, surface water & ground water, ambient air quality and on biotic environment. Impacts on many of these resources could be irreversible which would lead to loss of economic welfare.

4. Environmental Health Impacts of Cement Production

The most crucial environmental impacts of air pollutants are on human health. The Particulate Matter has been associated with various short and long term diseases. Prolonged exposure to it

reduces life expectancy The growing concern among the inhabitants surrounding these cement plants are claims of decreasing health status which the local residents ascribe to the large presence of cement plants and demand their closure or relocation.

Nearly 32,845 persons from 4586 households (2001 Census) inhabit in this cement producing area. The residents have been claiming of adverse health impacts of the growing cement plants and the associated air pollution. Samee and Kanth (2005) analysed the health impacts of J & K cements Ltd located in Khrew which is functional since 1982. They compared the incidence of chest infection/respiratory tract infection before and after the establishment of the cement plant at Khrew. The data assessed from Primary Health Unit (PHU) of Khrew showed that the number of chest/respiratory tract infection cases were 82 for the year 1976-77 which constituted 2 % of the population. However, during 2001-02 such cases were found to be 365 and constituted 5% of the population. They concluded that increase in the incidence of chest and respiratory tract infections can be attributed to the increasing pollution due to cement plants. No health related secondary sources of information were available from the other listed villages. However, the distribution of diseases deduced from the monthly out-patient disease specific hospital visits from the Primary Health Unit Khrew for the year 2009-2010 is given in Table No. 4.

Table No. 4 :Disease Wise Monthly Out Patient Hospital Visits/Cases at Primary Health Unit Khrew, 2009-2010

Month	Acute Respiratory Infections	Bronchitis	Asthma	All Other Cases	Total Cases
Apr-2009	84	5	1	263	353
May-2009	54	41	5	238	338
Jun-2009	70	40	8	301	419
Jul-2009	80	41	11	439	571
Aug-2009	100	41	11	539	691
Sep-2009	145	75	22	758	1000
Oct-2009	110	41	11	626	788
Nov-2009	80	40	8	332	460
Dec-2009	145	34	15	466	660
Jan-2010	115	75	35	783	1008
Feb-2010	111	90	35	716	952
Mar-2010	97	95	22	761	975
Total	**1191**	**618**	**184**	**6222**	**8215**
% of Annual Total Cases	**14.50**	**7.53**	**2.24**	**75.73**	100

Source: Primary Health Unit, Khrew, 2009-2010

The compiled table shows the three major classifications of respiratory and lung related diseases [ARI (which includes Influenza and excludes Pneumonia), Bronchitis and Asthma) while rest of the communicable and non-communicable diseases have been clubbed in the category of all other cases. The total out-patient visits (OPD) visits during the 2009-2010 at the PHU Khrew were 8215. Out of which 14.50 % cases were of ARI, 7.53 % cases were of Bronchitis and 2.24% cases were of Asthma which together constitutes the 24.27% of cases. Seventy six percent of the annual cases were new while rest were old. This ratio shows that the respiratory illness cases are quite high in Khrew. Increasing pollution specific diseases have economic implications like increasing medical expenditures, frequent physician visits, loss of work, school days missed, increase in other preventive and mitigating activities, loss of leisure, inconvenience, pain and sufferings etc. Hence reducing the pollution and the associated diseases will ultimately increase the welfare of the people and economists are trying to quantify these welfare gains using various methods of valuation.

The increasing ratio of respiratory and lungs related diseases can be attributed to many factors like increasing in air pollution, changing life styles, occupational exposure, individual's health stock, socio-economic structure, etc. A cause and effect type relationship can capture the impact of these factors on the prevalence/incidence of respiratory illnesses. A comprehensive study covering major pollution prone areas needs to answer varied research questions. For example whether there is any

significant positive relationship between the air pollution and prevalence of respiratory illness. If yes, what is its magnitude?

4.1 Acute Respiratory illness Cases and Air Pollution: Evidence from Secondary Data

The association between air pollution (PM_{10}) and *Acute Respiratory illness (*ARI) cases was also shown on the basis of secondary data. The time series data on monthly PM_{10} levels and number of monthly out-patient ARI cases at Primary Health Unit Khrew were available from April 2009 to March 2010 . The 12 month data of number of ARI cases/month was regressed on the monthly PM_{10} using OLS technique. The data on ARI at Primary Health Unit Khrew was recorded from 16th of one month to 15th of next month while for PM_{10} it was from 1st to 30th of each month. Therefore, the PM_{10} data was taken with one month lag. Figure No. 1 shows the graph of monthly PM_{10} and ARI cases (Khrew) from April 2009 to March 2010. Both PM10 and No. of ARI cases seem to follow same trend.

The association of PM_{10} with ARI cases was shown with the help of OLS Regression. The results are reported in Table No. 5. The estimated regression line based on the limited observations showed that monthly out-patient ARI cases are positively related with air pollution. The coefficient of PM_{10} (with one month lag[10]) has positive sign and was statistically significant at 10% level. The adjusted R^2 was 0.241. The single predictor has reasonable explanatory power and the F-statistic show Model was significantly different from zero. Therefore, time series data also shows positive association between air pollution and acute respiratory illness.

Figure No: 1

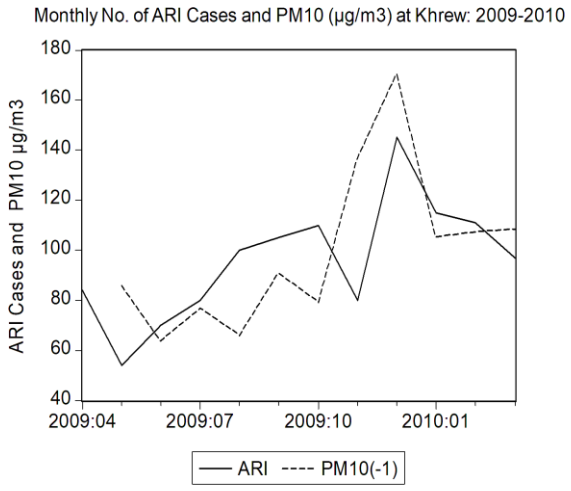

Table No. 5 Estimates of OLS Regression				
Dependent Variable: No. ARI Cases/Month		Sample: 2009:05 2010:03		
Method: Least Squares		Included observations: 11		
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	53.426	22.301	2.396	0.040
PM10(-1)	**0.440**	0.215	2.044	**0.071**
R-squared	0.317	Mean dependent var		97.00
Adjusted R-squared	0.241	S.D. dependent var		24.94
S.E. of regression	21.729	Akaike info criterion		9.158
Sum squared resid.	4249.22	Schwarz criterion		9.230
Log likelihood	-48.37	F-statistic		4.178

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5. Conclusions

An overview of environmental policy implementation in this case for cement plants reveals some existing loopholes. Cement plant establishment requires the environmental clearance from the regulatory agencies/institutions. The cement plant sitting criteria as approved in the 19th board meeting of J&K SPCB (2009-10) laid down some requirements/specification for cement plants to get environmental clearance. To have an overlook we mention briefly the core parameters like-maintaining distance from some sensitive places/spots. For example, distance from national highway (750ft), state highway (300ft) municipal limits of Srinagar City (2Km), major district head quarter (1Km), nearest residential area (0.5Km) approved water supply of 20 Kiloliters (0.5Km), Hospital/nursing home/health centre (0.75KM), notified bird or other sanctuary/national park (1Km), orchards/abi-aval (irrigated land)/saffron fields (0.5Km), educational or similar institutes (1Km).

Besides installation of pollution control devices/adaptation of other pollution control measures and meeting of emission standards' prescribed under environment protection act/rules especially the notification (GSR-N0. 176 (E) dated 02/04/1996 as amended from time to time is mandatory.

The existing sitting criteria are not comprehensive to ensure the environmental sustainability. For example, the distance parameters are not adequate given the growing scientific evidence that air pollutants can reach far-off places. A half kilometer distance from residential area cannot guarantee no-impact and is not sufficient. There is no policy guideline for the area lying in-between the cement plant and residential area. As even if at the starting/establishment of cement plant the distance is maintained but eventually with expansion in settlements the required distance eventually vanishes. The most important loophole in the sitting criteria is that the ambient air quality that prevails in this area does not figure anywhere in the sitting criteria. Under existing sitting criteria individually the setting up of a cement plant may full fill all the criteria but together the emissions of cement plants add heavy pollutants into the atmosphere. The existing relationship between emissions from stacks and ambient air quality which would determine the health of environment has been given inadequate regard in the environmental sitting criteria. Therefore, the existing *sitting* criteria of cement plants is inadequate and leads to the emergence of cluster of cement plants which individually may have emissions below norms but the total emissions in this air shed are alarming which are detrimental to health, agriculture, forests, biodiversity and ecology .

The environmental policy implementation for the cluster cement plant needs to be revisited to ensure that the development is sustainable in its sprit. Informed inputs for the policy formulation would, therefore, require the estimates of air pollution impacts and their quantification. Whenever industrial activity increases substantially in a limited area the quality of environment deteriorates rapidly. Environment pollution and health hazards are the outcome of the policies with less regard to adverse health consequences. The increasing air pollution depicts that the environment-development trade-off is heavily biased towards development. The critical impact is on the health of the surrounding communities with more than thirty thousand population exposed to the higher levels of air pollution throughout the year.

However rapid industrialization with increased pollution emissions has posed threats to fragile eco-zones and core zones of biosphere which is a major cause of concern. The Industrialization needs to be complementary to other sectors of economy in order to achieve the sustainable development. Too ambitious industrialization with less regard for the preservation of environment is no way a sustainable development. The trade-off between economic and environmental interests needs a promotional methodology that will provide very less chance for environmental degradation. Industrialization without environmental consideration would lead to a major policy failure in terms of sustainability. Though the state has ecological importance in terms of its tourism potential, core zones of biosphere reserves, fragile eco-zones and rare flora & fauna of national importance, environmental regulation becomes necessary.

End Notes

[1] Cement Manufacturers' Association (CMA), New Delhi, Official Website, http://www.cmaindia.org/portal/static/Dynamicfacts.aspx

[2] A factory with an installed capacity exceeding 297,000 tonnes per annum (or 900 tonnes per day) is a large plant and with capacity up to this limit is a mini plant.

[3] Cement Manufacturers Association, 2011. Data accessed online at www.cmaindia.org on 21/09/2001.

[4] online at www.cmaindia.org/org/portal/industry/cementMapInfo.aspx?ST=JK accessed on: 21/09/2011

[5] These proportions vary little between plants. This data was of Saifco Cements Pvt. Ltd. Provided by JKSPCB 2009-10.

[6] The CMA statistics based upon only two members from J & K shows it as 0.20 million tonnes for the whole state.

[7] Government of India, EPA Notification [S.O.393 (3) dated 26th April 1987.

[8] See National Ambient Air Quality Standards, Central Pollution Control Board, Notification No. B-29016/20/90/PCI-L dated: 18th November, 2009, New Delhi.

[9] The nearest plant to Khonmoh station is about 0.7 Km away however for Khrew it is 2 Km.

[10] With one month log of PM10 the ARI data and PM10 data overlaps over 15 days.

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