Air Quality Assessment near Marble Mine Area in Tehsil -Kotputali, District- Jaipur, Rajasthan (India)

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ABSTRACT

Mining Industry has rapidly deteriorated quality of the natural wealth called as resources. These industries are getting centers of the pollution sources; we need timely actions and various mitigative measures so that natural resources can be confined. To assess the impact on air one of the marble mine was selected in Tehsil- Kotputli, District-Jaipur. Ambient air quality monitoring was conducted in summer seasons 2013 & 2014 for 8 locations in the core & buffer zone of the project site for parameters like PM_{10}, $PM_{2.5}$, SO_x, NO_x. The data on pollutants concentrations were processed for different statistical parameters like arithmetic mean, minimum & maximum concentration and various percentiles values. The monitoring results shows that all the parameters studied were within the permissible limit except PM_{10}. PM_{10} for all the 8 Stations were found between **107.1 $\pm$ 5.79** to **140.4 $\pm$ 5.58 in** Summer Season 2013 and **102.5 $\pm$ 2.60** to **135.1$\pm$5.44** in Summer Season 2014 respectively. The minimum concentration was recorded in the mine site **107.1 $\pm$ 5.79 & 104.3 $\pm$ 5.31** in 2013 & 2014 and maximum in Village Dantil **139.2 $\pm$ 5.59 & 134.6 $\pm$ 5.38** and Village Dandha **140.4 $\pm$ 5.58 & 135.1 $\pm$ 5.44** in 2013 & 2014. We concluded that in Summer Season 2013 the production of dust occurs from many operations in the mining like quarrying and by processing viz. drilling or blasting from deposit beds, loading and transportation, crushing of stones, etc. So, the air pollutants are on maximum side. But in 2014 results are reduced with the comparison to the Summer Season 2013 because when the mine digs deeper the most of the air pollutant concentration were encircled in the mine.

Keyword: Air Quality, Kotputli, Mining, Marble, NO_x, Particulate Matter, SO_x

INTRODUCTION

Rajasthan is known as the one of the most important mineral prospective states of India and from the last 34 years it has increased extremely the mining industries but mining can change most of the minor minerals tied with changing climate has posed serious problems to the environment fabric in the state . [1].The important perspective of this study is to estimate the possible environmental impacts that might generate from mining industries as a rapid growth industrial sector in Jaipur.

Mining Industry has rapidly deteriorated quality of the natural wealth called as resources These types of mining industries are getting centers of the pollution sources, we need timely actions and various mitigative measures so that natural resources can be confined. Mining and related phenomenon has an insightful and ample persuade on the earth's natural environment. On the one side mining industries increase the comfort of human life while on other hand; it pollutes the natural ecosystem.

Rajasthan is having a huge range of minerals in which construction stones is an important place. One of the most important building stone is marble which occupies a distinctive location among the other building stones due to the pleasant look and easy carving. Occurrences of marble are widely distributed in India.

Rajasthan is having the largest resources of superior quality of marble in India. Increasing popularity of the marbles in Rajasthan, keeps on growing demand for completed and fragmentary products, invention of new marble deposits increasing the growing private and public supports have led to a significant growth in Marble Industry of this State. Due to this, numbers of marble quarries as well as marble processing units have extensively risen up mainly during the last decade

We can say that Marble Waste is an Environment Hazard: Marble Waste becoming a major disaster to the environment in the Rajasthan. In the mining and processing activities of marble approx. about 1.5-2.0 million tons of marble waste is generated which is known as Marble Slurry. In spite of this the technical, operational and management practices in the mining process are not as much developed and they contributed extensively to the greater waste generation. Two types of waste are generated from the marble processing. At the time of marble processing, 30% of the stone (In case of unprocessed stone) goes to scrap because minor or smaller size and/or irregular shape. Then the product sold to the chip manufacturers. However, in the case of semi-processed slab, the scrap level reduces to 2-5% whereas the other waste material is called as marble slurry [2].

Slurry is called as the water containing marble powder. The water can be reused till it gets thick enough (70% water and 30% marble powder).

We can estimate that approx. 1 ton of marble stone processed in gang-saw or a vertical/horizontal cutter generates almost 1 ton of slurry (70% water). Marble Slurry is the fine particles generated in process of cutting, grinding and polishing process and dissolved in the water[3]. The suspension of marble fines in water is generated during processing and polishing because water is used as a cooling agent to cool down the cutting blades. We can say that sludge is composed mainly of calcium carbonate or as a byproduct. The dimensional marble industry produces high percent of the waste generation [4]

The main waste components are Solid marble waste; powder and slurry which are the major sources of the environmental degradation in the area.

Out of the 32 districts, marble deposits are being oppressed in 20 districts. Rajasthan is the foremost important producer of marble and shares more than 90 % of the total country production [5, 6].

Air quality near open cast mines is directly or indirectly affected by uploading and loading, transportation, condition of roads and huge quantity of fugitive dust emission, blasting etc.[7]. **Singh and Puri reported** RPM value was also found at an alarming stage in Korba coalfield due to mining activity. Mining are necessary for development and economic growth and its impact on environment is oblivious which cannot be ignored, but some extend it can be unavoidable [8].

The study assesses through simple preliminary EIA for the major effective impacts of air pollution through the marble mine. Environment Impact Assessment (EIA) is a systematic tool to assess the environmental, ecological, social and economic impacts of a project prior to decision-making. It is a decision-making tool, which guides the decision makers in taking appropriate decisions for proposed projects. It aims at predicting environmental impacts at an early stage of project planning and design, find ways and means to reduce adverse impacts, shape projects to suit the local environment and present the predictions and options to decision makers. By using EIA, both environmental and economic benefits can be achieved [9].

The study has been conducted within the buffer zone called as the study area, eight monitoring locations (Including mine site) has been randomly selected to assess the impacts of marble mine by air pollution.

MATERIALS AND METHOD

Study area

Rajasthan is situated on the north-western part of India. It covers 3, 42,239 square kilometers (132,139 square miles).The study area is located about 10.5 km in NE direction is Kotputli town and is accessible from National Highway-8 which is approx 3.0 km in the SE direction of mine site. State Highway 37-B is at a distance of 7.0 Km in NNE Direction of mine site. The lease area is about 88 km away from Jaipur (i.e. District Headquarter). Table1 and Fig.1 show important marble deposits and available reserves in Rajasthan. Fig. 2 show the location of the Study area.

Table 1: Important Marble deposits and available reserves in Rajasthan

S.No	Deposit/ Belt	District
1.	Agaria, Amet, Kilwa, Morwad, Dharmita, Katre, Parvati,Koyal,Morchana, Arana	Rajsamand
2.	Makrana, Borawad(White), ChosiraDwagri (Pink, Kumari.	Nagaur.
3.	Kesariaji(Rikhabdeo),Odwas	Udaipur
4.	Babarmal (Devimata)	Udaipur
5.	Tripura Sundari – Talai – Odabagi – Bhim – kund - Vithaldeo, Prithvipura,Paloda	Banswara
6.	**Andhi-Bhainslana**	**Jaipur**
7.	Jhiri-Sariska	Alwar
8.	Selwara-Dhanwan-Koteswar	Sirohi
9.	Jahajpur-Kekri	Bhilwara
10.	Kalyanpura-Narwar-Saradhana	Ajmer
11.	Patan-Rampura	Sikar
12.	Umar	Bundi
13.	Sabla,Nandli-dad, Peeth,Manpur,Dachki	Dungarpur
14.	Mandal, Deh	Chittorgarh
15.	Bar-Sendra, Sarangwa, Sevari, Kundal	Pali
16.	Mooisagar, Amarsagar, Habur, Naripa	Jaisalmer
17.	PachoriChadi, Moriya Munjasar	Jodhpur

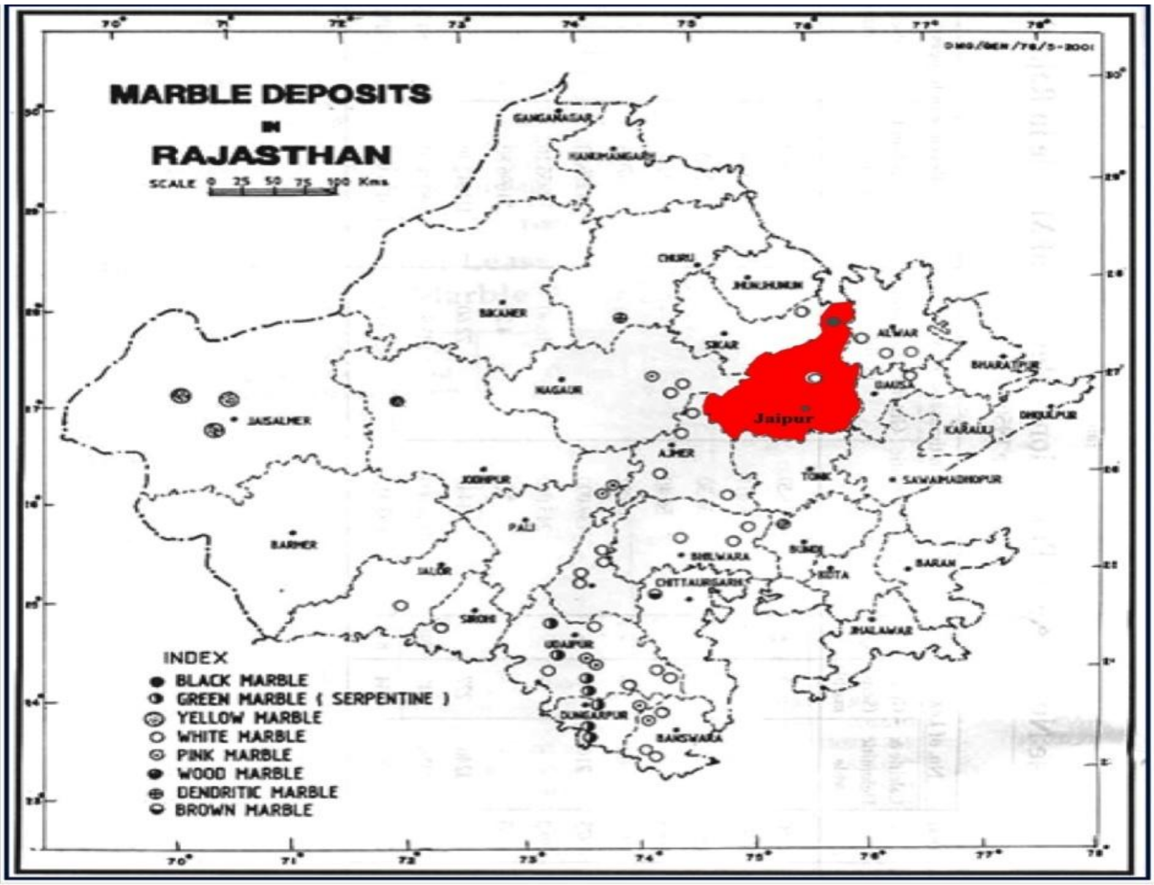


Fig.1: Shows the marble deposits in Rajasthan

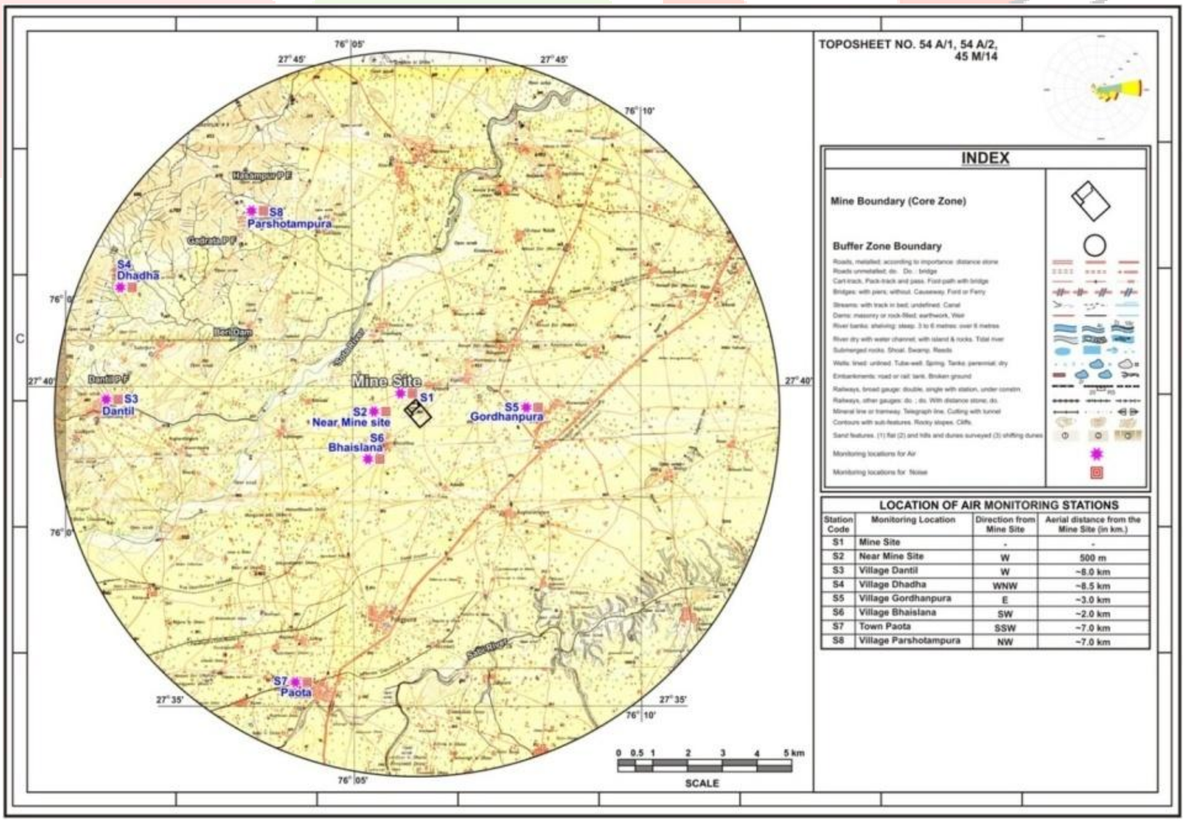


Fig. 2: Monitoring Locations of the study

The environmental impacts from the mining activity on air have been assessed. Ambient air quality monitoring was done to determine the general back ground at the concentration levels. Air qualities were monitored as per standard methods in the 10 km study area to observe pollution trends throughout the region. It helps in providing a data base for evaluation of effects of a project activity in that region. It will be also useful in ascertaining the quality of air environment in conformity to standards of the ambient air quality.

Monitoring was done during summer season (April, May and June) for two seasons (2013 & 14) from the study area. Results are shown in Table 2 to 9 and graphical representation of the same is shown in Fig. 3 to 10.

The data on pollutants concentrations were processed for different statistical parameters like arithmetic mean, minimum & maximum concentration and various percentiles values.

RESULTS AND DISCUSSION

Ambient Air Quality: To know the ambient air quality at a larger distance i.e. in the buffer zone of 10Km. radius, air quality survey has been conducted at different location.

Analyze the Particulate Matter PM_{10} in the ambient air.

With the standard (IS 5182, part-23) method for measurement of Respirable particulate matter PM_{10} in the ambient air with the help of appropriate cyclonic particle fractionation device (APM-860 BL, Lata Envirotech Model).Observed values are shown in Table 2 & 3 for two seasons.

Table 2: Observed values of PM_{10} Summer Season 2013 of the selected sampling locations

Station	Location	Analysis Results	Control(µg/ m3)
S1	Mine Site	107.1 ± 5.79	100
S2	Near Mine Site	113.6 ± 1.69	100
S3	Village Dantil	139.2 ± 5.59	100
S4	Village Dhandha	140.4 ± 5.58	100
S5	Village Gordhanpura	113.5 ± 2.72	100
S6	Village Bhaislana	129.5 ± 4.06	100
S7	Town Paota	107.6 ± 3.10	100
S8	Village Parshotampura	110.6 ±2.59	100

Mean ± SE (Standard Error), n=6

Table 3: Observed values of PM_{10} next Summer Season of the selected sampling locations

Station	Location	Analysis Results	Control(µg/ m3)
S1	Mine Site	104.3 ± 5.31	100
S2	Near Mine Site	111.6 ± 1.91	100
S3	Village Dantil	134.6 ± 5.38	100
S4	Village Dhandha	135.1 ± 5.44	100
S5	Village Gordhanpura	108.7 ± 2.68	100

S6	Village Bhaislana	126.8 $\pm$ 3.70	100
S7	Town Paota	102.5 $\pm$ 2.60	100
S8	Village Parshotampura	108.1 $\pm$ 2.98	100

Mean $\pm$ SE (Standard Error), n=6

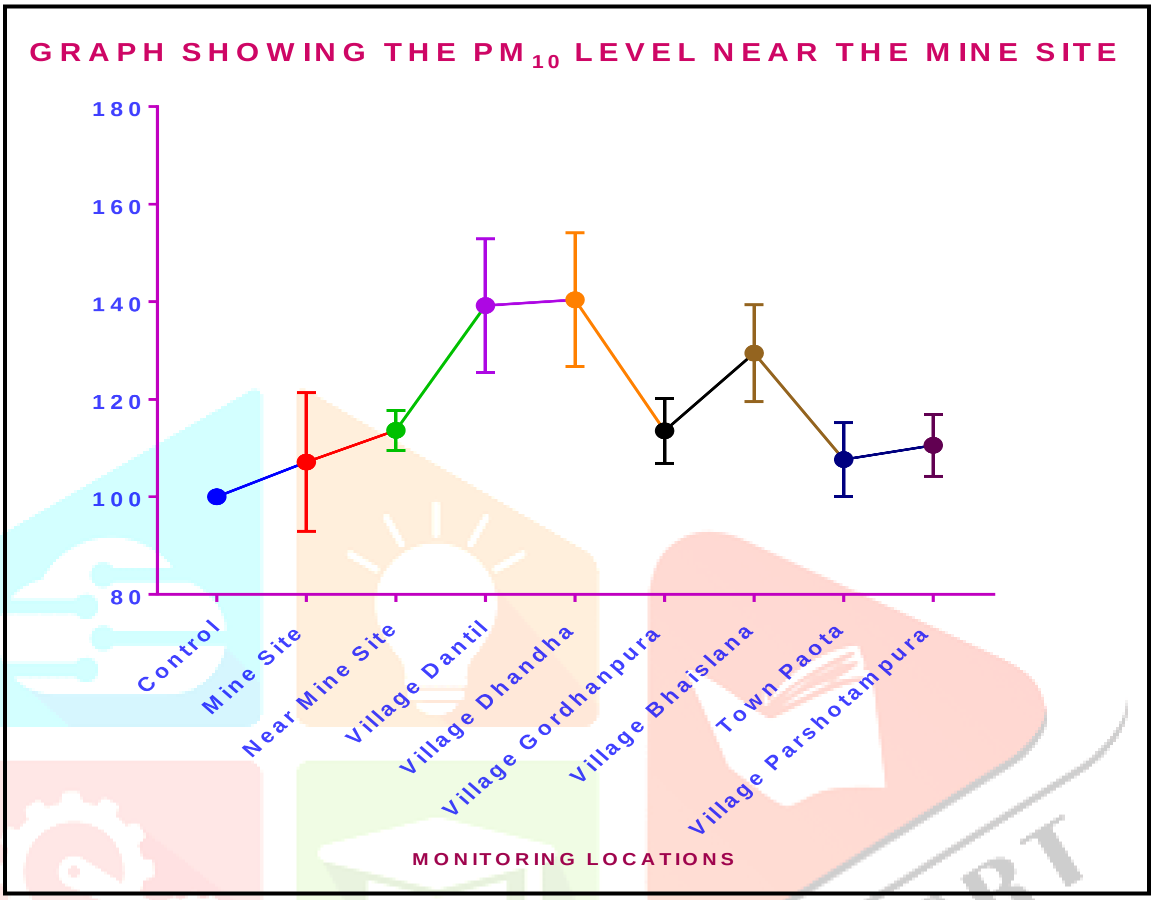


Fig. 3: Showing the PM $_{10}$ level near the mine site in Summer Season 2013

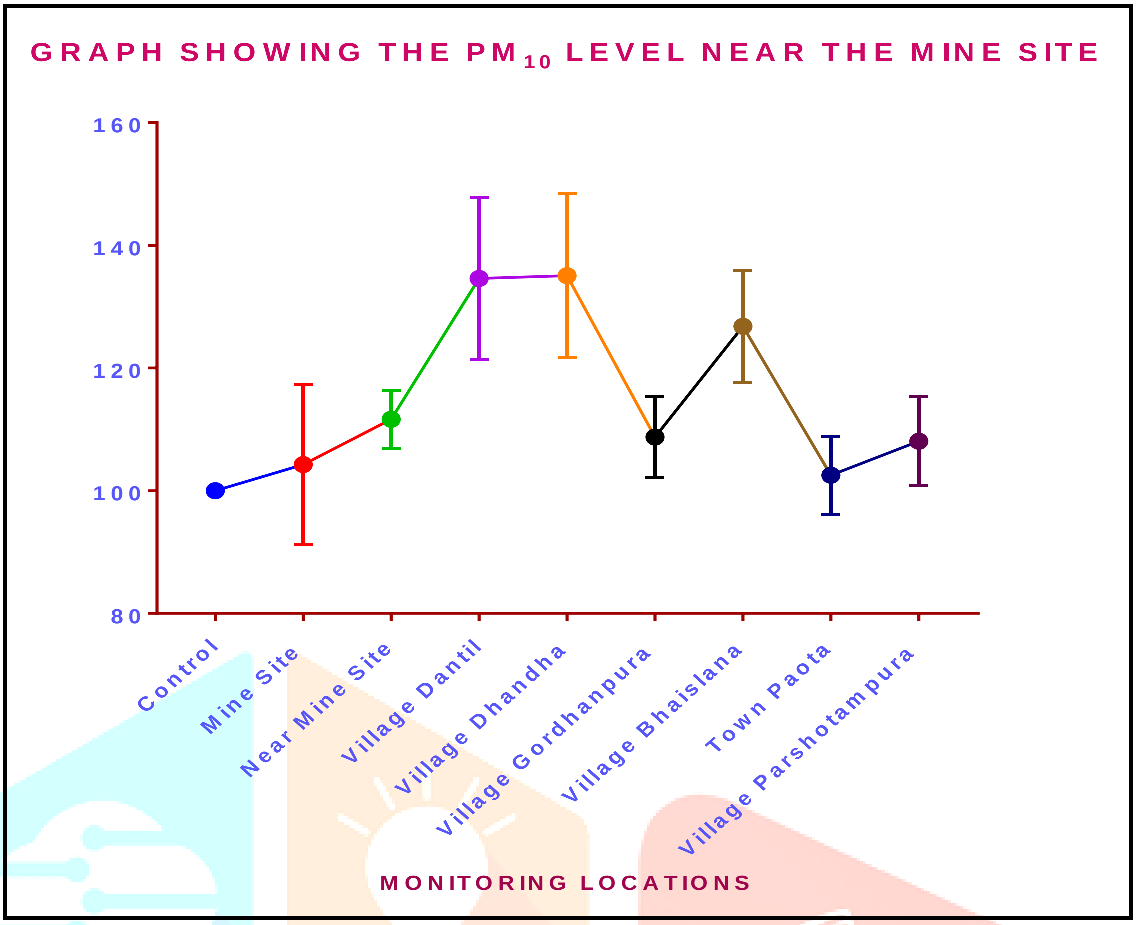


Fig. 4: Graph Showing the PM $_{10}$ level near the mine site in Summer Season 2014

Analyze the Particulate Matter $PM_{2.5}$ in the ambient air

PM $_{2.5}$ refers to fine particles that are 2.5 micrometers (µm) or smaller in diameter size. With the standard (IS 5182, part-23) method for measurement of respirable particulate matter $PM_{2.5}$ in the ambient air with the help of appropriate cyclonic particle fractionation device (APM-860 BL, LataEnvirotech Model). Observed values are shown in Table 4 & 5 for two seasons.

Table 4: Showing the results of PM $_{2.5}$ Summer Season 2013 of the selected sampling locations

Station	Location	Analysis Results	Control(µg/ m3)
S1	Mine Site	43.86 $\pm$ 6.42	60
S2	Near Mine Site	44.88 $\pm$ 5.29	60
S3	Village Dantil	48.79 $\pm$ 5.20	60
S4	Village Dhandha	42.65 $\pm$ 4.40	60
S5	Village Gordhanpura	39.83 $\pm$ 4.44	60
S6	Village Bhaislana	44.93 $\pm$ 4.25	60
S7	Town Paota	39.71 $\pm$ 5.60	60
S8	Village Parshotampura	46.20 $\pm$ 4.61	60

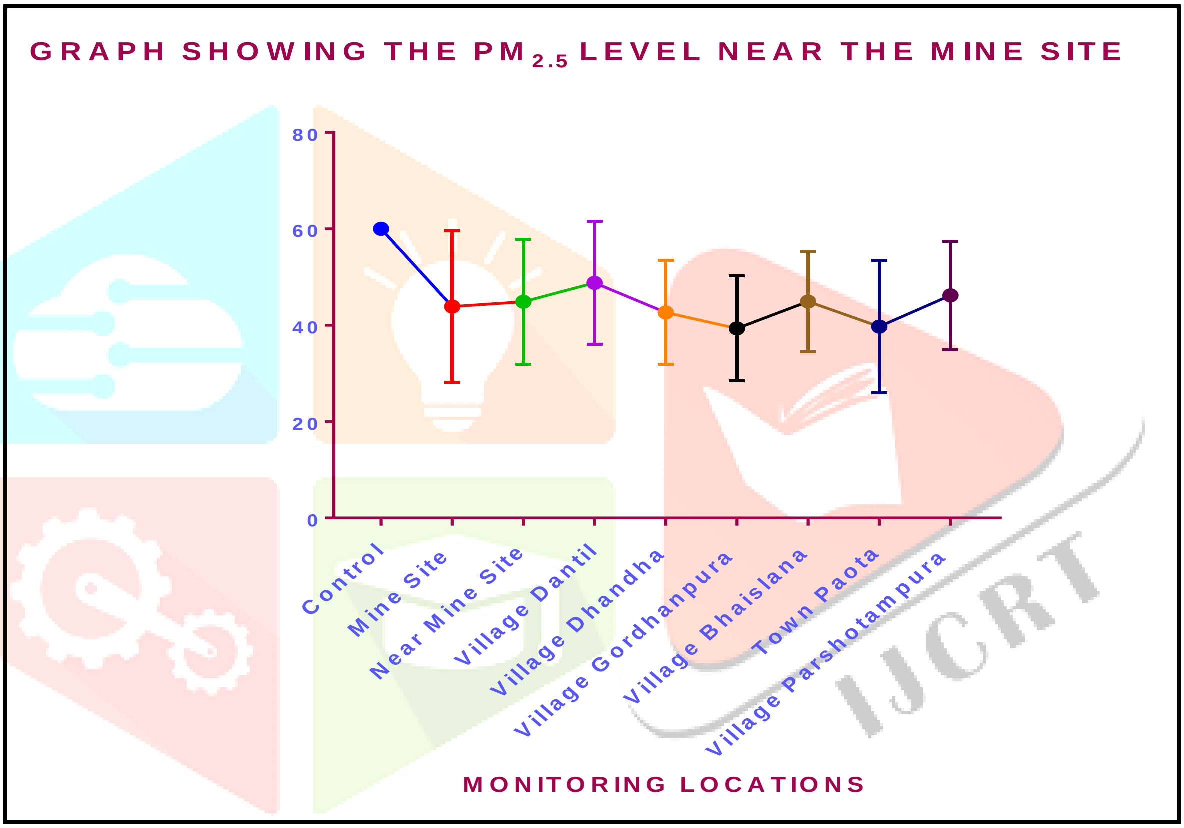
Mean $\pm$ SE (Standard Error), n=6

Table 5: Showing the results of PM $_{2.5}$ Summer Season 2014 of the selected sampling locations

Station	Location	Analysis Results	Control(µg/ m3)

S1	Mine Site	41.38 + 4.47	60
S2	Near Mine Site	41.19 + 3.89	60
S3	Village Dantil	45.10 + 4.17	60
S4	Village Dhandha	38.67 + 4.07	60
S5	Village Gordhanpura	37.08 + 4.05	60
S6	Village Bhaislana	45.55 + 5.22	60
S7	Town Paota	39.59 + 4.79	60
S8	Village Parshotampura	40.14 + 4.87	60

Mean + SE (Standard Error), n=6



Fig, 5: Graph showing the PM 2.5 Level near the mine site in Summer Season 2013.

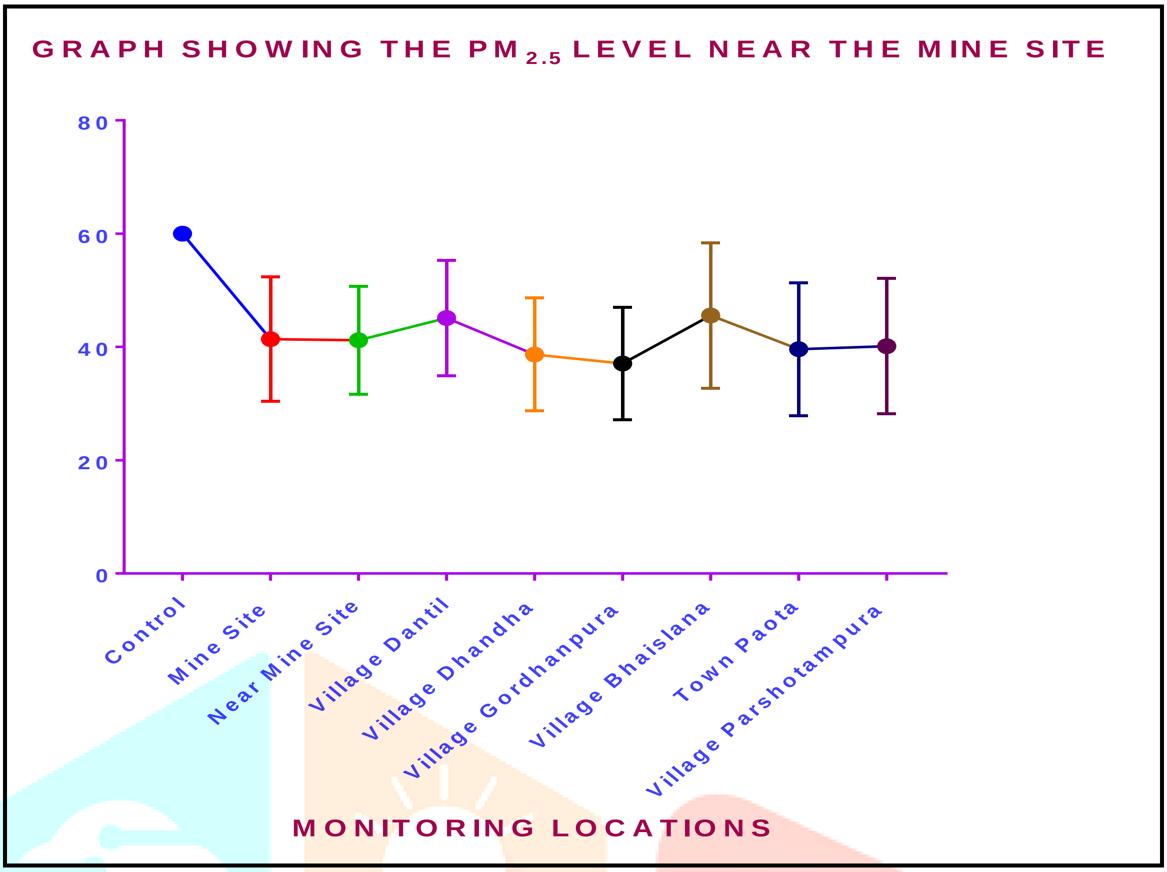


Fig. 6: Graph showing the PM 2.5 Level near the mine site in Summer Season 2014.

Analyze the oxides of Sulphur concentration in the ambient air.

With the standard (IS: 5182 Part 2 Measurement of Air Pollution: SO_2 by improved West & Gaeke Method Sulphur di oxide from air is absorbed in a solution of potassium tetrachloro-mercurate (TCM). A di chlorosulphitomercurate complex which resists oxidation by the oxygen in the air is formed. The complex is made to react with pararosaniline and formaldehyde to form the intensely colored rosaniline methyl sulphonic acid [11]. Observed values are shown in Table 6 & 7 for two seasons.

Table 6: Showing the results of SO_X Summer Season 2013 of the selected sampling locations

Station	**Location**	**Analysis Results**	**Control (µg/ m3)**
S1	Mine Site	53.86 ± 9.25	80
S2	Near Mine Site	64.74 ± 10.11	80
S3	Village Dantil	55.55 ± 8.60	80
S4	Village Dhandha	59.36 ± 6.21	80
S5	Village Gordhanpura	61.49 ± 5.72	80
S6	Village Bhaislana	44.63 ± 7.60	80
S7	Town Paota	54.35 ± 7.59	80
S8	Village Parshotampura	50.06 ± 8.52	80

Mean ± SE (Standard Error), n=6

Table 7: Showing the results of SO_X Summer Season 2014 of the selected sampling locations

Station	Location	Analysis Results	Control (µg/ m3)
S1	Mine Site	47.31 + 7.49	80
S2	Near Mine Site	55.46 + 6.51	80
S3	Village Dantil	53.99 + 6.56	80
S4	Village Dhandha	53.66 + 7.23	80
S5	Village Gordhanpura	50.61 + 5.10	80
S6	Village Bhaislana	44.67 + 4.59	80
S7	Town Paota	43.86 + 4.14	80
S8	Village Parshotampura	40.26 + 4.56	80

Mean + SE (Standard Error), n=6

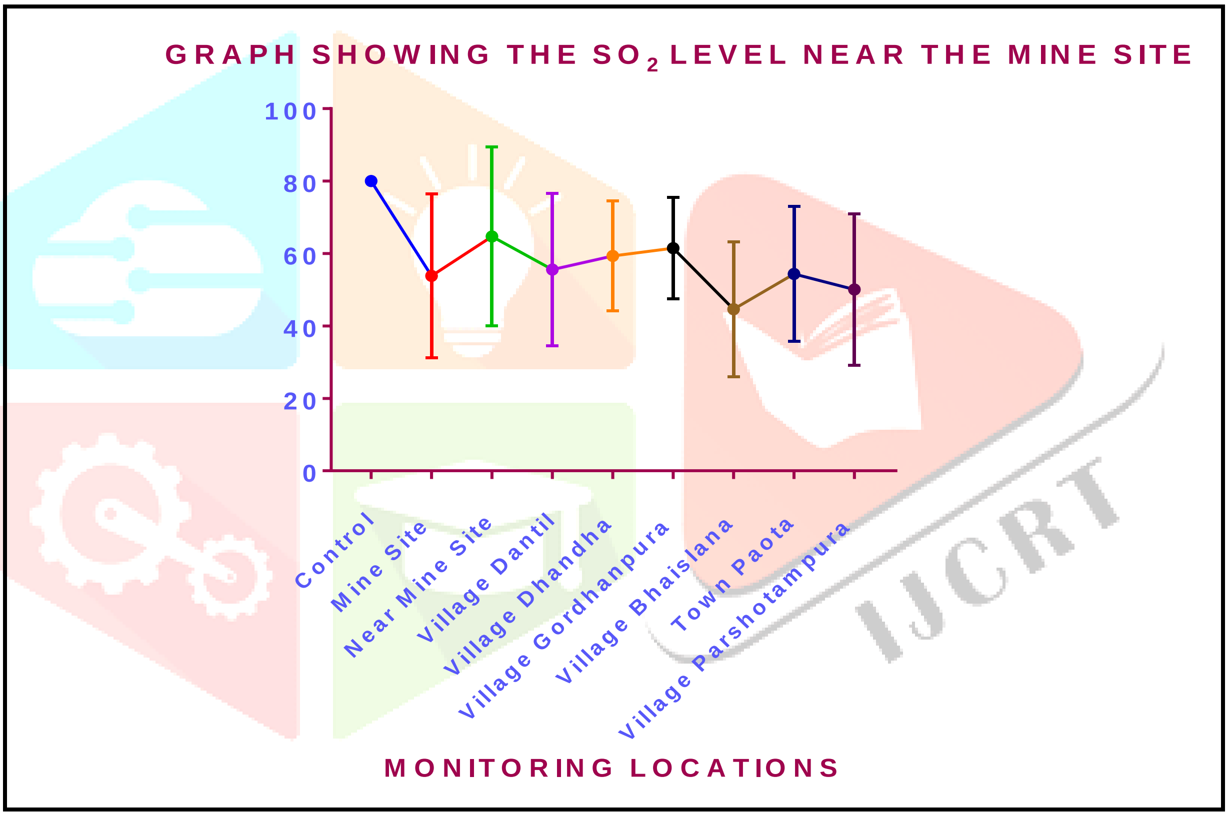


Fig. 7: Graph showing the SOx Level near the mine site in Summer Season 2013

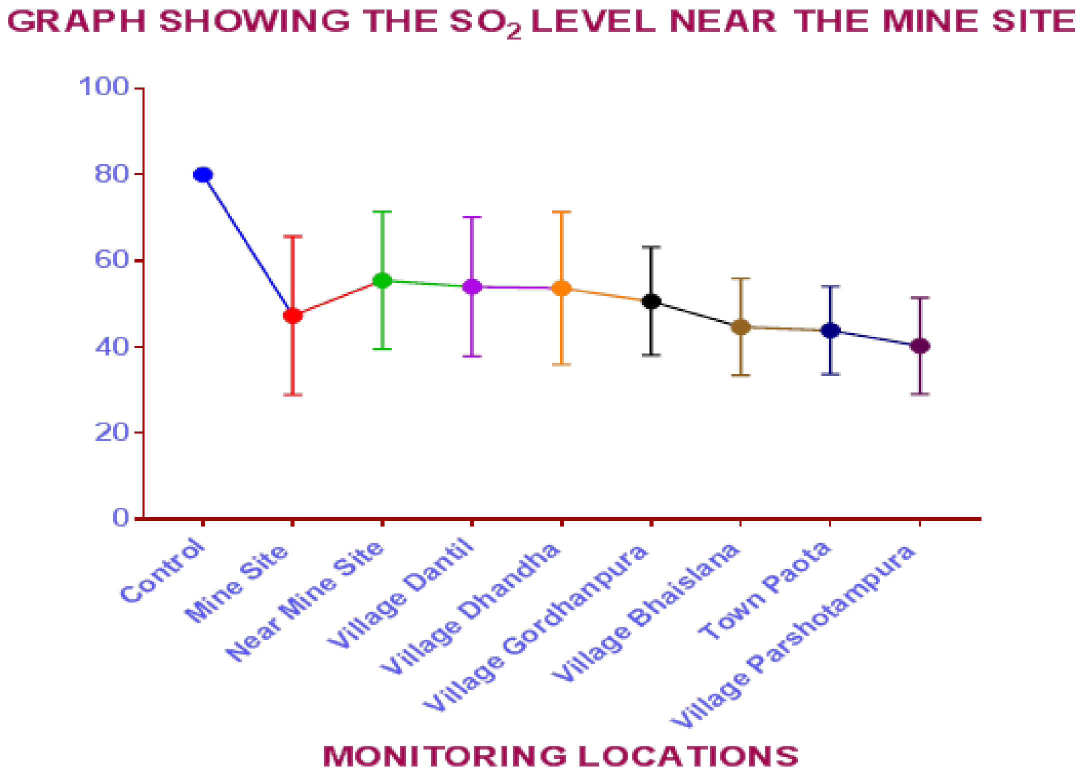


Fig. 8:Graph showing the SOx Level near the mine site in Summer Season 2014

Analyse the Oxides of Nitrogen concentration in the ambient air.

It was analysed with the modified Jacobs &Hochheiser method [11]. The concentration of nitrite ion (NO_2) produced during sampling was determined calorimetrically by reacting the nitrite ion with phosphoric acid, sulphanilamide and N-(1-napthylethylenediamine dihydrochloride (NEDA). Observed values are shown in Table 8 & 9 for two seasons.

Table 8: Showing the results of NO_X Summer Season 2013 of the selected sampling locations

Station	Location	Analysis Results	Control (µg/ m3)
S1	Mine Site	38.89 + 9.95	80
S2	Near Mine Site	56.70 + 9.80	80
S3	Village Dantil	63.70 + 8.86	80
S4	Village Dhandha	60.60 + 10.13	80
S5	Village Gordhanpura	51.93 + 11.71	80
S6	Village Bhaislana	50.42 + 11.10	80
S7	Town Paota	44.54 + 11.36	80
S8	Village Parshotampura	60.56 + 8.33	80

Mean + SE (Standard Error), n=6

Table 9: Showing the results of NO_X Summer Season 2014 of the selected sampling locations

Station	Location	Analysis Results	Control (µg/ m3)
S1	Mine Site	40.73 ± 9.22	80
S2	Near Mine Site	42.81 ± 5.08	80
S3	Village Dantil	49.58 ± 8.11	80
S4	Village Dhandha	54.47 ± 7.05	80
S5	Village Gordhanpura	49.53 ± 8.93	80
S6	Village Bhaislana	52.02 ± 4.72	80
S7	Town Paota	42.66 ± 7.95	80
S8	Village Parshotampura	47.41 ± 5.95	80

Mean ± SE (Standard Error), n=6

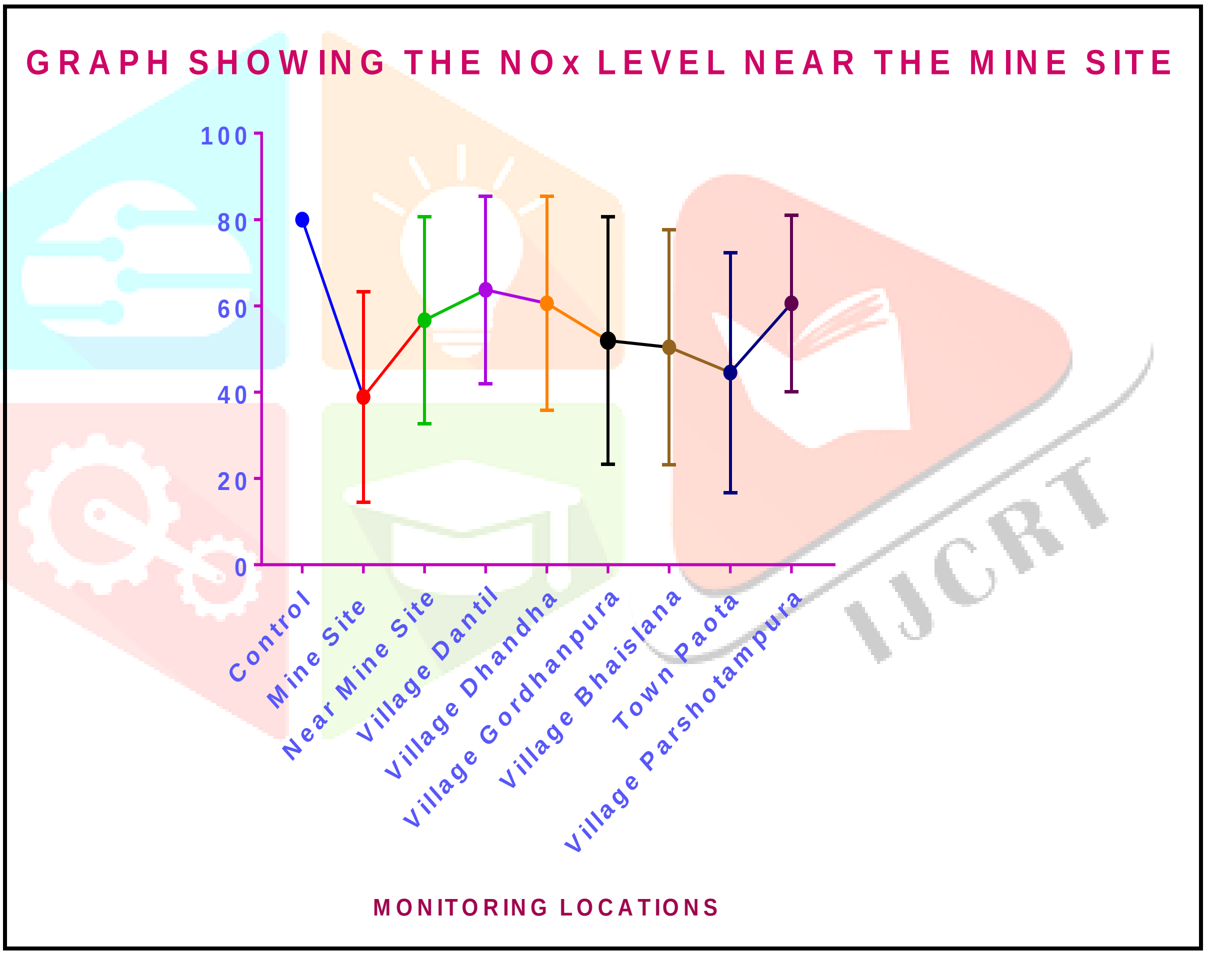


Fig. 9: Graph showing the NOx Level near the mine site in Summer Season 2013

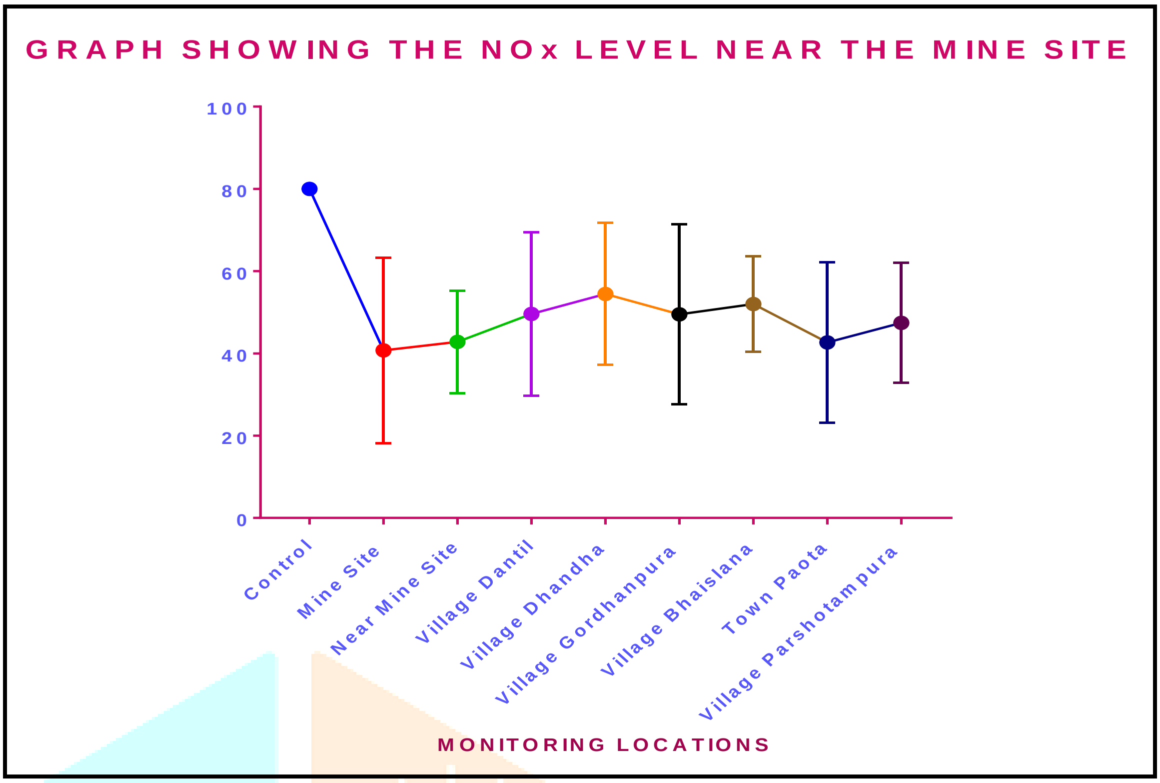


Fig.10: Graph showing the NOx Level near the mine site in Summer Season 2014

The present study was conducted in one of the mine in Kotputli District in which 8 samples were randomly monitored for air to observe the pollution trends in the region with respect to quantifying the impact of mine on the surrounding area.

***PM$_{10}$*:** Ambient Air Quality Monitoring reveals that the concentration of PM_{10} for all the 8 AAQM Stations were found between **107.1 + 5.79** to **140.4+5.58 in** Summer Season 2013 and **102.5 + 2.60** to **135.1+5.44** in Summer Season 2014, respectively. The minimum concentration was recorded in the mine site **107.1+5.79 & 104.3 +5.31** in 2013 & 2014 and maximum in Village Dantil**139.2 + 5.59 & 134.6 + 5.38** and Village Dandha**140.4 + 5.58 & 135.1 + 5.44** in 2013 & 2014, respectively. In Town Paota, the second minimum concentration was recorded **107.6 + 3.10 & 102.5 + 2.60.** The present research reveals that the values showed that the samples are above the maximum permissible limit as recommended by CPCB. From the control mine site, Near Mine Site, Village –Dantil, Village-Dandha and Village – Bhaislana were significant in the summer season 2013 & 2014.Similarly, same type of precise study was conducted by Ghose *et al.* [10] that dust is generated due to different mining activities. In the work zone air quality and seasonal variations were described revealing high pollution potential due to Particulate matters and consequent impact on human health. The environmental degradation due to open case mining activities in Gwalior and Bundelkhand in which they collected the field air samples from the mine and analyzed & it is noticed that the results were exceeded from the limits as fixed by CPCB[11].

***PM$_{2.5}$* :** $PM_{2.5}$ for all the 8 AAQM Stations were found between **39.71 + 5.60** to **48.79 + 5.20** and **37.08 + 4.05** to **45.55 + 5.22** in Summer Season 2013 & 2014 respectively and all samples found within the permissible limit by CPCB [11]. The maximum concentration was found in the Village-Dantil **48.79 + 5.20** and minimum concentration was found in Town Paota **39.71 + 5.60** in Summer Season 2013 whereas in Summer Season 2014 the maximum concentration was found in Village Bhaislana **45.55 ± 5.22** and the minimum concentration was found in Village-Dandha **38.67 ±4.07**.Surender Singh Chauhan [12] stated that mining and its activities the suspended particulate matter in the air which is harmful to the health of the workers exposed to the mine environment.

***SO_X*:** The concentrations of SOx were found to be in the range of **44.63 ± 7.60** to **64.74 ± 10.11** and **40.26 ± 4.56** to **55.46 ± 6.51** in Summer Season 2013 & 2014, respectively.In Summer Season 2013 the minimum concentration was found in the Village –Bhaislana **44.63 ± 7.60** and the maximum concentration was found in the Near Mine Site **64.74 ± 10.11.** However in the Summer Season 2014 the minimum concentration wasrecorded in the Village- Parshotampura**40.26 ± 4.56** and maximum concentration wasfound in the Near Mine Site **55.46 ± 6.51.** [7]. Bamniya *et al*. [13] experimented about the Sox Concentration in Zinc smelter in Value of Sox concentration was found very high at station-1 and low at station-4 due to dilution and dispersal of air pollutants.

NOx: Similarly Nox Concentrations were found to be in the range of**38.89 ±9.95** to **63.70 ± 8.86** and **40.73 ±9.22** to **54.47 + 7.05** in Summer Season 2013 & 2014, respectively. In the Summer Season 2013 the minimum concentration was found to be in the Mine Site **38.89 ±9.95** and maximum concentration was found to be in the Village- Dantil **63.70 ± 8.86** whereas in the Summer Season 2014 the minimum concentration recorded in the Mine Site was **40.73 ± 9.22** and the maximum concentration recorded in the Village-Dandha **54.47 ±7.05**.

In the present study, Observation showed that a negative correlation was detected with the Air pollutants due to the mining. Results were statistically significant ($P < 0.05$) in relation to the air parameters. Analysis of Variance (ANOVA) showed that the P value for PM_{10}0.0012 and the R Square 0.7436 in Summer Season 2013 which showed the significant matching ($P < 0.05$) **. In the Summer Season 2014 it was shown that the P Value for PM_{10} is 0.0010 and the R Square is 0.7303 for PM_{10} which is also statistically significant matching to the ($P<0.05$) **. The results were statistically significant from the control ($P<0.05$) ** in 2013 where as with a reduction of significant in ($P<0.05$) ** 2014.

From the Summer Season 2013 we have observed that from the Control location i.e. Mine Site, adjusted P value is 0.0044, Near Mine Site is 0.0055, Village-Dantil is 0.0089, Village-Dandha is 0.0438, Village Bhaislana is 0.0088 and Town Paota 0.0090 were significant. Village Dantil was significant with Village Gordhanpura the adjusted P Value was0.0433 and Village-Purshotampura0.0416 and from the Village Dandha was significant with Town Paota0.0397 and Village Purshotampura0.0462. All the results have been found above the permissible limits prescribed by the CPCB.In the Summer Season 2014 from the present study, results revealed that from the Control Mine Site the adjusted P Value is 0.0419, Near Mine Site is 0.0192, Village-Dandha is 0.0148 and Village-Bhaislana is 0.0089 was significant. Results showed that Village Dantil was significant with Town Paota0.0396. Village Dandha was significant with Village-Gordhanpura is 0.0420 & Town Paota is 0.0496. Village Bhaislana was significant with Town-Paota is 0.0287.

From the present study we could observe that in Summer Season 2013 $PM_{2.5}$ showed a statistically significant (P<0.05)** in relation to the air parameters. Analysis of Variance (ANOVA) showed that P Value for PM 2.5 is 0.0082 and the R Square is 0.2418 in Summer Season 2013 which shows that matching was effective (P<0.05)** whereas in Summer Season 2014 the P Value for PM 2.5 is 0.0022 and the R Square is 0.2461 and the results shown the significant matching(P<0.05)**.Results were significant from the control which caused impact to the environment from marble mine.

From the multiple Comparisons in Summer Season 2013 in which Control was significant with Mine Site the adjusted P Value is 0.0496, Near Mine Site is 0.0023, Village Dandha is 0.0478 and Village Gordhanpura is 0.0385. Village Dandha was significant with Town Paota is 0.0225 and Village-Parshotampura is 0.0258.Village- Dandha was significant with Village Bhaislana is 0.0365, Village-Gordhanpura and Town –Paota is 0.0258. Village Bhaislana was significant with Town Paota0.0245and Village Parshotampura0.0266.

In the Summer Season 2014 from the multiple comparisons in which Control were significant with Near Mine Site is 0.0491, Village Dandha 0.0355 and Village-Gordhanpura 0.0260. Village Gordhanpura was significant with Village – Bhaislana0.0385, Town Paota0.0258 and Village- Parshotampura 0.0254.

From the present study we could observe that that results of Summer season 2013 is on the higher side whereas the Summer Season 2014 is on lower side as when we compared with the 2013 results which caused impact to the environment, health of the local peoples, mine workers etc.

From the study we could observe that in Summer Season 2013 So_x showed a statistically significant matching (P<0.05).Analysis of Variance (ANOVA) showed that a P Value for So_x is 0.0044 and the R Square is 0.2564 which shows the matching was significant (P<0.05) **.However in Summer Season 2014 the P Value for Sox was0.0138 and the R Square was0.0475 and this shows the significant matching with (P<0.05)*.

In Summer Season 2013 Control wassignificant with Mine Site the adjusted P value forVillageDantil0.0236, Village Bhaislana0.0365, Village Parshotampura0.0254, Village-Dandha0.0365 and Town-Paota0.0234.Mine site wassignificant with Village-Dantil0.0314 and Village Parshotampura0.0145. Village Gordhanpurawassignificant with Town Paota0.0254 and Village-Bhaislana0.0345.

In the Summer Season 2014 we have observed that Control was significant with Village Gordhanpura0.0358, Village-Bhaislana0.0263, Town Paota0.0254 and Village Parshotampura0.0312. Near mine site wassignificant with Village Gordhanpura0.0245; Bhaislana0.0236 and Village-Parshotampura0.0354. Village Dantil was significant with Village Dhandha 0.0214, Village-Gordhanpura0.0145 and Village Bhaislana0.256. Village Gordhanpura was significant with Village-Bhaislana0.354 and Town Paota0.0245. The impact of SOxis to irritatethe human upper respiratory tract. It caused the most serious air pollution occurred when there was a synergistic effect of Sox with Particulate Matter[14].

The present study revealed that in the Summer Season 2013 NOx showed a Non-Statistically Significant Matching. Analysis of Variance shows that a P Value for NO_Xwas0.2677 and the R square was0.2205 whereas in Summer Season 2014 the P Value for Noxwas0.0572 and the R Square was0.369. These 70% values were the permissible limits and 30% value was above the prescribed standard.

In Summer Season 2013 Control was significant with Village- Dandha the adjusted P Value of Village-Gordhanpurawas0.0235, Town Paota0.0258 and Village Dantil0.0214. Near mine site was significant with Village – Bhaislana0.0457, Village- Dandha0.0125 and Village Purshotampura0.0354.Village-Gordhanpura was significant with Village- Bhaislana0.0425, Town- Paota0.0247 and Village-Parshotampura0.365.

In the present study in 2014 Control was significant with Near Mine Site 0.0258, Village- Bhaislana0.0365 and Village-Parshotampura0.0258. Village Dantil was significant with Village-Dandha0.0547; Village-Gordhanpura0.0258 and Village- Bhaislana. Village- Bhaislana was significant with Town – Paota0.256 and Village-Parshotampura0.0458.

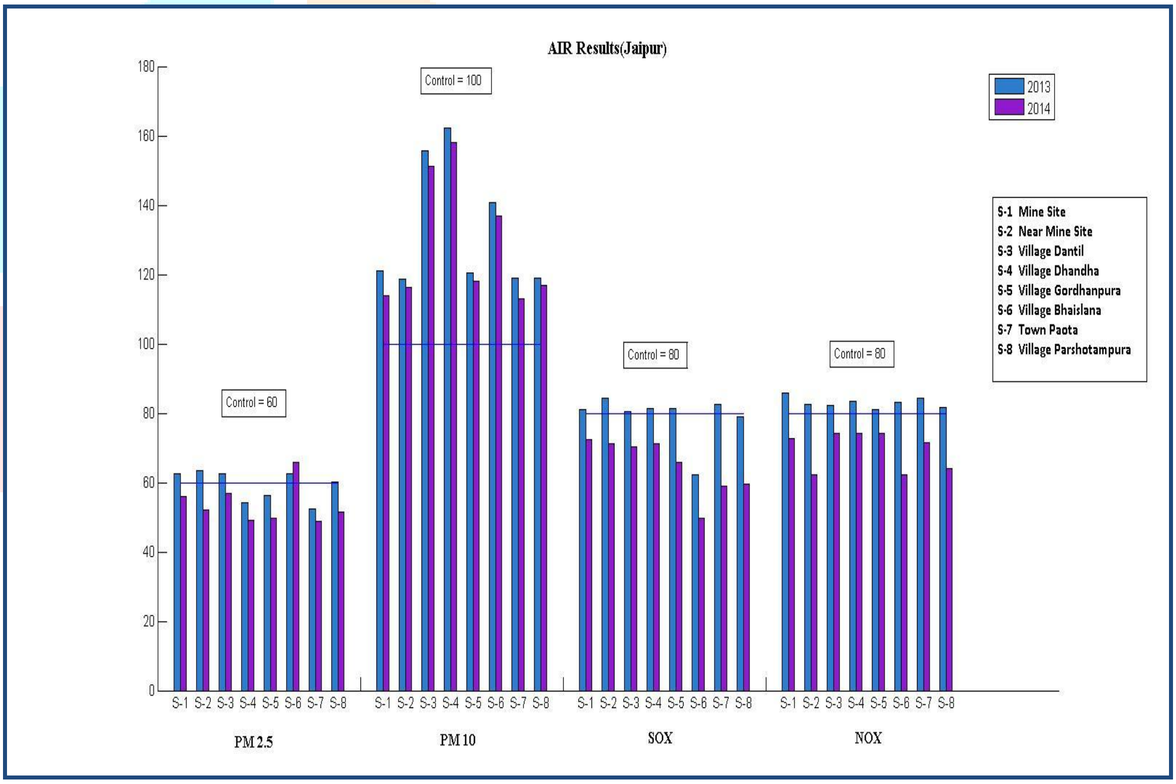


Fig.11: Comparative Studies Showing the Results of Air in Summer Season 2013 & 2014

CONCLUSIONS

The monitoring results of PM_{10} were found across the permissible limits. Results of the study show that mining activities have significant effects on the environment. Mining affects environment adversely. The study reveals that in Summer Season 2013 the dust emission occurs from many operations in the stone quarrying and processing viz, drilling or blasting from deposit beds, loading and transportation of rocks at crushers, open conveyors, primary, secondary and tertiary crushing of stones, screening transporting rock by belt conveyors, storage and loading of the crushed materials etc. So, the air pollutants were found at the high side. But as we observed that in Summer Season 2014 results are reduced with the comparison to the Summer Season 2013 because when the mine digs deeper the most of the air pollutant concentration were encircled in the mine. From the study we have conclude that it's really important to take a various mitigative measures to protect the environment or the surrounding area. Marble production in the state has a great contribution in the market due to the different activities and these mines create a lot of jobs or employment in local area. There will be further improvement in infrastructure like education, roads, availability of drinking water, medical facilities in adjacent villages.

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