Investigation of Cement Production Industry and Their Effect around Satna

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Abstract— This paper presents expectations of air pollution (dust, SO2, NOx and CO2) discharged from a KJS cement plant around Satna (M.P). The GACM (Gaussian air contamination model) is utilized and the anticipated groupings of the air Pollution are contrasted. It is discovered that the long stretch of September speaks to the most dire outcome imaginable where the climatic soundness condition. The, PM10 and PM2.5 focuses surpassed the qualities set by the standard close to the region of the Cement plant a good ways off nearer than 300 m. The proposed moderation measures should constrain the surrounding air toxin fixations to be in consistence with the standard qualities .There is well documented between cement industry development and there environmental air pollution but there are no enough studies. that have Analytical calculation in the current study impact of SO2,NOX,CO2, & PM10, Around cement industry area (Satna). Were Investigated Using Gaussian plume model which assumes constant wind and dispersion coefficients in vertical direction. The maximum ground level concentration agrees well in both models. The past Literature review Doesn't Provide analysis of pollution control method and removing method on cement plant. also The past Literature Review doesn't "Calculate Pollutant gas level around the cement industry. & Basic Analysis of reduce Pollution Level after Covid -19 Lockdown.

Keywords: Air pollution, Cement, Stake emission, Gaussian model, SO2, PM10. Basic Analysis Industrial Impact of Covid-19(Lockdown)

I. INTRODUCTION

The decline of air quality in urban area may be credited to quick industrialization. SAQ (surrounding air quality) has decline to such an point that it negatively affects the health and welfare of human being. Satna tourism located in the state of North-eastern (M.P),Central india. Satna is known for being one of the largest cement production city in the world. or Known as the CC (Cement- City) of India. this affected by growing the air pollution level as a result of RIAU(Rich Industrial activity and urbanization). all industry that has high rank on the list of pollutants is KJS cement plant. KJS cement plant is situated at the distance of 3km from the Maihar on the Rewa road in satna dist. (M.P).

The opening of harmful matter into the air (pollution). more than ever from the cement industrial site has been convicted by various research. many cement factory have engaged various preventive determine such as constructing a very high stack among other protective measure, in effect the rate of atmosphere pollution has highly been reduce though more can be done. the wind ground remains a great factor which seems to be predictable to a large extent.

Cement factory may not manage air pollution wind stack therefore. analysis the wind field chimney stack the air pollution spreading around the cement factory but also ensuring a CO_2,SO_2,NO_X, and PM_{10}, By Gaussian Model pollution evaluate of other pollutions. from anthropogenic source. distribution of air pollution in and around any cement factory depend upon different factors including height of stack, Weather condition, landscape, Air up-thrust etc. Naturally air pollutant dispersion calculate should have taken concern of source character, terrain and meteorology feature of the air polluting source. AOC(absorption of contaminants) and air pollutants in the environment is determined by various method and process.

Which are advection dispersion ground evidence etc. all these procedure are frequently. investigate and as such different models (e.g. dispersion model, particle model (Boubel et al 1994)[1], remote sensing dispersion model (wijeratre,2006), to essentially describe the Dynamic of in the air pollution [2], environmental impact estimation, risk analysis and disaster planning and source study, model have been categorized into intermediary (e.g screen model)[3], advanced (e.g British model ADMS et. al. 1994) [4], Danish model OML (berkowicz et. al, 1987)[5], particular (e.g solid gas dispersion model)[6], additionally to identify the origin of PM_{10}, in the environment of shanghai, single PM_{10}, particle from two environmental check location and six pollution emitter source were calculated by scanning nuclear microscope tech. the result of this study show that most of the calculated PM_{10}, particle are derived from building construction site cement factories, vehicles wear out, coal boilers ans steel mills [7],in another study, atmospheric particle mass awareness were measured at a site adjacent to lake hartwell, GA, During sex dry sampling event in february -march 2003[8]. particulate substance was collected on a evidence plate mounted into a specially designed wind vane and was consequently analyzed to determine the particle size division. for modeling pollutant dispersion, as an instance, olcese and toselli[9].developed a model for reactive emissions from industrial stacks. their model was based on the diff. approach to the turbulent focus of primary and secondary pollutants resulting from point source emissions moreira et al.[10]. They discovered quantities of toxic metals (lead and cadmium) whose value exceeds the standard of World Health Organi carbon dioxide emission create from cement manufacture (Hendriks et al., 1998)[11]. Atmospheric dust is an significant source of air pollution mainly in dry climates. Mineral dust contains high concentration of many metals known to have toxic things not only on plants and nature but also on humans (Branquinho, C. et al., 2008; Shukla et al., 1990; Hirano et al., 1995)[12]. It has been reported that 1 kg of cement manufactured in Egypt generates about 0.07 kg of dust in the atmosphere (Hindy et al., 1990)[13]. The typical gaseous

emissions to air from cement manufacturing plants include nitrogen oxides (NOx), sulphur dioxide (SO2), carbon oxides (CO and CO2) and dust (Pregger et al., 2009; Kampa and Castanas 2008; Egyptian Environmental Affairs Agency EEAA, 2005)[14]. zation (WHO). Olukorede et a., (2011) and Gbadebo et al., (2010)[15].

Emission	Detailed Pollutant	Basis Classification	Position
Gas	SO_2	Point Source	Raw mill and kiln stack exit
	NO_X		
	CO		
Dust	Dust Particle(PM)	Point Sources	Clinker cooler and cement mill stacks exit
		Volume Source	Outlets during dust control devices

Table 1: Major Sources of the main pollutants of the cement plant

Month	Average wind direction (degree from North)	Average Wind Speed (m/s)	Common Average Wind Direction	Average Emission	Strength class	Average Temperature (^{0}C)
Jan.	225.7	2.47	SW-NE	Slight	C	15
Feb.	243.0	2.89	SW-NE	Slight	C	11
March	261.7	2.7	SW-NE	Moderate	B	11.7
April	279.5	2.63	NW-SE	Strong	B	31
May	267.9	2.52	SW-NE	Strong	B	35
June	305.8	5.5	NE-SW	Moderate	B	15
July	299.3	2.8	NW-SE	Strong	A	25.9
Aug.	300.1	2.10	NW-SE	Strong	A	24.8
Sept.	304.9	1.80	NW-SE	Strong	A	23.6
Oct.	279.5	1.90	SW-NE	Moderate	B	22.5
Nov.	191.8	2.75	NW-SE	Moderate	B	18.7
Dec.	195.2	3.40	SW-NE	Slight	C	11.4

Table 2: Summary of the average weather condition data and the stability class representing the period from 2006 to 2017

		Fuel Type	
		Fuel oil	Natural Gas
Amount burn (ton/day)		374	599
Sulfur content (%)		3.76	Negligible
Gas flow rate at the stack exit (Nm^3/hr)	-	309894	309893
SO_2 (mg/Nm^3)	Predicted emission (calculated based on the amount of the fuel to be burnt and its sulfur content)	3801	Negligible
	The maximum allowable limit set by the Gaussian model	6500	6500
NO_X (mg/Nm^3)	Predicted emission (EPA AP - 42)	161.2	169.3
	The max. allowable limit set by Model	1800	1800
CO(mg/Nm^3)	Predicted Emission (EPA AP-42)	161.2	169.4
	The max. allowable limit set By the Model	250	250
TSP (mg/Nm^3)	Predicted emission (carlo tozzi, 2006) General Kiln Clinker Cooler Cement mill Volume source	5-200 115.47(10.1g/s) 91.12 (8.5g/s) 56.23(1.6g/s) 4.6(g/s)	5-200 115.47(10.1g/s) 91.12 (8.5g/s) 56.23(1.6g/s) 4.6(g/s)
	The maximum allowable limit set by the Gaussian model	150	150

Table 3: The expected pollutants emission Concentration at the process stack exits and from the volume source of the KJS Cement plant fuel Type

Month	Stack exit Temperature (^{0}C)	Downwind distance at which the max. concentration exits (m)	Predicted ambient SO_2 concentration (ppm)		
			Month	24-Hour	Annual
September	90 Based on the max. allowable stack Exit concentration	751	0.79	0.41	0.017
	90 using fuel oil	751	0.46	0.24	0.010
	131	751	0.77	0.42	0.017
December	90	2000	0.55	0.28	0.012
	131	2000	0.47	0.24	0.012
	Maximum limit		0.30	0.14	0.04

Table 4: Modeling Results for the SO_2 Gas.

Month	Stack exit temp. (^{0}C)	Downwind Distance at which the max. Concentration Exists (m)	Predicted ambient NO_X Concentration (ppm)		
			Hourly	24-Hr	Annual
September	90	750	0.31	0.16	0.006
	131	750	0.2	0.15	0.006
December	90	2000	0.048	0.047	0.031
	130	2000	0.041	0.041	0.027
Maximum limit (NO_2)			0.21	0.08	0.05

Table 5: Modeling Result for the NO_X, Gas.

Month	Stack exit Temperature	Downwind distance at which the max. concentration exists (m)	Predicted ambient CO Concentration (ppm)	
			Hourly	8-Hour
Sept.	90	750	0.071	0.047
	131	750	0.067	0.045
Dec.	90	2000	0.047	0.031
	131	2000	0.047	0.027
Max. Limit			26	9

Table 6: Modeling result for the CO Gas.

Distance(m)	Source	Predicted ambient TSP concentration ($\frac{\mu}{m^3}$)		
		Hourly	24-Hr	Annual
250	All stacks and volume vent	364.53	192.05	8.41
	Area Source	151.1	80.54	3.52
	Max. 24-hr, Background concentration (measured during 5 days)	-	86	3.76
	Total	-	359.61	15.6
500	All stack and volume vent	217.24	115.05	5.03
	Area source	25.52	13.51	0.57
	Max. 24-hr background concentration (measured during 5 days)	-	86	3.75
	Total	-	214.56	9.40
750	All stacks and volume vent	109.61	58.06	2.53
	Area source	7.23	3.80	0.16
	Max. 24-hr background Concentration (measuring during 5days)			
	Total	-	147.8	6.47
Maximum limit		-	260	75

Table 7: Cumulative ambient Concentration of TSP resulting from all stacks, the volume source vent, the background concentration and the area source as predicted by the air pollution model.

In this paper the focus is the air pollutants emitting smoke particle, stack height, SO_2,NO_X, CO_2,CO, & PM_{10} pollutants concentration at a selected location. analysis Un-stable or Neutral condition, the up-wind or downwind method was used to measure particle concentration and to determine particle size distribution an GPM(Gaussian Plume Model) From KJS Cement plant or Nearest Batching plant Chimney height, wind speed has been compared with the performance of GPM and also Analysis of Covid-19 Lockdown Impact of Industrial pollution Reduce Concept.

II. MEASUREMENTS:

SO_2, & Particles Focus:- To calculate SO_2 & PM_{10}, from deserter dust source Gaussian method was used in this method surrounding SO_2 & PM_{10} Concentrations are calculated up-wind and down-wind of a dust starting place. the different between the two focus is considered to the SO_2 & PM_{10}, focus due to the DES (Deserter emission source).

To calculate particle focus we have used the Gaussian Plume method in this method, a high volume pump is located in an suitable location rather a little bit higher from land level on sunny day June Wind speed moderate Wind speed ($\cup = 5.5 m/s$).in view of the location of the PSA(Pollutants Spreading in the air). A fiber glass filter is located in the filter holder and sampling is done at detailed time intervals. before using the filters kept for 24 hours in silica gel desiccators to insure balance to the temperature and relation humidity held at stable values. from then on, the filters are weighed using an exact level. After sampling, the dampness of filters are absorbed over again, the differences between the filters weights are calculated.

1) Particle Size Distribution:-

To Measure PM During the extractive process, it is important to sample so that a representative sample of PM inter the sampling device. the parameter that must be controlled to establish iso-kinetics is the gas velocity within the sample probe, which must be equal to the actual gas velocity at the sample point in the source exhaust dust.

III. BACKGROUND

There will be three process stacks install for the KJS cement plant.
These three stacks are:

1) The raw mill and kiln,
2) The cooler clinker, and
3) The cement mills.

Dust [which include (Total Suspended Particulates (TSP), Particulate Matter smaller that 10μm (PM10) and SO_2, NOx and CO are probable to exit from the raw mill and kiln stack. Dust is the only probable discharge from the cooler stack and the cement mills stack.

The source of the pollutants from the Cement Plant –studied here– are classify as:

1) point source which are the stacks exits at the Cement Plant,
2) Volume source which are the places within the Cement Plant, and the pollutants from these spaces usually exit the chimney outlets.

Table (1) presents a summary of the major sources and classification of the main pollutants of the cement plant.

IV. METHODOLOGY

The Gaussian model Equation-(4) for air class is used to estimate the concentration of the emission from the cement plant area in the ambient air at a height of 203 meter. above the land level. The ambient air concentrations are considered along a distance of 4 km from the stack in the downwind direction and along a distance of 4 km in the crosswind route where the pollutant basis is at the centerline of this space.

$$\langle \rho_A \rangle (x, y, 0, H) = \frac{Q}{\pi \sigma_y \sigma_z \cup} \exp\left[-\frac{1}{2}\left(\frac{y}{\sigma_y}\right)^2\right] \exp\left[-\frac{1}{2}\left(\frac{H}{\sigma z}\right)^2\right] \quad (4)$$

where:
c = pollutant concentration, g/m^3
Q = pollutant emission rate, g/s
π = pi, 3.14159 ∪ = mean wind speed, m/s
σ_y = standard deviation of horizontal plume concentration, evaluated in terms of downwind distance x, m
σ_z = standard deviation of vertical plume concentration, evaluated in terms of downwind distance x, m
exp = base of natural logs, 2.71828183
H = effective stack height, m
x = downwind distance along the plume mean centerline from point of source, m
y = crosswind distance from the centerline of the plume, m
Z = height of the point (at which the ambient concentration is estimated) above ground surface, m

$$\Delta H = \frac{V_S D_S}{\cup}\left(1.5 + 2.68 \times 10^{-3} P_a \frac{T_S - T_a}{T_S} D_S\right) \quad (22)$$

where:
ΔH = Plume rise in m
Vs = stack exit velocity in m/s
D = Stack diameter in m
∪ = mean wind speed in m/s
P = pressure in millibars.
Ts = stack gas temperature in K
Ta = atmospheric temperature in K.

In arrange to be able to evaluate the 1-hour absorption of pollutants predict by the mock-up with the Indian Air Quality Standards, the 24-hour and the once a year average equivalent values are calculated. An atmospheric stability dependent formula (Duffee, O'Brien and Ostojic 1991 sited by SENES, 2003) (Equation -3) for time exchange from a 1-hour to 24-hour period is used.

$$C_0 = (C_1)\left(\frac{t_1}{t_0}\right)^n$$

where:
t_1= the longer averaging time, hr
t_o = the shorter averaging time, hr
n = the stability dependent exponent, 0.2
C_1 = the concentration at the longer averaging time, μg/m3 or ppm
C_o = the concentration at the shorter averaging time, μg/m3 or ppm

For convert from a 24-hr time border to time frame of up to used (Equation -5)

Distance	Source	Predicted ambient PM_{10} Concentration ($\frac{\mu g}{m^3}$)		
		Hourly	24-hour	Annual
250	All stacks and Volume vent	181.7	96.53	4.23
	Area source	76.05	40.28	1.76
	Max. 24-hrs background concentration (measured during 5days)	-	42	1.87
	Total	-	1.76.80	7.7
500	All stacks and Volume vent	108.62	57.52	2.51
	Area source	12.75	6.74	0.2
	Max. 24-hrs background concentration (measured during 5days)	-	42	1.86
	Total	-	107.27	4.71
750	All stacks and Volume vent	53.80	28.03	1.27
	Area source	3.61	1.91	0.09
	Max. 24-hrs background concentration (measured during 5days)	-	42	1.87
	Total	-	73.97	3.25
Maximum Limit			120	70

Table 8: Cumulative ambient concentrations of PM_{10} resulting from all stacks, the volume source vent, the background concentration and the area source as predicted by the air pollution model

$$C_1 = (C_0)\left(\frac{t_0}{t_1}\right)^{0.53} \quad (5)$$

The signs are as defined for Equation (5). The forecast of PM10 are projected based on the guess that they are equal to 50% of the TSP. assumed to be 50 % of the PM10 (Carlo Tozzi, 2006). The needed meteorological data to be used for the input of the model were obtained from the weather station which is the nearest station located about 16 km from the KJS cement plant location.

V. METEOROLOGICAL FACTS USED FOR AIR QUALITY MODELING

The replica key climate data contain: (1) usual monthly temperature (2) standard monthly solar radiation (3) standard monthly wind speed and (4) The standard general wind direction (degree from true north). These standard values are obtainable in Table (2). These facts are for the stage from 2006 to 2017.The constancy class obtainable in Table (2) is resolute based on the remarkable stability-category classification given by Turner (Noel De Nevers, 2000).

The current average wind trend is 50 % of the time from northwest to southeast and 50 % of the time from southwest to northeast (Table 2). Therefore, one month on behalf of each wind direction is modeled. The most horrible case is when the constancy condition is classified as C and the wind speed is moderate for the same class. For the case of the wind route from northwest to southeast, the moderate wind speed connected with solidity condition classified as C, was for the month of June. Therefore, the month of June represent the worst-case situation for this wind route. In fact, the month of June represents the worst-case situation throughout the year. Hence, the results of the case of the month of June are discuss.

Fig. 1: Elevation Analysis For KJS Cement Plant

For the wind route from southwest to northeast, some of the months represent class B constancy situation and others signify class C stability situation. Class C was chosen randomly to be modeled. The month of June was modeled because it has the strong wind speed (worst case scenario) among the months that have class C stability situation.

A. Stacks Emission Modeling contribution:-

The giving data to the model contain the following:

1) Raw mill and kiln stack data plus:
   (a). Stack physical height of (H_s):- 203 m,
   (b). Stack exit diameter of 1.07m, (c). Stack exit gas temperature (T_s):- 475^{0}C in combined operation, (d) emission rate :- 2200g/s (E). (e) exit velocity 11.5 m/s (V_s). (f) Air temperature (T_a):- 15^{0}C
2) effluence source data for the raw mill and kiln stack including:
   a. The probable gas flow rate from the stack is 309893 Nm3/hr, b. Fuel type to be used. The cement company considers two alternatives: fuel oil and natural gas. c. The amount of the fuel to be burnt per day during operation is shown in Table (3) for each type of fuel. d. scenarios were used to acquire the stack exit gas concentrations to be used in the model: (1) the gas concentrations were calculate based on the fuel type or the company is committed to comply with the standards of the gas emissions at the stack exit and because these values were higher than those calculated or estimated ones. Therefore, the pollutant emissions from the stacks and from the volume sources of the cement plant models follows:

1) SO2 modeling contribution

The sulfur at ease of the fuel types is obtainable as well as the quantity of each fuel to be burnt every day. Therefore, the focus of SO2 at the mountain exit could be calculate and used in the model. a. In case of fuel oil, it is found that the predict SO2 focus at the Stack is 3802 mg/Nm3 (Based on burning 5.45 tons/day of fuel oil or coal that has 4.2 % sulfur content, Table 3) which is less than the value set by the indian Air quality standard of 6500 mg/Nm3, and hence it was used to predict the ambient air focus for the month of June. b. In case of natural gas, the sulfur content is small and consequently, the SO2 ambient focus is predict to be small as well and is not significant.

2) NOx modeling contribution

a. In case of fuel oil, it is found that the predict NOx focus at the stack exit according to EPA AP-42 is 1019.8 mg/Nm3 (Table 3), which is less than the value set by the Indian air quality standards at stationary sources of 1800 mg/Nm3. Therefore, the value set by the Jordanian standard is the worst-case scenario and it is used for the model contribution. b. In the case of natural gas, it is found that the predicted NOx concentration at the stack is 2243.4 mg/Nm3 based on the EPA AP-42 (Table 3), which is higher than the value set by the Indian standard of 1800 mg/Nm3, but the company shall not violate the standard regulating the emission at the source Air quality standard and it is obligated to take improvement measures.

3) CO modeling contribution

In the cases of natural gas and fuel oil, it is found that the predict CO focus at the stack exit is 169.5 and 161.1 mg/Nm3, consequently, (EPA AP-42) (Table 3), and in both gear it is less than the cost set by the Indian Air quality standard of 250 mg/Nm3. Therefore, the value set by the average is the worst-case scenario used for the model contribution.

4) TSP modeling input

a. In case of the raw mill and kiln stack, it is found that the predicted TSP is 118.49 mg/Nm3 (according to the KJS Cement Inventory), (Carlo Tozzi, 2006) (Table 3), which is less than the value set by the Indian Air quality standard of 150 mg/Nm3. Therefore, the standard value is modeled for the two months of June and July as it is the worst-case scenario. Also, the predicted value is modeled for the month of June. b. In case of the cooler clinker stack, it is found that the predicted TSP value is 91.11 mg/Nm3.(Table 3), and it is modeled for the month of June. c. In case of the cement mill stack, it is found that the predicted TSP value is 56.24 mg/Nm3 (Carlo Tozzi,2006).

(Table 3), and it is modeled for the month of June. d. In case of the volume sources, it is found that the predicted TSP value is 4.6 g/s (Carlo Tozzi, 2006) (Table 3), and it is modeled for the month of June.

VI. RESULTS AND DISCUSSION

The modeled air quality parameters are: SO_2, NOx CO and TSP for the two months of June and July. Also, the two temperatures (475^0C and 15^0C) for the stack exit gas effluent are studied for each of the two months.

A. Raw Mill and Kiln Stack Emission Modeling Results

The results of the air quality parameters ambient concentrations are shown graphically in Figures similar to Figures (1.1.a through 1.4.b) (shown here for the SO_2). The other figures for the rest of pollutants are not shown here, but their main findings are reported in Tables and discussed for each of the pollutants. As explained before, all of the results presented in this study (except for the case of SO_2 emission resulting from using fuel oil (Figures 1.1. and 1.1.d) are based on the worst-case scenario which is to assume that the concentrations of all of the calculated parameters at the stack exit equal the maximum limits set by the Indian Air quality standard(2014). This was simply done because the values set by the standard are higher than those predicted ones in most of the cases and because the company is obligated to comply with the standard at the stack exit. Therefore, this worst-case scenario is not particular to any type of fuel, which means that the model output presented in all of the Figures (except Figures 1.1.c and 1.1.d) is applicable to any fuel type.

The SO_2 results are shown in Figures (1.1.a through 1.4.b). The Figures display the results by two ways; one is by using an X-Y axis using Excel spread sheet and the other one is by using contour lines software. The maximum hourly concentrations in the ambient air at the 1.6 m above ground level compared with the maximum limits set by the Indian air quality standard. Also, the equivalent daily and annual concentrations are calculated from their corresponding hourly values and they are presented in Table (4) as well. The maximum hourly ambient concentrations of SO_2 range from 0.48 ppm (at a distance of 4 km) for the month of June (Figures 1.4.a and 1.4.b) to 0.8 ppm (at a distance of 750 m) for the month of July(Figures 1.1.a and 1.1.b). In all of the studied cases, the hourly and the daily ambient SO_2 concentrations exceeded the allowable limits of the Indian air quality standard of 0.3 ppm and 0.14 ppm (Table 4). These high predicted concentrations are due to the fact that the maximum allowable stack exit concentrations set by the standard – the worst case scenario- are used, and these results are also based on the assumption that no emission control devices are installed at the stack and no other mitigation measures are implemented. Therefore, the cement company shall implement the necessary mitigation measures to control SO_2 emissions. Another fact will contribute to lower SO_2 emissions; the SO_2 gas is expected to be in contact with the calciner raw material at 800-1000^{o}C, and is expected to be absorbed by calcium oxide and other basic oxides to form calcium sulfate and calcium sulfite, therefore, only trace amounts of SO_2 will be emitted from the 204 m stack. As a result, the cement company can easily achieve a much lower SO_2 emission value than the indian air quality standard limit. The annual ambient SO_2 concentrations range from 0.011 ppm to 0.018 ppm and all of these values are lower than the annual average set by the standard of 0.04 ppm (Table 4).

B. The NOx Modeling Results

The NOx results were plotted in figures similar to those shown in (Figure 1.1.a through 1.4.b) and are not shown here. The maximum hourly concentration calculated by the model and the estimated equivalent daily and annual concentrations in the ambient air at 1.6 m from the ground level for the NOx are presented in Table (5) and are compared with the maximum limits set by the Indian air quality standard (2014). The maximum hourly ambient concentrations of NOx range from 0.183 ppm (at a distance of 4 km) for the month of June to 0.32 ppm (at a distance of 750 m) for the month of September. The hourly ambient NOx concentration exceeded the allowable limit of the Indian air quality standard of 0.21 ppm for the month of June only. In all cases presented in Table (5), the 24-hr NOx concentrations exceeded the value of 0.08 set by the standard. These high predicted concentrations are due to the fact that the maximum allowable stack exit concentration set by the standard were used and also these results were based on the assumption that no mitigation measures are implemented. Therefore, the cement company shall implement the mitigation measures discussed later to control NOx emissions. The annual ambient NOx concentrations range from 0.004 ppm to 0.007 ppm and all of these values are lower that the annual average set by the standard of 0.05 ppm.

C. The CO Modeling Results

The maximum hourly concentration calculated by the model and the estimated equivalent 8-hour concentration in the ambient air at 1.6 above the ground level for CO are presented in Table (6) and are compared with the maximum limits set by the Indian air quality standard. All of the calculated values are lower than those set by the standards.

D. TSP, PM10 Modeling Results

The largest emission source of dust is the kiln operation, which includes the feed system, the fuel firing system, the clinker burning, cooling and hauling systems.

(Egyptian Environmental Affairs Agency EEAA, 2005). Due to the complexity of evaluating the amounts of

dust emission during the construction and the operation phases of cement plants, it is the usual practice to focus on the mitigation measures to reduce the negative impacts of dust emissions. The mitigation measures should ensure the compliance. The cumulative ambient concentrations of the particulate matter were modeled and calculated at different distances from the cement plant. In the case of dust, the background concentrations as well as the area sources (not included in Table 1) are significant in contrary to the other air pollutants. Therefore, the measurements obtained during the 5 days monitoring. period and the dust emissions from the area sources are presented and added to dust emissions from the plant. Tables (7 through 9) show the ambient cumulative dust concentrations from all sources. The background concentrations were determined on a 24-hour basis by measuring the PM10 during the 5 days interval. The maximum measured concentration during the 5days period was used in the calculations. It is shown that the ambient concentrations beyond a distance of about 300 meters from the cement plant are in compliance with the Indian air quality standard (2014).For distances less than 300 m near the vicinity of the plant, the cement company shall implement the recommended mitigation measures to control the emissions of dust components.

VII. Mitigation measures

The control of dust resulting from hauling materials can be a difficult challenge and can be even a greater cause of air quality degradation than mill and kiln exhausts. However, the control and minimization of fugitive dust from cement plant operations require high cost technological solutions. Well-planned management of activities (e.g. in the methods of loading and material transfer) can reduce the generation of dust significantly and with relatively little additional cost. Options for controlling dust from other operations include: the use of covered or enclosed conveyers, crushers, material transfer points and storage areas; installation of dust collectors and/or bag filters where needed; paved roads; vacuum sweepers for plant roads; sprinklers for plant roads and storage piles; latex stabilizing sprays for storage piles; and site landscaping and vegetation (World Business Council for Sustainable Development, 2005). If natural gas is used as the energy supply, then the flue gas sulfur dioxide will be undetectable as sulfur is very low and almost undetectable in natural gas fuel. The carbon monoxide concentration in the exhaust gas is expected to be low as natural gas undergoes almost complete combustion in the calciner. The control of NOx could be achieved using low NOx emitting burners, by firing limestone under reducing atmosphere, and by recycling of kiln fuel gases for use in the pre-heaters and pre-calcinator (Obajana Cement PLC, 2005). To minimize CO_2 emissions; an important greenhouse gas not studied here, from cement plants, three ways for improvement have been identified: (1) increased energy efficiency in order to consume less energy, (2) using alternative fuels (e.g. biomass) to replace conventional fuels, and (3) greater use of cementious additions such as slag and fly ash (World Business Council for Sustainable Development, 2005).

VIII. Conclusions

As the demand for cement increases in standard to meet the development requirements, the number of planned cement plants to be constructed in the near future has increased. Even though cement manufacturing industry has many advantages such as providing the local society with job opportunities and contributing to the enhancement of the economical development, it has some negative impacts on humans and on the environment if not managed in the suitable way. This paper presents a investigation of a KJS cement plant located around satna (M.P) or city of cement. The focus of the paper is on the assessment of the air pollutants from the factory. The Gaussian air pollution model is used to predict the ambient concentrations of air pollutants including dust, SO_2, NOx and CO. The predicted values are compared with the Indian air quality standard (2014) and in the case of violations, mitigation measures are recommended to minimize the negative impacts of the air pollutants emitted from the cement industry & The massive impact of Corona-virus quarantines on air pollution or reduce industrial pollution,$PM_{2.5}$, overall world reduce around 20% or NO_x, and CO_2, reduce around 50%(↓). Also air quality improve. so that according to my opinion future alternative industrial lockdown (odd-even concept) All-over the world applied. because that is the very effective concept to reduce air pollution.

Acknowledgment

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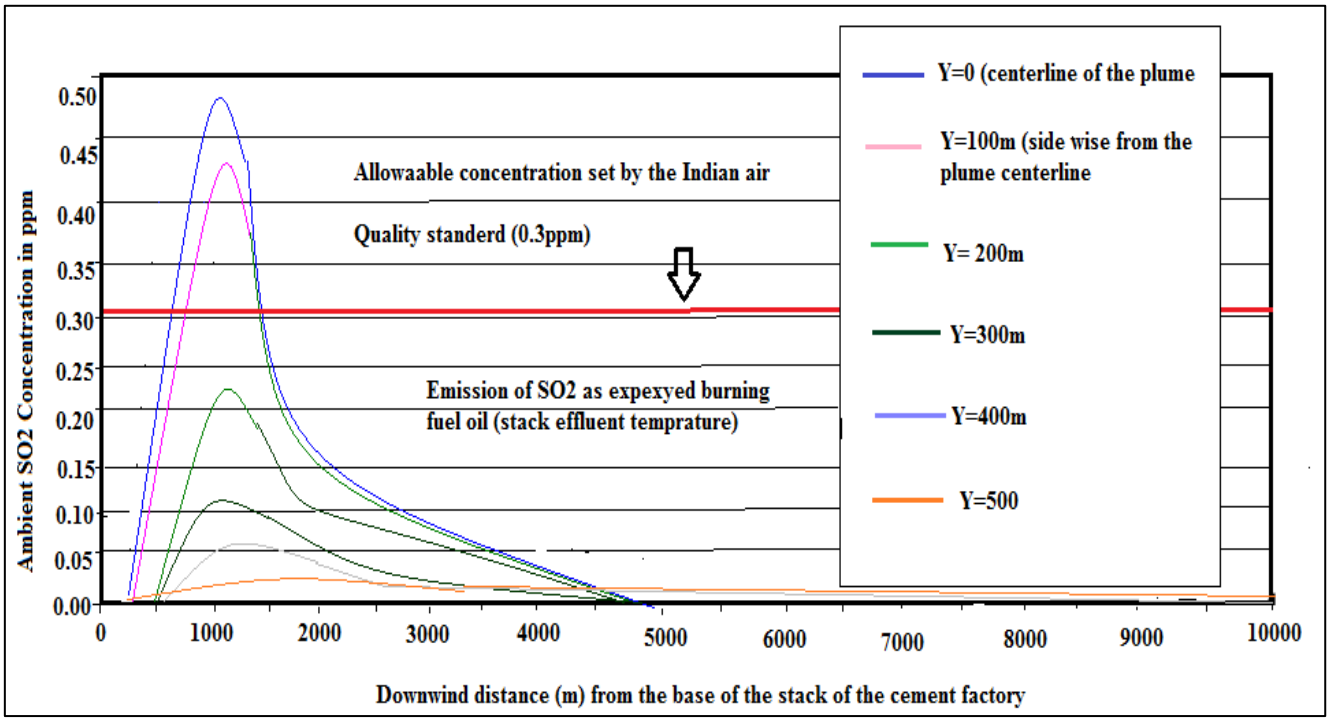
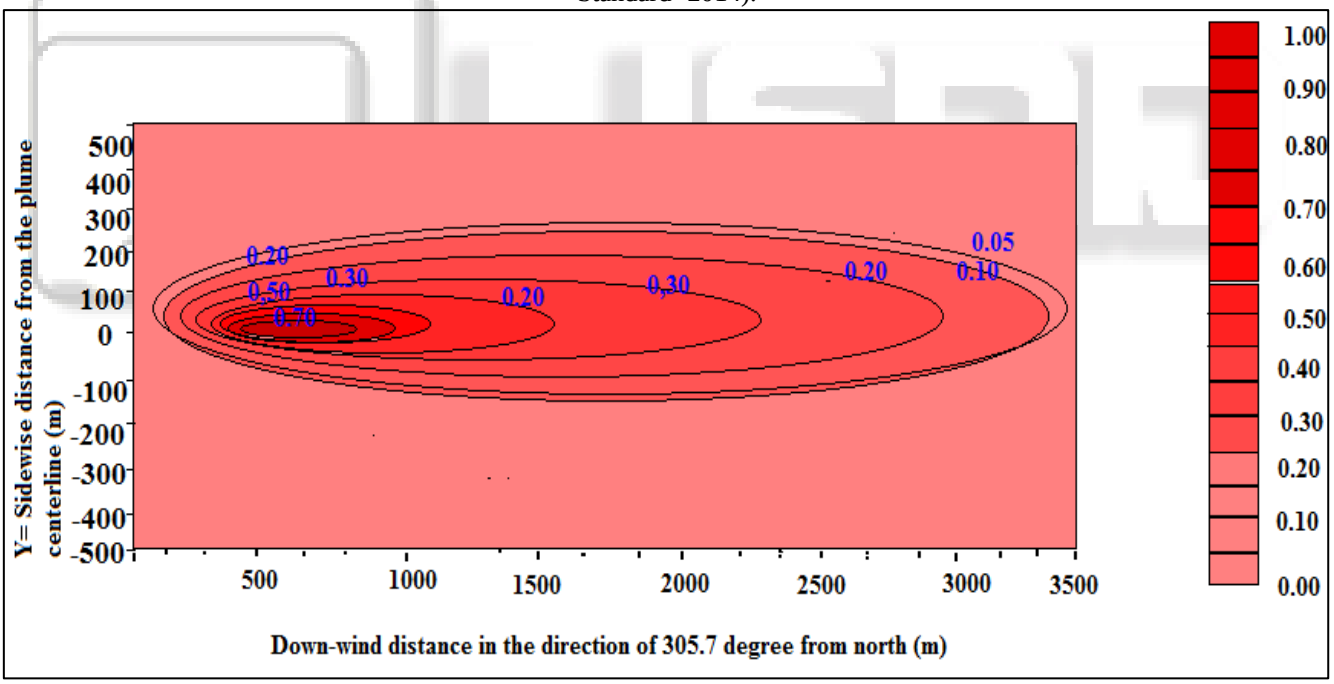
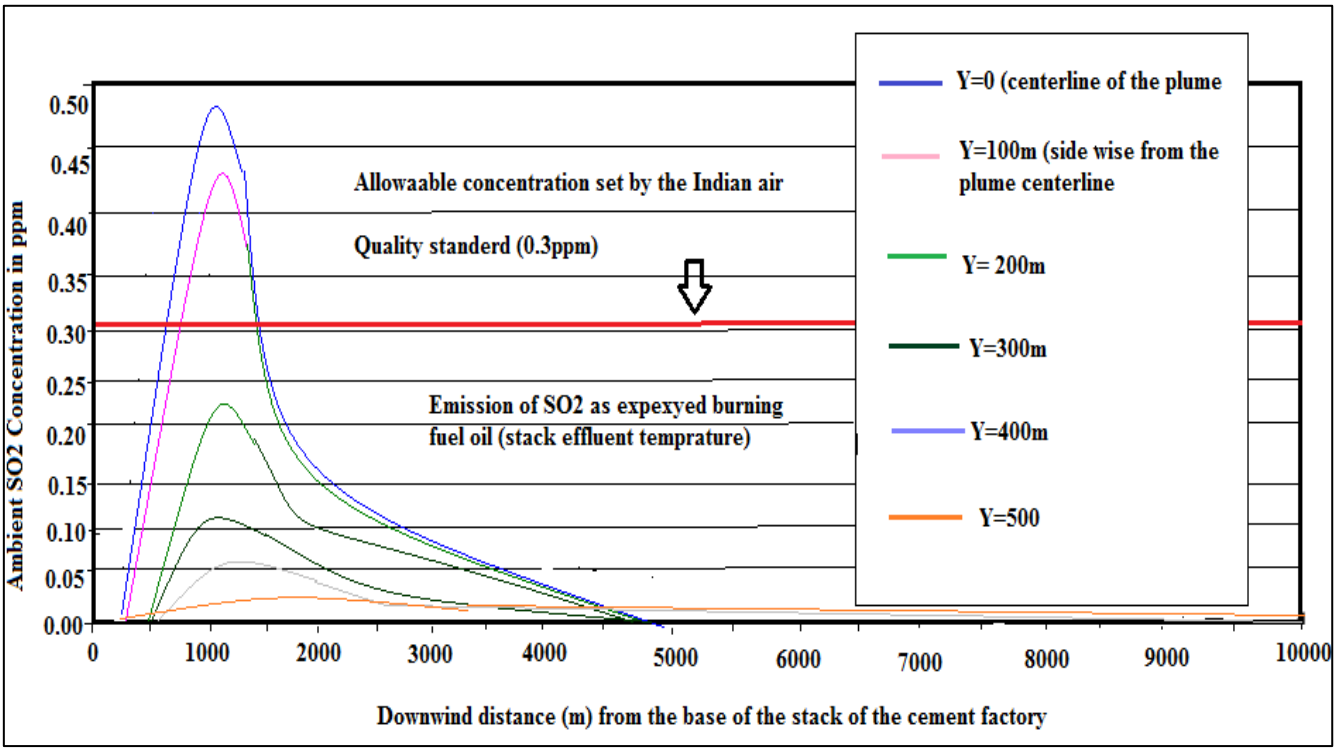


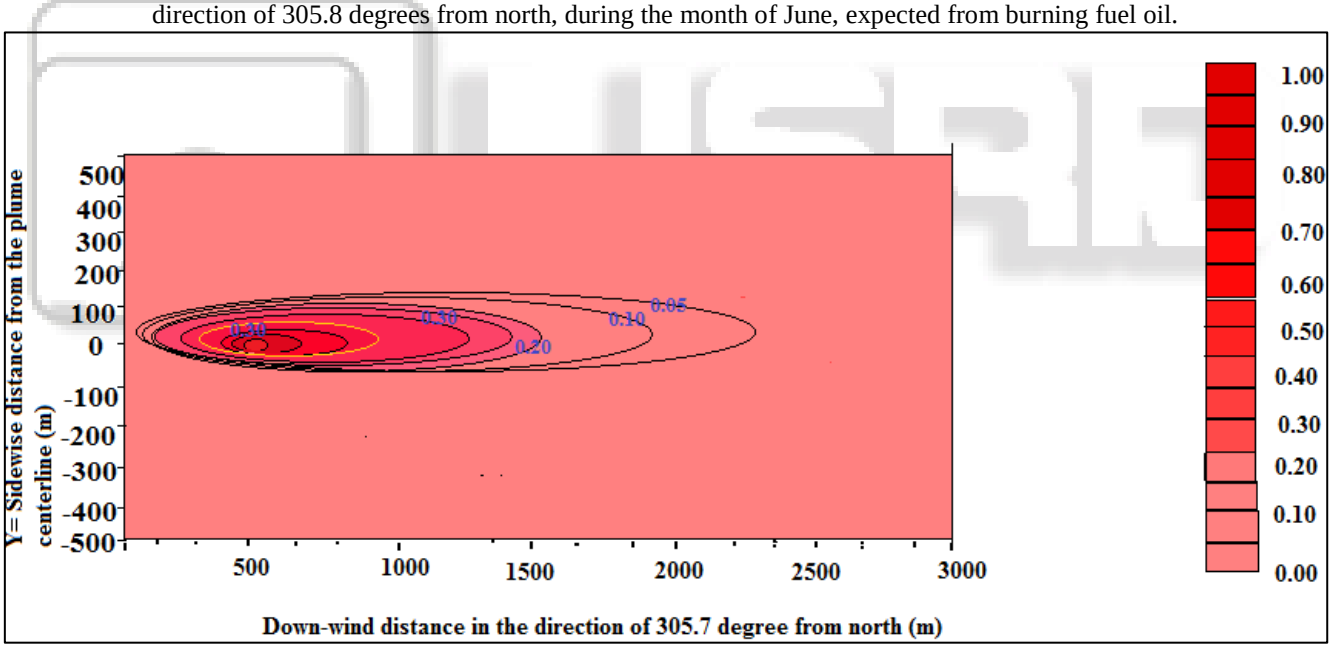
Graph (1- a): One hour ambient concentration of SO2 estimated by modeling at stability class A, wind speed of 5.5 m/s in the direction of 305.8 degrees from north, during the month of June, based on the allowable stack emission by (Indian Air quality Standard -2014).



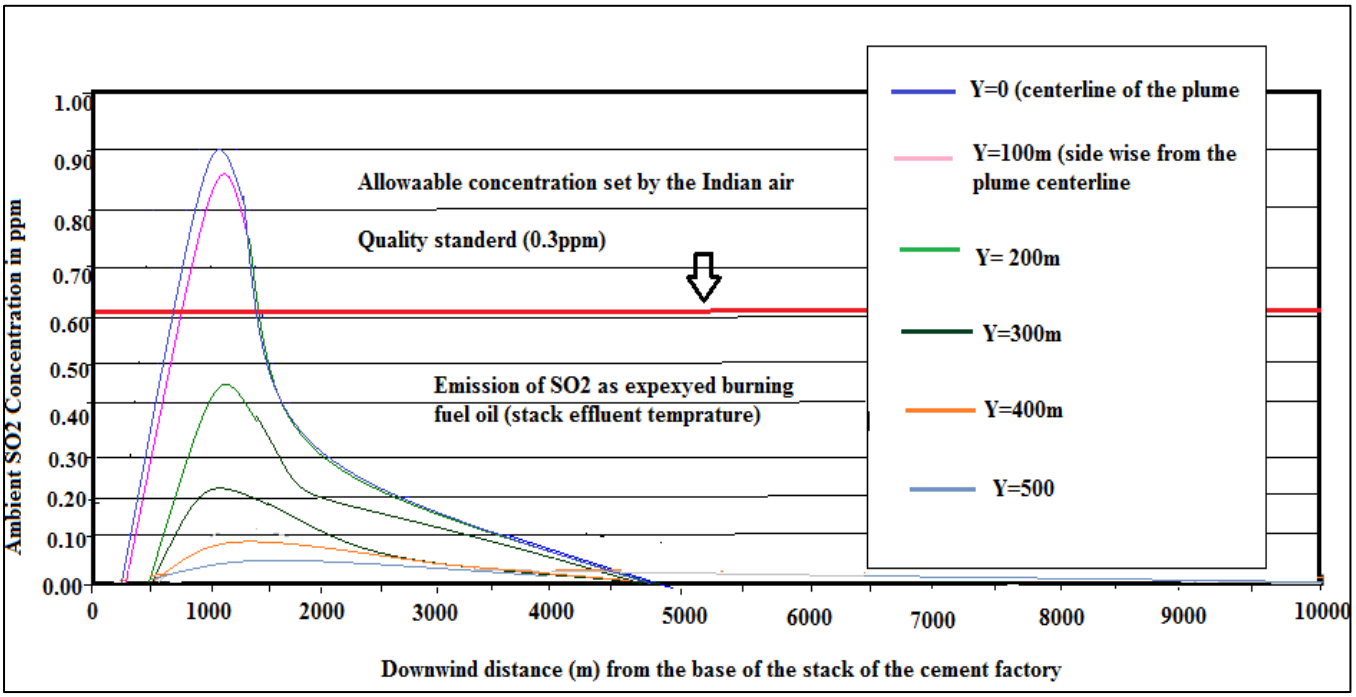
Graph (1-b): One-hour ambient concentration contour lines of SO2 at stability class A, wind speed of 5.5 m/s in the direction of 305.8 degrees from north, stack exit gas temperature of 475°C during the month of June, based on the allowable stack emission by (Indian air quality Standard).



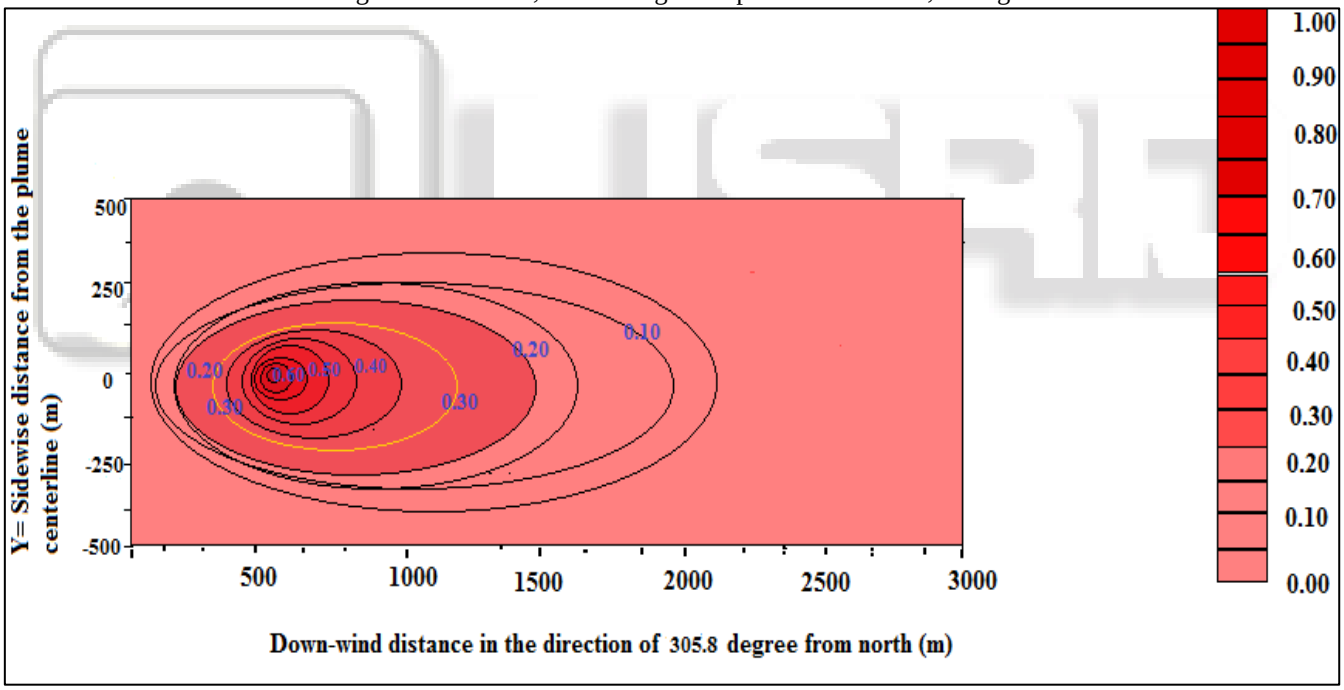
Graph (2-a): One hour ambient concentration of SO2 estimated by modeling at stability class A, wind speed of 5.5 m/s in the direction of 305.8 degrees from north, during the month of June, expected from burning fuel oil.



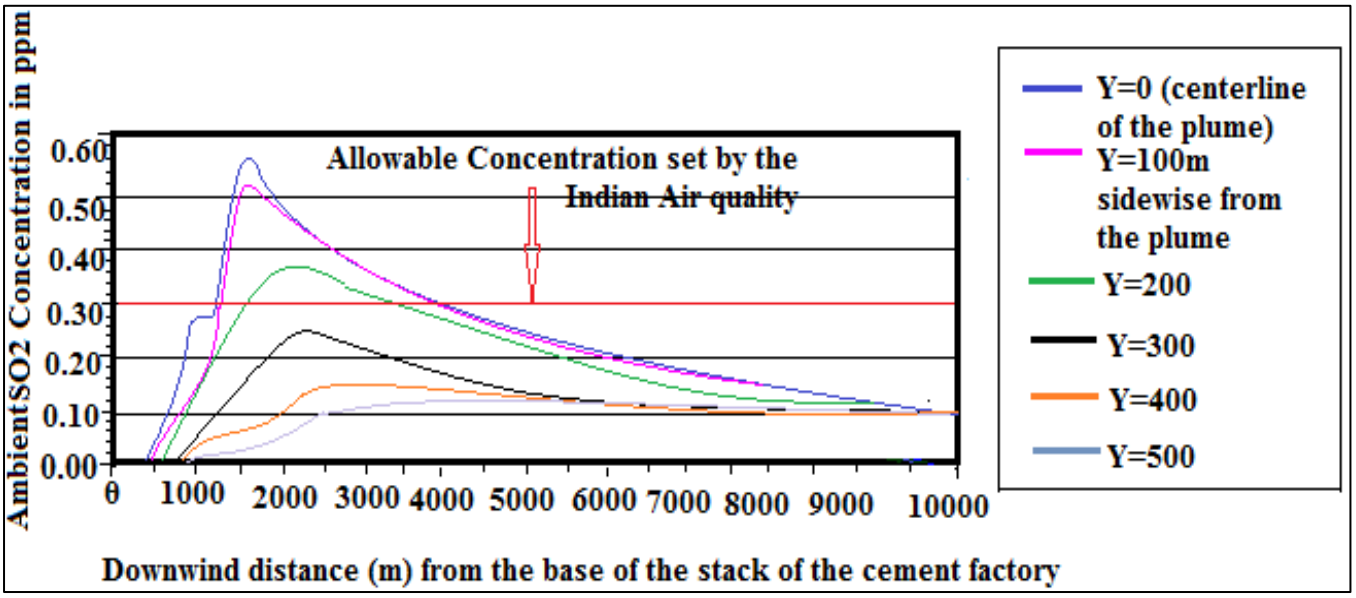
Graph (2-b): One-hour ambient concentration contour lines of SO2 at stability class A, wind speed of 5.5 m/s in the direction of 305.8 degrees from north, stack exit gas temperature of 475°C during the month of June (emission from burning fuel oil).



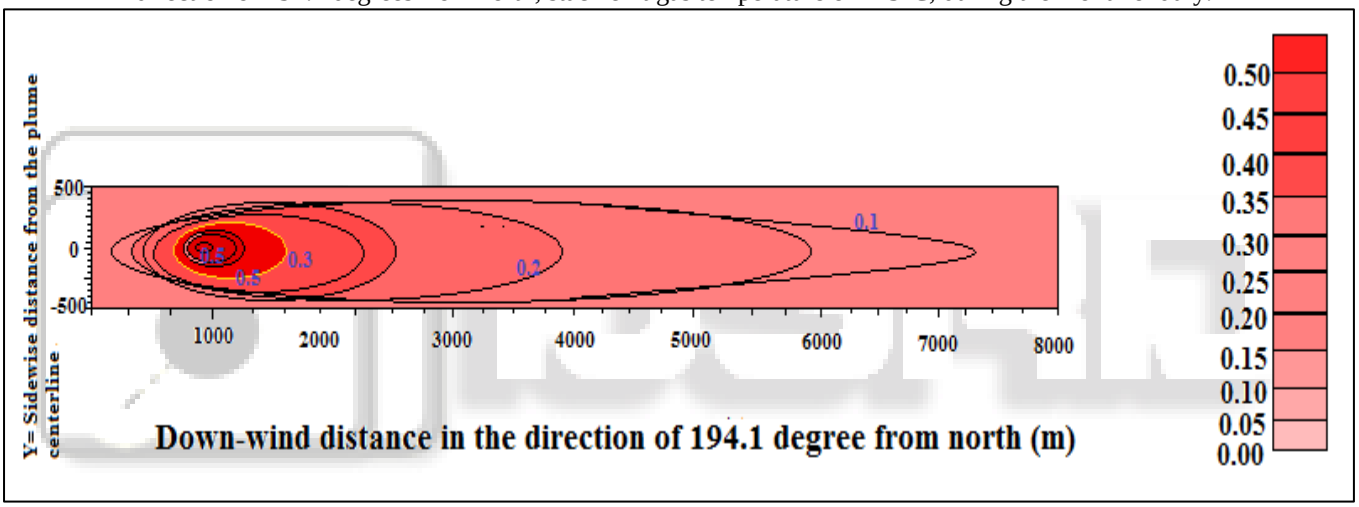
Graph (3-a): One hour ambient concentration of SO2 estimated by modeling at stability class A, wind speed of 5.5 m/s in the direction of 305.8 degrees from north, stack exit gas temperature of 475°C, during the month of June



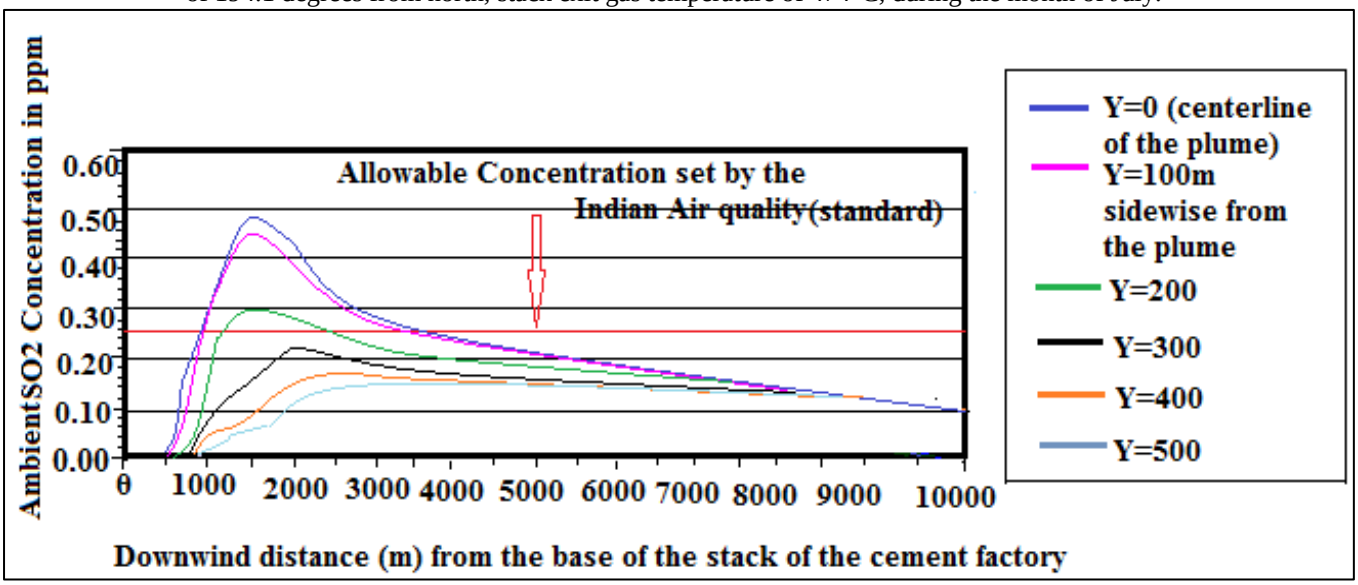
Graph (3-b): One-hour ambient concentration contour lines of SO2 at stability class A, wind speed of 5.5 m/s in the direction of 305.8 degrees from north, stack exit gas temperature of 475°C, during the month of June.



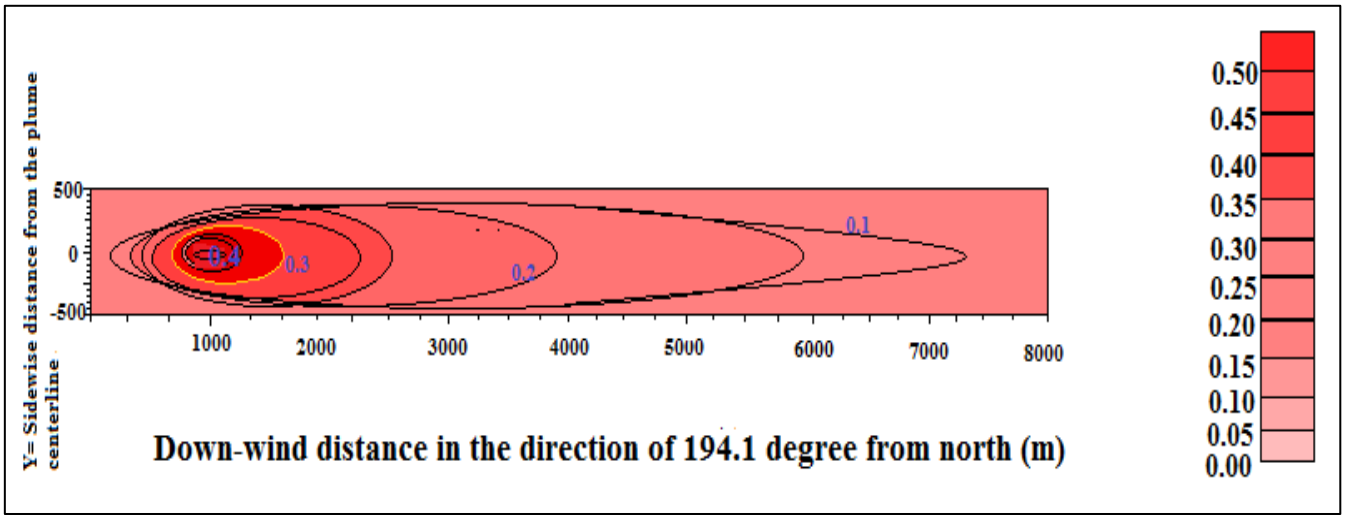
Graph (4-a): One hour ambient concentration of SO2 estimated by modeling at stability class C, wind speed of 5.4 m/s in the direction of 194.1 degrees from north, stack exit gas temperature of 475°C, during the month of July.



Graph (4-b): One-hour ambient concentration contour lines of SO2 at stability class C, wind speed of 5.4 m/s in the direction of 194.1 degrees from north, stack exit gas temperature of 474°C, during the month of July.



Graph (5-a): One hour ambient concentration of SO2 estimated by modeling at stability class C, wind speed of 5.4 m/s in the direction of 194.1 degrees from north, stack exit gas temperature of 474°C, during the month of July.



Graph (5-b): One-hour ambient concentration contour lines of SO2 at stability class C, wind speed of 5.4 m/s in the direction of 194.1 degrees from north, stack exit gas temperature of 474°C, during the month of July

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