3.6 AIR ENVIRONMENT

3.6.1 Meteorology

The meteorological data recorded during the monitoring period is very useful for proper interpretation of the baseline information as well as input for air quality prediction. Historical data on meteorological parameters will also play an important role in identifying the general meteorological regime of the region.

Kota has a semi arid climate with high temperatures throughout the year. Summers are long, hot and dry, starting in late March and lasting till the end of June. The monsoon season follows with comparatively lower temperatures, but higher humidity and frequent, torrential downpours. The monsoons subside in October and temperatures rise again. The brief, mild winter starts in late November and lasts until the last week of February. Temperatures hover between 26.7 °C (max) to 12 °C (min). This can be considered the best time to visit Kota because of intense heat in the summer.

The average annual rainfall in the Kota district is 660.6 mm. Most of the rainfall can be attributed to the southwest monsoonwhich has its beginning around the last week of June and may last till mid-September. Pre-monsoon showers begin towards the middle of June with post-monsoon rains occasionally occurring in October. The winter is largely dry, although some rainfall does occur as a result of the Western Disturbance passing over the region.

The year may broadly be divided into three seasons i.e., winter, summer and monsoon:

- Winter : November to February
- Summer : March to June
- South west Monsoon : June to September
- North east monsoon : October to December

Rajasthan State - Climate

Broadly speaking, Rajasthan has a tropical desert climate. It is extremely cold from October to February while the scorching sun tortures the land from March to September. Due to scanty rainfall, women can be seen carrying water for miles to meet their daily needs during summers. To the south of Rajasthan, River Luni and River Chambal River and its tributaries bless the people with their water and form an alluvial basin in Kota.

Temperature

There are distinct temperature range variations diurnal and seasonally throughout the state, revealing the most typical phenomenon of the warm-dry continental climate. The summer begins in the month of March while the temperature keeps rising progressively through April, May and June. West of Rajasthan and the eastern side of Aravalli Range, in the region of Bikaner, Phalodi, Jaisalmer and Barmer, the maximum daily temperature hovers around 40°C to 45°C. Sometimes, it even reaches as high a 49°C during the summer months. Nights of summers see a considerable temperature fall with a minimum daily temperature around 20°C to 29°C. However, Udaipur and Mount Abu have a pleasanter climate in summers with a relatively lower daily maximum temperature that reaches 38°C and 31.5°C, respectively. The daily minimum temperature at nights for these two stations hovers around 25°C and 22°C, respectively. The major portion of the state consists of the arid west and the semi-arid mid-west has an average maximum of 45°C in June.

January is the coldest month in the state of Rajasthan. The minimum temperature sometimes falls to -2°C in the night at places like Sikar, Churu, Pilani and Bikaner. The sandy land gets even colder with occasional

secondary Western winds that cross the western, northern and eastern Rajasthan during winter months, and even cause light rainfall and chilly winds can be experienced during this period. Most of the Rajasthan, except the southeast Rajasthan comprising of Kota, Bundi and Baran and western Barmer have an average temperature of more than 10°C. Due to the cold western winds, the whole of Rajasthan sometimes come under the spell of the cold wave for 2 to 5 days during winters.

Rainfall

Rajasthan being the desert area, its climate varies mostly from arid to sub-humid. To the west of the Aravallis, the climate is marked by low rainfall, extreme diurnal and annual temperature, low humidity and high velocity winds. In the east of the Aravallis, the climate is semi-arid to sub-humid marked by lower wind velocity and higher humidity and better rainfall. The annual rainfall in the state differs significantly. The average annual rainfall ranges from less than 10 cm in north-west part of Jaisalmer region (lowest in the state), to 20 to 30 cm in the regions of Ganganagar, Bikaner and Barmer, 30 to 40 cm in the regions of Nagaur, Jodhpur, Churu and Jalor and more than 40 cm in the regions of Sikar, Jhunjhunun, Pali and the western fringes of the Aravalli range. The more fortunate eastern side of the Aravallis sees 55 cm rainfall in Ajmer to 102 cm rainfall in Jhalawar. Mount Abu in the Sirohi district in the southwest region receives the highest rainfall in the state (163.8 cm).

The southwest monsoon begins in the last week of June in the eastern parts and may last till mid-September. There are occasionally pre-monsoon showers in mid-June while post-monsoon rains may occur in October. Winters may also receive a little rainfall with the passing of western distribution over the region. However, Rajasthan receives most of its monthly rainfall during July and August.

The details of rainfall data is presented in **Table 3.4**

Table 3-4: Rain fall data of Kota District (2009-2013)

	Rain fall (in mm)				
	2009	**2010**	**2011**	**2012**	**2013**
January	0	0.5	0	5.9	0
February	0	1.2	4.5	0	14.5
March	2.4	0	0	0	2.6
April	0.4	0.8	0	5.5	1.6
May	1.8	0	2.8	26	0.3
June	35.2	29.5	409	22.3	149.6
July	316.1	167.8	242.1	197.1	501.7
August	113	251.2	358.7	269	381.3
September	35.6	90	179.9	109.8	63
October	34.9	0.2	0	0	72.6
November	33.7	52	0	0	0.4
December	4.8	0.3	0	0	3.2
Annual Total	**577.9**	**593.5**	**1197**	**635.6**	**1190.8**

Source: District Rainfall Hydromet division, Indian Meteorological Department.

Methodology

On-site monitoring was undertaken for various meteorological parameters as per BIS and IMD guidelines to generate the site-specific data. The generated data was then compared with the meteorological data of Kota, IMD.

Methodology of Data Generation

The automatic meteorological data recording instrument was installed near to the project site to record wind speed, wind direction, relative humidity and temperature. Cloud cover was recorded by visual observation. Rainfall was monitored by rain gauge.

Hourly average, maximum, and minimum values of wind speed, direction, relative humidity, rainfall, and temperature were recorded continuously at this station during December 2014.

Analysis of Meteorological Data Recorded Near the Project Site

The meteorological data recorded at the project site and Windrose diagrams are presented in **Figure 10.**

It was observed that the temperature at the proposed site during the study period ranged from 6°C to 30°C. While relative humidity of the area varied between 23% and 96%. Avg. wind speed is 3.6 to 5.7 m/sec.

Predominant winds from SW direction, followed by West and NW of the total time, the clam conditions were observed for 56.68% of the total time during study period.

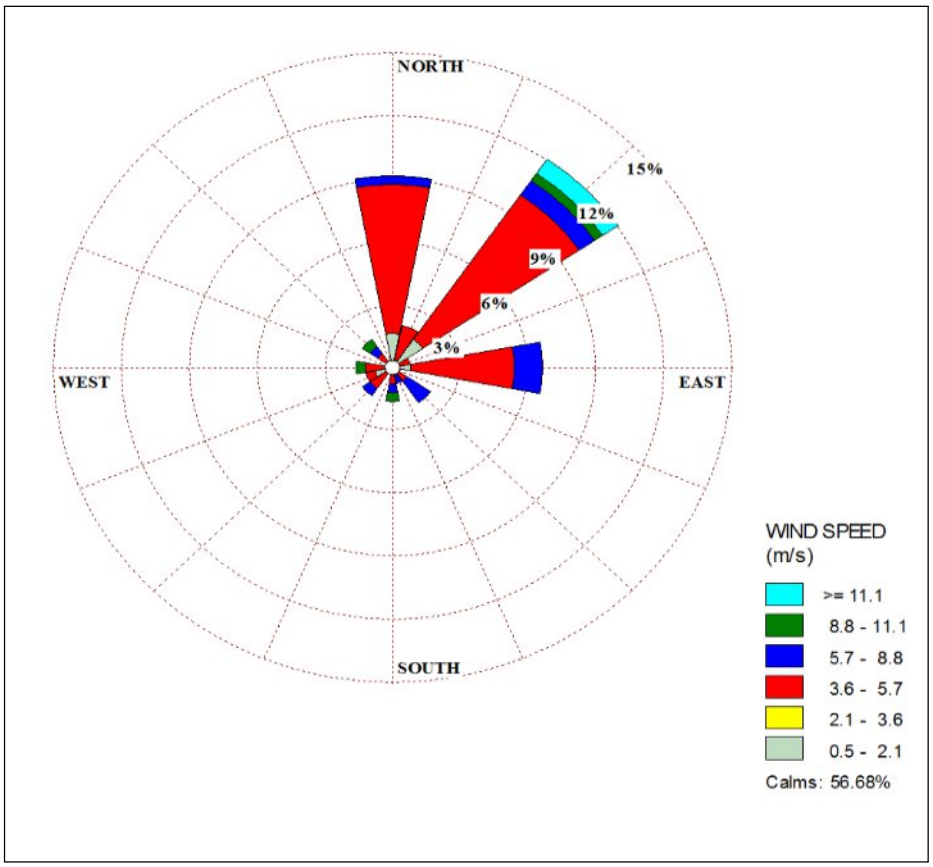

Figure 10: Wind rose for the winter season -2014(December)

Ambient Air Quality

The various sources of air pollution in the region are industries and vehicular traffic. The prime objective of the baseline air quality study (10-km radius) was to assess the existing air quality of the area to form base line

information. The study area represents mostly rural environment.

The regional climatological data was used as a guideline to know the predominant wind direction during study period. Ambient air monitoring was carried out at 4 locations. The details about sampling locations are depicted in **Figure-11** and presented in **Table-3.5.** Photographs showing Ambient Air Sampling with samplers are presented in **Figure 12.**

The locations were identified keeping in view predominant wind directions prevailing during study period, sensitive receptors and human settlements. The levels of, Respirable Particulate Matter (PM_{10}), Fine Particulates ($PM_{2.5}$), Sulphur Dioxide (SO_2), Oxides of Nitrogen (NO_X) and Carbon Monoxide (CO), were monitored for establishing the baseline status. PM_{10} was collected with the help of particulate samplers as 24 hourly average by drawing air through the cyclone at the rate of 1.0 -1.5 m^3/min through glass fiber filter paper over which particulates less than 10 µ gets deposited. The dust deposited over the filter paper is measured as PM_{10}. The fine particulate matter ($PM_{2.5}$) was measured by using Envirotech APM 550 Fine particulate sampler using WINS Impactor with a flow rate set to 16.7 lpm and the concentrations were measured by Gravimetric method. Due to the high suction of the air in SPM sampler the vacuum is created which is utilised for sampling SO_2, NO_X using separate rotameter and parameters were measured by wet chemical methods colorimetrically.

Summary of Ambient air quality within the study area monitored for in December 2014 is presented in **Table 3.5**

The minimum, maximum and average values have been computed from the observed raw data for all the AAQ monitoring stations.

Table 3-5: Details of ambient air quality monitoring locations

S.No	Location code	Location name	Distance & direction
1	AAQ1	Project site	-
2	AAQ2	Ranpur village	3.46km(NE)
3	AAQ3	Baori khera	5.41Km (S)
4	AAQ4	Banda	7.88km(WSW)

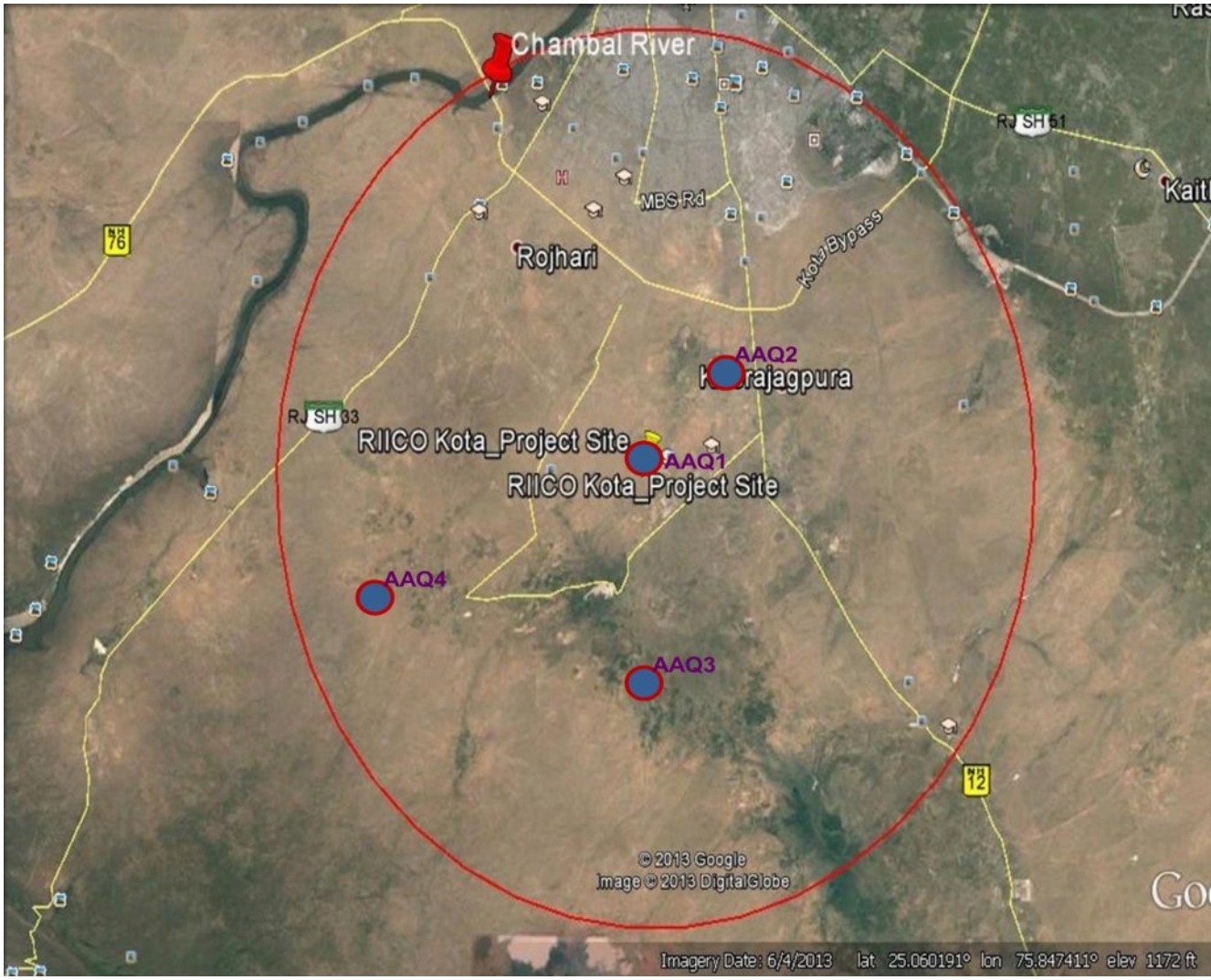

Figure 11: Ambient Air Quality Monitoring Locations

	
AAQ1:Project site,Kuber	AAQ2:Ranpur village
	
AAQ3:Baori khera village	AAQ4:Banda village

Figure 12: Photographs showing Ambient Air sampling with samplers

Table 3-6: Summary of Ambient air quality results

S.No.	Sample location	PM-10	PM-2.5	SOX	NO2
1	RIICO-kota,Ranpur Idustrial area(AAQ1)	51.28	20.45	12.40	10.05
2	Ranpur village	34.38	13.70	10.18	8.40
3	Baori khera	41.38	16.53	9.08	7.55
4	Banda	39.4	15.7	9.5	8.4
Method References		CPCB Guidelines	CPCB Guidelines	CPCB Guidelines	CPCB Guide
Unit		µg/m^3	µg/m^3	µg/m^3	µg/m^3
Standards		100	60	80	80

Avg: 24 hrs.

3.6.2 Observations of Primary Data

The minimum and maximum concentrations for PM_{10} were recorded as 31.6 µg/m^3 and 52.9 µg/m^3 respectively. The minimum concentration was recorded at Ranpur village and the maximum concentration was recorded at Project location. The average concentrations were ranged between and 34.38 to 51.28 µg/m^3.

The minimum and maximum concentrations for $PM_{2.5}$ were recorded as 12.6 µg/m^3 and 21.1 µg/m^3 respectively. The minimum concentration was recorded at Ranpur village and the maximum concentration was recorded at Project location. The average concentrations were ranged between 12.9 and 21 µg/m^3.

The minimum and maximum concentrations for SO_2 were recorded as 8.9 µg/m^3 and 12.9 µg/m^3 respectively. The minimum concentration was recorded at Baori khera and the maximum concentration was recorded at Project location .The average concentrations were ranged between 8.9 and 12.9 µg/m^3.

The minimum and maximum concentrations for NO_x were recorded as 7.2 µg/m^3 and 10.4 µg/m^3 respectively. The minimum concentration was recorded at Baori khera and the maximum concentration was recorded at Project location. The average concentrations were ranged between 7.2 and10.4 µg/m^3.

The minimum and maximum CO concentrations were recorded as 142µg/m3 and 96 µg/m3 respectively. The average concentrations vary between 142 and 295 µg/m3.

The concentration of the above five criteria pollutants was observed well within the limits promulgated by CPCB for industrial, residential, rural and other areas.