Plant Location Specific Emission Standards (Study report by CEA)

Salient points:

- Evidence based study
- Methodology
- Scientific Data collection
- Findings
- Recommendations

Evidence Based study

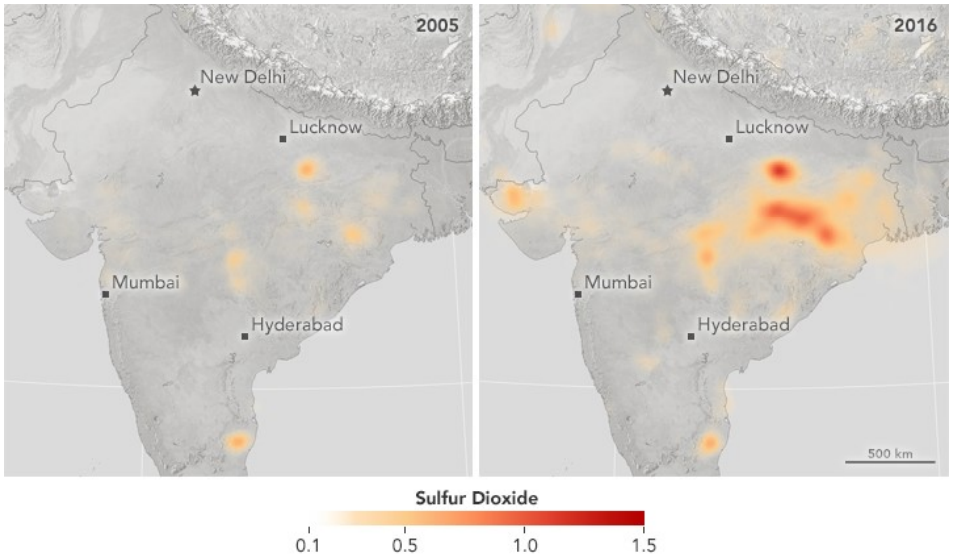
➢**Satellite image (NASA website)** indicates the concentration of SO_2 at certain height and not the ground SO_2 levels in the area. Hence, Ground Air Quality measurements play an important role.

➢**CPCB Ambient Air Quality Data 2018** (24 hr. average (max.) and annual average), CEA analysed the latest Ambient Air Quality data (SO_2, NO_2, PM_{10}, $PM_{2.5}$) monitored at 745 Stations located across the length and breadth of country.

Satellite Imagery of SO_2 Emissions

- Satellite Imagery gives **a bird's eye view of the regions where high concentration** of SO_2 is occurring in the atmosphere. It broadly isolates the problem region which requires immediate course correction.

- The figure indicates the changes in the vertical column density of atmospheric SO_2 from year 2005 to 2016. It shows that the SO_2 hot spots (2016) are **concentrated in small clusters in states of Odisha, Jharkhand, Chhattisgarh, Maharashtra, Tamil Nadu and Gujarat**, etc. having large capacities of Thermal Power Plant, which would need to be effectively taken care of on priority basis.



(courtesy NASA)

- Satellite image indicates the **concentration of SO_2 at certain height and not the ground SO_2 levels** in the area. Hence, Ground Air Quality measurements play an important role.

Methodology

- For ascertaining **Dispersion of Emissions from the stack**, the modelling studies and the satellite imagery are useful tools.

- **Satellite imagery indicates the hot spots** which would need to be effectively taken care of on priority basis.

- **Ground level SO2 levels** are considered.

- **Air Quality Dispersion Modeling** Study, Jan 2020 (IIT Kanpur)

Data collection

- CEA analysed the latest Ambient Air Quality data (SO2, NO2, PM10, PM2.5) monitored at **745 Stations located across the length and breadth of country**.

- In an attempt to explore the possibility of correlation the **ground based emission** levels with the **satellite based data**. Ground based SO_2 measured levels (CPCB, 2018) were categorized into 5 distinctive levels-

Category →	Level I	Level-II	Level III	Level IV	Level V
SO2 →	>40 µg/m^3	31-40 µg/m^3	21-30 µg/m^3	11-20 µg/m^3	0-10µg/m^3

Data Collection (cont…)

- In June 2020, CEA sent request to all the Thermal Power Generating Companies to furnish ambient air quality data (PM/SO_2/NOx) *at least for past one year* collected from the AAQMS located in their plants.

- The data was analyzed for an installed capacity of **86,272 MW** by CEA and has been tabulated as below. Plant capacity is categorized considering the maximum and average value of SO_2 levels in their vicinity.

- Thermal Power Plant capacity categorized considering the average value of SO_2 in their vicinity.

SO2 level Average	0-10	11-15	16-20	21-25	26-30	31-35	36-40	>40
Thermal Capacity	23,330	16,770	24,954	10,320	2,700	2,520	2,527	1,930
Percentage	27.43%	19.72%	29.34%	12.13%	3.17%	2.96%	2.97%	2.27%

Ambient Air Quality, SO_2 Levels ($\mu g/m^3$)
Central Sector Plants

NTPC Plants	April-19	May-19	June-19	July-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	Jan-20	Feb-20	Mar-20	Data Type
NTPC/IGSTPP	9.4	9.0	8.6	8.0	8.0	8.1	8.3	7.2	6.5	8.4	13.5	12.0	Max.
NTPC/Unchahar TPS	22.6	6.6	10.5	11.2	11.1	10.7	11.4	6.7	7.6	7.5	7.6	15.9	Max.
NTPC/Barh TPS	16.4	16.2	16.3	16.4	13.2	18.0	14.8	23.2	24.2	23.6	23.6	24.8	Max.
NTPC/Kahalgoan TPS	12.4	15.3	15.1	16.4	15.8	63.3	23.5	9.3	20.7	24.0	14.8	28.9	Max.
NTPC/Talcher Kaniha TPS	20.8	24.9	25.6	17.4	20.5	28.4	26.9	26.7	21.6	20.8	19.8	27.3	Max.
NTPC/Bhilai TPS	27.5	18.9	22.8	18.6	20.1	19.5	21.8	16.4	19.7	40.0	35.6	40.0	Max.
NTPC/Sipat TPS	35.1	57.3	37.0	14.9	19.4	22.8	15.9	18.9	11.4	41.1	30.3	12.4	Max.
NTPC/Vindhyachal TPS	30.1	29.5	31.7	35.9	56.4	46.2	24.9	25.6	23.2	33.5	23.5	20.3	Max.
NTPC/Mouda TPS	14.2	119.7	53.1	16.7	19.3	19.7	23.9	46.2	23.4	23.1	16.8	28.1	Max.
NTPC/Farakka TPS	74.8	12.4	21.5	30.3	32.0	37.0	40.0	29.4	32.4	33.9	38.3	24.4	Max.
NTPC/Kudgi TPS	238.9	27.1	20.3	12.6	18.7	18.6	18.2	15.4	16.8	48.9	96.4	62.6	Max.
NTPC/TandaTPS	49.4	62.1	58.4	35.2	16.9	7.8	20.9	99.0	54.2	88.0	94.0	75.0	Max.
NTPC/Simhadri TPS	72.9	55.6	17.9	26.6	32.4	41.6	106.2	61.3	88.4	72.4	98.8	66.2	Max.
NTPC/Rihand TPS	142.3	192.2	213.7	18.5	14.6	21.0	32.7	29.7	38.3	27.6	32.8	33.8	Max.
NTPC/Solapur TPS	43.9	38.9	174.9	49.7	74.6	196.9	51.4	29.8	66.1	33.0	35.1	53.0	Max.
NTPC/Talcher Thermal TPS	239.0	236.2	177.2	24.2	26.5	22.9	23.0	27.2	28.9	30.1	31.7	29.6	Max.
NTPC/Vallur TPS	30.7	50.4	36.6	88.5	75.0	92.8	93.5	92.1	92.1	94.5	89.5	88.8	Max.
NTPC/Singrauli TPS	78.2	33.6	17.0	16.4	35.5	26.0	156.5	197.8		139.6	74.9		Max.
NTPC/Barauni TPS	82.0	80.0	75.0	83.0	86.0	78.0	92.0	75.0	91.0	73.0	69.0	65.0	Max.
NTPC/Dadri TPS	86.0	55.9	99.8	213.4	172.4	73.4	21.0	26.5	30.6	223.7	14.9	23.8	Max.
NTPC/Kanti TPS	110.0	120.7	125.0	156.0	190.0	125.1	154.0	145.0	160.0	164.0	110.0	80.0	Max.
NTPC/Ramagundam TPS	193.6	249.5	199.4	107.7	186.0	129.0	142.6	118.9	139.0	142.9	143.6	56.1	Max.
NTPC/Korba TPS	218.3	230.7	156.5	25.0	12.8	71.8	65.2	399.1	446.4	155.7	177.2	158.5	Max.

Good

Moderately Polluted

Satisfactory

Poor

Ambient Air Quality, SO_2 Levels ($\mu g/m^3$)
Central Sector Plants (contd.)

NLC/DVC Plants	April-19	May-19	June-19	July-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	Jan-20	Feb-20	Mar-20	Data Type
NLCIL/TPS-II	5.9	5.9	5.8	7.2	4.0	3.7	3.7	3.3	3.5	3.8	3.5	5.2	Max. Avg
NLCIL/TPS-1 Expansion	7.4	8.5	6.4	6.1	8.1	7.3	9.9	5.4	5.4	4.9	4.9	5.0	Max. Avg
NLCIL/TPS-1	9.6	9.2	9.3	6.3	7.8	7.7	11.0	5.5	5.6	5.6	4.2	6.2	Max. Avg
NLCIL/Barsingsar TPS	9.6	9.0	9.2	8.1	8.0	8.2	8.6	9.2	11.9	10.0	9.9	11.5	Max.
NTPC/Unchahar TPS	22.6	6.6	10.5	11.2	11.1	10.7	11.4	6.7	7.6	7.5	7.6	15.9	Max.
NLCIL/TPS-II Expansion	10.4	12.9	9.9	9.0	23.6	17.8	20.0	9.8	5.1	7.3	17.0	7.2	Max. Avg
DVC/Meija TPS	22.0	21.8	18.8	17.9	17.9	17.9	17.6	7.6	19.8	21.1	19.6	18.2	Avg.

Good

Moderately Polluted

Satisfactory

Poor

Ambient Air Quality, SO_2 Levels ($\mu g/m^3$)
State Sector Plants

State Sector Plants	Apr-19	May-19	June-19	July-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	Jan-20	Feb-20	Mar-20	Data Type
WBPDCL/ Sagardighi TPS	-	-	-	2.7	7.1	3.1	2.8	3.0	3.7	5.3	4.7	6.6	Avg.
WBPDCL/Kolaghat TPS	9.9	9.1	9.1	11.0	9.6	9.2	9.1	9.8	9.7	10.6	10.7	14.2	Avg.
GSECL/ Sikka TPS	6.1	6.1	5.9	9.3	8.8	7.6	8.8	10.9	11.8	22.1	18.2	19.4	Avg.Avg
GSECL/ Gandhinagar TPS	13.4	13.4	11.9	12.6	10.3	7.8	8.7	11.4	13.2	12.4	11.6	12.6	Avg.Avg
HPGCL/ DCRTPP	11.4	10.6	11.8	12.3	13.0	12.7	12.6	13.8	13.3	14.4	14.8	12.5	Max. Avg
HPGCL/RGTPP,Hissar	16.3	15.3	15.7	14.3	13.0	13.7	14.7	17.7	15.3	15.7	16.3	15.7	Max. Avg
GSECL/ Wanakbori	20.6	17.3	16.8	16.4	7.0	7.4	19.5	8.0	20.7	22.0	20.5	21.6	Avg.Avg
GSECL/ Ukai TPS	14.5	18.7	17.5	17.6	14.9	18.1	20.8	18.5	18.1	19.8	19.7	18.5	Avg.Avg
GSECL/ Kutch Lignite TPS	26.7	26.1	24.6	22.6	23.5	21.5	21.3	21.4	22.8	21.7	20.3	19.8	Avg.Avg
HPGCL/ Panipat TPS	24.3	23.8	21.4	-	-	20.8	25.6	23.4	22.5	-	18.6	25.4	Max.
RRVUN/ Suaratgarh TPS	27.9	34.6	38.2	64.3	33.5	34.1	25.0	14.7	48.4	6.7	30.3	11.6	Max.
RRVUNL/Kalisindh TPS	55.2	59.1	64.0	83.9	122.0	7.6	-	3.0	0.0	0.0	0.0	0.0	Max.
MPPGCL/ Amarkantak TPS	11.5	10.3	4.8	4.4	14.0	5.3	17.5	31.3	187.8	30.4	41.2	234.8	Max.
MPPGCL/ Satpura TPS	94.5	82.6	80.0	0.0	79.6	63.3	54.3	51.6	48.5	43.5	46.6	52.8	Max. Avg
MPPGCL/ Shree Singaji TPS	63.0	6.5	144.4	66.6	58.7	37.9	74.8	77.7	72.1	68.2	62.6	61.4	Max. Avg
GGSSTPP/ Rupnagar	87.0	92.0	89.0	86.0	87.0	88.0	91.0	94.0	84.0	89.0	87.0	-	Max.
MPPGCL/Sanjay Gandhi TPS	572.8	372.0	290.9	87.9	66.4	13.0	154.4	136.3	-	313.1	544.1	294.2	Max. Avg

Good

Moderately Polluted

Satisfactory

Poor

Ambient Air Quality, SO_2 Levels ($\mu g/m^3$)
Private Sector Plants

Pvt. Sector Plants	Apr-19	May-19	June-19	July-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	Jan-20	Feb-20	Mar-20	Data Type
Adani Power/ Udupi Power	8.2	8.7	9.1	8.2	8.8	10.8	8.8	6.5	6.5	9.5	9.6	6.9	Avg.Avg
NPL/ Rajpura TPS	10.7	6.4	7.4	7.2	7.9	7.9	9.0	11.3	9.7	9.1	11.0	11.3	Avg.Avg
CESC/ Budge Budge TPS	9.8	11.1	12.0	15.3	17.8	20.5	22.7	24.2	4.0	3.3	6.1	7.3	Max.
PPGCL/Bara TPS	14.2	13.2	14.4	21.0	21.0	21.8	13.1	12.8	12.8	15.2	15.0	13.0	Max. Avg
Tatapower/CGPL,Mundra	16.8	16.4	15.8	16.7	12.7	13.1	13.5	16.6	16.7	16.6	17.1	17.2	Avg.Avg
Adani Power/ Kawai	16.2	17.5	14.0	17.6	19.1	16.7	17.0	18.6	17.2	18.2	20.0	21.3	Max. Avg
Adani Power/Mundra	28.5	25.0	21.7	26.0	27.0	29.3	27.1	29.5	26.6	27.5	27.3	25.7	Max. Avg
Tatapower/ Maithon	37.5	38.6	41.1	40.8	36.9	36.3	35.6	34.9	34.2	33.6	33.0	29.6	Avg.Avg
Tatapower/ Jojobera TPS	41.5	42.2	43.1	39.6	33.5	31.7	43.0	37.9	39.7	38.7	36.5	40.9	Avg.Avg
Tatapower/ Trombay TPS	45.2	43.9	41.0	39.3	36.7	34.5	34.3	40.6	39.2	38.4	43.5	40.4	Avg.Avg
Dhariwal Ltd./ Chandrapur	47.1	54.8	32.1	88.0	41.4	32.1	24.1	13.6	73.4	16.6	39.8	33.9	Max.

Good

Satisfactory

Moderately Polluted

Poor

Data Collection (cont…)

- Thermal Power Plant capacity categorized considering mainly the maximum levels of SO_2 in their vicinity averaged over a period of one year.

SO_2 max. Range (µg/m3)	0-10	11-15	16-20	21-25	26-30	31-35	36-40	>40
Thermal Capacity	10,920	10,160	7,560	6,340	9,834	10,380	2,528	28,550
Percentage	12.66%	11.78%	8.76%	7.35%	11.40%	12.0%	2.93%	33.09%

- As per the above data, immediate action may have to be considered for a capacity of about **33%** and for **15%** in the next phase.

Air Quality Dispersion Modeling Study, Jan 2020
SO_2 emission: *Talwandi Sabo Thermal Power Plant, Punjab.*

- **Study Conclusions**

➢ The model computed **SO_2 peak concentration is in the month of April** 45.9µg/m^3. The **peak contribution towards Delhi** was 40µg/m^3 at a distance of about 2.0km and **drops sharply to less than 1µg/m^3 at a distance of 40km from the plant**. Thus beyond 40km the impact of SO_2 becomes insignificant.

➢ The **NO_2 modelled peak concentration was in April at 52µg/m^3.** The **peak contribution towards S-E direction** was 45µg/m^3 at a distance of 2.5km and drops sharply to less than 1µg/m^3 at a 40km distance from the plant. Thus, beyond 40km the impact of NO_2 becomes insignificant.

Findings

➢**SO_2 ground based levels across the country are mostly within a range of 0-40µg/m^3** (*Good* as per CPCB standards) and similar trend with some exceptions are seen in the case of NO_2 levels.

➢**Major cause of concern is the PM_{10}, $PM_{2.5}$ levels** which are relatively very high. *High Particulate Matter* levels is a country wide phenomena. PM contribution from all the Thermal Power Plants shall have to be controlled necessarily to the new emission standards (Dec 2015).

➢**A baseline SO_2/NOx can be maintained in air across the country** with pockets where stringent air emission norms shall be implemented. It will ensure the baseline SO2/NOx levels everywhere and norms will be relatively stringent in areas where air quality is critically poor and relatively relaxed where air quality is not so bad.

➢**Same norms for SO_2/NOx may not be required** where the existing ambient air has got substantial *environmental capacity* to accommodate the emissions and hence may not exceed the limits as prescribed by CPCB.

➢Study conducted by Prof. Mukesh Sharma, Dept. of Civil Engineering, IIT Kanpur on the behalf of Private Power Producer, also **concluded that beyond 40km the impact of SO_2 /NOx becomes insignificant.**

Recommendations

To mitigate the challenges faced by the *New Emission Norms* following measures can be adopted.

1. ***Uniform Ambient Air Quality*** **-** Implementing uniform emission norms of TPS may result in different air quality at different location. *Identical norms* for Thermal Power Plants located *in critically polluted area* and in *areas where air quality is good* doesn't look to be proper as additional costs are involved. Aim should be to achieve *Uniform Air Quality* throughout the country.

It is proposed to **implement FGD for the Thermal Power Plants *region-wise*** as given in the table below:

Region	Ambient Air SO_2 levels	FGD Installation
1	$>40\mu g/m^3$	Immediately
2	$>30\mu g/m^3$ & $\leq 40\mu g/m^3$	In 2nd phase
3	$>20\mu g/m^3$ & $\leq 30\mu g/m^3$	Not required at present
4	$>10\mu g/m^3$ & $\leq 20\mu g/m^3$	
5	$>0\mu g/m^3$ & $\leq 10\mu g/m^3$	

- In areas where the development is high, the atmospheric *air quality is poor* and is prone to serious atmospheric pollution problems, *strict control of emissions* shall be required in such *key areas* for TPS as categorised under Region 1.
- In next phase FGD to be implemented in the Power Plant which are under Region 2
- Presently, no action shall be required for Power Plant those are under Region 3,4 & 5.

Recommendations (cont…)

2. ***Graded Action Plan*** for large base of Thermal Power plants will help in utilizing the resources in effective manner and it will help in fine tuning the technology for local conditions. Unworkable time schedule will create market scarcity leading to import, jacked up prices unnecessary burden on power utilities.

- FGD orders shall be onetime affair creating large demands and later the capacities may remain idle. Hence, it would be prudent to have FGD implementation in such a way that there would be **continuous demand for a longer period of time**.
- Thus, if the process of emission control in the country is completed in **longer time frame (10-15 years)** and considering in first phase Thermal Power Plants located in critically polluted areas, it will achieve tangible results in combating emissions and help in developing indigenous manufacturing base, skilled manpower in the country which shall take care of the local operating conditions.

Thanks