

BEFORE THE NATIONAL GREEN TRIBUNAL,  
PRINCIPAL BENCH, NEW DELHI  
Original Application No. 605 OF 2024

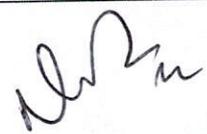
IN THE MATTER OF

**News Item titled "Oh-zone! Why this prominent pollution in Delhi air is becoming a cause of concern" appearing in the Times of India dated 22.04.2024 before NGT (PB), New Delhi.**

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Filed by:

  
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New Delhi  
Dated: 19/04/2025

BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL

PRINCIPAL BENCH AT NEW DELHI

ORIGINAL APPLICATION NO. 605 OF 2024

**IN THE MATTER OF:**

News Item titled "Oh-zone! Why this prominent pollutant in Delhi air is becoming a cause for concern" appearing in The Times of India dated 22.04.2024 before NGT (PB), New Delhi.

**AFFIDAVIT ON BEHALF OF RESPONDENT NO-4 - MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE.**

I, Mukesh Balodhi S/o Sh D.N Balodhi aged about 42 years old, presently working as Scientist E', with the Ministry of Environment, Forests & Climate Change, Government of India having office at New Delhi, do hereby solemnly affirm and declare as under:

1. That, I am well acquainted with the facts and circumstances of the present case and competent to swear this affidavit in the instant case.
2. That, the present affidavit is filed in respectful compliance of the order of this Hon'ble Court dated 23.12.2024, wherein the Hon'ble Tribunal inter-alia passed the following order (reproduced relevant extracts only):-



M. Balodhi

②

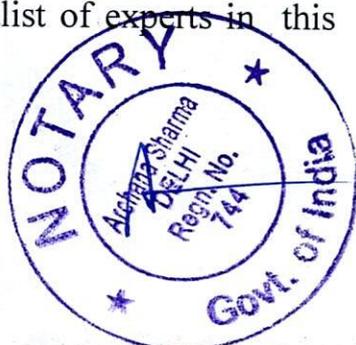
*“5. The feasibility and mechanism for implementation of recommendations made by CPCB needs consideration. Hence, we deem it proper to implead the following as respondent no. 4:-*

*4. MOEF&CC through the Secretary.*

*6. Let Notice be issued to respondent no. 4 for filing the response by way of affidavit, especially commenting upon the recommendations that have been made by CPCB as quoted above”*

A copy of the Hon'ble Court order dated 23.12.2024 is annexed at **ANNEXURE-A.**

3. That the Answering Respondent has perused the report dated 20.12.2024 prepared by the Central Pollution Control Board (in short CPCB). A true copy of the CPCB report dated 20.12.2024 is annexed at **ANNEXURE-B.**
4. That, the Answering Respondent agrees with the findings, observations and Way forward/Recommendations contained in the said report.
5. That the Answering Respondent , considering the importance of the subject matter and the need for a more comprehensive understanding ,the MoEFCC recommends constitution of an Expert Committee comprising of specialist of experts in this relevant field and submit report in a time-



*M. Balodhi*

bound manner as mentioned in the CPCB report and the findings thereof will be placed before the Hon'ble Tribunal.

6. That this affidavit is being filed in compliance with the direction of the Hon'ble Tribunal and for placing the Answering Respondent stand on record.
7. That, in view of the foregoing submissions, this Hon'ble Tribunal may be pleased to pass such or further orders as it may deem fit in the given circumstances of the case.

*Identify the deponent who has signed/put T.J. In my presence*

*M Balodhi*

**DEPONENT**

(मुकेश बलोधी)  
(MUKESH BALODHI)  
वैज्ञानिक 'ई'/Scientist 'E'  
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय  
Min. of Environment, Forest and Climate Change  
भारत सरकार, नई दिल्ली  
Govt. of India, New Delhi

**VERIFICATION:**

Verified at New Delhi on the 19 APR 2025 of April, 2025 that the contents of the above affidavit and the accompanying report are true and correct to the best of my knowledge and belief and nothing material has been suppressed or concealed therein.



Certified that the foregoing statement was declared or solemn affirmation before me which has been read over to the deponent who has admitted

It as Correct

*A* Notary DELHI

19 APR 2025

*M Balodhi*

**DEPONENT**

(मुकेश बलोधी)  
(MUKESH BALODHI)  
वैज्ञानिक 'ई'/Scientist 'E'  
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय  
Min. of Environment, Forest and Climate Change  
भारत सरकार, नई दिल्ली  
Govt. of India, New Delhi

Item No. 22

Court No. 1

**BEFORE THE NATIONAL GREEN TRIBUNAL  
PRINCIPAL BENCH, NEW DELHI**

Original Application No. 605/2024

News Item titled "Oh-zone! Why this prominent pollutant in Delhi air is becoming a cause for concern" appearing in The Times of India dated 22.04.2024

Date of hearing: 23.12.2024

**CORAM: HON'BLE MR. JUSTICE PRAKASH SHRIVASTAVA, CHAIRPERSON  
HON'BLE DR. A. SENTHIL VEL, EXPERT MEMBER**

Respondents: Mr. Amit Singh Chauhan, Ms. Shikha Chauhan, Mr. Neelmani Guha & Ms. Shaima, Advs. for CPCB (Through VC)  
Dr. Abhishek Atrey & Ms. Jyoti Verma, Advs. for CAQM (Through VC)  
Mr. Balendu Shekhar & Ms. Tanisha Samanta, Advs. for DPCC

**ORDER**

1. In this Original Application, the Tribunal is considering the issue of rising levels of ground level ozone in Delhi, which in many areas exceeds eight hours standard.

2. In pursuance to earlier directions of the Tribunal, CPCB has filed the report dated 20.12.2024. The report of the CPCB discloses the measures for control of ozone which has been taken and also suggest a way forward. The measures which have been taken are disclosed as under:-

***"6. Measures for control of ozone***

*It has been recognised globally that control of ozone is only possible through control of its precursors. It is also evident that control of local sources of its precursors may not yield significant benefits in terms of ozone reduction, as both ozone and its precursors can be transported over hundreds of kilometres.*

*Considering the same, the government has undertaken several initiatives at the national level, to control the precursors of ozone, i.e. NOx and VOC, and methane and CO to some extent.*

The Government has launched National Clean Air Programme (NCAP) in 2019 as a national level strategy to reduce air pollution levels across the country. CPCB has identified 130 million plus/non-attainment cities (cities exceeding NAAQS, consecutively for five years). City Specific Clean Air Action Plans have been prepared and rolled out for implementation in all these 130 non-attainment/million plus cities to improve the air quality. These city specific clean air action plans target city specific air polluting sources like Soil & Road Dust, Vehicles, Domestic Fuel, MSW Burning, Construction Material and Industries with short-term priority action as well as those to be implemented in a medium to longer time frame along with the responsible agencies which improves the ambient air quality. Under NCAP, annual action planning for approved city action plans need to be submitted by concerned Urban Local Bodies (ULBs), which comprise the following actions to control NOx emissions:

- Use of off-peak passenger travel time to move freight and restrict entry of heavy vehicles into cities during the day
- Clean Fuel & Fuel Quality in vehicles
- Introduction of new electric buses (with proper infrastructure facilities such as charging stations) and CNG buses for public transport which will reduce plying of private vehicles on road and help to curb tail-pipe emissions.
- CNG infrastructure for auto gas supply in the city and transition of public transport vehicles to CNG mode.
- Charging infrastructure for E-vehicles
- Phase out old vehicles and introduce vehicle scrappage policy.
- Intensify monitoring of industries to reduce emission by the industries.
- Shifting of polluting industries.
- Conversion to CNG/PNG from pet coke / wood / coal / Furnace oil.
- Regular check and control of burning of municipal solid wastes.

Besides, waste management rules w.r.t solid waste, bio-medical waste, and hazardous wastes etc. are being implemented and EPR (Extended Producer Responsibility) regime for plastic waste, e-waste, used oil, tyre, etc. is in place, which stipulates mandatory targets for recycling/reuse, ensuring waste is managed in environmentally sound manner, thereby preventing it from burning and minimizing VOCs and CO emissions. Solid Waste Management Rules emphasizes on segregation and pre-processing/composting and thus minimising dumping/landfilling which has potential of Methane and VOCs formation. Further, CPCB has issued guidelines on Environmentally Sound Facilities for Handling and Scrapping of End of Life Vehicles, implementation of which helps in control of CO/VOC emissions which otherwise would be generated when environmentally sound recycling practices are not adopted.

Further, sector-specific interventions are listed below:

#### **A. Transport Sector**

- The introduction of BS VI-compliant vehicles across the country since April 2020 have reduced NOx emissions as compared to

erstwhile BSIV-compliant vehicles, with 70-85% reduction in the case of 2-wheelers, 25%-68% in the case of 4-wheelers, and 87% in the case of heavy-duty vehicles. There is also 29-49% reduction in CO emissions from BSVI compliant 2 wheelers as against BSIV compliant 2 wheelers.

- BS-VI fuel has been introduced which has 5 times less Sulphur content (50 ppm in BS-IV to maximum 10 ppm in BS-VI compliant fuel). This has enabled the introduction of advanced emission control technologies, including Diesel Particulate Filters (DPF) to reduce Particulate Matter (PM) and Selective Catalyst Reduction (SCR) systems for reduction in Nitrogen Oxides (NOx) emissions in BS-VI vehicles.
- Vapour Recovery System (hereinafter referred as VRS) has been installed at all Delhi-NCR petrol pumps, in compliance with the orders of the Hon'ble NGT and Hon'ble Supreme Court. Further, VRS has been installed at those pumps selling more than 100 KLPM petrol and located in million plus cities and selling more than 300 KLPM petrol and located in cities with population more than 1 lakh. Installation of VRS minimizes the release of Benzene and other VOC emissions during petroleum refueling and unloading operations.
- The government is also promoting electric mobility, resulting in zero vehicular emissions, under the PM Electric Drive Revolution in Innovative Vehicle Enhancement (PM E-DRIVE) Scheme launched in September, 2024 with an outlay of ₹10,900 crore. The scheme aims to support electric vehicles including e-2W, e-3W, e-Trucks, e-buses, e-Ambulances, EV public charging stations and upgradation of testing agencies.
- Over 25 states have notified or drafted state Electric Vehicle (EV) policy, to promote the use of EVs.
- The Government has been promoting blending of ethanol in petrol under the Ethanol Blended Petrol (EBP) Programme. The National Policy of Biofuels-2018, as amended in 2022, inter-alia advanced the target of 20% blending of ethanol in petrol to Ethanol Supply Year (ESY) 2025-26 from 2030. The target of 10% ethanol blending in petrol was achieved in June, 2022 i.e., five months ahead of the target during ESY 2021-22. Use of E10 fuel is expected to reduce CO and HC emissions by 20% in 2 wheelers and 4 wheelers as compared to normal gasoline. Use of E20 fuel is expected to reduce HC emissions by 20% for 2 wheelers and 4 wheelers, compared to emissions with normal gasoline. In case of CO, use of E20 fuel is expected to reduce CO emissions by 50% in case of 2 wheelers and 30% in case of 4 wheelers.
- The Ministry of Road Transport and Highways has formulated the Vehicle Scrapping Policy that includes a system of incentives/disincentives for creation of an ecosystem to phase out older, unfit polluting vehicles through a network of Registered Vehicle Scrapping Facilities (RVSFs) and Automated Testing Stations (ATSS). Phasing out of older vehicles will further reduce emissions. Further, environmental friendly disposal of older vehicles through scrapping facilities also reduces the emissions

which would have been released, had these vehicles been disposed off through unauthorised centers.

#### **B. Power plants and Industries**

- Industrial emission Standards for NOx and VOC have been revised/ introduced for various sectors such as man-made fiber industry, Fertilizer Industry, Pharmaceutical industry, paint industry etc.
- NOx emission standards have also been prescribed for coal/lignite-based thermal power plants, industrial boilers, Cement Plant (without co-processing of wastes) and Standalone Clinker Grinding Plants, furnaces etc.
- Promotion of installation of efficient Ultra Supercritical/ Supercritical units over Subcritical Thermal Units as these units are more efficient and their emission per unit of electricity generation is less than subcritical units.
- Ministry of Power has issued a policy on utilization of Biomass for Power generation through co-firing in coal-based power plants. The policy mandates 5-7% co-firing of Biomass primarily of agro residue with coal, after assessing the technical feasibility.
- Inefficient and old thermal power plants having capacity of about 18,802.24 MW comprising 267 units have already been retired till 30.06.2024.
- India in its Intended Nationally Determined Contributions (INDCs) stands committed to achieve about 50 percent cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030. As of Jul 2024, India has already achieved 45.5% Installed Capacity from non-fossil fuel-based resources.

#### **C. Biomass burning, with emphasis on paddy straw burning in Northern India**

1. Central Pollution Control Board (CPCB) has framed Guidelines for grant of one-time financial support under Environment Protection Charge funds for establishment of pelletisation and Torrefaction plants to promote utilisation of paddy straw. In case of setting up of pelletisation plant, Rs. 28 lakhs per tonne per hour (TPH), or 40% of the capital cost considered for plant and machinery of a 01 TPH plant, whichever is lower, is provided as one-time financial assistance with a maximum total financial support of Rs. 1.4 crore per proposal. In case of setting up of torrefaction plants, Rs. 56 lakhs per TPH, or 40% of the capital cost considered for plant and machinery of a 01 TPH plant, whichever is lower, is provided as one-time financial assistance with a maximum total financial support of Rs. 2.8 crore per proposal. A total of 17 applications for establishment of pelletization and Torrefaction plants under the above mentioned CPCB Guidelines have been sanctioned so far, out of which 02 plants are not coming up. Pellet production capacity of 15 sanctioned plants is 2.07 lakh tonne/annum. These plants are expected to utilize 2.70 lakh tonne of paddy straw per annum.
2. CPCB had deployed 26 teams (in 16 districts of Punjab and 10 districts of Haryana) for the period 01st October - 30th November, 2024 to intensify monitoring and enforcement actions regarding stubble burning. These teams coordinated with concerned

authorities/ officers deployed at the district level by the State Govt. and reported to the Commission for Air Quality Management in National Capital Region and Adjoining Areas (CAQM).

3. CAQM has issued directives & advisories to various stakeholders including the 11 Thermal Power Plants (TPPs) located within 300 km of Delhi, State Governments of Punjab, Haryana and Uttar Pradesh on "Ex-Situ Stubble Management" and to establish an ecosystem and robust supply chain mechanism to boost ex-situ utilisation of straw for tackling the problem of stubble burning.
4. CAQM has also directed coal based TPPs including cogenerating Captive TPPs situated in NCR to initiate immediate steps to co-fire biomass-based pellets (with focus on paddy straw utilization) with coal through a continuous and uninterrupted supply chain targeting at least 5% co-firing of biomass pellets.
5. CAQM has provided a Framework to the states concerned for control / elimination of crop residue burning and directed these to draw up detailed state-specific action plans based on the major contours of the framework. Based on the framework, action plans for prevention and control of paddy stubble burning were prepared and directions were issued by CAQM to state governments of Haryana, Punjab, UP, Rajasthan and NCT of Delhi for strict implementation of the framework and revised action plan
6. As per revised model contract for use of biomass in TPPs, issued by Ministry of Power, power plants within 300 kms of NCR shall use minimum 50% of raw material as stubble/ straw/crop residue of rice paddy sourced from Punjab, Haryana or NCR.
7. Ministry of Petroleum and Natural Gas (MoPNG) has launched a scheme to provide financial assistance to Compressed Bio-gas producers for procurement of biomass aggregation equipment for ex-situ management of paddy straw.
8. Ministry of Agriculture & Farmers Welfare (MoA&FW) in 2018 launched scheme for providing subsidy for purchase of crop residue management machinery and establishment of custom hiring centres (CHCs) in NCT of Delhi and the States of Punjab, Haryana and Uttar Pradesh for insitu management of paddy straw. MoA&FW in 2023 revised guidelines under the scheme to support establishment of crop residue/paddy straw supply chain, by providing financial assistance on the capital cost of machinery and equipment.
9. MNRE is supporting setting up of Biomass Briquette/Pellet manufacturing plants and to support Biomass (non-bagasse) based cogeneration projects in Industries in the country, by providing Central Financial Assistance (CFA).
10. MNRE is also providing CFA for setting up of Waste to Energy plants for generation of Biogas, Bio-CNG/enriched Biogas/Compressed Biogas, Power/ generation of producer or syngas, from urban, industrial, agricultural wastes and municipal solid waste.

11. Under the Pradhan Mantri JI-VAN Yojana, a 2G Ethanol Project has been set up by Indian Oil Corporation Limited at Panipat, Haryana, which is expected to utilize 2 lakh metric tonnes of paddy straw per annum. Another 2G Ethanol Project is being set up by HPCL at Bathinda (Punjab).

Regarding control of Methane, being a greenhouse gas, measures to control methane emissions are undertaken by several Ministries/Departments and reported to the United Nations Framework Convention on Climate Change. These measures include:

1. Promotion of Small Hydro Power, Bagasse and Biomass based power, by MNRE
  2. Promoting System of Rice Intensification as part of National Food Security Mission (NFSM) and Bringing Green Revolution to Eastern India (BGREI)
  3. Increasing area under Direct Seeded Rice (DSR) as part of National Food Security Mission (NFSM) and Bringing Green Revolution to Eastern India (BGREI)
  4. Promoting crop diversification
  5. Balanced Ration for Livestock, which promotes Optimum feeding of animals through Ration Balancing Programme (RBP)
  6. Feeding bypass proteins: Optimizing the use of protein supplement within the ruminant system
  7. Sub-Mission on Agricultural Mechanization (SMAM) and central sector scheme on promotion of agricultural mechanization for in-situ management of crops residue launched to increase the reach of farm mechanization to small and marginal farmers and promoting 'Custom Hiring Centres' to offset the high cost of individual ownership"
3. CPCB is directed to file the report disclosing how effectively these measures are being implemented.
4. The CPCB reports discloses following suggestions:-

#### **"7. Way forward**

*It has been globally established that the control of ozone concentration is only possible through control of its precursors at a regional or national level, and the Government of India has taken several initiatives as listed in Section 6 above for their control.*

*However, considering the elevated levels of ozone that were observed during COVID-19 lockdown (April 2020) and that the ozone concentration is also influenced by transboundary movement, soil and biogenic emissions, a detailed study may be required with help of air quality experts in order to evaluate the reasons for higher ozone levels at various locations in Delhi, and further ozone formation modelling may be required to assess the contribution of transboundary, biogenic and anthropogenic sources.*

*The matter has also been discussed with air quality experts and it has been expressed that a study is required and the same is expected to come*

*out with the steps that may be required to specifically plan and control the sources of ozone (and its precursors). The study for Delhi is likely to take about one year."*

5. The feasibility and mechanism for implementation of recommendations made by CPCB needs consideration. Hence, we deem it proper to implead the following as respondent no. 4:-

4. MOEF&CC through the Secretary.

6. Let Notice be issued to respondent no. 4 for filing the response by way of affidavit, especially commenting upon the recommendations that have been made by CPCB as quoted above. Let the response be filed at least one week before the next date of hearing.

7. Counsel for the CPCB has sought time for the purpose of ensuring the detailed study as mentioned in para 7, quoted above.

8. Hence, we direct the CPCB to file a fresh report at least one week before the next date of hearing.

9. List on 21.04.2025.

Prakash Shrivastava, CP

Dr. A. Senthil Vel, EM

December 23, 2024  
Original Application No. 605/2024  
SN..

BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL  
PRINCIPAL BENCH, DELHI

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ORIGINAL APPLICATION NO. 605 of 2024

In the matter of: -

News Item titled "Oh-zone! Why this prominent pollutant in Delhi air is becoming a cause for concern" appearing in The Times of India dated 22.04.2024

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Sr. No.	Particulars	Page no.
1.	Report of CPCB in compliance to Hon'ble NGT order dated 06.09.2024 in O.A No. 605/2024.	1-14
2.	Annexure-I A copy of Hon'ble NGT order dated 06.09.2024, in O.A No.605/2024.	15-18

Filed by Adv. Amit Singh Chauhan  
On behalf of Central Pollution Control Board

Place: Delhi

Dated:20.12.2024

Report of CPCB in Original Application No. 605/2024 News Item titled "Oh-zone! Why this prominent pollutant in Delhi air is becoming a cause for concern" appearing in The Times of India dated 22.04.2024

Hon'ble NGT in OA no. 605/2024 vide order dated 06.09.2024 directed the respondents on submit reports regarding exceedance of ground level ozone in certain specified areas and the targeted approach for control of ozone. Relevant extract from the order is reproduced below:

*"8. Learned Counsel for the Respondents seeks four weeks' time to place on record the relevant material showing why in certain specified areas the ozone is found to be exceeding the parameters, any targeted approach which can be adopted for those areas and also any targeted approach which can be adopted for the ozone itself because the measures which have been adopted and disclosed in the reports are of general nature relating to the control of the pollution level in the air in respect of all the pollutants.*

*9. Let such reports by way of affidavit be filed through e-filing.*

*10. List on 23.12.2024."*

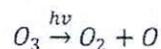
Copy of the order of the Hon'ble NGT dated 06.09.2024 is annexed as Annexure-I.

The ozone chemistry, its precursors, analysis at the stations exceeding the standards, challenges in understanding its origin, understanding of modelling and simulation, and measures to control it are described in subsequent sections.

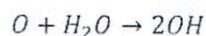
### 1. Ozone chemistry

The gas phase chemistry of tropospheric ozone as described in Sharma et al. (2017) is presented below.

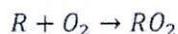
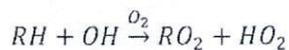
In stratosphere, ozone is formed naturally when oxygen absorbs UV radiation ( $\lambda < 240$  nm) from sunlight and nascent oxygen atom is formed. This atom then forms ozone after reacting with the  $O_2$  molecule. A part of this naturally formed stratospheric ozone goes down to troposphere. In troposphere, radiations from sun disassociate ozone into  $O_2$  molecules and atoms.



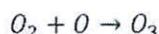
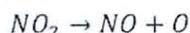
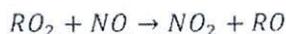
Disassociated oxygen atom reacts with water to form OH radicals.



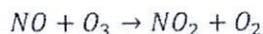
In the troposphere, anthropogenic interference starts through emissions of NO<sub>x</sub>, VOCs, and CO (carbon monoxide) released from various sources. VOCs or CO react with OH and form intermediary compounds like RO<sub>2</sub>.



RO<sub>2</sub> helps oxidize NO released from sources to NO<sub>2</sub>, which is a primary gas responsible for ozone formation. NO<sub>2</sub> is photolytically disassociated into atomic oxygen and NO, and nascent oxygen atom reacts with oxygen to form ozone



While NO<sub>2</sub> helps in formation of ozone, NO on the other hand can react with ozone and destruct it. This is called the titration reaction.



VOCs compete with ozone to oxidise NO to NO<sub>2</sub> and hence, they help in formation and retaining ozone concentrations in a region. The ratios of different precursor species, solar radiation intensities, and transport of ozone from outside play an important role in defining its concentrations in a region.

## 2. Ozone precursors and its sources

International studies agree that tropospheric or ground-level ozone is formed primarily from complex non-linear photochemical reactions between two major classes of air pollutants, volatile organic compounds (VOC) and nitrogen oxides (NO<sub>x</sub>). Besides, Carbon monoxide (CO) and methane (CH<sub>4</sub>) emitted by residential and agricultural sources also play a role in ozone formation. These reactions typically depend upon the presence of heat and sunlight, resulting in higher ambient ozone concentrations in summer months.

NO<sub>x</sub> from anthropogenic activities come from combustion of coal, gasoline, and oil in motor vehicles, industrial operations, and power generation facilities. VOCs are mainly released through gasoline combustion and distribution, upstream oil and gas production, wood burning, and the evaporation of solvents and liquid fuels.

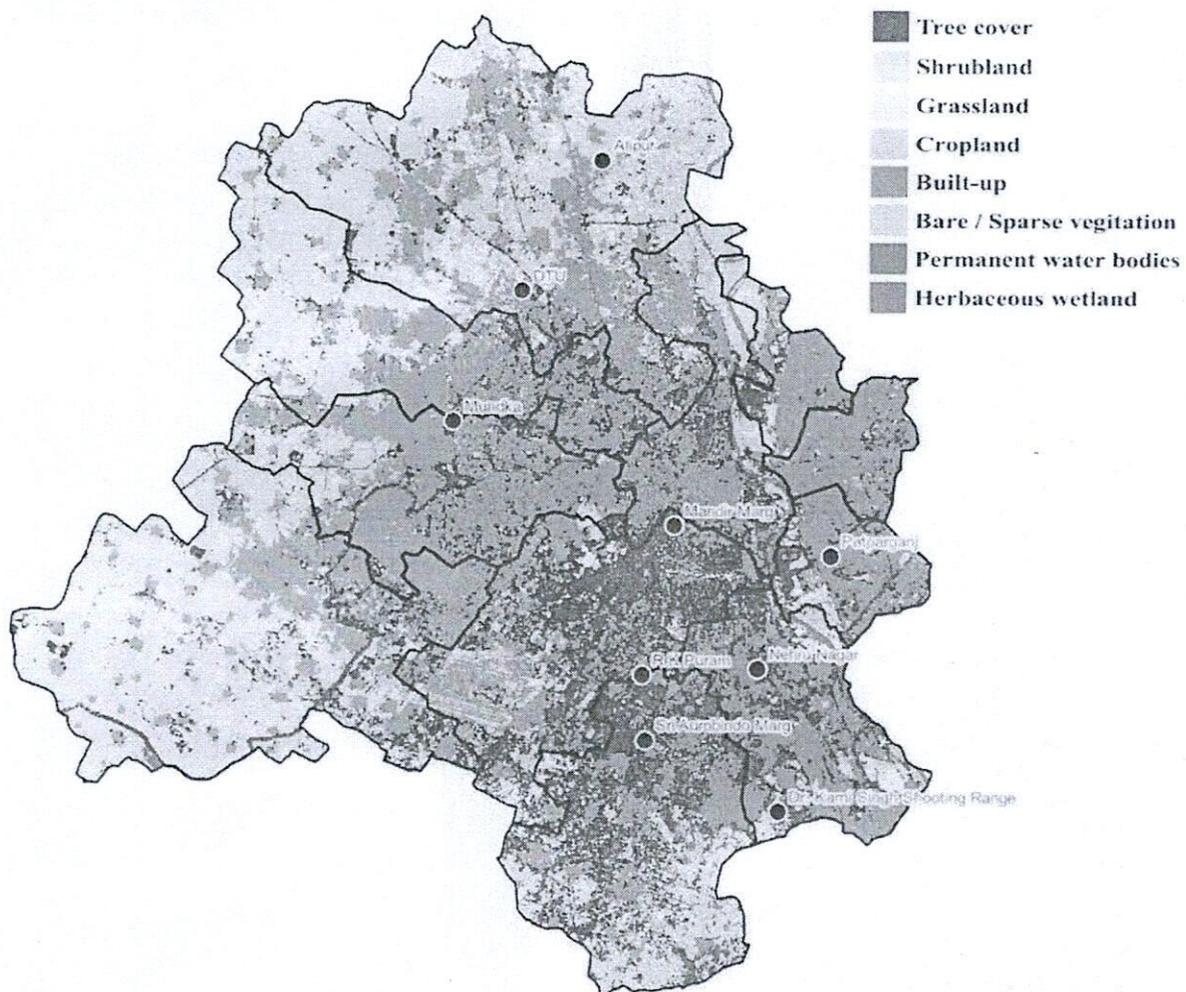
In case of Delhi-NCR, as per TERI-ARAI source apportionment study (2018), Transport sector, power plants and industries account for 60%, 15% and 10% of the total NO<sub>x</sub> emission load in NCR. In case of NMVOCs (non-methane VOCs), transport sector, residential sector and agricultural burning accounts for 53%, 22% and 13% of the total emission load in NCR.

In case of Delhi, 81% and 80% of the total emission load for NO<sub>x</sub> and NMVOCs respectively can be attributed to the transport sector.

Ozone precursors can also have a natural origin, such as biogenic emissions of VOC, soil emissions of NO<sub>x</sub>, wildfire emissions of CO and biosphere emissions of methane.

### 3. Data Analysis at 09 identified stations exceeding NAAQS

As per the report submitted to the Hon'ble NGT, there were 09 stations exceeding 8-hourly ozone NAAQS during pre-monsoon 2023 (March-May). These 09 stations are DTU, Mandir Marg, RK Puram, Dr. Karni Singh Shooting Range, Nehru Nagar, Patparganj, Mundka, Sri Aurobindo Marg and Alipur.



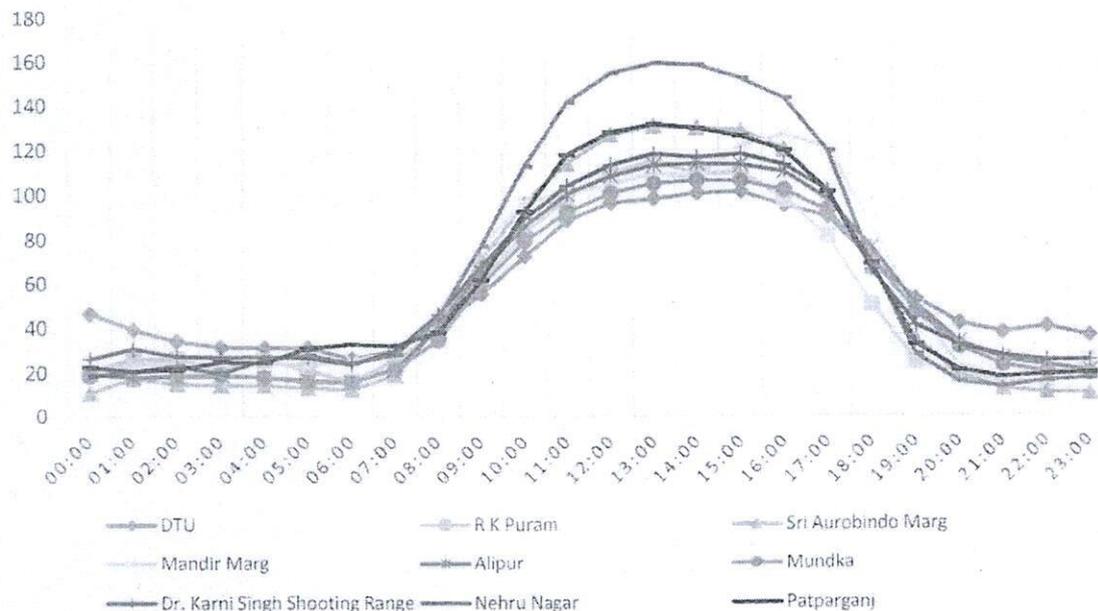
*Fig. 1 LULC map for Delhi and the 09 identified stations*

The 09 stations are well distributed across the city, however, all these stations are in proximity to green areas, crop land or shrub land, as per the LULC (land use land cover), obtained from global land cover data from 2021 WorldCover- European Space Agency. Fig. 1 depicts the 09

stations on LULC map of Delhi. However, other stations such as Aya Nagar (0% of 8 hourly exceedances in pre-monsoon season) and Najafgarh (1.8% of 8 hourly exceedances in pre-monsoon season) which are located in similar areas did not witness exceedances of ozone concentration unlike these 09 stations. Thus, there may be some correlation but it could not be established.

The concentration of ozone was further analysed at these 09 stations for March-May 2023.

### DIURNAL VARIATION FOR OZONE (MAR-MAY 2023)

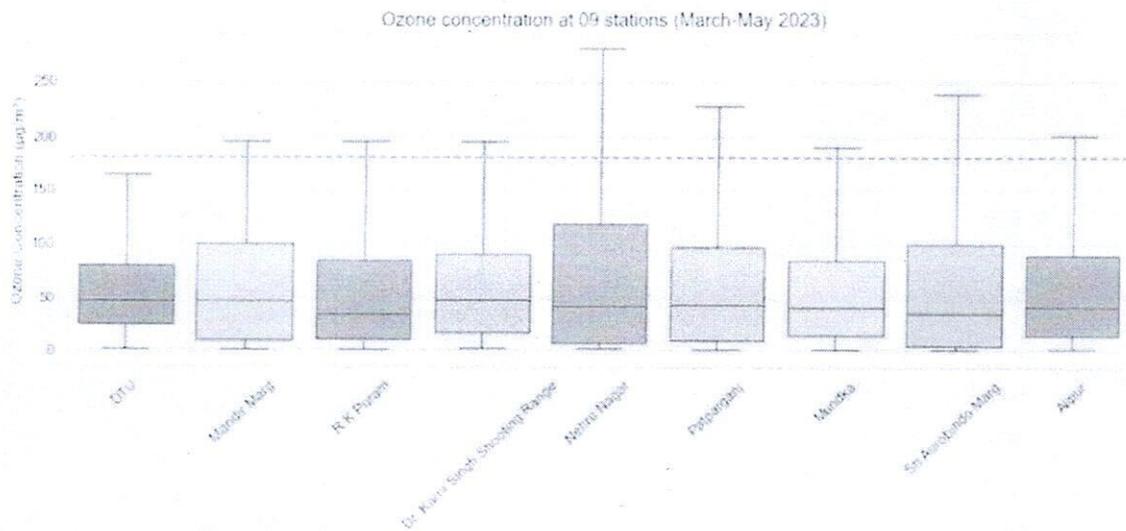


**Fig. 2 Diurnal variation for Ozone at 09 identified stations for March-Mar 2023**

The diurnal variation for ozone for three months for all 09 identified stations, depicted in Fig. 2, showed a similar trend with ozone concentration rising during day time and then declining at night.

The hourly ozone concentration at the 09 stations for Mar-May 2023 are plotted in Fig 3.

The plot indicates that while there are values exceeding the hourly NAAQS for Ozone, i.e.  $180\mu\text{g}/\text{m}^3$ , most of the hourly values are below the prescribed hourly NAAQS.



**Fig. 3** Box plots for hourly Ozone at 09 identified stations for March-Mar 2023

Further, during COVID-19 in the month of April 2020, elevated levels of Ozone were observed at certain stations in Delhi when there was a nationwide lockdown and the emissions of NO<sub>x</sub> and VOCs from anthropogenic sources were curtailed.

#### 4. Challenges

There are many challenges in understanding ozone formation and its origin, which are described below:

1. Ozone and its precursors can travel hundreds of kilometres downwind from their point of origin. Peak ozone concentrations generally occur in the afternoon when sunlight is the most intense. However, areas located downwind of significant VOC and NO<sub>x</sub> sources may experience peak ozone levels later in the day, such as during the afternoon or evening, after winds have transported ozone and its precursors over long distances. This allows elevated ozone levels to appear in remote locations and at varying times of the day.
2. Identifying the source of ozone pollution is challenging due to the multiplicity of VOC sources. While transportation and industrial activities contribute significantly to non-methane VOC emissions, residential activities, such as the use of household cleaning solvents, are also notable contributors. Additionally, vegetation naturally emits reactive VOCs—such as isoprene, limonene, and other terpenes—that play a significant role in ozone formation. Methane, emitted from agricultural sector, waste management,

landfills, and energy production, is another ozone precursor. Importantly, different VOCs have varying potentials for ozone creation.

3. Once formed, ground-level ozone can persist for days to weeks in the atmosphere. As a result, high ozone concentrations are often observed far away from the precursors sources, frequently influenced by transboundary transport events.
4. Ozone has a complex relationship with meteorological variables such as solar radiation, relative humidity, precipitation, ambient temperature, which introduces further complexities.
5. A number of VOCs have a major role to play in ozone formation, however, only Benzene is widely monitored compared to other VOCs, being a pollutant notified under NAAQS.

The above challenges make it difficult to assess the origin of ozone and as a result, it is difficult to ascertain the reasons behind higher levels of ozone concentration at the 09 identified locations.

#### **5. Modelling and simulation**

A 2009 report on ozone policy considerations in UK by the Air Quality Expert Group (AQEG), an Expert Committee to DEFRA (Department for Environment, Food and Rural Affairs), UK had suggested that there is no consistent and comprehensive understanding of model performance and the uncertainties that affect them. The areas of uncertainty indicated in the report include:

- Theoretical aspects of ozone modeling that remain partially understood or are simplified through model parameterizations.
- Uncertainties associated with the extensive input data required for setting up and running ozone models, including anthropogenic and biogenic emissions, boundary conditions, model initialization, and data assimilation processes
- Empirical challenges in representing ozone formation processes within models, particularly for parameters that are difficult or impossible to measure or observe, such as reactive free radical species, VOC concentrations, and secondary organic reaction products
- As temporal averaging increases, a model becomes less capable of capturing processes and system dynamics that fluctuate over time. This is because the driving processes and parameters are assumed to remain constant during the averaging period, even though they may be highly variable or sporadic in reality

However, despite the uncertainties, a 2021 report by the AQEG on Ozone in the UK has recommended conducting detailed modelling analysis and simulations to understand the underlying drivers of ozone, and the impact of policy initiatives on ozone concentrations.

A review of studies using photo-chemical models at urban, regional and global scales to assess ground-level ozone (GLO) concentration conducted by Sharma et. Al. (2017) suggested that the models capture inter-annual and synoptic-scale variability well, but underestimate the magnitude of fluctuations on shorter time scales and that the models predict middle ranges of GLO better than the extreme values. Further, models with finer resolutions inputs performed better to certain extent, however, further improvement in resolutions (beyond 10 km) did not always show much improvement.

There have been limited studies for ozone modelling in India and thus further study is needed to understand the formation of ozone and role of its pre-cursors.

#### **6. Measures for control of ozone**

It has been recognised globally that control of ozone is only possible through control of its precursors. It is also evident that control of local sources of its precursors may not yield significant benefits in terms of ozone reduction, as both ozone and its precursors can be transported over hundreds of kilometres.

Considering the same, the government has undertaken several initiatives at the national level, to control the precursors of ozone, i.e. NO<sub>x</sub> and VOC, and methane and CO to some extent.

The Government has launched National Clean Air Programme (NCAP) in 2019 as a national level strategy to reduce air pollution levels across the country. CPCB has identified 130 million plus/non-attainment cities (cities exceeding NAAQS, consecutively for five years). City Specific Clean Air Action Plans have been prepared and rolled out for implementation in all these 130 non-attainment/million plus cities to improve the air quality. These city specific clean air action plans target city specific air polluting sources like Soil & Road Dust, Vehicles, Domestic Fuel, MSW Burning, Construction Material and Industries with short-term priority action as well as those to be implemented in a medium to longer time frame along with the responsible agencies which improves the ambient air quality. Under NCAP, annual action planning for approved city action plans need to be submitted by concerned Urban Local Bodies (ULBs), which comprise the following actions to control NO<sub>x</sub> emissions:

- Use of off-peak passenger travel time to move freight and restrict entry of heavy vehicles into cities during the day

- Clean Fuel & Fuel Quality in vehicles
- Introduction of new electric buses (with proper infrastructure facilities such as charging stations) and CNG buses for public transport which will reduce plying of private vehicles on road and help to curb tail-pipe emissions.
- CNG infrastructure for auto gas supply in the city and transition of public transport vehicles to CNG mode.
- Charging infrastructure for E-vehicles
- Phase out old vehicles and introduce vehicle scrappage policy.
- Intensify monitoring of industries to reduce emission by the industries.
- Shifting of polluting industries.
- Conversion to CNG/PNG from pet coke / wood / coal / Furnace oil.
- Regular check and control of burning of municipal solid wastes.

Besides, waste management rules w.r.t solid waste, bio-medical waste, and hazardous wastes etc. are being implemented and EPR (Extended Producer Responsibility) regime for plastic waste, e-waste, used oil, tyre, etc. is in place, which stipulates mandatory targets for recycling/reuse, ensuring waste is managed in environmentally sound manner, thereby preventing it from burning and minimizing VOCs and CO emissions. Solid Waste Management Rules emphasizes on segregation and pre-processing/composting and thus minimising dumping/landfilling which has potential of Methane and VOCs formation. Further, CPCB has issued guidelines on Environmentally Sound Facilities for Handling and Scrapping of End of Life Vehicles, implementation of which helps in control of CO/VOC emissions which otherwise would be generated when environmentally sound recycling practices are not adopted.

Further, sector-specific interventions are listed below:

#### **A. Transport Sector**

- The introduction of BS VI-compliant vehicles across the country since April 2020 have reduced NOx emissions as compared to erstwhile BSIV-compliant vehicles, with 70-85% reduction in the case of 2-wheelers, 25%-68% in the case of 4-wheelers, and 87% in the case of heavy-duty vehicles. There is also 29-49% reduction in CO emissions from BSVI compliant 2 wheelers as against BSIV compliant 2 wheelers.
- BS-VI fuel has been introduced which has 5 times less Sulphur content (50 ppm in BS-IV to maximum 10 ppm in BS-VI compliant fuel). This has enabled the introduction of advanced emission control technologies, including Diesel Particulate Filters (DPF) to reduce Particulate Matter (PM) and Selective Catalyst Reduction (SCR) systems for reduction in Nitrogen Oxides (NOx) emissions in BS-VI vehicles.

- Vapour Recovery System (hereinafter referred as VRS) has been installed at all Delhi-NCR petrol pumps, in compliance with the orders of the Hon'ble NGT and Hon'ble Supreme Court. Further, VRS has been installed at those pumps selling more than 100 KLPM petrol and located in million plus cities and selling more than 300 KLPM petrol and located in cities with population more than 1 lakh. Installation of VRS minimizes the release of Benzene and other VOC emissions during petroleum refueling and unloading operations.
- The government is also promoting electric mobility, resulting in zero vehicular emissions, under the PM Electric Drive Revolution in Innovative Vehicle Enhancement (PM E-DRIVE) Scheme launched in September, 2024 with an outlay of ₹10,900 crore. The scheme aims to support electric vehicles including e-2W, e-3W, e-Trucks, e-buses, e-Ambulances, EV public charging stations and upgradation of testing agencies.
- Over 25 states have notified or drafted state Electric Vehicle (EV) policy, to promote the use of EVs.
- The Government has been promoting blending of ethanol in petrol under the Ethanol Blended Petrol (EBP) Programme. The National Policy of Biofuels-2018, as amended in 2022, inter-alia advanced the target of 20% blending of ethanol in petrol to Ethanol Supply Year (ESY) 2025-26 from 2030. The target of 10% ethanol blending in petrol was achieved in June, 2022 i.e., five months ahead of the target during ESY 2021-22. Use of E10 fuel is expected to reduce CO and HC emissions by 20% in 2 wheelers and 4 wheelers as compared to normal gasoline. Use of E20 fuel is expected to reduce HC emissions by 20% for 2 wheelers and 4 wheelers, compared to emissions with normal gasoline. In case of CO, use of E20 fuel is expected to reduce CO emissions by 50% in case of 2 wheelers and 30% in case of 4 wheelers.
- The Ministry of Road Transport and Highways has formulated the Vehicle Scrapping Policy that includes a system of incentives/disincentives for creation of an ecosystem to phase out older, unfit polluting vehicles through a network of Registered Vehicle Scrapping Facilities (RVSFs) and Automated Testing Stations (ATs). Phasing out of older vehicles will further reduce emissions. Further, environmental friendly disposal of older vehicles through scrapping facilities also reduces the emissions which would have been released, had these vehicles been disposed off through unauthorised centers.

## **B. Power plants and Industries**

- Industrial emission Standards for NOx and VOC have been revised/ introduced for various sectors such as man-made fiber industry, Fertilizer Industry, Pharmaceutical industry, paint industry etc.
- NOx emission standards have also been prescribed for coal/lignite-based thermal power plants, industrial boilers, Cement Plant (without co-processing of wastes) and Standalone Clinker Grinding Plants, furnaces etc.
- Promotion of installation of efficient Ultra Supercritical/Supercritical units over Subcritical Thermal Units as these units are more efficient and their emission per unit of electricity generation is less than subcritical units.
- Ministry of Power has issued a policy on utilization of Biomass for Power generation through co-firing in coal-based power plants. The policy mandates 5-7% co-firing of Biomass primarily of agro residue with coal, after assessing the technical feasibility.
- Inefficient and old thermal power plants having capacity of about 18,802.24 MW comprising 267 units have already been retired till 30.06.2024.
- India in its Intended Nationally Determined Contributions (INDCs) stands committed to achieve about 50 percent cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030. As of Jul 2024, India has already achieved 45.5% Installed Capacity from non-fossil fuel-based resources.

**C. Biomass burning, with emphasis on paddy straw burning in Northern India**

1. Central Pollution Control Board (CPCB) has framed Guidelines for grant of one-time financial support under Environment Protection Charge funds for establishment of pelletisation and Torrefaction plants to promote utilisation of paddy straw. In case of setting up of pelletisation plant, Rs. 28 lakhs per tonne per hour (TPH), or 40% of the capital cost considered for plant and machinery of a 01 TPH plant, whichever is lower, is provided as one-time financial assistance with a maximum total financial support of Rs. 1.4 crore per proposal. In case of setting up of torrefaction plants, Rs. 56 lakhs per TPH, or 40% of the capital cost considered for plant and machinery of a 01 TPH plant, whichever is lower, is provided as one-time financial assistance with a maximum total financial support of Rs. 2.8 crore per proposal. A total of 17 applications for establishment of pelletization and Torrefaction plants under the above mentioned CPCB Guidelines have been sanctioned so far, out of which 02 plants are not coming up. Pellet production capacity of 15 sanctioned plants is 2.07 lakh tonne/annum. These plants are expected to utilize 2.70 lakh tonne of paddy straw per annum.
2. CPCB had deployed 26 teams (in 16 districts of Punjab and 10 districts of Haryana) for the period 01st October - 30th November, 2024 to intensify monitoring and

enforcement actions regarding stubble burning. These teams coordinated with concerned authorities/ officers deployed at the district level by the State Govt. and reported to the Commission for Air Quality Management in National Capital Region and Adjoining Areas (CAQM).

3. CAQM has issued directives & advisories to various stakeholders including the 11 Thermal Power Plants (TPPs) located within 300 km of Delhi, State Governments of Punjab, Haryana and Uttar Pradesh on "Ex-Situ Stubble Management" and to establish an ecosystem and robust supply chain mechanism to boost ex-situ utilisation of straw for tackling the problem of stubble burning.
4. CAQM has also directed coal based TPPs including cogenerating Captive TPPs situated in NCR to initiate immediate steps to co-fire biomass-based pellets (with focus on paddy straw utilization) with coal through a continuous and uninterrupted supply chain targeting at least 5% co-firing of biomass pellets.
5. CAQM has provided a Framework to the states concerned for control / elimination of crop residue burning and directed these to draw up detailed state-specific action plans based on the major contours of the framework. Based on the framework, action plans for prevention and control of paddy stubble burning were prepared and directions were issued by CAQM to state governments of Haryana, Punjab, UP, Rajasthan and NCT of Delhi for strict implementation of the framework and revised action plan
6. As per revised model contract for use of biomass in TPPs, issued by Ministry of Power, power plants within 300 kms of NCR shall use minimum 50% of raw material as stubble/ straw/crop residue of rice paddy sourced from Punjab, Haryana or NCR.
7. Ministry of Petroleum and Natural Gas (MoPNG) has launched a scheme to provide financial assistance to Compressed Bio-gas producers for procurement of biomass aggregation equipment for ex-situ management of paddy straw.
8. Ministry of Agriculture & Farmers Welfare (MoA&FW) in 2018 launched scheme for providing subsidy for purchase of crop residue management machinery and establishment of custom hiring centres (CHCs) in NCT of Delhi and the States of Punjab, Haryana and Uttar Pradesh for insitu management of paddy straw. MoA&FW in 2023 revised guidelines under the scheme to support establishment of crop residue/paddy straw supply chain, by providing financial assistance on the capital cost of machinery and equipment.
9. MNRE is supporting setting up of Biomass Briquette/Pellet manufacturing plants and to support Biomass (non-bagasse) based cogeneration projects in Industries in the country, by providing Central Financial Assistance (CFA).
10. MNRE is also providing CFA for setting up of Waste to Energy plants for generation of Biogas, Bio-CNG/enriched Biogas/Compressed Biogas, Power/ generation of

producer or syngas, from urban, industrial, agricultural wastes and municipal solid waste.

11. Under the Pradhan Mantri JI-VAN Yojana, a 2G Ethanol Project has been set up by Indian Oil Corporation Limited at Panipat, Haryana, which is expected to utilize 2 lakh metric tonnes of paddy straw per annum. Another 2G Ethanol Project is being set up by HPCL at Bathinda (Punjab).

Regarding control of Methane, being a greenhouse gas, measures to control methane emissions are undertaken by several Ministries/Departments and reported to the United Nations Framework Convention on Climate Change. These measures include:

1. Promotion of Small Hydro Power, Bagasse and Biomass based power, by MNRE
2. Promoting System of Rice Intensification as part of National Food Security Mission (NFSM) and Bringing Green Revolution to Eastern India (BGREI)
3. Increasing area under Direct Seeded Rice (DSR) as part of National Food Security Mission (NFSM) and Bringing Green Revolution to Eastern India (BGREI)
4. Promoting crop diversification
5. Balanced Ration for Livestock, which promotes Optimum feeding of animals through Ration Balancing Programme (RBP)
6. Feeding bypass proteins: Optimizing the use of protein supplement within the ruminant system
7. Sub-Mission on Agricultural Mechanization (SMAM) and central sector scheme on promotion of agricultural mechanization for in-situ management of crops residue launched to increase the reach of farm mechanization to small and marginal farmers and promoting 'Custom Hiring Centres' to offset the high cost of individual ownership

#### **7. Way forward**

It has been globally established that the control of ozone concentration is only possible through control of its precursors at a regional or national level, and the Government of India has taken several initiatives as listed in Section 6 above for their control.

However, considering the elevated levels of ozone that were observed during COVID-19 lockdown (April 2020) and that the ozone concentration is also influenced by transboundary movement, soil and biogenic emissions, a detailed study may be required with help of air quality experts in order to evaluate the reasons for higher ozone levels at various locations in Delhi, and further ozone formation modelling may be required to assess the contribution of transboundary, biogenic and anthropogenic sources.

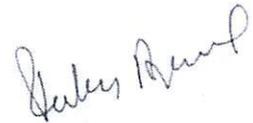
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The matter has also been discussed with air quality experts and it has been expressed that a study is required and the same is expected to come out with the steps that may be required to specifically plan and control the sources of ozone (and its precursors). The study for Delhi is likely to take about one year.

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(Pankaj Agarwal)

Scientist 'F'

Central Pollution Control Board

**Dated: 20.12.2024**

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Item No. 15

Court No. 1

**BEFORE THE NATIONAL GREEN TRIBUNAL  
PRINCIPAL BENCH, NEW DELHI**

Original Application No. 605/2024

News Item titled "Oh-zone! Why this prominent pollutant in Delhi air is becoming a cause for concern" appearing in The Times of India dated 22.04.2024

Date of hearing: 06.09.2024

**CORAM: HON'BLE MR. JUSTICE PRAKASH SHRIVASTAVA, CHAIRPERSON  
HON'BLE MR. JUSTICE ARUN KUMAR TYAGI, JUDICIAL MEMBER  
HON'BLE DR. A. SENTHIL VEL, EXPERT MEMBER**

Respondents: Mr. Amit Singh Chauhan, Ms. Shikha Chauhan, Mr. Neelmani Guha & Ms. Shaima, Advs. for CPCB  
Mr. Pankaj Agarwal & Mr. Aditya Sharma, Scientists, CPCB (Through VC)  
Dr. Abhishek Atrey & Ms. Jyoti Verma, Advs. for CAQM  
Mr. Balendu Shekhar & Ms. Tanisha Samanta, Advs. for DPCC

**ORDER**

1. This original application is registered *suo-motu*. The Tribunal is examining the issue of rising levels of ground level of ozone in Delhi in the background that in many areas exceeds the 8-hourly average National Ambient Air Quality standards (NAAQS).

2. Vide order dated 27.05.2024, the concerned Respondents were impleaded and notices were issued to them. Respondent No.5 -CAQM has filed a response dated 30.08.2024, which discloses the role and harmful effects of Ozone (O<sub>3</sub>) as under:-

*"5. That Ozone (O<sub>3</sub>) in the troposphere plays a crucial role in air quality. Near the surface, Ozone acts as an oxidant and chronic exposure to high levels of O<sub>3</sub> is harmful to human health and vegetation at elevated levels. Therefore, O<sub>3</sub> is known as a criteria air pollutant. Both natural (e.g. stubble and biomass burning, and biogenic emissions) and anthropogenic source (e.g. industry and transportation) are responsible for the release of precursors of ozone in the atmosphere. At the surface, O<sub>3</sub> is formed as a secondary air pollutant."*

3. Major sources of precursors of Ozone like VOC and NOx etc. are shown to be as under:

*“That Major Sources of precursors of Ozone like VOCs, NOx etc. include*

- *Industries like chemical manufactures, paint manufacturers etc.*
- *Fossil fuel based Thermal Power Plants;*
- *Fossil fuel burning*
- *Vehicles*
- *Open burning sources like MSW burning, Agricultural Residue Burning.”*

4. Though the report of CAQM mentions the initiatives taken by the Commission towards abatement of pollutants like VOCs and NOx, leading to the formation of ground-level ozone but it has not been disputed that these are the general measures that have been taken but they are not targeted measures for the specific areas where the parameters are exceeding.

5. The report has been filed by the DPCC disclosing the areas where the concentration of ozone was found to be exceeding 8 hourly average prescribed NAAQS standard as under:

*“4. That, Ozone concentration of DPCC, {8 hours average (8am to 4pm) for the summer month April 2023 and May 2023} is enclosed herewith as Annexure-1. The data shows that in summer months (April 2023 and May 2023) Ozone concentration exceeds the 8 hrs. prescribed standard i.e. 100ug/m<sup>3</sup> in some CAAQM Stations like Mundka (April-11 days, May-12 days), Nehru Nagar (April-30 days, May-26 days), Shri Aurobindo Marg (April-19 days, May- 19 days), Alipur (April-16 days, May-13 days), Dr. Karni Singh Shooting Range (April-16 days, May-16 days), Mandir Marg (April-15 days, May-10 days), Patparganj (April-26 days, May-19 days) and R.K Purum (April- 03 days, May- 17 days) significantly.”*

6. The CPCB has also filed the report making the following disclosure

*“3. That, the news item relates to the rising levels of ground-level ozone in Delhi, with many areas exceeding the prescribed National Ambient Air Quality Standards (hereinafter referred as NAAQS) and the health effects associated with it.*

4. At the outset, it is humbly submitted that Ozone is a secondary pollutant, formed in the atmosphere by reaction between oxides of nitrogen and volatile organic compounds (hereinafter referred as VOCs) in the presence of sunlight. Further, 1 hourly and 8 8 hourly average NAAQS have been prescribed for Ozone as 180ug/m<sup>3</sup> and 100 ug/m<sup>3</sup> respectively.

5. That with regards to the concerns raised regarding high levels of Ozone in Delhi, the data for ozone concentrations at the Continuous Ambient Air Quality Monitoring Station (CAAQMS) in Delhi was analyzed and summary of exceedance is submitted as follows:

EXCEEDANCE OF NAAQS FOR OZONE FOR 2023

% exceedance (counts) of NAAQS for Ozone in the entire year	Number of stations		
	1 hourly NAAQS	8-hourly NAAQS	average
More than 5%	0	07	
Less than 5%	37	30	
Total no. of CAAQMS where sufficient data was available (more than 75%)	37	37	

EXCEEDANCE OF NAAQS FOR OZONE FOR SUMMER SEASON 2023 (MAR-MAY)

% exceedance (counts) of NAAQS for Ozone in the summer seasons (March - May)	Number of stations		
	1 hourly NAAQS	8-hourly NAAQS	average
More than 5%	01	09	
Less than 5%	36	29	
Total no. of CAAQMS where sufficient data was available (more than 75%)	37	38	

7. As per the said report in 7 stations 8 hourly average NAAQS was found to be exceeding for ozone in the entire year and in 9 stations it was found to be exceeding for summer season 2023 (March-May)

8. Learned Counsel for the Respondents seeks four weeks' time to place on record the relevant material showing why in certain specified areas the ozone is found to be exceeding the parameters, any targeted approach which can be adopted for those areas and also any targeted approach which can be adopted for the ozone itself because the measures which have been adopted and disclosed in the reports are of general nature relating to the control of the pollution level in the air in respect of all the pollutants.
9. Let such reports by way of affidavit be filed through e-filing.
10. List on 23.12.2024.

Prakash Shrivastava, CP

Arun Kumar Tyagi, JM

Dr. A. Senthil Vel, EM

September 06, 2024  
O.A. No. 605/2024  
A