BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL

PRINCIPAL BENCH, NEW DELHI

IN THE MATTER OF:-

Original Application No. 687/2023

In Re: Air Quality Index in Various Cities

Along with Original Application No. 663 of 2023

News Item published in the Indian Express dated 07.10.2023 titled "GRAP Stage I kicks in as air quality dips to poor condition likely to prevail till Sunday"

Along with Original Application No. 1228/2024

News Item titled "lancet Study links mortality rates to poor air quality 12 strategies to combat country's air pollution crisis" appearing in the Indian Express dated 13.09.2024

Along With Original Application No. 646/2024

News Item titled "How Partial Combustion Fuels Your Bad Air Woes" appearing in The Times of India dated 02.05.2024

INDEX

5.	**Annexure A4 (Colly)** - Copy of the Photographs of stubble burning in Punjab and news reports.	**140-151**
6.	**Annexure A5** - Copy of the CPCB Bulletin dated 04.11.2025.	**152-164**
7.	**Annexure A6** - Copy of the Rajya Sabha Answer to Unstarred Question dated 27.07.2023	**165-176**
8.	**Annexure A7** - Copy of the Delhi State Action Plan.	**177-260**

Place: New Delhi

Date: 06.11.2025

Sanjay Upadhyay

Senior Advocate

Supreme Court of India

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

IN THE MATTER OF:-

Original Application No. 687/2023

In Re: Air Quality Index in Various Cities

Along with Original Application No. 663 of 2023

News Item published in the Indian Express dated 07.10.2023 titled "GRAP Stage I kicks in as air quality dips to poor condition likely to prevail till Sunday"

Along with Original Application No. 1228/2024

News Item titled "lancet Study links mortality rates to poor air quality 12 strategies to combat country's air pollution crisis" appearing in the Indian Express dated 13.09.2024

Along With Original Application No. 646/2024

News Item titled "How Partial Combustion Fuels Your Bad Air Woes" appearing in The Times of India dated 02.05.2024

Note on behalf of the Amicus Curiae

1. The present Note is in continuation of the previous note dated 22.09.2025 wherein the list of States along with their Non-Attainment Cities, which are not parties in the Original Application No. 687/2023, were submitted before this Hon'ble Tribunal in compliance with the Order dated 04.09.2025.
2. This Note further provides immediate concerns and some illustrative medium term and long term steps for air quality management in Delhi NCR given the current emergent situation that is manifest in not only Delhi NCR but also in the entire country in general. Further, it is humbly submitted that this Note is notwithstanding the proceedings that is under the aegis of the Hon'ble Supreme Court in W.P.(C) No. 13029 of 1985 titled MC Mehta v. Union of India and Others.

I. Immediate Concerns for Delhi NCR

3. Stage I GRAP was initiated on 14.10.2025 and Stage II GRAP Orders were issued on 19.10.2025. Despite the Stage II GRAP Orders, the AQI has consistently remained in poor to very poor quality. Some immediate concerns for poor air quality include:

i. Reports of water sprinkling close to AQ Monitors and tampering with AQI meters

4. Multiple Newspaper reports clarify that there has been tampering with AQI monitor readings by undertaking sprinkling close to AQI monitors and thus reducing the PM level reading by the monitors to mislead and misinform the severity of the air quality situation. One specific example reported by Indian Express was the reduction in the PM reading at Anand Vihar ISBT where the monitor showed a steep fall in PM reading from 370 to 197 micrograms per cubic meter between noon and 3pm, which appears to be an impossibility.

5. The same situation was also noticed near the RK Puram AQ Monitor where sprinklers were making rounds at 15-20 minute intervals. The same situation of sprinkling close to air quality monitors was also reported from Agra. In Haryana, 65% of the AQI monitors were reported to go offline during peak smog months. The copy of the newspaper reports are marked and annexed as **Annexure A1 [Colly].**

6. **Action Sought:** The SPCBs of these states must explain to this Hon'ble Tribunal the reasons for such anomalies and disruptions as this appears to be a very serious allegation where human health and right to life itself is at stake. The CAQM also needs to explain the action taken in this regard.

ii. Failure of emergency measures such as cloud seeding

7. The Government of Delhi along with IIT Kanpur had signed a 3.21 crore MOU for undertaking five trials of cloud seeding exercise to induce artificial rain for reducing pollution levels in Delhi. Two experiments were undertaken in October 2025, however the experiment failed both the times. The copy of the newspaper reports containing details of cloud seeding experiment in Delhi are marked and annexed as **Annexure A2 [Colly].**
8. One of the main causes for the failure as reported by both IIT Kanpur and IIT Delhi is that winter months are climatologically unsuitable for consistent cloud seeding due to lack of moisture and saturation and western disturbances. Further, there are multiple reports which clarify that cloud seeding is only a short term measure for combating air pollution and the effects of pollution rebound after a few days. The copy of the IIT Delhi Report dated October 2025 on cloud seeding is marked and annexed as **Annexure A3.**
9. **Action Sought:** The Delhi Government may be asked to explain the raison de etre of going for cloud seeding and paying tax payers money. What were the other emergency measures taken for curbing air pollution other than cloud seeing measures which has turned out to be a failure admittedly.

iii. Continuation of stubble burning in Punjab and Haryana and NCR region

10. Latest photographs from November as well as newspaper reports clarify that stubble burning continues in parts of Punjab, Haryana and NCR Delhi albeit slightly reduced as per some studies. The copy of the Photographs of stubble burning in Punjab and news reports are marked and annexed as **Annexure A4. [Colly]**
11. **Action Sought**: A clear status of such stubble burning incidents and the action taken may be sought from CAQM as well as SPCBs. Secondly, what are the ground measures that have been taken to discourage or incentivize the stubble burning. The State of Punjab in its Affidavit dated 09.11.2023 has submitted that

as much as 350 crores (140 crores by the State Government + 210 crores by the Government of India) Action Plan was approved by the State Government. So what are the measurable outcomes?

12. Further clarifications are required with respect to whether similar action been taken by the other NCR States? Can MSP benefits be linked with stubble burning? As per studies done by agencies in Punjab, portion of MSP is required to be used for Crop Residue Management. Those portions may be withheld till there is evidence of zero tolerance towards stubble burning.

II. Other Concerns – Source Apportionment Studies (SASs) are still ongoing in most cities and City Action Plans (CAPs) in Non-Attainment Cities (NACs) have not been updated/revised.

Background

13. This Hon'ble Tribunal vide Order dated 29.07.2025 had directed the Central Pollution Control Board to ascertain and disclose the current tatus of SAS in the 53 cities mentioned in the Chart submitted by the MoEF&CC in OA No. 687/2023 vide Affidavit dated 22.10.2024. Further, CPCB was also directed to ascertain how many cities out of 53 cities have revised their CAP based upon SAS an ascertain the progress of CAP.

14. CPCB in compliance of the Order dated 29.07.2025, filed its Reply dated 02.09.2025 clarifying that:

a) Out of the 53 Cities, 19 are covered in NAC which are covered under NCAP. Out of the remaining 34 cities , 16 cities fall within Delhi NCR and remaining 18 cities are neither covered under NCAP nor under Delhi NCR.

STATUS OF 19 CITIES COVERED UNDER NCAP AS NACs

b) Source Apportionment Studies (SAS) completed in 12 cities, and underway in 7 cities (Para 3(a), Pg. 6511)

UTTAR PRADESH

i. Noida (Uttar Pradesh) – at initial stage [As per UP Reply dated 30.10.2025, SAS is expected to be completed by 31st Jan. 2026 (Pg 6812-13)]

ii. Khurja (Uttar Pradesh) – at completion stage [As per UP Reply dated 30.10.2025, SAS under peer-review (Para 7, Pg 6813)

iii. Jhansi (Uttar Pradesh) - at completion stage [As per UP Reply dated 30.10.2025, pending for peer-review (Para 7, Pg 6813)]

iv. Lucknow (Uttar Pradesh) - at completion stage As per UP Reply dated. 30.10.2025, pending for peer-review (Para 7, Pg 6813)]

PUNJAB

v. Amritsar (Punjab) - at completion stage [As per Punjab Reply dated 01.10.2025, SAS final draft under review, to be completed by 30.11.2025 (Para 5 Pg 6621)]

MAHARASHTRA

vi. Thane (Maharashtra) – at completion stage [Maharashtra's reply has not received as on 04.11.2025]

HARYANA

vii. Faridabad (Haryana) - at completion stage [As per HSPCB Reply dated 29.10.2025, SAS peer-review pending, to be completed by 31.01.2026 (Para 3, Pg 6651-52)]

c) In the 12 cities where SAS have been completed, i.e. the City Action Plans are yet to be refined/ aligned as per the SAS. (Para 3(c), Pg. 6512)

d) The existing CAP in these cities are merely based on the available data and understanding of pollution sources in each city. (Para 3(b), Pg. 6512)

15. Thereafter, on 04.09.2025 this Hon'ble Tribunal noted that the Source Apportionment Studies in 131 NACs are not under consideration before the Hon'ble Supreme Court and the status of the same has been filed by the Action Taken Report of CPCB. The list has been produced in the abovesaid Order under

Annexure I. It was also pointed out that all the States/UTs where these 131 cities are located have ben impleaded and serviced. The Secretary, Environment Department of these States were directed to take expeditious steps for completing SAS and placed on report the status of SAS in these cities and consequential revision of the CAP. The Affidavits were accordingly directed to be filed within six weeks.

16. The 131 Cities are distributed as follows – Andhra Pradesh (13) , Assam (5), Bhar (3), Chandigarh (1),Chhattisgarh(3), Delhi (1), Gujarat (34), Himachal Pradesh (7), Jammu and Kashmir (2), Jharkhand (3) , Karnataka (4) , Madhya Pradesh (7), Maharashtra (19), Meghalaya (1), Nagaland (2) ,Orissa (7), Punjab (9) , Rajasthan(5), Tamil Nadu (4) , Telangana (4), Uttar Pradesh (16+1), Uttarakhand (3), West Bengal (6) and Haryana (1).This Hon'ble Tribunal also directed for submitting the list of cities/States which were not part of OA No. 687/2023 and were required to be impleaded.

17. Accordingly the Amicus has submitted on 22.09.2025 the List of Non- Cities in States , which are not are of O.A. No 687/2023 which include Andhra Pradesh. Assam, Chandigarh, Chhattisgarh, Karnataka, J&K, Nagaland , Orissa, Tamil Nadu, Telangana, Uttarakhand, and West Bengal. Further, the List of NACs which are not part of OA although States have been impleaded, was also submitted at Pag 6615 to 6617.

18. In compliance of the Hon'ble NGT's order dt. 04.09.2025, replies filed by the States of Punjab, Haryana, Uttar Pradesh, NCT Delhi, Himachal Pradesh and Jharkhand.

19. The State of Punjab has filed their Compliance Affidavit dated 01.10.2025 submitting the status of SAS and CAPs in NACs as follows-

a. 9 cities of Punjab declared as NAC by CPCB – Ludhiana, Jalandhar, Khanna, Mandi, Gobindgarh, Patiala, Dera Bassi, Dara Baba, Naya Nangal and Amritsar. (Para 4, Pg 6620).

b. SAS of 8 NAC's - completed & submitted to CPCB by PCB. (Para 5, Pg. 6620-6621 & A/A, Pg. 6623).

c. SAS of Amritsar pending – final draft received from IIT Delhi and is under review & expected to be completed by 30.11.2025. (Para 5, Pg. 6621)

d. SAS of 7 cities conducted by IIT Delhi & SAS of Ludhiana conducted by Punjab State Council for Science and Technology, Chandigarh and Energy & Resources Institute, New Delhi. (Para 6, Pg. 6621)

e. Task of revision of CAP to be undertaken by stakeholder Department Revised CAP would be submitted to PPCB which would further submit it to Directorate of Environment & Climate Change, Punjab for submission to CPCB. To be completed by 31.12.2025. (Para 7, Pg. 6621)

20. The NCT Delhi has filed their Reply Affidavit dated 24.10.2025 submitting that SAS and CAPs -

a. 3 SAS completed/undertaken by Government of NCT Delhi & DPCC: - (Para 6, Pg. 6627 & A/A, Pg. 6629)

b. Comprehensive study on Air Pollution and Greenhouse Gases in Delhi-2016 – IIT Kanpur

c. Source Apportionment of Ambient Particulate Matter during Winter Season in Delhi-2017 - IIT Madras & IIT Delhi

d. Real Time Source Apportionment and Forecasting for Advance Air Pollution Management in Delhi (2023)" – IIT Kanpur led consortium of organizations (IIT Kanpur, IIT Delhi, TERI, Air Shed and Indian Institute of Science Education and Research – Mohali)

e. Annual Action Plan prepared in compliance with NGT directions dt. 08.10.2018 in OA 681/2018. (Para 7, Pg 6627)

f. Thereafter, Environment Action Plan, given its comprehensive & integrative approach, adopted as State Action Plan for Clean Air and submitted to CPCB in compliance with NGT directions dt. 11.12.2024 in OA 159/2021 (SZ). (Para 8, Pg 6627)

g. 40% reduction of PM10 and PM 2.5 being targeted by 2026. (Para 4, Pg 6626)

21. The Affidavit dated 29.10.2025 filed by HSPCB on behalf of Additional Chief Secretary, Environment Department Haryana: -

a. Only city of Faridabad has been declared as NAC by CPCB. (Para 1, Pg 6651)

b. SAS of Faridabad assigned to TERI – submitted final report (Annex-I, Pg 6653-6806) in September, 2025. (Para 2, Pg 6651)

c. Peer review of SAS report pending, review of city action plan will be done and submitted to CPCB after peer review. This will be completed by 31.10.2026. (Para 3, Pg 6651-6652)

22. The Reply dated 29.10.2025 filed by State of Himachal Pradesh clarifies that

a. 7 Non-Attainment Towns included in Himachal Pradesh - Baddi. Nalagarh, Parwanoo, Paonta Sahib, Kala Amb, Sundernagar and Damtal. (Para 3, Pg 6633)

b. Work of SAS awarded to IIT Kanpur on 04.06.2019 - sanctioned cost Rs. 2,20,66,000. (Para 4, Pg 6633)

c. Between 07.07.2022 - 28.11.2022, IIT Kanpur submitted draft Report for SAS all Non-Attainment Towns & same was shared with institute of reputes for peer review (as shortlisted by MoEF&CC). (Para 5, Pg 6633)

d. Meeting conducted on 20.07.2023 (A/A, Pg 6636-6638) to review the SAS. (Para 5, Pg 6633)

e. Meeting of State Steering Committee conducted on 08.11.2023 (A/B, Pg 6639-6644) under chairmanship of Chief secretary to the Government of Himachal Pradesh to discuss SAS for each Non-Attainment Towns. CAP of 7 towns was updated & endorsed (Annex C, Pg 6645-6649). (Para 7, Pg. 6633-6634)

23. The Action taken Report dt. 30.10.2025 filed by State of Uttar Pradesh submits the status of SAS and CAP as follows -

a. 17 NACs identified by CPCB (including 7 million-plus cities and 10 non-million-plus cities). (Para 4, Pg 6811)

b. With respect to the Status of SAS of 17 NACs, the State of Uttar Pradesh has submitted that - (refer Table, Pg. 6812).

i. Completed in 5 NACs – Agra, Kanpur, Prayagraj, Varanasi & Ghaziabad. However, revision of CAP would be done within 3 months & submitted to CPCB for approval. (Para 8, Pg. 6813)

ii. Ongoing in 7 NACs – Meerut (expected completion dt. Nov. 2025), Anpara & Gajraula (expected completion dt. 31.10.2025), Bareilly (31.01.2026), Moradabad (28.02.2026), Noida (31.01.2026) & Gorakhpur (Oct. 2026)

iii. Submitted & pending peer review 5 Nos.- Lucknow, Jhansi, Raebareli, Khurja, Firozabad.

c. Revised of CAP for remaining 12 cities would be formulated promptly upon receipt of respective study reports and submitted to CPCB for approval. (Para 8, Pg 6813)

b. City specific Clean Air Action Plans for 17 NACs were prepared by UPPCB in view of NGT direction in OA 681/2018 dt. 21.8.2020 (A/1, Pg 6815-6850) based on available data and study of pollution sources of each city. (Para 5, Pg 6811)

24. The State of Jharkhand has filed its Affidavit dated 29.10.2025, submitting that Source Apportionment Study has been completed in April 2025 for Jharia Coalfields Region.

III. CAPs not revised in accordance with SAS - defiance of various NGT Orders:

25. **08.10.2018**: In OA 681/2018 titled NGT Order in News Item Published in the Times of India, authored by Shri Vishwa Mohan Title "NCAP With Multiple Timelines to Clear Air In 102 Cities to be Released Around August 15" - All States directed with NACs to prepare appropriate action plans to take into account the GRAP, the Comprehensive Action Plan (CAP), and CPCB action plan and it should be consistent with the carrying capacity assessment of the non-attainment cities in terms of vehicular pollution, etc. Guidelines may accordingly be framed to regulate vehicles in non-attainment cities based on carrying capacity assessment and source apportionment. (Refer S.No 52, Page 1870, Compilation of Judgments)

26. **06.08.2019**: In OA 681/2018 – Expert team of CPCB was directed to design a model/SOP for Source Apportionment and carrying capacity assessment which may be replicated for all NACs. (Para 26(II)/Pg 18). Hon'ble NGT further directed the states to prepare action plans for the additional 20 NACs on the pattern of 102 NACs and after CPCB's approval, they must initiate time bound action on remediation. (Para 26(VI)/Pg 19)

27. **22.11.2023**: In OA 687/2023 – Directed that actions for improving air quality should be in accordance with the approved action plan with priority to address the cause which is governing the air quality as per source apportionment (para 10/pg 18).

28. **05.12.2023**: In OA 687/2023 categorically directed that the cities under consideration where apportionment study has not been done are required to

complete the said apportionment study w.r.t the factors contributing to pollution & focus on those factors which have a larger share in contribution (para 8/pg 3).

29. The Affidavits filed by the State Governments in compliance of Order dated 31.10.2024, specifically the Affidavit of the State of Uttar Pradesh reveals that there were NAC's in Uttar Pradesh who were not a part of the OA, and have not completed their SAS. These Cities are as follows –

1. Meerut – Ongoing (Expected completion dt. – Nov, 2025)
2. Anpara & Gajraula - Ongoing (Expected completion dt. – 31.10.2025)
3. Bareilly - Ongoing (Expected completion dt. – 31.01.2026)
4. Moradabad - Ongoing (Expected completion dt. – 28.02.026)
5. Noida - Ongoing (Expected completion dt. – 31.01.2026)
6. Gorakhpur - Ongoing (Expected completion dt. – Oct, 2026)
7. Raebareli – Submitted and pending for peer review
8. Firozabad - Submitted and pending for peer review

30. Further, even the NCT of Delhi has also not revised their State Action Plan since 2018 despite conducting the Source Apportionment Study in 2023. In the case of State of Punjab, the revised CAP deadline is given as 31.12.2025. Thus, in most cities, revised CAPs as per SAS are still not available.

IV. Complacent attitude of Regulators

31. It also evident from CPCB Reply dated 02.09.2025 that apart from writing letters to SPCB/PCCs for timely completion of SASs and refining CAPs, it appears that no genuine efforts made by CPCB for its compliance. (Para 3(d), Pg. 6512 & A2, Pg. 6518)

32. Further, the CAQM reply dated 24.07.2025 states that upon being asked by the learned Amicus to provide an updated status report of implementation challenges of direction issued thus far, CAQM has highlighted the challenge of strict

enforcement of directions/advisories, targeted policy actions, rules/regulations and guidelines by concerned agencies at the ground level. (Para 9, Pg 5423). There is no reporting on the Implementation by GRAP measures or how they are addressing the said challenges that they have outlined.

Suggested Measures/Directions to be Passed:

33. That the defaulting cities i.e. cities who are yet to conduct SAS or undertaking the same may be directed to immediately expedite its completion in a time bound manner and align it with their CAP in order to efficiently streamline the budgetary allocation under NCAP.

34. That the cities, who have completed their SAS but have not aligned/refined it with their SAS, may be directed to align/refine the same in a time bound manner for efficient streamlining of budgetary allocation under NCAP

35. CPCB and MoEF&CC may be directed to take appropriate actions against such defaulting cities as the current air quality situation is so severe that mere letters to ensure compliance is not sufficient. Such regulators may further be directed to file an action taken report to update the Tribunal with action taken against such defaulters.

V. Medium Term – Airshed Approach & City Specific GRAP

A. Airsheds Approach

36. A committee should be constituted for the establishment and monitoring of Urban Airshed Models in states across India. In its Additional Note dt. 17.12.2024, the Amicus had suggested that the MoEF&CC and the participating states may be directed to provide to the status of the World Bank assisted programme on State and Regional Airshed Plans for Indian Cities and States, including the State of Uttar Pradesh's Clean Air Management Project under the same (Para xiv, Pg 1804).

37. To the same, the MoEF&CC has submitted that that state governments are engaging with financial institutions like World Bank for availing additional resources (Para 14, Pg 5441-5442). Proposals involving funding from foreign organization/multilateral organization relating to environment are submitted to Dept. of Economic Affairs, Ministry of Finance. During the process inputs from MoEF&CC are taken into consideration. (Para14, Pg 5442). Accordingly, MoEF&CC has provided its inputs on such proposals by UP & Haryana. (Para 14, Pg. 5442)

38. **Importance of Airshed Approach** – A case in point is to look at the AQI as on 05.11.2025 of Delhi and the NCR as well as the cities in the neighbouring States as per the CPCB Bulletin.

i. Delhi – 291
ii. Rohtak -329
iii. Meerut – 292
iv. Kurukshetra – 266
v. Khurja – 238
vi. Karnal – 270
vii. Kaithal – 294
viii. Jind – 275
ix. Hapur – 299
x. Greater Noida – 262
xi. Ghaziabad – 325
xii. Gurugram – 219
xiii. Baghpat - 279

Thus, the AQI of Delhi cannot improve unless the AQI of the surrounding/neighbouring cities is also improved. The copy of the CPCB Bulletin is marked and annexed as **Annexure A5.**

Measures/Directions to be passed -

39. Views of NAC and the respective States on Pros and Cons of Airshed Approach or Air Pollution Control Areas approach which are statutorily mandated which approach should be adopted across States.

40. Can a Technical Committee be constituted by NGT to identify airsheds across States. Already IIT Delhi had conducted a study identifying 8-9 Air Sheds in India . The copy of the Rajya Sabha Answer to Unstarred Question dated 27.07.2023 is marked and annexed herein as **Annexure A6.**

41. Whether there should be City Specific GRAP?

42. GRAP to be implemented stage wise across States and not as an emergency measure at Stage III or IV and above.

B. Implementation of GRAP Measures

43. GRAP can no longer be limited to the NCR region and areas adjoining to it and should be extended to other states and regions. GRAP shall not be treated as an emergency measure. Further, there is a need for the constitution of regional bodies in each identified region in order to monitor the air quality and take necessary measures if required. As per the Air Quality Bulletin dt. 01.11.2023, a lot of cities outside the territorial ambit of the CAQM Act have recorded Poor Air Quality.

C. No synergy/harmonization between GRAP measures with the Action of Delhi

44. The GRAP measures mentioned in the Action Plan of Delhi, including stopping of all construction activities, ban on operation of stone crushers and hot mix plants for two weeks in November is not in synergy with the GRAP measures in the present Schedule dated 13.12.2024, which was issued by CAQM. The State

Action Plan has not been updated with the latest GRAP Stages as well as measures and responsibilities of authorities mentioned therein.

45. The State Action Plan of Delhi was prepared by the Air Quality Monitoring Committee. There is no clarity with respect to whether the Air Quality Monitoring Committee, which was constituted in 2018, continues to exist and whether the said Committee is actively working on updation of the Action Plan of Delhi. The copy of the Delhi State Action Plan is marked and annexed as **Annexure A7**.

D. Institutional Monitoring and Reporting

46. The Sub Committee of GRAP is required to review the actions being undertaken under GRAP and their effectiveness in mitigating air pollution. However, with respect to NACs, the nodal authority is MoEF&CC. Thus, there is lack of synergy at the institutional level with respect who is responsible for monitoring and reporting. While CPCB along with MoEF&CC monitor implementation of NAC , CAQM Sub Committee is responsible for monitoring the actions undertaken under GRAP. Clearly , a better mechanism or a one stop institutional framework is required for monitoring and reporting at the institutional level, so that policy decisions are not taken in exclusion by one regulatory authority.

Place: New Delhi
Date: 06.11.2025

Sanjay Upadhyay
Senior Advocate
Supreme Court of India

6936

16

ANNEXURE A/1[COLLY]

Video shows MCD water tankers spraying mist at Anand Vihar AQI station in Delhi; causes uproar

Accusing the state government of manipulation of pollution data to artificially lower AQI readings, Bharadwaj called it "data management, not pollution control"

Updated on: Oct 26, 2025 10:32 AM IST

By Aheli Das

TOP NEWS

Six killed after being hit by train while crossing tracks in UP's Mirzapur

A still from a video of the reported incident. (Videograb)

New Delhi: A video posted by the Aam Aadmi Party's (AAP's) Delhi chief Saurabh Bharadwaj, showing two Municipal Corporation of Delhi (MCD) water tankers spraying water around the sensors of the Anand Vihar air quality monitoring station, led to a political row on Saturday.

Accusing the state government of manipulation of pollution data to artificially lower air quality index (AQI) readings, Bharadwaj called it "data management, not pollution control."

Bharadwaj took to X and wrote: "BJP Government – Pollution Data Fraud. Water is being sprayed day and night at the Delhi pollution monitoring station to reduce the pollution and

6938

18

AQI readings. These are the same people who say there is no dishonesty in EVMs. When they engage in dishonesty in everything, what can be expected from them?"

The government did not respond to queries on the matter.

An unnamed state government official, however, denied the allegations and pointed out that water sprinkling is done throughout the city to mitigate pollution and the same was being done at Anand Vihar. To be sure, sprinkling of water can help contain dissemination of dust -- a major cause of air pollution, which is measured under PM10 concentration. However, doing so only next to a station may temporarily contain PM10 concentration in the small area around said station, which may bring down readings there, experts have warned.

Also read: Delhi air turns 'very poor' after witnessing slight improvement | Check AQI here

The official cited swift action by the government, citing deployment of 376 anti-smog guns, 266 water sprinklers and 91 road-sweeping machines. Besides, 311 inspections of illegal dumping sites were conducted and action taken in 173 instances.

East Delhi's Anand Vihar has remained a notorious hot spot of pollution as it hosts a railway station, an interstate bus terminal (ISBT), industrial areas and roads unfit to cater to its footfall. Even when post-monsoon showers in the first half of October the AQI "moderate" level, Anand Vihar remained in the deep-end of "poor". On Saturday, while most other air pollution monitoring stations remained in the "very poor" or "poor" zone, Anand Vihar clocked "severe" air. The AQI at the station at 9pm was 431.

Air Quality Monitoring Saurabh Bharadwaj Aam Aadmi Party Catch every big hit, every wicket with Crickit, a one stop de...
Next Story

6940

20

News / Cities / Others / Goa Govt Suspends Sale Of Ola Electric Scooters As Complaints Rise

Next Story

Data gaps, odd patterns: Questions over Delhi AQI

HT analysis of CPCB data finds gaps, shifting pollutants, and anomalies may make Delhi's AQI appear cleaner than real conditions during its most toxic week.

Published on: Nov 05, 2025 5:16 AM IST

By Abhishek Jha

A fall in Delhi's AQI from 366 to 309 may partly stem from missing PM2.5 data and shifting dominant pollutants at key CPCB monitoring stations. (Vipin Kumar/HT)

Delhi's official air quality index dropped from 366 to 309 between November 2 and 3, but a detailed analysis of monitoring data raises questions about the reliability of pollution readings during one of the city's most toxic weeks of the year.

Missing data, suspicious measurement patterns, and algorithmic loopholes in how the city's average AQI is calculated appear to have combined to produce readings that may not accurately reflect ground conditions, an HT analysis of Central Pollution Control Board data shows.

To understand the issue, it is essential to unpack the mechanism to calculate AQI, which contains built-in flexibility designed to ensure readings are available even when some stations malfunction. But this flexibility can be exploited to generate more favourable pollution assessments, particularly when data goes missing during the most polluted hours of the day or when the dominant pollutant at a station switches from one that generates a higher index to one that shows lower readings.

The analysis of 168 hours of data from October 28 to November 4 found that missing station data was not random. With more data missing during polluted hours than clean ones, the net effect would be to make Delhi's air quality appear better than actual conditions.

What are the loopholes in AQI calculation?

Between Nov 2–3, Delhi's AQI fell from 366 to 309, but data inconsistencies and changing pollutant patterns suggest readings may not show ground reality. (HT)

The AQI calculation works through a multi-step process. The 24-hour average concentration of six pollutants and 8-hour average for carbon monoxide and ozone is converted into a sub-index at each of Delhi's 39 air quality monitoring stations. The highest sub-index among the eight pollutants is declared the AQI for that station. The average AQI across the 39 stations becomes Delhi's official reading.

However, the system allows three significant relaxations:

One: An AQI need not be calculated across all 39 stations for the city average.

Two: Only 16 of 24 hours of data is sufficient for calculating the sub-index for a pollutant.

Three: A 24-hour sub-index is not needed for all eight pollutants. If the sub-index is available for three pollutants, and one of them is either PM2.5 or PM10, the station's AQI

can be calculated.

Have the loopholes been in play in AQI calculation in the past week?

Yes. All 39 stations were used only on November 1 in the CPCB bulletin for the week ending November 3, which gives the 24-hour average up to 4pm. On other days, only 37 or 38 stations were included.

But, more crucially, the prominent pollutant — the one whose sub-index determines a station's AQI — also changed during the week. PM2.5, the expected prominent pollutant at this time of year when pollution peaks, was prominent at only 32-36 stations. PM10 was the prominent pollutant at all other stations, except on November 3, when nitrogen dioxide was the most prominent pollutant at the Lodhi Road station run by the Indian Institute of Tropical Meteorology.

Chart 1

The prominent pollutant changing at a station would not necessarily indicate a problem if data was collected for all 24 hours for at least PM2.5 and PM10, both of which typically generate higher sub-indices than other pollutants around this time. However, even among stations where PM2.5 data was available for the required 16 hours, between 8% (October 28 and 29) and 19% (November 3) had less than 24 hours of data.

Chart 2

Does use of the loopholes affect AQI data?

At a theoretical level, missing data can either increase or decrease the 24-hour average depending on whether the missing hours are relatively clean or polluted. An examination of what happened in reality for PM2.5 data over the 168 hours shows the hours when the fewest stations were recording data were the four hours from noon to 3 p.m. — typically the cleanest hours of the day. This pattern would tend to push the PM2.5 average up.

The next set of hours with the most missing stations were the five hours from 7 a.m. to 11 a.m. and the hour starting at 2 am — relatively polluted periods. This would push the average down.

Whether this represents a long-term trend or a recent pattern is difficult to verify. The CPCB dashboard that provides sub-indices for all pollutants takes hours to extract even a week's worth of data, making historical analysis impractical.

Chart 3

The trends between November 2 and November 3 show multiple anomalies

The city's average AQI dropped from 366 to 309 between November 2 and 3. While meteorological factors contributed to this decline — the AQI decreased at all but three

stations that generated readings on both days — data anomalies also appear to have played a role.

Station-level AQI improved most dramatically at three locations: the Lodhi Road station run by IITM, the Shri Aurobindo Marg station run by the Delhi Pollution Control Committee, and the ITO station run by CPCB. The average AQI at these stations nearly halved (from 319 to 164, 294 to 157, and 280 to 155 respectively) even as the city's average decreased by only 16%.

The prominent pollutant changed at all three stations: from PM2.5 to PM10 at ITO and Aurobindo Marg, and from PM2.5 to nitrogen dioxide at Lodhi Road–IITM.

While this shift appears plausible at Aurobindo Marg, where data for both PM2.5 and PM10 was missing during the same two hours, the patterns at the other two stations raise concerns. At Lodhi Road–IITM, the PM2.5 index trended above the PM10 index for most of the day but was much lower in three hours. Moreover, at Lodhi Road, the IITM station showed significantly lower PM2.5 readings than the India Meteorological Department station at the same location, suggesting measurement discrepancies between monitoring systems.

At ITO, both PM2.5 and PM10 sub-indices were below 50 between 4-5 a.m. when data transmission stopped. When the station resumed transmitting at noon, both indices had jumped above 350 — a trajectory that appears difficult to explain through normal atmospheric conditions.

Chart 4

What does this mean?

With one to two stations missing PM2.5 data — the most significant pollutant during this season — at any given hour, Delhi's AQI data may not fully capture pollution levels across the city. When this occurs at heavily polluted locations like ITO, it can lower the city average without reflecting actual conditions on the ground.

Stations also appear to generate sudden spikes and drops in readings, which could result from calibration issues or external factors affecting measurements. Environmental groups have reported observing water being sprinkled near some monitoring stations in recent days, though officials have not confirmed whether this occurred or how it might affect readings.

These patterns suggest that day-to-day trends in the city's average AQI — which is meant to communicate health risk to residents — may not provide a reliable picture of actual pollution levels during critical periods.

The Indian EXPRESS
JOURNALISM OF COURAGE

Sprinklers continue rounds at monitoring stations amid row over air pollution in Delhi

According to locals from the area, the activity has been ongoing post Diwali

Written by Sophiya Mathew , Drishti Jain
New Delhi | October 27, 2025 05:25 AM IST
3 min read

Sprinklers at Anand Vihar monitoring station (Express/Gajendra Yadav)

Water sprinklers continued to make rounds at regular intervals around Air Quality Monitoring stations on Sunday, even as the city’s air quality remained in the upper range of the poor category.

On Saturday, the Aam Aadmi Party had alleged that water was being sprayed day and night right outside the area where the air for monitoring is sucked in at the Anand Vihar ISBT pollution station “to artificially lower” AQI (air quality index) readings.

The BJP had dismissed the charge as foolish and politically motivated.

At Anand Vihar, water sprinklers were seen circling Anand Vihar ISBT spot at around 1:30 pm, and returning occasionally. The PM levels showed a steep fall from 370 to 197 microgrammes per cubic meter between noon and 3 pm.

According to locals from the area, the activity has been ongoing post Diwali.

At RK Puram, the AQI monitor is placed inside the Kendriya Vidyalaya in Sector 2. The area has a heavy tree cover.
Water sprinklers were seen making multiple rounds at 15-20 minute intervals on the road outside the school, and the road remained wet.

Between 1:00 and 2:30 p.m., both Anand Vihar and R.K. Puram stations show a drop in PM2.5 and PM10 levels, which coincides with the time of water sprinkling nearby. At Anand Vihar, PM2.5 fell from about 180 µg/m³ to around 100 µg/m³, and PM10 from around 500 µg/m³ to below 200 µg/m³. R.K. Puram also saw a similar, though smaller, fall.

Sprinkling water near Pollution monitoring centre in R K Puram on Sunday (Express/Gajendra Yadav)

Experts said that sprinkling increases the moisture content in the air and heavier dust particles settle temporarily.

“Because the monitor is located near one of the exit points at the very crowded Interstate Bus Terminal, instead of capturing ambient air, this station mostly captures key pollutants from road dust and tail pipes,” said an expert about the monitor at Anand

Vihar.

Added moisture in the air attaches to particulate matter, making the particles heavier so they settle down, resulting in lower readings at the monitoring site.

“The nearest obstruction shouldn’t be within 20 metres of a monitoring station,” said Sunil Dahiya, leading analyst and founder of Envirocatalysts, a Delhi-based think tank.

However, a gradual fall in pollution levels after noon, is also typical of warmer conditions setting in during the day. Rising temperatures cause vertical air mixing (as warm air rises it lifts the pollution load) and dispersal of pollutants. So, the post-noon decline likely comes from both local cleaning from sprinkling and natural dispersal due to warmer daytime conditions.

Delhi Pollution Control Committee officials did not respond to calls and messages.

Reality Check: Delhi's air quality stations riddled with faulty displays, dead monitors

Delhi has dozens of air monitoring stations meant to provide live updates on city's air quality for citizens. But India Today's on-ground verification found several either hidden, dysfunctional, or incorrectly placed.

6954

34

What impact did water sprinkling have at Anand Vihar station?

DeeperDive BETA | Why is the Narela AQI display non-functional?

As Delhi continues to choke on toxic air, India Today's ground investigation across multiple air quality monitoring stations has uncovered widespread negligence, from malfunctioning display boards and questionable placement of sensors to discrepancies between on-ground readings and official data.

While the Central Pollution Control Board (CPCB) official claimed all 39 of Delhi's air monitoring stations are functional, reality on the ground paints a very different picture. Across the city, from Narela to Shahdara and Punjabi Bagh to RK Puram, several display boards meant to inform the public about local pollution levels were either defunct, hidden, or placed amid greenery.

NARELA: CLEAN AIR AMID GREENERY

In outer Delhi's Narela, the air quality monitoring station has been installed inside the ITI campus — surrounded by dense greenery. The display board here is non-functional, and what's more, an anti-smog gun was found operating right in front of the station during India Today's visit.

ITI students said the display board was unreadable, leaving residents with no way to see live data.

"It has been over two months and the board has been like this," one ITI student said. Another added that they rely on media for AQI data.

MCD staffer Dayachand was overseeing the cleaning work and sprinkling in the area. He admitted that cleaning around the site had intensified "a day or two ago."

Water being sprinkled near monitoring station in Narela. (Screengrab)

Water bottle for Rs 100, coffee for Rs 700: Supreme Court raps cinemas

Bihar Assembly polls | High stakes battle

Delhi Air Pollution: Politics, Health Crisis & Cloud Seeding Debate Intensify

The continuous cleaning was keeping dust levels abnormally low around the station.

When asked about monitoring units being placed among dense greenery, Dayachand made it clear that he was from the sanitation department and the monitoring station was the responsibility of another department.

AYA NAGAR: AQI DISPLAY DEAD FOR 18 MONTHS

At Aya Nagar, the air quality display machine outside the IMD office has been defunct for one and a half years. A local guard confirmed on camera that "the machine has been off for the last 18 months." While he claimed that indoor instruments inside the office were still working, public access was prohibited.

A dead monitoring board in Aya Nagar. (Screengrab)

India Today found that several such AQI stations across Delhi had display boards either switched off or malfunctioning. In a city where pollution levels routinely breach hazardous limits, such prolonged inaction by responsible departments raises serious questions about accountability.


Water bottle for Rs 100, coffee for Rs 700: Supreme Court raps cinemas


Bihar Assembly polls | High stakes battle

Delhi Air Pollution: Politics, Health Crisis & Cloud Seeding Debate Intensify

6960

40

In RK Puram, the AQI display board installed on the rooftop of Kendriya Vidyalaya has been off since Diwali. Even when operational, the board is almost invisible — placed behind thick tree cover and about 50 metres from the main road.

"It's been off for two to three days," a security guard told India Today on condition of anonymity. The placement ensures that even if the board worked, hardly any passerby could view it — completely defeating its purpose.


Water bottle for Rs 100, coffee for Rs 700: Supreme Court raps cinemas


Bihar Assembly polls | High stakes battle

Delhi Air Pollution: Politics, Health Crisis & Cloud Seeding Debate Intensify

A zoomed in view of the AQI display board installed on the rooftop of Kendriya Vidyalaya in RK Puram. (Screengrab)

The display's inaccessibility and recent malfunction point to poor planning and lack of oversight. In a high-traffic area like RK Puram, where vehicle emissions significantly affect air quality, this lack of visibility undermines public awareness.

BAWANA: AQI STATION AMID TREES, BOARD DEAD

display board, located almost 200 metres away, was also found to be malfunctioning, with no data visible on its screen.

AQI station located amid trees in Bawana. (Screengrab)

Local residents pointed out that while the AQI machine sits in a green patch, the nearby industrial zone suffers from thick pollution. “The station should be near factories, not under trees,” local residents said. “Otherwise, the data will always look cleaner than it really is.”

The station, installed during the AAP government’s previous term, continues to operate with the same flaws.

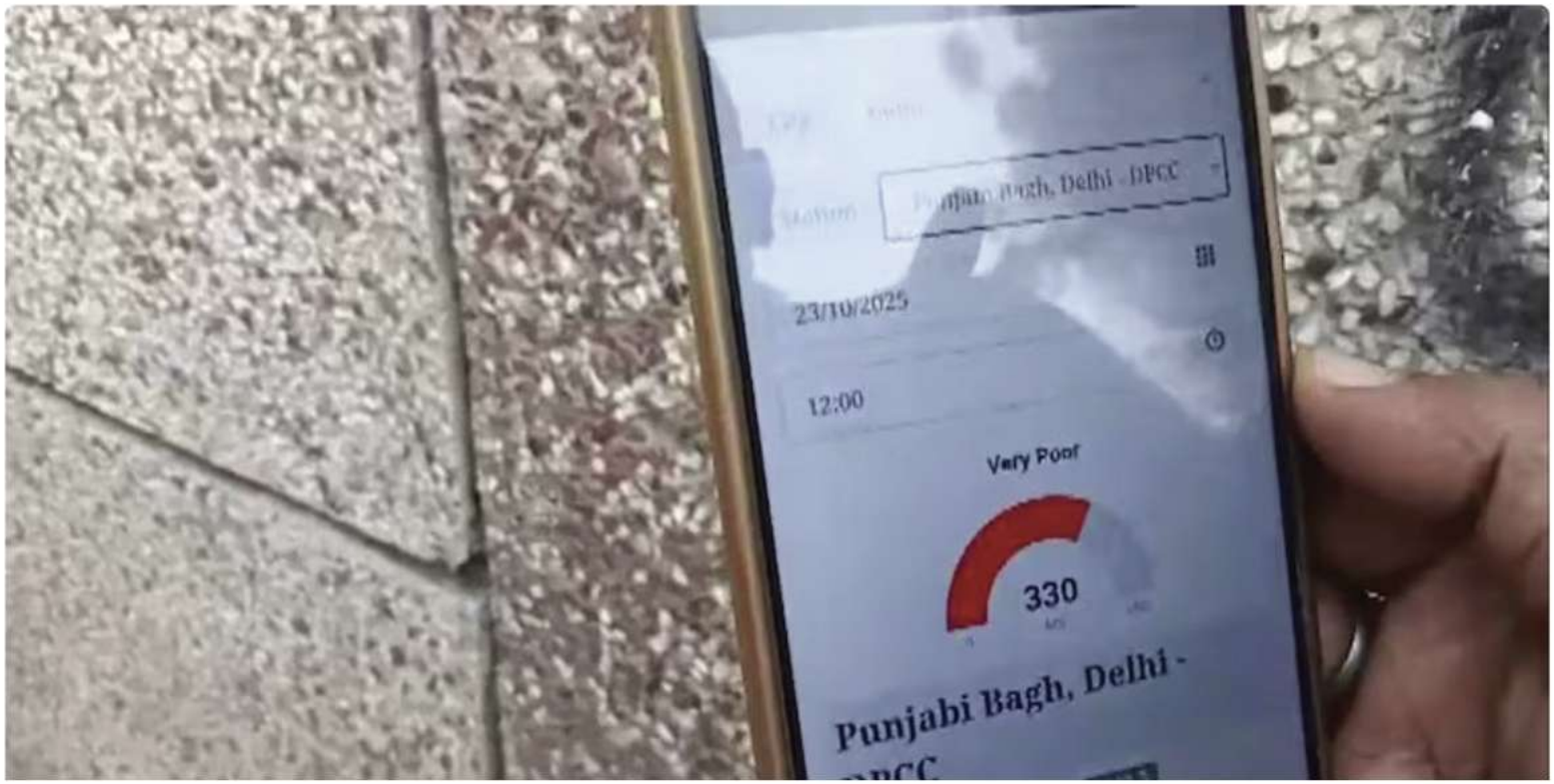
PUNJABI BAGH: BOARD SHUT, CPCB DATA SHOWS ‘VERY POOR’

In West Delhi’s Punjabi Bagh, among the capital’s most polluted zones post-Diwali, the AQI display at Sarvodaya Kanya Vidyalaya was found completely shut down when the India Today team visited around noon on October 23.

The display board wasn't working at Punjabi Bagh. (Screengrab)

Locals said the board had been off for “three to four days.” One guard said, “It used to work before Diwali. The department team was here that night, but no one came after that.”

Despite the display being dead, CPCB's website continued to show Punjabi Bagh's AQI above 300.



AQI data for Punjabi Bagh at CPCB's website. (Screengrab)

For over an hour, the India Today team waited at the site, but the display showed no signs of functioning.

KARKARDOOMA AND SHAHDARA: MONITORS OUTDATED OR DOWN

Outside Karkardooma Court and the CPCB headquarters, display boards continued to flash data from October 22, even as the date had rolled over to October 23. Officials refused to comment, while a guard admitted off-camera, “It’s like this often. Sometimes it works, sometimes not.”

In Shahdara, the air quality monitoring centre opposite local MLA Sanjay Goel’s residence has been non-functional for several days. Sources said the malfunction was due to “technical faults and maintenance delays.” Meanwhile, nearby areas continued to experience worsening air quality due to garbage burning, vehicle smoke, and dust, with no fresh AQI data available.

NAJAFGARH: WORKING ON-GROUND, BUT MISSING ONLINE

At Najafgarh’s Chaudhary Brahm Prakash Charak Hospital, the AQI display board was seen updating data in real time, showing PM2.5 and PM10 readings. However, when India Today checked the CPCB and DPCC websites, data from this station was missing entirely. Officials attributed it to “server glitches.”

Glitches seen in display board at Najafgarh. (Screengrab)

A hospital supervisor said, “The centre operates 24 hours a day, and people in the area often look at the display. We’ve never checked if the data appears online.”

The monitoring unit operates in auto mode, surrounded by trees, a small waste dump, and a water treatment plant.


Water bottle for Rs 100, coffee for Rs 700: Supreme Court raps cinemas


Bihar Assembly polls | High stakes battle

Delhi Air Pollution: Politics, Health Crisis & Cloud Seeding Debate Intensify

India Today's team also visited the Lodhi Road and ITO AQI stations. At Lodhi Road, near the IMD office, the display board was blank, even though CPCB's website showed PM2.5 levels above 300. At ITO, another crucial CPCB station, the readings had not been updated for two days. The same figures — PM2.5 at 113 and PM10 at 259 — continued flashing since October 22.

OKHLA: RARE CASE OF TRANSPARENCY

At Okhla Industrial Area Phase-II, the air monitoring station under the Delhi Pollution Control Committee (DPCC) was found fully operational. The display matched CPCB and DPCC data, and water sprinkling was being carried out nearby.

Locals confirmed regular monitoring. "The display always works," said one resident. "Pollution has risen after Diwali, but the government is taking steps. Cleaning and water spraying happen daily."

The DPCC staff told India Today over the phone that the system was automated and ran round the clock, with engineers checking it "whenever a fault occurs."

OFFICIAL RESPONSE

Anil Gupta, member of both DPCC and CPCB, said there was "no intention to hide data":

"Look, there are forty air quality monitoring stations in Delhi. Thirty-nine of them are working; one is separate. If you check the CPCB or DPCC sites, you will see readings from continuous online monitoring sessions," Gupta said.

He added, “Many times, after events like Diwali, some stations temporarily shut down due to sparks or other issues. Sometimes the readings exceed capacity temporarily, but there is no intention to hide any data... If you check the data for 2021, 2022, 2023, or 2024, it’s a regular occurrence that sometimes an instrument breaks down. Around Diwali, this is normal, either maintenance is happening, or a spark occurs. A “spark” means a unique reading goes exceptionally high temporarily."

Meanwhile, Mohan P. George, former senior scientist with DPCC and now a consultant on clean air and sustainable mobility at the Centre for Science and Environment, explained the ideal standards for AQI monitoring.

“CAQM or AQI data monitoring stations must be free of any obstruction for access to free flowing winds. The stations with maintenance and repairs must work for at least 340 days of the year. The stations should not be covered with trees as there should not be any obstruction at 30 degrees angle on the rooftop of the station for clear data collection. Road curve stations such as one at ITO or near the roads measure the impact of vehicles on the air quality and not the ambience,” George said.

THE BIGGER PICTURE

Delhi has dozens of air monitoring stations meant to provide live updates for citizens. But India Today’s on-ground verification found several either hidden, dysfunctional, or incorrectly placed — some in green zones, others showing outdated or mismatched data.

The city’s residents, gasping for clean air, are left with little clarity about the true state


Water bottle for Rs 100, coffee for Rs 700: Supreme Court raps cinemas


Bihar Assembly polls | High stakes battle

Delhi Air Pollution: Politics, Health Crisis & Cloud Seeding Debate Intensify

6970

50

network appears to be running on shaky ground. In a city struggling to breathe, even the truth about the air seems clouded.

- Ends ■

(With input from Milan Sharma, Sushant Mehra, Amarjeet Singh, Amardeep Kumar, Rajesh Khatri, OP Shukla, Manoranjan, Bharat Kumar, Ashutosh Kumar)

Published By: Anuja Jha *Published On: Oct 23, 2025*


Water bottle for Rs 100, coffee for Rs 700: Supreme Court raps cinemas


Bihar Assembly polls | High stakes battle

Delhi Air Pollution: Politics, Health Crisis & Cloud Seeding Debate Intensify


Water bottle for Rs 100, coffee for Rs 700: Supreme Court raps cinemas


Bihar Assembly polls | High stakes battle


Delhi Air Pollution: Politics, Health Crisis & Cloud Seeding Debate Intensify

w/115942331.cms)
maharashtra-cm-swearing-in-traffic-restrictions-announced-for-december-5-in-mumbai/articleshow/115954534.cms)
eader-at-golden-temple/articleshow/115958514.cms)
w/115942331.cms)
TRENDING maharashtra-cm-swearing-in-traffic-restrictions-announced-for-december-5-in-mumbai/articleshow/115954534.cms)
leader-at-golden-temple/articleshow/115958514.cms)
w/115942331.cms)
maharashtra-cm-swearing-in-traffic-restrictions-announced-for-december-5-in-mumbai/articleshow/115954534.cms)
leader-at-golden-temple/articleshow/115958514.cms)

Agra's air quality data questioned amid claims of manipulation after Diwali

Deepak Lavania
(Https://Timesofindia Indiatimes Com/Toireporter/Author-Deepak-Lavania-479242379 Cms) / Nov 12, 2024, 23:15 IST

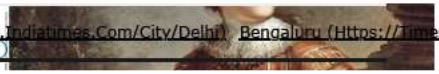
FOLLOW US (/articleshowprint/115227599.cms) MORE NEWS://TIMESOFINDIA.INDIATIMES.COM/PUBLICATIONS

Agra: Post Diwali, while northern India and various cities in the state are grappling with severe respiratory issues, Agra's air quality data shows "unexpectedly good readings". However, environmentalists claim that "this does not reflect the actual air quality but rather indicates deliberate manipulation".

According to sources, in order to artificially lower the air quality index (AQI) readings, continuous water spraying is being carried out, which reduces the recorded levels of PM-2.5 and PM-10 particles. At the Agra Municipal Corporation building, sophisticated monitoring equipment and sensors are installed on the roof. A 1,000-litre water tank has been placed there, connected to a 20-foot-high pipe with two sprinklers. A motor pump operates throughout the day, continuously spraying water near the sensors, significantly reducing the measured levels of dust and particulate matter.

The Central Pollution Control Board (CPCB) and UP Pollution Control Board (UPPCB) have jointly set up six monitoring stations across Agra, located at Sanjay Place, Rohta, Manoharpur, Shashtripuram, Awas Vikas Colony, and Shahjahan Park. The average AQI of the city is calculated from these stations.

Meanwhile, local doctors report a 40% increase in respiratory and asthma cases.



The OPD at SN Medical College is seeing over 100 patients every day, many of whom complain of difficulty breathing and a burning sensation in their eyes. Tour guides said that the Taj Mahal remains shrouded in a thick layer of smog during the early morning hours.

However, the CPCB's `Sameer' app, which provides hourly updates on the AQI, continues to show Agra's air quality as being comparable to monsoon conditions.
Environmental experts have raised concerns over the manipulation of data.
Dr Sharad Gupta, an environmentalist, said, "The public is being misled while the actual air quality remains poor. This is especially concerning when compared to neighbouring districts like Bharatpur, where AQI readings indicate `poor' air quality."

"Before 2023, Agra's AQI typically ranged between 350-495 from Nov to Jan. However, in the past two years, these numbers have mysteriously dropped, suggesting pollution levels have decreased by as much as 90%," Gupta added.
Social activist Naresh Paras said, "Attempting to manipulate pollution readings raises serious concerns about data integrity and public health. While officials artificially maintain favourable AQI readings, residents continue to suffer from deteriorating air quality. This undermines genuine efforts to combat pollution and creates a false impression that may delay necessary interventions."
He added, "Transparent and accurate air quality monitoring is crucial, as it directly impacts public health policies and measures to combat pollution. Immediate attention and corrective action are needed to ensure the authenticity of air quality data available to the public and policymakers."
Reacting to the matter, Vishwanath Sharma, the regional officer of UPPCB, acknowledged water spraying on city roads but denied any knowledge of spraying at monitoring stations. "The entire matter will be investigated," he said.

Stay updated with the latest news (https://timesofindia.indiatimes.com/news) on Times of India (https://timesofindia.indiatimes.com/). Don't miss daily games (https://timesofindia.indiatimes.com/games) like Crossword (https://timesofindia.indiatimes.com/games/crossword), Sudoku (https://timesofindia.indiatimes.com/games/sudoku), and Mini Crossword (https://timesofindia.indiatimes.com/games/mini-crossword).


About the Author
Deepak Lavani...
Deepak Lavania is based in Agra serving as Principal Correspondent, covering districts of Agra and Aligarh. Read More

Start a Conversation

Printed from
THE TIMES OF INDIA

Agra's air quality data questioned amid claims of manipulation after Diwali

Nov 12, 2024, 11.15 PM IST

Agra: Post Diwali, while northern India and various cities in the state are grappling with severe respiratory issues, Agra's air quality data shows "unexpectedly good readings". However, environmentalists claim that "this does not reflect the actual air quality but rather indicates deliberate manipulation".

According to sources, in order to artificially lower the air quality index (AQI) readings, continuous water spraying is being carried out, which reduces the recorded levels of PM-2.5 and PM-10 particles. At the Agra Municipal Corporation building, sophisticated monitoring equipment and sensors are installed on the roof. A 1,000-litre water tank has been placed there, connected to a 20-foot-high pipe with two sprinklers. A motor pump operates throughout the day, continuously spraying water near the sensors, significantly reducing the measured levels of dust and particulate matter.

The Central Pollution Control Board (CPCB) and UP Pollution Control Board (UPPCB) have jointly set up six monitoring stations across Agra, located at Sanjay Place, Rohta, Manoharpur, Shashtripuram, Awas Vikas Colony, and Shahjahan Park. The average AQI of the city is calculated from these stations.

Meanwhile, local doctors report a 40% increase in respiratory and asthma cases. The OPD at SN Medical College is seeing over 100 patients every day, many of whom complain of difficulty breathing and a burning sensation in their eyes. Tour guides said that the Taj Mahal remains shrouded in a thick layer of smog during the early morning hours.

However, the CPCB's 'Sameer' app, which provides hourly updates on the AQI, continues to show Agra's air quality as being comparable to monsoon conditions. Environmental experts have raised concerns over the manipulation of data.

Dr Sharad Gupta, an environmentalist, said, "The public is being misled while the actual air quality remains poor. This is especially concerning when compared to neighbouring districts like Bharatpur, where AQI readings indicate 'poor' air quality."

"Before 2023, Agra's AQI typically ranged between 350-495 from Nov to Jan. However, in the past two years, these numbers have mysteriously dropped, suggesting pollution levels have decreased by as much as 90%," Gupta added.

Social activist Naresh Paras said, "Attempting to manipulate pollution readings raises serious concerns about data integrity and public health. While officials artificially maintain favourable AQI readings, residents continue to suffer from deteriorating air quality. This undermines genuine efforts to combat pollution and creates a false impression that may delay necessary interventions."

He added, "Transparent and accurate air quality monitoring is crucial, as it directly impacts public health policies and measures to combat pollution. Immediate attention and corrective action are needed to ensure the authenticity of air quality data available to the public and policymakers."

Reacting to the matter, Vishwanath Sharma, the regional officer of UPPCB, acknowledged water spraying on city roads but denied any knowledge of spraying at monitoring stations. "The entire matter will be investigated," he

Printed from
THE TIMES OF INDIA

AQI-puncture: 65% of Haryana pollution monitors go offline

Oct 30, 2025, 11.40 AM IST

Gurgaon: Haryana's pollution monitoring network was severely compromised with 20 out of 32 stations, including three in the city, going offline Wednesday, skewing data recording at a time when air quality needs to be closely watched.

As a result, there was no decoding of the nature of the haze that hung over the city with the official data showing AQI at 150 (moderate). But this data was from the lone functional station at Vikas Sadan.

The other three stations, located at Gwalpahari, Teri Gram and Sector 51, were offline due to technical snags and delayed calibration, according to Haryana State Pollution Control Board (HSPCB) officials. The same happened in Faridabad, Hisar, Panchkula, Rohtak and other places. Outages left these centres without real-time pollution data, just as stubble burning and changing weather conditions increase levels of particulate matter.

Shubhansh Tiwari, a research associate at Centre for Science and Environment, said, "Industrial belts and traffic corridors are missing from the data. Despite AQI in Gurgaon hovering between 150 and 180 over the past week, labelled as "moderate", residents have reported experiencing smog, eye irritation and breathlessness."

HSPCB officials claimed that repairs are under way, but didn't provide a specific timeline about when the monitoring stations would be restored.

Manoj Kumar, an analyst at Centre for Research on Energy and Clean Air (CREA), said calibration and maintenance should be done well before the pollution season, not during it. "Renewed failure of AQI monitoring stations undermines public confidence in air quality data. When monitors go offline during high-pollution episodes, we lose the evidence base for any future policy evaluation," he added.

Last winter, several NCR stations went offline during peak smog months, raising questions about reliability of the monitoring network and the state's preparedness to track pollution in real time.

Explainers

Delhi's experiment with cloud seeding

The Delhi government and the Indian Institute of Technology, Kanpur teamed up to produce artificial rain using IIT-K's aircraft. However, three back-to-back attempts to make the skies open up in Delhi's outskirts by coaxing sparse clouds failed

6980

60

Govt carried out cloud seeding operations in collaboration with IIT Kanpur X.com

Anup Verma

Updated on: 02 Nov 2025, 8:34 am · 5 min read

Artificial rain is an idea that has found political currency in the national capital region to scrub the air of hazardous pollutants.

Related Stories

What is so Scientific about artificial rain?

Gufran Beig · 02 Nov 2025

How cloud seeding works to clean toxic air

Prabhat Shukla ·
29 Oct 2025

Delhi conducts first cloud-seeding trial; artificial rain likely soon

Express News Service ·

Employed as a costly drought relief measure since the 1950s across the country to address human distress, Delhi-NCR tried it out to reduce atmospheric pollution. However, three back-to-back attempts to make the skies open up in Delhi's outskirts by coaxing sparse clouds failed.

The Delhi government and the Indian Institute of Technology, Kanpur had teamed up to produce artificial rain using IIT-K's aircraft. However, quick fix solutions without addressing the underlying causes of pollution often fail to deliver relief.

Stages of seeding

At the heart of the concept of artificial rain is a process called cloud seeding. It is a technique of weather modification, which catalyses the natural process of cloud precipitation. The most important condition for its success is that the target clouds must hold sufficient levels of moisture. These clouds are injected with chemical particles, which act as a kind of seed around which water droplets and ice crystals can form. These formations are called the nuclei.

Once a sufficient volume of droplets or ice crystals forms inside a cloud, they start growing and combine to become heavy enough to fall as rain or snow. Inducing the cloud to dump the water that it might otherwise carry away or hold back is part of the process.

Scientists begin by making cloud and moisture assessment in the region where artificial rain is desired. Apart from the presence of clouds and moisture in them, parameters like proper height, atmospheric temperature and density of clouds come into play before the seeding target is selected.

As for the seeding agents, they include chemical substances such as silver iodide, solid carbon dioxide or dry ice, salt particles or sodium chloride, rock salt and iodised salt. These materials help create the nuclei for condensation or freezing. These seeding agents are then released into the clouds by aircraft, rockets, or ground-based generators, each one of which has cost implications. For Delhi, the IIT-Kanpur team decided to use a modified aircraft to carry flares that burned the chemicals at a particular altitude.

There are two types of seeding, hygroscopic seeding (using salts) at the base of warm clouds; and glaciogenic seeding (using silver iodide particles) in cold clouds. IIT-Kanpur attempted glaciogenic seeding in Delhi.

The case of Delhi

For decades, the NCR and its adjoining areas have been reeling under humongous air pollution. It attains life-threatening levels during the winter when winds drop, temperature inversion traps pollutants,

stubble-burning in neighbouring states adds to smoke, and dust gets stirred up from construction sites. Vehicular emissions add to the noxious cocktail.

As a counter-measure, the Delhi government sought to experiment with artificial rain. It hoped that artificial rain, even for a short time, could help wash away some of the fine particulate matter, like PM2.5 and PM10, from the air, improve visibility, and give some relief from high pollution.

Experts believe that for a city like Delhi, even if a little rain can be induced to help wash away particulate matter, it can contribute to public health, visibility and overall ease of living. Globally, cloud seeding has been attempted in several countries, like the US, China, and UAE, mostly for enhancing rainfall, snowpack, controlling hail, clearing fog, etc., and the Delhi government wants to build on this theme.

The government signed a memorandum of understanding with IIT-Kanpur to carry out several — initially five, possibly up to nine — experimental cloud-seeding flights. It sanctioned `3.21 crore for the initial phase of up to five trials. Each aircraft sortie carried out so far lasted 90 minutes, covering roughly 100 sq km in and around Delhi, using a modified Cessna 206H that carried flare-type seeding equipment. The target areas were mainly in the northwest and outer Delhi and Noida.

The experiment

The IIT-Kanpur team chose the day of operation when the meteorological data showed favourable cloud movement over Delhi and sufficient moisture concentration, and dropped seeding chemicals into the clouds. The expectation was that rainfall could begin within 15 minutes to four hours after seeding, but there was not even a drop.

Scientists believe the key reason for the failure was low moisture content in the targeted clouds. The IIT-Kanpur team noted humidity levels as low as 10-15% in the seeded clouds, well below what is generally considered favourable for the success of such an exercise.

Another IIT-Delhi report analysed data from 2011 to 2021 to conclude that Delhi's winter is climatologically unsuitable for consistent cloud seeding due to a fundamental lack of sufficient moisture and saturation, particularly during the peak pollution months of December and January. It found December-January coinciding with both the most severe pollution episodes and the driest climatological conditions.

Western Disturbance

While Western Disturbances (WDs) are the primary drivers of potential seeding conditions, viable windows of opportunity

are rare, confined to specific anomalous events. Even on days identified as potentially promising (e.g., cloudy WD days without rain), a multi-criteria Moisture Suitability Index (MSI) indicated they frequently lack the necessary combination of moisture depth, saturation and atmospheric lift required for successful seeding, the report said.

Even if successful, "induced rainfall would likely provide only a brief respite (typically one to three days) before pollution levels rebound, the report said. Given the high operational costs, the scientific uncertainties inherent in aerosol-laden environments, and the absence of any moderation in underlying emission sources, cloud seeding cannot be recommended as a primary or strategic measure for Delhi's pollution management, the authors argued.

Coming back to the recent experiment, despite there being no significant rain, some reduction in the levels of particulate matter was observed in Delhi's trial zones. For example, before seeding, PM2.5 levels were 221, 230, and 229 micrograms per cubic metre in areas like Mayur Vihar, Karol Bagh, and Burari in Delhi, respectively. Post-seeding, they dropped to 207, 206, and 203. Similar small drops for PM10 were noted. Experts, however, say that since rainfall did not take place, the decline in the levels of particulate matter or pollution

in general may have been caused by other factors, like wind settling and timing of measurement.

Learning curve

For his part, IIT-Kanpur Director Manindra Agrawal said though the cloud seeding trials did not produce rain, they provided valuable data and scientific insights for future operations. "It helped us understand the relationship between the amount of seeding material used, the moisture content of clouds, and their ground-level impact. This will help us fine-tune future operations," he said.

"We need at least 30 to 50% cloud moisture. Since that was not available, we decided to wait until conditions improve," he said, adding the trials will resume once the situation improves.

Delhi's winter atmosphere unsuitable for cloud seeding: IIT Delhi report

Due to a lack of sufficient moisture and saturation during the winter months of December and January, cloud seeding is a non-viable solution that offers only short-lived benefits, says the study

Updated – November 01, 2025 11:49 am IST

PTI

An anti-smog gun sprays water droplets to curb air pollution as air quality deteriorates across northern India, at North Campus, in New Delhi. File | Photo Credit: PTI

Delhi's winter atmosphere is climatologically unsuitable for consistent cloud seeding due to a fundamental lack of sufficient moisture and saturation, particularly during the peak pollution months of December and January, according to an IIT Delhi report.

The report, based on a comprehensive analysis integrating climatological data (2011-2021) by IIT's Centre for Atmospheric Sciences, comes against the backdrop of the Delhi government conducting two cloud-seeding trials in Burari, north Karol Bagh and Mayur Vihar in collaboration with IIT Kanpur, but there was no rain. The

institute had earlier conducted successful trials in Kanpur in 2017-18, but this was the first such experiment in the Delhi-National Capital Region (NCR) region.

"While cloud seeding is theoretically feasible under specific atmospheric conditions, during Delhi's winter, its practical utility as a consistent and reliable air-quality intervention is constrained. The necessary atmospheric conditions are rare and frequently coincide with natural rainfall, limiting the potential marginal gain," the report said.

"Even when successful, induced rainfall would likely provide only a brief respite (typically one to three days) before pollution levels rebound. Given the high

operational costs, the scientific uncertainties inherent in aerosol-laden environments, and the absence of any impact on underlying emission sources, cloud seeding cannot be recommended as a primary or strategic measure for Delhi's pollution management.

"At best, it could serve as a high-cost, tactical intervention during declared air-quality emergencies, contingent upon a forecast meeting stringent MSI-based suitability criteria. Ultimately, the study underscores that sustained emission reduction remains the best viable and durable solution to Delhi's chronic air pollution crisis," it added.

The report noted that decadal analysis (2011-2021) indicates that the core winter months of December and January coincide with both the most severe pollution episodes and the driest climatological conditions.

"There is a fundamental lack of sufficient moisture and saturation during the peak pollution months (December-January), coinciding precisely when intervention is most needed. While Western Disturbances (WDs) are the primary drivers of potential seeding conditions, viable 'windows of opportunity' are rare, confined to specific anomalous events.

"Even on days identified as potentially promising (e.g. cloudy WD days without rain), a multi-criteria Moisture Suitability Index (MSI) indicates they frequently lack the necessary combination of moisture depth, saturation and atmospheric lift required for successful seeding," it said.

The study highlights complexities arising from Delhi's high aerosol environment.

High aerosol loading [characterised by high Aerosol Optical Depth (AOD)] is associated with increased cloud cover and higher liquid/ice water content, particularly during rainy conditions.

However, favourable microphysical conditions (low cloud base, high water content) often coincide with naturally occurring precipitation, limiting the potential added benefit of seeding. The vertical separation between the shallow aerosol layer (below 2 km) and typical seedable cloud layers (2-5 km) also presents significant operational targeting challenges.

Thermally, glaciogenic seeding appears potentially viable during core winter, but operational feasibility seems restricted to existing rainy conditions.

Regarding pollution removal, the analysis confirms that heavy natural rainfall is highly effective (80-95% washout for PM2.5, PM10, NOX), while light rain offers minimal impact. Importantly, even after significant washout, air quality improvements are short-lived, with pollutant concentrations typically recovering to pre-event levels within one to five days due to persistent emissions.

Ozone concentrations often increase post-rainfall. While dry WDs provide some limited ventilation, significant concerns remain regarding the environmental/health impacts of seeding agents like AgI (silver iodide), high operational costs and scientific uncertainties.

"Given these constraints, cloud seeding cannot be recommended as a primary or reliable strategy for Delhi's winter air pollution management. It should be viewed, at best, as a potential high-cost, emergency short-term measure, contingent on stringent forecasting criteria.

"The study underscores that sustained emission reduction remains the most viable and necessary long-term solution," the report said.

Published – November 01, 2025 11:17 am IST

ARTICLE DATED 04.11.2025 PUBLISHED IN THE HINDU

facebook.com/thehindu X.com/the_hindu instagram.com/the_hindu

Has cloud seeding been effective?

How does the process work? How does it aim to settle the build of smog and particulate matter in the air? When did India first experiment with cloud seeding? What was the Cloud Aerosol Interaction and Precipitation Enhancement Experiment? Have the recent trials in Delhi been successful?

EXPLAINER

Jacob Koshy

The story so far:

For the first time in nearly 50 years, Delhi conducted two cloud seeding trials with the Indian Institute of Technology Kanpur (IITK) last week. The aim was to induce rain over Delhi to settle the build of smog and particulate matter that had deteriorated the air quality.

What is cloud seeding?

Cloud seeding involves spraying a salt mixture into clouds. The science is that such seeding, which is done by aircraft fitted with flares that fire the salt mixture into clouds, can induce ice or water vapour within the clouds to form water droplets. When lots of such droplets coalesce, they can pour down as rain.

What has been its history?

Cloud seeding has been around for at least three quarters of a century with mixed success. Beginning in the 1940s, General Electric scientists William Schaefer and Bernard Vonnegut chanced upon the principle of using dry ice to form ice crystals in their lab freezer. They then decided to experiment on real clouds. It was reported that they successfully made it snow over Pittsfield in Massachusetts, U.S. This got the U.S. government excited and a formal programme called Project Cirrus was born. While creating rain was certainly on the back of their minds, the big excitement was the prospect of taming hurricanes, which did not pan out well. In the 1950s and 60s, the use of cloud seeding as a weather modification tool became popular. The Soviets seeded clouds over Leningrad to protect May Day parades – years before China used cloud seeding for clear skies ahead of the inaugural ceremony of the Olympics in 2008. The U.S. launched Project Skywater, dumping silver iodide from planes over the Rockies.

For a better sky: A view of the aircraft after the second trial of cloud seeding in Delhi, on October 28. ANI

What has India's experience been?

Nearly coincident with Project Cirrus, S.K. Banerji, the first Indian Director General of the India Meteorological Department (IMD), oversaw the first cloud seeding experiments in Kolkata by releasing salt and silver iodide in hydrogen balloons in 1952. Most of these were administered as rockets that were fired from the ground. And while these experiments seemed to suggest that on the days when seeding was done, there was more rain compared to days when there was no seeding, it wasn't verifiable if the rain was due to natural sources or from the seeding. There was even an attempt to conduct such seeding in Delhi in 1962 but it failed.

It's only from the 1970s that researchers properly started to use planes and fly to the top of the clouds to spray salt solutions. They also studied cloud physics, condensation, what kind of clouds gave rain, which ones didn't, and so on. Several States, when grappling with drought, have experimented with cloud seeding. The results have been sporadic and there was never any systematic way to tell how much rain could reasonably be expected if a certain amount of salt mixture was scattered. There was also less clarity on where exactly one could expect rain. The cost-benefit also was not clear, given that hiring aircraft, pilots, technical personnel and making salt mixtures was expensive.

What was the CAIPEEX?

Initiated by the Pune-based Indian Institute of Tropical Meteorology in 2009, Cloud Aerosol Interaction and Precipitation Enhancement Experiment (CAIPEEX) was a systematic scientific investigation to quantify if there were any benefits from cloud seeding. For that it actually studied the interior world of clouds, its physics, and water droplet formation for nearly a decade after which from 2017-2019 they physically identified, using radar and other instruments, clouds that were suitable for seeding.

This experiment was conducted over a drought prone region called Solapur, Maharashtra, and hence a natural test ground to measure enhancement (if there was any). Once the clouds were identified they flew aircraft and fired flares of calcium chloride (no silver iodide used) into some clouds and left others 'unseeded.' Their overall finding was that Solapur got an extra 867 million litres of water – which is considerable. In terms of rainfall measured on the ground: seeded clouds gave an average 46% more rain at the seeded locations relative to the unseeded ones.

Over a 100 square km area downwind, there was 18% more rain in the seed versus unseeded.

What happened in Delhi?

There were two flights on October 28 when IIT Kanpur flew its own plane and flared clouds. The results were disappointing with no rainfall triggered, though researchers at IITK said that some parts of Delhi reported a 'light drizzle' and a 'small improvement' in air quality. The drawback was the quality of clouds. The CAIPEEX demonstrated that only monsoon clouds which had a certain quantity of moisture could hope to yield sufficient water. Such clouds are absent in the post-monsoon over Delhi.

For seven years, there have been various proposals for seeding over Delhi that have been discouraged by scientists due to the winter atmospheric characteristics. IIT Kanpur has however said that it will continue 'trials' during this season.

THE GIST

- Cloud seeding has been around for at least three quarters of a century with mixed success.
- Cloud seeding involves spraying a salt mixture into clouds. The science is that such seeding, which is done by aircraft fitted with flares that fire the salt mixture into clouds, can induce ice or water vapour within the clouds to form water droplets.
- There were two flights on October 28 when IIT Kanpur flew its own plane and flared clouds. The results were disappointing with no rainfall triggered.

What are the challenges with

discoveries from the high seas. The treaty

ANNEXURE A/3

Can Cloud Seeding Help Tackle Delhi's Air Pollution?

A

Report

Centre for Atmospheric Sciences (CAS)

Indian Institute of Technology Delhi

New Delhi - 110016

October 2025

Prepared by (In alphabetical Order):

Aasif Ahmad Wagay, Aiswarya Ramachandran, Alice Jeeva P J, Anirudh K M, Aparna Aparajita, Ardra D, Chaithra S T, Charudatt J Puri, Debjit Paul, Dhishana P R, Emili Singha Roy, Gobinda Manna, Joswin P Joy, Pankaj Lal Sahu, Payel Kundu, Rupanjan Banerjee, Sanya Narbar, Saran Rajendran, Shreya Srivastava, Sojol Das, Subhadeep Ghosh, Tanerao Singh Sankhla, and Vasu Singh

Mentors (In alphabetical Order):

Prof. Krishna Mirle Achutarao, Prof. Sagnik Dey, Prof. Sajeev Philip, Prof. Sandeep Sukumaran, and Prof. Shahzad Gani

Executive Summary

This report assesses the atmospheric feasibility of utilizing cloud seeding as a strategy to mitigate severe winter air pollution in Delhi. A comprehensive analysis, integrating climatological data (2011-2021), aerosol-cloud interaction assessments, and pollutant washout/recovery, leads to the primary conclusion that Delhi's winter atmosphere is climatologically unsuitable for consistent and effective cloud seeding.

There is a fundamental lack of sufficient moisture and saturation during the peak pollution months (December-January), coinciding precisely when intervention is most needed. While Western Disturbances (WDs) are the primary drivers of potential seeding conditions, viable "windows of opportunity" are rare, confined to specific anomalous events. Even on days identified as potentially promising (e.g., cloudy WD days without rain), a multi-criteria Moisture Suitability Index (MSI) indicates they frequently lack the necessary combination of moisture depth, saturation, and atmospheric lift required for successful seeding.

Furthermore, the study highlights complexities arising from Delhi's high aerosol environment. High aerosol loading (characterized by high Aerosol Optical Depth; AOD) is associated with increased cloud cover and higher liquid/ice water content, particularly during rainy conditions. However, favorable microphysical conditions (low cloud base, high water content) often coincide with naturally occurring precipitation, limiting the potential added benefit of seeding. The vertical separation between the shallow aerosol layer (below 2 km) and typical seedable cloud layers (2-5 km) also presents significant operational targeting challenges. Thermally, glaciogenic seeding appears potentially viable during core winter, but operational feasibility seems restricted to existing rainy conditions.

Regarding pollution removal, the analysis confirms that heavy natural rainfall is highly effective (>80-95% washout for $PM_{2.5}$, PM_{10}, NO_X), while light rain offers minimal impact. Importantly, even after significant washout, air quality improvements are short-lived, with pollutant concentrations typically recovering to pre-event levels within 1-5 days due to persistent emissions. Ozone concentrations often increase post-rainfall. While dry WDs provide some limited ventilation, significant concerns remain regarding the environmental/health impacts of seeding agents like AgI, high operational costs, and scientific uncertainties.

Given these constraints, cloud seeding cannot be recommended as a primary or reliable strategy for Delhi's winter air pollution management. It should be viewed, at best, as a potential high-cost,

emergency short-term measure, contingent on stringent forecasting criteria. The study underscores that sustained emission reduction remains the most viable and necessary long-term solution.

Disclosure: This study and report were produced during a Hackathon on the topic held between 13-15 October 2025 at the Centre for Atmospheric Sciences (CAS) IIT Delhi. The participants were PhD students at CAS who received mentorship from CAS faculty. This study has not been through any peer review at this time. Artificial intelligence (AI) language models were utilized during the preparation of this report.

Contact for Further Details:

Head,
Centre for Atmospheric Sciences
Indian Institute of Technology Delhi
Hauz Khas, New Delhi 110016
Email: hodcas@admin.iitd.ac.in

Background

The National Capital Region (NCR) of India, centred around Delhi, faces an escalating air quality crisis, particularly during the winter months (October-February). High emission rates from diverse sources - including vehicular traffic, industrial activities, construction dust, agricultural biomass burning, and residential heating - combine with unfavorable meteorological conditions to create prolonged episodes of severe pollution. Winter meteorology is characterized by low temperatures, weak winds, frequent thermal inversions, and a shallow planetary boundary layer (PBL), which collectively trap pollutants near the surface, leading to hazardous concentrations of particulate matter (PM2.5, PM10) and other harmful substances often exceeding international health guidelines manifold.

Historically, the primary natural mechanism for cleansing Delhi's atmosphere during winter has been precipitation associated with the passage of Western Disturbances (WDs). These synoptic-scale weather systems, originating in the Mediterranean region, travel eastward and bring moisture into Northwest India. Sufficiently strong WDs can induce widespread light-to-moderate rainfall, which effectively scavenges airborne pollutants through processes like nucleation scavenging within clouds and impaction scavenging below clouds. Studies have shown significant improvements in air quality following such rain events.

However, the frequency and intensity of rain-bearing WDs are variable, and recent climate projections suggest a potential decline in their occurrence, raising concerns about the future reliability of this natural cleansing process. Furthermore, many WDs are weak or dry, bringing cloud cover and humidity but failing to produce substantial rainfall, sometimes even exacerbating pollution by strengthening temperature inversions. The inability of the atmosphere to naturally cleanse itself frequently during peak pollution periods underscores the need to explore alternative mitigation strategies.

Cloud seeding emerges as one such potential intervention. It is a form of weather modification that aims to enhance precipitation from existing clouds by introducing artificial aerosol particles that can act as efficient Cloud Condensation Nuclei (CCN) or Ice Nucleating Particles (INP). Common methods include hygroscopic seeding (using salts like NaCl or $CaCl_2$ in warm clouds to accelerate droplet coalescence) and glaciogenic seeding (using agents like silver iodide (AgI) or dry ice in cold clouds containing supercooled water to promote ice crystal formation). While primarily developed and operationally used for augmenting water supplies in arid and semi-arid

regions, including extensive programs in India, the potential application of cloud seeding for air pollution reduction via enhanced wet deposition is a relatively new but increasingly relevant area of investigation. The severe air quality situation in Delhi, coupled with the known effectiveness of natural rain in clearing pollutants, makes it an important test case for assessing the feasibility of this approach. This report evaluates the atmospheric conditions necessary for successful cloud seeding during Delhi's winter, examines the influence of the region's high aerosol loading on cloud properties, and analyses the efficiency and longevity of pollutant removal by precipitation, providing an assessment of whether cloud seeding can be a viable tool in tackling the city's air pollution crisis.

List of Abbreviations

AgI: Silver Iodide

AOD: Aerosol Optical Depth

CAAQMS: Continuous Ambient Air Quality Monitoring Stations

CAPE: Convective Available Potential Energy

CBH: Cloud Base Height

CC: Cloud Cover

CCN: Cloud Condensation Nuclei

CDNC: Cloud Droplet Number Concentration

CPCB: Central Pollution Control Board

GCCN: Giant Cloud Condensation Nuclei

IN: Ice Nuclei

INP: Ice Nucleating Particles

LWC: Liquid Water Content

MSI: Moisture Suitability Index

NCR: National Capital Region

NOX: Nitrogen Oxides (NO & NO_2)

NWDNR: Non-Western Disturbance Non-Rainy Days

NWDR: Non-Western Disturbance Rainy Days

PBL: Planetary Boundary Layer

PM2.5: Particulate Matter with aerodynamic diameter ≤ 2.5 μm

PM10: Particulate Matter with aerodynamic diameter ≤ 10 μm

RH: Relative Humidity

SNA: Sulfate, Nitrate, Ammonium

TCWV: Total Column Water Vapour

WD: Western Disturbances

WDNR: Western Disturbance Non-Rainy Days

WDR: Western Disturbance Rainy Days

Table of Contents

1. Assessment of Atmospheric Moisture, Dynamics and Thermodynamics

1.1 Introduction

Water scarcity and severe air pollution are among the most critical environmental challenges facing urban centres worldwide, particularly in megacities such as New Delhi. Natural precipitation plays an important role in both problems; it replenishes water resources and effectively removes pollutants from the atmosphere through washout. Given the significance of rainfall, weather modification through cloud seeding has long been explored as a potential tool for augmenting water supplies, especially in drought-prone regions. The primary methods of cloud seeding (static, dynamic, and hygroscopic) have a long history of application in India for drought mitigation (Malik et al., 2018). These techniques aim to enhance a cloud's natural precipitation efficiency by introducing specific aerosol particles, such as silver iodide or hygroscopic salts, to alter its microphysical processes (Malik et al., 2018).

Despite its long history and continued use in operational programs worldwide, cloud seeding remains a scientifically contentious field. As highlighted in a foundational review by Bruintjes (1999), definitively proving the effectiveness of any seeding operation is inherently difficult. The immense natural variability of cloud systems makes it challenging to distinguish a modest, human-induced effect from what would have occurred naturally, a problem often referred to as the "black box" of weather modification (Bruintjes, 1999). This persistent uncertainty has led to a divide between the operational needs of water managers and the rigorous level of proof required by the scientific community. Malik et al. (2018) present a balanced perspective, framing cloud seeding as a potentially valuable tool for water resource management while also emphasising its environmental implications, high operational costs, and the continuing lack of conclusive scientific evidence for its effectiveness.

In Delhi, the context is further complicated by unique winter meteorological conditions and a severe, recurring air pollution crisis. Winter (late October-February) is characterised by low temperatures (falling to 3°C in January) for Delhi, scarce rainfall primarily dominated by WDs, and northwesterly winds. This winter rainfall constitutes around 15% of the yearly precipitation over northwest India, crucial for the rabi crop (Yadav et al., 2012). Delhi's winter rainfall is relatively scarce and primarily associated with WDs traversing the Himalayas, bringing occasional light to moderate precipitation (Hunt et al., 2025). Critically, a shallow planetary boundary layer

(PBL) often forms due to severe thermal inversions, trapping pollutants and leading to severe air pollution episodes (Arun et al., 2018; Murthy et al., 2020). Thermodynamic conditions exhibit weak instability due to these inversions, with low Convective Available Potential Energy (CAPE) values compared to summer, highlighting WDs as the primary synoptic driver for winter precipitation (Kumar et al., 2024).

For decades, strong WDs bringing widespread rain have been the city's primary natural cleansing mechanism, effectively scavenging pollutants like PM2.5 (Particulate Matter with aerodynamic diameter $\leq$ 2.5 μm) and PM10 (Particulate Matter with aerodynamic diameter $\leq$ 10 μm) and improving air quality (Hunt et al., 2025; Xie et al., 2024). The efficiency of this washout increases with rainfall intensity and duration (Chowdhury et al., 2016; Luan et al., 2019; Roy et al., 2019). However, recent climate projections show a robust declining trend in WD frequency, suggesting this natural cleansing mechanism is becoming less reliable (Hunt et al., 2019). Furthermore, many WDs are "weak" or "dry", increasing cloud cover and humidity but failing to produce sufficient rain, sometimes worsening pollution by strengthening inversions.

This confluence of severe air pollution and the declining reliability of natural cleansing mechanisms has intensified interest in exploring artificial solutions like cloud seeding in Delhi. The growing understanding of how anthropogenic air pollution itself impacts clouds adds another dimension. Research by Givati and Rosenfeld (2005) established that air pollution (by adding numerous small CCN) can suppress natural precipitation, paradoxically suggesting that these same polluted clouds might be more susceptible to enhancement through seeding, which aims to counteract this suppression effect. This has opened a new frontier for cloud seeding research: its direct application as an air quality improvement tool. Theoretical models (Agrawal et al., 2024) and preliminary field experiments (Ku et al., 2023) suggest seeding can enhance rainfall to mitigate pollutant concentrations. Pilot projects, such as one initiated by IIT Kanpur, are exploring this potential for Delhi's winter. While concerns about cost and the environmental impact of seeding agents like silver iodide remain (Fajardo et al., 2016), the scale of Delhi's public health crisis necessitates investigating cloud seeding as a potential emergency response tool, rather than a permanent solution.

However, the success of any seeding operation is fundamentally constrained by pre-existing atmospheric conditions. For seeding to be viable, a "window of opportunity" must exist, characterised by sufficient atmospheric moisture, favourable cloud dynamics (including cloud condensation nuclei characteristics), and an environment conducive to precipitation growth.

Critical knowledge gaps remain in systematically assessing these conditions, identifying days with moisture and cloud cover comparable to naturally rainy days (>7.5mm), and understanding pollutant recovery dynamics post-rainfall, especially during Delhi's severe pollution episodes. This chapter analyses the winter climatology of key atmospheric variables over Delhi and develops the MSI to quantify the frequency of conducive conditions and identifies days with moisture content and cloud cover comparable to those experiencing natural moderate to heavy rainfall (>7.5mm).

1.2 Data and Methods

1.2.1 Study Region

The analysis focuses on two nested geographical domains (Figure 1):

- An inner domain centred directly over Delhi (28.4°-29°N, 76.8°-77.4°E), used for detailed local analysis.
- A broader outer domain covering the larger North Indian plains (27°-32°N, 74°-81°E), used to analyse the synoptic-scale weather patterns that influence the region, such as Western Disturbances.

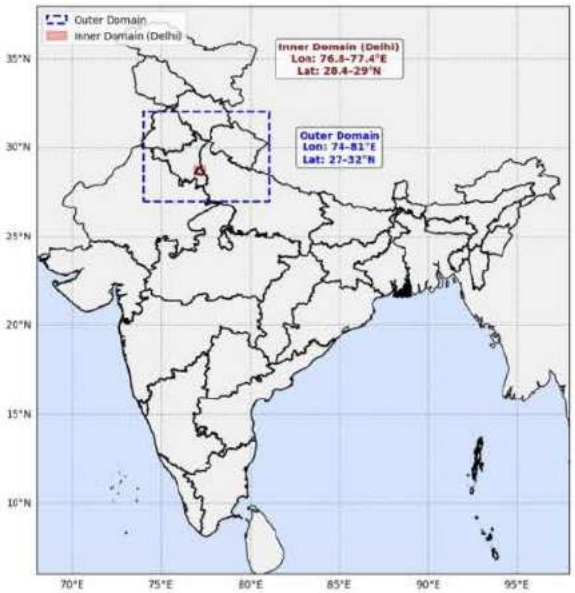


Figure 1:Study area.

We considered a domain that covers the entire Delhi-NCR region for the study. We selected only those WDs that could potentially influence the NCR region by considering NCR as the centre and applying a 1000 km buffer around it, corresponding to the characteristic spatial scale of a WD, which typically has a diameter of about 1000 km (Hunt et al., 2018).

1.2.2 Data and Variables

The primary data source for this research is the ERA5 global atmospheric reanalysis dataset, produced by the European Centre for Medium-Range Weather Forecasts (ECMWF). We utilise hourly data with a spatial resolution of 0.25° x 0.25° for the winter months (October through February) spanning a decadal period from 2011 to 2021.

We use the following atmospheric variables for the analysis.

- Total Column Water Vapour (TCWV): Represents the total integrated amount of water vapour in a vertical column of the atmosphere (mm), providing a measure of the depth and overall size of the moisture reservoir.
- Temperature (t): Used to determine the thermal properties of the atmospheric layer, which is critical for identifying whether conditions are suitable for warm-cloud (hygroscopic) or cold-cloud (glaciogenic) seeding.
- Relative Humidity (r): This percentage value indicates the air's proximity to saturation, a direct requirement for cloud droplet formation and persistence.
- Specific Cloud Liquid Water Content (CLWC): This measures the mass of liquid water droplets (g/kg) already present in the cloud. A non-zero value is critical as it represents the actual "seedable medium" that seeding agents would interact with.
- Vertical Velocity (omega): This variable measures large-scale atmospheric motion (Pa/s). A negative value indicates rising air (lift), which drives cloud development and is essential for a successful seeding operation.

Humidity data used to calculate column integrated humidity was obtained from the ERA5 global reanalysis with resolution 0.25° x 0.25° (Hersbach et al., 2020).

1.2.3 Methods

Climatological Baseline

A long-term climatology was first established for each variable by calculating the monthly mean for all winter months over the 2011-2021 period. This baseline represents the "normal" atmospheric state for Delhi's winters and serves as a reference against which specific weather events can be compared.

The Moisture Suitability Index (MSI)

The MSI is a 5-point scoring system applied to daily-averaged data. For each day in the study period, a score is calculated by awarding one point for each of the following six criteria that are met:

1. Presence of Cloud for Seeding: Cloud Fraction >= 0.25.
2. Saturation check: Relative Humidity (RH) averaged between 850 hPa and 600 hPa > 60%.
3. Fuel check: Liquid Water Content (LWC, at 850 hPa) > 0.5 g m^{-3} .
4. Level of freezing: 0°C line should be at 700 hPa or above.
5. Lift Check: Vertical velocity (w) at 850 hPa > 1.5 m s^{-1}.

Days are then categorised based on their final score. The final output is a quantitative summary detailing the frequency of suitable days, providing a robust, multi-faceted assessment of cloud seeding potential.

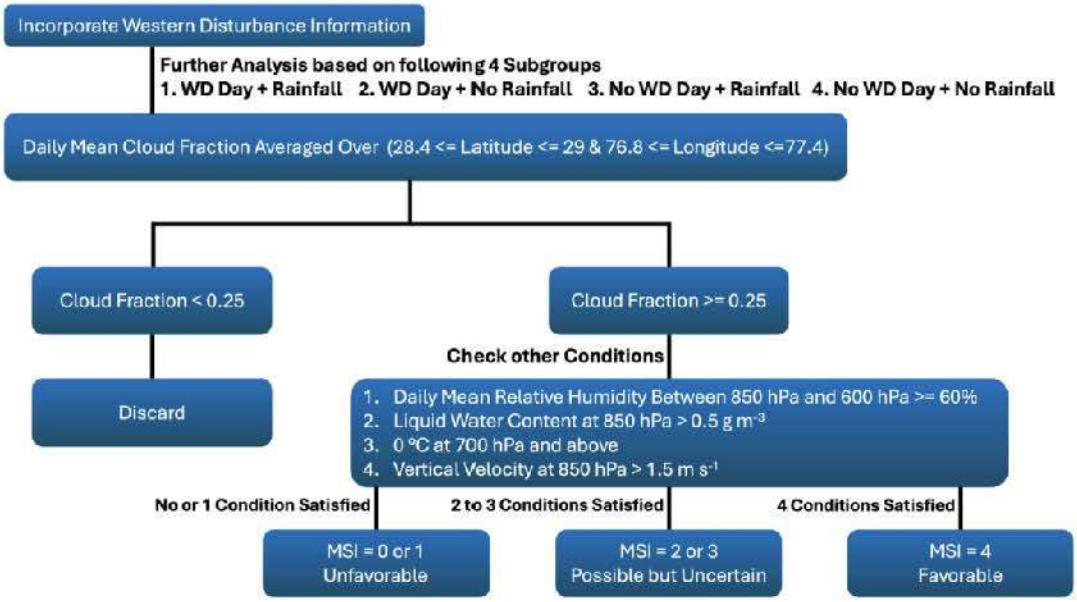


Figure 2: Flowchart for the calculation of MSI. The flowchart also shows the meteorological parameters considered and their corresponding thresholds.

Classification of Western Disturbances and Rainfall Intensity

The WDs whose tracks passed through this box between the months of October to February for the years 2011-2021 were selected. The WD tracks were obtained from Hunt et al. (2018). The identified WDs were then classified into rain-inducing and dry WDs.

The rainy days during the study period were classified as either WD-associated or locally induced, using the India Meteorological Department (IMD) daily gridded (0.25°x0.25°) rainfall data (Pai et al., 2014). The rainy days were further classified into light rainy days, which received rainfall less than 7.5mm and moderate to heavy rainy days (received more than 7.5mm rainfall) based on the rainfall intensity classification by IMD (https://imdpune.gov.in/Reports/glossary.pdf). The light rainy days were considered further to account for the possibility of rainfall enhancement by cloud seeding, and to find the days that are suitable for cloud seeding. The non-rainy days within the study period were filtered to find the days with moisture greater than the lower quartile of the moisture distribution of the rainy days.

The non-rainy days and light rain days with conditions conducive for cloud seeding were selected by defining thresholds for column-integrated specific humidity (q_int) from 100hPa to 300hPa and total cloud cover (CC). Days whose values of q_int and CC exceeded these thresholds were identified. The threshold for q_int and CC were defined as the values that divide the rainfall days into the 25th percentile (Figure 13, 14 and 15).

1.3 Results

1.3.1 Climatological Characteristics of Winter Months (Oct-Feb) Atmospheric Conditions over Delhi

Total Column Water Vapour

Figure 3 provides the climatological baseline for Total Column Water Vapour (TCWV) during Delhi's winter, revealing crucial patterns for assessing cloud seeding feasibility. A prominent seasonal drying trend is evident: October, retaining post-monsoon moisture, is the wettest month with TCWV often exceeding 15-18 mm. Moisture progressively decreases through November and December, with average values over Delhi dropping to 9-12 mm. January marks the climatological minimum, where TCWV across most of the region, including Delhi, falls below 9 mm, frequently

into the 3-6 mm range. A slight moisture increase occurs in February, likely associated with early Western Disturbances.

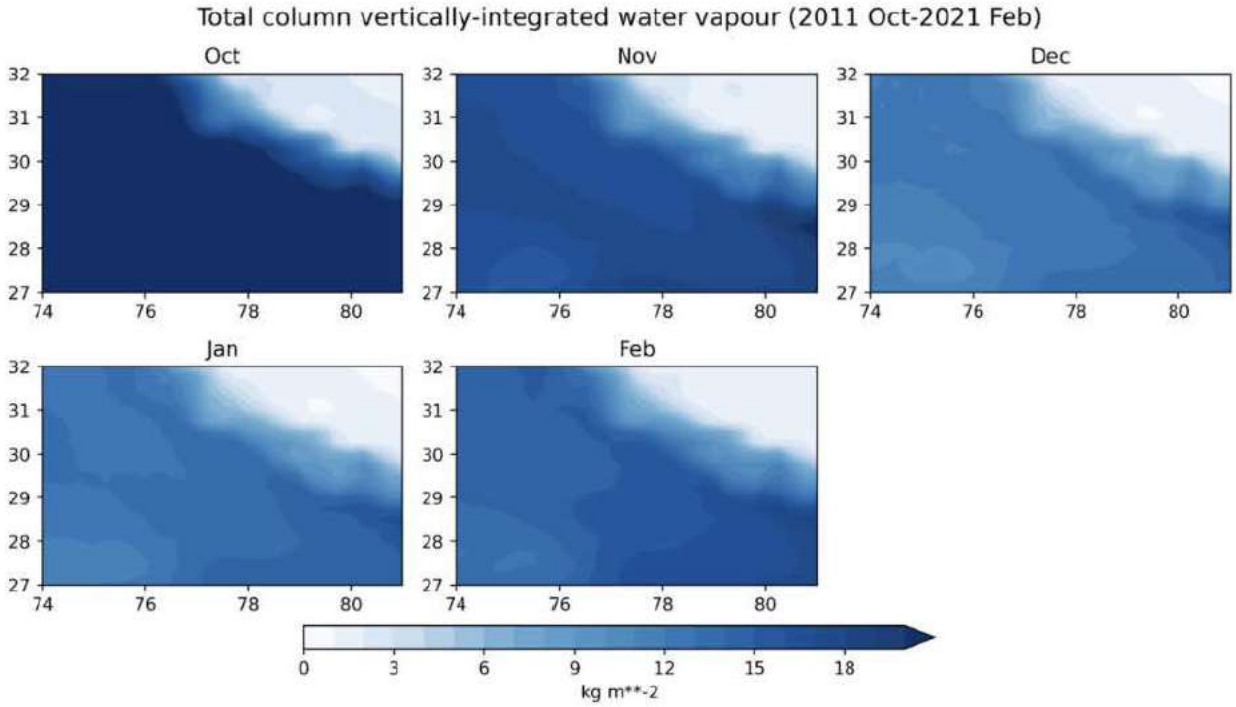


Figure 3: Monthly Climatology of TCWV over North India for winter months (October-February) from 2011 to 2021.

Alongside this seasonal change, a consistent spatial moisture gradient exists, oriented from the drier northwest (towards Punjab/Rajasthan) to the wetter southeast (towards Uttar Pradesh/Himalayan foothills, influenced by Bay of Bengal moisture and orographic effects). Delhi's location within this gradient subjects it to variable moisture depending on synoptic flow. Crucially, this analysis highlights that the period experiencing the most severe air pollution (December and January) coincides precisely with the driest atmospheric conditions. The average TCWV during these months falls significantly below typical thresholds considered necessary for successful cloud seeding, strongly suggesting that favourable conditions are not the norm. Therefore, viable opportunities for precipitation enhancement would likely be restricted to anomalous weather events, primarily strong Western Disturbances, capable of temporarily injecting sufficient moisture into the region to overcome the prevailing dry winter baseline.

Figure 4 shows the average diurnal cycle of TCWV over the study region, characterized by a consistent pattern across winter months. Driven by solar radiation, moisture levels typically reach a minimum in the early morning and peak in the early afternoon before declining. This analysis strongly reinforces the seasonal drying trend, with October being the moistest and

December/January the driest, showing clear separation in absolute TCWV values even between the daily maximums and minimums of different months. Notably, the inner domain (Delhi) is consistently moister than the broader outer domain, potentially due to local factors. While the diurnal peak in the early afternoon represents the most likely time for potential seeding, a significant challenge remains: even at this daily maximum, the absolute TCWV during the core winter months (December/January, ~10-13 mm) consistently falls below conservative thresholds for effective cloud seeding. This reinforces the conclusion that suitable conditions are likely anomalous rather than typical for Delhi's winter.

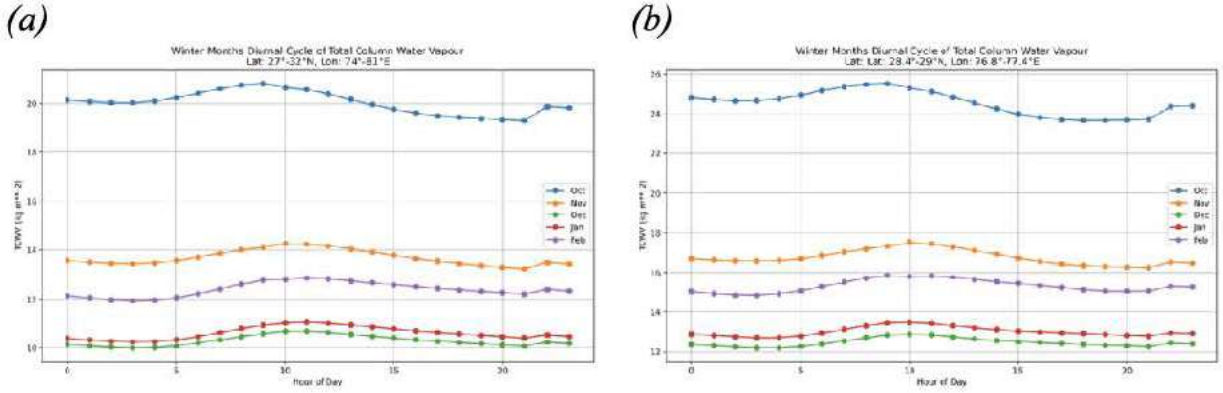


Figure 4: Mean diurnal cycle of TCWV for winter months (2011-2021) over (a) the inner Delhi domain (top panel) and (b) the broader outer domain (bottom panel). The plots show the spatially averaged TCWV (in kg m^{-2}) for each hour of the day (in UTC), illustrating the daily moisture pattern for each month.

Temperature

Figures 5 and 6 reveal the winter thermal structure over the study region, highlighting expected seasonal cooling (warmest in October, coldest in January) and a standard vertical temperature lapse rate, alongside a cooler northeastern spatial gradient. This thermal analysis is crucial for determining feasible cloud seeding strategies. The 850 hPa temperature shows a distinct seasonal transition: in October and November, it is consistently above freezing (0°C), defining a "warm cloud" environment suitable only for hygroscopic seeding. However, during the core winter months of December and January, the average 850 hPa temperature drops at or below freezing, creating the potential for supercooled liquid water. This shift makes glaciogenic (cold cloud) seeding theoretically possible during deep winter, contingent on the presence of sufficient cloud liquid water.

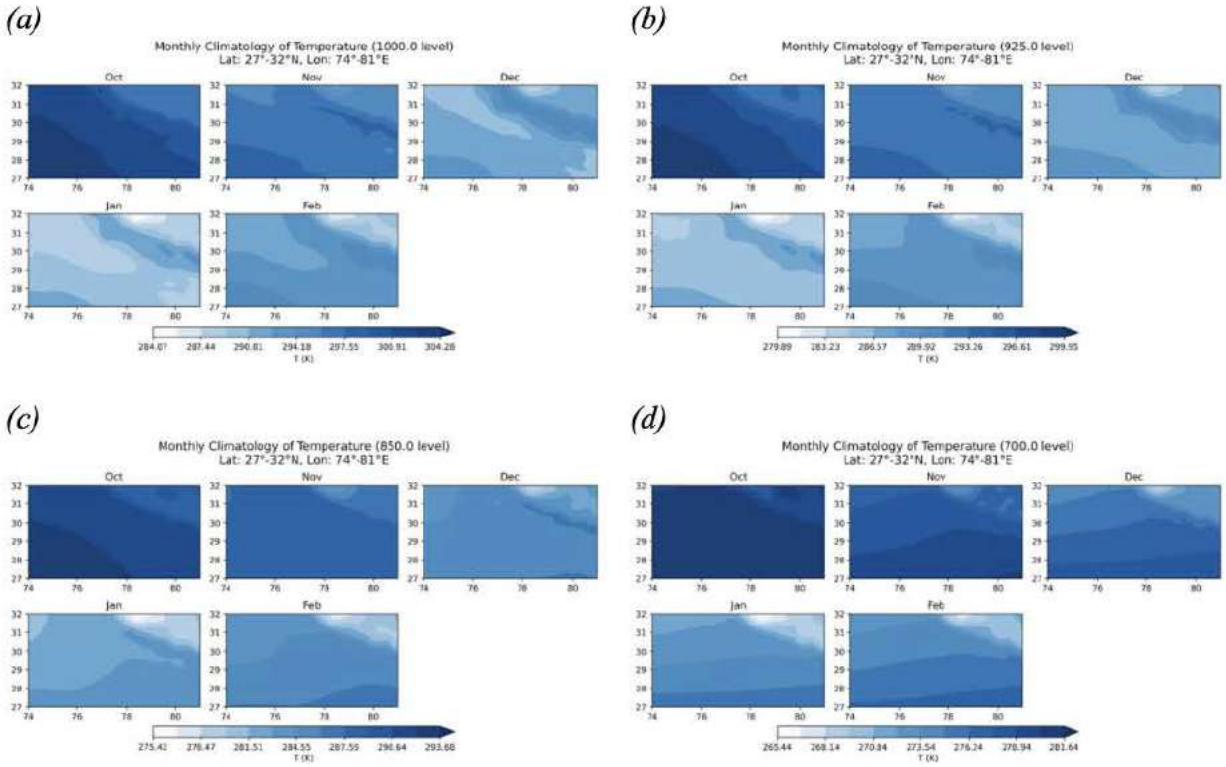


Figure 5: Monthly Climatology of temperature over North India for winter months (October-February) from 2011 to 2021. The panels show the long-term average spatial distribution of temperature (in Kelvin) at four different pressure levels: (a) 1000 hPa, (b) 925 hPa, (c) 850 hPa, and (d) 700 hPa.

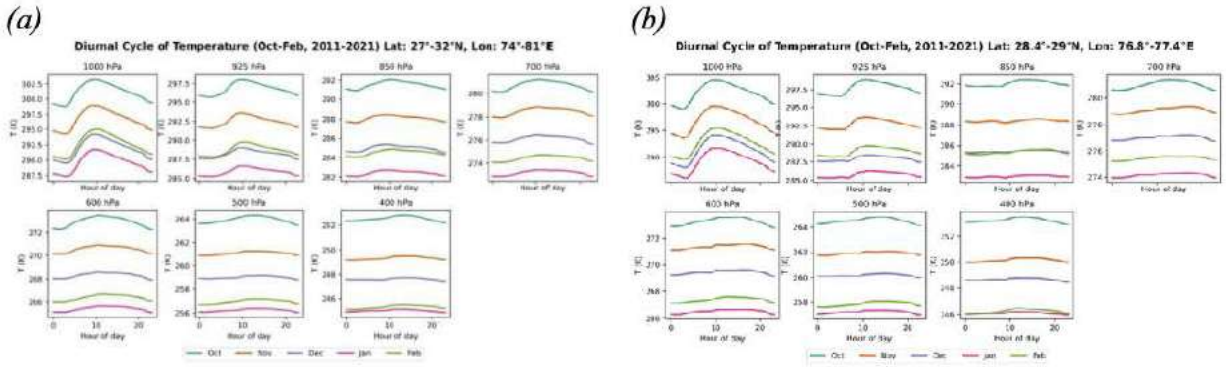


Figure 6: Mean diurnal cycle of Temperature (T) for the winter months (October-February) from 2011 to 2021. The panels show the average daily temperature pattern (in Kelvin) at various pressure levels for (a) the broader outer domain and (b) the inner Delhi domain. Each subplot corresponds to a specific pressure level, with colored lines representing the spatially averaged temperature for each hour of the day (UTC).

The diurnal temperature cycle (Figure 6), driven by solar heating, is a strong surface-level phenomenon with a 5-6 K range but weakens rapidly with altitude, becoming negligible at key cloud-forming levels like 850 hPa and above. At these altitudes, temperatures remain nearly constant throughout the day, primarily governed by the larger seasonal trend. This indicates that while moisture might peak in the afternoon, the critical thermal conditions dictating the

appropriate seeding methodology (hygroscopic vs. glaciogenic) are stable throughout the day and depend mainly on the specific winter month.

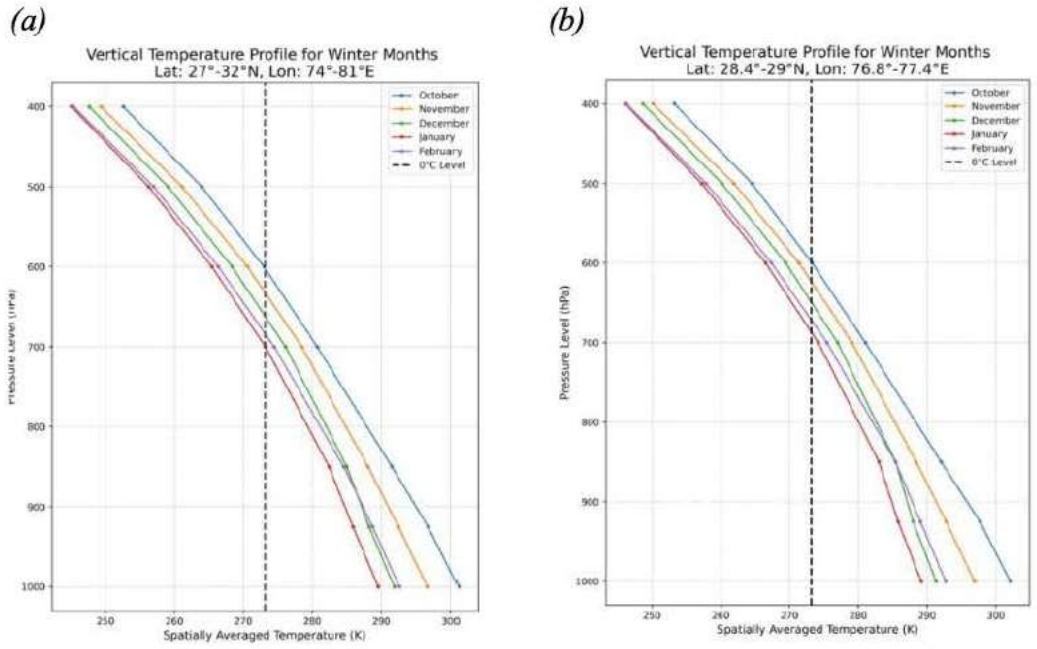


Figure 7: Vertical profiles of spatially averaged Temperature (T) for winter months (2011-2021). The plots show the change in mean temperature (K) with pressure level (hPa) for (a) the inner Delhi domain and (b) the broader outer domain. The dashed vertical line indicates the 0°C (273.15 K) freezing level.

The vertical temperature profiles (Figure 7) illustrate the atmosphere's thermal structure, showing a standard lapse rate and systematic cooling from October to a minimum in January. This seasonal evolution critically affects the height of the freezing level, which directly dictates the appropriate cloud seeding methodology. In early winter (Oct-Nov), the high freezing level ensures the 850 hPa layer is well above 0°C, classifying clouds as "warm" and making only hygroscopic seeding viable. Conversely, during core winter (Dec-Jan), the freezing level descends below 800 hPa, meaning the atmosphere at 850 hPa and above is, on average, below freezing; this creates the necessary thermal condition for supercooled liquid water, making glaciogenic (cold cloud) seeding theoretically possible, provided sufficient supercooled water exists.

Relative Humidity

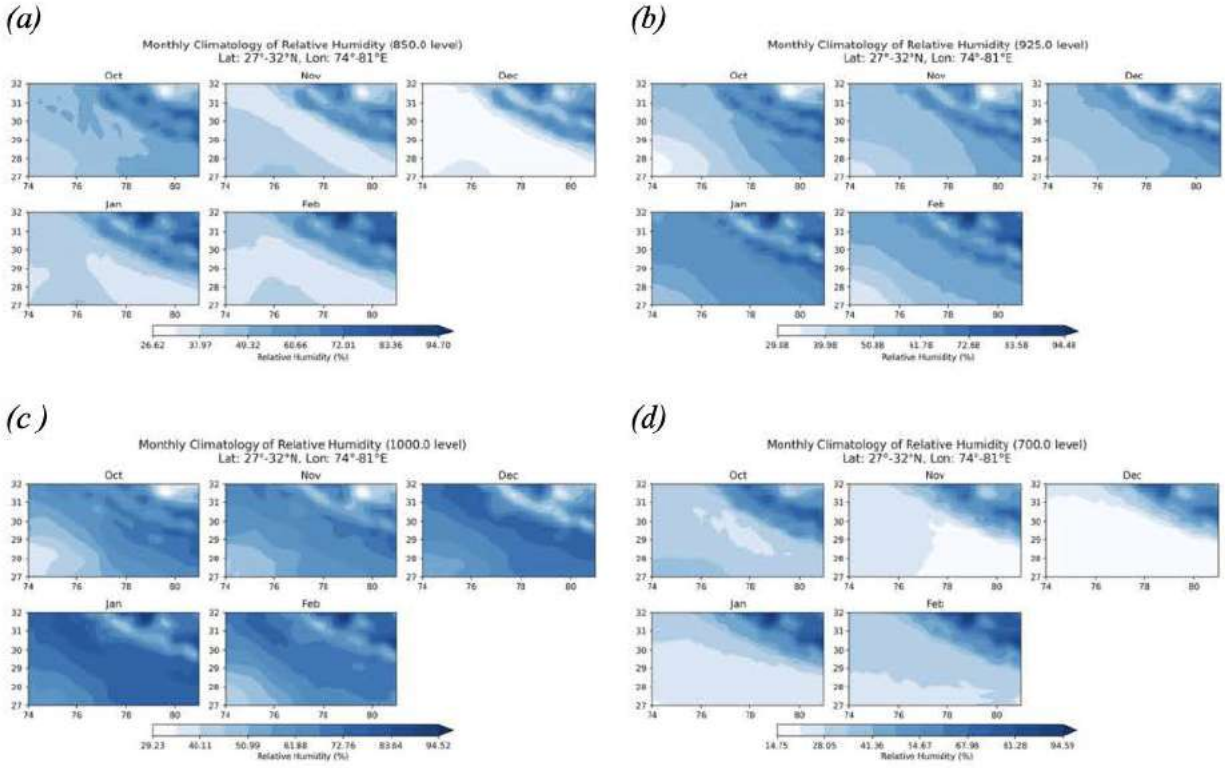


Figure 8: Monthly Climatology of Relative Humidity over North India for winter months (October-February) from 2011 to 2021. The panels show the long-term average spatial distribution of relative humidity (in %) at four different pressure levels: (a) 1000 hPa, (b) 925 hPa, (c) 850 hPa, and (d) 700 hPa.

The climatology of relative humidity (Figure 8) shows that the atmosphere over the region is, on average, far from saturation during the peak winter months. Spatially, the highest relative humidity is consistently found along the northeastern part of the domain, near the Himalayan foothills, where orographic lift forces air to cool and approach saturation. Seasonally, there is a significant drying trend from a relatively moist October to a much drier November and December, followed by a slight increase in January and February. The analysis of the 850 hPa level, which is critical for the MSI's "Saturation Check", is particularly showing. During the core winter months of December and January, the average relative humidity over most of the domain, including the Delhi region, is climatologically in the 50-70% range. This is well below the 80% threshold required for a successful Saturation Check, indicating that on a typical winter day, the air is too dry to support the formation and persistence of seedable clouds.

The diurnal variation of relative humidity (Figure 9) is a distinct boundary-layer feature that varies inversely with the daily temperature cycle. At the surface (1000 hPa), relative humidity is at its

maximum during the cool early morning hours and drops to a minimum during the warm afternoon. This strong daily swing weakens significantly with altitude, becoming much less defined by the 850 hPa level. Importantly, at this cloud-forming altitude, the average relative humidity during the core winter months of December and January consistently remains low, ranging between 40-60% in the outer domain and only slightly higher in the inner domain. These values are well below the 80% threshold required by the MSI's "Saturation Check," reinforcing the conclusion that the atmosphere is, on average, too dry to support cloud formation, even during its most humid part of the day.

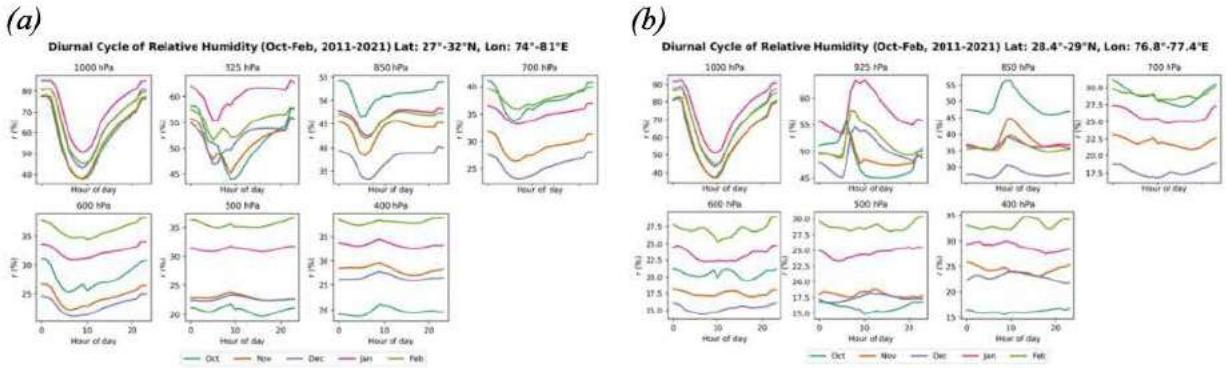


Figure 9: Mean diurnal cycle of RH for the winter months (October-February) from 2011 to 2021. The panels show the average daily pattern at various pressure levels for (a) the inner Delhi domain and (b) the broader outer domain. Each subplot corresponds to a specific pressure level, with colored lines representing the spatially averaged rh (in %) for each hour of the day.

The vertical profiles of relative humidity (Figure 10) exhibit a more intricate structure than those of other variables, characterised by alternating layers of moisture and dryness. Rather than showing a simple decrease with altitude, the profiles reveal a relatively moist boundary layer capped by a markedly drier mid-troposphere. Across all months, relative humidity is highest near the surface (1000-900 hPa) and decreases sharply to a minimum around 850 hPa. Above this dry layer, a modest recovery is often observed in the mid-troposphere (approximately 700-600 hPa).

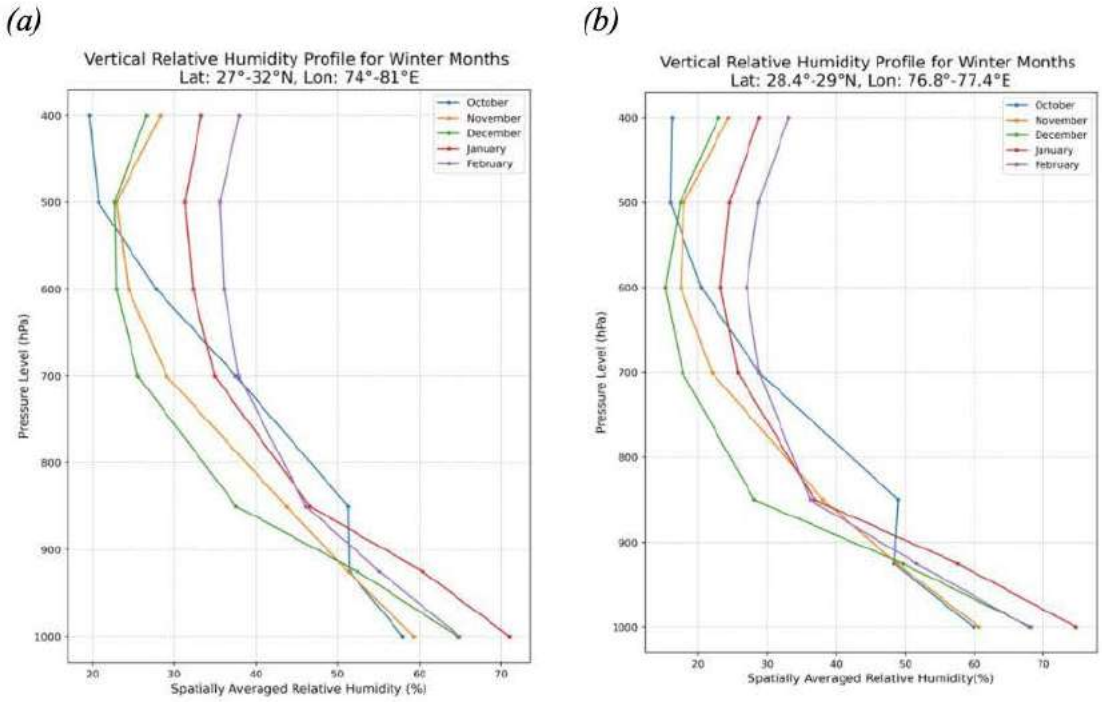


*Figure 10: Vertical profiles of spatially-averaged RH for winter months (2011-2021). The plots show the change in mean relative humidity (%) with pressure level (hPa) for (a) the broader outer domain and (b) the inner Delh*i domain.

This vertical configuration has important implications for the Saturation Check (RH > 80%) component of the MSI. The analysis indicates that at the key cloud-forming level of 850 hPa, the atmosphere is climatologically at its driest point within the lower troposphere. During the core winter months of December and January, the mean relative humidity at this level remains exceptionally low, typically between 40% and 55%. These values are well below the 80% threshold required for the formation of seedable clouds, clearly suggesting that the atmosphere is, on average, too far from saturation to support such operations.

1.3.2. Quantifying Potential Seeding Opportunities

Analysis of Rainfall Events and Seeding Suitability

A total of 137 rainfall events were found during the period of study. WD-induced rainfall events constituted 112 of the total rainfall events and the rest 34 were non-WD-induced rainfall events (Figure 11). This shows that during winter, the probability of rain without the influence of WD is

low. The mean of vertically integrated specific humidity (1000hPa- 300hPa) of rainy days was 29.98 kg/m^2 and 19.99 kg/m^2 for non-rainy days (Figure 11).

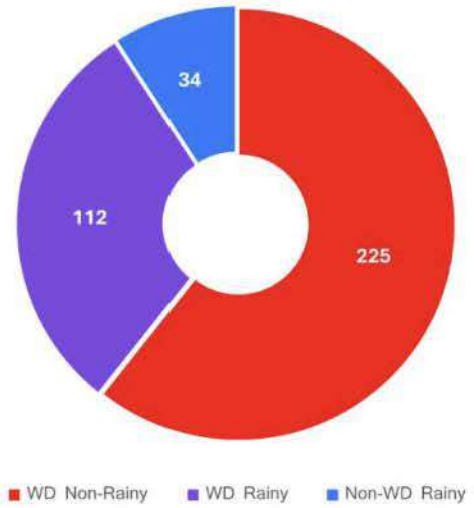


Figure 11: Pie chart showing the number of WD-induced and non-WD rainfall during the study period

To explore the suitable conditions for cloud seeding, non-rainy and light-rain days were analyzed for thermodynamic and cloud conditions. Thresholds for column-integrated specific humidity (q_{int}) and CC were defined as the 25th percentile values from all rainy days (Figs. 13-15). Days exceeding both thresholds were considered potentially suitable for cloud seeding. Using this approach, 92 days during the study period were identified as having moisture and cloud conditions comparable to moderate-to-heavy rainfall days (>7.5 mm). These days exhibit promising atmospheric conditions and therefore represent better opportunities for cloud-seeding interventions during winter compared to other non-rainy or light-rain days.

Number of Seedable Days in Each Month

This section quantifies the frequency of potentially "seedable" days by analysing the occurrence of cloudy days during the winter season. Using cloud fraction as a proxy for cloud cover, Figure 16 categorises the number of days meeting various cloud fraction thresholds (0.25, 0.5, and 0.75). The days are further classified based on the presence of a WD-the primary synoptic system for winter precipitation, whether rainfall occurred over Delhi.

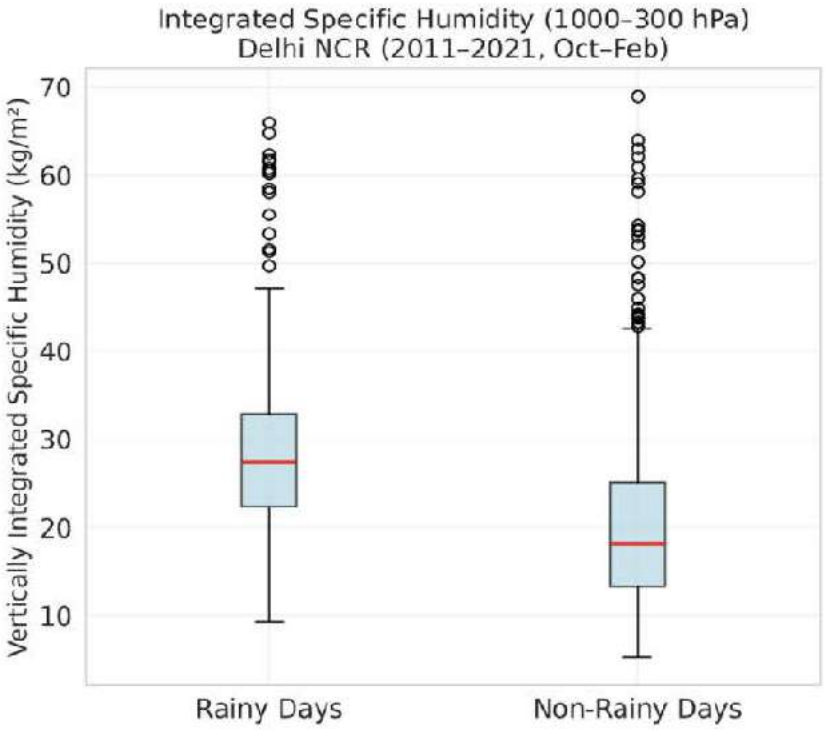


Figure 12: Vertically integrated specific humidity (kg/m^2) for rainy and non-rainy days

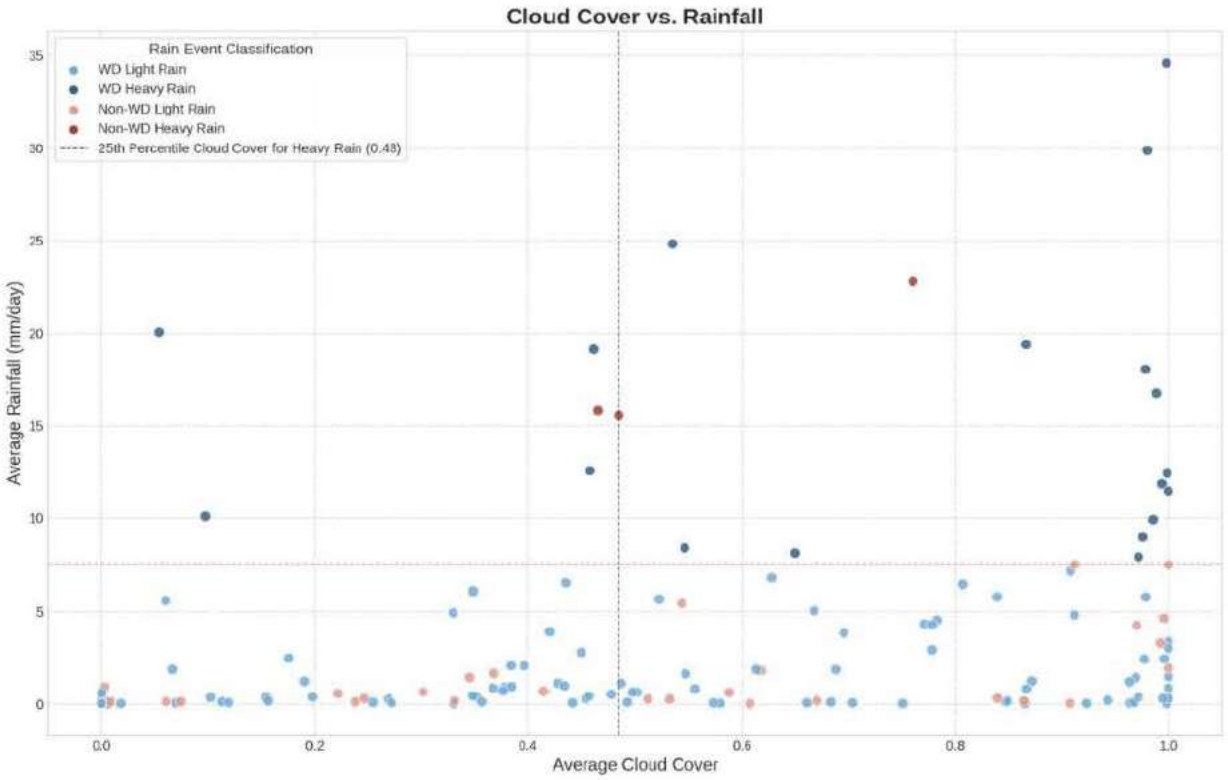


Figure 13: Scatter plot of rainfall vs average cloud cover fraction

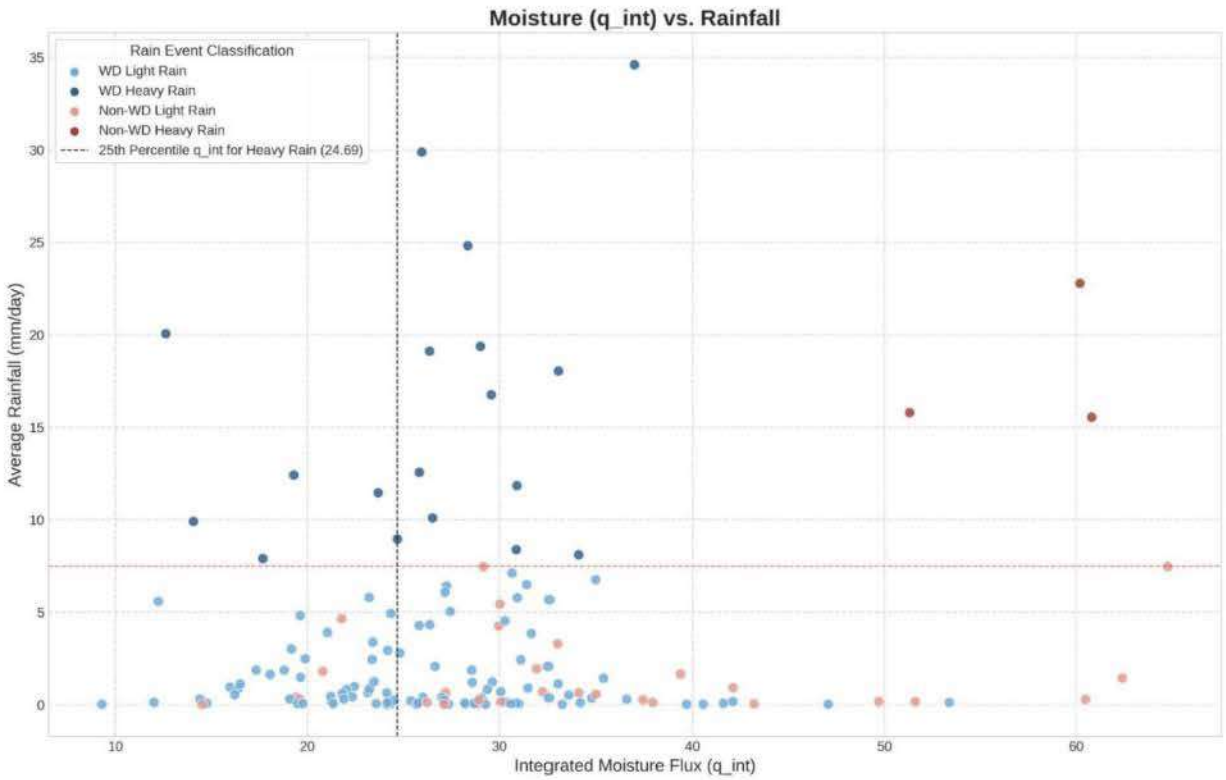


Figure 14: Scatter plot of moisture(q_int) vs rainfall

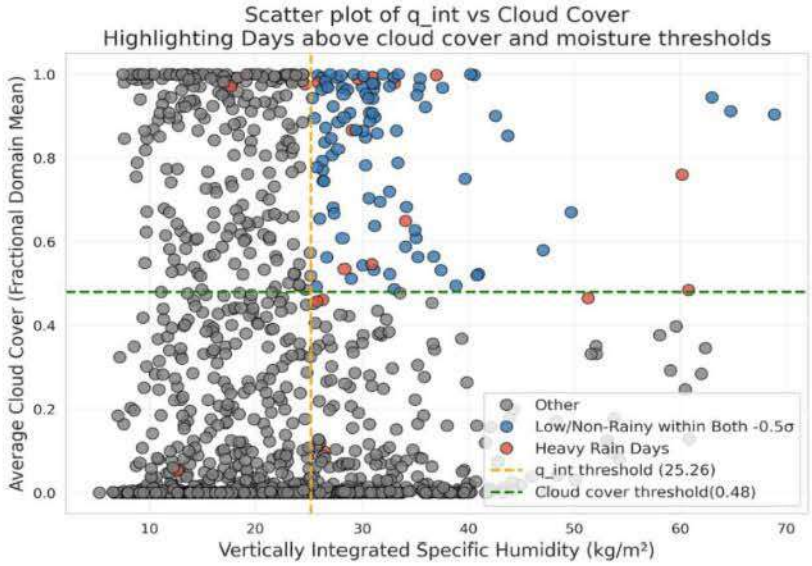


Figure 15: Scatter plot of moisture (q_int) vs average cloud cover fraction

The monthly distribution of cloudy days over Delhi reveals a distinct seasonal increase from October to February, peaking in January and February, and is strongly controlled by synoptic activity associated with WDs. Overall, while days with cloud fraction >0.25 are frequent (often >100 per month), the number decreases sharply at higher thresholds (0.5, 0.75), especially outside of active WDs. The analysis confirms WDs are the dominant mechanism for winter rainfall,

evidenced by the high number of rainy days during WD events (e.g., 38 in both Jan and Feb) compared to the infrequent non-WD rainy days. Conversely, the majority of cloudy but non-precipitating days occur without WD influence, representing periods of stable cloud cover. The most promising "window of opportunity" for cloud seeding lies within the "WD Day But No Rainfall" category; these days feature a dynamic, moisture-bearing system and cloud presence but lack natural rainfall. However, these opportunities are infrequent, with only 12 such days in December 17 in January, and 15 in February meeting the minimum cloud fraction threshold (>0.25) over the decade studied. This quantification aligns with the broader climatological analysis, indicating that ideal days for potential cloud seeding are not a common feature but rather a limited subset of specific synoptic events.

All			
Month \ Cloud Fraction	0.25	0.5	0.75
Oct (310 days)	31	12	4
Nov (300 days)	67	19	10
Dec (310 days)	97	48	23
Jan (310 days)	146	81	22
Feb (283 days)	144	70	30

WD Day But No Rainfall			
Month \ Cloud Fraction	0.25	0.5	0.75
Oct (39 days)	2	0	0
Nov (39 days)	9	2	1
Dec (50 days)	12	3	2
Jan (54 days)	17	3	0
Feb (43 days)	15	5	1

Not WD Day And No Rainfall			
Month \ Cloud Fraction	0.25	0.5	0.75
Oct (253 days)	24	9	3
Nov (246 days)	51	16	9
Dec (239 days)	70	36	17
Jan (209 days)	88	53	13
Feb (192 days)	90	46	20

Not WD But Rainfall			
Month \ Cloud Fraction	0.25	0.5	0.75
Oct (12 days)	4	3	1
Nov (3 days)	2	0	0
Dec (3 days)	2	1	0
Jan (9 days)	9	6	4
Feb (7 days)	7	3	3

WD Date And Rainfall			
Month \ Cloud Fraction	0.25	0.5	0.75
Oct (6 days)	1	0	0
Nov (12 days)	5	1	0
Dec (18 days)	13	8	4
Jan (38 days)	32	19	5
Feb (38 days)	31	16	6

Figure 16: Number of days in each month when the cloud fraction was more than 0.25. The days have been further classified into days with cloud fraction thresholds of 0.25, 0.5, and 0.75. For all three subgroups the days have been divided based on Western Disturbance activity and associated rainfall over Delhi.

Assessment of Seeding Suitability with the MSI

This analysis applies the MSI to the categorised cloudy days, providing a quantitative assessment of truly seedable opportunities. The results distinguish between days that are merely cloudy and those that possess the deeper atmospheric conditions necessary for precipitation enhancement.

Figure 17 links MSI scores (1-4, representing met conditions met beyond cloud cover) with cloud fraction thresholds (0.25, 0.5, 0.75), categorised by WD presence and rainfall. Analysis reveals that under WD but no rainfall conditions, cloudy days are infrequent, peaking slightly in Dec-Feb,

and almost exclusively exhibit MSI=1, meaning only the cloud fraction threshold is met, with rare MSI=2 cases in Jan/Feb. Conversely, no WD and no rain conditions show much higher frequencies of cloudy days, especially in Jan/Feb, but these are dominated by MSI=1 and 2, indicating cloud formation under limited dynamic/thermodynamic support, with MSI > 2 being absent. The no WD but rainfall category represents very few, weakly organised events (MSI=1 or 2).

WD No Rain

Cloud Fraction	0.25				0.5				0.75			
MSI / Month	1	2	3	4	1	2	3	4	1	2	3	4
Oct												
Nov	2				1							
Dec	4				1				1			
Jan	3	2				1						
Feb	6				1							

No WD No Rain

Cloud Fraction	0.25				0.5				0.75			
MSI / Month	1	2	3	4	1	2	3	4	1	2	3	4
Oct	5				4				1			
Nov	4				2				1			
Dec	8	1			3				1			
Jan	27	1			17	1			7	1		
Feb	25	2			14	1			8			

No WD But Rain

Cloud Fraction	0.25				0.5				0.75			
MSI / Month	1	2	3	4	1	2	3	4	1	2	3	4
Oct	3				3				1			
Nov	1											
Dec	2				1							
Jan	2	1			2	1			2	1		
Feb	3				2				2			

WD Rainy

Cloud Fraction	0.25				0.5				0.75			
MSI / Month	1	2	3	4	1	2	3	4	1	2	3	4
Oct												
Nov	1											
Dec	8				5				3			
Jan	15	1			10	1			3	1		
Feb	12	4			6	4			3	3		

Figure 17: Number of days in each month with corresponding MSI (ranging from 1-4) classified into days with cloud fraction thresholds of 0.25, 0.5, and 0.75. For all three subgroups the days have been divided based on Western Disturbance activity and associated rainfall over Delhi.

Even the WD rainy category, while showing the highest cloud fractions (especially in Jan/Feb), mostly corresponds to MSI=1 and 2. This suggests that while WDs bring extensive cloud cover, the full suite of necessary meteorological conditions for high suitability is often not met simultaneously. Overall, winter cloudiness in Delhi predominantly occurs under weak to moderate atmospheric support (MSI $\leq$ 2), with WDs being the primary driver for widespread and dense cloud cover, particularly during rainy phases. Crucially, this confirms that the number of genuinely "seedable" days is extremely limited. Even when promising cloudy conditions coincide with a WD, the underlying atmosphere is frequently too dry or stable to meet the multi-faceted MSI criteria, reinforcing that viable seeding opportunities are rare, anomalous events rather than common features of Delhi's winter.

2. Role of Cloud Condensation Nuclei and Cloud Seeding Potential

2.1 Introduction

Delhi's persistent air pollution crisis presents a complex atmospheric challenge driven by high aerosol loading, urban emissions, and unfavorable meteorological conditions. Aerosols alter radiation balance and microphysical processes by acting as CCN, influencing droplet formation, cloud lifetime, and precipitation efficiency. During winter, the boundary layer remains shallow, trapping particulate matter and further elevating CCN concentrations. Understanding the interactions between aerosols, CCN, and clouds is crucial for determining the potential of cloud seeding as a rainfall enhancement and pollution mitigation strategy.

This section reviews cloud–aerosol interactions and seeding feasibility for Delhi using experimental and modeling studies from India and across the world. The objective is to assess whether artificially induced rain through targeted cloud seeding could promote wet scavenging of pollutants and reduce airborne particle concentrations in Delhi's atmosphere.

Recently, IIT Kanpur and IMD announced a plan to run a cloud seeding experiment as a trial for addressing the severe air pollution in Delhi-NCR during October 2025. They propose to use modified Cessna aircraft 206H using flares mixed with Silver Iodide (AgI), powdered rocksalt and iodised salt. It is hypothesised that this mixture facilitates cloud drop formation by triggering the formation of Ice crystals on AgI. Trial runs of aircraft are proposed to fly over an area of 100 sq km for about 5 times each lasting about 90 minutes at a height of about 10000 ft, targeting nimbostratus clouds with moisture content >50%. It is estimated to cost about Rupees 1 crore for one mission. This report in view of this proposal is an attempt to explore whether there are enough clouds for successful seeding, why AgI is important, and the implications of such an experiment for the environment of a polluted Delhi during the dry winter season.

Precipitation in clouds happens when the pull of gravity overcomes the buoyancy of cloud droplets or ice crystals, which can only happen after sufficient droplet/crystal growth. AgI, particularly used in seeding cold clouds to induce rain, as proposed to be the case here, boosts the droplet/ice crystal formation in clouds. Cloud seeding has been successfully attempted to increase precipitation and/or hail suppression in some trials while only a few trials have been done to

mitigate pollution through wet scavenging. The earliest use of cloud seeding for strategic (Operation Popeye in Vietnam) and disaster management purposes (Project Stormfury) was reported by the United States, the latter of which was deemed a failure.

The dominant meteorological and thermodynamic variables controlling cloud formation and the success of a seeding event are moisture content, availability of CCN, and strong updraft velocities. The major criticism against cloud seeding is its feasibility and efficiency for large-scale implementation with CCN injection into small point sources, particularly in cold cloud conditions. Most mixed-phase or cold clouds don't have ice crystals above -12 °C, hence natural ice nuclei (IN) are not sufficient, and weak updrafts in wintertime add further problems. CCN activation and cloud formation is very sensitive to the initial conditions of the thermodynamic, radiative, and aerosol properties, which make this system non-linear with competing feedback mechanisms. The complex cloud structures coupled with how aerosols change their behaviour near clouds and with varying meteorological conditions, makes it difficult to establish proper causal chains involved in cloud seeding with available statistical tests and modeling methods.

2.1.1 Cloud Condensation Nuclei (CCN)

CCN are aerosol particles that initiate droplet formation under supersaturated conditions. Their number concentration, composition, and size distribution determine the cloud droplet number concentration (CDNC) and influence precipitation formation. The Twomey effect explains that higher CCN concentrations produce smaller droplets, enhancing cloud albedo but suppressing warm rain initiation. Over Delhi, elevated aerosol levels from vehicular and biomass sources lead to enhanced CCN, forming numerous small droplets less capable of coalescence. This delays precipitation and results in thicker, longer-lived clouds (Koren et al., 2005).

Clouds in polluted regions are more vigorous in convection owing to a combination of suppression of early rainout of cloud and its stabilisation with suppression of freezing and release of latent heat at higher altitude. Aerosol perturbations cause secondary convection, which is observed mostly in warm clouds. Generally, if there are high amounts of aerosols, more invigoration is expected as CCN can be higher and thus increases the formation of small cloud drops, which in turn increases the collision and coalescence process and thus resulting in rain. Even if the atmosphere is cleaner, large drops can form, overcoming the updrafts and precipitate later. Polluted clouds are less likely to form warm precipitation as these clouds last longer, and drops can go even higher increasing cloud top height. Above the freezing level, if ice-nucleating particles are scarce, heterogeneous

ice nucleation remains inefficient, allowing supercooled droplets to persist and thereby delaying precipitation.

Observational evidence supports aerosol invigoration of convection, where polluted environments with elevated CCN produce stronger updrafts and taller clouds. However, excessive aerosol loading can suppress rainfall entirely by inhibiting droplet growth. Such microphysical dynamics define the baseline for evaluating cloud seeding effectiveness in Delhi's atmosphere.

2.1.2 Theoretical Background and Cloud Microphysics

The Köhler theory explains droplet activation as a balance between solute effect and curvature effect. Kaplan's microphysical framework provides a dynamic perspective on vapor pressure, droplet growth, and supersaturation. In polluted regions, smaller hygroscopic particles dominate, leading to high CCN counts but reduced droplet size. Consequently, the collision-coalescence process weakens, delaying warm rain. In contrast, larger Giant CCN (GCCN) enhance droplet growth and early precipitation formation. Thus, cloud seeding introduces artificial GCCN or IN to compensate for natural rain suppression.

Cloud Seeding Mechanisms

Cloud seeding involves the deliberate introduction of nucleating agents to stimulate precipitation. It includes two primary approaches: hygroscopic seeding (warm clouds) and glaciogenic seeding (cold clouds). Hygroscopic seeding uses salts such as NaCl or KCl below cloud base to promote droplet coalescence, while glaciogenic seeding employs silver iodide (AgI) particles to initiate freezing near cloud tops. The effectiveness depends on parameters such as cloud liquid water content, vertical velocity, and updraft structure.

Globally, seeding experiments have shown varying success rates. Israel's long-term program reported rainfall enhancement of 13-16%. China's dynamic and static seeding programs improved snowfall and rainfall formation. In contrast, Thailand's randomized trials achieved limited statistical significance but indicated positive local effects. UAE's missions showed increased PM10 concentrations due to residual AgI. Meanwhile, the Korean and Australian experiments demonstrated fine-dust reduction and increased precipitation under specific synoptic conditions.

Global Studies:

Table 1. Global studies

	Place	Time period	Method	Remarks
1	United Arab Emirates (UAE)	Jan-March 2017	Glaciogenic seeding (AgI)	The PM10 and PM2.5 data showed a significant increase in PM10 concentrations during Jan–March 2017, when the cloud mission occurred, compared to the months thereafter. The AgI crystals fired into the clouds but failed to take part in any nucleation process eventually fell down while degrading into smaller particles forming PMs of different sizes that may be suspended and float in the atmosphere (Malik et al. 2018)
2	Northern Israel	Since 1975	Glaciogenic Seeding (AgI)	Enhanced rainfall there by 13-16% (Gagin and Neumann 1981)
3	Wyoming	2007-2010	Glaciogenic seeding (AgI)	AgI seeding could produce additional precipitation in winter orographic clouds (Huggins, 2009)
4	NW Thailand	April-May-June 1994-1998	Glaciogenic seeding	This experiment did not reach statistical significance in the time allotted to it. Thus, this experiment did not "demonstrate" or prove the efficacy of glaciogenic cloud seeding in this context. The confidence interval analyses suggest there is 72% confidence that there was a positive effect of seeding on cells, 79% confidence that there was a positive seeding effect on units, but only 20% confidence that there was a positive effect on cells and units when considered jointly.
5	West Korea	November 2020	Hygroscopic seeding	The average concentration of cloud, drizzle, and precipitation particles increased after seeding as compared with the observations before and during seeding. (aircraft data) Cloud seeding was found to be effective for reducing fine dust concentration.

6	China	1997-2007	Glaciogenic seeding	Glaciogenic cloud seeding has 2 approaches, 1) static seeding, which focuses on cloud microphysical processes, and is used to create ice crystal particles and enhance snow and graupel production by increasing the number of ice particles and triggering precipitation processes earlier in the lifetime of the cloud. 2) dynamic seeding, which increases the buoyancy of the cloud by converting supercooled liquid drops to ice.
7	Idaho	Jan-March 2017	Glaciogenic seeding	In some cases, the experiment detected zigzag lines of reflectivity in radar data that corresponded with the seeded material, and in-situ measurements showed changes in the cloud's microphysical properties. Researchers are continuing to analyze the data to quantify the amount of additional snowfall produced by seeding and determine the conditions under which seeding is most effective.

Indian Studies:

Table 2. Indian studies

	Place	Time period	Method	Remarks
1	Karnataka	Aug-Nov 2017 (Varshad hare)	Hygroscopic seeding	Unique rainfall data at high spatial (5 km) and temporal (15 min) resolution First time the response of seeding in terms of increase in rainfall at the ground Enhancement of rainfall due to seeding by floating control-target area rainfall Mean increase in rainfalls due to hygroscopic and glaciogenic was ~12 and 19.9 mm. The average increase of 27.9% at Taluk level rainfall above the natural rainfall (618 events)

2	Solapur, Maharashtra (CAIPEEX IV)	Monsoon period for 2018 and 2019	Hygroscopic seeding	Rainfall can be enhanced by up to ≅ 46±13 % at some locations and on average, ≅ 18±2.6 % in 100 square kilometers area in the downwind of seeding location. Contributed to ≅ 867 million liters of water, yielding a positive cost-benefit ratio.

Some Modelling studies:

Table 3. Modelling studies

	Study	Citation	Major findings
1	A mathematical model for the removal of pollutants from the atmosphere through artificial rain	Tripathi, A., Misra, A. K., & Shukla, J. B. (2021). A mathematical model for the removal of pollutants from the atmosphere through artificial rain. Stochastic Analysis and Applications, 40(3), 379–396. https://doi.org/10.1080/07362994.2021.1915802	The nonlinear mathematical model is analyzed in the presence of white noise and proved that if rain persists, the pollutants can be totally washed out. It has been observed that the environmental disturbances are not much favorable in such experiments as the presence of environmental disturbance may destabilize the system. It is found that to remove pollutants completely, it is necessary to prevent the formation of pollutants. The simulation is performed to support the analytical findings.

2	Assessment of Possible Precipitation Enhancement by Glaciogenic Cloud Seeding Using WRF: A Case Study	Pourghasemi, M.A., Memarian, M.H. & Zare, A. Assessment of Possible Precipitation Enhancement by Glaciogenic Cloud Seeding Using WRF: A Case Study. Russ. Meteorol. Hydrol. 47, 553–560 (2022). https://doi.org/10.3103/S1068373922070 10X	The successful rate of cloud seeding operations greatly depends on the local atmospheric condition, such as temperature and water vapor at the most appropriate height on this experimental day. As a result of increasing the number of aerosols at the SEED simulation the cloud cover is increased, water vapor mixing ratio is decreased, and updrafts and downdrafts become more intense and frequent. That provides favorable conditions for more rainfall. However, the increase in IN, in a result of seeding, has different effects on the simulated region
3	The effects of giant CCN on clouds and precipitation: A case study from the Saudi Arabia program for the assessment of rainfall augmentation	Teller, Amit & Axisa, Duncan & Breed, Daniel & Bruintjes, Roelof. (2008). THE EFFECTS OF GIANT CCN ON CLOUDS AND PRECIPITATION: A CASE STUDY FROM THE SAUDI ARABIA PROGRAM FOR THE ASSESSMENT OF RAINFALL AUGMENTATION.	Used the measured data in two similar cloud models in order to compare their performances in one particular scenario. In polluted environment where aerosol concentration in large, additional GCCN may increase the total precipitation while in clean case where the aerosol loading is low, additional GCCN reduced the total precipitation due to the reduced amount of water vapor in the mixed phase region of the cloud as precipitation starts earlier in this case injecting hygroscopic material to the cloud, as part of cloud seeding, in order to increase the concentration of GCCN might have a negative effect on precipitation in certain conditions where it may speed up the formation of large droplet in the warm regions of the cloud while it prevents much of the water vapor to reach higher altitude so graupel and ice production will be suppressed.

4	Assessing glaciogenic seeding impacts in Australia's Snowy Mountains: an ensemble modeling approach	Chen, S., Xue, L., Tessendorf, S. A., Chubb, T., Peace, A., Kenyon, S., Speirs, J., Wolff, J., and Petzke, B.: Assessing glaciogenic seeding impacts in Australia's Snowy Mountains: an ensemble modeling approach, Atmos. Chem. Phys., 25, 6703–6724, https://doi.org/10.5194/acp-25-6703-2025, 2025.	Simulated seeding efficacy highly depends on meteorological conditions. Stratiform cases exhibited consistent precipitation enhancement, while convective cases showed reductions and downwind shifts in precipitation. Cases, with deep, convective clouds and active precipitation processes, are considered the least ideal for cloud seeding.

2.3 Data and Methods

The methodology integrates observational and literature-based synthesis. Koren et al. (2010) analysed cloud properties by dividing AOD into different regimes (low, medium and high), and the same approach is followed here. Cloud climatology parameters such as cloud base height, cloud fraction, and liquid water content (2011-2021) were analyzed against different AOD bins. Vertical aerosol optical depth profiles were also examined to infer CCN variations.

Table 4. Datasets

Data sets used	**Time period**	**Resolution (lat x lon)**
ERA5 Cloud cover	2011-2021	0.25°x0.25°
ERA5 Cloud base height	2011-2021	0.25°x0.25°
ERA5 Cloud type	2011-2021	0.25°x0.25°
CALIPSO vertical distribution of AOD	2011-2021	333m
MERRA2 AOD	2011-2021	0.5°x0.625°
Ceilometer (IITD-Sonipat Observatory)	2021-2022 (1 day for each month - ONDJF)	-

2.4 Results

Vertical aerosol profiles

CALIPSO data is used to look at the vertical aerosol profiles over the Delhi region (Figure 18). High values of the backscatter coefficient in the lower atmosphere (below 2km) indicate the aerosol layers. This finding is corroborated by data from instruments at the IITD-Sonipat Observatory. Ceilometer backscatter coefficients and depolarization ratios show similar aerosol layers confined close to the surface.

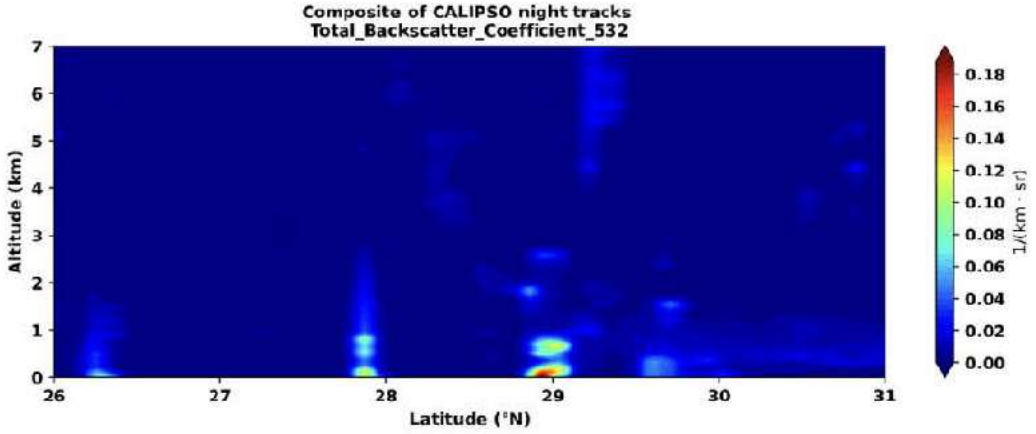
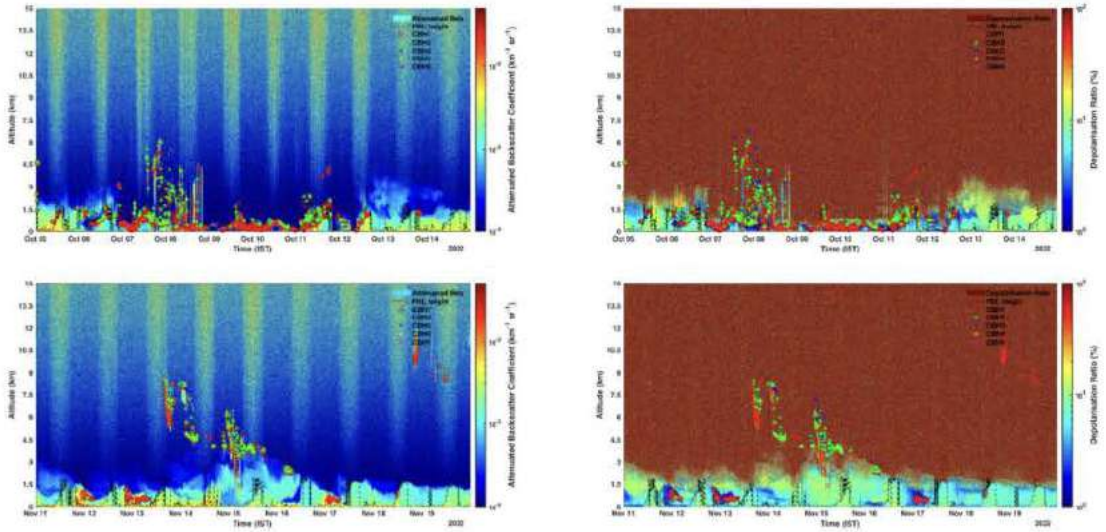


Figure 18: Composite vertical profiles of the total backscatter coefficient at 532nm using night tracks (14 passes) from the CALIOP instrument.



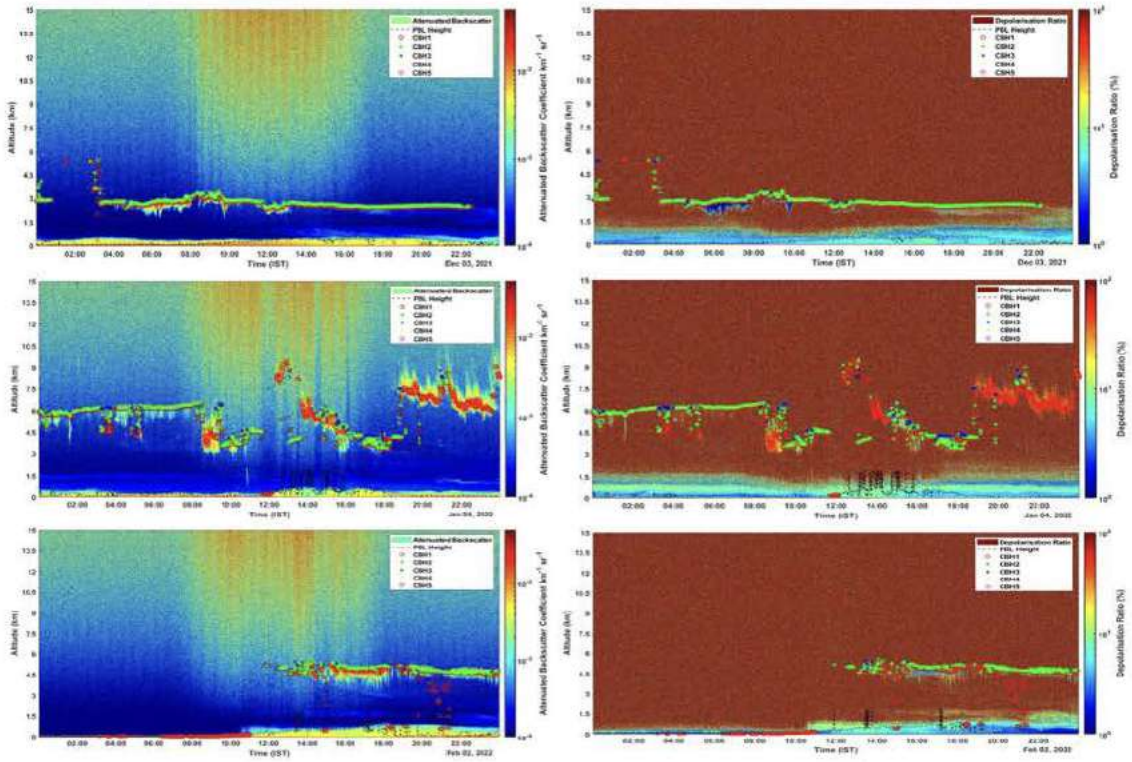


Figure 19: Data from the ceilometer at the IITD-Sonipat Observatory showing one day for each month from October 2021 to February 2022 in order. The left panels show the backscatter coefficient, and the right panels show the depolarization ratios. October and November have higher cloud layers. The higher backscatter coefficient around 3km in the Dec-Feb months indicates the presence of cloud layers, while that near the ground suggests aerosols are confined close to the surface.

Cloud occurrence frequency

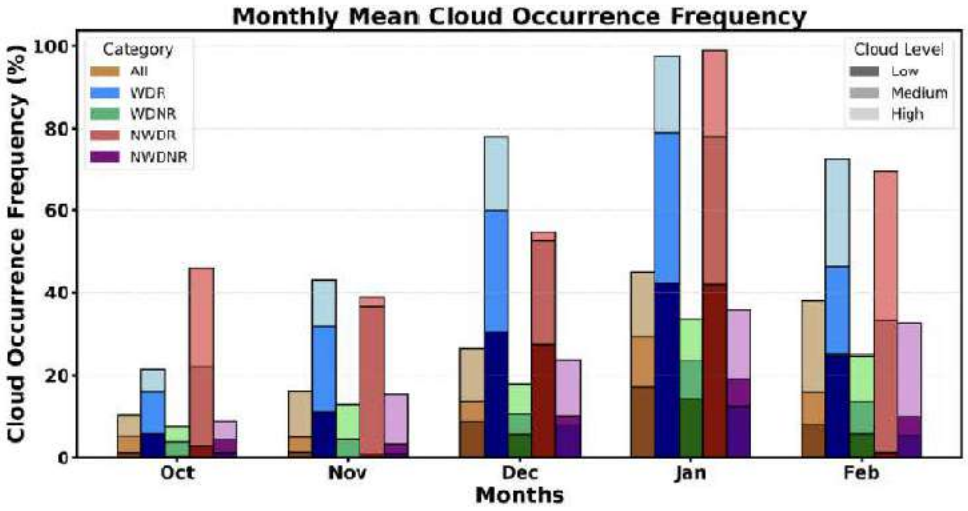


Figure 20: Cloud occurrence frequency for each category, month-wise. It is highest for the Western Disturbance rainy days and non-Western Disturbance rainy days, which is to be expected. The DJF winter months have a greater number of WDs than the ON months, which is reflected in the occurrence frequency as well. (WDR - Western Disturbance Rainy Days, WDNR - Western Disturbance Non-Rainy Days, NWDR - Non-Western Disturbance Rainy Days, and NWDNR - Non-Western Disturbance Non-Rainy Days).

Cloud cover by AOD bins

Figure 21 shows the total cloud cover and cloud base height distributions by AOD bins. We divide the AOD into three bins - Low (0-0.15), Medium (0.15-0.35) and High (>0.35). This classification is based on Fan et al. (2009). Both rainy day categories (WDR and NWDR) do not have any days in the low AOD category. a) Cloud cover is generally less in the dry winter months over the region. All three AOD categories show less than ~30% cloud cover for most day types. The 2 outliers noted here are the greater fraction for NWDR days in both the medium and high regimes, and for WDR in the high AOD regime. b) Cloud base height can indicate the Lifting Condensation Level/Convective Condensation Level (LCL/CCL). The cloud base height here shows an inverse relationship with the aerosol loading, showing higher values for lower aerosol loads. The low aerosol regime shows cloud base heights around 7-8km, with WDNR levels going even above 10km, while the high aerosol regime shows cloud base heights below 4km. However, there is no clear pattern that emerges amongst the different day types.

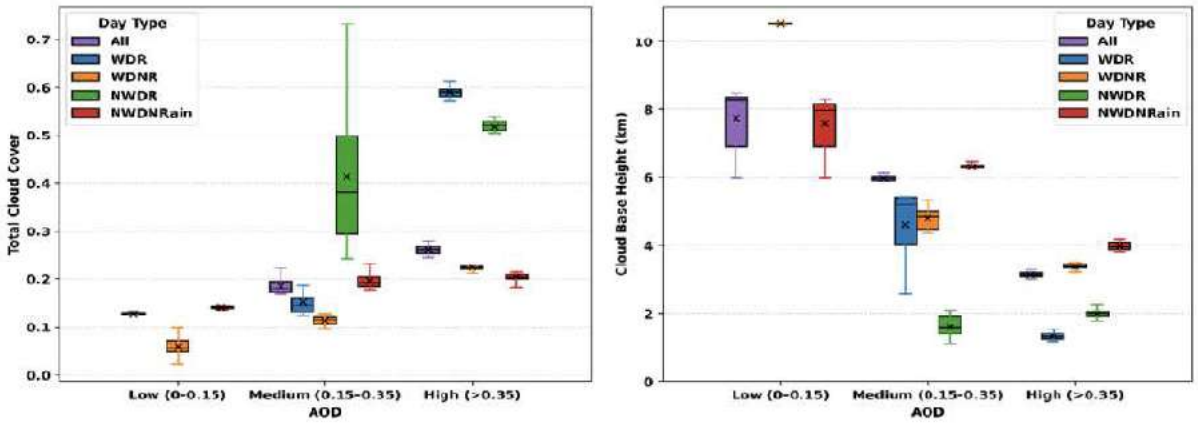


Figure 21: Total cloud cover and cloud base height distributions by AOD bins.

Cloud liquid/ice water by AOD bins

Both show higher values predictably for the rainy days, especially for the high aerosol loading (which implies higher CCN). Non-WD rainy days show higher values for both variables in the medium AOD regime as well, which is not observed for the WD rainy days. Low cloud cover in the low aerosol regime translates to very low values of liquid/ice water.

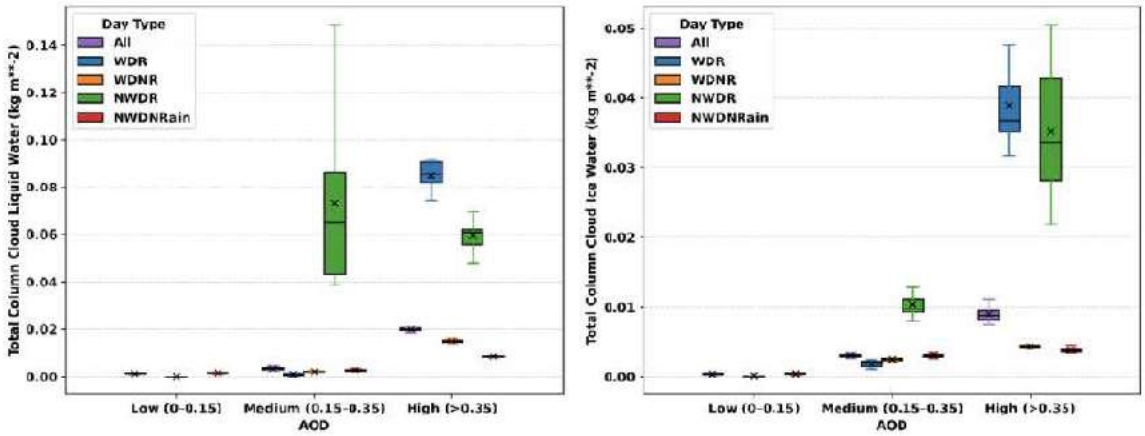


Figure 22: Same as Figure 21 but for total column liquid and ice water.

Cloud types by AOD bins

The type of clouds observed (low, medium and high) are also analysed using the ERA5 dataset. The dataset defines low clouds as having a cloud base height (CBH) from the surface up to 2 km, medium clouds are from 2 km to 6 km, and high clouds are above 6 km. Cloud cover in general remains low (less than ~35%) and rainy days (both WDR and NWDR) experience much more clouds, especially the low and medium types, than non-rainy days, which is to be expected.

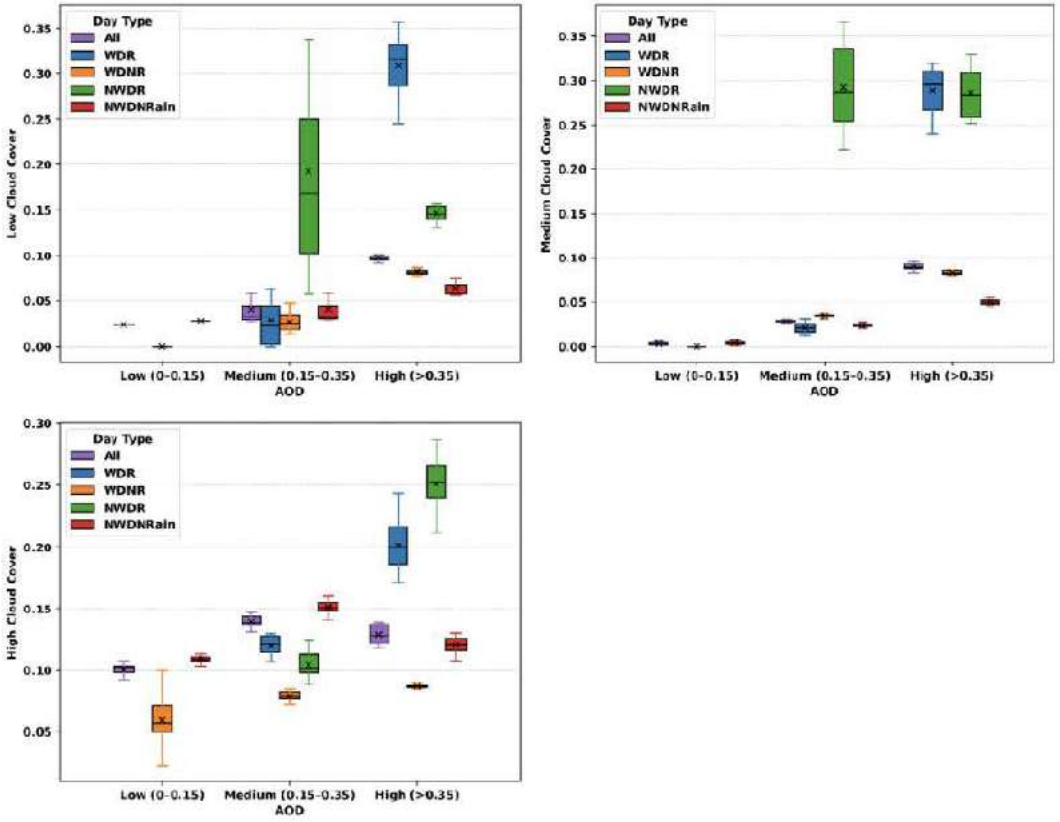


Figure 23: Same as Figure 21 but for the low cloud cover, medium cloud cover and high cloud cover respectively.

The analysis reveals that the winter months in Delhi tend to have aerosols concentrated close to the surface, which can be explained by the low height of the boundary layer. Cloud cover remains low (<30%) throughout and increases only during WD and non-WD rainy days, as expected. Cloud cover also shows an inverse relationship with AOD; the highest fractions are observed over the high AOD regime. No clear pattern emerges for the cloud base height.

Based on a review of existing literature, cloud seeding seems to be possible when pre-existing conditions of rain are present, as determined by meteorological and thermodynamic variables. Provided that rain conditions exist, ice water is notably higher only at high AOD bins, indicating that ice nucleation processes are favored during high AOD days, which can serve as a proxy for the availability of more CCN and secondary convection, as discussed theoretically.

3. Pollutant Removal Efficiency and Post-Rainfall Recovery Dynamics

3.1 Introduction

The Indo-Gangetic Plain (IGP) remains one of the most polluted regions in India, with NCR frequently reporting wintertime PM2.5 levels exceeding 300 $\mu g/m^{3,}$ nearly 20 times the WHO guideline (Guttikunda and Calori, 2013). Persistent emissions from traffic, industries, construction, biomass burning, and dust, combined with weak dispersion and strong temperature inversions with low boundary layer height, create severe pollution episodes. Due to anthropogenic activities from various emission sectors are formed secondary inorganic aerosols (sulfate, nitrate, ammonium or SNA) dominate fine-particle mass concentration, contributing up to 70 % of PM2.5 during stagnant conditions (Tiwari et al., 2015), while mineral dust, organics, and black carbon further enhance the regional aerosol burden (Gani et al., 2019). Despite policy interventions such as the Graded Response Action Plan, air quality improvements remain episodic, underscoring the need for rapid, short-term mitigation strategies during extreme pollution events (UNDP report, 2024).

Rainfall is a natural mechanism for atmospheric cleansing, removing aerosols and soluble gases through in-cloud and below-cloud scavenging (Seinfeld and Pandis, 2016). Empirical and modeling studies report 10 to 40% reductions in PM during rain, depending on droplet size, intensity, and aerosol composition (Maria et al., 2005; Lu et al., 2019; Jones et al., 2022). Hygroscopic and coarse particles such as sulfate, nitrate, and dust are most efficiently removed, whereas hydrophobic black carbon and organics show weaker scavenging (Hegg et al., 2011). However, observed improvements are transient: concentrations often return to pre-event levels within 24 - 72 hours due to persistent emissions and boundary-layer recovery (Fujino et al., 2022; Zhao et al., 2020).

Cloud seeding, which aims to enhance rainfall by stimulating droplet formation and coalescence, could theoretically amplify this cleansing process. India's CAIPEEX program (CAIPEEX report, 2023) has demonstrated rainfall increases of 18 - 46% through hygroscopic and glaciogenic seeding, but its potential to mitigate air pollution remains unexplored. The complex aerosol mixes and meteorological heterogeneity of Delhi–NCR make it an ideal yet challenging testbed to assess whether induced precipitation can meaningfully reduce particulate and gaseous pollution.

Rain removes aerosols via in-cloud nucleation scavenging and below-cloud impaction scavenging, with a clear size dependence. Using the scavenging amount mode framework, Wang et al. (2021) showed that the rain-rate bins contributing most to removal are ~10-12 mm/day (Aitken), 8-9 mm d^{-1} (accumulation), and 7-8 mm d^{-1} (coarse), and that rainfall frequency-not peak intensity-governs climatological wet removal. Convective precipitation, with larger drops, tends to remove submicron particles more effectively at 0.3-20 mm/day, while stratiform rain more efficiently scavenges coarse particles. However, rainfall is not a lasting solution for ultrafines (PM1; Particulate Matter with aerodynamic diameter ≤ 1 μm). Direct washout is weak, and Zhao et al. (2023) showed a compensating pathway: by clearing pre-existing surface area, rain lowers the condensation ($\Delta CS \approx 4\times10^{-2}\ s^{-1}$) and coagulation sinks ($\Delta CoagS \approx 1.5\times10^{-4}\ s^{-1}$), enabling new particle formation within ~1–60 h post-rain. Such events can supply 15-80% of N_{13-100} and up to ~47% of PM2.5 mass, replenishing fine particles. Overall, rain yields transient PM reductions unless paired with precursor emission controls.

3.2 Data and Methods

3.2.1. Air Quality Data

We collected open-source real-time air quality data for Continuous Ambient Air Quality Monitoring Stations (CAAQMS) available as on October 12, 2025 from the Central Pollution Control Board (CPCB; https://airquality.cpcb.gov.in/ccr/#/caaqm-dashboard-all/caaqm-landing). We consider data for five criteria air pollutants and meteorological parameters: particulate matter PM2.5 and PM10, Sulfur dioxide (SO_2), Nitrogen Oxides ($NOX \approx NO + NO_2$), and ozone (O_3), wind speed and wind direction at 1-hour resolution for the five-year period, 2017-2024. We considered a total of 5 sites out of 81 available sites (Fig. 3.1) within the Delhi NCR region for our study domain. The selected sites were filtered based on the criterion of having more than 80% data availability for each primary (SO_2, NOX) and secondary pollutant (PM2.5, PM10, O_3) for every year between 2017 and 2024, addressing the persistent data quality issues in the CAAQMS dataset (Figure 24). In terms of data availability, more monitoring sites became operational after 2019, whereas earlier years exhibited significant data gaps and a limited number of sites. Our data selection criteria focused on the most recent 8-year period (2017-2024) of available data (Figure 25). We further categorised the selected sites based on their land-use characteristics, including dense urban, industrial, green space, residential, and peri-urban areas (Table 5).

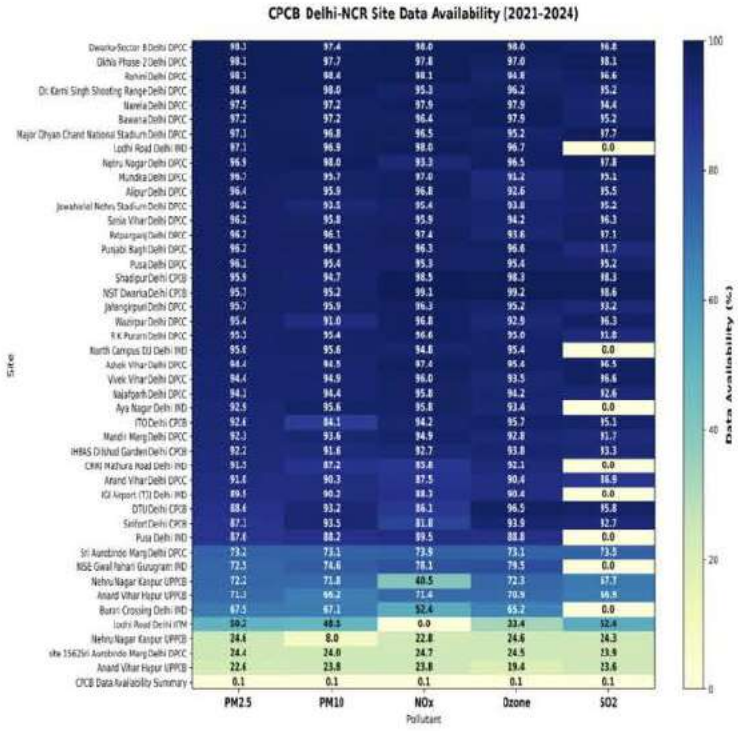


Figure 24: Availability of CPCB data (in percentage) for different criteria pollutants (PM2.5, PM10, NOX, O_3, SO_2) for different stations in the Delhi NCR Region.

Figure 25: Availability of CPCB data (in percentage) for different species (PM2.5, PM10, NOX, O_3, SO_2) for selected stations in the Delhi Region.

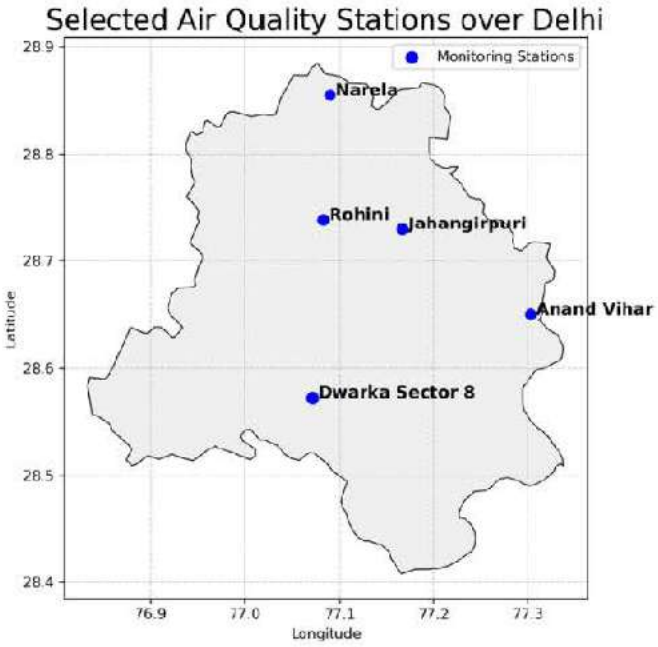


Figure 26: Locations of the selected air quality monitoring sites across the Delhi region.

To enhance the robustness of the air quality data preprocessing, we adopted widely used statistical approaches for identifying and removing outliers. Outlier detection and removal were carried out following the methodology proposed in the previous studies, which defines valid data within the 5th and 95th percentile range of the distribution. Data values outside this range were considered outliers and excluded from further analysis.

Table 5: Details of selected stations and respective land use land cover type

STATION	TYPE
Anand Vihar	Dense urban/Traffic Corridor
Jahangirpuri	Dense urban/ Residential
Dwarkar sector-8	Residential Colony
Narela	Suburban and Peri-urban
Rohini	Residential Colony

To analyze the effect of rainfall on particulate matter concentrations, AOD from MERRA-2 of resolution 0.5° x 0.625° was selected as a proxy. The day of rain was considered as t_0 and the AOD time series was plotted for the period t_{0-5} to till the AOD value reaches pre-rain 5 day mean for those rainfall events (WD and non-WD) with no other rainy days within the period of t_0-5 to

t_0. Welch's t-test was used to determine whether the reductions in AOD were statistically significant after the rain.

The climatology of winds was calculated for all days when WD tracks (both rain-inducing and dry) were present within the 10° box. The days of dry WD influence on wind speeds were identified as those with wind speeds greater than the climatological wind speed. The day of maximum influence (t_0) for each dry WD was defined as the day with the maximum wind speed over Delhi during its passage through the box. The AOD time series was also plotted for the period from t_0–5 until it returned to the pre-event five-day average. Welch's t-test was used to find whether the changes in AOD were statistically significant after t_0.

To quantify the immediate and lasting impact of rainfall on air quality, two key metrics were calculated for each event. The % Washout measures the direct cleansing efficiency of a rain event, calculated as the percentage change between the pollutant concentration on the day before the rain and the day after ((Pre-Rain concentration - Post-Rain concentration) / Pre-Rain concentration * 100). A higher positive percentage indicates a more effective removal of that pollutant from the atmosphere. Following this initial cleansing, the Recharge time was estimated to determine how long the beneficial effects lasted. This was calculated as the number of days it took for a pollutant's concentration to climb back up to or exceed its pre-rainfall level. This metric provides a practical measure of the duration of improved air quality following a precipitation event, indicating how quickly local emissions and atmospheric conditions cause pollution to rebound.

Following the removal of outliers, monthly analyses were conducted for each selected station. The time series of particulate pollutants (PM2.5 and PM10) exhibit clear seasonal patterns, with the highest concentrations during the post-monsoon and winter months (October to February) and lower concentrations during the monsoon season (July to September), a pattern that repeats consistently across the study period. This seasonal cycle is further illustrated in Fig 5. In contrast, ozone (O_3) shows an inverse pattern, with elevated concentrations during the hot, sunny pre- and post-monsoon months, and lower levels during the peak winter pollution episodes. It is also evident that pollutant concentrations are site-specific. Among the selected stations, Anand Vihar consistently shows the highest pollutant levels, particularly for PM10 and NO_x, consistent with previous findings (e.g., Kaushik et al., 2023), which identified Anand Vihar as one of the most polluted regions in Delhi with elevated NO_x concentrations.

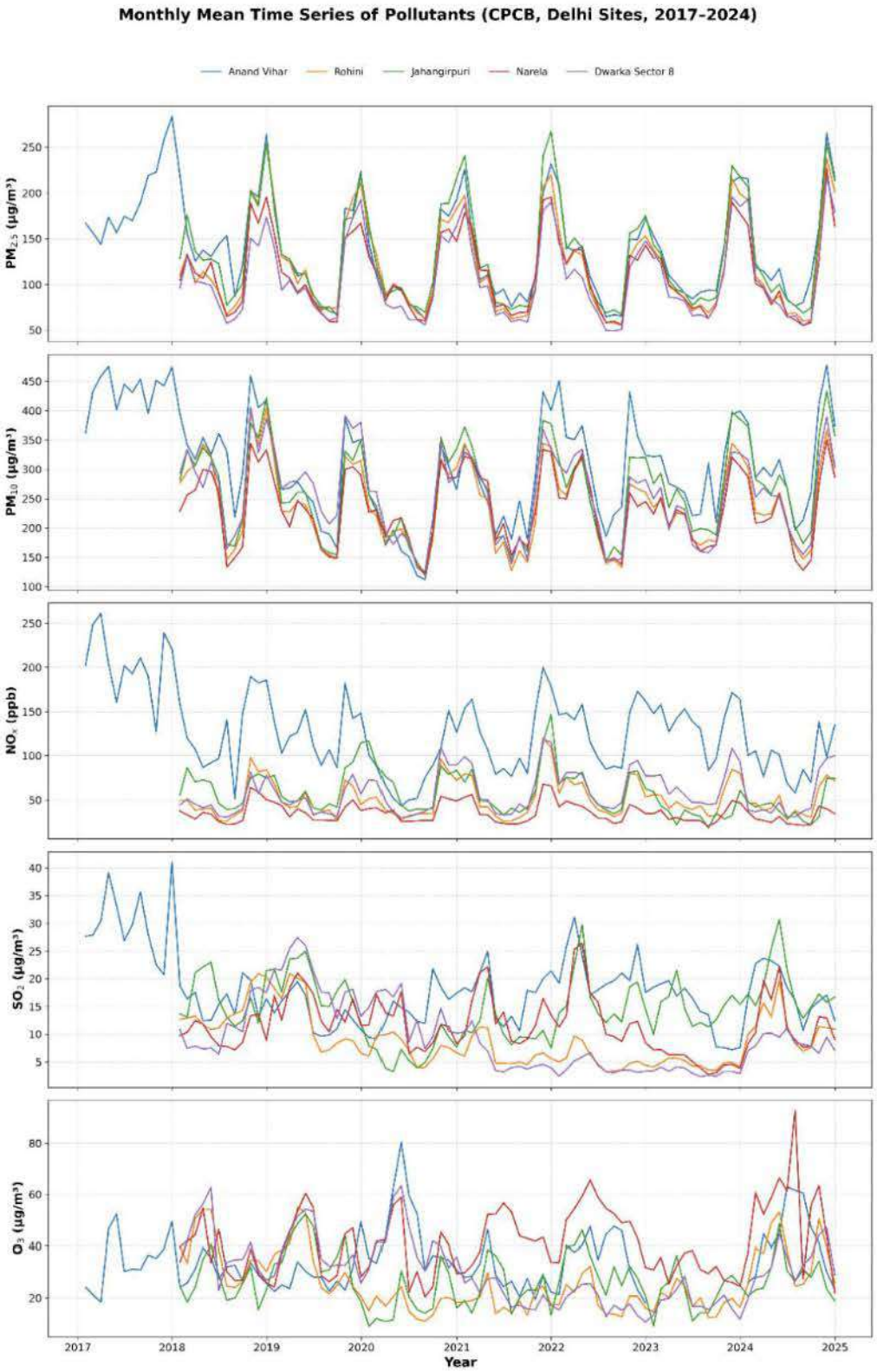


Figure 27: Monthly averaged time series of the criteria pollutants (PM2.5, PM10, NOX, SO_2, O_3) for selected stations (different colours represent different stations) during the period 2017-2024.

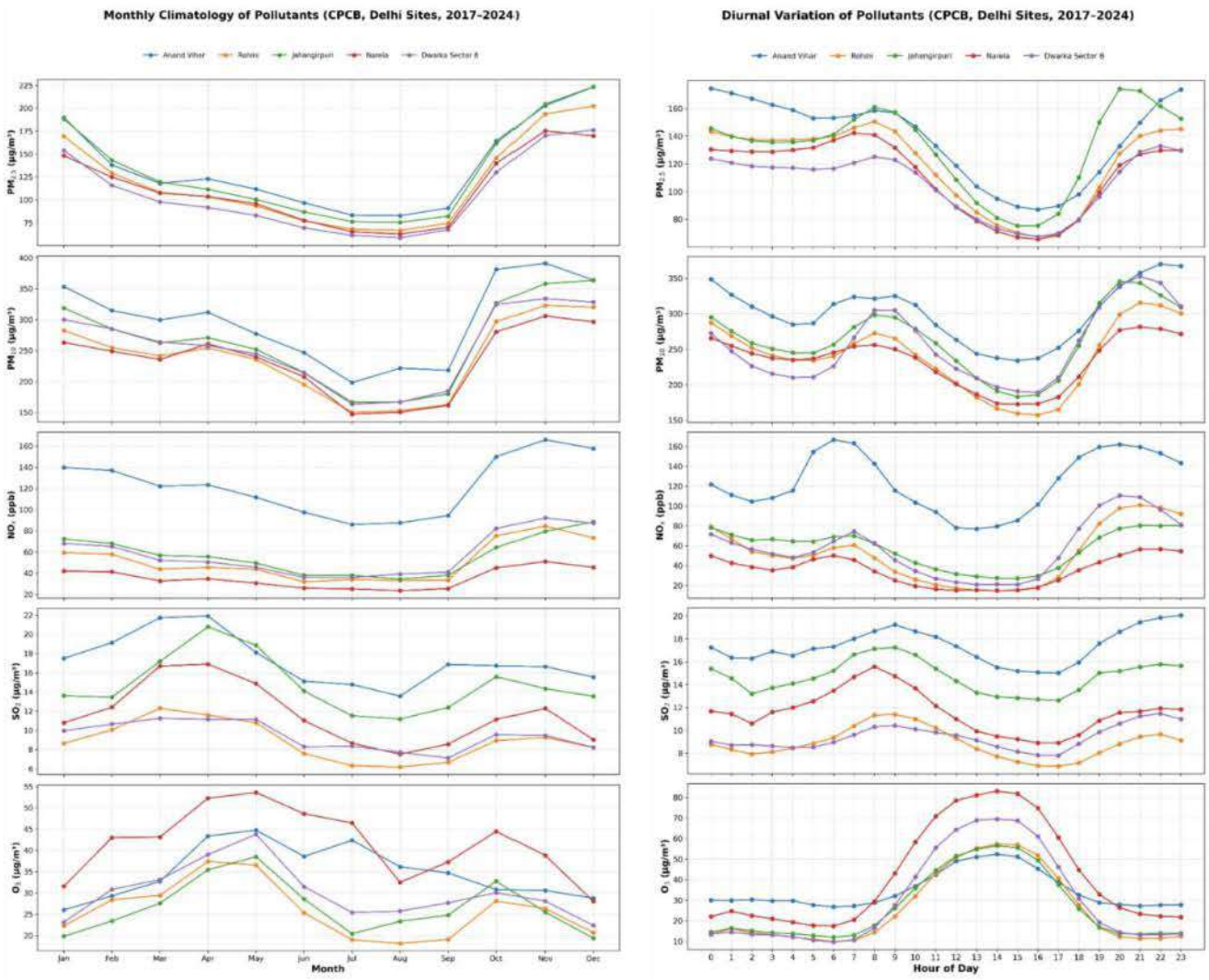


Figure 28: Monthly climatology (left panel) and diurnal variation (right panel) of different criteria air pollutants at the selected stations during the period 2017-2024.

Figure 28 shows the monthly climatology and diurnal variation of different species for selected stations. The seasonal pattern of all the pollutants except ozone shows higher values during the post-monsoon period and lower values during the monsoon in all the stations. However, the ozone shows a different pattern for some stations, like Narela and Anand Vihar (higher values during monsoon). The figure clearly shows that the pollutant levels are specific to the stations, also. Among the selected stations, Anand Vihar shows higher values for all the pollutants except PM2.5. The diurnal variation of most pollutants, excluding ozone, shows a distinct morning peak and afternoon minimum, corresponding to reduced atmospheric mixing in the early morning and enhanced dispersion during the daytime. In contrast, ozone exhibits an opposite pattern, with maximum concentrations in the afternoon due to active photochemical production, and lower concentrations during the early morning hours.

3.2.2. Rainfall classifications

IMD gridded data is available at a daily temporal resolution, whereas the spatial resolution is 0.25-degree for rainfall. The IMD gridded rainfall dataset was prepared by (Pai et al., 2014). Rainfall events were then classified into four categories based on total rainfall intensity according to the IMD report.

- Very light: 0.1 - 2.4 mm
- Light: 2.5 - 7.5 mm
- Moderate: 7.6 - 35.5 mm
- Heavy: > 35.5 mm

Here we considered four types of rainfall events for each station to show how many days experienced very light rain, light rain, moderate rain, and heavy rain (Table 6). Hourly air quality data for key pollutants (PM2.5, PM10, NO_2, and O_3) were obtained from the CPCB network, comprising 81 active continuous monitoring stations across the NCR.In contrast, daily rainfall data for Delhi were collected from the same study period to facilitate correlation with air quality parameters. Specific rainfall episodes were identified according to predefined criteria for intensity (x) and duration (y) thresholds, allowing the isolation of distinct rainfall events for further analysis.

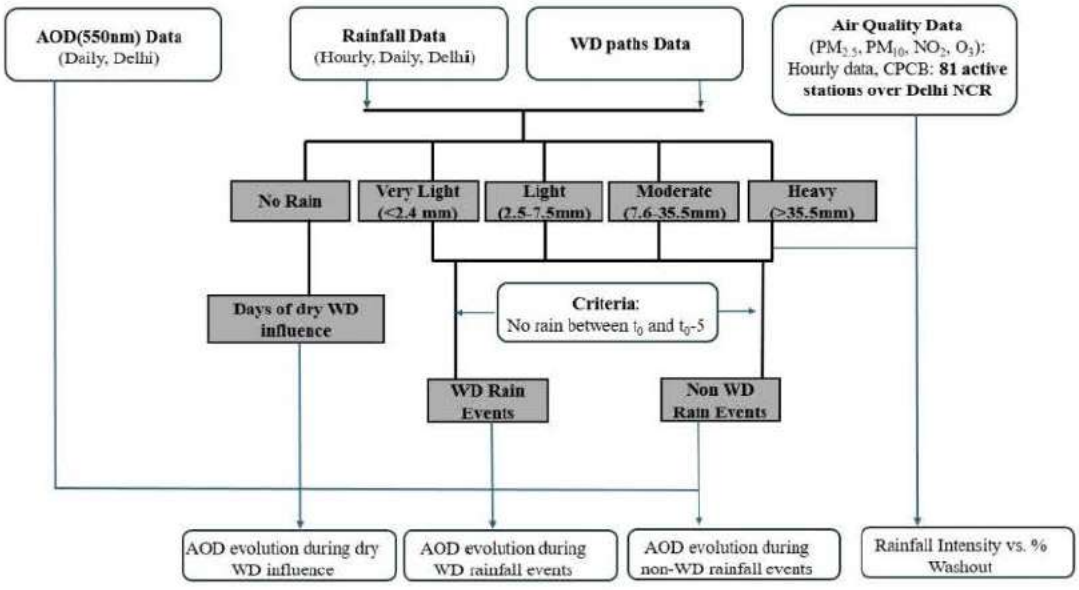


Figure 26: Schematic of the workflow.

We have selected 5 stations with continuous data of both pollutants and wind for further analysis. The analysis has been done for different rainfall events (light, moderate and heavy rainfall events for each station). The details of selected events at the monitoring stations are provided in Table 6.

Table 6: Details of selected rainfall events at the monitoring stations during the period 2019–2024.

STATION	Heavy rain (HR)	Moderate rain (MR)	Light rain (LR)
Anand Vihar	18 Oct 2021	09 Feb 2022	20 Feb 2024
Jahangirpuri	09 Oct 2022	09 Feb 2022	20 Feb 2024
Dwarkar sector-8	18 Oct 2021	01 Feb 2024	20 Feb 2024
Narela	18 Oct 2021	30 Jan 2024	20 Feb 2024
Rohini	18 Oct 2021	9 Feb 2022	20 Feb 2024

3.3 Results

3.3.1. AOD Evolution During Rainfall Events: Western Disturbances vs. Non-WD Events

AOD after WD-rainfall events showed reductions 12.7%, 27.9%, 28.5% for t_0+1, t_0+2, and t_0+3 days respectively when compared to the pre-rain 5 day mean. The AOD reductions of t_0+2 and t_0+3 were statistically significant ($p<0.1$) and others were insignificant for WD-rainfall events (Fig. 30a). The non-WD rainfall events also showed reductions in AOD post rain, but the magnitudes were less for t_0+1 and t_0+2 but higher for t_0+3 when compared to that of WD-rainfall post reductions (Fig. 30b).

The q_{int} curve and AOD curve show similar variation before and after the rainfall events for both WD-rainfall and non-WD rainfall. This can be due to the fact that aerosols absorb moisture and grow in size.

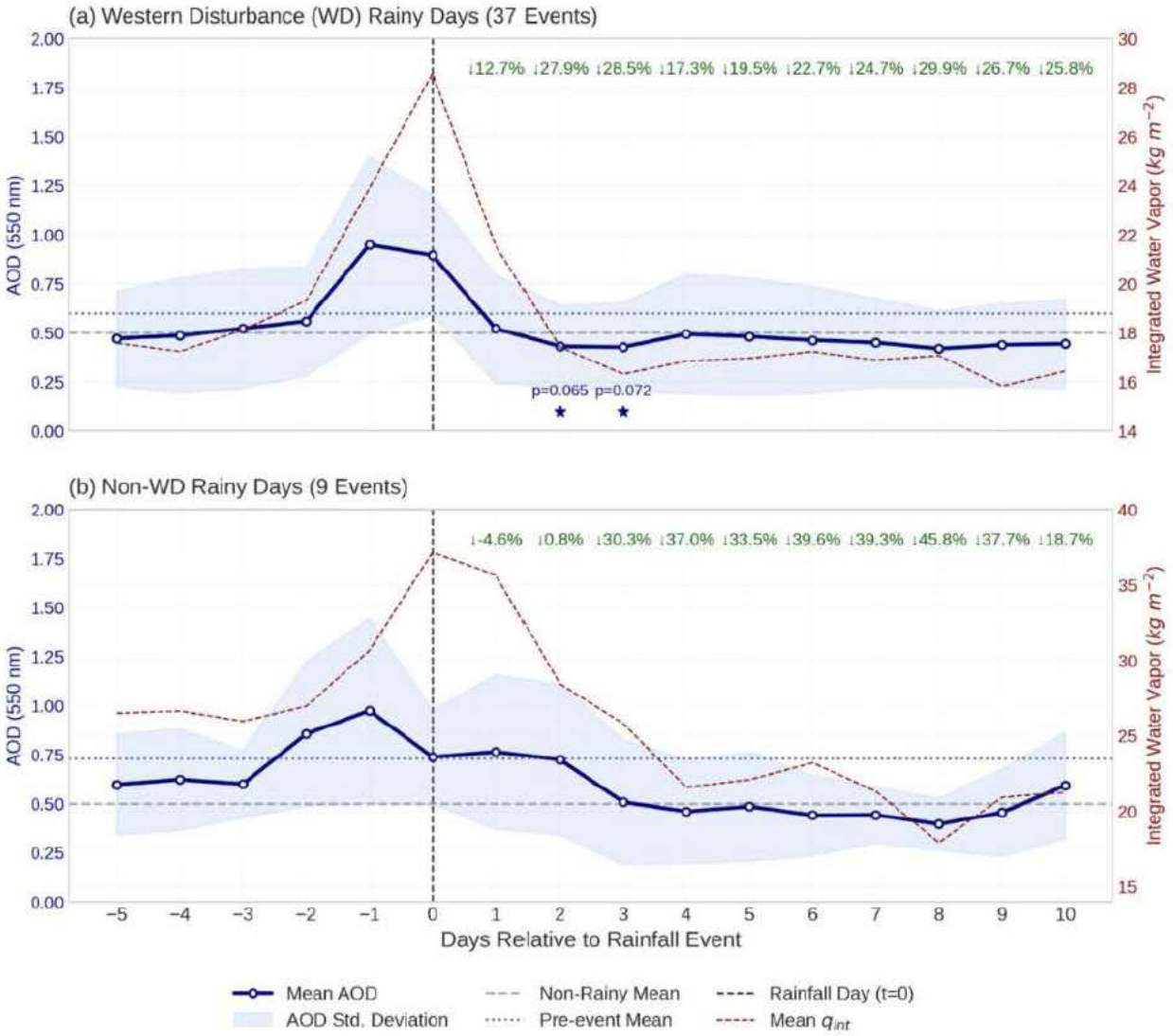


Figure 30: AOD evolution before and after WD-induced and other light and heavy rainfall events.

3.3.2. Rainfall intensity vs washout efficiency

Figure 31 reveals a consistent and clear pattern in Delhi's winter precipitation from 2017 to 2024. Across all five monitoring stations, light rainfall events are by far the most common, occurring frequently throughout the season. Moderate rainfall is significantly less frequent, while heavy, air-cleansing downpours are a rare occurrence, with most sites experiencing only a handful of such events over the entire study period. Interestingly, there is some noticeable geographical variation, as stations like Anand Vihar and Okhla registered more moderate and heavy events compared to Narela, which recorded no heavy events at all. This data suggests that while the city regularly experiences light winter drizzles, the kind of intense rainfall needed for a major pollution washout is an infrequent phenomenon.

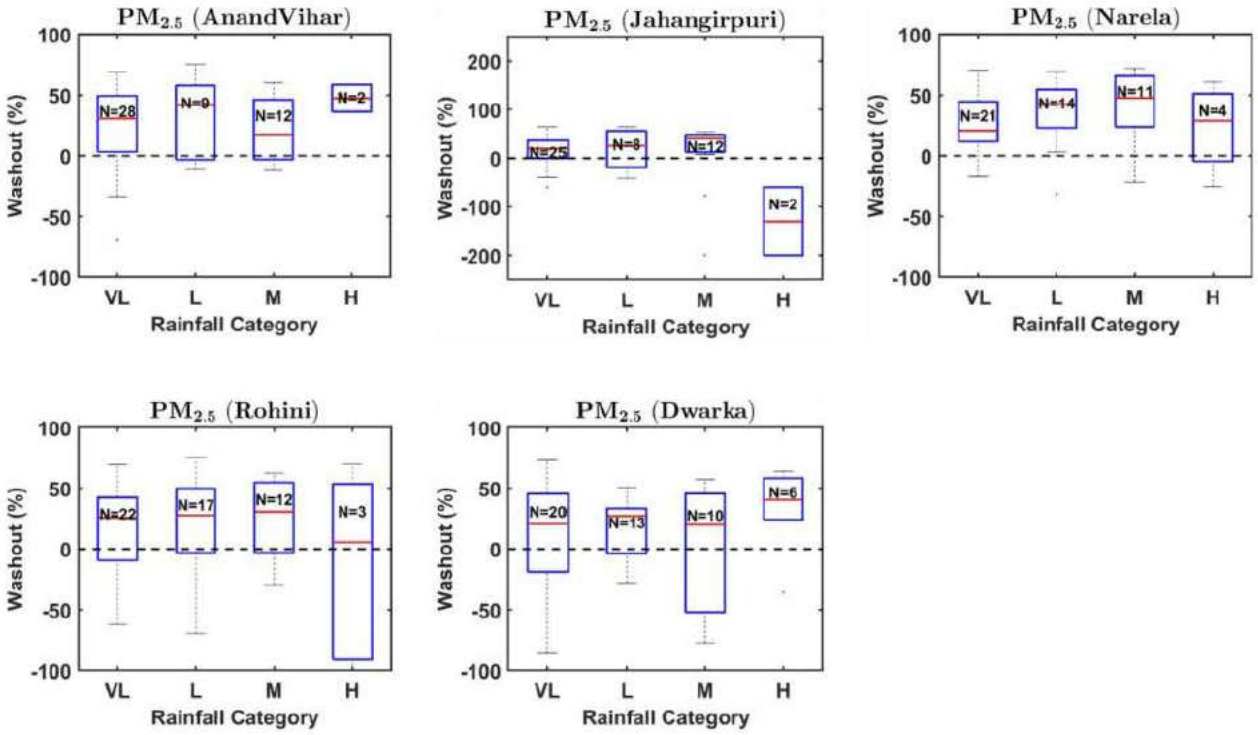


Figure 31: Number of rainfall events at the selected stations during the winter months (October-February) for the period 2017-2024. Rainfall is categorised into [Heavy (H), Moderate (M), Light (L), and Very Light (VL)] rainfall intensities.

This analysis (Figure 32) visualises the relationship between rainfall intensity and its cleansing effect on the atmosphere. For pollutants like particulate matter (PM2.5, PM10) and NOX, there is a clear dose-response pattern: heavy rain is a highly effective scavenger, consistently producing a median washout of 80-95%, while moderate rain's effect is substantial but less potent, and light rain's impact is minimal and highly variable. A striking contrast is seen with ozone, which consistently shows a negative washout-meaning its concentration typically increases after a rain event, likely due to complex photochemical reactions. This highlights that while rainfall is a potent natural cleanser for most primary pollutants, its interaction with secondary pollutants like ozone is far more complex.

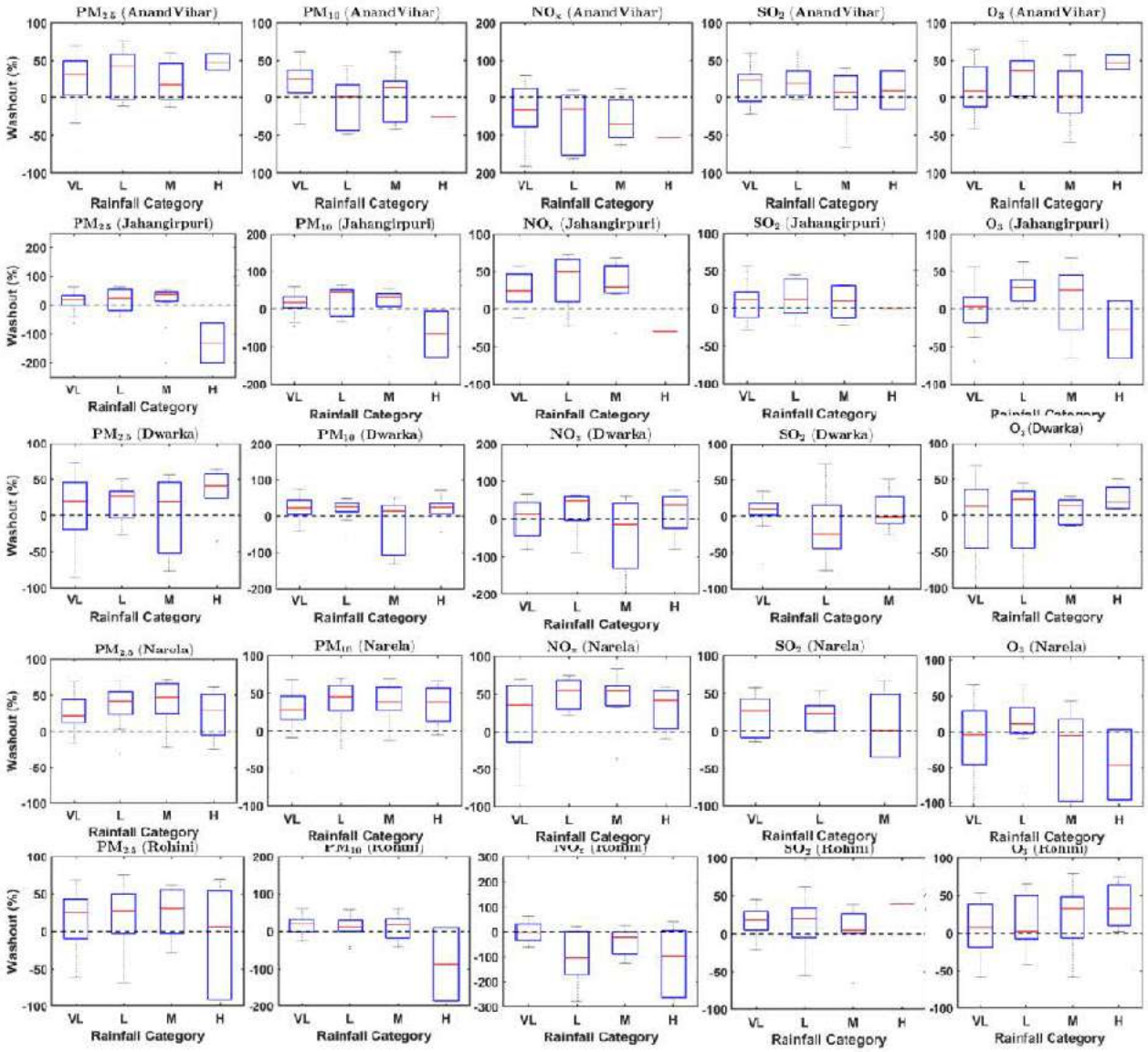


Figure 32: Distribution of pollutant washout percentages following winter rainfall events from 2017 to 2024. The data is grouped by rainfall intensity [Heavy (H), Moderate (M), Light (L), and Very Light (VL)] for five key air pollutants across five Delhi monitoring stations.

3.3.3. AOD Evolution During Dry WD Events

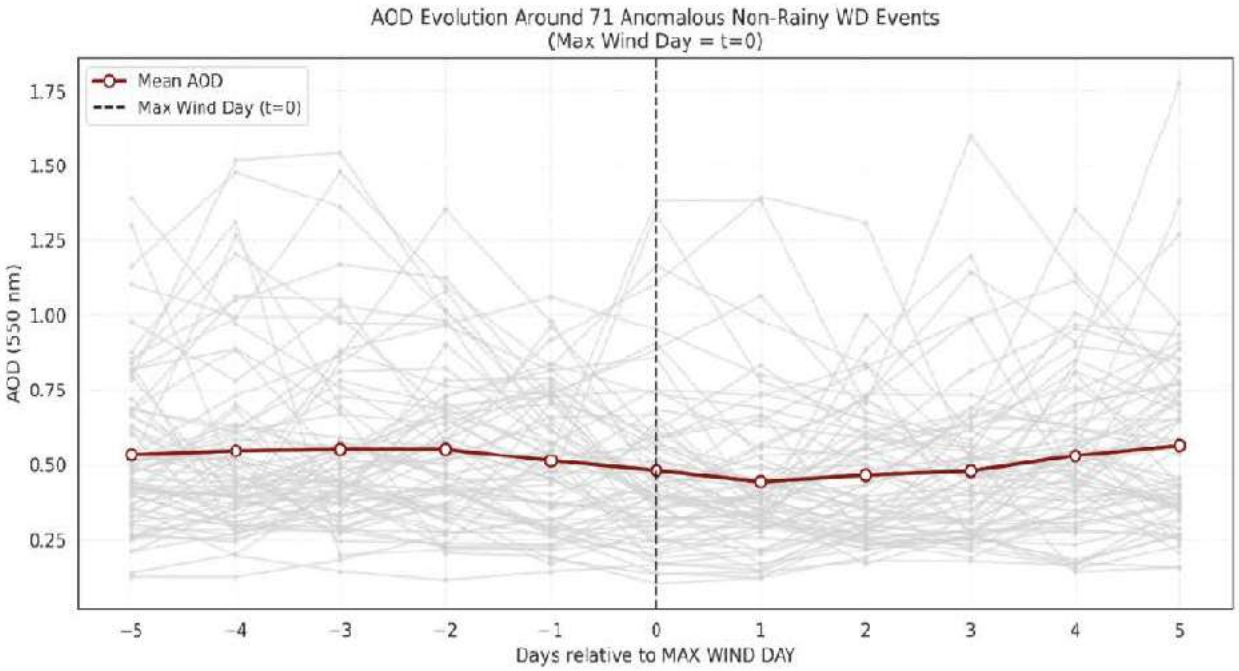


Figure 33: AOD evolution before and after WD-induced and other light and heavy rainfall events

The passage of dry Western Disturbances was associated with a reduction in AOD from day t_0-2 to t_0+1 (Figure 33). However, this reduction was not statistically significant ($p > 0.1$) when compared to the mean AOD on non-rainy days. This decrease in aerosol loading is likely attributable to the synoptic-scale ventilation characteristic of dry WDs, which import cleaner air masses and enhance vertical mixing through increased wind speeds.

3.3.4. Recharge time for pollutants: Case studies

In order to assess the recharge time of each pollutant to regain its original concentration, light, moderate, and heavy rainfall events were analysed at each station. The analysis for Anand Vihar (Figure 34) station clearly demonstrates that the intensity of rainfall has a direct and significant impact on air pollutant concentrations. The heavy rainfall event resulted in a dramatic washout effect, slashing particulate matter levels by over 80% and substantially reducing NOX. This cleaning effect was less pronounced during the moderate rain and was minimal following the light rain, where the dip in pollution was barely distinguishable from daily fluctuations. Interestingly, ozone levels consistently rose immediately after rainfall, highlighting a different atmospheric reaction compared to the other pollutants. While pollution levels begin to rebound in the days following a significant rain event, the recovery to pre-rainfall concentrations is a gradual process, often taking longer than the five-day period observed.

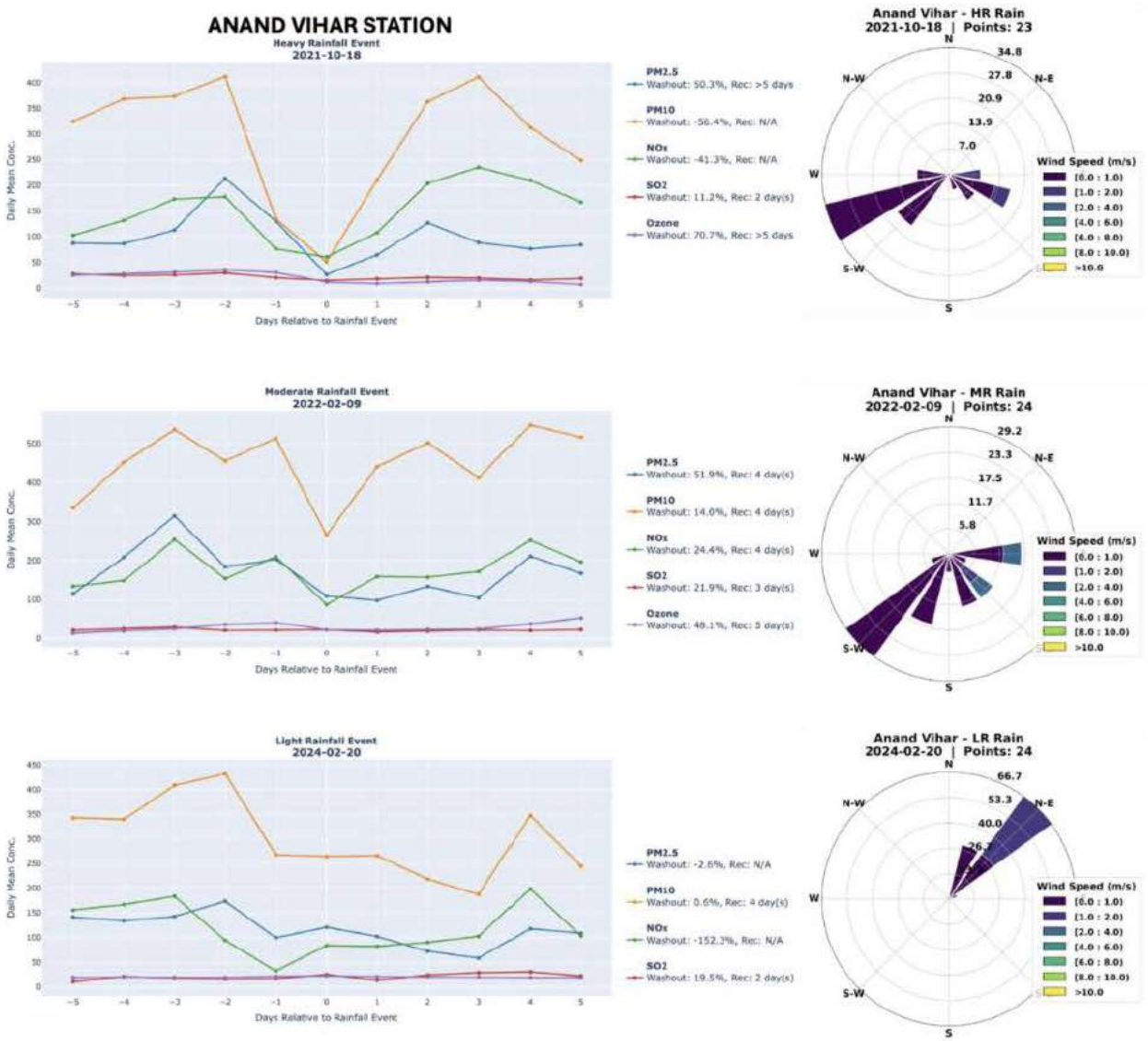


Figure 34: Concentrations of criteria air pollutants at the Anand Vihar station during heavy (upper panel), moderate (middle panel), and light (lower panel) rainfall events, with days relative to rainfall on the x-axis and pollutant concentrations on the y-axis. Each panel includes a corresponding wind rose diagram.

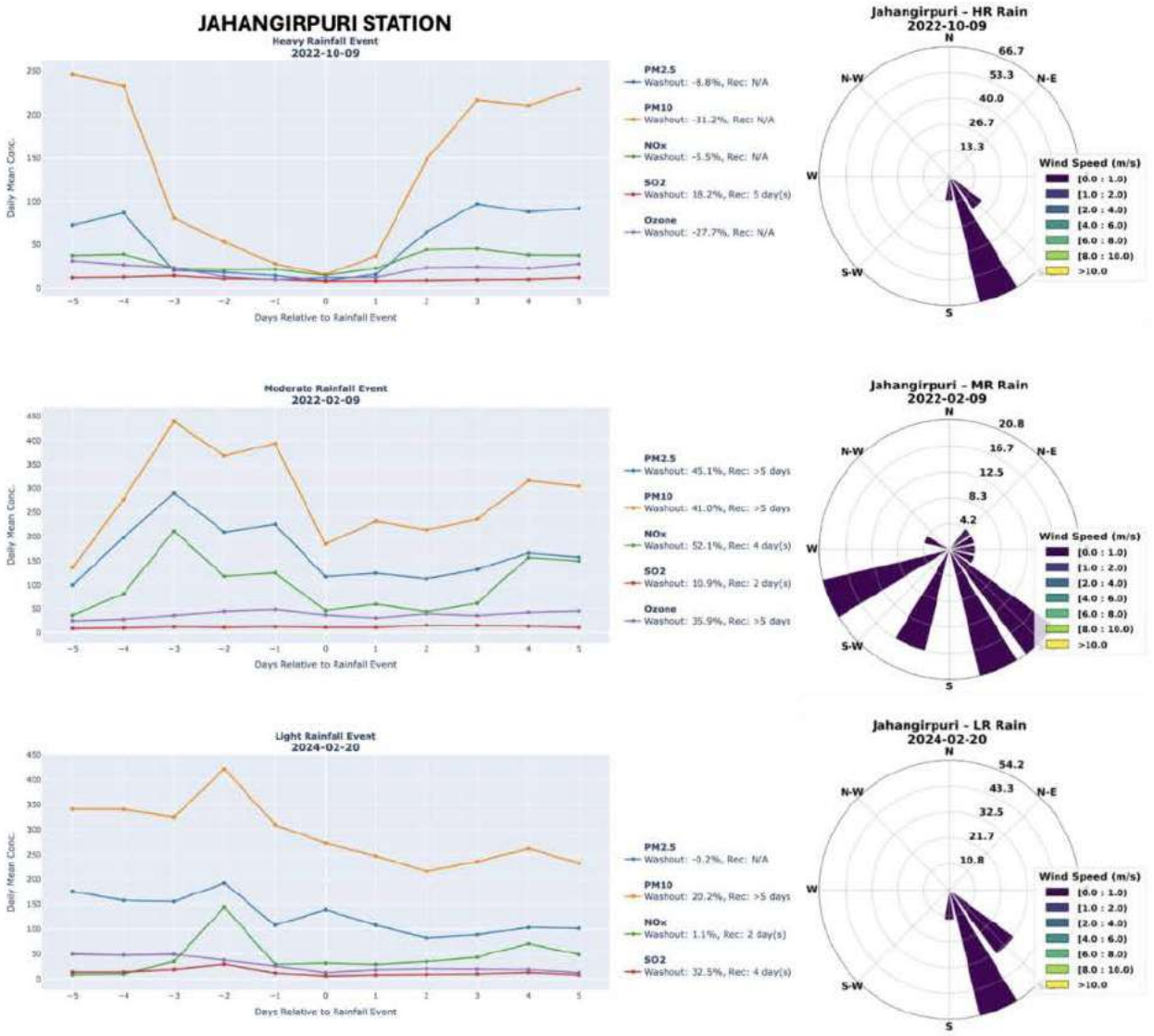


Figure 35: Concentrations of criteria air pollutants at the Jahangirpur station during heavy (upper panel), moderate (middle panel), and light (lower panel) rainfall events, with days relative to rainfall on the x-axis and pollutant concentrations on the y-axis. Each panel includes a corresponding wind rose diagram.

At the Jahangirpuri station (Figure 35), the data illustrate a clear dose-response relationship between rainfall intensity and its cleansing effect on the air. The heavy rainfall event triggered a profound washout, causing particulate matter and NOX concentrations to plummet by over 80-90%. This effect was substantially diminished during the moderate rain, which produced a noticeable but far less dramatic reduction in pollutants. The impact of the light rainfall was marginal, with only a slight dip in pollution that was quickly reversed in the following days. In contrast to other pollutants, ozone consistently exhibited an inverse relationship, increasing in concentration after each rain event, particularly after the heavy downpour. The recovery of particulate and NOX pollution following the most significant washout was slow, indicating that a

single heavy rainfall event can effectively reset air quality for several days before levels begin to creep back up.

Data from Dwarka (Figure 36) shows a clear link between rainfall intensity and its air-cleaning power. The heavy downpour was extremely effective, slashing particulate and NOX pollution by over 90%. While moderate rain also had a significant clearing effect, the light rain barely made a difference. Following a major washout, pollution levels begin a gradual but steady climb back toward their previous concentrations over several days.

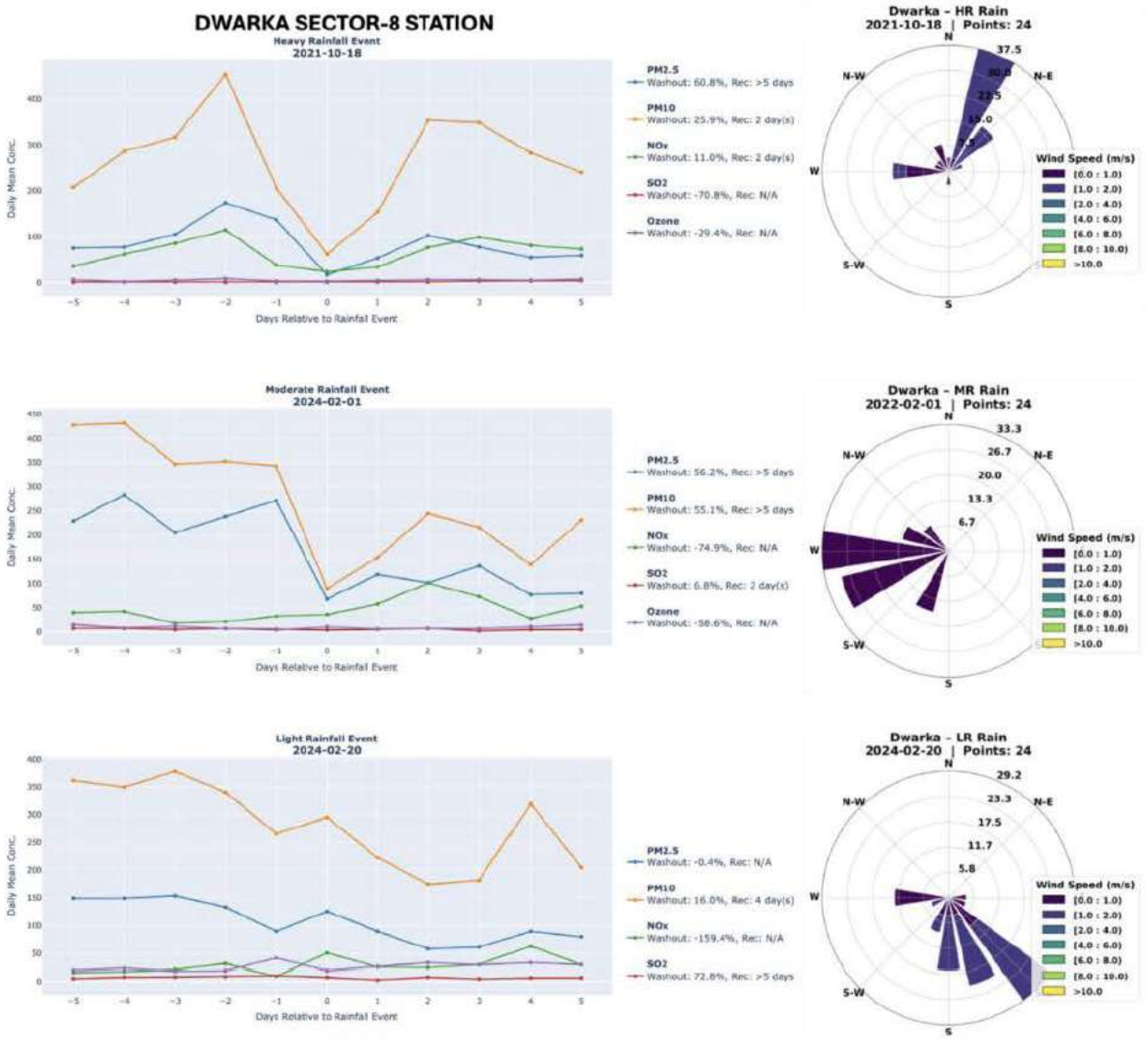


Figure 36: Concentrations of criteria air pollutants at the Dwaraka sector-8 station during heavy (upper panel), moderate (middle panel), and light (lower panel) rainfall events, with days relative to rainfall on the x-axis and pollutant concentrations on the y-axis. Each panel includes a corresponding wind rose diagram.

At the Narela station (Figure 37), the analysis reveals a clear dependence of air pollutant removal efficiency on rainfall intensity. Heavy rainfall events effectively reset the air quality, reducing concentrations of key pollutants such as particulate matter and NOX by more than 95%. Moderate

rainfall also contributes to pollutant removal, though with a markedly lower efficiency compared to heavy rain. In contrast, light rainfall exhibits only a transient and limited cleansing effect, with pollutant concentrations rapidly returning to their pre-event levels. The influence of wind is evident during the moderate rainfall case, where the recharge time for pollutants extends beyond five days, indicating the combined effect of rainfall and other meteorological parameters on post-rain pollution recovery.

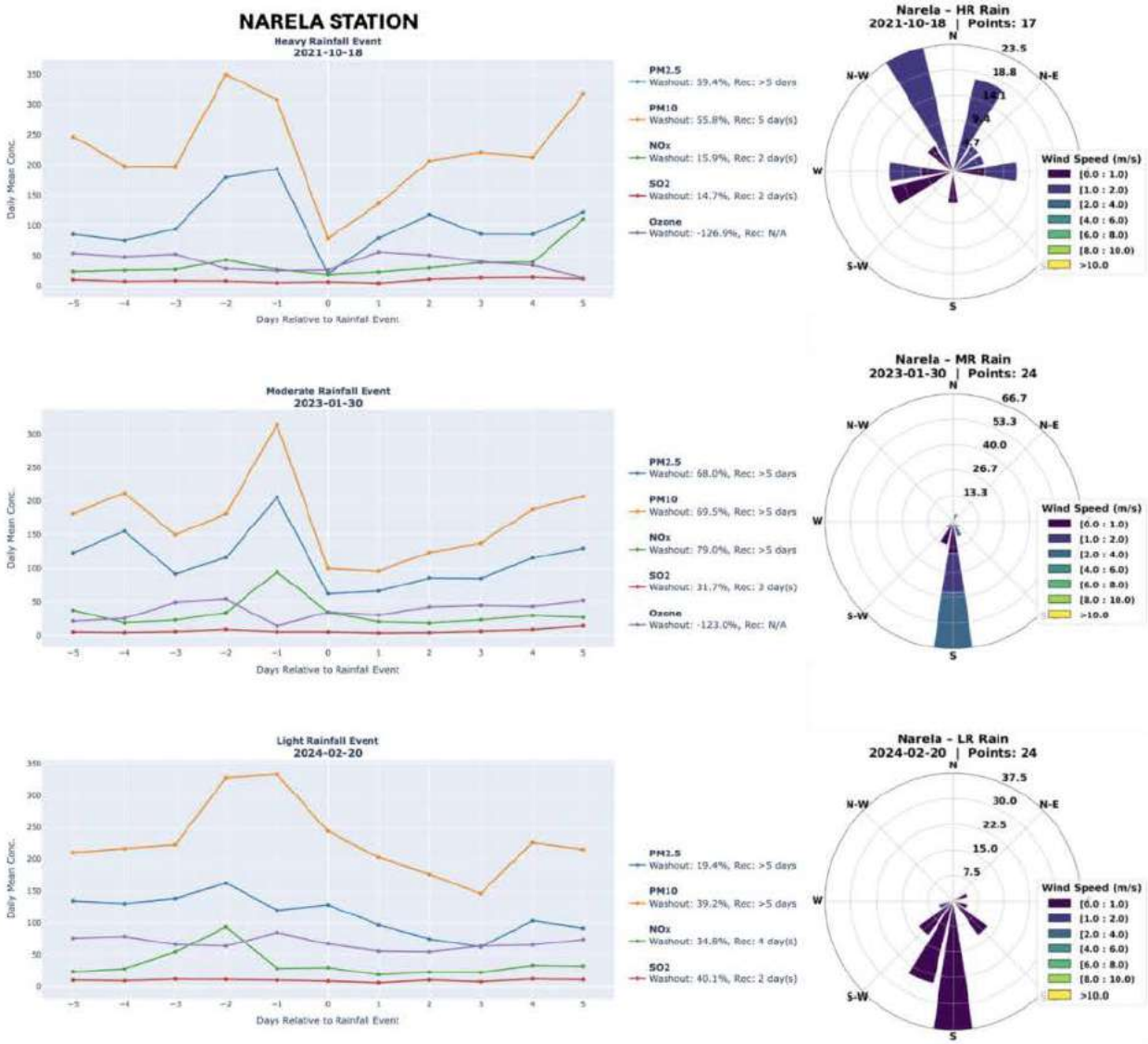


Figure 37: Concentrations of criteria air pollutants at the Narela station during heavy (upper panel), moderate (middle panel), and light (lower panel) rainfall events, with days relative to rainfall on the x-axis and pollutant concentrations on the y-axis. Each panel includes a corresponding wind rose diagram.

The analysis at Rohini station (Figure 38) demonstrates a clear and direct relationship between rainfall intensity and its air-purifying capability. The heavy rainfall event had a profound washout effect, causing a near-total collapse in particulate matter and NOX concentrations with reductions exceeding 90%. This dramatic cleansing was also seen during the moderate rain, which, while less

potent, still managed to slash key pollutant levels by roughly 80%, proving highly effective. In stark contrast, the light rainfall provided only a modest and short-lived dip in pollution, with concentrations quickly rebounding within a day or two. A consistent outlier across all events was ozone, which tended to increase after a downpour, suggesting it is governed by different atmospheric chemistry. Overall, the analysis shows that significant rainfall can effectively reset local air quality for several days, whereas light rain offers only a brief and temporary respite.

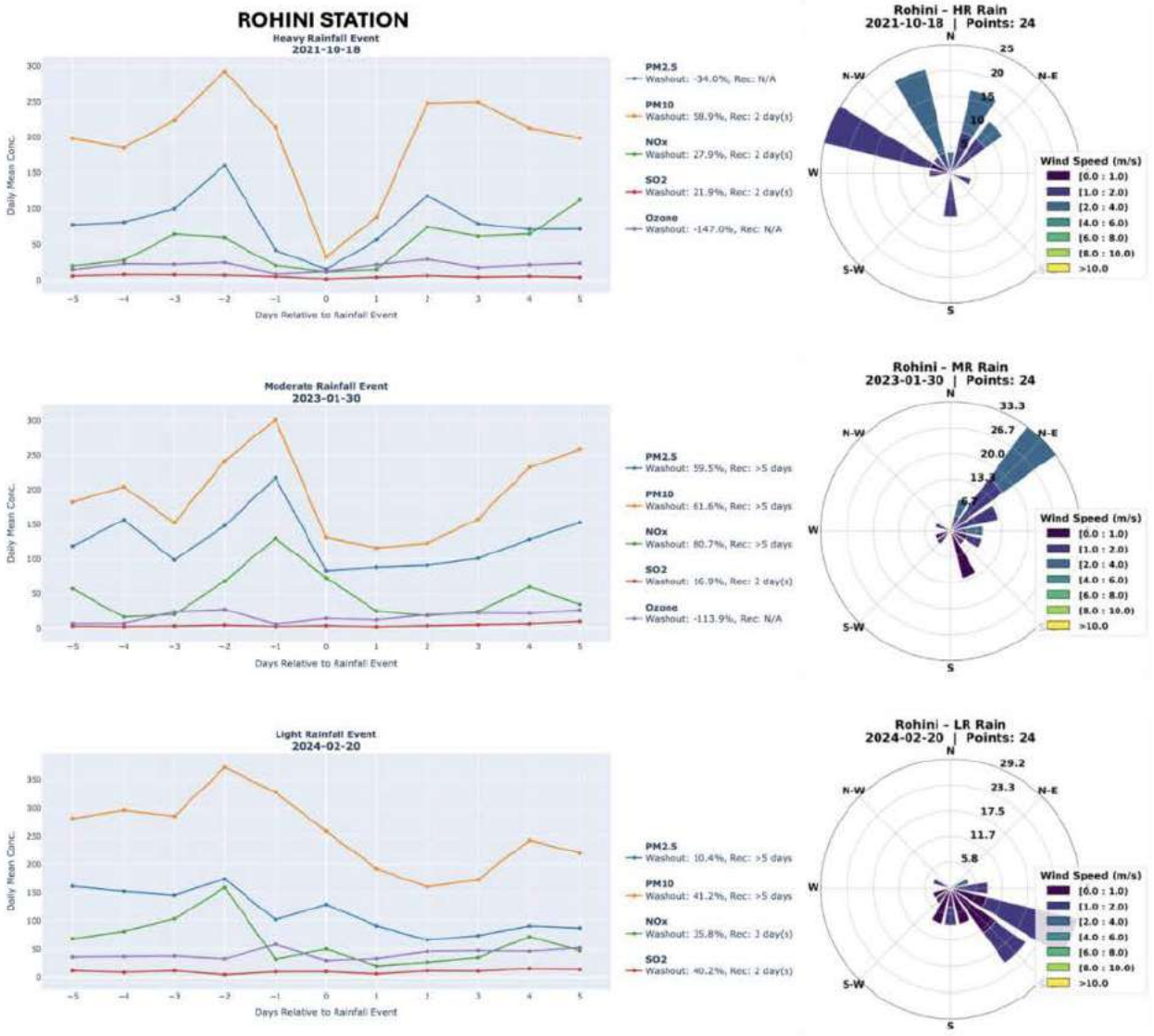


Figure 38: Concentrations of criteria air pollutants at the Rohini station during heavy (upper panel), moderate (middle panel), and light (lower panel) rainfall events, with days relative to rainfall on the x-axis and pollutant concentrations on the y-axis. Each panel includes a corresponding wind rose diagram.

4. Summary and Conclusions

- **Climatological Suitability is Low:** ***Delhi's winter atmosphere is climatologically unsuitable for consistent cloud seeding due to a fundamental lack of sufficient moisture and saturation, particularly during the peak pollution months of December and January.*** A decadal analysis (2011-2021) indicates that the core winter months - December and January-coincide with both the most severe pollution episodes and the driest climatological conditions. Mean TCWV falls below 9 mm, while relative humidity at 850hPa remains between 40-55%, well below the ~80% threshold typically required for sustained cloud formation and persistence.
- **Seedable Days are Quantitatively Rare - Limited Seeding Opportunities:** ***Viable "windows of opportunity" are rare and confined to anomalous weather events, primarily specific types of Western Disturbances. Even days with promising cloud cover and WD presence often lack the necessary combination of moisture depth, saturation, and atmospheric lift, resulting in low MSI scores.*** Application of the MSI provides a quantitative basis for assessing potential cloud seeding opportunities. Days meeting multiple criteria-adequate cloud cover, saturation, lift, liquid water content, and suitable freezing levels-are infrequent. The most promising subset, classified as *Western Disturbance days without rainfall*, averages only about one to two days per month. This finding confirms that thermodynamic conditions conducive to seeding are anomalous rather than typical.
- **Identified Potential Days:** ***Despite the overall poor conditions, analysis identified 92 days over the decade with moisture and cloud cover comparable to naturally occurring moderate-to-heavy rainfall days (>7.5 mm), representing the upper limit of potential opportunities.***
- **Synoptic Control is Dominant:** ***The analysis identifies Western Disturbances as the primary synoptic-scale mechanism capable of generating potential seeding conditions. However, the majority of WD-influenced days are either dry or produce only light precipitation, failing to provide the necessary confluence of moisture and dynamic lift required for confident seeding operations.***
- **Aerosol Vertical Structure Poses Targeting Challenges:** ***Observations from CALIPSO and ground-based ceilometers show that aerosol concentrations are predominantly confined to a shallow boundary layer below 2 km, whereas seedable cloud layers during winter are typically located between 2-5 km. This vertical separation complicates the***

delivery and activation of seeding agents, reducing the likelihood of effective aerosol - cloud interaction.

- **Aerosol-Cloud Interactions:** ***High aerosol concentrations during winter are associated with increased cloud cover, lower cloud base heights (CBH < 2-4 km), and higher cloud liquid/ice water content, particularly during rainy conditions (both WD-associated and non-WD associated).*** This suggests aerosols significantly influence cloud microphysics and potentially favor ice nucleation processes at high AOD levels.
- **Cloud Microphysics are Linked to Pre-existing Rainfall:** ***Analysis of cloud properties across AOD bins reveals that favorable microphysical conditions for seeding- specifically, low cloud bases (<4 km, suitable for aircraft access) and high liquid or ice water content - tend to occur on days already experiencing natural precipitation.*** This limits the potential marginal benefit of seeding, as enhancing rainfall from already precipitating clouds offers uncertain efficacy.
- **Pollution Alters the Baseline Cloud Regime:** A positive correlation between high AOD and both lower cloud bases and higher water content suggests that Delhi's polluted atmosphere, rich in CCN, modifies cloud microphysics. ***While seeding could theoretically counteract precipitation suppression caused by numerous small droplets, the nonlinear and complex aerosol-cloud interactions in such an environment make outcomes highly unpredictable.***
- **Seeding Methodology:** ***The thermal structure indicates glaciogenic seeding (e.g., using AgI) is potentially viable during core winter (Dec-Jan) when temperatures at cloud level are below freezing, while hygroscopic seeding is less promising during this period.***
- **Operational Feasibility:** ***Aircraft-based seeding (typically around 2km altitude) appears operationally feasible primarily during rainy conditions (WDR and NWDR) when CBH is sufficiently low, coinciding with medium-to-high AOD levels.***
- **Washout Efficiency is Strongly Dose-Dependent:** Rainfall intensity exhibits a clear nonlinear relationship with pollutant scavenging. ***Heavy rainfall (>35.5 mm) achieves substantial reductions in $PM_{2.5}$, PM_{10}, and NO_x concentrations (>80-95%), while light rainfall (<7.5 mm) provides only limited and variable washout (<30%), often within the range of statistical uncertainty.***
- **Air Quality Improvements/Pollutant Recovery are Short-Lived:** ***Analysis of "recharge time" across five monitoring stations shows that even after heavy rainfall-or a hypothetically successful seeding event-pollutant concentrations typically return to pre-event levels within 1-5 days.*** Persistent emissions and the re-establishment of stable

boundary-layer conditions drive this rapid rebound, sharply limiting the duration of any improvement. Following rainfall events, pollutant levels typically recover within 4-5 days for PM2.5/PM10 and 2-3 days for NOX/SO_2, though recovery times are strongly influenced by prevailing meteorological conditions like wind speed.

- **Ozone Dynamics Respond Adversely:** ***A consistent finding is that rainfall events often coincide with negative washout effects for ozone, with concentrations tending to rise post-event.*** This pattern indicates that cloud seeding is ineffective for ozone mitigation and may temporarily exacerbate this pollutant.
- **Ventilation by Dry Western Disturbances Provides Limited Relief:** ***Dry WDs can reduce AOD by approximately 10-20% through enhanced wind speeds and vertical mixing, offering a secondary mechanism for pollutant dispersion.*** However, this effect is weaker and less consistent than wet scavenging.
- **Major Concerns & Limitations:** ***Significant concerns remain regarding the environmental and health impacts of seeding agents like AgI (toxicity, bioaccumulation), the high operational costs, and the uncertainty of large-scale effectiveness. Cloud seeding should be viewed as a potential emergency, short-term measure rather than a sustainable long-term solution, which requires integrated emission control strategies.***

While cloud seeding is theoretically feasible under specific atmospheric conditions, during Delhi's winter, its practical utility as a consistent and reliable air-quality intervention is constrained. The necessary atmospheric conditions are rare and frequently coincide with natural rainfall, limiting the potential marginal gain. Even when successful, induced rainfall would likely provide only a brief respite (typically one to three days) before pollution levels rebound. Given the high operational costs, the scientific uncertainties inherent in aerosol-laden environments, and the absence of any impact on underlying emission sources, cloud seeding cannot be recommended as a primary or strategic measure for Delhi's pollution management. At best, it could serve as a high-cost, tactical intervention during declared air-quality emergencies, contingent upon a forecast meeting stringent MSI-based suitability criteria. Ultimately, the study underscores that sustained emission reduction remains the best viable and durable solution to Delhi's chronic air pollution crisis.

References

1. Arun, S. H., Sharma, S. K., Chaurasia, S., Vaishnav, R., & Kumar, R. (2018). Fog/low clouds detection over the Delhi Earth Station using the Ceilometer and the INSAT-3D/3DR satellite data. *International Journal of Remote Sensing*, 39(12), 4130–4144. https://doi.org/10.1080/01431161.2018.1454624
2. Azeez, H. M., Ibraheem, N. T., & Hussain, H. H. (2024). Alternate Chemical Compounds as a Condensation Nucleus in Cloud Seeding. *Nature Environment and Pollution Technology*, *23*(3), 1795–1799. https://doi.org/10.46488/NEPT.2024.V23I03.052
3. Breed, D., Rasmussen, R., Weeks, C., Boe, B., & Deshler, T. (2014). Evaluating Winter Orographic Cloud Seeding: Design of the Wyoming Weather Modification Pilot Project (WWMPP). *Journal of Applied Meteorology and Climatology*, *53*(2), 282–299. https://doi.org/10.1175/JAMC-D-13-0128.1
4. Bruintjes, R. T. (1999). A review of cloud seeding experiments to enhance precipitation. *Bulletin of the American Meteorological Society*, 80(5), 805-820
5. *CAIPEEX Cloud Physics Literacy Course Report* (2023). Indian Institute of Tropical Meteorology. Retrieved from https://www.tropmet.res.in/~lip/Publication/Technical-Reports/CAIPEEX-Report-July2023.pdf
6. Chen, M., Jing, X., Li, J., Yang, J., Dong, X., Geerts, B., Yin, Y., Chen, B., Xue, L., Huang, M., Tian, P., & Hua, S. (2025). Accelerated impact of airborne glaciogenic seeding of stratiform clouds by turbulence. *Atmospheric Chemistry and Physics*, *25*(14), 7581–7596. https://doi.org/10.5194/ACP-25-7581-2025
7. Chen, S., Xue, L., Tessendorf, S. A., Chubb, T., Peace, A., Kenyon, S., Speirs, J., Wolff, J., & Petzke, B. (2025). Assessing glaciogenic seeding impacts in Australia's Snowy Mountains: an ensemble modeling approach. *Atmospheric Chemistry and Physics*, *25*(13), 6703–6724. https://doi.org/10.5194/ACP-25-6703-2025
8. Chowdhury, S., Dey, S., Ghosh, S. et al. Satellite-Based Estimates of Aerosol Washout and Recovery over India during Monsoon. Aerosol Air Qual. Res. 16, 1302–1314 (2016). https://doi.org/10.4209/aaqr.2015.01.0018
9. Fajardo, C., Costa, G., Ortiz, L., Nande, M., Rodríguez-Membibre, M., Martín, M., & Sánchez-Fortún, S. (2016). Potential risk of acute toxicity induced by AgI cloud seeding on soil and freshwater biota. *Ecotoxicology and Environmental Safety*, *133*, 433–441. https://doi.org/10.1016/j.ecoenv.2016.06.028
10. Farahat, A., & Abuelgasim, A. (2022). Effect of cloud seeding on aerosol properties and particulate matter variability in the United Arab Emirates. *International Journal of Environmental Science and Technology*, *19*(2), 951–968. https://doi.org/10.1007/S13762-020-03057-5/FIGURES/11
11. Forest Survey of India. *State of Forest Report*; Ministry of Environment & Forests: Dehradun, India, 2011.
12. Freud, E., Koussevitzky, H., Goren, T., & Rosenfeld, D. (2015). Cloud microphysical background for the Israel-4 cloud seeding experiment. *Atmospheric Research*, *158–159*, 122–138. https://doi.org/10.1016/J.ATMOSRES.2015.02.007

13. Fujino, R., Miyamoto, Y., & Kiryu, T. (2025). PM2. 5 concentration decreases with snowfall as revealed by surface observation data. *SOLA*, *21*, 101-107, https://doi.org/10.2151/sola.2025-013.
14. Gani, S., Bhandari, S., Seraj, S., Wang, D. S., Patel, K., Soni, P., Arub, Z., Habib, G., Hildebrandt Ruiz, L., and Apte, J. S.: Submicron aerosol composition in the world's most polluted megacity: the Delhi Aerosol Supersite study, Atmos. Chem. Phys., 19, 6843–6859, https://doi.org/10.5194/acp-19-6843-2019
15. Gautam, A. S., Tripathi, S. N., Joshi, A., Mandariya, A. K., Singh, K., Mishra, G., Kumar, S., & Ramola, R. C. (2021a). First surface measurement of variation of Cloud Condensation Nuclei (CCN) concentration over the Pristine Himalayan region of Garhwal, Uttarakhand, India. *Atmospheric Environment*, *246*, 118123. https://doi.org/10.1016/J.ATMOSENV.2020.118123
16. Gautam, A. S., Tripathi, S. N., Joshi, A., Mandariya, A. K., Singh, K., Mishra, G., Kumar, S., & Ramola, R. C. (2021b). First surface measurement of variation of Cloud Condensation Nuclei (CCN) concentration over the Pristine Himalayan region of Garhwal, Uttarakhand, India. *Atmospheric Environment*, *246*, 118123. https://doi.org/10.1016/J.ATMOSENV.2020.118123
17. Geerts, B., & Rauber, R. M. (2022). Glaciogenic Seeding of Cold-Season Orographic Clouds to Enhance Precipitation: Status and Prospects. *Bulletin of the American Meteorological Society*, *103*(10), E2302–E2314. https://doi.org/10.1175/BAMS-D-21-0279.1
18. Givati, Amir, and Daniel Rosenfeld. "Separation between cloud-seeding and air-pollution effects." Journal of Applied Meteorology 44.9 (2005): 1298-1314.
19. Global Modeling and Assimilation Office (GMAO) (2015), inst3_3d_asm_Cp: MERRA-2 3D IAU State, Meteorology Instantaneous 3-hourly (p-coord, 0.625x0.5L42), version 5.12.4, Greenbelt, MD, USA: Goddard Space Flight Center Distributed Active Archive Center (GSFC DAAC), Accessed Enter User Data Access Date at doi: 10.5067/VJAFPLI1CSIV.
20. Guo, X., & Zheng, G. (2009). Advances in weather modification from 1997 to 2007 in China. *Advances in Atmospheric Sciences*, *26*(2), 240–252. https://doi.org/10.1007/S00376-009-0240-8/METRICS
21. Guttikunda, S. K., & Calori, G. (2013). A GIS based emissions inventory at 1 km× 1 km spatial resolution for air pollution analysis in Delhi, India. *Atmospheric Environment*, *67*, 101-111. https://doi.org/10.1016/j.atmosenv.2012.10.040
22. Hegg, D. A., Clarke, A. D., Doherty, S. J., & Ström4, J. (2011). Measurements of black carbon aerosol washout ratio on Svalbard. *Tellus B: Chemical and Physical Meteorology*, *63*(5), 891-900, https://doi.org/10.1111/j.1600-0889.2011.00577.x
23. Hersbach H, Bell B, Berrisford P, et al. The ERA5 global reanalysis. Q J R Meteorol Soc. 2020; 146: 1999–2049. https://doi.org/10.1002/qj.3803
24. Hunt, K. M. R., Baudouin, J., Turner, A. G., Dimri, A. P., Jeelani, G., Chattopadhyay, R., Cannon, F., Arulalan, T., Shekhar, M. S., Sabin, T. P., & Palazzi, E. (2025). Western disturbances and climate variability: a review of recent developments. Weather and Climate Dynamics, 6(1), 43–112. https://doi.org/10.5194/wcd-6-43-2025

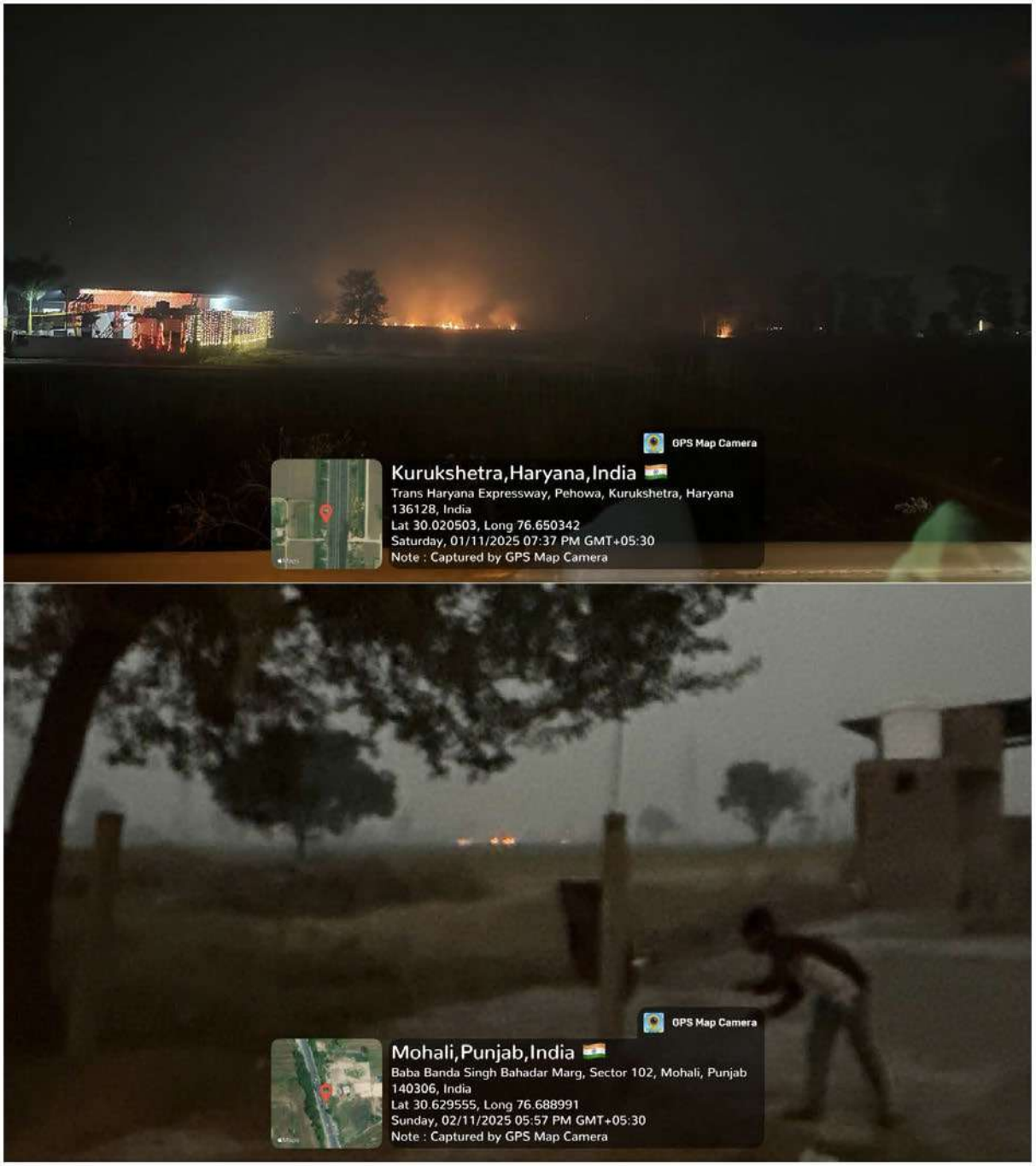
25. Hunt, K. M. R., Turner, A. G., & Shaffrey, L. C. (2019). Falling trend of Western disturbances in future climate simulations. *Journal of Climate*, *32*(16), 5037–5051. https://doi.org/10.1175/jcli-d-18-0601.1
26. Hunt, K.M.R., Turner, A.G. and Shaffrey, L.C. (2018), The evolution, seasonality and impacts of western disturbances. Q.J.R. Meteorol. Soc., 144: 278-290. https://doi.org/10.1002/qj.3200
27. Jones, A. C., Hill, A., Hemmings, J., Lemaitre, P., Quérel, A., Ryder, C. L., and Woodward, S.: Below-cloud scavenging of aerosol by rain: a review of numerical modelling approaches and sensitivity simulations with mineral dust in the Met Office's Unified Model, Atmos. Chem. Phys., 22, 11381–11407, https://doi.org/10.5194/acp-22-11381-2022
28. Kalsi, S. R. and Halder, S. R.: Satellite observations of interaction between tropics and mid-latitudes, Mausam, 43, 59–64, 1992. https://wcd.copernicus.org/articles/6/43/2025/#xref_paren.184, https://wcd.copernicus.org/articles/6/43/2025/#xref_text.186, https://wcd.copernicus.org/articles/6/43/2025/#xref_text.188
29. Kaushik, N., & Das, R. M. (2023). Investigation of NOX and related secondary pollutants at Anand Vihar, one of the most polluted area of Delhi. *Urban Climate*, *52*, 101747.
30. Koren, I., Feingold, G., & Remer, L. A. (2010). The invigoration of deep convective clouds over the Atlantic: Aerosol effect, meteorology or retrieval artifact? *Atmospheric Chemistry and Physics*, *10*(18), 8855–8872. https://doi.org/10.5194/ACP-10-8855-2010
31. Ku, J. M., Chang, K. H., Chae, S., Ko, A. R., Ro, Y., Jung, W., & Lee, C. (2023a). Preliminary Results of Cloud Seeding Experiments for Air Pollution Reduction in 2020. *Asia-Pacific Journal of Atmospheric Sciences*, *59*(3), 347–358. https://doi.org/10.1007/S13143-023-00315-7/FIGURES/9
32. Ku, J. M., Chang, K. H., Chae, S., Ko, A. R., Ro, Y., Jung, W., & Lee, C. (2023b). Preliminary Results of Cloud Seeding Experiments for Air Pollution Reduction in 2020. *Asia-Pacific Journal of Atmospheric Sciences*, *59*(3), 347–358. https://doi.org/10.1007/S13143-023-00315-7/FIGURES/9
33. Ku, Jung Mo, et al. "Preliminary results of cloud seeding experiments for air pollution reduction in 2020." Asia-Pacific Journal of Atmospheric Sciences 59.3 (2023): 347-358.
34. Kulkarni, J. R., Morwal, S. B., & Deshpande, N. R. (2019). Rainfall enhancement in Karnataka state cloud seeding program "Varshadhare" 2017. *Atmospheric Research*, *219*, 65–76. https://doi.org/10.1016/J.ATMOSRES.2018.12.020
35. Kumar, Mohit and Chakravarty, Kaustav and Deshpande, Sachin and Mise, Dhwanit J., Analyzing the Atmospheric Dynamics, Thermodynamics and Cloud Microphysics in Two Rainfall Events Over the Delhi Region. Available at SSRN: https://ssrn.com/abstract=5215126 or http://dx.doi.org/10.2139/ssrn.5215126
36. Lu, X., Chan, S. C., Fung, J. C., & Lau, A. K. (2019). To what extent can the below-cloud washout effect influence the PM2. 5? A combined observational and modeling study. *Environmental Pollution*, *251*, 338-343, https://doi.org/10.1016/j.envpol.2019.04.06
37. Luan, T., Guo, X., Zhang, T. et al. Below-Cloud Aerosol Scavenging by Different-Intensity Rains in Beijing City. J Meteorol Res 33, 126–137 (2019). https://doi.org/10.1007/s13351-019-8079-0

38. Malik, Shaista, et al. "Cloud seeding; its prospects and concerns in the modern world-A review." Int. J. Pure App. Biosci 6.5 (2018): 791-796.
39. Maria, S. F., & Russell, L. M. (2005). Organic and inorganic aerosol below-cloud scavenging by suburban New Jersey precipitation. *Environmental science & technology*, *39*(13), 4793-4800, https://doi.org/10.1021/es0491679
40. Murthy, B., Latha, R., Tiwari, A., Rathod, A., Singh, S., & Beig, G. (2020). Impact of mixing layer height on air quality in winter. *Journal of Atmospheric and Solar-Terrestrial Physics*, 197, 105157. https://doi.org/10.1016/j.jastp.2019.105157
41. Neyman, J., Osborn, H. B., Scott, E. L., & Wells, M. A. (1972). Re-Evaluation of the Arizona Cloud-Seeding Experiment. *Proceedings of the National Academy of Sciences*, *69*(6), 1348–1352. https://doi.org/10.1073/PNAS.69.6.1348
42. Pai D.S., Latha Sridhar, Rajeevan M., Sreejith O.P., Satbhai N.S. and Mukhopadhyay B., 2014: Development of a new high spatial resolution (0.25° X 0.25°) Long period (1901-2010) daily gridded rainfall data set over India and its comparison with existing data sets over the region; MAUSAM, 65, 1(January 2014), pp1-18.
43. Pokharel, B., & Geerts, B. (2016a). A multi-sensor study of the impact of ground-based glaciogenic seeding on clouds and precipitation over mountains in Wyoming. Part I: Project description. *Atmospheric Research*, *182*, 269–281. https://doi.org/10.1016/J.ATMOSRES.2016.08.008
44. Pokharel, B., & Geerts, B. (2016b). A multi-sensor study of the impact of ground-based glaciogenic seeding on clouds and precipitation over mountains in Wyoming. Part I: Project description. *Atmospheric Research*, *182*, 269–281. https://doi.org/10.1016/J.ATMOSRES.2016.08.008
45. Pourghasemi, M. A., Memarian, M. H., & Zare, A. (2022). Assessment of Possible Precipitation Enhancement by Glaciogenic Cloud Seeding Using WRF: A Case Study. *Russian Meteorology and Hydrology*, *47*(7), 553–560. https://doi.org/10.3103/S106837392207010X/FIGURES/3
46. Prabhakaran, T., Murugavel, P., Konwar, M., Malap, N., Gayatri, K., Dixit, S., Samanta, S., Chowdhuri, S., Bera, S., Varghese, M., Rao, J., Sandeep, J., Safai, P. D., Sahai, A. K., Axisa, D., Karipot, A., Baumgardner, D., Werden, B., Fortner, E., … Nanjundiah, R. (2023). CAIPEEX: Indian Cloud Seeding Scientific Experiment. *Bulletin of the American Meteorological Society*, *104*(11), E2095–E2120. https://doi.org/10.1175/BAMS-D-21-0291.1
47. Rosenfeld, D., Yu, X., Liu, G., Xu, X., Zhu, Y., Yue, Z., Dai, J., Dong, Z., Dong, Y., Peng, Y., Yu, X., Liu, G., Xu, X., Zhu, Y., Yue, Z., Dai, J., Dong, Z., Dong, Y., & Peng, Y. (2011a). Glaciation temperatures of convective clouds ingesting desert dust, air pollution and smoke from forest fires. *Geophysical Research Letters*, *38*(21). https://doi.org/10.1029/2011GL049423
48. Rosenfeld, D., Yu, X., Liu, G., Xu, X., Zhu, Y., Yue, Z., Dai, J., Dong, Z., Dong, Y., Peng, Y., Yu, X., Liu, G., Xu, X., Zhu, Y., Yue, Z., Dai, J., Dong, Z., Dong, Y., & Peng, Y. (2011b). Glaciation temperatures of convective clouds ingesting desert dust, air pollution and smoke from forest fires. *Geophysical Research Letters*, *38*(21). https://doi.org/10.1029/2011GL049423

49. Roy, A., Chatterjee, A., Ghosh, A., Das, S. K., Ghosh, S. K., & Raha, S. (2019). Below-cloud scavenging of size-segregated aerosols and its effect on rainwater acidity and nutrient deposition: A long-term (2009–2018) and real-time observation over eastern Himalaya. Science of The Total Environment, 674, 223–233. https://doi.org/10.1016/j.scitotenv.2019.04.165
50. Seinfeld, J. H., & Pandis, S. N. (2016). *Atmospheric chemistry and physics: From air pollution to climate change* (3rd ed.). Wiley.
51. Super, A. B. (1990). Winter Orographic Cloud Seeding Status in the Intermountain West. *The Journal of Weather Modification*, *22*(1), 106–116. https://doi.org/10.54782/JWM.V22I1.342
52. Tan, I., Storelvmo, T., & Choi, Y. S. (2014). Spaceborne lidar observations of the ice-nucleating potential of dust, polluted dust, and smoke aerosols in mixed-phase clouds. *Journal of Geophysical Research: Atmospheres*, *119*(11), 6653–6665. https://doi.org/10.1002/2013JD021333
53. Teller, A., Axisa, D., Breed, D., & Bruintjes, R. J12. 2 THE EFFECTS OF GIANT CCN ON CLOUDS AND PRECIPITATION: A CASE STUDY FROM THE SAUDI ARABIA PROGRAM FOR THE ASSESSMENT OF RAINFALL AUGMENTATION.
54. *The Second Israeli Randomized Cloud Seeding Experiment: Evaluation of the Results in: Journal of Applied Meteorology and Climatology Volume 20 Issue 11 (1981)*. (n.d.). Retrieved October 24, 2025, from https://journals.ametsoc.org/view/journals/apme/20/11/1520-0450_1981_020_1301_tsircs_2_0_co_2.xml
55. Tiwari, S., Beig, G., & Kumar, P. (2015). Black carbon and aerosol chemical composition in urban India. *Atmospheric Pollution Research, 6,* 107–121. https://doi.org/10.5094/APR.2015.013
56. Tripathi, A., Misra, A. K., & Shukla, J. B. (2022). A mathematical model for the removal of pollutants from the atmosphere through artificial rain. *Stochastic Analysis and Applications*, *40*(3), 379–396. https://doi.org/10.1080/07362994.2021.1915802
57. UNDP. (2024). Multi-Sectoral Action Plan for Air Pollution Mitigation in Gurugram,India 2025-2030. United Nations Development Programme. Licence: CC BY-NC-SA 3.0 IGO. https://www.undp.org/sites/g/files/zskgke326/files/2025-02/multi-sectoral_action_plan_for_air_pollution_mitigation_in_gurugram_india_2025-2030.pdf
58. Wehbe, Y., Tessendorf, S. A., Weeks, C., Bruintjes, R., Xue, L., Rasmussen, R., Lawson, P., Woods, S., & Temimi, M. (2021). Analysis of aerosol-cloud interactions and their implications for precipitation formation using aircraft observations over the United Arab Emirates. *Atmospheric Chemistry and Physics*, *21*(16), 12543–12560. https://doi.org/10.5194/ACP-21-12543-2021
59. Woodley, W. (2003). *Results of On-Top Glaciogenic Cloud Seeding in Thailand. Part I: The Demonstration Experiment in: Journal of Applied Meteorology and Climatology Volume 42 Issue 7 (2003)*. Results of On-Top Glaciogenic Cloud Seeding in Thailand. Part I: The Demonstration Experiment. https://journals.ametsoc.org/view/journals/apme/42/7/1520-0450_2003_042_0920_roogcs_2.0.co_2.xml?tab_body=pdf

60. Xie, Y., Zhou, M., Hunt, K.M.R. et al. Recent PM2.5 air quality improvements in India benefited from meteorological variation. Nat Sustain 7, 983–993 (2024). https://doi.org/10.1038/s41893-024-01366-y
61. Xie, Y., Zhou, M., Hunt, K.M.R. et al. Recent PM2.5 air quality improvements in India benefited from meteorological variation. Nat Sustain 7, 983–993 (2024). https://doi.org/10.1038/s41893-024-01366-y
62. Yadav, R.K., Rupa Kumar, K. & Rajeevan, M. Characteristic Features of Winter Precipitation and Its Variability Over Northwest India. *J Earth Syst Sci* **121**, 611–623 (2012). https://doi.org/10.1007/s12040-012-0184-8
63. Zhao, X., Sun, Y., Zhao, C., & Jiang, H. (2020). Impact of precipitation with different intensity on PM2. 5 over typical regions of China. *Atmosphere*, *11*(9), 906, https://doi.org/10.3390/atmos11090906

ANNEXURE A/4
[COLLY]




GPS Map Camera
Kurukshetra,Haryana,India
Trans Haryana Expressway, Pehowa, Kurukshetra, Haryana
136128, India
Lat 30.020917, Long 76.650392
Saturday, 01/11/2025 07:37 PM GMT+05:30
Note : Captured by GPS Map Camera

The Indian EXPRESS
JOURNALISM OF COURAGE

Punjab farmers protest stubble burning penalties, demand dues and bonus

Samyukt Kisan Morcha has urged Punjab to oppose the Electricity Amendment Bill 2025 and to immediately release ₹109 crore pending dues owed to farmers by cooperative sugar mills.

Written by Raakhi Jagga Follow
Ludhiana | November 4, 2025 04:58 PM IST
3 min read

Farmer leader Balbir Singh Rajewal at protesting site in PU. (Source: Express Photo)

Responding to the call of the Samyukt Kisan Morcha (SKM) in Punjab, farmers and labourers across the state on Wednesday jointly submitted memorandums to all Deputy Commissioners to stop the alleged harassment against them in the name of pollution control for burning stubble.

The SKM said that the farmers are already suffering due to low paddy yields and crop damage due to floods, as the government has neither provided machinery nor offered any cash assistance for stubble management. “All punitive actions against farmers compelled to burn stubble must be stopped immediately,” the memorandum said.

“We also demand immediate release of ₹109 crore pending dues owed to farmers by cooperative sugar mills and an increase in the sugarcane price to ₹470 per quintal,” said Jagmohan Singh Patiala, state general secretary of Bharatiya Kisan Union (BKU) Dakaunda.

The memorandum further sought an assured supply of DAP (diammonium phosphate) fertiliser, an end to forcing farmers to buy unnecessary fertilisers and pesticides along with DAP and urea, and relaxation of the moisture limit in paddy procurement from 17 per cent to 22 per cent. Deductions made in mandis on the pretext of moisture and discoloured grains amounted to exploitation of farmers and must be stopped, it said.

Due to unseasonal rains, paddy yield has dropped significantly across Punjab. In many places, paddy crops have been destroyed by bacterial leaf blight. “The SKM demands a ₹500 per quintal bonus for reduced yield and ₹50,000 per acre compensation where crops were completely damaged,” said Balbir Singh Rajewal, national coordination committee member of SKM.

The SKM also said both the Punjab and Central Governments had merely made symbolic gestures in the name of flood relief. It demanded full compensation for affected families, including owners of riverine (kachha) lands.

Through the memorandums, the SKM termed the Electricity Amendment Bill 2025 as an attack on states’ rights and an attempt to privatise power distribution. It urged the Punjab Government to pass a resolution opposing the Bill and send it to the Centre before November 8.

“The SKM Punjab strongly opposed the dissolution of the Senate and Syndicate of Panjab University, Chandigarh, calling it a direct blow to Punjab’s rights. It demanded restoration of the university’s earlier status and re-establishment of a truly democratic

system," said Joginder Singh Ugrahan, national coordination committee member of SKM.

'Withdraw all cases registered against farmers'

The organisation also sought the withdrawal of all cases registered against farmers during and after the Delhi farmers' movement and the 'Rail Roko' agitation.

Leaders who led delegations to submit memorandums in different districts included Balbir Singh Rajewal, Joginder Singh Ugrahan, Harinder Singh Lakhowal, Ruldu Singh Mansa, Boota Singh Burj Gill, Nirbhai Singh Dhudike, Manjit Singh Dhaner, Dr. Darshan Pal, Balkaran Singh Brar, Dr. Satnam Singh Ajnala, Harmeet Singh Kadian, Jangveer Singh Chauhan, Sukhdev Singh Araiyanwala, Balwinder Singh Malli Nangal, Farman Singh Sandhu, Boota Singh Shadipur, Nachhattar Singh Jaito, Malook Singh Heerke, Prem Singh Bhangu, Veer Singh Barwa, Hardev Singh Sandhu, Kiranjeet Singh Sekho, Balwinder Singh Raju, Binder Singh, Bough Singh Mansa, Harbans Sangha, and Harjinder Tanda.

The Indian EXPRESS
JOURNALISM OF COURAGE

'Farmers clearing field as wheat sowing window narrowing': Punjab sees 78% jump in farm fires in just 10 days

Year's total paddy stubble burning cases 35% less than 2024

Written by Anju Agnihotri Chaba Follow
Jalandhar | November 5, 2025 11:08 AM IST
4 min read

In just two weeks of this year's paddy harvesting season, Punjab has recorded 95 farm fires (Express photo).

In the past 10 days, Punjab has registered a 78 per cent jump in paddy stubble burning cases this season.

According to data from the Punjab Remote Sensing Centre (PRSC), the state has recorded 2,839 stubble-burning incidents between September 15 and November 4, compared to 4,394 cases during the same period last year and 14,173 in 2023. This marks a 35 per

cent decline from last year and an 80 per cent decline compared to 2023.

However, from October 26 to November 4, Punjab reported 2,218 farm fires — more than 3/4 of this season's total.

A closer look at daily trends also reveals that the fire density has surged sharply since October 26, coinciding with the completion of paddy harvesting and the beginning of the wheat-sowing period, which ideally falls between November 1 and November 15.

This season, the highest single-day spike came on November 1, when 442 fires were recorded, followed by 321 Tuesday , 283 on October 29 and 256 on November 3.

Officials said the sudden increase reflects the farmers' urgency to prepare fields for wheat as the sowing window is rapidly shrinking.

"With every passing day after November 15, wheat yield potential drops. Farmers are clearing fields faster this year due to the delayed paddy harvest and narrowing sowing window," said an agriculture official, adding that this year, wheat sowing has already begun, and around 30 per cent (10.5 lakh hectares) of the targeted 35 lakh hectares have been sown so far.

Among districts, Sangrur with 510 and Tarn Taran with 506 cases toped the list of farm fires, followed by Ferozepur at 296, Amritsar (249), Bathinda at 197, Patiala at 167, and Mansa at 126. Kapurthala (110), Moga (101), these nine districts alone account for around 80 per cent of all stubble-burning incidents in the state so far.

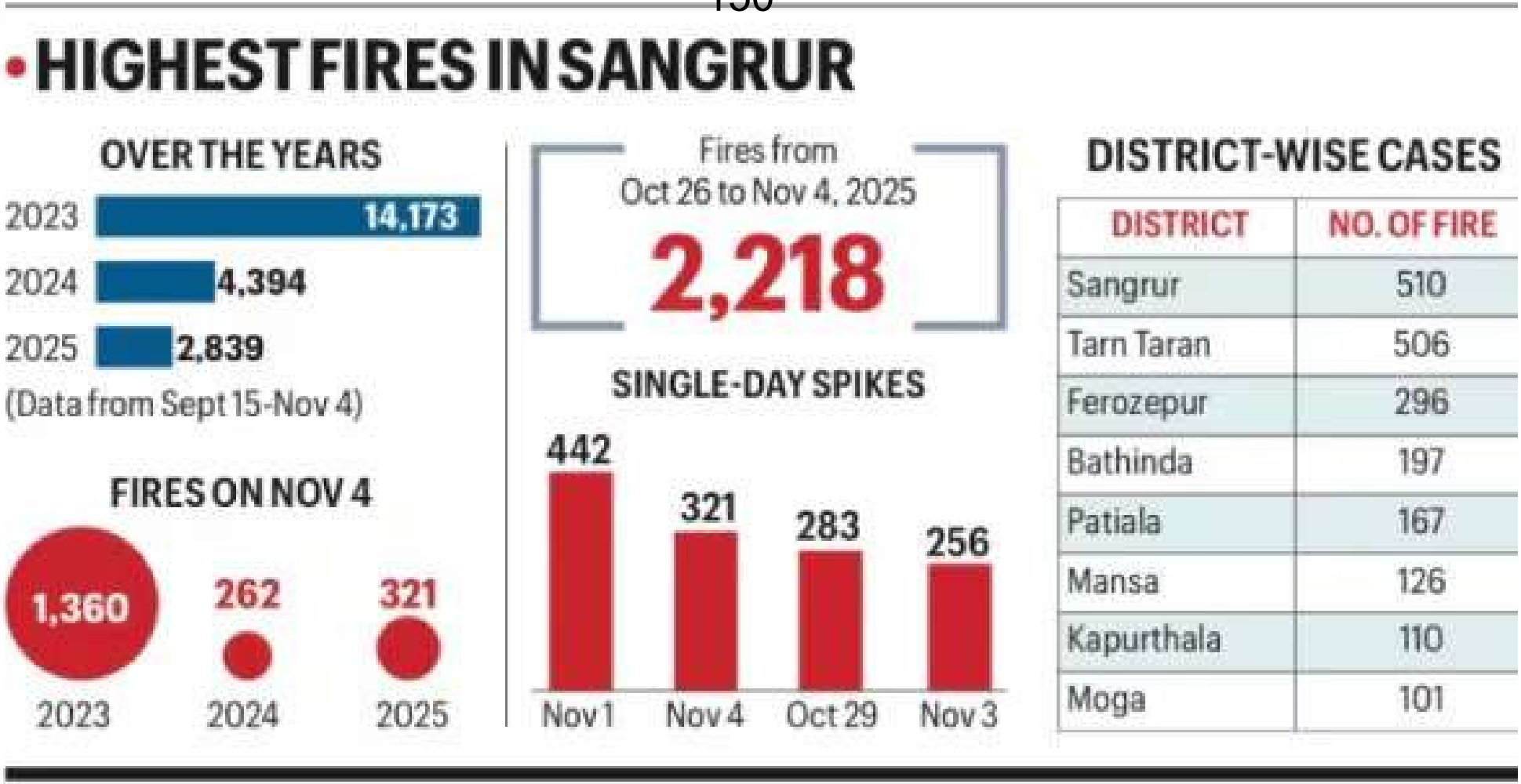
District-level comparisons show that Sangrur had recorded 629 cases in the same period last year and 2,147 cases in 2023 while Tarn Taran had recorded 579 in 2024 and 1,585 in 2023 in the same period.

On November 4, Punjab recorded 321 fresh fire incidents, up from 262 on the same day last year but much lower on the same day in 2023 when it was 1360.

While the cumulative number of fire incidents is significantly lower this year, the recent surge could narrow the gap if the trend continues.

Agriculture experts said the overlap between paddy harvesting and wheat sowing is tightening each year as monsoon withdrawal and harvesting get delayed. “This year’s paddy harvest was delayed due to prolonged rain in October. Farmers now have barely two weeks to prepare their fields for wheat, so many resort to burning despite awareness and penalties,” said an official from the Punjab Pollution Control Board (PPCB).

The official added that while the overall numbers are encouraging, the late-season fires remain a concern. “The next 10 days are crucial. The number of fires could rise as more areas complete harvesting,” the official said.



There are 31.72 lakh hectares of land under paddy cultivation, of which 85.79 per cent of harvesting had been completed as of November 3.

"Despite the overall improvement in numbers compared to the past two years, Punjab's fire map this week has once again turned red, signaling that the battle against stubble burning remains far from over — especially as the state races against the clock to finish wheat sowing before mid-November," said another agriculture officer.

In Punjab, according to the Punjab Pollution Control Board, there are 31.72 lakh hectares of land under paddy cultivation, of which 85.79 per cent of harvesting had been completed as of November 3. Till the same date, environmental compensation had

been imposed in 1,009 cases, amounting to Rs 52.75 lakh, of which Rs 23.65 lakh has been recovered.

A total of 765 FIRs have been registered against farmers under Section 223 of the BNS for stubble burning, while 946 red entries have been made in farm records. Prosecution action has been initiated under Section 14 of the CAQM Act against nine nodal or supervisory officers, and 576 warning or show-cause notices have been issued to other nodal/supervisory officers.

Stay updated with the latest - Click here to follow us on Instagram

ANNEXURE A/5

Air Quality Index on Nov 04, 2025 @ 4 PM

(Average of past 24 hours)

S.No	City	Air Quality	Index Value	Prominent Pollutant	No. of Stations Participated/ Total Stations
1	Agartala	Good	39	PM_{10}	1/2
2	Agra	Satisfactory	95	PM_{10}	6/6
3	Ahmedabad	Satisfactory	58	PM_{10}, $PM_{2.5}$	8/9
4	Ahmednagar	Good	42	PM_{10}	1/1
5	Ajmer	Satisfactory	89	PM_{10}	1/1
6	Akola	Good	47	PM_{10}	1/1
7	Alwar	Satisfactory	92	PM_{10}	1/1
8	Amaravati	Satisfactory	68	PM_{10}	1/1
9	Ambala	Poor	264	$PM_{2.5}$	1/1
10	Amravati	Satisfactory	51	PM_{10}	2/2
11	Amritsar	Moderate	140	$PM_{2.5}$	1/1
12	Anantapur	Satisfactory	59	$PM_{2.5}$	1/1
13	Angul	Moderate	144	$PM_{2.5}$	1/1
14	Ankleshwar	Satisfactory	69	CO	1/1
15	Araria	Satisfactory	84	$PM_{2.5}$	1/1
16	Ariyalur	Good	49	PM_{10}	1/1
17	Arrah	Good	48	CO	1/1
18	Asansol	Moderate	175	$PM_{2.5}$	3/4
19	Aurangabad (Bihar)	Moderate	104	$PM_{2.5}$	1/1
20	Aurangabad (Maharashtra)	Satisfactory	69	O_3, $PM_{2.5}$	2/3

Air Quality Index on Nov 04, 2025 @ 4 PM

(Average of past 24 hours)

S.No	City	Air Quality	Index Value	Prominent Pollutant	No. of Stations Participated/ Total Stations
21	Baddi	Poor	219	O_3	1/1
22	Badlapur	Satisfactory	80	PM_{10}	1/1
23	Baghpat	Poor	279	$PM_{2.5}$	1/2
24	Bahadurgarh	Satisfactory	57	$PM_{2.5}$	1/1
25	Balasore	Moderate	182	$PM_{2.5}$	1/1
26	Ballabgarh	Moderate	141	$PM_{2.5}$	1/1
27	Banswara	Satisfactory	76	PM_{10}	1/1
28	Baran	Satisfactory	99	$PM_{2.5}$	1/1
29	Barbil	Moderate	157	$PM_{2.5}$	1/1
30	Bareilly	Moderate	114	PM_{10}	2/2
31	Baripada	Moderate	152	$PM_{2.5}$	1/1
32	Barmer	Satisfactory	75	PM_{10}	1/1
33	Barrackpore	Poor	204	$PM_{2.5}$	1/1
34	Bathinda	Moderate	182	$PM_{2.5}$	1/1
35	Begusarai	Satisfactory	91	$PM_{2.5}$	1/1
36	Belapur	Satisfactory	66	PM_{10}	1/1
37	Bengaluru	Satisfactory	72	CO, PM_{10}	13/14
38	Bettiah	Moderate	151	$PM_{2.5}$	1/1
39	Bhagalpur	Moderate	168	$PM_{2.5}$	1/2
40	Bharatpur	Satisfactory	78	PM_{10}	1/1

Air Quality Index on Nov 04, 2025 @ 4 PM

(Average of past 24 hours)

S.No	City	Air Quality	Index Value	Prominent Pollutant	No. of Stations Participated/ Total Stations
41	Bhilai	Satisfactory	54	O_3, PM_{10}	2/3
42	Bhilwara	Good	42	PM_{10}	1/1
43	Bhiwadi	Poor	236	PM_{10}, $PM_{2.5}$	2/2
44	Bhiwandi	Satisfactory	83	PM_{10}	1/1
45	Bhiwani	Poor	287	$PM_{2.5}$	1/1
46	Bhopal	Moderate	101	PM_{10}	3/3
47	Bhubaneswar	Moderate	131	$PM_{2.5}$	1/2
48	Bikaner	Moderate	126	PM_{10}	1/1
49	Bilaspur	Good	50	PM_{10}	1/1
50	Bileipada	Moderate	118	PM_{10}	1/1
51	Boisar	Satisfactory	69	PM_{10}	1/1
52	Brajrajnagar	Satisfactory	83	PM_{10}	1/1
53	Bulandshahr	Poor	264	$PM_{2.5}$	1/1
54	Bundi	Satisfactory	79	PM_{10}	1/1
55	Buxar	Satisfactory	86	$PM_{2.5}$	1/1
56	Byasanagar	Moderate	112	$PM_{2.5}$	1/1
57	Chamarajanagar	Good	41	PM_{10}	1/1
58	Chandigarh	Moderate	115	$PM_{2.5}$	3/3
59	Chandrapur	Moderate	109	PM_{10}	2/2
60	Charkhi Dadri	Poor	252	$PM_{2.5}$	1/1

Air Quality Index on Nov 04, 2025 @ 4 PM

(Average of past 24 hours)

S.No	City	Air Quality	Index Value	Prominent Pollutant	No. of Stations Participated/ Total Stations
61	Chengalpattu	Satisfactory	51	PM_{10}	1/1
62	Chennai	Satisfactory	97	PM_{10}	7/9
63	Chhal	Moderate	150	O_3	1/1
64	Chhapra	Good	32	PM_{10}	1/1
65	Chikkamagaluru	Satisfactory	66	PM_{10}	1/1
66	Chittoor	Satisfactory	97	$PM_{2.5}$	1/1
67	Chittorgarh	Satisfactory	57	O_3	1/1
68	Churu	Moderate	162	PM_{10}	1/1
69	Coimbatore	Satisfactory	72	$PM_{2.5}$	2/2
70	Cuddalore	Satisfactory	73	PM_{10}	1/2
71	Cuttack	Moderate	138	$PM_{2.5}$	1/1
72	Dausa	Moderate	117	PM_{10}	1/1
73	Davanagere	Good	34	CO	1/1
74	Dehradun	Satisfactory	82	$PM_{2.5}$	1/1
75	Delhi	Poor	291	PM_{10}, $PM_{2.5}$	38/39
76	Dewas	Satisfactory	70	PM_{10}	1/1
77	Dhanbad	Moderate	126	$PM_{2.5}$	1/2
78	Dharuhera	Poor	227	$PM_{2.5}$	1/1
79	Dharwad	Satisfactory	70	PM_{10}	1/1
80	Dholpur	Moderate	115	PM_{10}	1/1

Air Quality Index on Nov 04, 2025 @ 4 PM

(Average of past 24 hours)

S.No	City	Air Quality	Index Value	Prominent Pollutant	No. of Stations Participated/ Total Stations
81	Dhule	Good	47	$PM_{2.5}$	1/1
82	Dindigul	Satisfactory	65	PM_{10}	1/1
83	Dungarpur	Satisfactory	62	PM_{10}	1/1
84	Durgapur	Moderate	153	PM_{10}, $PM_{2.5}$	3/3
85	Eloor	Satisfactory	90	CO	1/1
86	Faridabad	Moderate	194	$PM_{2.5}$	3/4
87	Fatehabad	Good	28	CO	1/1
88	Firozabad	Satisfactory	87	PM_{10}, $PM_{2.5}$	2/2
89	Gadag	Good	23	SO_2	1/1
90	Gandhinagar	Satisfactory	66	CO, PM_{10}	2/3
91	Gangtok	Satisfactory	59	O_3	1/1
92	Gaya	Moderate	183	PM_{10}, $PM_{2.5}$	3/3
93	Ghaziabad	Very Poor	325	PM_{10}, $PM_{2.5}$	4/4
94	Gorakhpur	Satisfactory	97	PM_{10}	1/1
95	Greater Noida	Poor	262	$PM_{2.5}$	2/2
96	Gummidipoondi	Moderate	143	$PM_{2.5}$	1/1
97	Gurugram	Poor	219	PM_{10}, $PM_{2.5}$	4/4
98	Guwahati	Satisfactory	57	SO_2, PM_{10}, $PM_{2.5}$	4/4
99	Gwalior	Moderate	123	PM_{10}	3/4
100	Hajipur	Poor	256	$PM_{2.5}$	1/1

Air Quality Index on Nov 04, 2025 @ 4 PM

(Average of past 24 hours)

S.No	City	Air Quality	Index Value	Prominent Pollutant	No. of Stations Participated/ Total Stations
101	Haldia	Moderate	197	$PM_{2.5}$	1/1
102	Hanumangarh	Satisfactory	100	PM_{10}	1/1
103	Hapur	Poor	299	$PM_{2.5}$	1/1
104	Haveri	Satisfactory	57	PM_{10}	1/1
105	Hisar	Moderate	124	PM_{10}	1/1
106	Hosur	Good	41	PM_{10}	1/1
107	Howrah	Poor	217	$PM_{2.5}$	4/5
108	Hubballi	Satisfactory	53	PM_{10}	1/2
109	Hyderabad	Satisfactory	75	PM_{10}	13/14
110	Indore	Good	50	O_3, NO_2, PM_{10}	5/6
111	Jabalpur	Moderate	147	O_3, $PM_{2.5}$	4/4
112	Jaipur	Satisfactory	99	PM_{10}, $PM_{2.5}$	6/6
113	Jaisalmer	Satisfactory	89	PM_{10}	1/1
114	Jalandhar	Moderate	155	$PM_{2.5}$	1/1
115	Jalgaon	Satisfactory	66	PM_{10}	1/1
116	Jalna	Satisfactory	65	PM_{10}	1/1
117	Jalore	Satisfactory	73	PM_{10}	1/1
118	Jhalawar	Satisfactory	83	$PM_{2.5}$	1/1
119	Jhansi	Satisfactory	79	PM_{10}	1/1
120	Jhunjhunu	Moderate	137	PM_{10}	1/1

Air Quality Index on Nov 04, 2025 @ 4 PM

(Average of past 24 hours)

S.No	City	Air Quality	Index Value	Prominent Pollutant	No. of Stations Participated/ Total Stations
121	Jind	Poor	275	$PM_{2.5}$	1/1
122	Jodhpur	Satisfactory	53	O_3, PM_{10}, $PM_{2.5}$	5/5
123	Kadapa	Satisfactory	54	$PM_{2.5}$	1/1
124	Kaithal	Poor	294	$PM_{2.5}$	1/1
125	Kalaburagi	Satisfactory	52	SO_2, PM_{10}	2/2
126	Kalyan	Satisfactory	74	$PM_{2.5}$	1/2
127	Kanchipuram	Satisfactory	91	$PM_{2.5}$	1/1
128	Kannur	Satisfactory	59	PM_{10}	1/1
129	Kanpur	Moderate	118	PM_{10}	2/4
130	Karauli	Moderate	102	PM_{10}	1/1
131	Karnal	Poor	270	$PM_{2.5}$	1/1
132	Karur	Good	46	$PM_{2.5}$	1/1
133	Kashipur	Moderate	181	$PM_{2.5}$	1/1
134	Katihar	Satisfactory	61	CO	1/1
135	Katni	Moderate	148	PM_{10}	1/1
136	Keonjhar	Moderate	138	PM_{10}	1/1
137	Khanna	Poor	237	$PM_{2.5}$	1/1
138	Khurja	Poor	238	$PM_{2.5}$	1/1
139	Kohima	Satisfactory	71	SO_2	1/1
140	Kolhapur	Good	38	O_3, PM_{10}	2/2

Air Quality Index on Nov 04, 2025 @ 4 PM

(Average of past 24 hours)

S.No	City	Air Quality	Index Value	Prominent Pollutant	No. of Stations Participated/ Total Stations
141	Kolkata	Moderate	199	$PM_{2.5}$	7/7
142	Koppal	Satisfactory	54	CO	1/1
143	Korba	Satisfactory	68	PM_{10}, $PM_{2.5}$	2/2
144	Kota	Satisfactory	89	PM_{10}, $PM_{2.5}$	3/3
145	Kurukshetra	Poor	266	$PM_{2.5}$	1/1
146	Latur	Good	40	O_3	1/1
147	Lucknow	Moderate	149	PM_{10}, $PM_{2.5}$	6/6
148	Ludhiana	Poor	202	$PM_{2.5}$	1/1
149	Madikeri	Good	29	$PM_{2.5}$	1/1
150	Madurai	Satisfactory	66	PM_{10}	1/1
151	Mahad	Good	38	PM_{10}	1/1
152	Maihar	Good	48	PM_{10}	1/1
153	Malegaon	Satisfactory	67	PM_{10}	1/1
154	Mandi Gobindgarh	Moderate	137	PM_{10}	1/1
155	Mandideep	Moderate	112	$PM_{2.5}$	1/1
156	Mandikhera	Satisfactory	73	CO	1/1
157	Manesar	Satisfactory	86	$PM_{2.5}$	1/1
158	Mangalore	Satisfactory	59	PM_{10}	1/1
159	Manguraha	Moderate	130	PM_{10}	1/1
160	Meerut	Poor	292	PM_{10}, $PM_{2.5}$	3/3

Air Quality Index on Nov 04, 2025 @ 4 PM

(Average of past 24 hours)

S.No	City	Air Quality	Index Value	Prominent Pollutant	No. of Stations Participated/ Total Stations
161	Milupara	Good	47	PM_{10}	1/1
162	Moradabad	Moderate	189	PM_{10}, $PM_{2.5}$	6/7
163	Motihari	Satisfactory	71	PM_{10}	1/1
164	Mumbai	Satisfactory	64	O_3, PM_{10}	28/30
165	Munger	Moderate	124	$PM_{2.5}$	1/1
166	Muzaffarnagar	Poor	265	$PM_{2.5}$	1/1
167	Muzaffarpur	Moderate	118	CO, $PM_{2.5}$	3/3
168	Mysuru	Good	50	PM_{10}	1/1
169	Nagaon	Satisfactory	56	PM_{10}	1/1
170	Nagaur	Moderate	135	PM_{10}	1/1
171	Nagpur	Satisfactory	80	PM_{10}, $PM_{2.5}$	4/4
172	Naharlagun	Good	23	$PM_{2.5}$	1/1
173	Namakkal	Satisfactory	72	PM_{10}	1/1
174	Nanded	Satisfactory	58	PM_{10}	1/1
175	Narnaul	Poor	216	$PM_{2.5}$	1/1
176	Nashik	Good	47	PM_{10}, $PM_{2.5}$	3/4
177	Navi Mumbai	Satisfactory	58	PM_{10}	6/8
178	Nayagarh	Satisfactory	68	PM_{10}	1/1
179	Noida	Very Poor	304	PM_{10}, $PM_{2.5}$	4/4
180	Ooty	Satisfactory	74	PM_{10}	1/1

Air Quality Index on Nov 04, 2025 @ 4 PM

(Average of past 24 hours)

S.No	City	Air Quality	Index Value	Prominent Pollutant	No. of Stations Participated/ Total Stations
181	Pali	Satisfactory	77	$PM_{2.5}$	1/1
182	Palkalaiperur	Good	25	PM_{10}	1/1
183	Palwal	Moderate	131	$PM_{2.5}$	1/1
184	Panchgaon	Satisfactory	67	PM_{10}	1/1
185	Panchkula	Moderate	177	$PM_{2.5}$	1/1
186	Parbhani	Good	37	PM_{10}	1/1
187	Patiala	Moderate	183	$PM_{2.5}$	1/1
188	Patna	Moderate	197	PM_{10}, $PM_{2.5}$	6/6
189	Perundurai	Good	47	PM_{10}	1/1
190	Pimpri-Chinchwad	Satisfactory	62	CO, PM_{10}	4/4
191	Pithampur	Satisfactory	81	PM_{10}	1/1
192	Pratapgarh	Satisfactory	69	PM_{10}	1/1
193	Prayagraj	Moderate	104	PM_{10}	3/3
194	Puducherry	Satisfactory	56	PM_{10}	1/1
195	Pudukottai	Good	42	PM_{10}	1/1
196	Pune	Satisfactory	62	PM_{10}, $PM_{2.5}$	7/13
197	Purnia	Satisfactory	69	$PM_{2.5}$	1/1
198	Raipur	Satisfactory	76	PM_{10}	4/4
199	Rairangpur	Satisfactory	95	PM_{10}	1/1
200	Rajamahendravaram	Satisfactory	64	PM_{10}	1/1

Air Quality Index on Nov 04, 2025 @ 4 PM

(Average of past 24 hours)

S.No	City	Air Quality	Index Value	Prominent Pollutant	No. of Stations Participated/ Total Stations
201	Rajgir	Satisfactory	94	$PM_{2.5}$	1/1
202	Rajsamand	Satisfactory	54	PM_{10}	1/1
203	Ramanathapuram	Good	44	PM_{10}	1/1
204	Ratlam	Satisfactory	85	PM_{10}	1/1
205	Rishikesh	Satisfactory	84	PM_{10}	1/1
206	Rohtak	Very Poor	329	$PM_{2.5}$	1/1
207	Rourkela	Moderate	126	PM_{10}	2/3
208	Rupnagar	Satisfactory	94	$PM_{2.5}$	1/1
209	Sagar	Satisfactory	62	PM_{10}	1/2
210	Saharsa	Satisfactory	77	$PM_{2.5}$	1/1
211	Samastipur	Satisfactory	70	$PM_{2.5}$	1/1
212	Sangli	Satisfactory	53	PM_{10}	1/1
213	Sasaram	Moderate	103	PM_{10}	1/1
214	Satna	Satisfactory	64	PM_{10}	1/1
215	Sawai Madhopur	Satisfactory	94	PM_{10}	1/1
216	Shillong	Good	12	NH_3	1/2
217	Shivamogga	Satisfactory	60	PM_{10}	1/1
218	Sikar	Moderate	138	PM_{10}	1/1
219	Silchar	Satisfactory	53	PM_{10}	1/1
220	Siliguri	Satisfactory	57	PM_{10}	1/1

Air Quality Index on Nov 04, 2025 @ 4 PM

(Average of past 24 hours)

S.No	City	Air Quality	Index Value	Prominent Pollutant	No. of Stations Participated/ Total Stations
221	Singrauli	Moderate	189	$PM_{2.5}$	1/1
222	Sirohi	Satisfactory	78	PM_{10}	1/1
223	Sirsa	Moderate	179	$PM_{2.5}$	1/1
224	Sivasagar	Good	48	PM_{10}	1/1
225	Siwan	Very Poor	324	$PM_{2.5}$	1/1
226	Solapur	Good	48	PM_{10}	2/3
227	Sri Ganganagar	Moderate	112	PM_{10}	1/1
228	Surat	Satisfactory	51	PM_{10}	1/1
229	Talcher	Moderate	132	$PM_{2.5}$	1/1
230	Tensa	Satisfactory	81	PM_{10}	1/1
231	Thane	Satisfactory	60	PM_{10}, $PM_{2.5}$	2/2
232	Thiruvananthapuram	Good	48	PM_{10}, NO_2	2/2
233	Thoothukudi	Severe	406	PM_{10}	1/1
234	Thrissur	Satisfactory	55	$PM_{2.5}$	1/1
235	Tiruchirappalli	Good	42	PM_{10}	1/1
236	Tirumala	Good	42	$PM_{2.5}$	1/1
237	Tirunelveli	Good	33	PM_{10}	1/1
238	Tirupur	Satisfactory	55	PM_{10}	1/1
239	Tonk	Moderate	109	PM_{10}	1/1
240	Tumidih	Satisfactory	67	PM_{10}	1/1

Air Quality Index on Nov 04, 2025 @ 4 PM

(Average of past 24 hours)

S.No	City	Air Quality	Index Value	Prominent Pollutant	No. of Stations Participated/ Total Stations
241	Udaipur	Satisfactory	88	PM_{10}	1/1
242	Udupi	Good	18	PM_{10}	1/1
243	Ulhasnagar	Satisfactory	93	PM_{10}	1/1
244	Vapi	Satisfactory	76	PM_{10}	1/1
245	Varanasi	Satisfactory	84	PM_{10}	3/4
246	Vijayawada	Satisfactory	78	O_3, PM_{10}, $PM_{2.5}$	3/4
247	Virar	Good	50	PM_{10}	1/1
248	Virudhunagar	Satisfactory	69	PM_{10}	1/1
249	Visakhapatnam	Satisfactory	96	PM_{10}	1/1
250	Vrindavan	Moderate	115	PM_{10}	1/1
251	Yadgir	Good	34	NO_2	1/1
252	Yamuna Nagar	Poor	229	$PM_{2.5}$	1/1

Air Quality Index on Nov 04, 2025 @ 4 PM

(Average of past 24 hours)

Cities absent in AQI Bulletin due to insufficient data:

1) Aizawl, 2) Bagalkot, 3) Belgaum, 4) Bidar, 5) Bihar sharif, 6) Byrnihat, 7) Chikkaballapur, 8) Damoh, 9) Darbhanga, 10) Ernakulam, 11) Hassan, 12) Imphal, 13) Jorapokhar, 14) Karwar, 15) Kishanganj, 16) Kochi, 17) Kolar, 18) Kollam, 19) Kozhikode, 20) Kunjemura, 21) Mira-bhayandar, 22) Nagapattinam, 23) Nalbari, 24) Nandesari, 25) Panipat, 26) Pathardih, 27) Raichur, 28) Ramanagara, 29) Ranipet, 30) Salem, 31) Sonipat, 32) Sri vijaya puram, 33) Srinagar, 34) Suakati, 35) Thanjavur, 36) Tirupati, 37) Tumakuru, 38) Ujjain, 39) Vatva, 40) Vellore, 41) Vijayapura.

Note:

* In case of a city with multiple monitoring locations, average value is used to indicate air quality. Air quality may show variations across locations, and averaging is not a scientifically sound approach. However, for the sake of simplicity this method is being followed. For AQI of monitoring locations, website (http://cpcb.gov.in) website may be referred.

* The data available at the portal is provided by different agencies. Any use of this data in research publication or any other form of publication shall duly acknowledge the contribution of respective agencies in generating the data.

Health Statements for AQI Categories

AQI	Category	Color Code	Possible Health Impacts
0-50	Good		Minimal Impact
51-100	Satisfactory		Minor breathing discomfort to sensitive people
101-200	Moderate		Breathing discomfort to the people with lungs, asthma and heart diseases
201-300	Poor		Breathing discomfort to most people on prolonged exposure
301-400	Very Poor		Respiratory illness on prolonged exposure
401-500	Severe		Affects healthy people and seriously impacts those with existing diseases

ANNEXURE A/6

OIH

GOVERNMENT OF INDIA
MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE

RAJYA SABHA
UNSTARRED QUESTION No. 831
TO BE ANSWERED ON 27.07.2023

Airshed based approach to check air pollution

831. SHRI SURENDRA SINGH NAGAR:

Will the Minister of ENVIRONMENT, FOREST AND CLIMATE CHANGE be pleased to state:

(a) whether Government has earmarked and expanded special airsheds to effectively monitor and manage air quality levels across the country;
(b) if so, the details of criteria and parameters in the definition of airshed;
(c) whether Government has the latest information on the measures to be taken in the IndoGan getic plain using airshed-based approaches to check air pollution in the region; and
(d) if so, the details of the measures being taken during the financial year 2022-23?

ANSWER

MINISTER OF STATE IN THE MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE
(SHRI ASHWINI KUMAR CHOUBEY)

(a) & (b)
According to the study conducted by IIT-Delhi to demarcate the major air sheds in India, based on satellite data, across the seasons, India has 8-9 major air sheds of varying geographic coverage. The Indo-Gangetic Plain (IGP) behaves either as a gigantic single air shed (e.g., during the pre-monsoon season of Mar-May) or as two large air sheds, west and east during monsoon (Jun-Sep), north and south during post-monsoon (Oct-Nov) and north-west and the remaining during winter (Dec-Feb). North-Eastern India is divided into two or three (smaller) air sheds. The western region remains an isolated air shed during Dec-Sep, while it becomes part of the northern IGP air shed during Oct-Nov. Peninsular India is divided into two air sheds, which vary seasonally. The northern part of India is divided into two air sheds – one covering the mountainous regions and the other covering the foothills.

(c)& (d)
A joint committee has prepared a comprehensive report on the best possible technologies for various emission sources at all scales to be operational in IGP region to check air pollution.The sector wise specific recommendations of the Joint Committee to be taken in the IndoGangetic plain using airshed-based approachesare annexed as Annexure-I.

Further, under National Clean Air Programme (NCAP), 24 States/ UTs with non-attainment and million plus cities have been directed to prepare state action plans following an airshed based approach for implementing air quality management policies across the states. At present 41 out of 131 non-attainment and million plus cities have been identified in IGP States/ UTs for focused improvement in air quality through implementation of city action plans. The details of measures being taken during the financial year 2022-23 to check air pollution in the region is annexed at Annexure-II.

*****

Annexure-I

Sector wise Specific Recommendations of the Joint Committee

Domestic Sector:

i. A program for switching over from solid to cleaner gaseous fuel for domestic sector should be formulated and implemented in a time-bound manner. The plan may include expansion of LPG network and putting up Compressed Biogas (CBG) network using biomass such as crop residue, dung, wet organic municipal waste, etc., particularly in rural areas. To deal with high air pollution levels in critical winter months, feasibility of distributing two domestic LPG cylinders free of cost or on subsidized rate among the BPL families may be examined.
ii. Promotion and rapid distribution of government-approved improved cook stoves in rural areas and among the urban road-side shanties.
iii. Make all efforts at Block/Panchayat level to educate households through anganwadi workers and ANM nurses not to burn any biomass including dung and encourage and promote LPG usages.

Transport Sector:

i. All the diesel city public transport should be phased out completely in next five years, and city transport should be operated only through metro, e-vehicle or on CNG. All new public transport should be CNG or electric buses.
ii. Public transport to be strengthened with metro and/or adequate number of buses, route plan based on commute surveys and Mobile App based ticketing and seating system is developed in all major cities.
iii. Public transport can be made cheaper than two-wheeler cost.
iv. Adequate vehicle scrappage infrastructure should be developed in next three years. Extended Producer Responsibility (EPR) may be considered for vehicle manufactures, who will have to build required vehicle scrap plants.
v. Incentivise and aggressively implement e-mobility including required charging infrastructure. Strategic plan for EV charging infrastructure at each 3 km in urban areas, 25 km on highways (both sides) and 100 km for buses and trucks and swappable battery stations.
vi. Linking of PUC centres with remote server and elimination of manual intervention in PUC testing.
vii. Use off-peak passenger travel times to move freight (within the city) and restrict the entry of heavy vehicles into cities during 6:00 am to 9:00 pm in winter and 6:00 am to 10:00 pm in other seasons.
viii. Check Overloading: Use weigh-in-motion bridges/machines (WIM) and Weigh bridges at entry points to the city and at toll plaza to check the payload of commercial vehicles. As per CMVR, a penalty of 10 times the applicable rate for overloaded truck is applicable.
ix. Prepare plan for improvement of infrastructure for decongestion of roads.
x. Prepare and implement zonal plans to develop an NMT (non-motorized transport) network
xi. Proper road maintenance and marking, smart traffic signaling, encroachment-free roads, the standard design of the speed breakers, speed warnings and traffic discipline should be enforced for emission reduction.

xii. Poor quality lubricants and their inappropriate recycling is important cause of real driving emissions. The quality of lubricants should improve and recycled unorganized sales of the lubricants should be stopped.

xiii. EVs should be aggressively promoted. However, till the time battery-EVs take over, strong hybrid electric vehicles (HEVs) that blend fuel and electric power are much more fuel-efficient and should be promoted.

xiv. Control of particulate emission through gasoline particulate filter (GPF) is a new technology and can be adopted in new BSVI vehicles for reducing emissions in the near to mid-term period.

Industry (Brick kiln, MSME, Induction Furnace, etc.):

i. All the industries must stop using solid and liquid fuel and switch over to cleaner source of energy viz. electricity, gaseous fuel or bio-mass, in a time-bound and phased manner (say five years). Industrial clusters having uncontrolled PM emission of 500 tons per day (equivalent to 100 MW coal power plant) may be taken up on priority. Such clusters should also become candidate for priority of PNG infrastructure.

ii. In the industrial clusters, wherever feasible, common boilers (to supply steam) with adequate emission control measures may be installed, which will be a win-win option for industries and regulators.

iii. Brick kilns should be converted to Zig-Zag technology. The revised norms notified by MoEFCC should be strictly enforced.

iv. In induction furnaces new technology requiring collection of emission from sideways but with much higher suction rate that does not interfere with the movement of crane should be adopted.

v. Small scale sugar mills (<1000 tons cursed per day) (Khandsari) should be treated as MSMEs. These should shift to forced draft from current practice of natural draft for better combustion and install simple air pollution control devices like cyclones and multi-clones.

vi. Technology upgradation must be targeted in MSMEs and adequately supported. Regular training program should be conducted for the skill development.

vii. Carry out pollution load estimation from industrial sector to enable setting of target for emission.

viii. For MSMEs, a resource centre on technology-linked emissions achievements and multiple technology options and vendors (with the cost) linked to different levels of control be established at national and state levels; however, standards should be attained with the industry.

<u>Open burning:</u>

Action plans for crop residue management are already in place for States of Haryana, Punjab, Delhi and NCR districts of Uttar Pradesh & Rajasthan. These should be implemented expeditiously. Every year, target and focus on at least five districts for zero crop residue burning in the States of Haryana and Punjab during post-monsoon.

<u>Dust Control:</u>

i. Identification and greening of open spaces, green cover on central verges and on the roadsides, repair and re-laying of pavements, grassing of road shoulders, washing and mechanical/vacuum-based street sweeping and proper disposal of collected dust must

be ensured in cities and towns with more than 5 lakh population. Indian Road Congress/Bureau of Standards must bring out silt load standards for roads. All major urban roads, State Highways and NHAI must maintain silt load of 2.0 g/m2 or less on their roads and assess the silt load twice a year (winter and summer) at an interval of 50 km on both sides of the road.

ii. All the Railway Siding should construct warehouse for storage of cement bags or other dusty material to minimize fugitive emissions during loading, unloading and storage and avoid these operations on open platforms. Mechanical handling of bags of cement or dusty material be done using conveyor belts, possibly horizontally movable belts. Enclosures in the form of flexible belt curtain may be provided on the warehouse openings used for transfer of material.

iii. Construction & Demolition (C&D) waste processing facilities of adequate capacities should be set up, to begin with, in cities having population more than 5lakh. C&D waste collection points must be created in different zones of the cities, and in no case, it should be allowed to be dumped in non-designated areas, particularly along roadside. Recycling of processed waste must be encouraged, facilitated and, wherever feasible, mandated.

Research & Development, Training and Capacity Building:

i. Focused research on IGP air pollution problems must be taken up, which can be coordinated through a dedicated Center/Cell established specifically for the purpose. The Center may collaborate with research & academic institutes and encourage/facilitate startups for developing affordable cleaner technologies (particularly for small scale polluting industries) and best process practices & guidelines for various air polluting sectors.

ii. Training and capacity building of regulatory agencies, urban local bodies, panchayats, industries must be taken up as a regular and important component to create skilled human resource.

Enforcement and Administrative Issues:

i. An independent body to better coordinate performance measurement among the Central, State and other agencies (e.g., Industry, Municipal Corporation) responsible for taking air pollution control measures as per the targets should be established. The sector-wise report, clearly stating air quality achievements and evaluate air program results should be published and available for public scrutiny.

ii. The unorganized sectors should be facilitated to come on the mainstream within a specified timeframe and apply for consent under Air Act and meet emission standards.

iii. The review of existing technologies, emission norms, guidelines, process practices, etc. should be taken up every three to five years for upgradation.

Annexure II

Measures taken by the Government for Air Quality Management

I. Details of State-wise funds allocated to address air pollution during the financial year 2022-23 under National Clean Air Programme:

S. No.	State	Fund allocated during the Year (amount in ₹ crores) FY 22-23
1	Andhra Pradesh	75.06
2	Assam	24.10
3	Bihar	7.09
4	Chandigarh	6.87
5	Chhattisgarh	57.94
6	Delhi	22.50
7	Gujarat	173.29
8	Haryana	19.28
9	Himachal Pradesh	3.59
10	Jammu &Kashmi	32.50
11	Jharkhand	42.00
12	Karnataka	128.52
13	Madhya Pradesh	135.04
14	Maharashtra	386.83
15	Meghalaya	0.45
16	Nagaland	3.95
17	Odisha	38.52
18	Punjab	56.88
19	Rajasthan	103.76
20	Tamil Nadu	129.22
21	Telangana	92.96
22	Uttar Pradesh	672.83
23	Uttarakhand	22.30
24	West Bengal	173.42

* The funds were provided to SPCB/PCC for taking up pollution abatement measures

**Funds provided include funds under XV Finance Commission air quality grant for million plus cities and the fund provided by MoEFCC for taking measures for improvement of air quality in 82 non-attainment cities

II. Various measures taken by the Government to address air pollution *inter-alia* include:

i. Vehicular Emissions:

- Leapfrogging from BS-IV to BS-VI norms for fuel and vehicles since April, 2018 in NCT of Delhi and from 1st April, 2020 for rest of the country.
- Network of metro rails for public transport are enhanced and more cities are covered.
- Development of Expressways and Highways are also reducing the fuel consumption and pollution.
- Eastern Peripheral Expressway & Western Peripheral Expressway has been operationalized to divert non destined traffic from Delhi.
- Ban on all diesel vehicles older than 10 years and all petrol vehicles older than 15 years, in Delhi and NCR. (Hon'ble SC order dated 29.10.2018).
- Environment protection charges (EPC) have been imposed on diesel vehicles with engine capacity of 2000cc and above in Delhi NCR.
- Introduction of cleaner/alternate fuels like CNG, LPG, ethanol blending in petrol.
- Permit requirement for electric vehicles has been exempted.
- Promotion of public transport and improvements in roads and building of more bridges to ease congestion on roads.
- RFID (radio-frequency identity) system implemented by South Delhi Municipal Corporation (SDMC) for collection of toll and Environment Compensation Charges from commercial vehicles entering Delhi.
- Introduction of BS VI compliant vehicles across the country since April, 2020.
- Sustainable Alternative Towards Affordable Transportation (SATAT) has been launched as an initiative to set up Compressed Bio-Gas (CBG) production plants and make CBG available in the market for use in automotive fuels.
- Subsidy on e-vehicles under Faster Adoption and Manufacture of (Hybrid &) Electric Vehicles in India (FAME -II India) scheme of Ministry of Heavy Industries is provided.
- Installation of Vapour Recovery System (VRS) in new and existing petrol pumps selling gasoline >100kl per month in million plus cities and those selling >300kl per month in cities with population between 1 lakh to 1 million.

ii. Industrial Emissions:

- Notification regarding SO2 and NOx emission standards have been issued for Thermal Power Plants
- Ban on use of pet coke and furnace oil as fuel in NCR States since October 24, 2017 and ban on use of imported pet coke in the country since July 26, 2018, with exception for use in permitted processes (processes in cement plants, lime kilns and calcium carbide manufacturing units).
- Shifting of industrial units to PNG.
- Installation of online continuous emission monitoring devices in highly polluting industries.
- Brick kilns shifting to zig-zag technology or vertical shaft or use Piped Natural Gas as fuel in brick making to reduce pollution.
- System and Procedure for Emission Compliance Testing of Retro-fit Emission
- Control Devices (RECD) for Diesel Power Generating Set Engines up to Gross Mechanical Power 800 kW developed.
- Development of low carbon strategies across sectors such as phasing out older coal based power plants, compliance of standards, City Gas Distribution (CGD) network, emphasis on improved power reliability in urban areas, etc.

- Developing an eco-system for processing biomass/agriculture residue as fuel in industrial applications in Delhi-NCR.
- Uniform and affordable PNG pricing policy for aggravating use PNG as fuel in industrial applications in Delhi-NCR.

iii. Air Pollution due to dust and burning of waste:

- Notification of eight waste management rules covering solid waste, plastic waste, e-waste, waste tyres, bio-medical waste, C&D waste, hazardous waste and battery waste.
- Setting up infrastructure such as waste processing plants.
- Extended Producer Responsibility (EPR) for plastic and e-waste management has been mandated on producers.
- Ban on burning of biomass/garbage.
- Bio-mining of three dumpsites at Bhalswa, Okhla and Ghazipur is being carried out.
- Under Central Sector Scheme on 'Promotion of Agricultural Mechanization for in-situ management of Crop Residue in the States of Punjab, Haryana, Uttar Pradesh and NCT of Delhi', agricultural machines and equipment for in-situ crop residue management are promoted with 50% subsidy to the individual farmers and 80% subsidy for establishment of Custom Hiring Centers.
- The Commission for Air Quality Management in NCR and Adjoining Areas (CAQM) on 17.09.2021 directed the coal-based Thermal Power plants situated up to a radius of 300 Km of Delhi to co-fire biomass based Pellets, Torrefied Pellets/Briquettes (with focus on paddy straw) with Coal (up to 5-10%).
- Guidelines prepared for providing one-time financial assistance for establishment of paddy straw based pelletisation and torrefaction plants, under which individuals /entrepreneurs / companies, interested in setting up pelletisation and torrefaction plants, using only paddy straw generated in the NCT of Delhi, States of Punjab & Haryana, and NCR districts of Rajasthan & Uttar Pradesh can submit an application for obtaining a one-time grant on capital investment.
- Guidelines issued for supporting Municipal Corporations of the states of Punjab, Haryana, NCT of Delhi and NCR districts of Uttar Pradesh and Rajasthan, for establishing paddy straw based briquetting plants, for use of paddy straw based briquettes for cremation purpose only.
- Daily monitoring of Active Fire Events (AFEs) is done during stubble burning period and reports are shared with Commission on Air Quality Management in National Capital Region and Adjoining areas for suitable action.

iv. Monitoring of Ambient Air Quality:

- Expansion of air quality monitoring network in the country under National Air Monitoring Programme (NAMP).
- Initiation of pilot projects to assess alternate ambient monitoring technologies such as satellite-based monitoring.

v. National Clean Air Programme:

- With the prime objective of abating Air Pollution, the Ministry, in 2019 launched a National Clean Air Programme (NCAP) as a National-level Strategy outlining the actions for reducing the levels of air pollution at city and regional scales in India.
- NCAP targets to achieve upto 40% reduction in Particulate Matter concentrations by 2026 or achievement of National Ambient Air Quality STandard in 131 NACs & MPCs.

- Under NCAP, Non-attainment cities have been identified based on ambient air quality levels exceeding National Ambient Air Quality Standards (NAAQS) which were notified to protect human health. City Specific Clean Air Action Plans have been prepared and rolled out for implementation in 131 non-attainment and million plus cities.
- Activities in these cities include strengthening of ambient air quality network, source apportionment studies, dust mitigation measures, composting units, infrastructure for non-motorized transport, shifting to clean energy in unorganized sectors, etc.
- The NCAP focuses on multi-sectoral sources of pollution including power plants, industries, vehicles, open burning of waste, construction & demolition activities, etc.; inter-Ministerial coordination for convergence of actions and interventions; and partnership with Institutes of National repute and International Agencies as Knowledge Partners
- Public Grievances and Response System (PGRS) is developed under NCAP.
- Emergency Response System (ERS) has been prepared in NCAP cities.
- Air quality monitoring cell has been constituted across the country in NCAP Cities.
- PRANA a portal for monitoring implementation of NCAP has been launched.
- Introduction of new modules within PRANA
    - Mission LiFE Module
    - Ranking Module
    - State Action Plan Module
    - IoR&NKN Module
    - International Agencies Module
- Implementing Swach Vayu Survekshan (SVS) 2022- Evaluation of self-assessment reports of NCAP cities and awarded top 9 best performing cities under SVS-2022.

vi. Other Steps:

- Public Complaints regarding air pollution issues in Delhi NCR are taken through 'Sameer App', 'Emails' (Aircomplaints.cpcb@gov.in) and 'Social Media Networks' (Facebook and Twitter).
- Introduction of green crackers with low emission and noise levels. Green Crackers have 30% potential reduction of PM and gaseous emissions compared to conventional firework.
- Ministry is promoting people's participation and awareness building among citizens for environmental conservation through Mission Life activities and Green Good Deeds that focus on promotion of cycling, saving water and electricity, growing trees, proper maintenance of vehicles, following of lane discipline and reducing congestion on roads by car-pooling etc.
- Extension of UjawalaYojana to ensure shifting to cleaner fuel.
- Swacch Bharat Mission and Waste Management initiatives.
- The Commission for Air Quality Management in NCR and Adjoining Areas (CAQM) has come out with a policy to curb air pollution in NCR, along with a standard list of approved fuels for NCR for industrial and other applications.

ACTION PLAN FOR A[illegible]N AND IT'S CONTROL E[illegible]Y MONITORING COMM[illegible])

(In compliance to Hon'ble NGT in the order dated 08.10.2018 passed in OA no. 681/2018 in the matter of: news item published in the times of India authored by Shri Vishwa Mohan titled "NCAO with multiple timelines to clear air in 102 cities to be released around August 15")

Submitted to

Central Pollution Control Board (CPCB)

by

Department of Environment, Govt. of Delhi/ Delhi Pollution Control Committee (DPCC)

INDEX

ACTION PLAN BY AIR QUALITY MONITORING COMMITTEE (AQMC) FOR

AIR POLLUTION AND ITS CONTROL IN COMPLIANCE TO IN COMPLIANCE TO THE DIRECTIONS OF THE HON'BLE NGT CONTAINED IN THE ORDER DATED 08.10.2018 PASSED IN OA NO. 681/2018 IN THE MATTER OF: NEWS ITEM PUBLISHED IN THE TIMES OF INDIA AUTHORED BY SHRI VISHWA MOHAN TITLED "NCAO WITH MULTIPLE TIMELINES TO CLEAR AIR IN 102 CITIES TO BE

I. BACKGROUND:

Hon'ble NGT vide order dated 08.10.2018 in O.A No. 681/2018 in the matter of: News Item Published in the Times of India Authored by Shri. Vishwa Mohan Titled "NCAO with Multiple Timelines to clear Air in 102 Cities to be released around August 15" has directed constitution of Air Quality Monitoring Committee (AQMC) comprising of Directors of the following Departments for NCT of Delhi:

1. Department of Environment, GNCTD
2. Transport Department, GNCTD
3. Industries, GNCTD
4. Urban Development, GNCTD
5. Agriculture, GNCTD
6. Member Secretary, Delhi Pollution Control Committee (DPCC)

As per the order AQMC had to prepare appropriate action plans within two months aimed at bringing the standards of air quality within the prescribed norms within six months from date of finalization of the action plans as per directions contained in the order. The AQMC had to function under the overall supervision and coordination of Principal Secretary, (Environment) Department of Environment, GNCTD.

The directions of the Hon'ble Tribunal as contained in the above order said are as reproduced below:

15….. issue direction as follows:

i. *All the States and Union Territories with non-attainment cities must prepare appropriate action plans within two months aimed at bringing the standards of air quality within the prescribed norms within six months from date of finalization of the action plans.*

ii. *The Action Plans may be prepared by six-member committee comprising of Directors of Environment, Transport, Industries, Urban Development, Agriculture and Member Secretary, State Pollution Control Board or Committee of the concerned State. The Committee may be called Air Quality Monitoring Committee (AQMC). The AQMC will function under the overall*

supervision and coordination of Principal Secretary, Environment of the concerned State/Union Territory. This may be further supervised by the Chief Secretaries concerned or their counterparts in Union Territories by ensuring intra-sectoral co-ordination.

iii. *The Action Plans may take into account the GRAP, the CAP and the action plan prepared by CPCB as well as all other relevant factors. The Action Plans may be forwarded to the CPCB by 31.12.2018. The same may be placed before the Committee as directed in direction no. vi. The Action Plan will include components like identification of source and its apportionment considering sectors like vehicular pollution, industrial pollution, dust pollution, construction activities, garbage burning, agricultural pollution including pollution caused by burning of crop residue, residential and indoor pollution etc. The action plan shall also consider measures for strengthening of Ambient Air Quality (AAQ) monitoring and steps for public awareness including issuing of advisory to public for prevention and control of air pollution and involvement of schools, colleges and other academic institutions and awareness programmes.*

iv. *The Action Plan will indicate steps to be taken to check different sources of pollution having speedy, definite and specific timelines for execution.*

v. *The Action Plan should be consistent with the carrying capacity assessment of the non-attainment cities in terms of vehicular pollution, industrial emissions and population density, extent of construction and construction activities etc. The carrying capacity assessment shall also lay emphasis on agricultural and indoor pollution in rural areas. Depending upon assessed carrying capacity and source apportionment, the authorities may consider the need for regulating number of vehicles and their parking and plying, population density, extent of construction and construction activities etc. Guidelines may accordingly be framed to regulate vehicles and industries in non-attainment cities in terms of carrying capacity assessment and source apportionment.*

vi. *The Committee comprising of (a) Shri. Prashant Gargava, Member Secretary, CPCB, (b) Dr. Mukesh Khare, Professor, IIT Delhi, and (c) Dr. Mukesh Sharma, Professor, IIT Kanpur shall examine the Action Plans and on the recommendations of the said Committee, the Chairman, CPCB shall approve the same by 31.01.2019.*

vii. *The Chief Secretaries of the State and Administrators/ Advisors to Administrators of the Union Territories will be personally accountable for failure to formulate Action Plans, as directed.*

viii. *The CPCB, SPCBs and State Pollution Control Committees shall develop a public grievance redressal portal for redressal of public complaints on air pollution along with a supervisory mechanism for its disposal in a time bound manner. Any visible air pollution can be reported at such portal by email/SMS.*

ix. *The CPCB and all the State Pollution Control Boards and Pollution Control Committees shall collectively workout and design a robust nationwide ambient air quality monitoring programme in a revised format by strengthening the existing monitoring network with respect to coverage of more cities/towns. The scope of monitoring should be expanded to include all twelve (12) notified*

parameters as per Notification No B-29016/20/90/PCI-L dated 18th November, 2009 of CPCB. The continuous Ambient Air Quality Monitoring Stations (AAQMS) should be preferred in comparison to manual monitoring stations. The CPCB and States shall file a composite action plan with timelines for its execution which shall not be more than three months. It is expected that all such AAQMS shall be connected to central server of CPCB for reporting analysis of results in a form of Air Quality Bulletin for general public at regular intervals atleast on weekly basis and ambient air quality on continuous basis on e-portal. MoEF&CC will provide requisite funds for the purpose. MoEF&CC in consultation with Ministry of Housing and Urban Affairs, MoRTH, Ministry of Petroleum and Natural Gas, Ministry of Agriculture, Cooperation and Farmers Welfare or any other Ministry to lay down such guidelines as may be considered necessary for improvement of air quality in the country.

16. *A copy of this be sent by e-mail to all the concerned i.e. Ministries of Environment, Forest & Climate Change, Housing and Urban Affairs, Road Transport and Highway, Agriculture, Petroleum and the Chief Secretaries of all the States and Union Territories for compliance.*
17. *We understand that some of the Zonal Benches of the National Green Tribunal have also passed directions on the subject of Ambient Air Quality and the States in those Zones are in the process of implementation of such directions. Specific reference may be made in this regard to judgement dated 11.08.2016 in O.A No. 33/2018/EZ in the matter of Subhas Datta v. State of West Bengal & Ors. We make it clear that this order shall not be considered as an impediment to those actions but as an addition or supplement thereto for achieving the object of this order at the macro level and of the said order at the micro level in the concerned cities.*
18. *Needless to say, that order of National Green Tribunal is binding as a decree of Court and non-compliance is actionable by way of punitive action including prosecution, in terms of the National Green Tribunal Act, 2010.*
19. *The CPCB may compile the data and furnish the same to this Tribunal by email at filing.ngt@gmail.com on or before 15.2.2019.*
20. *Put up for consideration in the last week of February, 2019.*

Accordingly, first meeting of AQMC under the Chairmanship of Principal Secretary (Environment) was held on 16.11.2018. Deliberations of the meeting are as reproduced below:

1. *Department of Environment/Delhi Pollution Control Committee will prepare the draft Action Plan by taking into account the GRAP, CAP, 41 directions issued by CPCB and other plans and will send to all the Members of the Committee and other Stakeholder Departments by* ***30th November, 2018*** *for obtaining their comments.*

2. *All the Members of AQMC and other Stakeholder Departments will send the comments positively by **10th December, 2018** to Department of Environment for finalization of Action Plan.*

3. *Department of Environment/ Delhi Pollution Control Committee will finalize the Action Plan and put up for the approval of Chief Secretary, Delhi by **20th December, 2018.***

4. *After the approval of the Chief Secretary, Delhi the Department of Environment will submit the finalized Action Plan to CPCB by **25th December, 2018.***

The AQMC constituted for the purpose has noted the following back ground facts that were placed before by the Department of Environment, Government of Delhi.

II. INTRODUCTION:

Air pollution in Delhi is a serious cause of concern for the Government of NCT of Delhi. World Health Organization defines air pollutants as substances put into the air by activities of mankind into concentration sufficient to cause harmful effects to health, crop-yield and property. Air Pollution mainly constitutes particulate matter and gases. Increasing levels of $PM_{2.5}$ (Particulate Matter of less than 2.5 micron size), PM_{10} (Particulate Matter of less than 10 micron size), NO_2 (Nitrogen dioxide) in ambient air have been in attention of the media, Courts and various other organizations as well as general public. Meteorological factors viz Wind Speed, Wind Direction, humidity , temperature etc also plays a crucial role in the air pollution episodes that happens in the winter months in the whole of North India. It is also evident that Delhi's Environment is highly influenced by different meteorological phenomena. In summer, the particulate is influenced by dust storm from Rajasthan and in winter by calm conditions and inversion as well as biomass burning in NCR.

As per the study got conducted by Department of Environment, Govt. of Delhi through IIT Kanpur in 2015, the major sources of air pollution in Delhi have been identified as under:-

- Vehicular pollution.
- Road and soil dust and its re-suspension.
- Dust generated due to construction and demolition activities.
- Burning of dry leaves/garbage etc.
- Industrial pollution emissions.
- Trans-state movement of pollutants specially due to burning of crop residue in neighboring states.
- Industrial sources/Thermal Power stations.

The possible main reasons for high level of air pollution were as follows:

(a) Crop residue burning in neighboring states.
(b) Non-favorable metrological conditions like calm wind, temperature inversion at lower height.
(c) Vehicular Pollution.
(d) Dry conditions helping re-suspension of particulate matter (PM).

III. MONITORING OF AIR POLLUTION:

To monitor the Ambient Air Quality parameters, there are 40 Continuous Ambient Air Quality Monitoring Stations (CAAQMS) in Delhi (DPCC-26, CPCB-6, MoES-8). The Online data of Ambient Air Quality of DPCC 26 CAAQMS are available on DPCC website. It is also noted that the monitoring data of DPCC CAAQMS are also taken for the overall calculations being done by CPCB for its Air Quality Index (AQI) calculations and also for the forecasting of the air pollution for the three days by the SAFAR program of Ministry of Earth Sciences, Govt. of India.

IV. DUST STORM EPISODE WITNESSED FROM 12TH JUNE TILL 17TH JUNE 2018 AND VERY POOR AIR QUALITY CONDITION IN OCTOBER, 2018 IN THE CITY:

An incidence of Dust storm occurred during the month of June, 2018. The figure 1 and 2 shows the variation in concentration of $PM_{2.5}$ and PM_{10} from 1st January, 2018 to 28th Nov, 2018. This period consist of winter and summer in Delhi. In Summer, the last peak of PM_{10} was recorded from 12th June to 16th June when concentration of PM_{10} reached

up to 1511 µg/m³ on 13th of June. However, $PM_{2.5}$ reached up to 271 µg/m³ on the same day. When Delhi faced severe Dust storm like conditions from 12th June to 17th June 2018. It may be attributed to the windblown dust from the Rajasthan Fig. 3 & Fig. 4 shows the variation in concentration of PM_{10} and $PM_{2.5}$ for the period of October and November, 2018. The higher values in winter months can be attributed to emission from local sources and trans-state movement of pollutant specially due to burning of crop residue in neighboring states, lower mixing height and other meteorological conditions like calm condition, low temperature etc.

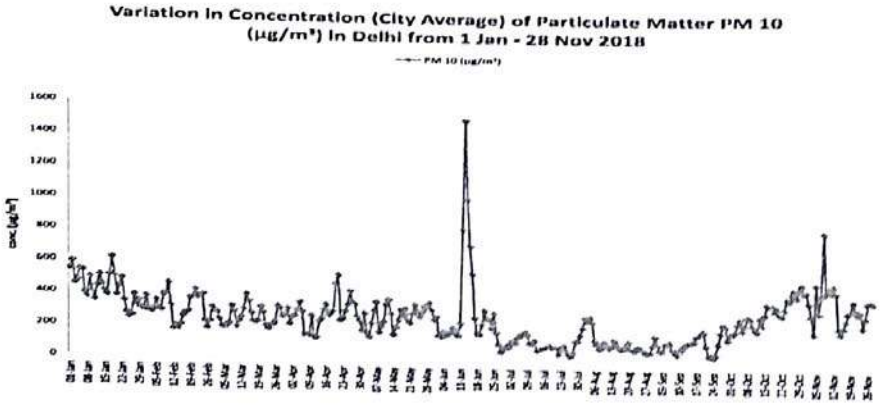


Figure- 1

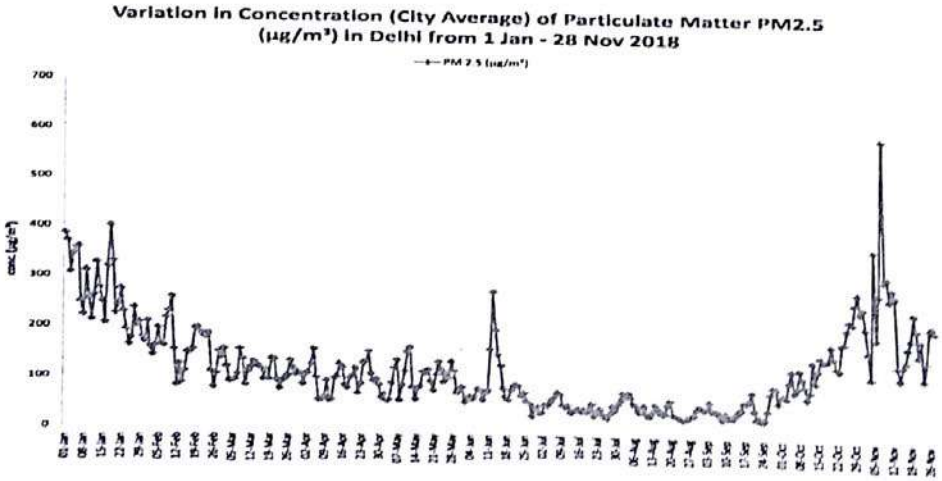


Figure- 2

Variation in Concentration (City Average) of Particulate Matter PM10 (µg/m³) in Delhi from 1 Oct - 28 Nov 2018

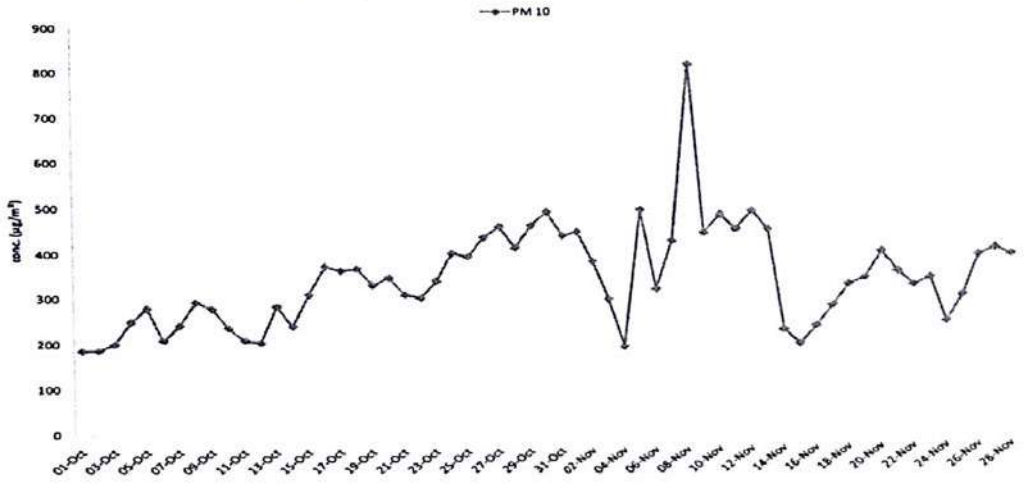


Figure- 3

Variation in Concentration (City Average) of Particulate Matter PM2.5 (µg/m³) in Delhi from 1 Oct - 28 Nov 2018

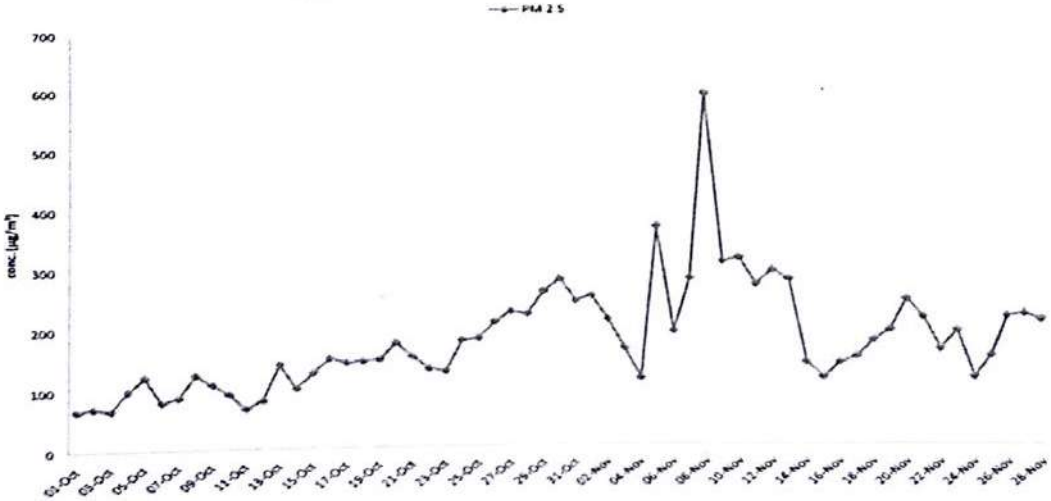


Figure- 4

The AQMC members have been briefed, that in view of the importance and magnitude of the problem, the issue of Air Pollution Control were reviewed at different levels both in Government of India and Govt. of NCT of Delhi. The AQMC member had been briefed that meetings held both at Government of India level and at Government of Delhi level which are depicted below;

At Government of India, Principal Secretary to Prime Minister, Secretary, Ministry of Environment Forests and Climate Change, Govt. of India, Chairman (EPCA), Chairman (Central Pollution Control Board) have been reviewing the Air Pollution Control to be taken at short, medium and long term measures.

At Government of Delhi level, periodical meetings have been held at level of Hon'ble Lt. Governor, Hon'ble Minister (Environment), Chief Secretary, Delhi and Secretary (Environment), Govt. of Delhi.

V. ACTIONS SO FAR TAKEN TOWARDS CONTROLLING AIR POLLUTION:

1. Review Meetings held at Govt of India

- Hon'ble Minister and Secretary, MoEF&CC, GOI had convened review meetings periodically with all stakeholders and reviewed the Air Pollution Control Measures taken by all agencies.
- High Level Task Force (HLTF) on issues of air pollution control has been constituted under Pr. Secretary to Prime Minister and its periodical report on recommendations of HLTF is being compiled and sent to Secretary, MoEF&CC, GOI by Government of Delhi. This report is discussed and based on this report Principal Secretary to PM convenes review meeting at regular intervals.
- The HLTF reviews action taken report submitted by all the agencies including the neighboring states of Rajasthan, Haryana, UP and Punjab.
- The High Level Task Force reviews the following aspects of Air Pollution(Control & Management):-

i. Installation and getting data of Continuous Ambient Air Quality Monitoring Stations (CAAQMS).
ii. Procurement and deployment of Mechanical Road Sweeping (MRS) Machines.
iii. Water sprinkling using treated sewage water in the roads.
iv. Massive greening program by all the agencies.
v. Dust Mitigation in all the major construction sites. Inspection and fining of violators who have not taken control measures.
vi. Vertical greening of pillars and flyovers.
vii. Deployment of water tankers by the construction agencies.
viii. Removal of silt from drains and dumping in designated sites.
ix. Prevention of biomass burning by the farmers in the state of Punjab and Haryana.
x. Procurement and distribution of Stubble Removal Machines to the farmers.
xi. Switching over to PNG by Industries.
xii. Operationalize Western & Eastern Peripheral Expressway.
xiii. Paving of roadsides to minimize dust.
xiv. Speedy implementation and establishment of Solid Waste Processing Plant.
xv. Speedy procurement of Buses by DTC and on Cluster mode.
xvi. Providing last mile connectivity by DMRC by dove-tailing metro stations through mini buses and e-rickshaws.
xvii. Removal of encroachment on roads by the civic agencies.

2. **Meetings by Environment Pollution (Prevention and Control) Authority (EPCA)**

Chairman, EPCA have also convened a number of meetings in order to ensure timely implementation of various projects. Meetings were held periodically to review the progress of various measures taken by different agencies for control of air pollution particularly with respect to implementation of GRAP. Specific review meetings had been held for Anand Vihar, Bawana-Narela areas to control the air pollution.

3. **Meetings by Hon'ble Lt Governor:**

Hon'ble Lt. Governor of Delhi had also reviewed with all the Departments and local bodies on the issues relating to Air Pollution in NCT of Delhi. The implementation of various projects both ongoing and new with timelines had been reviewed. Hon'ble LG has also specifically reviewed various action taken to control air pollution in the Anand Vihar ISBT area and Bawana-Narela area. He has tasked agencies with Short Term and Long Term Action Plan to mitigate the same.

4. **Meetings by Hon'ble Minister (Envt & Forests) Govt of Delhi.**

Hon'ble Minister (Environment & Forests), GNCTD also convened a number of meetings to discuss regarding the measures taken for controlling Air Pollution with all the agencies involved in various activities for the control of air pollution as well as for implementation of GRAP.

5. **Meetings by Chief Secretary, Delhi.**

Various review meetings had been convened by the Chief Secretary, Delhi from time to time. All Municipal Commissioner, Local Bodies, Transport Commissioner, Forest Department and all other concerned departments progress on various projects / measures are discussed and reviewed in the meeting. Specific timelines are given to the agencies for implementation of all measures before onset winter in 2018.

VI. IMPLEMENTATION OF GRADED RESPONSE ACTION PLAN (GRAP) IN DELHI:

The AQMC members had been briefed, that, due to the poor Air Quality Index (AQI), Severe Category of GRAP provisions had been invoked in the month of June, 2018 and during 1st November to 12th Nov, 2018.

Further, the AQMC members had been informed that based on the directions of EPCA, the provisions of GRAP under Very poor category was invoked from 15.10.2018 till 15.03.2019 with following directions:

- Increasing bus and metro services by augmenting contract buses and increasing frequency of service.
- Increase frequency of mechanized cleaning of road and sprinkling of water on roads. Identify road stretches with high dust generation.
- Residential Welfare Associations and individual house owners to provide electric heaters during winter to security staff to avoid open burning by them.
- Alert in newspaper/TV//Radio to advise people with respiratory and cardiac patients to avoid polluted areas and restrict outdoor movement
- Stop use of diesel generators sets.
- Shut down Badarpur Power Plant as of October15, 2018.
- Take steps to maximize generation of power from existing natural gas based plants to reduce operation of coal based power plants in the NCR.

Besides, the AQMC members had been informed that as directed by EPCA following directions had been issued with effect from 1st Nov 2018:

- All construction activities involving excavation, civil construction (excluding internal finishing/work where no construction material is used) to remain closed in Delhi and other NCR districts from November 1-12, 2018.
- All stone crushers, hot mix plants generating dust pollution to remain closed in Delhi and other NCR districts from November 1-12, 2018.
- All industries using coal and biomass as fuel (excluding thermal and Waste to Energy Plants) to remain closed in Delhi and other NCR districts from November 4-10, 2018. Industries that use natural gas as fuel can continue to operate.
- Transport department/traffic police to intensify checking of polluting vehicles and control traffic congestion in Delhi and other NCR districts during November 1-12, 2018. There should be no tolerance for visibly pollution vehicles. This will require stringent monitoring and on-spot fines for visibly polluting vehicles.

- Intensify patrolling , including night patrolling in industrial areas and other 'hot spots' in the city so that there is complete control on waste burning as well as industrial emissions. EPCA has already brought to your attention that it has found many cases of waste burning and industrial emissions, which is a gross violation of GRAP conditions.
- Intensity efforts for interrupted power supply in NCR towns to avoid requirement of operating DG sets and inconvenience to public.
- Publish in newspapers and disseminate widely the following information for the general public:
    - The need for public to minimize exposure and also advice people to minimize their travel using private vehicles as much as possible.
    - Enumerate and list all actions that have to be taken under GRAP, so that people are informed and can act as stakeholders in the efforts to control pollution.
    - Publish list of penalties that have been imposed and actions taken against people/industries found polluting. This information will provide deterrence and help improve enforcement.

This was followed by EPCA directions for stoppage of Trucks from 8th Nov to 12th Nov 2018. EPCA, in agreement with CPCB task force on 12 Nov 2018, allowed construction activity only during day time between 6 am to 6 pm.

52 joint teams involving SDMs, officers of CPCB, DPCC & Local bodies had been deployed from 1st Nov, 2018 to 10th Nov, 2018. Night patrolling by the Environmental Marshalls were also carried out to prevent garbage/biomass or waste burning etc. Remedial actions on the spot where ever such burning was found was also done

VII. ACTION PLANS/ PROPOSALS OF DELHI GOVERNMENT TO TACKLE THE AIR POLLUTION SITUATION IN DELHI:

The AQMC members had been briefed regarding the action plan/ proposals of the various Government Departments and also by local bodies in respect of following:

- Mechanical road sweeping
- Water sprinkling using treated sewage water.
- Solid waste management both centralised & Decentralised.
- Plans for remediation of dump sites.
- C&D waste management,
- silt management,
- plantation,
- Greening & Paving.
- Greening of fly overs and over bridges.
- Greening of open spaces, vertical gardens etc.
- Industrial air pollution control by converting them to PNG.
- Fiscal incentives to the industries, tandoors and hotels & restaurants for conversion into PNG from conventional fuels.
- Various enforcement actions taken by DPCC in respect of dust control and bio mass burning etc by imposing heavy fines.
- Deployment of environmental Marshals in each ward.
- Enforcement actions taken by other agencies.
- Action taken by industries in the non confirming areas.

The detailed action plans in respect of each of these activity is given below in detail:

Augmentation of Solid Waste processing facilities by MCDs:

- By increasing capacity of Waste to Energy Plant from existing 5100 TPD to 10,300 TPD to take care of entire waste by establishing new units /capacity addition at Okhla, Tehkhand, Ghazipur and Bhalaswa.
- By increasing capacity of C & D waste recycling from existing 2650 TPD to 4650 TPD, to take care of the entire C & D waste by establishing new units.
- By establishing smaller facilities to process Bio-degradable waste at decentralized locations of capacity ranging from 1 TPD to 5 TPD.

Greening of unpaved area:

- MCDs, NDMC and PWD has plan/ proposals for Greening / paving of central verges / road berms / unpaved.

Water Sprinkling on roads:

- MCDs, NDMC and PWD has plan/ proposals for augment regular water sprinkling on roads before sweeping by deploying sufficient number of water tanker with sprinklers.

Public Transport:

- Procurement of 2000 CNG buses by Transport Department.
- Procurement of 1000 electric buses by Transport Department.
- Last mile connectivity by DMRC - The DMRC has contributed a subsidiary company and procuring feeder buses to serve as last mile connectivity in an organized way.
- DMRC is in process of acquiring additional metro coaches.
- Journey Planner app integrating Metro, DIMTS and DTC services
- Ensure that non- destined trucks do not enter Delhi.
- Ensuring compliance of the Toll and Municipal charges for entering of trucks in Delhi.
- Policy on Promotion and use of e vehicles including buses.

VIII. MEASURES THAT ARE CONTINUOUSLY BEING TAKEN TO CONTROL AIR POLLUTION IN DELHI:

1. **Monitoring and Action against persons for burning of waste material/garbage in open**:- Government has undertaken special drive of inspections to prevent air pollution due to burning of leaves/garbage in open areas.
   i. To receive the public complaints in order to stop the burning of Garbage/Waste material/ Leaves, Delhi Pollution Control Committee

(DPCC) has opened "Whatsapp account with mobile number 9717593574" and "9717593501".

ii. Sub Divisional Magistrates (SDMs) along with Tehsildars (Executive Magistrate), Department of Revenue, GNCTD, have been authorized to take action against violations. Penalty is being imposed in accordance with the directions of Hon'ble National Green Tribunal.

iii. For prohibition of burning of dry leaves / garbage / plastic etc, Municipal Corporation of Delhi (MCDs)/ Delhi Development Authority (DDA) has been asked that if any violation found, concerned S.O. (Horticulture) and Sanitation Inspection will be held responsible personally and action will be taken against them.

iv. Other Civic Agencies also have imposed fines in respect of violations found at sites.

2. **Monitoring and Action against violators of dust control measures:-** Govt. has launched special drive to improve air quality by way of enforcing Dust Control Measures by the construction project agencies/ individuals. Area SDMs, Tehsildars, Assistant Engineers of Public Works Development (PWD) and Delhi Pollution Control Committee (DPCC) are regularly inspecting projects for checking the compliance of dust control and levy compensation for violations of dust control measures.

i. SDMs alongwith Tehsildars (Executive Magistrate), Department of Revenue, Govt. of NCT of Delhi and Assistant Engineer of Public Works department (PWD) have been authorized to take action against violations. Penalty is being imposed in accordance with the directions of Hon'ble National Green Tribunal.

ii. All local bodies and DDA have also been asked to apprise public in general and owners and builders in particular who have got their building plans sanctioned for following dust control measures.

iii. DPCC has imposed fine on construction projects who have obtained Environmental Clearance (built up area more than 20,000/- sq. Mtrs)

Review meetings have been convened with stakeholder departments/Agencies for prohibition of burning of leaves, garbage, plastic, rubber etc in open and for taking dust control measures at construction sites.

ROAD DUST CONTROL MEASURES:

• **Mechanical Road Sweepers :**	
○ Existing	48 Nos. (SDMC = 18, North DMC=12, EDMC=10, NDMC=7, DCB=01)
○ New being procured	12 Nos. (SDMC = 6, North DMC=6)
- *All existing and new MRS-fitted with GPS* - *Online Schedule is published on respective websites.* - *Online feedback from RWAs and individuals provided on FaceBook & Twitter* - *Third Part Monitoring by TERI*	**NDMC:-** • GPS are exists in 03 Nos. of existing MRS • GPS to be provide in 04 Nos. newly procured MRS. **North DMC:** MRS, location and running can be tracked through web link:- https://track.roadpoint.in/login.html https://www.facebook.com/Monitoring-of-Mechanical-Road-Sweepers-in-North-DMC-668310160204472/ https://twitter.com/sweeper_road **SDMC:** **http://esbm.mcdonline.gov.in/SWMS/solidwasteDashboard/Dashboard/ms"** **EDMC**: http://solutionsget.in & http://facebook.com/EDMCMRS
• **Water Sprinklers / Tankers :**	
○ Existing	341 Nos (SDMC=132, North DMC=110, EDMC=40, NDMC=14, PWD=44, DCB=01).
○ New being procured	161 Nos (SDMC = 17, North DMC= 104 nos , EDMC=40)

Challan issued/Fine imposed with respect to Dust Control at construction sites (since 01.01.2018 till 30.11.2018)			
S.No	Department	For Dust Control at construction sites	
		Challans/ Notice issued	Amount collected (Rs.)
1	East Delhi Municipal Corporation (EDMC)	3470	47,76,500/- (Deposited) 2,55,53,500/- (Pending)
2	South Delhi Municipal Corporation (SDMC)	5191	17,464,200/-
3	North Delhi Municipal Corporation (NDMC)	447	93,000,00/-
4	PWD	62	7,10,000/-
5	DPCC	7 (Closure Direction)	1,55,50,000/-
6	Revenue Department	104	35,51,000/-
7	Delhi Cantonment Board	01	50,000/-
8	New Delhi Municipal Council	04	50,000/- (Deposited) 1,50,000/- (Pending)

3. **NGT Orders/Judgments in O.A No 21/2014** regarding air pollution control-action taken are being complied in coordination with concerned departments and three monthly comprehensive report in compliance to NGT directions is being sent to CPCB.

4. **Promotion of Battery Operated Vehicles**:- With the view to promote non-polluting e-vehicles, Govt. has announced subsidy schemes for adopting various kinds of e-vehicles such as Two-Wheeler, Four-Wheelers and also e-rickshaws. Owners of newly purchased battery operated 4 wheelers and 2 wheelers are given subsidy by GNCTD, in addition to subsidy by Govt. of India @ Rs 2000-5500 for two wheelers and Rs. 30000/-to1,50,000/- for four wheelers. One time fixed subsidy of Rs. 30,000/- is given to Battery Operated e-rickshaw owner, authorized by Transport Department and registered in the NCT of Delhi.

5. **Prohibition on bursting of firecrackers:** Direction U/S 31(A) of Air (Prevention & Control of Pollution) Act, 1981 read along with Rule 20A of Air (Prevention & Control of Pollution) (Union Territories) rules, 1983 to ban bursting of firecrackers/ fireworks at all times except on religious occasions has been issued on 08.12.2016.

   Hon'ble Supreme Court issued directions via order dated 23.10.2018 & subsequent orders in Writ Petition (Civil) No. 728 of 2015 regarding bursting of Firecrackers. DPCC has printed leaflets containing Supreme Court directions in brief for awareness of type of firecrackers allowed and harmful effects of bursting of Firecrackers.

6. **Imposition of Change on lights and heavy duty commercial vehicles entering Delhi:** In compliance with the order dated 09.10.2015 and 16.12.2015 of Hon'ble Supreme Court, Environment Compensation Charge (ECC) is levied on Delhi bound light and heavy duty commercial goods vehicles. Notifications have been issued as per Hon'ble Supreme Court directions.

7. **Greening of City**: As per latest Forest Survey of India report 2017, Green cover of Delhi has increased to about 305.41 sq km from 26 Sq. Km in 1997. The increased green cover also acts as carbon sink. Target of plantation set for 2018-2019 is 32.18 lakhs saplings by all greening agencies of which more than 25 Lac saplings have been already planted.

8. Environmental Marshalls:

Department of Environment, Govt. of Delhi has deployed Home Guard (HG) volunteers as Environmental Marshals. 83 home guards have been deployed in wards of three Municipal Corporations. They have been instructed to act as eyes of Environment Dept./DPCC and report the instances of violations. Environmental Marshals have been deployed for night patrolling also.

Total Cases Reported Dec'17- Nov'18	
Total Violation	13528
Cases Resolved at site	12398
Not Resolved	1130

9. Public Awareness conducted by Department of Environment, Govt. of Delhi:-

- Organized workshops for areas under Jurisdiction of North MCD, South MCD and East MCD on "Prohibition on open burning of any kind of material – A Small Step Targeting Big Impact" respectively at Delhi Secretariat. Workshop was for public awareness and interaction with implementing authorities. The officials from North MCD and South MCD i.e. SI/ASI and horticulture wing participated in the workshop along with RWAs, School/Colleges from the areas under jurisdiction of North and South MCD.
- Every year Anti-Fire Cracker Campaign is being organised with Eco-Club Schools/Colleges.
- Public notices have been issued on prohibition on open burning of leaves, waste, garbage etc.
- Organized workshop for area under Jurisdiction of North MCD on "Dust Control Measures at construction sites to Control Air pollution".

IX. NEW INTITAIVES BY DELHI GOVERNMENT:

i. Green Budget Implementation:

The Government of Delhi has passed a Green Budget where in provisions have been made for providing subsidy to the following:

- Conversion of Industries to PNG – approved by Cabinet on 04.09.2018.
- Conversion of coal based Tandoors to Gas based - approved by Cabinet on 04.09.2018.

Also a real-time source apportionment study in partnership with the University of Washington is proposed and it will carry out near-continuations analysis of factors causing pollution on a regular basis.

A draft RFP is being prepared to provide a dedicated information system showing current levels of pollution by installing 1000 indoor display panels inside all Governments building that are dealing with the public.

ii. Notification issued on Approved Fuel:

The Delhi Pollution Control Committee (DPCC) has issued approved fuel notification on 29.6.2018. As per the notification only approved fuels are permitted to be used which as follows:

1. Petrol (BS VI with 10 PPM Sulphur) as per the Notification of Government of India as amended from time to time.
2. Diesel (BS VI with 10 PPM Sulphur) as per the Notification of Government of India as amended from time to time.
3. Liquid Petroleum Gas (LPG)
4. Natural Gas/Compressed Natural Gas (CNG)
5. Aviation turbine fuel
6. (a) Firewood for crematoriums and for other religious purposes.

(b) Wood Charcoal for Tandoors and Grills of Hotels/ Restaurant/ Banquet Halls/ Eating Houses having emission channelization / control system.

(c) Wood Charcoal for use in clothes ironing.

7. Biogas
8. Refuse Derived Fuel (only for Waste-to-Energy Plants)
9. Any other clean fuel notified by the Govt. of NCT of Delhi / Govt. of India, subsequent to this notification.

Note:

1. Besides above, Coal with low Sulphur (less than 0.4%) permitted for use in Thermal Power Plant only.
2. All other fuels will be deemed "**unapproved**" and so disallowed for use in NCT of Delhi.
3. Existing Industries / Units shall convert / switch over from their existing fuels to the above mentioned Approved Fuels within 90 days from the date of issue of this Notification.

The AQMC members have further been briefed about the initiatives at a pilot. R&D scale done by CPCB in respect of the control of air pollution at construction sites and at heavy traffic intersections etc.

i. At 5 main intersections a device called WAYU with static filters has been installed which will operate in series to suck and control the emissions from the traffic intersection including at ITO junction. This has been awarded by CPCB to NEERI as an R&D study.

ii. At 3 construction sites in Delhi a dust suppressant is being used as a pilot project by CPCB through NEERI.

iii. Dynamic filters in buses are also being tried on a pilot basis by CPCB/ MoEF & CC, GOI.

iv. With the joint collaboration of various Ministries namely, MOEF&CC, MOES, IMD, IITM, CPCB, DPCC etc an advance early warning systems has been launched.

v. A Grievances redressal portal SAMEER has been launched by CPCB.

X. NCR STATES RELATED ISSUES WHICH IMPACT AMBIENT AIR QUALITY OF DELHI:

Following issues as mentioned below specifically relate to NCR states which impact ambient air quality of Delhi:

- The feasibility of providing U-Turn and underpass near borders to turn back the non-destined vehicles trying to enter the city needs to be explored.
- Air quality monitoring stations as set up in Delhi to be set up in NCR with online display of data.
- Local bodies and major construction agencies in Delhi have already been directed to use dust suppression methods on the construction sites to reduce the dust emissions. Delhi Police and Department of Transport have been directed to allow transportation of construction material and demolition waste only in closed and properly covered trucks. The neighboring states must ensure that all the construction sites must undertake the dust suppression methods to control the dust emission from the construction sites. Further, any construction material or construction waste carried to Delhi must be transported in closed or properly covered trucks.
- The practice of burning of paddy stubs in the agricultural zones adjoining Delhi needs to be stopped. Agriculture burning in the NCR and neighboring states is other major contributor of the particulate and other gaseous pollutants in Ambient Air of Delhi. It is pertinent to mention here that from October to January are crucial months for Delhi, as with onset of winter, concentration of particulate and gaseous pollutants increase significantly. Agricultural fire in Punjab & Haryana is a major cause, the Aqua satellite of NASA had taken the image and shared it in public domain. The images show the cloud of ash spreading almost in the northern belt and especially on Delhi.

Though, stringent steps have been taken/being taken by Delhi Govt. for reducing air pollution in Delhi, there is an urgent need that NCR states also take similar steps as taken by Govt. of Delhi.

The AQMC members have been briefed regarding the steps taken by the Government of India for control of Agricultural residue burning in the NCR states. The scheme of subsidy for purchase of a Happy Seeder machine and also for providing subsidy for mulching machine.

XI. THE ACTION PLANS SO FAR BEING IMPLEMENTED:

(1) The action points of CAP (Comprehensive Action Plan) for Air Pollution Control in Delhi & NCR (Annexure I):

➢ **Air Quality Monitoring**

- DPCC has set up 26 real time monitoring stations apart from 14 air quality monitoring stations that are operated by Central Pollution Control Board (CPCB) and Ministry of Earth Sciences (MoES) with continuous relay of information.
- A real-time source apportionment study in partnership with the University of Washington is proposed and it will carry out near-continuations analysis of factors causing pollution on a regular basis.
- RFP is being prepared to provide a dedicated information system showing current levels of pollution by installing 1000 indoor display panels inside all Governments building that are dealing with the public.
- NCR-wide air quality monitoring expansion
- Undertake satellite-based monitoring for tracking and enforcing agriculture waste burning

➢ **Action to reduce vehicular emissions**

- Ensure on-schedule implementation of BS VI fuel and emission standards

- Action on Dieselization
- Expand CNG programme across NCR
- Introduce battery-operated vehicles
- Install vapour recovery systems in fuel refuelling outlets to reduce benzene emissions in NCR
- Auditing of Pollution under Control (PUC) certification centres
- Tighten PUC norms for post 2000 vehicles. Upgrade in-use emissions testing for diesel vehicles.
- Implementation an on-board diagnostic system fitted in new vehicles inspection.
- Link PUC certificates with annual vehicle insurance to ensure 100 per cent compliance
- Enforcement of law against visibly polluting vehicles.
- Delhi to review and upgrade Burari commercial vehicle testing centre
- Ensure requisite infrastructure for hydro testing of CNG cylinders in Delhi and NCR
- Divert truck traffic
- Check overloading
- Fast track construction of Western and Eastern Peripheral Expressways
- Inter-state freight transport plan
- Fuel quality: Prepare an action plan to check fuel adulteration and random monitoring of fuel quality data.

➢ **Strategies to reduce vehicle numbers on roads**

- Improvement in bus numbers and services
- Implement the recommendations of Route Rationalization Report of GNCTD
- Reform of DTC and Cluster Bus Operations – modernize fleet and crew scheduling process of DTC, install GPS units on DTC buses and create a traffic control cell for monitoring bus movement, rationalize scheduling of buses under DTC and cluster scheme

- IT system in buses, bus- stops and control centre and passenger information systems for reliability of bus services, and service monitoring
- Bus parking should be made integral to urban planning. Multi-level bus parking to be provided in depots to more efficiently use available land area.
- Need bus fare policy to ensure that it is affordable and remains competitive *vis-a-vis* the operational cost of two- wheelers.
- Enforce bus lanes and keep them free from obstruction and encroachment
- Augmenting the service of Metro for carrying more passengers
- Three-wheelers: Implement electro-mobility for three-wheelers to make them zero emission as efficient feeder system for last mile connectivity and integration with bigger public transport systems. Organise their services for efficient deployment.
- BRTS / LRTS to be implemented in targeted high frequency routes and complemented with bus services with proper integration of routes, stations and terminals
- Fare integration and common ticketing; bring ETVMs into all DTC buses. Common mobility cards to be the mandatory access card for buses
- Implementation of multi- modal integration plan for bus-Metro IPT-NMT at key/ all interchange points
- Demarcation and development of Influence Zones around Metro stations as per MPD-2021 to improve access to the public transport system
- Proper regulations and organization including providing driver-training, certification, etc. for cab and auto-rickshaw drivers
- NCR connectivity for public transport – need bus and Metro plans
- Rationalize entry taxes in NCR under the NCR reciprocal agreement to lower costs of travel by public transport
- Integrate ITS in bus systems in cities in NCR (automated vehicle location, passenger information system, fare collection system)
- Regional Rapid Transit System (RRTS) integrated with local transit systems should be implemented to provide seamless connectivity between regional and sub-regional centres of NCR

- Integrated passenger terminals to be created with mixed use and multi- modal facilities for passenger comfort, integrating regional and local public transit systems
- Implement traffic impact assessment of infrastructure project for planning and management

- **Non- Motorized transport (NMT) network**
- **Parking policy to reduce congestion and pollution**
- **Enforcement and Management**
- **Parking pricing and penalty**

- **<u>Traffic management</u>**
  - Introduce early alarm system during traffic congestion for the benefit of commuters on major routes, to facilitate route diversion
  - Consider introducing plan for flexi / staggered timings to minimize peak movement of vehicles on-roads.
  - Synchronize traffic movements / introduce intelligent traffic systems for lane-driving
  - Formulate action plan for controlling decongestion of fuel stations including increasing the number of dispensing machines.
  - Electronic monitoring of traffic violations
  - Examine existing framework for removing broken down buses / trucks from roads and create a system for speedy removal and ensuring minimal disruption to traffic from such buses/ trucks.
  - Conduct audit of traffic intersections and install functional traffic signals at all major intersections in all NCR cities.
  - Conduct review of traffic signalling system at all intersections in Delhi / Noida and Gurugram and other NCR towns that are traffic hotspots and bring requisite changes to reflect the traffic movement pattern at intersections.
  - Enforce lane driving through heavy fining as in Mumbai

➢ **Power plants and industries**

- Permanent closure of Badarpur Power Plant after commissioning of the Tughlakabad sub-station or move towards cleaner natural gas. (Badarpur Power Plant closed permanently w.e.f. 15.10.2018)
- Closure of Badarpur during peak winter months when Graded Response Action Plan is in force. (Badarpur Power Plant closed permanently w.e.f. 15.10.2018)
- Monitoring of fly ash pond at Badarpur, particularly during summer months to control fugitive dust.
- Plan for site restoration of over 60 ha fly ash pond of Badarpur
- Time-bound action based on plan for restoration of fly ash pond land area.
- Move to full utilization of the cleaner natural gas- based Bawana station for power supply to Delhi.
- Progressively close the older and more polluting thermal power plants in NCR and to move to cleaner natural gas.
- Urgent ban on furnace oil, pet coke, which are dirty industrial fuels with high sulphur and heavy metals.(Govt. of Delhi issued notification for approved fuel in Delhi in June, 2018)
- Strict enforcement against illegal use of such fuels, including fuels which do not have specifications laid down or are included in the acceptable fuels as mandated by state pollution control boards.
- Strict enforcement of Air Pollution Control Measures in all industries includes those located in unauthorized areas.
- Stop unrestricted import of such fuels, which are high in pollution because of high Sulphur or toxins
- Ensure that the sale, transportation and distribution of such fuels follows CMVR strictly for hazardous goods and ensure that there is no sale in restricted regions.
- Ensure calibration and working of Continuous Emission Monitoring System (CEMS) in all industries in NCR and provide information to monitoring agencies to begin and work out how this information can be provided to public as this will ensure that the system is operational.

- **Brick-kilns**
  - Convert all brick kilns to zigzag technology – from natural draft kilns to induced--draft kilns (zigzag technology)

- **Incinerators**
  - Implementation emission norms for incinerators and examine the feasibility of less polluting alternatives.
  - Implement CEMS for incinerators and provide data on emissions on an open platform progressively
  - Develop a siting policy for biomedical incinerators.

- **Waste-to-Energy plants**
  - Strict implementation of emission norms, use state of the art technology and provide emission data to State Pollution Control Boards
  - Develop a sitting policy for waste to energy plants

- **Generator sets**
  - Ensure that only those DG sets that meet the standards are allowed to operate.
  - Operating time of DG sets should be regulated according to graded action plan.
  - Only approved fuel should be allowed
  - Non-usage of DG sets in social events as per graded action plan
  - Alternate power systems should be promoted in cell towers, and use of DG sets discouraged

- **Open burning (including solid waste and agricultural residues)**
  - SC order dated 16.12.2015 has directed a complete ban on garbage burning in the entire NCR region
  - Ensure proper collection of horticulture waste (biomass) and composting-cum-gardening approach; municipal zonal offices should be responsible for controlling burning of leaves and garbage on roads / parks.

- Implement citizen reporting app -- reporting of garbage / municipal solid waste burning through mobile- based applications and other social media platforms linked with Central and state-level control rooms for accountability

➢ **Regional problem and Biomass Burning**

- Ensure strict enforcement of ban on burning of agriculture waste and crop residues in Punjab and Haryana.
- To increase subsidy for purchase of equipment that eliminates the need for burning stubble and straw.
- Enforce the series of directives from the Hon'ble Supreme Court and NGT on ban on agricultural burning and recycling and reuse of this waste.

➢ **Episodic events**

- Fire crackers -- Implement and monitor the SC order of September 12, 2017 & its subsequent orders in Oct, 2018.

➢ **Domestic chulha burning and open eateries**

- In slums and low-income neighbour hoods, as well as roadside eateries/dhabas/ restaurants etc promote and give access to LPG and electricity. Link commercial license to clean fuels.
- Prohibit use of coal in hotels and restaurants, eliminate use of kerosene for cooking in NCR and incentivize move to LPG.
- A targeted programme can be developed with the Union Ministry of Petroleum and Natural Gas for wider distribution of LPG.

➢ **Control measures of Road Dust**

- SC direction dated December 16, 2016 has directed repair and building of pavements and vacuum cleaning of roads.
- Enforcement of air pollution control in concrete batching (use of water spray and wind breakers, bag filter at silos and enclosures, hoods, curtains etc)

➢ **Control measures for construction dust**

- SC order dated 16.12.2015 directed the Delhi Govt. to ensure measures are taken to mitigate dust pollution from construction
- For material handling and construction demolition, it should be obligatory on part of the developers to provide evidence of debris disposal at designated sites. Promote recycling of construction material

(2) The action points of GRAP (Graded Response Action Plan) (Annexure II):

- The GRAP was notified by MoEF & CC, GoI on January 12, 2017
- To be Enforced / Monitored by EPCA
- Task Force constituted in CPCB – review air quality status, suggest additional measures during Severe + days, area specific local plans;
- Actions under moderate to poor to continue throughout the year
- Very poor and Severe category actions during winter months.
- Emergency actions after 48 hours of persistent severe plus situation.

Range of PM_{10} and $PM_{2.5}$ as per the ambient air quality:

Stage	PM10	PM2.5
Good	<100	<60
Moderate to Poor	101-350	61-120
Very Poor	351-430	121-250
Severe	430-500	250-300
Severe +	>500	>300

Stage-wise Action required to be taken by various Agencies

➢ **Stage: Moderate to Poor**

- Stop Garbage Burning.
- Strict enforcement by PCBs in Industries.

- Strict enforcement in Thermal power plants.
- Mechanized sweeping of roads.
- Water sprinkling on unpaved roads.
- Strict enforcement of vehicular pollution norms and imposing fines.
- Dust control enforcement in construction activities.
- Additional traffic Police deployment for smooth flow of traffic.
- Diversion of non destined trucks.
- Enforcement of ban on fire crackers.
- Watering of fly ash ponds.
- Information dissemination and public participation.

➢ **Stage: Very Poor**

- Increased frequency of Mechanized road sweeping and water sprinkling especially in hotspots.
- Stop use of DG Sets.
- Enhancement of parking fees by 3 to 4 times.
- Increasing the bus and metro services.
- Ban on coal and firewood burning in hotels and eateries.
- Involvement of RWAS for providing electric heaters to security to reduce the garbage/Leaf burning.
- Public advisory in the media regarding ill effects of Air Pollution and to remain indoors.

➢ **Stage: Severe**

- Increased frequency of Mechanized road sweeping and water sprinkling especially in hotspots.
- Closing of brick kilns, hot mix plants and stone crushers.
- Shutting down of BTPS.
- Intensify public transport services.
- Introduce differential rates to encourage off peak travel.

- **Stage: Severe plus**
  - Stop entry of truck except carrying essential goods.
  - Stop all construction activities.
  - Introduction of odd-even scheme for private vehicles.
  - Consider in task force to close down of schools.

XII. CONCLUSIONS

In compliance to order OA 681 of 2018, Air Quality Monitoring Committee (AQMC) meeting held under the Chairmanship Pr. Secretary (Environment), GNCTD on 16.11.2018. Both CAP and GRAP are being implemented in Delhi along with 41 directions issued by CPCB under Air Act (**Annexure III**) by various implementing agencies for controlling air pollution in Delhi, mandatorily. All the above stated action plan/ directions cover all the aspects/ steps to be taken to control air pollution. In view of this, preparation of another action plan with respect to Delhi will be a duplicate exercise and may not be desirable for Delhi as the implementation of these plans is being monitored at different levels at Government of Delhi, by EPCA, CPCB, MOEF&CC, GOI and by Pr. Secretary to Prime Minister.

Department of Environment
Govt. of NCT of Delhi
6th Level, C-Wing, Delhi Secretariat, I.P. Estate, New Delhi -110002
Tele: 23392306 Fax: 23392029

F. DPCC/(10)(10)/(....)/Leg 18/7025-7033 Date: 14/11/18

OFFICE ORDER-CUM-MEETING NOTICE

Sub: Constitution of Air Quality Monitoring Committee (AQMC) in respect of Delhi in Compliance to the directions of the Hon'ble NGT contained in the order dated 08.10.2018 passed in OA No. 681/2018 in the matter of: NEWS ITEM PUBLISHED IN THE TIMES OF INDIA AUTHORED BY SHRI VISHWA MOHAN Titled "NCAO with Multiple Timelines to clear Air in 102 Cities to be released around August 15"

The directions of the Hon'ble Tribunal as contained in the above order said are reproduced below:

15..... issue direction as follows:

i. *All the States and Union Territories with non-attainment cities must prepare appropriate action plans within two months aimed at bringing the standards of air quality within the prescribed norms within six months from date of finalization of the action plans.*

ii. *The Action Plans may be prepared by six-member committee comprising of Directors of Environment, Transport, Industries, Urban Development, Agriculture and Member Secretary, State Pollution Control Board or Committee of the concerned State. The Committee may be called Air Quality Monitoring Committee (AQMC). The AQMC will function under the overall supervision and coordination of Principal Secretary, Environment of the concerned State/Union Territory. This may be further supervised by the Chief Secretaries concerned or their counterparts in Union Territories by ensuring intra-sectoral co-ordination.*

iii. *The Action Plans may take into account the GRAP, the CAP and the action plan prepared by CPCB as well as all other relevant factors. The Action Plans may be forwarded to the CPCB by 31.12.2018. The same may be placed before the Committee as directed in direction no. vi. The Action Plan will include components like identification of source and its apportionment considering sectors like vehicular pollution, industrial pollution, dust pollution, construction activities, garbage burning, agricultural pollution including pollution caused by burning of crop residue, residential and indoor pollution etc. The action plan shall also consider measures for strengthening of Ambient Air Quality (AAQ) monitoring and steps for public awareness including issuing of advisory to public for prevention and control of air pollution and involvement of schools, colleges and other academic institutions and awareness programmes.*

iv. *The Action Plan will indicate steps to be taken to check different sources of pollution having speedy, definite and specific timelines for execution.*

v. *The Action Plan should be consistent with the carrying capacity assessment of the non-attainment cities in terms of vehicular pollution, industrial emissions and population density,*

extent of construction and construction activities etc. The carrying capacity assessment shall also lay emphasis on agricultural and indoor pollution in rural areas. Depending upon assessed carrying capacity and source apportionment, the authorities may consider the need for regulating number of vehicles and their parking and plying, population density, extent of construction and construction activities etc. Guidelines may accordingly be framed to regulate vehicles and industries in non-attainment cities in terms of carrying capacity assessment and source apportionment.

vi. *The Committee comprising of (a) Shri. Prashant Gargava, Member Secretary, CPCB, (b) Dr. Mukesh Khare, Professor, IIT Delhi, and (c) Dr. Mukesh Sharma, Professor, IIT Kanpur shall examine the Action Plans and on the recommendations of the said Committee, the Chairman, CPCB shall approve the same by 31.01.2019.*

vii. *The Chief Secretaries of the State and Administrators/ Advisors to Administrators of the Union Territories will be personally accountable for failure to formulate Action Plans, as directed.*

viii. *The CPCB, SPCBs and State Pollution Control Committees shall develop a public grievance redressal portal for redressal of public complaints on air pollution along with a supervisory mechanism for its disposal in a time bound manner. Any visible air pollution can be reported at such portal by email/SMS.*

ix. *The CPCB and all the State Pollution Control Boards and Pollution Control Committees shall collectively workout and design a robust nationwide ambient air quality monitoring programme in a revised format by strengthening the existing monitoring network with respect to coverage of more cities/towns. The scope of monitoring should be expanded to include all twelve (12) notified parameters as per Notification No B-29016/20/90/PCI-L dated 18th November, 2009 of CPCB. The continuous Ambient Air Quality Monitoring Stations (AAQMS) should be preferred in comparison to manual monitoring stations. The CPCB and States shall file a composite action plan with timelines for its execution which shall not be more than three months. It is expected that all such AAQMS shall be connected to central server of CPCB for reporting analysis of results in a form of Air Quality Bulletin for general public at regular intervals atleast on weekly basis and ambient air quality on continuous basis on e-portal. MoEF&CC will provide requisite funds for the purpose. MoEF&CC in consultation with Ministry of Housing and Urban Affairs, MoRTH, Ministry of Petroleum and Natural Gas, Ministry of Agriculture, Cooperation and Farmers Welfare or any other Ministry to lay down such guidelines as may be considered necessary for improvement of air quality in the country.*

16. *A copy of this be sent by e-mail to all the concerned i.e. Ministries of Environment, Forest & Climate Change, Housing and Urban Affairs, Road Transport and Highway, Agriculture, Petroleum and the Chief Secretaries of all the States and Union Territories for compliance.*

17. *We understand that some of the Zonal Benches of the National Green Tribunal have also passed directions on the subject of Ambient Air Quality and the States in those Zones are in the process of implementation of such directions. Specific reference may be made in this regard to judgement dated 11.08.2016 in O.A No. 33/2018/EZ in the matter of Subhas Datta v. State of West Bengal & Ors. We make it clear that this order shall not be considered as an impediment to those actions*

but as an addition or supplement thereto for achieving the object of this order at the macro level and of the said order at the micro level in the concerned cities.

18. *Needless to say, that order of National Green Tribunal is binding as a decree of Court and non-compliance is actionable by way of punitive action including prosecution, in terms of the National Green Tribunal Act, 2010.*
19. *The CPCB may compile the data and furnish the same to this Tribunal by email at filing.ngt@gmail.com on or before 15.2.2019.*
20. *Put up for consideration in the last week of February, 2019.*

Accordingly, as per para 15 of the above said order, a six member Air Quality Monitoring Committee (AQMC) comprising of Directors or Officers of equivalent rank of the following Departments is being constituted for NCT Delhi:

1. Department of Environment, GNCTD
2. Transport Department, GNCTD
3. Industries, GNCTD
4. Urban Development, GNCTD
5. Agriculture, GNCTD
6. Member Secretary, Delhi Pollution Control Committee (DPCC)

AQMC will prepare appropriate action plans within two months aimed at bringing the standards of air quality within the prescribed norms within six months from date of finalization of the action plans as per directions contained in the order. AQMC will function under the overall supervision and coordination of Principal Secretary, (Environment), Department of Environment, GNCTD. This may be further supervised by the Chief Secretary, Delhi. AQMC have to forward the Action plan to CPCB by 31.12.2018.

This is issued with the approval of Chief Secretary, Delhi.

First meeting of the Committee is to be held on 16.11.2018 at 4:30 PM under the Chairmanship of Principal Secretary (Environment) in Conference Room of Department of Environment, 6th Floor, C Wing, Delhi Secretariat.

S. M. Ali
Spl. Secretary (Environment)

To:

1. Pr. Secretary, Department of Urban Development, GNCTD
2. Pr. Secretary, Department of Industries, GNCTD
3. Commissioner, Transport Department, GNCTD
4. Secretary cum Commissioner, Development Department, GNCTD
5. Member Secretary, Delhi Pollution Control Committee (DPCC)
6. Director, Department of Environment, GNCTD

Copy for kind information to:

1. Chairman, Central Pollution Control Board
2. Secretary (Environment)-Cum-Chairman DPCC, Department of Environment, GNCTD
3. OSD to Chief Secretary, Delhi

C/27

DEPARTMENT OF ENVIRONMENT

GOVT. OF NCT OF DELHI, 6TH LEVEL, C-WING
DELHI SECRETARIAT, NEW DELHI-110002
Tel: 23392034

F. DPCC/(10)(10)/(....)/Leg 18/7360-7372

Date- 22/11/18

MINUTES OF MEETING

Minutes of the meeting of Air Quality Monitoring Committee (AQMC) held under the Chairmanship Pr. Secretary (Environment), GNCTD on 16.11.2018 in respect of Delhi in Compliance to the directions of the Hon'ble NGT contained in the order dated 08.10.2018 passed in OA No. 681/2018 in the matter of: NEWS ITEM PUBLISHED IN THE TIMES OF INDIA AUTHORED BY SHRI VISHWA MOHAN Titled "NCAO with Multiple Timelines to clear Air in 102 Cities to be released around August 15"

Meeting of Air Quality Monitoring Committee was held on 16.11.2018 under the Chairmanship of Pr. Secretary (Environment), GNCTD at Delhi Secretariat. The list of participants is at **Annexure – I.**

I. The meeting was attended by Secretary (Development Department), representing Agriculture Department GNCTD, Member Secretary (DPCC), Director (Environment), GNCTD, Dy. Commissioner (Transport Department), GNCTD and Senior Officers from Industry department/DSIIDC.

II. Director (Environment) briefed the Committee about the order of Hon'ble NGT dated 08.10.2018 and apprised that Action Plan is to be prepared within 2 months from the date of order aiming at bringing the standard of air quality within permissible norms within 06 months from date of finalization of the action plan and to be forwarded to Central Pollution Control Board (CPCB) by 31.12.2018.

III. The said Action Plan is to be prepared as per order of Hon'ble NGT and will include components like identification of source and its apportionment considering sectors like vehicular pollution, industrial pollution, dust pollution, construction activities, garbage burning, agricultural pollution including pollution caused by burning of crop residue, residential and indoor pollution etc. The action plan shall also consider measures for strengthening of Ambient Air Quality (AAQ) monitoring and steps for public awareness including issuing of advisory to public for prevention and control of air pollution and involvement of schools, colleges and other academic institutions and awareness programmes. The Action Plan will indicate steps to be taken to check different sources of pollution having speedy, definite and specific timelines for execution.

IV. After discussing the order of Hon'ble NGT in detail the AQMC Chaired by Pr. Secretary (Environment), GNCTD decided the following:

1. Department of Environment/Delhi Pollution Control Committee will prepare the draft Action Plan by taking into account the GRAP, CAP, 41 direction issued by CPCB and other plans and will send to all the Members of the Committee and other Stakeholder Departments by **30th November, 2018** for obtaining their comments.

(Action: Dept. of Environment/DPCC)

2. All the Members of AQMC and other Stakeholder Departments will send the comments positively by **10th December, 2018** to Department of Environment for finalization of Action Plan.

(Action: All Members of the AQMC and other Stakeholder Departments)

3. Department of Environment/ Delhi Pollution Control Committee will finalize the Action Plan and put up for the approval of Chief Secretary, Delhi by **20th December, 2018.**

(Action: Dept. of Environment /DPCC)

4. After the approval of the Chief Secretary, Delhi the Department of Environment will submit the finalized Action Plan to CPCB by **25th December, 2018.**

(Action: Dept. of Environment /DPCC)

Meeting ended with a vote of thanks to the Chair.

Dr. Anil Kumar
Director (Environment)

To:

1. Pr. Secretary, Department of Urban Development, GNCTD
2. Pr. Secretary, Department of Industries, GNCTD
3. Commissioner, Transport Department, GNCTD
4. Secretary cum Commissioner, Development Department, GNCTD
5. Member Secretary, Delhi Pollution Control Committee (DPCC)
6. Director, Department of Environment, GNCTD
7. Sh. Tarun Kapoor, Dy. Commissioner, Transport Department, GNCTD
8. Sh. S. K. Singh, Advisor, DSIIDC, GNCTD
9. Sh. Vinod Kumar, Dy. Commissioner, Department of Industries, GNCTD

Copy for kind information to:

1. Chairman, Central Pollution Control Board
2. Secretary (Environment)-Cum-Chairman DPCC, Department of Environment, GNCTD
3. OSD to Chief Secretary, Delhi
4. PA to Special Secretary (Environment), GNCTD

ATTENDANCE SHEET

Sub: Meeting convened under the chairmanship of Pr. Secretary (Environment), GNCTD, for constitution of Air Quality Monitoring Committee (AQMC) in respect of Delhi in Compliance to the directions of the Hon'ble NGT contained in the order dated 08.10.2018 passed in OA No. 681/2018 in the matter of: NEWS ITEM PUBLISHED IN THE TIMES OF INDIA AUTHORED BY SHRI VISHWA MOHAN Titled 'NCAO with Multiple Timelines to clear Air in 102 Cities to be released around August 15'

Date: 16.11.2018 **Time:** 4:30 PM

S. No.	Name of Officer	Designation	Telephone Number	E-mail ID	Signature
1.	Dr. Dilraj Kaur	Secy Devt Sprvt-2			
2.	S.K. Singh	Advisor (Dell/Dc/Ind.)	22457015		
3.	Vinod Kumar	Dy Com (INSS)	9811871386		
4.	V.K. Saraswat	PCO Transport	7042755737		
5.	Dr. M. Dhanamadhi	Scientist	25274136		
6.	S.M. Ali	Member Secretary DPCC			
7.	Dr. Anil Kumar	Director (Env) GNCTD	9717593505		
8.	Tarun Kapoor	Dy Comm (Tpt)	9717197362		
9.					
10.					
11.					
12.					
13.					
14.					
15.					
16.					
17.					
18.					
19.					
20.					
21.					

COMPREHENSIVE ACTION PLAN FOR AIR POLLUTION CONTROL IN DELHI & NCR

1. Source-wise clean air action plan and compliance strategy for Delhi and NCR to meet clean air standards

2.1 Air quality monitoring

S. No.	Action points	Agency responsible	Timeline of EPCA for Implementation	Decision during the Meetings in MoEF&CC
2.1.1	**DPCC to set up 20 more real time monitoring stations:** The grid plan should be representative of population distribution and land use including residential, commercial, industrial, roadside and sensitive areas. Delhi currently has 28 real time air quality monitoring stations that are operated by Central Pollution Control Board (CPCB), Delhi Pollution Control Committee (DPCC), and Ministry of Earth Sciences (MOES) with continuous relay of information. These include 10 manual stations and 18 real time stations.	Department of Environment (DOE), Delhi Pollution Control Committee (DPCC)	Done	Agreed
2.1.2	**NCR-wide air quality monitoring expansion:** The SC order of 2.12.2016 has directed CPCB to expand monitoring in the NCR. Accordingly, CPCB has submitted a plan	Central Pollution Control Board (CPCB) State pollution	Rajasthan: Done Uttar Pradesh: December 2017 Haryana: January 2018	Rajasthan: N.A UP: February 2018 Haryana: January 2018

	to the Hon'ble Court. This includes – 1. Uttar Pradesh has 10 manual and 1 real time monitoring stations with one each in Ghaziabad and Noida. Real time stations will be set up by March 2017. TheUP State Pollution Control Board will set up 6 manual and 8 real time stations. 2. Haryana has 4 real time stations and will set up 13 more real time and 22 manual stations. 3. Rajasthan has 9 manual stations; 2 real time stations are under installation, which will be completed by March 2017. The Hon'ble SC, vide its order dated 06.02.3017, has directed utilization of Rs2.5 crore from the fund created from Environment Protection Charge on big diesel cars for installing monitoring stations and a Central Control Room for operational control and reporting in Delhi NCR. This is as per the plan submitted by CPCB.	control boards in NCR		
2.1.3	**Enforce Graded Response Action Plan** as directed by	EPCA, Task Force under	Ongoing. Has been enforced	Agreed

	the Hon'ble Supreme Court and notified by the Ministry of Environment, Forests and ClimateChange	CPCB	during 2017 and helped to bring down severe levels of pollution	
2.1.4	Undertake satellite- based monitoring for tracking and enforcing agriculture waste burning	State governments , CPCB	Ongoing during crop burning season each year	Agreed
2.1.5	**Research studies including air pollution inventory, source apportionment, health impact studies, exposure impacts and other relevant studies:** Govt. to support researchworks / scientific studies by academic / research institutions. Expertise will be sought from various institutions to develop protocols for assessment of the research proposals	Environment departments and state boards in NCR	Ongoing(CPCB to give progress every 3 months)	Agreed

2.2 Action to reduce vehicular emissions

S. No.	Action points	Agency responsible	Revised timeline for implementation	Decision during the Meetings in MoEF&CC
EMISSION AND FUEL QUALITY FOR NEW VEHICLES				
2.2.1	Ensure on-schedule implementation of BS VI fuel and emission	State transport departments, Ministry of Road Transport and Highways		Decision pending with Hon'ble court.

	standards, including early delivery of BS VI fuel for vehicles to modify technologies. Ensure registration of only BS IV vehicles from April 1, 2017 and only BS VI-compliant vehicles from April 2020 Supreme Court order of March 29, 2017 has directed that no vehicle that is not BSIV compliant can be registered from April 1, 2017. Any BSIII vehicle that comes for registration will have to provide the proof of sale before March 31, 2017 .	(MORTH) and Ministry of Petroleum and Natural Gas (MOPNG)		
2.2.2	**Action on dieselization:** The SC order dated 12.8.2016 has imposed an environment pollution charge of 1% on registration of diesel vehicles with 2,000 cc and above. A fund has been created from this revenue to	CPCB		Decision pending with Hon'ble court.

	fund pollution controlefforts. Tax measures are needed to nullify incentives for diesel cars over petrol cars.			
2.2.3	**Expand CNG programme across NCR:** The SC orders dated 16.12.2015, 5.1.2016 and 10.5.2016 have directed CNG stations to be set up across NCR and taxis to convert to CNG. NCR to expand CNG bus and auto fleets (*see agenda on public transport*).	MOPNG, GAIL / IGL	Between December 2015 to current, the number of CNG stations has increased. Another 92 stations have been added across NCR. MoPNG to provide a plan for further expansion and for use in buses and public transport, including removal of fiscal distortions that are barriers to fast adoption of this fuel as against diesel.	MOPNG to provide plan for further expansion of CNG across NCR by end of January 2018.

2.2.4	**Introduce battery-operated vehicles in targeted segments of two-wheelers, three-wheelers and buses.** Plan infrastructure for charging and battery disposal. **Identify and notify commercial areas in cities with high footfalls and good public transport and goods transport connectivity that can be pedestrianized, supported by zero emission battery-operated vehicles:** Priority may be accorded to battery-operated para-transit as feeders and for last mile connectivity in such areas. Ensure organized deployment to reduce congestion.	DOE & DPCC,SPCBs, Transport Dept, municipal bodies, Discoms	MoRTH to submit plan within 3 months with deliverables, focus on speedy implementation to target 3 wheelers and buses and feeder services like taxis, metro-feeder and to provide NCR-wide charging infrastructure. **Plan by February 28, 2018**	The issue of e- mobility is under discussion in NITI Aayog and group of Secretaries. This may take some more time. MoRTH has issued enabling regulations already. State government of Delhi and those of NCR states should prepare the plan within one (1) month for speedy implementation, as per MoRTH regulations.

2.2.5	**Install vapour recovery systems in fuel refueling outlets to reduce benzene emissions in NCR.** **CPCB has issued direction for installation of stage I and Stage II vapor recoverysystem in all retail outlets with capacity 3000 klm and more in 46 million plus cities by December 2017. In Delhi and NCR all retail outlets should complywith this.**	MOPNG, Transport Dept., state boards, DOE	**May 2018** (6 months from approval of plan)	Agreed
	ON-ROAD VEHICLES			
2.2.6	**Auditing of Pollution under Control (PUC) certification centres** The SC orders dated 25.11.2016, 2.12.2016, 17.1.2017 and 06.02.2017 have directed the government and EPCA to audit stations in Delhi- NCR and suggest improvements.	State departments of transport in Delhi and NCR	In its order of August 10, 2017 Hon'ble Court has already given directions to MoRTH on this. MoRTH to provide compliance report to Hon'ble Court on implementatio n of its directions by December 10, 2018.	MORTH has already issued directions to states. Compliance from State Governments expected by 31st January 2018
2.2.7	**Tighten PUC norms for post-2000 vehicles.**	Ministry of Road Transport and Highways	Hon'ble Court has in the October 11, 2017	Noted

	Upgrade in-use emissions testing for diesel vehicles.		order directed ARAI (Automotive Research Association of India) to give report on this matter within 8 weeks to EPCA.	
2.2.8	**Implement an on-board diagnostic system fitted in new vehicles for vehicle inspection. Improve facilities for its implementation**	Ministry of Road Transport and Highways Department of Transport, NCR	The Union has to revert back on the proposal for hand-held scanners to verify the functioning of OBD system and the plan proposed by the Hon'ble Court (vide its order dated October 11) to phase in the introduction, starting Grade A cities. MORTH	Affidavit already filed by MoRTH in SC. Further direction of SC are awaited.
2.2.9	**Link PUC certificates with annual vehicle insurance to ensure 100 per cent compliance.**	MORTH, Transport Departme nt, IRDA (Insurance Regulatory and Development Authority)	Done. In its order of August 10, 2017 Hon'ble Court has already given directions to MoRTH on this. MoRTH to provide compliance report to Hon'ble Court on implementatio n of its directions by December 10, 2018. MORTH	MORTH has already written to LIC and IRDA.MORTH to provide compliance by 28thFebruary 2018.

2.2.10	**Enforcement of law against visibly polluting vehicles: impose penalty, launch extensive awarenessdrive against polluting vehicles.**	Department of Transport, GNCTD, Rajasthan, UP, Haryana	Ongoing	Agreed
2.2.11	**Delhi to review and upgrade the Burari commercial vehicle testing centre.**	Transport Departme nt, Delhi	February 28, 2018	Commercial Vehicle Testing Centres coming up immediately in Jhuljhuli. 4 such other centres coming up in 6 months. Burari is still pending approval.
2.2.12	**Ensure requisite infrastructure for hydro testing of CNG cylinders in Delhi and NCR.**	State transport departments, Ministry of Petroleum and Natural Gas	February 28, 2018	This is a safety issue and is having monitored as part of Delhi Govt. Action Plan

TRANSIT TRUCK TRAFFIC				
2.2.13	**Divert truck traffic:** SC orders dated 9.10.2015, 16.12.2015 and 5.1.2016 directing diversion of non-destined trucks and imposition of ECC on incoming trucks. **SC order for installation of RFID system in Delhi:** As per the orders dated 9.10.2015, 5.1.2016 and 22.8.2016, the SDMC is tendering for RFID for 13 entry points, which account for 80% of commercial traffic into Delhi. The system will be commissioned before next winter.	Delhi Transport Department and Municipal Corporation of Delhi	Ongoing	Agreed. Turn around facility will be provided on priority basis in Badarpur, Kundli, Tikri, Gurgaon, NH24. NHAI and PWD will give timelines for the same.
2.2.14	**Check overloading:** The SC order dated 5.1.2016 directing for weigh-in-motion bridges / machines (WIM) at entry points to Delhi. NHAI has commissioned 60 WIM at 6 toll plazas for entry into Delhi. However, implementation of its penalty, which is 10 times of applicable rate for over-loaded vehicles, is lagging.	NHAI to commission WIMS and enforce at all entry points	February 28, 2018	Agreed

2.2.15	**Fast track construction of Western and Eastern Peripheral Expressways:** Take steps to expedite early completion of the Expressways and submit a completion schedule. SC orders dated 11.2.2005, 11.3.2005, 1.8.2005 and 31.3.2016 on building / upgrading alternative bypass roads. The EPE is on schedule for completion in July 2018 and one stretch of WPE has been commissioned. The EPCA has given a report on existing alternative routes that need upgradation. This is also being pursued with MoRTH and NHAI.	NHAI schedule for EPE is mid-2018 Haryana governme nt schedule for WPE is mid- 2019	NHAI and Haryana government to come back to Hon'ble Court on expediting schedules in next hearing on December 6, 2017.	Both express ways would be open to public by April, 2018
2.2.16	**Inter-state freight transport plan:** Submit plan for inter- and intra-state transport sector for short term, mid-term and long term action points to improve rail-based freight traffic to reduce dependence on trucks.	Transport Department to coordinate with NCRPB and Railway Ministry	Submission of plan by February 28, 2018	MOUD to coordinate with State Government and railways and submit plan with one (1) month.

2.2.17	**Fuel quality:** Prepare an action plan to check fuel adulteration and random monitoring of fuel quality data. The MoPNG has set up a fuel testing laboratory, based on previous SC directions. To review its operations and to ensure that fuel testing is done across NCR for all combustion fuels.	MOPNG	February 28, 2018	Agreed

2.3 Strategies to reduce vehicle numbers onroads

S. No.	Action points	Agency responsible	Revised timeline for implementation	Decision during the Meetings in MoEF&CC
	PUBLIC TRANSPORT STRATEGIES			
2.3.1	**Improvement in bus numbers and services.** SC orders dated 27.7.1998 and 5.1.2016 directing Delhi government to abide by SC direction to augment to 10,000 buses by 2000 and the Union to provide land for bus depots.	Delhi Transport Department, DTC, DIMTS, DDA	Delhi government must ensure total compliance with order of 1998 and 2016 by December 2018. This requires a total fleet of at least 10,000 buses	Agreed
2.3.2	Implement the recommendations of Route Rationalization Report of GNCTD. Improve availability by rationalizing routes and fleet enhancement with requisite modification	Delhi Transport Department, DTC and DIMTS	Immediate	June , 2018
2.3.3	Reform of DTC and Cluster Bus Operations – modernize fleet and crew scheduling process of DTC, install GPS units on DTC buses and create a traffic control cell for monitoring bus movement, rationalize scheduling of busesunder DTC and cluster scheme.	Delhi Transport Department, DTC and DIMTS	Immediate	4000 buses to install GPS in 3 months. Remaining fleet by December 2018.

2.3.4	IT system in buses, bus-stops and control centre and passenger information systems for reliability of bus services, and service monitoring.	Delhi Transport Department, DTC and DIMTS	Immediate	Initial activities by March, 2018. Completion by December 2018.
2.3.5	Bus parking should be made integral to urban planning. Multi- level bus parking to be provided in depots to more efficiently use available land area. Multi-modal, multi-use bus depots to be developed to provide high-class bus services and terminal experience to passengers. Should include well equipped maintenance workshops.	Delhi Transport Department, DTC and DIMTS	Immediate. EPCA report on availability of bus depot land shows that land is available for additional 2000 buses and that Delhi government must use options for multi-level parking in rest. DDA has made the requisite changes in Master Plan to allow for multi-levelparking	Millennium Depot issue pending in the court. Timelines can be finalised after court decision.
2.3.6	Need bus fare policy to ensure that it is affordable and remains competitive *vis-a-vis* the operational cost of two- wheelers.	Delhi Transport Department, DTC and DIMTS	Immediate	Agreed
2.3.7	Enforce bus lanes and keep them free from obstruction and encroachment.	Delhi Transport Department, DTC, DIMTS	Immediate	Agreed. To be enforced by Delhi Police and compliance given

2.3.8	**Augmenting the service of Metro for carrying more passengers:** SC order dated 5.1.2016 directing for augmentation of service / coaches. Metro has submitted to EPCA its plan for inducting 486 additional coaches by December 2017 for existing lines. Of this, 270 have been procured. In addition, Metro has submitted proposal for 602 coaches, which is being examined by the Delhi govt.	DMRC	December 2018	Proposal pending with Delhi Govt. Timeline is agreeable.
2.3.9	**Three-wheelers** Implement electro-mobility for three-wheelers to make them zero emission as efficient feeder system for last mile connectivity and integration with bigger public transport systems. Organise their services for efficient deployment.	State transport departments	May 2018	State govt. of Delhi and those of NCR states to submit the plan within one (1) month for speedy implementation.
2.3.10	BRTS / LRTS to be implemented in targeted high frequency routes and complemented with bus services with proper integration of routes, stations and terminals. Explore feasibility of BRT / LRTS connectivity between Delhi and other NCR cities	Delhi Transport Department, DTC and DIMTS	Transport departments of Delhi, Haryana, UP and Rajasthan to provide action plan with schedules of key BRTS/LRTS corridors by February 28, 2018	Transport departmens of Delhi and Haryana to submit Action Plan by 28th February 2018.
2.3.11	Fare integration and common ticketing; bring ETVMs into all DTC buses. Common mobility cards to be the mandatory access card for buses.	Delhi Transport Department, DTC and DIMTS	Immediate	Agreed

2.3.12	Implementation of multi-modal integration plan for bus-Metro IPT-NMT at key / all interchange points.	Delhi Transport Department, DTC and DIMTS	Immediate DIMTS(Delhi integrated multi model system) Delhi Govt.	Delhi Transport Department to submit a plan in 3 months
2.3.13	Demarcation and development of Influence Zones around Metro stations as per MPD-2021 to improve access to the public transport system.	Transport Department, PWD, DDA /UTTIPEC, DMRC, DTC, DIMTS	Immediate	Delhi Transport Department to submit a plan in 3 months
2.3.14	Proper regulations and organization including providing driver-training, certification, etc. for cab and auto-rickshaw drivers	DDA, MCD, PWD	Immediate	Delhi Transport Department to submit a plan in 3 months
2.3.15	**NCR connectivity for public transport – need bus and Metro plans.** Rationalize routes and augment public transport in NCR on CNG mode.	Ministry of Urban Development, NCR Planning Board, state governments	MoUD to submit a comprehensive plan by February 28, 2018 with clear deliverables	MOUD to submit the plan within one (1) month.
2.3.16	**Rationalize entry taxes in NCR under the NCR reciprocal agreement to lower costs of travel by public transport.**	Ministry of Urban Development, NCR Planning Board, state governments	Immediate	Matter to be taken up for discussion by Secretary (EF & CC) with Secretary MOUD
2.3.17	Integrate ITS in bus systems in cities in NCR (automated vehicle location, passenger information system, fare collection system).	Ministry of Urban Development, NCR Planning Board, state governments	Immediate	Agreed

2.3.18	Regional Rapid Transit System (RRTS) integrated with local transit systems should be implemented to provide seamless connectivity between regional and sub-regional centres of NCR.	Ministry of Railways and state governments	National Capital Region Transport Corporation (NCRTC) to submit plan with schedules by December 2017.	MOUD to submit plan within one (1) month.
2.3.19	Integrated passenger terminals to be created with mixed use and multi-modal facilities for passenger comfort, integrating regional and local public transit systems.	Ministry of Railways and state governments	Immediate	MoUD to submit plan within one (1) month after coordination with Railways and State Government.
2.3.20	Implement traffic impact assessment of infrastructure project for planning and management.	Ministry of Urban Development, Municipal governments, planning departments of cities, DDA in Delhi	Immediate	MoUD to submit plan within one (1) month.

2.4 Non-motorized transport (NMT)network

S. No.	Action points	Agency responsible	Revised timeline for implementation	Decision during the Meetings in MoEF&CC
2.4.1	**Prepare and implement zonal plans for developing an NMT network. This should include the following action points with appropriate timelines for implementation:** • Implement network plan for footpaths on	PWD, MCD, NDMC, DDA, Traffic Police, UTTIPEC	All NCR states to provide plans with clear deliverables and schedule for last- mile connectivity by February 28, 2018	State Government of Delhi and NCR to submit plan within three (3) months.

	all roads, as per the IRC codes and Street Design Guidelines. Target specific kilometers of footpaths and cycle tracks to be completed in a phased manner and cover the entirecity. Identify roads where dedicated and wide footpaths and cycle tracks (two- way) can be created on either side of the street, as per Street Design Guidelines. • Implement a network plan for more secondary street networks and ungated streets to provide direct shortest routes for pedes-trians and cyclists. Vehicular traffic can also be redistributed from major junctions through multiple routes to decongest. Sig-nal-free corridors should be avoided as more road-space only attracts more traffic and impedes people's movement. • Plan and upgrade pedestrian / NMT crossings at least every 250 m, with pedestrian signals and signages. These should preferably be at-grade. Reduce block sizes to reduce walking and cycling distances. • Synchronization of signals should be			

	implemented on a priority basis with an integrated IT- based traffic management system so that inspite of having frequent at-grade pedestrian cross- ings, traffic can move swiftly across signals. • Cycle sharing systems being introduced as feeders to public transport to be expanded to cover entire Delhi. • Identify and notify key commercial areas with high footfalls and good public transport connectivity to create pedestrian plazas. • Make safety and walkability audits of walking and cycling infrastructure mandatory. Encroachment of NMT lanes to be made punishable offence underthe current provision of law.			

2.5 Parking policy to reduce congestion and pollution

S. No.	Action points	Agency responsible	Revised timeline for Implementation	Decision during the Meetings In MoEF&CC

2.5.1	**Parking policy and enforcement measures to be prepared and finalized for implementation in Delhi and NCR. To include – i) Enforcement strategies ii) Parking pricing policyand iii) Parking management strategies. Delhi Master Plan 2021 has provided for a ParkingDistrict Management Plan.**	**Delhi:** DOE, UTTIPEC, all municipal agencies, traffic police, transport dept. **NCR:** All state governments, transport departments urban development departments	Implement parking policy by February 28, 2018	Agreed Other NCR states to study the Delhi model and adopt according to their requirements.
	ENFORCEMENT AND MANAGEMENT			
2.5.2	• Physically demarcate legal parking areas. Equip them with metering systems, proper signages, IT for information on parking availability to reduce cruising time and on-street management. • Existing / planned public parking facilities and on- street and off-street parking (including multi- level) facilities should bebundled for management by a single agency/ operator. New stand-alone parking only sites are mostly not required since parking is permitted in all use zones. • Parking facilities within developments (e.g. commercial/ residential/ institutional) should be shared and priced for enabling use by different types of	Municipal corporations in Delhi and NCR Urban development department	February 28, 2018 MCD& Municipal Corporation of NCR	Agreed Other NCR states to study the Delhi model and adopt according to their requirements.

	users during different times of the day, thus bringing down total parking space demand. • Plan and implement parking provision for buses, commercial vehicles and IPT- NMT modes, and for the differently- abled.			
	PARKING PRICING AND PENALTY			
2.5.3	• Introduce and further upgrade variable time- based pricing, as per market demand. Coordinated off-street and on- street / surface pricingin commercial and residential areas, and parking permits in residential areas. Parking should be charged as per duration, location in city and size of the vehicle. • Take steps to prevent parkingof vehicles in the non-designated areas. Penalties related to parking should be charged 10 times the parking fee along with impounding of vehicles after a certain level of violation. • Strict penalty for		28th February, 2018	To be part of Parking policy expected to be finalized by 31st March 2018

	violation of parking regulations and walkway encroachment. Parking on footpaths should be made a cognizable offence under the Delhi Municipal Corporation Act and PoliceAct. Reform parking lease agreements to increase parking revenue for local area development and public transport improvement.			

2.6 Traffic management

S. No.	Action points	Agency responsible	Revised timeline for implementation	Decision
2.6.1	• Introduce early alarm system during traffic congestion for the benefit of commuters on major routes, to facilitate route diversion.	PWD, MCD, NDMC, DDA, Traffic Police, UTTIPEC **NCR:** All state governments, transport departments urban development departments	State traffic police departments of Delhi, UP, Haryana and Rajasthan to implement this plan on traffic management by May 2018	Agreed ITMS project of DDA pending with MHA.
2.6.2	• Consider introducing plan for flexi / staggered timings to minimize peak movement of vehicles on roads.		May 2018	Agreed
2.6.3	• Synchronize traffic movements / introduce intelligent traffic systems for lane-driving.		May 2018	Agreed
2.6.4	• Formulate action plan for controlling decongestion of fuel stations including increasing the number of dispensing machines.		May 2018	Agreed
2.6.5	• Electronic monitoring of traffic violations.		May 2018	Agreed

2.6.6	• Examine existing framework for removing broken down buses / trucks from roads and create a system for speedy removal and ensuring minimal disruption to traffic from such buses / trucks.		May 2018	Agreed
2.6.7	• Conduct audit of traffic intersections and install functional traffic signals at all major inter sections in all NCR cities.		May 2018	Agreed
2.6.8	• Conduct review of traffic signaling system at all intersections in Delhi / Noida and Gurugram and other NCR towns that are traffic hotspots and bring requisite changes to reflect the traffic movement pattern at intersections.		May 2018	Agreed
2.6.9	• Enforce lane driving through heavy fining as in Mumbai.		May 2018	Agreed

2.7 Power plants andindustries

S. No.	Action points	Agency responsible	Revised timeline for implementation	Decision
2.7.1	Permanent closure of Badarpur Power Plant after commissioning of the Tughlakabad sub-station or move towards cleaner natural gas	NTPC and Power-grid corporation	Badarpur will be permanently closed by mid-2018	Agreed
2.7.2	Closure of Badarpur during peak winter months when Graded Response Action Plan is in force	NTPC/DPCC	Done	Agreed
2.7.3	Monitoring of flyash pond at Badarpur, particularly during summer months to control fugitive dust	DPCC	Done	Agreed
2.7.4	Plan for site restoration of over 600 ha fly ash pond of Badarpur	NTPC	Done. NTPC has submitted to DPCC on-site remediation before permanent closure	Agreed
2.7.5	Time-bound action based on plan for restoration of fly ash pond land area	NTPC	Site remediation by mid-July 2018	Agreed
2.7.6	Move to full utilization of the cleaner natural gas- based Bawana station for power supply to Delhi	Department of Power, Delhi with GAIL	Immediate	The recommendation is already implemented to a substantive extent with the decision regarding full utilization of one unit of the

				Bawana Plant. Unit 1 should be made operational by 1/3/2018.
2.7.7	Progressively close the older and more polluting thermal power plants in NCR and to move to cleaner natural gas. Change the merit order dispatch policy of the Union government so as to incentivize cleaner plants to operate in the region.	Ministry of Power and state governmen ts	MoP and MoPNG to provide plan with timelines by February 28, 2018	
		INDUSTRIES		
2.7.8	Urgent ban on furnace oil, pet coke, which are dirty industrial fuels with high Sulphur and heavy metals:	MoEF&CC and state governmen ts	Done. State governmen ts of Delhi, Haryana, UP and Rajasthan to comply with SC order of October 24, 2017	Agreed
2.7.9	Strict enforcement against illegal use of such fuels, including fuels which do not have specifications laid down or are included in the acceptable fuels as mandated by state pollution control boards	DPCC and state pollution control boards	Immediate . State governme nt of Delhi, Rajasthan, UP and Haryana to issue notification under Section 19.1 and 19.3 of Air Act, 1980 by December 31, 2017 State govt.	Agreed

2.7.10	Strict enforcement of air pollution control measures in all industries, includes those located in unauthorized areas.	DPCC and all state pollution boards	Immediate	Agreed
2.7.11	Stop unrestricted import of such fuels, which are high in pollution because of high Sulphur or toxins	Ministry of Commerce	Immediate	The matter is under discussion with MOPNG and DGFT and will be finalized shortly
2.7.12	Ensure that the sale, transportation and distribution of such fuels follows CMVR strictly for hazardous goods and ensure that there is no sale in restricted regions	Oil marketing companies	Immediate	Agreed
2.7.13	Ensure calibration and working of Continuous Emission Monitoring System (CEMS) in all industries in NCR and provide information to monitoring agencies to begin and work out how this information can be provided to public as this will ensure that the system is operational	CPCB, DPCC and all state boards	Immediate	Agreed
		BRICK-KILNS		
2.7.14	Convert all brick kilns to zigzag technology – from natural draft kilns to induced--draft kilns (zigzag technology).	MOEFCC and state pollution control boards	Done as per following schedule. Only brick kilns which have converted to zig-zag technology and have been certified by the state pollution	Agreed

			control board will be allowed to operate during winter2017-2018. By July 1, 2018, only brick kilns with zig-zag technology will be allowed to operate in NCR	
		INCINERATORS		
2.7.15	Implement emission norms for incinerators and examine the feasibility of less polluting alternatives.	Department of Environment, CPCB, DPCC, SPCBs	Immediate	Completed
2.7.16	Implement CEMS for incinerators and provide data on emissions on an open platform progressively.		Immediate	June, 2018
2.7.17	Develop a siting policy for biomedical incinerators.		February 28, 2018	Completed
		WASTE-TO-ENERGY PLANTS		
2.7.18	Strict implementation of emission norms, use state of the art technology and provide emission data to State Pollution Control Boards.	State Pollution Control Boards	Immediate	March, 2018
2.7.19	Develop a siting policy for waste to energy plants	MOEFCC, CPCB, State Pollution Control Boards	December 31, 2017	Completed

2.8 Generatorsets

S. No.	Action points	Agency responsible	Revised timeline for implementation	
2.8.1	Ensure that only those DG sets that meet the standards are allowed to operate.	CPCB, DPCC, SPCBs and Department of Environment	Immediate	Agreed
2.8.2	Operating time of DG sets should be regulated according to graded action plan.	CPCB, DPCC, SPCBs and Department of Environment	Done	Agreed
2.8.3	Only approved fuel should be allowed.	CPCB, DPCC, SPCBs and Department of Environment	Immediate	Agreed
2.8.4	Non-usage of DG sets in social events as per graded action plan.	CPCB, DPCC, SPCBs and Department of Environment	Done	Agreed
2.8.5	Alternate power systems should be promoted in cell towers, and use of DG sets discouraged.		Immediate	Agreed

2.9 Open burning (including solid waste and agriculturalresidues)

S. No.	Action points	Agency responsible	Revised timeline for implementation	
2.9.1	SC order dated 16.12.2015 has directed a complete ban on garbage burning in the entire NCR region. This is being monitored by Delhi and NCR state governments. Take stringent action against open burning of biomass / leaves / tyres etc. to control such activities	Department of Environment, SPCBs DPCC, municipal bodies, DPGS	Immediate	Agreed
2.9.2	Ensure proper collection of horticulture waste (biomass) and composting-cum-gardening approach; municipal zonal offices should be responsible for controlling burning of leaves and garbage on roads / parks. All horticulture agencies should have compost pits in parks.	Municipal bodies and other park owning bodies like DDA in Delhi	Immediate	Agreed

2.9.3	**Implement citizen reporting app --** reporting of garbage / municipal solid waste burning through mobile-based applications and other social media platforms linked with Central and state-level control rooms for accountability. Build an awareness campaign through RWAs, Eco Clubs and municipal authorities.		Immediate Delhi Govt.	Agreed
REGIONAL PROBLEM AND BIOMASS BURNING				
2.9.4	Ensure strict enforcement of ban on burning of agriculture waste and crop residues in Punjab and Haryana.	State governments in NCR and Punjab	Ongoing	Agreed
2.9.5	To increase subsidy for purchase of equipment that eliminates the need for burning stubble and straw.	State governments in NCR and Punjab	Ongoing	Agreed
2.9.6	Enforce the series of directives from the Hon'ble Supreme Court and NGT on ban on agricultural burning and recycling and reuse of this waste.	State governments in NCR and Punjab	Ongoing	Agreed
EPISODIC EVENTS				
2.9.7	**Fire crackers --** Implement and monitor the SC order of September 12, 2017	**Department of Environment, SPCBs DPCC, DCP**	Immediate	Agreed

2.10 Domestic chulha burning and open eateries

S. No.	Action points	Agency responsible	Revised timeline for implementation	
2.10.1	In slums and low-income neighbourhoods, as well as roadside eateries/dhabas/ resturauntsetc promote and give access to LPG and electricity. Link commercial license to clean fuels.	Department of Environment, MoPNG	Immediate	Agreed
2.10.2	Prohibit use of coal in hotels and restaurants, eliminate use of kerosene for cooking in NCR and incentivize move to LPG.	MoPNG and state governments	Immediate	Agreed
2.10.3	A targeted programme can be developed with the Union Ministry of Petroleum and Natural Gas for wider distribution of LPG.	MoPNG and state governments	Immediate	Agreed

2.11 Control measures for road dust

S. No.	Action points	Agency responsible	Revised timeline for implementation	
2.11.1	•SC direction dated December 16, 2016 has directed repair and building of pavements and vacuum cleaning of roads. This needs to	Department of Environment, municipal bodies, DDA, PWD, CPWD, DSIIDC,	Immediate and intensify during implementation of GRAP	Agreed

	be expedited and implemented across NCR. **Based on this, the following may be carried out:** •Implement street design guidelines for footpaths and cycle tracks with adequate vegetative buffers and paving of roads. Take steps for blacktopping / pavement of road shoulders to avoid road dust. •Phase-in mechanical / vacuum-based street sweeping wherever feasible; introduce wet / mechanized vacuum sweeping of roads. •Implement truckloading guidelines; use of appropriate enclosures for haul trucks; gravel paving for all haul routes. •Sprinkling of recycled water (without compromising other uses); introduce water fountains at major traffic intersections, wherever feasible. •Maintain pothole-free roads for free flow of traffic to reduce emissions and dust. •Increase green cover in Delhi. Undertake greening of open areas, gardens, community places, schools and	DTTDC Road-owning agencies, Police Dept. Forest Dept.		

	•housing societies.			
2.11.2	•Enforcement of air pollution control in concrete batching (use of water spray and wind breakers, bag filter at silos and enclosures, hoods, curtains etc.)		Immediate	Agreed

2.12 Control measures for construction dust

S. No.	Action points	Agency responsible	Revised timeline for implementation	
2.12.1	SC order dated 16.12.2015 directed the Delhi govt to ensure measures are taken to mitigate dust pollution from construction. The EPCA has given a concise check list for inspection of construction sites. This should be implemented. Undertake control measures for fugitive emissions from material handling, conveying and screening operations through water sprinkling, curtains, barriers and dust suppression units. Penalties have also been enhanced. Needs enforcement.	Municipal bodies, PWD, CPWD, DSIIDC, DTTDC, road owning agencies	Immediate	Agreed

2.12.2	For material handling and construction demolition, it should be obligatory on part of the developers to provide evidence of debris disposal at designated sites. Promote recycling of construction material. Implement provision of Central regulations for construction and demolition waste	Municipal bodies, PWD, CPWD, DSIIDC, DTTDC, road owning agencies	Immediate	Agreed

ANNEXURE - II

Central Pollution Control Board
Ministry of Environment, Forest & Climate Change
(Govt. of India)

Graded Response Action Plan for Delhi & NCR

In pursuant to the Hon'ble Supreme Court's order dated December 02, 2016 in the matter of M. C. Mehta vs. Union of India regarding air quality in National Capital Region of Delhi, a Graded Response Action Plan has been prepared for implementation under different Air Quality Index (AQI) categories namely, Moderate & Poor, Very Poor, and Severe as per National Air Quality Index. A new category of "Severe+ or Emergency" has been added. Ministry of Environment, Forests & Climate Change has notified for implementation of Graded Response Action Plan through Environment Pollution (Prevention & Control) Authority vide S.O. 118 (E) dated January 12, 2017 (copy enclosed).

Severe + or Emergency (ambient $PM_{2.5}$ or PM_{10} concentration values of 300µg/m^3 or 500 µg/m^3 respectively persist for 48 hours or more)	**Agency responsible/Implementing Agency**
Stop entry of truck traffic into Delhi (except essential commodities)	Municipal Corporations and Traffic Police of Delhi and NCR Towns
Stop construction activities	Delhi Pollution Control Committee/Municipal Corporations of Delhi and NCR towns
Introduce odd and even scheme for private vehicles based on license plate numbers and minimize exemptions	Secretary cum Commissioner of Transport Department, NCT of Delhi, and Transport Commissioners of NCR towns
Task Force to take decision on any additional steps including shutting of schools	
Severe (ambient $PM_{2.5}$ or PM_{10} concentration value is more than 250 µg/m^3 or 430µg/m^3 respectively)	**Agency responsible/Implementing Agency**
Close brick kilns, Hot Mix plants, Stone Crushers	Chairpersons Delhi Pollution Control Committee, State Pollution Control Boards of Haryana, Rajasthan, and Uttar Pradesh
	Superintendent of Police and Deputy Commissioner of respective districts
Shut down Badarpur power plant and maximize generation of power from existing natural gas based plants to reduce operation of coal based power plants in the NCR.	Chairpersons Delhi Pollution Control Committee, State Pollution Control Boards of Haryana, Rajasthan, and Uttar Pradesh

Intensify public transport services. Introduce differential rates to encourage off-peak travel.	Secretary cum Commissioner of Transport Department, NCT of Delhi, and Transport Commissioners of NCR towns
	Chairperson, Delhi Metro Rail Corporation (DMRC)
	Chairpersons, State Transport Corporations
Severe (ambient $PM_{2.5}$ or PM_{10} concentration value is more than 250µg/m^3 or 430µg/m^3 respectively)	**Agency responsible/Implementing Agency**
Increase frequency of mechanized cleaning of road and sprinkling of water on roads. Identify road stretches with high dust generation.	All road owning agencies including Municipal Corporations of NCT of Delhi and NCR towns, Public Works Departments and National Highway Authority of India
Very Poor (ambient $PM_{2.5}$ or PM_{10} concentration value is between 121-250µg/m^3 or 351-430 µg/m^3 respectively)	**Agency responsible/Implementing Agency**
Stop use of diesel generator sets	Chairpersons Delhi Pollution Control Committee, State Pollution Control Boards of Haryana, Rajasthan, Uttar Pradesh
Enhance parking fee by 3-4 times	Municipal Commissioner
	Municipal Corporations of NCT of Delhi and NCR towns
Increase bus and metro services by augmenting contract buses and increasing frequency of service	Principal Secretary, Department of Transport of NCT of Delhi
	Delhi Transport Corporation (DTC)
	Delhi Integrated Multi-modal Transit System Ltd (DIMTS)
	Delhi Metro Rail Corporation (DMRC)
	State Transport Corporations in NCR towns
Stop use of coal/firewood in hotels and open eateries	Municipal Corporations of NCT of Delhi and NCR towns
Residential Welfare Associations and individual house owners to provide electric heaters during winter to security staff to avoid open burning by them	Resident Welfare Associations
Alert in newspapers/TV/radio to advise people with respiratory and cardiac patients to avoid polluted areas and restrict outdoor movement.	Chairpersons, Delhi Pollution Control Committee, State Pollution Control Boards of Haryana, Rajasthan, and Uttar Pradesh
Moderate to poor(ambient $PM_{2.5}$ or PM_{10} concentration value is between 61-120 µg/m^3 or 101-350 µg/m^3 respectively)	**Agency responsible/Implementing Agency**
Stringently enforce/stop garbage burning in	Municipal Commissioner

landfills and other places and impose heavy fines on person responsible	Municipal corporations of Delhi and NCR towns
Close/stringently enforce all pollution control regulations in brick kilns and industries	Chairpersons, Delhi Pollution Control Committee, State Pollution Control Boards of Haryana, Rajasthan, and Uttar Pradesh
Moderate to poor(ambient $PM_{2.5}$ or PM_{10} concentration value is between 61-120 $\mu g/m^3$ or 101-350 $\mu g/m^3$ respectively)	**Agency responsible/Implementing Agency**
Stringently enforce pollution control in thermal power plants through PCB monitoring	Plant in-charge of power plants in NCR, and Delhi Pollution Control Committee and State Pollution Control Boards of Haryana, Rajasthan and Uttar Pradesh
Do periodic mechanized sweeping on roads with heavy traffic and water sprinkling also on unpaved roads every two days	Municipal Commissioner, Municipal Corporations of NCT of Delhi and NCR towns
	Commissioners, Traffic Police of Delhi and NCR towns to identify roads with heavy traffic and provide information to respective Municipal Commissioners
	Chief Engineers of officers in charge of CPWD, PWD of Delhi and NCR towns to identify unpaved roads with heavy traffic and provide information to respective Municipal Commissioners
Strict vigilance and no tolerance for visible emissions – stop plying of visibly polluting vehicles by impounding or heavy fine.	Commissioner or Officer in Charge, Transport Department and Traffic Police of NCT Delhi and NCR towns
Strict vigilance and enforcement of PUC norms	
Stringently enforce rules for dust control in construction activities and close non-compliant sites	Commissioner or Officers in charge of Police Departments of Delhi and NCR towns
Deploy traffic police for smooth traffic flow at identified vulnerable areas	Commissioners Traffic Police of Delhi and NCR Towns
Strictly enforce Supreme Court order on diversion of non-destined truck traffic and ensure only trucks registered after 2005 are allowed entry into Delhi	Municipal Corporations of NCT of Delhi and NCR towns
	Traffic Police of NCT of Delhi and NCR towns
Strictly enforce Supreme Court ban on firecrackers	Chief Controller of Explosives
	Petroleum and Explosive Safety Organizations (PESO)

	Commissioner of Officer in charge of licensing in the police departments of Delhi and NCR
Ensure fly ash ponds* are watered every alternate day during summer months (March – May).	Plant in charge of Power Plants in Delhi and NCR towns
Moderate to poor(ambient $PM_{2.5}$ or PM_{10} concentration value is between 61-120 $\mu g/m^3$ or 101-350 $\mu g/m^3$ respectively)	**Agency responsible/Implementing Agency**
Information dissemination Social media, mobile Apps should be used to inform people about the pollution levels, contact details of control room, enable them to report polluting activities/sources to the concerned authorities, and actions that will be taken by government based on the level of pollution.	Chairpersons, Delhi Pollution Control Committee, State Pollution Control Boards of Haryana, Rajasthan, and Uttar Pradesh

By Speed Post/Email. ANNEXURE-III

DELHI POLLUTION CONTROL COMMITTEE
DEPARTMENT OF ENVIRONMENT, GOVT. OF NCT OF DELHI
5TH FLOOR, ISBT BUILDING, KASHMERE GATE, DELHI-06
visit us at : http://dpcc.delhigovt.nic.in

F.No. DPCC/RDPC/18 (1) (b) / 2016/ 5169 – 5197 Dated: 06.11.2017

Sub : Minutes of Meeting to Review the Progress made / Action taken for compliance of the Directions issued by CPCB u/s 18(1) (b) of Air Act, 1981 for improving the air quality in Delhi and NCR, held on 10.10.2017 at 4 PM at Delhi Secretariat.

Please find enclosed herewith copy of Minutes of the Meeting to Review the Progress made / Action taken for compliance of the Directions (41 Points) issued by Central Pollution Control Board (CPCB) u/s 18(1) (b) of Air Act, 1981 for improving the air quality in Delhi and NCR, **held on 10.10.2017** at 4 PM at Delhi Secretariat.

The said Minutes have also been emailed to all concerned .

It was also decided in the said meeting that All the Departments/ Organizations shall provide Name & Designation of Nodal Officer & Alternate Representative from their Department / Organization along with his / her Mobile Number and Email ID for better communication and Action Taken Report and also to ensure their participation in the future review meetings on the said matter.

You are requested to take necessary action as mentioned in the said Minutes and Annexure " B" of the Minutes and send the Updated Action Taken Report to this office and also through email on dpcc.rdpc@gmail.com at the earliest preferably within 7 days.

Dupal Singh

(D.K. Singh)
Sr. Env. Engineer (RDPC)
Mobile No. 9717593512

Enclosure : Minutes of Meeting Dated 10.10.2017

To,

1. The Vice Chairman, Delhi Development Authority (DDA), C-3 Block, Vikas Sadan, INA, New Delhi-110023.
2. The Principal Secretary, General Administration Department (GAD), GNCTD, 2nd Level: Delhi Secretariat, I.P. Estate : New Delhi-110002
3. Chief Executive Officer, Office of Cantonment Board, Sadar Bazar, Delhi Cantt-10.
4. The Divisional Commissioner, Office of the Divisional Commissioner Delhi, Government of NCT of Delhi, 5- Sham Nath Marg, Delhi-110 054.
5. Development Commissioner, Development Department, Govt. of NCT of Delhi 5/9, Under Hill Road, Delhi-110 05.
6. The Sec-Cum-Commissioner, Head of Department, Food Supplies and Consumer Affairs Deptt. K- Block Vikas Bhawan, IP ESTATE, New Delhi-2
7. The Secretary, Directorate of Education, Government of NCT of Delhi, Old Secretariat, Delhi-110 054

Contd....2

8. Commissioner of Transport, Transport Department, Govt. of NCT of Delhi, 5/9, Under Hill Road, Delhi-54.
9. The Secretary, Public Works Department (PWD), 5th Level, Delhi Secretariat, I.P. Estate, New Delhi-110002
10. The Chairman, New Delhi Municipal Council, Palika Kendra, Parliament Street, New Delhi-110001
11. The Commissioner, South Delhi Municipal Corporation. 9th Floor, Dr. S.P.M. Civic Centre, Minto Road, New Delhi – 100 002
12. The Commissioner, North Delhi Municipal Corporation,4th Floor, Dr. S.P.M. Civic Centre, Minto Road, New Delhi – 100 002
13. The Commissioner, East Delhi Municipal Corporation, 419, Udyog Sadan, Patparganj Industrial Area, New Delhi – 110 096.
14. The Joint Commissioner of Police, Delhi Traffic Police, Police Headquarters, MSO Building, I.P.Estate, New Delhi-110002
15. The Managing Director, Indian Oil Corporation Ltd, Corporate Office,3079/3, J B Tito Marg, Sadiq Nagar, New Delhi - 110049
16. The Managing Director, Bharat Petroleum , Bharat Bhavan, 4 and 6 Currimbhoy Road, Ballard Estate, Mumbai 400001
17. The Managing Director, IBP Co Limited, IBP House, 34-A, Nirmal Chandra Street, Nirmal Chandra Street, Kolkata, West Bengal- 700013
18. The Managing Director, Hindustan Petroleum Corporation Limited. 3rd floor, Petroleum House, 17, Jamshedji Tata Road, Mumbai - 400020.
19. The Chairman, National Highways Authority of India(NHAI), G 5&6, Sector-10, Dwarka, New Delhi - 110 075
20. The Chief Executive Officer , Delhi Parks & Gardens Society (DPGS), Govt. of National Capital Territory of Delhi, 6th, Level C-Wing, Delhi Secretariat, I.P. Estate, New Delhi-02.
21. The Chief Executive Officer, BSES Yamuna Power Limited, Shakti Kiran Building, Karkardooma , Delhi -110032
22. The Chief Executive Officer, BSES Rajdhani Power Limited, BSES Bhawan, Nehru Place, Delhi -110019
23. The Chief Executive Officer, Tata Power Delhi Distribution Limited (TPDDL) , Hudson Lane , Kingsway Camp , Delhi -110009
24. The Director, Department of Environment, Govt. of NCT of Delhi, 6th, Level C-Wing, Delhi Secretariat, I.P.Estate, New Delhi-02.

Copy to:

1. Member Secretary, DPCC.
2. PS to Secretary (Environment) Cum Chairman, DPCC , for kind information to Chairman, Please.
3. Dr. MP George, Incharge Air Lab, DPCC
4. SEE (CMC-I), DPCC.
5. SEE (WMC-II), DPCC.

(D.K. Singh)
Sr. Env. Engineer (RDPC)

Minutes of Meeting to Review the Progress made / Action taken for compliance of the Directions issued by CPCB u/s 18(1) (b) of Air Act, 1981 for improving the air quality in Delhi and NCR, held on 10.10.2017 at 4 PM at Delhi Secretariat.

The meeting to review the progress made / action taken for compliance of the Directions issued by Central Pollution Control Board (CPCB) u/s 18(1) (b) of Air Act, 1981 for improving the air quality in Delhi and NCR was **held on 10.10.2017 at 4:00 PM at Delhi Secretariat** and the said meeting was taken by Special Secretary (Environment) cum Member Secretary, DPCC since the Secretary (Environment) cum Chairman, DPCC was preoccupied in some urgent work.

Representatives / Officers from various Departments / Organizations attended the said meeting and **Attendance Sheet is enclosed as Annexure " A".**

No representative of East Delhi Municipal Corporation (EDMC),Public Works Department (PWD) and Delhi Parks & Gardens Society (DPGS) was present in the said meeting. It was decided that letter be issued to these departments to ensure participation of the Nodal Officer / Representative their department in future meetings.

It was informed that DPCC has already issued Directions for Closure on 03.10.2017 to Badarpur Thermal Power Station for not operating the said power station w.e.f 17.10.2017 to 15.03.2018.

41 Action Points of the Directions issued by CPCB u/s 18(1) (b) of Air Act, 1981 vide letter dated 29.12.2015 for improving the air quality in Delhi and NCR were discussed one by one and action taken report was sought from the concerned departments / organizations. Only some of the departments (New Delhi Municipal Council, Traffic Police, Transport Department, North Delhi Municipal Corporation & Food Supplies and Consumer Affairs Deptt.) could provide their action taken report prior to / during the said meeting and therefore it was decided that all the concerned Departments / Organizations shall provide their action taken report through email to DPCC (on email ID : dpcc.rdpc@gmail.com) soon. However besides above mentioned Departments only Delhi Cantonment Board and Hindustan Petroleum Corporation Limited (HPCL) could provide the action taken report and rest of the Departments / Organizations are yet to provide their latest action taken report to DPCC.

W.R.T Action Point No. 38 "Ensure DG sets meeting the standards only be allowed to operate" it was decided that DISCOMS(BSES Yamuna , BSES Rajdhani and Tata Power Delhi Distribution Limited) in Delhi be also included in the agencies for taking necessary action and letter be issued to DISCOMS for taking necessary action against the DG Sets for violations.

Based on the discussions held in the said meeting and Action Taken Report submitted by the Departments/ Organizations, **Decisions taken in respect of 41 Action Points of the Directions issued by CPCB are given in the Table enclosed as Annexure "B".**

It was also decided that All the Departments/ Organizations shall provide Name & Designation of Nodal Officer & Alternate Representative from their Department / Organization along with his / her Mobile Number and Email ID for better communication and Action Taken Report and also to ensure their participation in the future review meetings on the said matter.

The meeting ended with a vote of thanks to the Chair.

Annexure "A"

Attendance Sheet for the Meeting of Secretary (Environment) Cum Chairman, DPCC , to review the Progress made / Action Taken for compliance of the directions issued by Central Pollution Control Board (CPCB) u/s 18(1) (b) of Air Act, 1981 for improving the air quality in Delhi and NCR held on 10.10.2017 at 5 P.M in the Conference Room No 3 — at Level 9, C Wing, Delhi Secretariat , I.P.Estate , Delhi -110002

Sl. No.	Name of Officer	Designation & Organization	Contact No.	Email	Signature
1.	S. M. Ali	Special Secy (Env) Cum Member Secy DPCC	9871006458	msdpcc@nic.in	In Chair
2	Rawinder Sni	A S/ Typist	8750871415	20nirawinder 1959@gmail.com	
3	Seema Singh	DDE(Sch.) DoE	9871671800	schbranch@hotmail.com	10/10/2017
4	Anupam Shekhar	J. Asstt. GAD (Admn)	9711857224.	gad.admn@gmail.com	10/10/17
5	AR SAINI	J.D (Agri) Dev Deptt	9654153128	Jdagri.delhi@gmail.com	
6	Harendra Pd	Ex. En. / EZ DDA.	9868141625	harendra2010@gmail.com	
7	Pavin Bansal	Assistant Engineer EZ/DDA	9811642955	Pavan.bansal@gmail.com	
8	Rajesh	FSO Deptt of Food Supply and CA	9540127625	rajeshgg@nic.in ra@gmail.com	
9	ANIL KR. GUPTA	SE North MCD	9717788033	sedemsndmc@gmail.com	Anil
10	D.S Khatri	Consultant (S) Delhi Cantt Board	7251111614	ceodelhicantt@gmail.com	
11	P. Ghosh	CM(RS)/SDO IOCL	9434222239	pghosh@indianoil.in	
12	S. Chowdhary	AM(E)/IDO IOCL	9654513989	sudhanshu@indianoil.in	
13	Abhishek Shaw	Sr. Manager BPCL	9873429929	abhishekshaw@bharatpetroleum	
14	A.P. SALUJA	Ch. Manager SLC HPCL	9988776261	apsaluja@hpcl.in	
15	Y.S mathur	Section officer (Horti.) HR/SDMC	9650798744	Sohqsdmc@gmail.com	

Sl. No.	Name of Officer	Designation & Organization	Contact No.	Email	Signature
16	PKBanerjee	DY. Director (Hort)/HQ / SDMC	9717787494	adhthq.mcd @gmail.com	PKB
17	R.R.Sharma	Director (Survey) Planing DDA	9810818300	dirsurvey@ dda.org.in.	[illegible]
18	V.K. Bhatia	SE / SDMC	97177-88050	dindeusce @ gmail.com	[illegible]
19	C.P. Singh	ED(Agri)/TA	9968260467	cpagridelhi @gmail.com	[illegible]
20	Harish Kumar	AD (Survey) MP/L 3 DDA	9818038777	[illegible]@gmail.com	[illegible]
21	Gurcharan Singh	Dy. C.A	9899894221	[illegible]@gmail	[illegible]
22	J.S. Sulop	Blower CPC MMA/ Consultant Sec	9810963018	Jagbirsulop @gmail.com	[illegible]
23	V.K. Saraswat	PCO Transport Deptt	7042755737	VK.saraswat61 @gmail.com	[illegible]
24	Dr Chetna Anand	Scientist, Depo of Env.	9717593542	dr.chetnaanand @gov.in	[illegible]
25	Dr Anil Kumar	Director (Env)	9717593505	direnv.delhi @nic.in	[illegible]
26	Dr. P. K. SHARMA	M.O.H New Delhi Municipal Council	9810077166		[illegible]
27	Dr RAMESH	CMO New Delhi Municipal Council	9810409961	doctorramesh kumar@yahoo.com	[illegible]
28	T.R.Meena	SE(NDMC)	9810681453	trmeena_57 yahoo.com	[illegible]
29.	D.K. SINGH	SEE, DPCC	9717593512	dksinghdpcc @gmail.com	[illegible]
30	V.K. Jain	EE, DPCC	9717593533	vkjaindpcc@ gmail.com	[illegible]