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'Strengthen pollution regulators, get more staff, train them in tech and back up with stringent norms'

Dr Sachchida Nand Tripathi talks about the 'low hanging fruits' approach to managing air pollution, wind patterns which magnify the impact of stubble burning, crop diversification and a realistic AQI assessment for Delhi. The session was moderated by Amitabh Sinha, Resident Editor, Pune

Illustration: Suvajit Dey

Amitabh Sinha: What is the air pollution status across Indian cities?

Air pollution has become a global environmental threat. *The Lancet* estimates that the current premature mortality due to air pollution alone is about nine million per year. Out of that, India's share is about 1.7 million. Some *Lancet* studies published from India show that the deaths due to outdoor pollution are rising, going up by about 25 per cent over the last decade. But the deaths due to indoor air pollution have dropped by 40 per cent. Now we have a comprehensive programme called the National Clean Air Programme (NCAP) with uniform standards. It has already distributed about Rs 600 crore to more than 82 cities, which has been topped by another Rs 5,000 crore as part of the 15th Finance Commission recommendations. The money given to 131 cities is to either augment their infrastructure — for example, creating or introducing more e-ways — or create more manpower and infrastructure for monitoring air pollution. As of today, our monitoring stations have increased from 200 to 350 and are expected to go up to 500 by the first phase of the programme in 2024. It is also being complemented by creating more networks of sensors which are portable devices made in India. In fact, we are trying to create a couple of large networks in Uttar Pradesh and Bihar by installing 1,400 sensors. About 90 institutions, including IITs, NITs and Central laboratories, are working with urban local bodies directly responsible for the implementation of this programme and creating a pan-India emission inventory.

Additionally, other ministries are contributing to this effort. For example, the Ministry of Earth Sciences has created a new system for air quality forecasting called the Early Warning System for Air Quality Forecast. It's working quite well but improving that is a major challenge.

Interestingly, for all cities this October, particularly Delhi, we saw a small bar of good days. There is now a framework which is trying to create an infrastructure in terms of monitoring, imparting capacity-building and making use of technologies to start mitigating or plugging the sources of pollution. We have to go a long way. One of the best examples is the California Air Resource Board, which brought major changes to the air quality index (AQI) of California. It took 40 years to bring about significant changes that started in 1970. So, this is going to be a long haul. One has to be patient and persistent.

> Pollution boards are severely understaffed. The DPCC and others have a sanctioned engineering strength of about 130. DPCC works with 50. We need to augment staff and train them rigorously

Amitabh Sinha: For Delhi, pollution has become an annual feature in the winter months. Why isn't there any change in pollution levels?

October brought some surprises. Till Diwali, we had relatively better air in Delhi-NCR. Then the AQI deteriorated. We'll have to wait for the data for November to be uploaded from all monitoring stations in Delhi. The number of fires has also dropped. So, the total number of fires, which peaked in 2021, was more than 20,000 if we combine Haryana, Uttar Pradesh and Punjab. Until now, Punjab, which has the largest share of farm fires, has dropped to about 8,000. Generally, when the fire plumes arrive in Delhi, and this is probably what has happened this year, they immediately increase the average particulate matter (PM) by a factor of two to three. If you calculate before and after scenarios, then the PM will go somewhere from 70-80 micrograms to 160 micrograms per cubic metre. To simplify, as stubble burning starts, the concentration of PM 2.5 rises from around 100 micrograms per cubic metre to around 200 micrograms per cubic metre. Now, the absolute number changes and the relative contribution of biomass burning also changes from 25 per cent to about 40 per cent, which is about 80 micrograms per cubic metre. That is why this one month becomes a very critical time. The main driver is biomass burning, which includes stubble as well as other sources.

Amitabh Sinha: Can the pollution load in Delhi only be attributed to biomass burning or are there other reasons?

It is not only biomass burning; the weather plays a major role. If PM levels are hovering at 100 to 200 micrograms per cubic metre, then 80 or 70 micrograms are coming from biomass burning. Trash and refuse are also being burnt in Delhi-NCR, which are difficult to distinguish.

A former CPCB (Central Pollution Control Board) official had looked into the ventilation coefficient, which basically gives an idea about how quickly particles can go up and leave the lowest part of the atmosphere, which happens in summer. Except for the burnings, many polluting sources exist in summer as well. But if you compare an average summer and an average end of October or November day, you will find there is a striking difference in PM levels. Ventilation in summer is much stronger. We know that for 10 to 15 days between October and November, straw is burnt in seven to 10 districts. Now, the wind direction also is northwesterly at this time, coming in from Punjab and crossing through Haryana to Delhi. After three days, it comes to Kanpur and then it will go further downwind. So, even 8,000 fire incidents could make a major difference in seven to 10 days.

Mallica Joshi: Stubble burning is the major reason for Delhi's pollution. But how can Delhi lower its emissions?

The Delhi-NCR region emits gases, which are a major contributor to the secondary particulate matter in the city. The sources are industries and power plants, which together contribute 10 to 15 per cent in terms of primary PM. But don't ignore these numbers. Our repeated findings show that in winter, the total secondary PM contribution can go up to 45 to 50 per cent of the total pollutants. Major industries are point sources and the pollution boards were designed to focus on them but they are currently severely understaffed. The Delhi Pollution Control Committee (DPCC) and others generally have a sanctioned engineering staff of about 130. DPCC works with 50. We need to augment staff and train them rigorously. These measures are very low-hanging fruits.

Also, we can move to using public transport like the Metro. We need to harness electronic vehicles (EVs) and see that all buses run on electricity. Vehicular traffic is exceeding 25 per cent of the pollutant load. So, we need to think of ways to bring it down. In California, authorities have instrumented mobile labs, which track and fine violators. We could also focus on heavy-duty trucks. They are relatively smaller in number but are proportionately large contributors. If you cut these emission sources down, you are still saving maybe another eight to nine per cent of pollution, which is a large number.

Amitabh Sinha: Stubble burning is relatively new, becoming a factor over the last five or six years. But Delhi was still polluted, not only in winter but across the year. Yet when you talk to the government, officials or people responsible for dealing with this problem, why are they not attuned to grabbing these "low-hanging fruits?" We seem to be more interested in fanciful ideas like artificial rain and smog towers. Why can't we do simple things like disposing of construction waste in a better way?

There is always a tendency to do something exciting and appealing. Yet global best practices tell us that the only way you can control this problem is by strengthening our regulators. Bring in more staff, keep them up to date, use technology and then back these up with stringent regulations. This is a very standard SOP. Unfortunately, it takes a lot of time and effort. That is where the challenge is.

We also probably need to create awareness among city municipalities. Regulators can only do that much. But the city also needs to start thinking that managing pollution is part of governance. Air quality has never been on the radar of municipalities. The time has come for them to start thinking in that direction. We have created a long-term capacity-building framework, which can act as a vehicle. Using that, future programmes can be designed and offered. Based on some large surveys we conducted, there is an appetite for one million jobs for air quality management in the country. But are we producing skilled people? Probably not. Can our academic institutions, mainly technical institutions, produce adequate manpower?

Manraj Grewal: Chandigarh has India's tallest purification tower. Is it possible to change air quality with such towers?

I am not aware of that tower. But one of your colleagues shared some data she got through an RTI on the smog tower in Delhi. I looked at the data for four seasons since that tower has been in operation, from late 2021 and through the summer of 2022. I found that the reduction at 300 feet, which is only 100 metres from the tower, is not large enough. I think it's a very insignificant reduction. Smog towers have not been a method or a way to mitigate ambient air pollution anywhere in the world.

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Anonna Dutt: Delhi moved to CNG in the late 1990s. There was a drastic drop in pollution levels but then it started going up again. Would the switch to EV be similar? Power plants generate a lot of secondary pollutants...

When we transitioned from gasoline to CNG in early 2000, it was confined mostly to public buses and to a certain extent cabs. Private vehicles did not transition to that extent. And the number of private vehicles has increased between 2010 and 2020. So, that offset the gains we got from CNG. I don't think we have that issue in EVs. If you have a car totally driven on electricity, you have zero emission. Soon the electricity will be generated from solar and other renewable sources of energy. Probably in the short-term, say five years, power plants might have some pollution issues.

Amitabh Sinha: Is the rise in vehicles the major reason for the increase in outdoor pollution in the country?

Mortality and connecting it with PM is more straightforward but then connecting it with the sources is slightly more complex. You need some additional metric to connect the dots. That is happening. You measure the oxidative potential of particulate matter. That clearly tells you how toxic the particles are. If they have a high oxidative potential, they tend to kill your cells more frequently. Fortunately, we have two sets of data from Delhi of the oxidative potential of particulate matter and connected it with the sources. In that order, we found the secondary organic particulates added with three or four metals. So, secondary organic PM could come from vehicles as well and contribute to mortality.

Amitabh Sinha: Can you explain a little bit about what primary and secondary contributions are?

Primary is something emitted directly. The dust that comes from the road is a primary particle. Those which are formed in situ in the atmosphere are secondary. They are not emitted as particles but rather, as gases. Then they undergo a whole range of chemical processes giving rise to particulate matter, which is called secondary PM.

Amitabh Sinha: Can you tell us about your new findings on the nature of pollution in Delhi?

We ran a campaign in 2019 in Delhi at a couple of stations, which the Delhi Government has been trying to follow. We get the real-time chemical speciation and track its sources. The most novel find was a very clear contribution of the secondary particulate matter to the overall PM for debris. And then we could map it to different physical sources because we had other supplementary information in terms of metals. It's an advanced method. We are trying it at other places. Biomass burning contribution could be tightly bracketed.

Amitabh Sinha: You've mentioned the *Lancet* study, which says that there has been a major improvement in indoor air pollution and a reduction in fatalities by 40 per cent. What are the possible reasons for that?

The Lancet paper was published by an Indian. It shows that there was a 40 per cent reduction in indoor pollution between 2010 and 2020. After 2014, the Pradhan Mantri Ujjwala Yojana (PMUY) was pushed with a greater pace. I happened to evaluate PMUY in six states by creating the primary data through 2,400 respondents. We deployed sensors to measure indoor and outdoor PM in 12 villages across six states. We found that villages where people were using LPG more had lesser emissions of particulate matter. Switching to cleaner fuel for cooking, water heating and other purposes made a difference.

Manraj Grewal: Every major city has a huge landfill, which in summer catches fire, causing smog. How do we deal with pollution from such landfills?

A landfill is a good way to deal with municipal solid waste. Of course, there are other challenges. For example, a country like ours will have to find space. The type of biochemical reactions that happens with bacteria inside the landfill produces methane, which easily catches fire. So, landfills have to be managed.

Amitabh Sinha: What's the AQI that can be realistically attained in Delhi?

For cities like Delhi, our first target should be to be well within the standard already in place all year long. We are violating that in winter. Places with good quality air are showing early signs of deterioration. The phase one of NCAP is already being implemented and we need to think of extending it to other places.

Our misconception is that the air in our rural areas is still clean, which probably may not be true, because if the plume passes from Delhi to Kolkata, then it goes over all the regions where there are cities, towns and villages. Our goal should be to attain our standard. Our second goal should be to look at the standard in a more comprehensive way.

Amitabh Sinha: How much of a problem is politicking creating in finding solutions?

The NCAP is in place. To curb stubble burning, the Central government has given Rs 1,700 crore to farmers in not only Punjab but Haryana and Uttar Pradesh too, mainly by subsidising large farm equipment like Happy seeders and so on. I don't know how much of that money could be utilised. At the same time, I believe that there are issues even with these large equipment in clearing the lowest part of the stubble. That kind of indicates that only in-situ treatments or methods are not the way forward.

At the same time, a particular variety of rice, which is grown mostly in Punjab, is a very water-intensive crop. The Punjab Preservation of Subsoil Water Act was brought in to shift the sowing of these crops from June to early July, which also gave rise to this problem because the whole harvesting period shifted to October.

We are looking at a double whammy, where the groundwater will be further depleted and air pollution will be further exacerbated. So, the only long-term solution could be maybe a hybrid one, where some of these in-situ and ex-situ methods are tried. But majorly, we have to somewhat shift to other crops and diversify them. This has to happen in three to four years. Farmers have to be convinced about it.

Amitabh Sinha: Some makeshift response measures have already come forward, Happy seeders being one of them...

These equipment were given at a highly subsidised rate. So, someone has to make them work. The Indian Council for Agricultural Research (ICAR) has come out with an interesting solution to make stubble biodegradable to the extent that it can become part of the soil. How do you scale it up? You cannot roll out a solution until you have the farming community ready to use it.

IDEA eXCHANGE

WHY **DR SACHCHIDA NAND TRIPATHI**

Dr Sachchida Nand Tripathi is a professor at IIT Kanpur and is known for his work on air pollution. In fact, he is one of the most quoted and cited scientists on air pollution in India right now. He is part of several committees looking for solutions to what has become a chronic problem. He has completed another paper on the pollution in Delhi during Diwali. He is responsible for indigenously built, low-cost, sensor-based network technologies for nationwide urban air quality monitoring and Real Time Source Apportionment (RTSA). His work on Taj Mahal discolouration led to policy interventions in Agra city