

Editorial

Trans-boundary Air Pollution Suffocated the Capital

Dr. UMESH CHANDRA KULSHRESTHA

School of Environmental Sciences, Jawaharlal Nehru University, New Delhi 110 067 India.





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First of all I wish all our readers a very Happy New Year 2018. Since it is my first issue after taking over as Editor-in-chief of the Current World Environment; I am grateful to all the authors, reviewers and other associated individuals and organizations for their cooperation and interest in the journal. This is indeed the journal which in true sense covers multiple aspects of environmental research. In this issue, we have papers on diversified topics including disaster management, environmental impact assessment, water treatment processes, lake hydrology assessment approaches, land use and cover changes, morphometric analysis of river basin, net primary production, nitrogen, decomposition, removal and speciation of metal from waste water, mangroves, physico-chemical and biological properties of lake water, biodiversity, phytoremediation, pedestrian bridge preferences, occupational health hazards of stone dust, biochemicals, mining, watershed management, heat indices, water quality assessment and statistical modeling etc.

However, this Editorial highlights the issue of trans-boundary air pollution in Delhi region due to crop residue burning in the neighboring states. Since, this problem of poor air quality and suffocation has been of great public concern, I am briefly mentioning the budget, emissions, air quality effect, chemistry and the feasible measures of control of crop residue burning in this article considering that this basic scientific information may help our enthusiastic readers.

For the last three decades, air pollution in the National Capital Region has been a hot topic for the government, public and the researchers. Recently, the same issue was caught in the media headlines due to crop/stubble residue burning of neighboring states Punjab and Haryana. Coincidentally, during the stubble burning period, winds were also very low which could not favor the dispersion of air pollutants at the desired rate. This led to stagnation of pollutants in the ambient air. Also, there was no precipitation which could have removed the pollutants to some extent. The trans-boundary transport of pollution was very significant which affected air quality and visibility in the NCR and beyond. The situation became so severe from 5th November onwards

CONTACT Umesh K  umeshkulshrestha@gmail.com  School of Environmental Sciences, Jawaharlal Nehru University, New Delhi 110 067 India.

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that most of us felt breathing and eye irritation problem. Especially, old age people, children and asthmatic patient communities were the most affected by the smog. Smog (smoke + fog) as it contains high levels of harmful gases and secondary aerosols.

Air Quality Issue

The AQI is primarily based on the PM 2.5 levels. It is to mention that the poor air quality and high Air Quality Index (AQI) of Delhi is a general feature of most of the urban areas in northern India which can be attributed the road dust, construction dust and the contribution from trans-boundary sources such as brick kilns, outsider diesel trucks and thermal power plant emissions etc. More detailed transport routes and scenario of trans-boundary air pollution in south Asia have been discussed by Kulshrestha and Kumar¹.

This year the severity of stubble burning affecting air quality started on November 5th 2017 and continued for around 20 days. During all these days, the AQI has been very high. According to CPCB report², the Air Quality Index (AQI) on November 5th was around 200 which and reached at a peak on 8th November touching a figure of 478. The situation prevailed upto around November 25th. These significantly higher AQI values have been attributed to stubble burning and smog effect. However, post- burning smog episode, the AQI values are not much reduced indicating that the PM 2.5 in Delhi region are contributed by multiple sources, apart from stubble burning. As mentioned above the road dust, construction dust, soil dust and diesel emissions are the major sources of pollution in Delhi during non-episodic period. Hence, there is need to accurately identify other significant sources which are responsible for poor air quality and high AQI in the capital region. Also, there is need to issue advisory based on a single AQI and its categories. Presently, two different AQI charts of two different agencies of government of India have different categories of AQI and the consequence forecast. The AQI chart of SAFAR programme has five categories while that of Central Pollution Control Board (CPCB) has six categories.

Emissions from Stubble Burning

The pollutants emitted by the crop or stubble burning have local as well as regional influence. After forest fires, agricultural residue burning is the major source of greenhouse gases which contributes around 25% of the total biomass burned globally. In Punjab state alone around 29.4 lac hectare area is used for rice crop and around 38.4 lac area for wheat crop³. Every year around 500 MT of biomass is produced in India where Punjab and Haryana states have significant share. Every year 90 MT of stubble burning is done in Punjab and Haryana. In these states, around 20% rice and wheat crop area is increased between 2006 and 2016 due to which production of residue is also increased. Infact, during traditional cutting, the plant was cut from the root but in the present mechanized practice, a long straw is left standing in the field. The disposal of 50-60 cm long stubble is not easy. Also, it cannot be used for fodder purpose. Such burning is fast and least expensive while the mechanical management of straw is time consuming. Moreover, the straw management equipments are very costly. The farmers are encouraged for burning as a cheap and best option. The crop price or the so called Minimum Support Price (MSP) does not include the cost of mechanical straw management equipment.

The rice crop residue burning in Punjab emits 133, 658, 8 and 4 Gg of fine particulate matter, CO, NO₂ and SO₂ while wheat residue burning emit around 57, 625, 1.4 and 1.8 Gg of fine particulate matter, CO, NO₂ and SO₂ respectively. In addition, there are organic compounds in the plume which are responsible for smog formation.

Chemistry of Smog

If you look at the chemistry of smog, it consists of NO₂, excessive O₃ and organic compounds such as aldehydes, ketones and peroxyacyl nitrate (PAN) etc. In general, the organic compounds are finally converted to CO₂ and H₂O in the atmosphere but before their conversion, these react with OH radical forming peroxy radical (ROO). The peroxy radical reacts with atmospheric NO forming NO₂ and alkoxy radical (RO). The

alkoxy radical can take hydrogen from other organic molecule forming ROH which is subsequently oxidized to CO₂ as follows-



In the sunlight, the NO₂ is reduced to NO and forming an atomic oxygen which further reacts with molecular oxygen finally forming O₃ as follows-



Through other reactions, the organic radicals (R and OR) react with NO radicals forming PAN. For example aldehyde reaction with OH produce acetyl radical (CH₃CO) which further reacts with oxygen and NO₂ forming PAN (CH₃COONO₂). The PAN are considered harmful for the lungs.



Feasible Control Measures

National Green Tribunal (NGT) has instructed the governments of Uttar Pradesh, Haryana and Punjab to control the burning so as to control air pollution reaching to NCR. The district level authorities have also taken steps regarding crop residue burning. These governments have issued notices to the offender farmers. All these efforts are seen in vain this year in the month of November. We need to develop a mechanism for controlling the mass level burning by the cooperation of farmers and local bodies. In order to control stubble burning and its consequences, the following measures are necessary- i) Formation of Inter-State Authority for Monitoring Trans-boundary Air Pollution, ii), Establishment of Biorefineries in the region, iii). Straw management price should be included in the Minimum Support Price (MSP) of the crops. With this episode, we need to identify the sources of air pollution in NCR. Also, we need to understand the difference of higher AQI and its health consequences during normal days vs crop burning period. We need to quantify the load of air pollution contributed by different states. Further, as mentioned earlier, I would like to add that the issue of trans-boundary air pollution needs immediate attention in south Asian context too. We need to quantify air pollution load contributed by each member country of south Asia. In this regard, a framework very similar to the Long Range Transport of Air Pollution (LRTAP) treaty of Europe, needs to be developed involving all the south Asian countries.

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