Shall we continue to inhale diesel exhaust – a potential human carcinogen

The International Agency for Research on Cancer (IARC), which is a part of the World Health Organization (WHO), classified diesel engine exhaust as carcinogenic to humans (Group 1) in 2012, based on sufficient evidence that exposure is associated with an increased risk for lung cancer[1]. In 1988, IARC had classified diesel exhaust as probably carcinogenic to humans (Group 2A). An advisory group recommended re-evaluation of carcinogenic potential of diesel exhaust. Based on the findings in large epidemiological studies, it was concluded that diesel exhaust is a cause of lung cancer (sufficient evidence) and a positive association (limited evidence) with an increased risk of bladder cancer was also noted[1]. It puts diesel in the same risk category as noxious substances such as asbestos, arsenic, mustard gas, alcohol and tobacco. The National Institute for Occupational Safety and Health (NIOSH), a part of Centre for Disease Control and Prevention (CDC) also studied workplace exposures to conclude that diesel exhaust is a potential occupational carcinogen[2].

Most of us are exposed to diesel exhaust (motor vehicle exhausts, other engines, power generators) through our occupational environment or ambient air. It is most harmful in mines and other enclosed workplaces. Apart from the mutagenic and carcinogenic effects, exposure to diesel has been associated with acute coronary syndrome and other thrombotic effects, pulmonary damage and neurotoxic effects. Several studies have linked diesel exhaust exposure to low birth weight in infants, premature births, congenital abnormalities and elevated infant mortality rate[3]. These are more hazardous in countries like India, where petrol prices are sky high compared to diesel and most vehicle manufacturers are now promoting diesel car engines. The share of diesel cars in the overall pie has been climbing rapidly[4], from 15% in 2008 to 21%, 25%, 36% and 47% in the following four years and 56% in the first half of 2013. Until alternative energy sources are fully developed and implemented, reliance on diesel fuel will increase. It is high time we should use new technology to reduce diesel emissions and enforce stricter emission rules. Research should be encouraged to find alternative sources of energy to replace diesel.

Increasing environmental concerns over the past two decades have resulted in stricter emission standards for diesel exhausts in North India and Europe. The developing world lacks regulatory standards and reliable data on the exposure and impact of diesel exhaust. Many countries have laid down emission standards, but the levels need to be curtailed further and most importantly, they have to be enforced with stringent measures. With the widespread exposure to carcinogenic diesel exhaust, it is now imperative that we take strong regulatory measures to curb the level of the carcinogen in ambient air. Since most human exposure comes from motor vehicle-related diesel exhaust, Government regulations may be more effective in limiting exposure than individual choices. The second most common site of exposure being the workplace, warrants regulatory measures there as well. Personal protective equipment, proper ventilation, good work practices such as changing clothes after work, washing hands regularly and keeping food out of the work area are some of the proven strategies that need to be instituted at workplaces with immediate effect to reduce exposure to diesel emissions.

Although there is no safe exposure level for environmental tobacco smoke and particulates from diesel exhaust, the entire attention of the public health arena has been shifted towards a tobacco smoke-free world. With particulate diesel exhaust presenting health risks similar to environmental tobacco smoke[5,6], there is no reason why we should not fight for a much reduced diesel exhaust level in air.

1. IARC, International Agency for Research on Cancer, World Health Organization, France, June 2012.
2. Centre for Disease Control and Prevention, http://www.cdc.gov/niosh/topics/cancer/npotocca.html
3. Krivoshto, I. N., Richards, J. R., Albertson, T. E. and Derlet, R. W., *J. Am. Board Fam. Med.*, 2008, **21**, 55–62.
4. http://www.team-bhp.com/forum/indian-car-scene/127239-september-2012-indian-car-sales-figures-analysis-8.html
5. Kunzli, N., *Eur. Respir. J.*, 2002, **20**, 198–209.
6. Pope III, C. A. *et al.*, *JAMA*, 2002, **287**, 1132–1141.

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Ganga Basin

Sharad Kumar Jain's arguments in *Current Science*[1] are untenable on several counts.

(1) A remark such as 'there are very few stations at altitudes greater than 2000 m', can be appreciated only if the author states how many stations are there, also gives realistic views on how many are needed, and demonstrates that the former is less than the latter. Without the numbers, remarks such as 'the meteorological data network ... is poor'; 'there are very few stations'; 'it is necessary to set up a dense network of automatic instruments', are vague. How many instruments would make the network sufficiently dense?

(2) 'Ganga Basin is home to nearly 40% of the Indian population' is a misleading statement in the present context. Ganga Basin includes tributaries of the

Ganga from places like Kedarnath in Uttarakhand and extending into central India in Madhya Pradesh. Being on different limbs of the Ganga, population in one sub-basin is not affected by hydrologic events in other sub-basins, viz. whether there is drought or flood in Chambal Basin makes no difference to people in Bhagirathi or Alaknanda basins. And whether the glaciers aggregate or melt away has no impact on people in the sub-basins of Chambal, Ken, Betawa, Son, etc. Even on the main Ganga, impact of any significant change in glaciers will be felt may be up to Haridwar, very little at Kanpur, and may not even be perceptible by the time the river enters Bihar.

(3) Secrecy of data of Ganga Basin is a favourite excuse for Indian hydrologists for their inability to produce any significant work in hydrologic modelling. Data on Narmada, Tapi, Sabarmati, Krishna, Godavari, Cauvery, Mahanadi, Subernarekha, Bramhani and Baitarni, ... are no secret. Have the Indian hydrologists community produced many research papers and hydrologic models on these basins? The flood-forecasting package most commonly used in India, a model-cum-software called Mike 11 and its next version System 21, has been developed by DHI, a Denmark based R&D group, which also did not have access to the Ganga Basin data. This proves that it is possible to develop flood-forecasting packages without Ganga Basin data.

(4) Dave Petley of Durham University, UK has been quoted as being amazed about secrecy of data from Ganga Basin, while there are good data available from other poor countries, most notably the Philippines. But if Petley were to look up in a map which are the countries adjacent to and downstream of the Philippines and the political relationship it has with downstream countries, he might appreciate why there is no secrecy of data in the Philippines.

1. Jain, S. K., *Curr. Sci.*, 2013, **105**, 885.

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Response:

Chetan Pandit writes that the arguments in my letter are untenable on several counts. However, he has not advanced any scientific reasons to counter my opinion. Although the points mentioned by him are not focused on the underlying theme of my letter, I am addressing them here to further buttress my arguments.

First, the comment about the hydrological data networks. According to the recommendations of the World Meteorological Organisation (WMO 2008)[1] which are followed all over the world, minimum suggested density of a streamflow network in the mountains is one river gauging station per 1000 sq. km area. For precipitation measurement in mountains, WMO recommends at least one non-recording station per 250 sq. km area and one-recording stations for 2500 sq. km area. The recommended minimum density of stations is necessary to correctly estimate precipitation and river flows and their variabilities. Now for illustration, the catchment area of the Ganga Basin up to Devprayag is 19,600 sq. km. There are 10 river gauging stations in this catchment operated by the Central Water Commission, where long-term data series are available. Clearly, the number is just half of the WMO recommendations. Out of these, two stations, namely Joshimath and Uttarkashi are located at 1375 and 1096 m respectively, and Badrinath at 3107 m. All other stations are at altitudes below 850 m. Thus, we have only one station at elevation exceeding 1500 m. Likewise, the long-term and recent rainfall data are available at about 10 stations operated by India Meteorological Department (IMD) and none of these is located at altitudes greater than 1500 m. Further, there is no long-term observed snowfall data series for this basin, although the area receives considerable snow. The situation in other mountains is also nearly the same. While analysing the rainfall data of the Himalayas, Nandargi and Dhar[2] noted that there is significant decline in the number of rainfall measuring stations, particularly after the year 2000. Clearly, we need to urgently strengthen the hydrometeorological observation network in the mountain areas in our country.

The reasons given by Pandit while questioning the statement ‘Ganga Basin is home to nearly 40% of the Indian population’ do not contain anything new and in fact support my arguments. Any large basin will have variations in water availability and demands – both spatially and temporally. I believe that integrated river basin management by addressing the supply and demand issues would be necessary for sustainable water use in India and to give protection against floods and droughts.

It is surprising that Pandit with wide experience in water sector is raising doubts about the studies and publications by Indian hydrologists on Narmada, Tapi, Sabarmati, Krishna, Godavari basins, etc. These basins have been the subject of numerous hydrological studies. An internet search using the keywords, e.g. ‘Mahanadi hydrological modeling’ yields more than 85,000 results. Agreed that most of the sites/pages will not be related to hydrologic modelling, but even if, say 3% of the pages are about some hydrologic study, it points to nearly 2500 works. Moreover, numerous past and even current Ph D/Master’s theses, reports of government organizations, papers from Indian journals and conference papers are not available on the internet. So, put together the number of hydrological studies on these basins is quite large, commensurate with our scientific and technical manpower and resources. Coincidentally, as I write this rebuttal, the 25 January issue of *Current Science*[3] has a paper on modelling of the Godavari Basin!

Hydrologic data secrecy was the subject matter of a note in *Current Science* by Harsha[4], who forcefully argued that ‘what neutralizes the argument behind data secrecy is the availability of the very same hydrological data of Region I (Indus basin) to Pakistan under Article VI of the Indus Water Treaty of 1960 and perhaps international users; also the lean season data of River Ganges at Farakka are available for all international users for easy download from the website of Bangladesh Joint Rivers Commission. What the policy-makers have failed to realize is that the adverse impact of data secrecy is felt more by the Regions I and II (Ganga, Brahmaputra and Barak basin), in respect of ability to model and predict likely climate change, plan, design and operate water resources projects, adaptation to climate change scenario, flood-risk management, river morphological studies and sustainable development as part of Integrated Water