An Analysis of Black Carbon and Health Effects

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Black Carbon (BC), also referred to as soot, black smoke and elemental carbon, is formed through incomplete combustion of carboneous materials. In indoor environments, BC is produced from solid biomass fuel (wood, crop residue and dung) used in cooking and heating stoves. In outdoor environments, it is produced from open biomass burning (forest and savannah) and fossil fuel combustion (diesel and coal). With the exception of natural forest fires, the majority of BC emissions are through anthropogenic sources. All the aforementioned combustions produce various types of soot; combustion of fossil fuel and biomass fuel create darker black soot while open burning of biomass creates lighter brown soot (PEW, 2010).

Recently, BC has surfaced as a major contributor to global climate change as it may account for 10-30% of total excess global warming (USAID, 2009). Since BC particles only stay in the atmosphere for a few days to weeks, many argue that a reduction in global BC emissions would be an effective method to mitigate global warming. The impact that BC has on global climate change depends on several factors such as particle size, radiative forcing and particle half-life. Some scientists argue for a reduction in global BC emissions and claim that it could not only provide direct and immediate health benefits to the communities that reduce them, but could also offer a means to reduce the pressure on climate change.

However, among the scientific community, there is no consensus as to the degree of impact that BC has on climate change. The Intergovernmental Panel on Climate Change (IPCC) estimates BC is responsible for 15% of excess global forcing, while Ramanthan and Carmicheal estimate as much as 60% of the current warming effect of CO_2 (Ramanathan et al., 2008). The wide range in global forcing discrepancy can be partially attributed to the net cooling effect that organic carbon (OC) and sulfates have on the atmosphere when co-emitted with BC during open combustion.

While there is debate about BC's ramification on climate change, the negative health impacts from BC exposure are clearly evident. Due to much of BC being of ultrafine particle size, it has been shown to initiate an inflammatory response when inhaled thus leading to respiratory disease, asthma, cardiovascular disease, decreased lung function, decreased IQ and cancer.

There are several strategies to reduce global BC emissions such as implementing modified diesel filters, switching to liquid petroleum gas from household solid fuel, banning and/or regulating slash and burn clearing of forests, and installing scrubbers and filters on ships. However, some experts argue the most cost effective intervention would be implementation of modified household fuel and stove interventions. Global BC reduction would not only provide an immediate solution to climate change but would also provide localized health benefit.