CONTRIBUTION OF BRICK KILNS TO AIR QUALITY AND HEALTH IMPACTS IN DHAKA, BANGLADESH

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Introduction

The brick industry is the main source of building material for Bangladesh's growing construction industry. 15 billion bricks are produced annually from approximately 5000 brick kilns around the country, and 90% of these kilns are outdated with uncontrolled emissions. 653 of these brick kilns are in our Dhaka modelling domain. Previous studies have investigated brick kiln emissions, but there has been little focus on the related health impacts. Thus, this study aims to determine the contribution of the brick kiln industry to air quality in Dhaka, evaluate its health effects, and generate policy-making scenarios.

Methods

The AirQUIS model was used to compile a complete emission inventory for Dhaka - for all source sectors as well as for the brick kiln sector separately. Dispersion modelling for $PM_{2.5}$, PM_{10}, and SO_2 was performed based on the inventory (using EPISODE within AirQUIS, 1x1km^2 resolution). The resulting estimated concentrations for all 653 brick kilns in the Dhaka modelling domain are plotted versus the estimated concentrations for all sources.

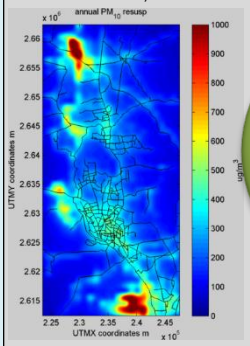
Results: Health Impacts

The annual impacts of the average annual PM_{10} concentrations in Dhaka are on the basis of the chosen exposure-responses linked to more than 850 premature deaths as well as 4000 incidences of hospital admissions for people with respiratory and cardiovascular diseases. The effects of SO_2 concentrations in Dhaka have similar health effects as PM_{10}.

Health endpoint	# of cases (PM10)			# of cases (SO2)		
	Dhaka			Dhaka		
	Value	S.E. (ER function)		Value	S.E.	
All-case mortality	857	573	1 139	917	689	1 143
Mortality due to CVD	313	235	390	252	189	314
Mortality due to RD	102	68	135	135	109	161
Mortality due to LC	292	262	320	-	-	-
Chronic respiratory illness, adults	500	485	515	-	-	-
Chronic respiratory illness, children	255	244	265	-	-	-
Hospital admissions for RD	2 088	1 751	2 422	2 095	1 688	2 497
Hospital admissions for CVD	1 841	1 323	2 353	3 914	3 320	4 501

Results: PM_{10} Dispersion Models

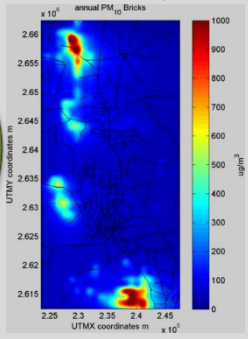
All Sources, 2013



Brick kiln sources contribute an average of **22%** of the annual PM_{10} concentrations at urban receptors

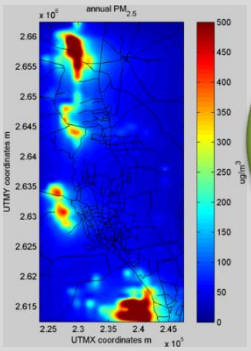
NOTE: Bangladesh PM_{10} Annual Limit Value is 50 µg/m³!

Brick Kilns Only, 2013



Results: $PM_{2.5}$ Dispersion Models

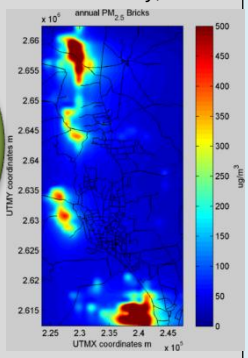
All Sources, 2013



Brick kiln sources contribute an average of **84%** of the annual $PM_{2.5}$ concentrations at urban receptors

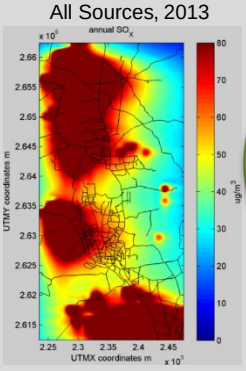
NOTE: Bangladesh $PM_{2.5}$ Annual Limit Value is 15 µg/m³!

Brick Kilns Only, 2013



Results: SO_2 Dispersion Models

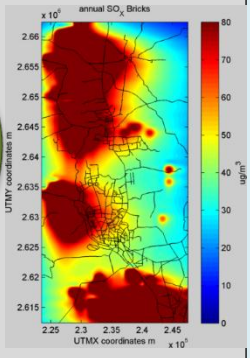
All Sources, 2013



Brick kiln sources contribute an average of **94%** of the annual SO_2 concentrations at urban receptors

NOTE: Bangladesh SO_2 Annual Limit Value is 80 µg/m³!

Brick Kilns Only, 2013



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