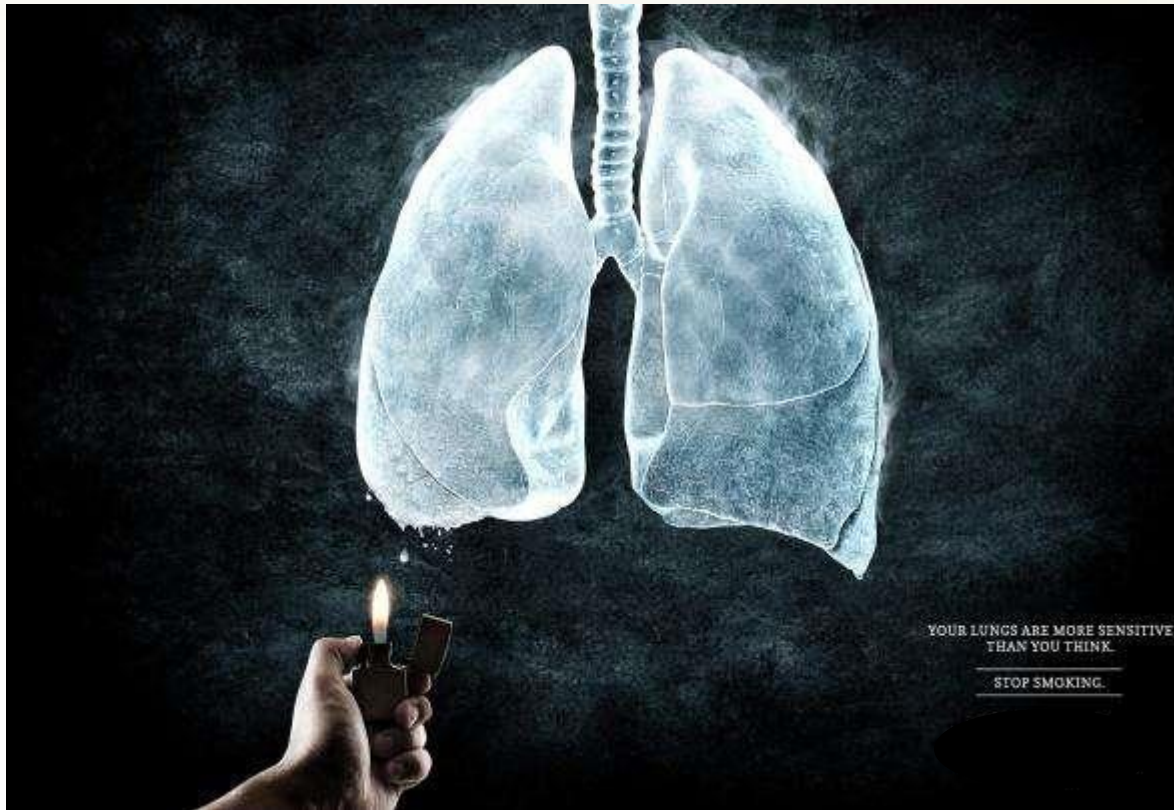


# AIR QUALITY & SUSTAINABLE PRACTICES



# ANY SMOKERS?



**LIVING IN DELHI  
GIVES YOU  
SMOKERS LUNGS**





# SOME FACTS

- ➡ 13 of the top 20 MOST Polluted cities of the world are in India
- ➡ Delhi ranks at # 1 out of 1600+ cities in air pollution
- ➡ Top 4 cities are Indian (Delhi, Patna, Gwalior & Raipur)

## Delhi world's most polluted city

**TOXIC** India slips to 155 among 178 countries on environment performance index, Capital pips Beijing to be city with dirtiest air

Chetan Chaudhary  
[www.bhaskar.com](http://www.bhaskar.com)

**NEW DELHI:** It's no surprise that pollution is a perpetual problem in India. But it's definitely disheartening to hear that India has slipped 32 ranks in the global Environment Performance Index (EPI) 2014 to rank a lowly 155 and its capital Delhi has earned the dubious tag of being the world's most polluted city.

A comparative study of 178 countries on nine environmental parameters released earlier this month by the US-based Yale University shows that one

and water resources, India's performance lags most notably in the protection of human health from environmental harms," said a statement issued by 'Epi'.

The study described India's air pollution as the worst in the world, tying with China in terms of the proportion of population exposed to average air pollution levels exceeding World Health Organisation (WHO) thresholds.

A deeper look at the data gathered by a Nasa satellite showed that Delhi had the highest particulate matter (PM) 2.5 pollution levels followed by Beijing. Delhi, with 80 million registered vehi-

cles, has the highest health implications. And while Beijing's infamy among has begged headlines and prompted government action, even led to the announcement of rewards for cutting back on pollution, the dangers in Delhi have been largely ignored.

According to a study by the Harvard International Review, every two in five persons in Delhi suffer from respiratory ailments. The Lancet's Global Health Burden 2013 report termed air pollution the sixth biggest human killer in India. The WHO last year termed air pollution carcinogenic.

### CAPITAL BREATHES UNEASY

Tops global cities with worst air pollution



**1** NEW DELHI, INDIA

### INDIA SLIPS IN RANK TOO

Is second-most polluted among its neighbours

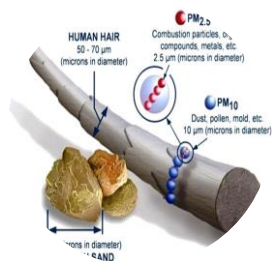
	2014	2013
Bangladesh	169	139
India	155	123
Pakistan	148	125
Nepal	139	30
China	118	121
Sri Lanka	69	58

Ranking based on 9 parameters: Health impact, air pollution, water & sanitation, water resources, agriculture, fisheries, forests, biodiversity & habitat.

# Understanding air pollution & how it affects us... (does it affect our immunity?)



# 3 BROAD BUCKETS



## Particulate Pollution

- PM10
- PM2.5
- RSPM
- SPM

**Minimize Exposure**

**Long term health effects**



## Gaseous Pollution

- Ozone
- VOC's
- NOx
- SOx

**Minimize Exposure**

**Long & short term health effects**



## Microbiological Pollution

- Bacteria
- Virus
- Mould

**Some Exposure OK**

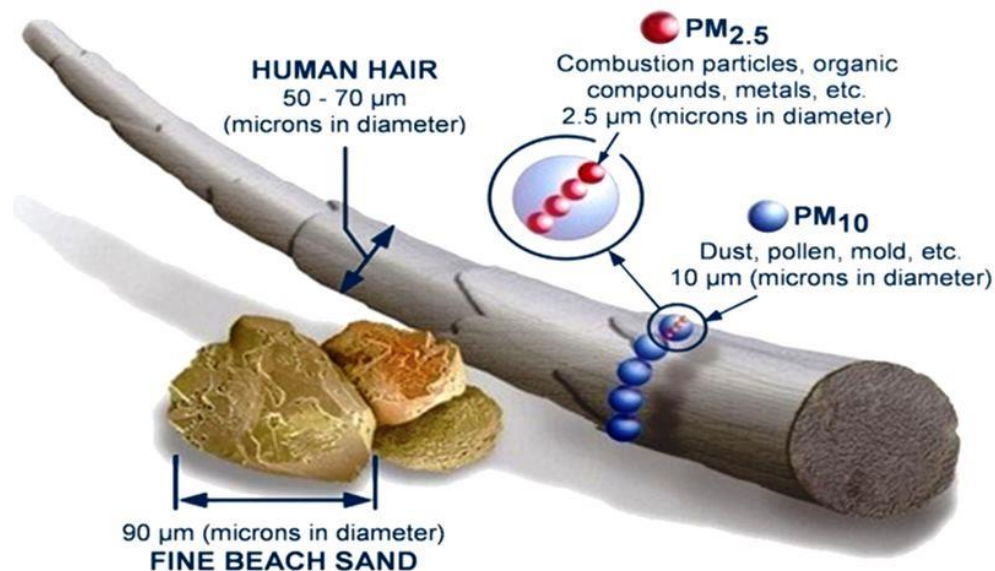
**Affects immunity**





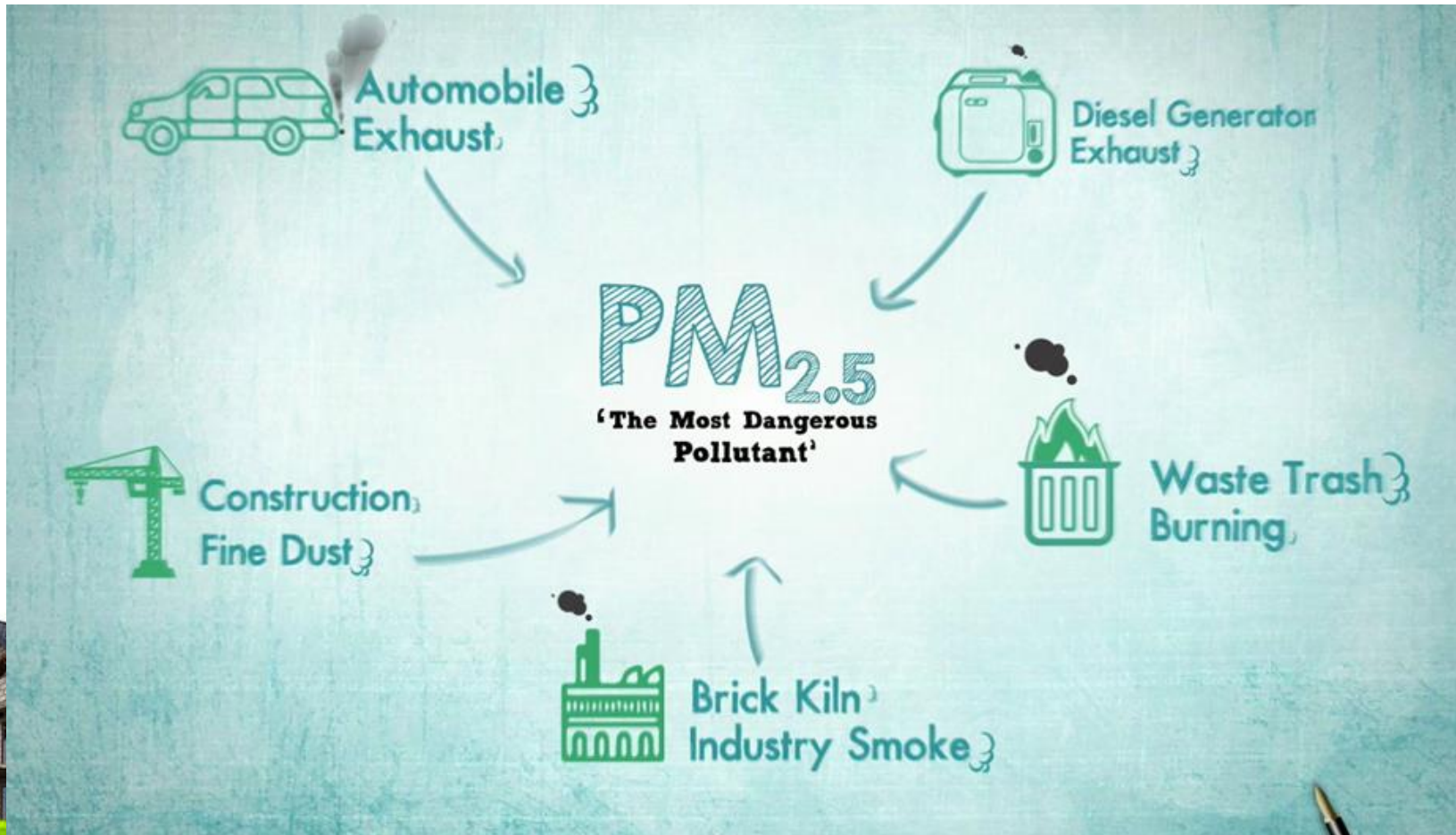
# PARTICULATE MATTER

$PM_{10}$  &  $PM_{2.5}$  One of the most dangerous air pollutants



❑ Leads to - Premature mortality, chronic respiratory disease, weakening of eyesight. Pre-existing heart or lung or asthmatic patients very sensitive to respirable PM

# Sources of PM<sub>2.5</sub>



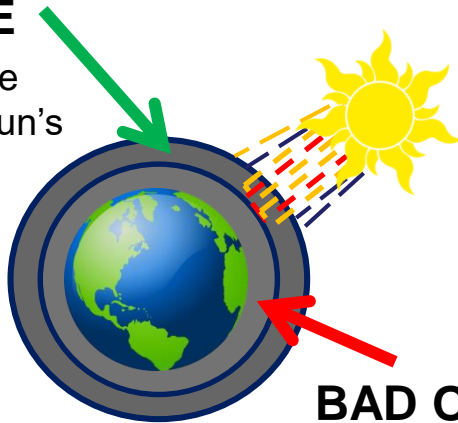


# OZONE ( $O_3$ )

*Forms in the atmosphere through a series of complex chemical reactions between oxides of nitrogen ( $NO_x$ ) and hydrocarbons*

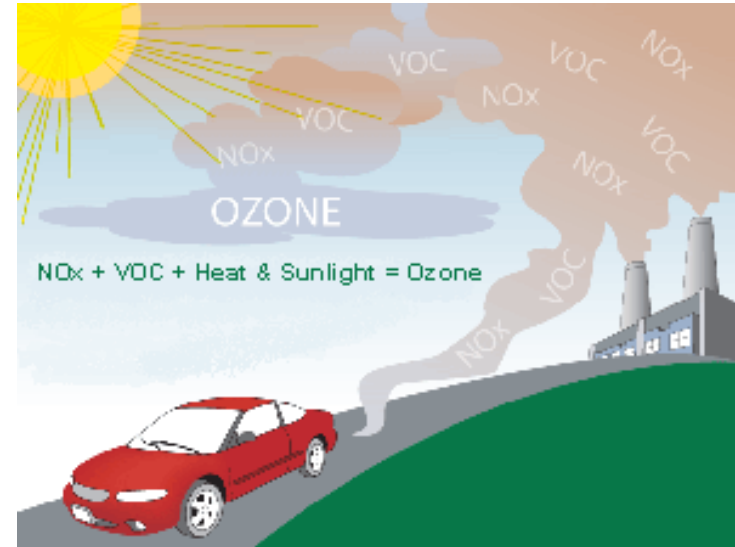
## GOOD OZONE

Stratosphere, ozone protects us from the sun's harmful ultraviolet radiation



## BAD OZONE

Troposphere, ground level ozone can damage lung tissue and plants



**Leads to - Wrinkles on skin, sensitive lungs, increased asthma attacks & daily mortality**



# HIGH OZONE & HIGH PM<sub>2.5</sub> DEADLY

***Study by  
Rice University  
&  
Houston Fire Department EMS***

*Direct correlation between out-of-hospital cardiac arrests (OHCA)  
and exposure to PM<sub>2.5</sub> and Ozone*

***Daily average increase in PM<sub>2.5</sub> of 6µg/m<sup>3</sup> per day over two  
days raised risk of OHCA by 4.6%***

***Each increase of Ozone of 20 ppb over one to three hours also  
increased OHCA risk, with a peak of 4.4%***



# A COMPARISON OF AMBIENT AIR

NEW YORK (NY) vs NEW DELHI (ND)



PM<sub>2.5</sub> - 7.2  $\mu\text{g}/\text{m}^3$   
Ozone - 21.1  $\mu\text{g}/\text{m}^3$

PM<sub>2.5</sub> - 100  $\mu\text{g}/\text{m}^3$   
Ozone - 212.4  $\mu\text{g}/\text{m}^3$

\*DATA FOR SAME WINTER NIGHT





**RISHIKESH, UTTARAKHAND – NOVEMBER 2014**

**PM<sub>2.5</sub> = 21 µg/m<sup>3</sup>**





**DELHI – NOVEMBER 2014**  
**PM2.5 = 489  $\mu\text{g}/\text{m}^3$**



# GULMARG, KASHMIR – MARCH 2015

PM2.5 = 0.0  $\mu\text{g}/\text{m}^3$





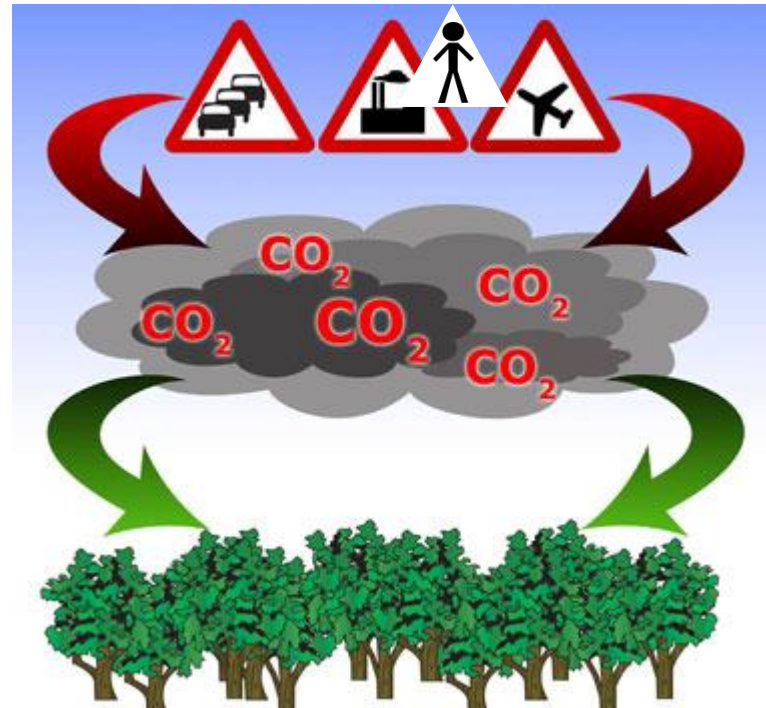
**DELHI – MARCH 2015**  
**PM2.5 = 180  $\mu\text{g}/\text{m}^3$**





# CARBON DIOXIDE

*High CO<sub>2</sub> is indicator of elevated levels of other pollutants*



**Leads to - Headaches, dizziness, restlessness, feeling of an inability to breathe, sweating, malaise, visual distortion, nausea / vomiting, loss of consciousness**

# AIR POLLUTION

HEALTH RISKS

## nervous system

- impaired cognitive and motor function
- strokes
- seizures

## respiratory system

chronic and acute respiratory diseases including:

- lung damage
- lung cancer
- bronchitis
- asthma

## cardiovascular system

- cardiovascular disease
- heart attack

## urinary system

- liver and kidney damage
- urinary and bladder cancer

## reproductive system

in females:

- birth defects
- infant mortality
- cancer risk

in males:

- infertility
- cancer risk



[climate.america.gov](http://climate.america.gov)

### Sources:

World Health Organization

<http://www.who.int/mediacentre/factsheets/fs313/en/>

U.S. Environmental Protection Agency

<http://www.epa.gov/region07/air/quality/health.htm>

National Institutes of Health

<http://www.niehs.nih.gov/health/topics/agents/air-pollution/>

Photos: Shutterstock.com

# WATER vs AIR

2-4 litres a day



???





# INDOOR VS OUTDOORS



# CAN THE PROBLEM BE FIXED? YES IT CAN... CASE IN POINT – A BREATHE EASY BUILDING

PARAMETER	WHO/ASHRAE GUIDELINE	OTHER BUILDING	BREATHE EASY BLDG	% REDUCE
CO <sub>2</sub> , ppm	ambient +700	1067.5	488	54
PM10, µg/m <sup>3</sup>	50	689	24	97
PM2.5, µg/m <sup>3</sup>	15	492	13	97
VOC - Benzene, ppb	NA	150	BDL	99.99
VOC - Acetaldehyde, ppb	NA	3125	BDL	99.99
VOC - Acetone, ppb	NA	800	BDL	99.99
VOC - Toluene, ppb	NA	275	BDL	99.99
Aerobic Plate Count, cfu	NA	153	26	83
Fungal Count, cfu	NA	48	<1	99.99



# WHAT ARE THE SOLUTIONS?



# SOLUTION 1

## Get clean air when indoors

We have tested nearly every air purifier available in India:

3 critical parameters – **OZONE, CADR and TRUE HEPA**

Many machines produce Ozone

**Reduce your exposure to PM2.5 when sleeping**



# SOLUTION 2a

## Get clean air when indoors

### NO AIR PURIFIER IS CAPABLE OF REDUCING CO<sub>2</sub>

- Bring in air from outside
- Filter the air before bringing it inside
- Cooling / heating should be balanced



# SOLUTION 2b

## Get clean air whilst sleeping

### NO AIR PURIFIER IS CAPABLE OF REDUCING CO2

- Grow lots of plants indoors (sterile vermi-manure / potting mixture)

#### "The Living Room Plant"

##### Areca Palm

*(Chrysalidocarpus lutescens)*



#### "The Bedroom Plant"

##### Mother-in-law's Tongue

*(Sansevieria trifasciata)*



#### "The Specialist Plant"

##### Money Plant

*(Epipremnum aureum)*





# SOLUTION 3

## Get clean air when indoors

### CENTRALLY AIR CONDITIONED BUILDINGS

- Breathe Davos quality air in Delhi
- Invited to PBC to experience this first hand







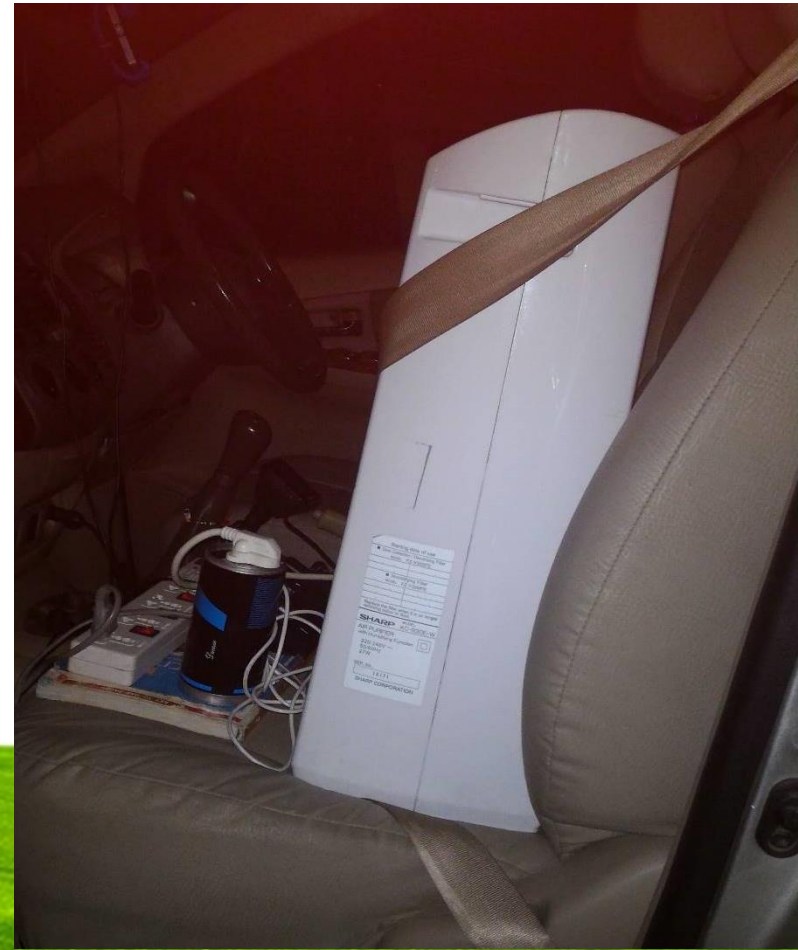


# SOLUTION 4

## Get clean air when driving

**A small air purifier can be fitted onto the front seat of the car**

- High quality DC to AC converter – Rs2500
- Air Purifier for Rs15,000
- Clean air in the car





# SOLUTION 5

## Get clean air when outdoors

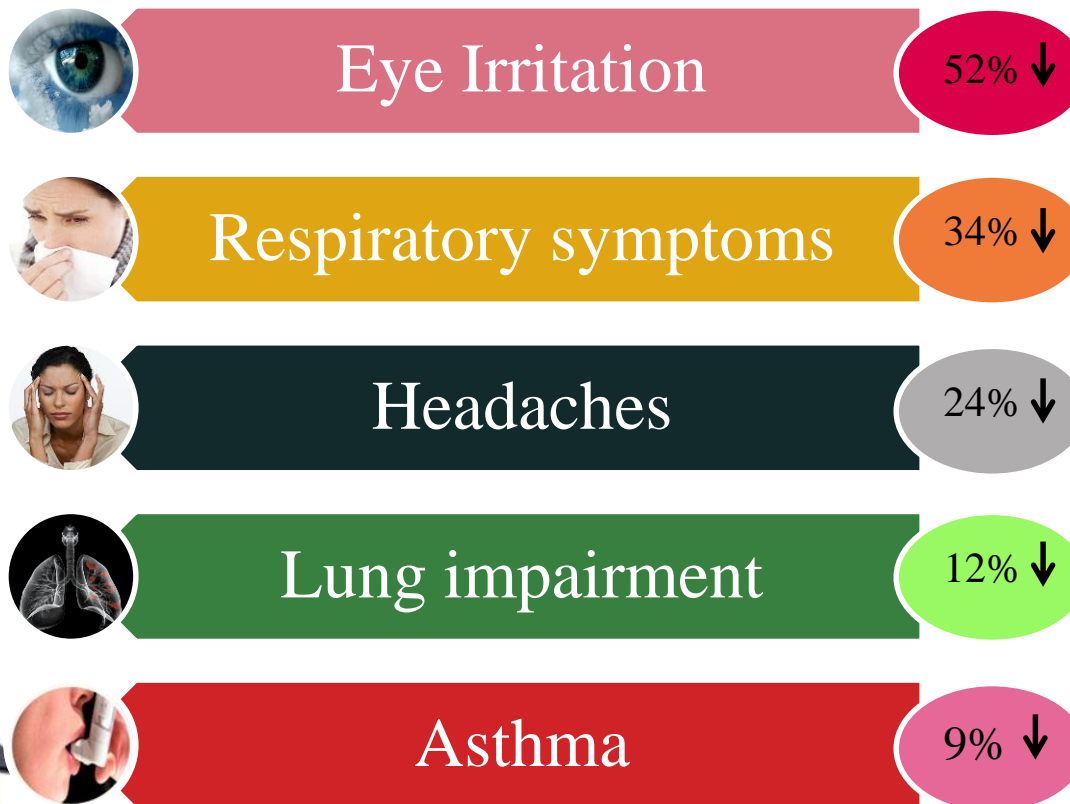
### Masks to protect when outdoors

- N95 / N99 – what is the difference
- Different price points



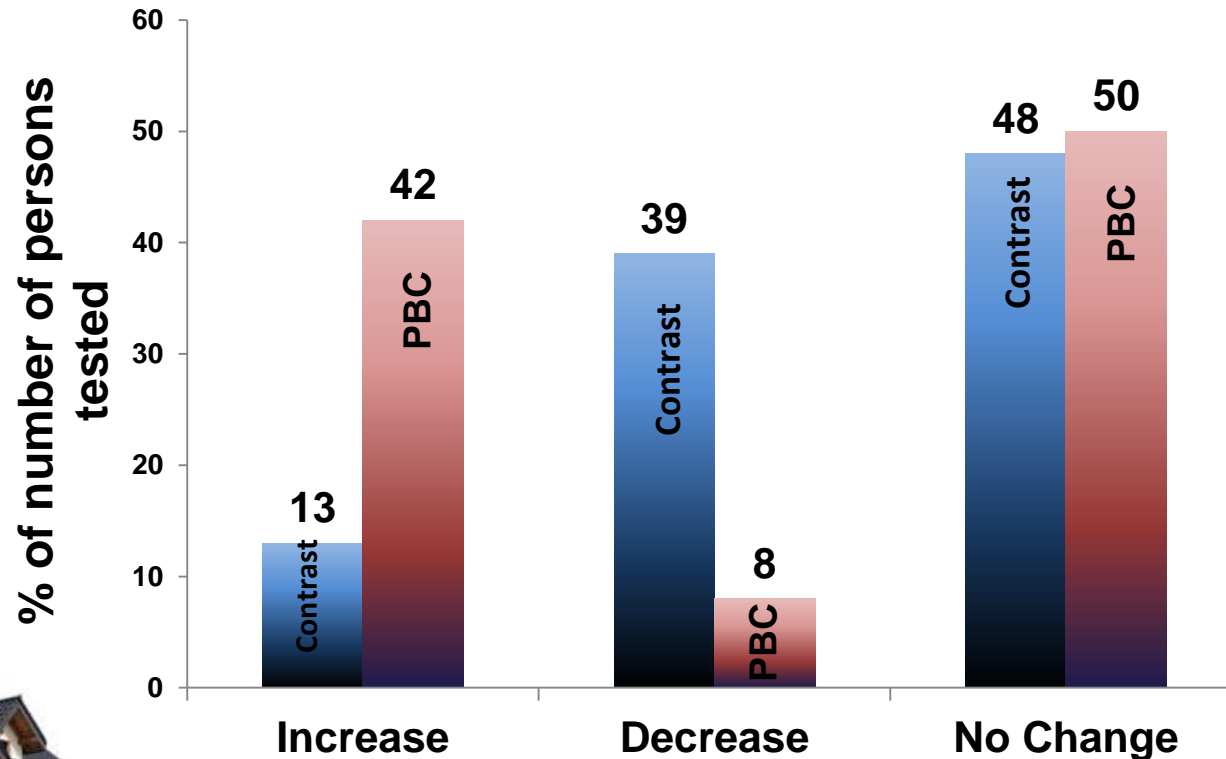
# RESULTS: Human Health

A study by Chittaranjan National Cancer Institute, Kolkata &  
Central Pollution Control Board (CPCB)  
Ministry of Environment & Forests, GOI



Providing cleaner air reverses the effects of pollution

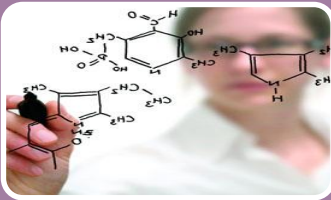
# RESULTS: Breathe Fresh, Feel Fresh



If a person spends 10 hours in oxygenated clean air, there is a 42% probability that their blood oxygen saturation level will go up by 1%



# FULL SERVICE IAQ SOLUTION PROVIDER



## IAQ TESTING

- Knowledge of what you are breathing is the first step to Clean Air
- Comprehensive suite of tests
- Reporting and recommendations for eventual corrective actions



## HOME SOLUTIONS

- Helping people breathe better air at home
- Testing of air quality at home, improving IAQ with plants and the right air purifier
- GOAL – Developing an air purifier that is AFFORDABLE by the masses and WORKS.



## LARGE COMMERCIAL SOLUTIONS

- We bring Davos to Delhi
- Improved energy efficiency and improved productivity of building occupants
- Mechanical filtration and Organic filtration technologies



## CSR – HELPING INDIA BREATHE

- NGO – Care for Air – in the making
- Creating a “mind map” of various organizations to understand gaps in air pollution issues
- Develop a 5 step plan for government with health effects studies to address air pollution

# Thank you



New Delhi, INDIA  
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