

NO_x it off now!

Air pollution mediation with photocatalytic pavements



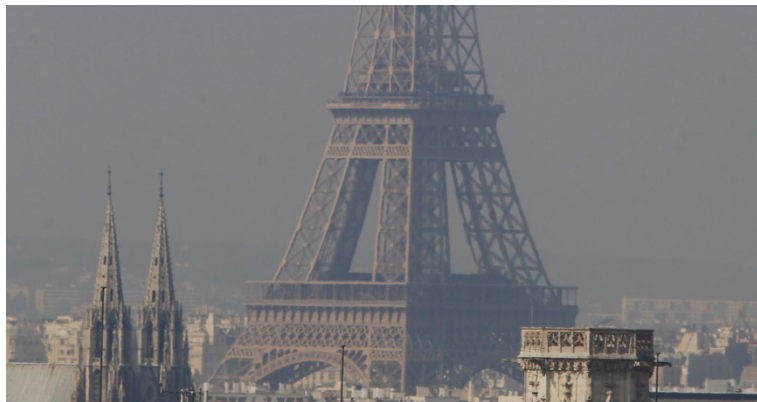
Chris Evers
727-638-1699

Air Pollution and it's causes

According to the EPA, over 90% of the fuel used for transportation is petroleum based

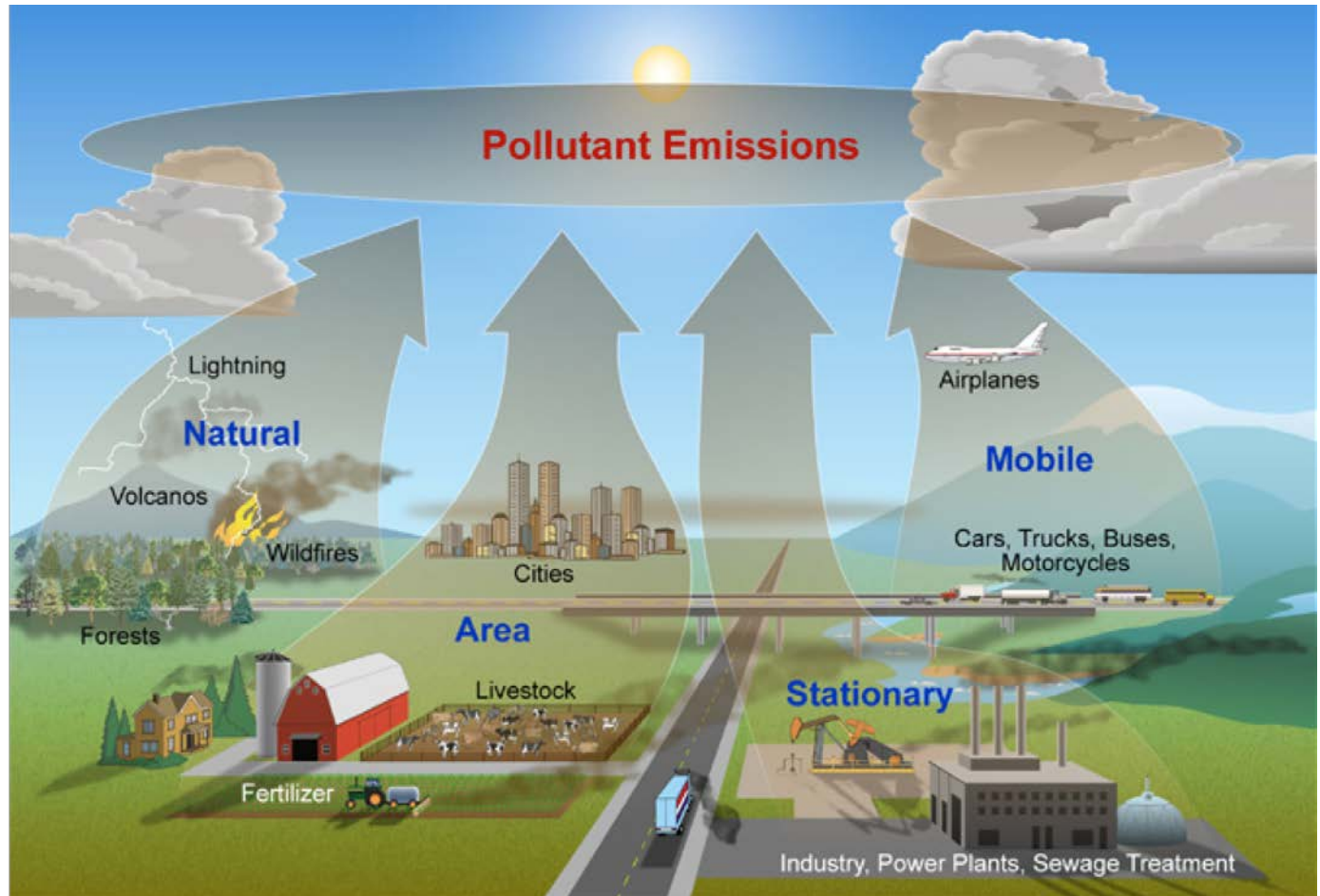
When combustion of oil occurs around 50% of the total emissions are NO_x

NO_x is the main culprit of visual air pollution and acid rain



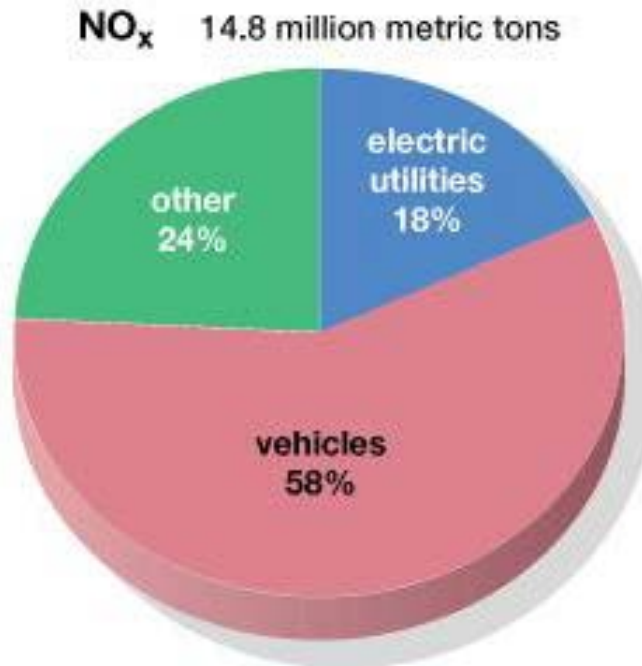
The causes:

Air pollution has many causes with some being natural, like volcanos



What is the leading cause of NO_x emissions?

The EPA estimates National NO_x emissions annually, the cause of the majority of NO_x emissions are caused by vehicles

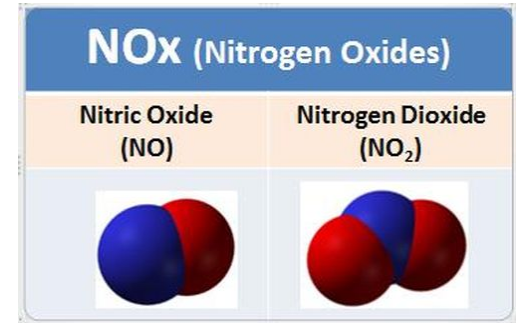


Source: EPA National Emissions Inventory (NEI)

What is NO_x?

NO_x is a term for mono-nitrogen oxides comprised of :

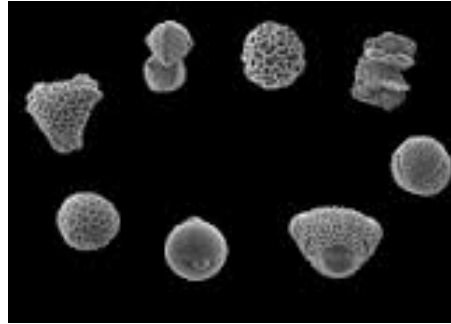
1. Nitric Oxide (NO)
2. Nitrogen Dioxide (NO₂)



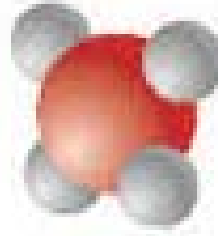
Nitrogen Dioxide receives special attention due to its adverse respiratory effects and because it acts as a precursor of both tropospheric ozone and particulate matter



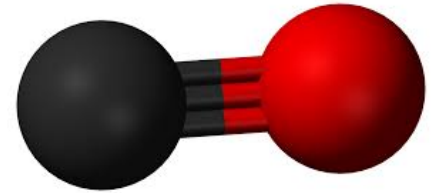
The main primary pollutants are...



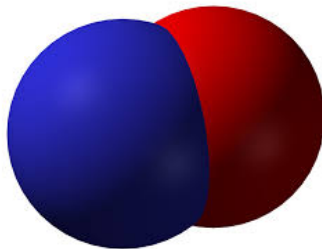
Particulate Matter
PM 2.5, PM 10



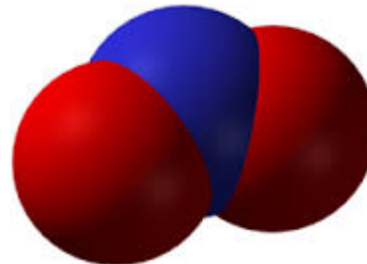
Volatile Organic
Compounds



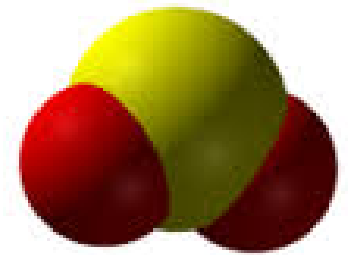
Carbon Monoxide



Nitric Oxide



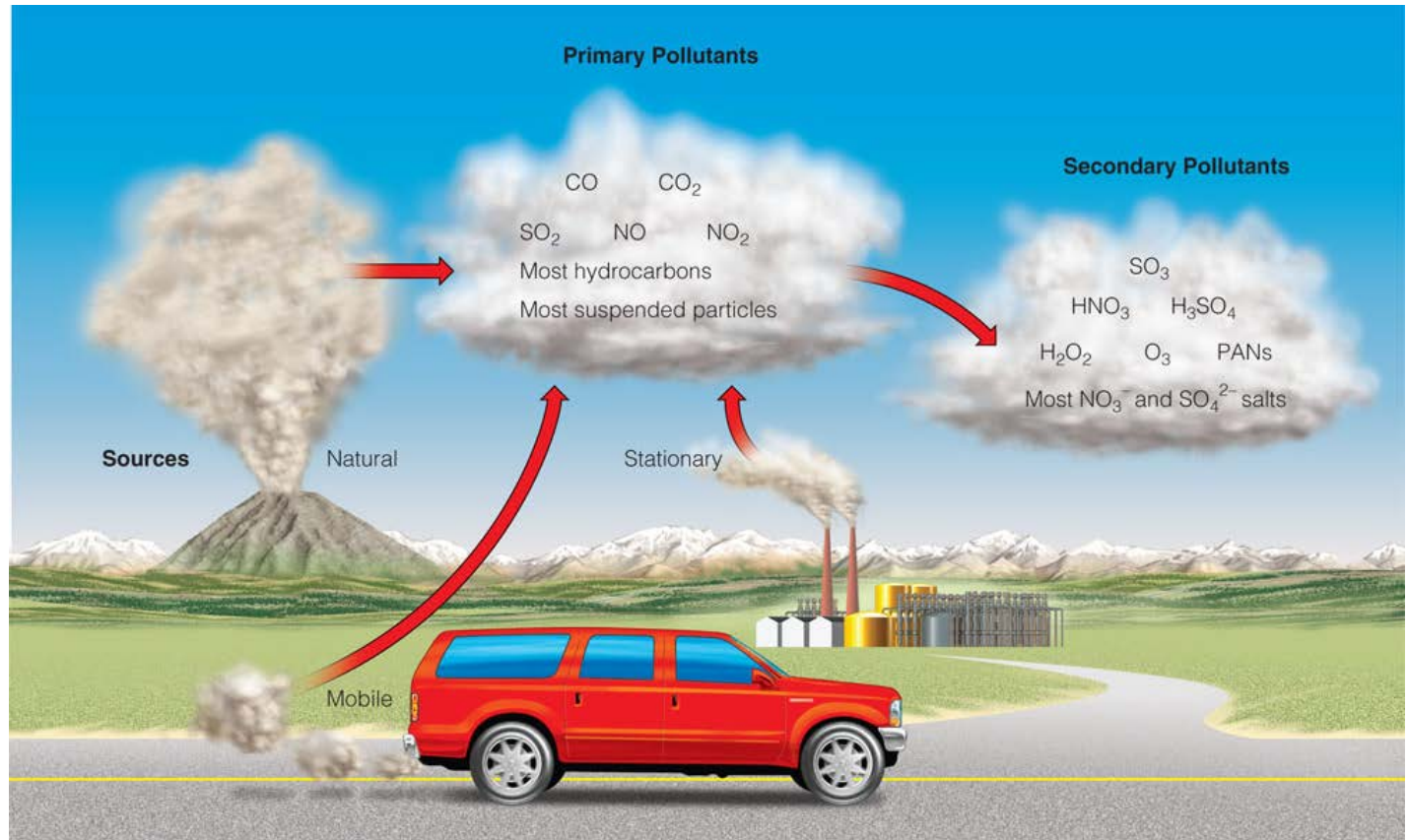
Nitrogen Dioxide



Sulphur Dioxide

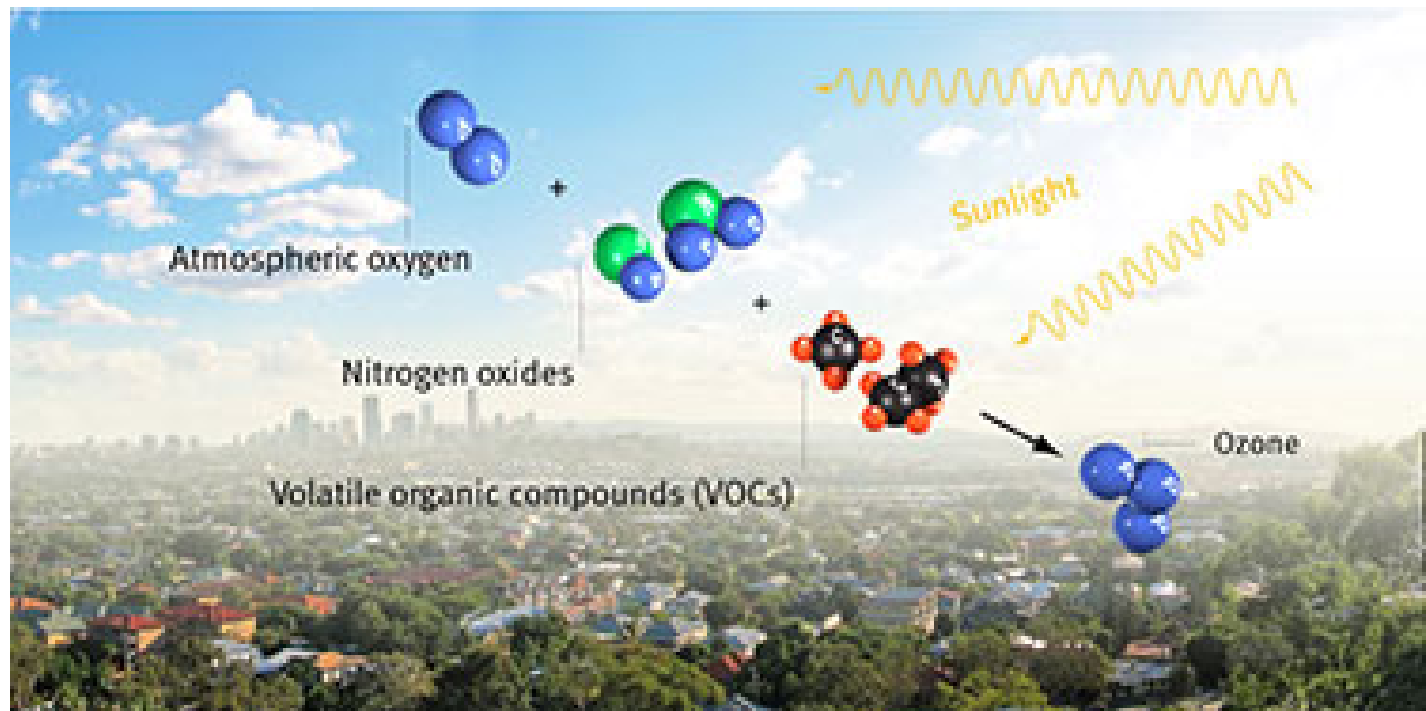
Primary pollutants

Primary pollutants are directly emitted from vehicles exhaust and contact the pavement on their way up



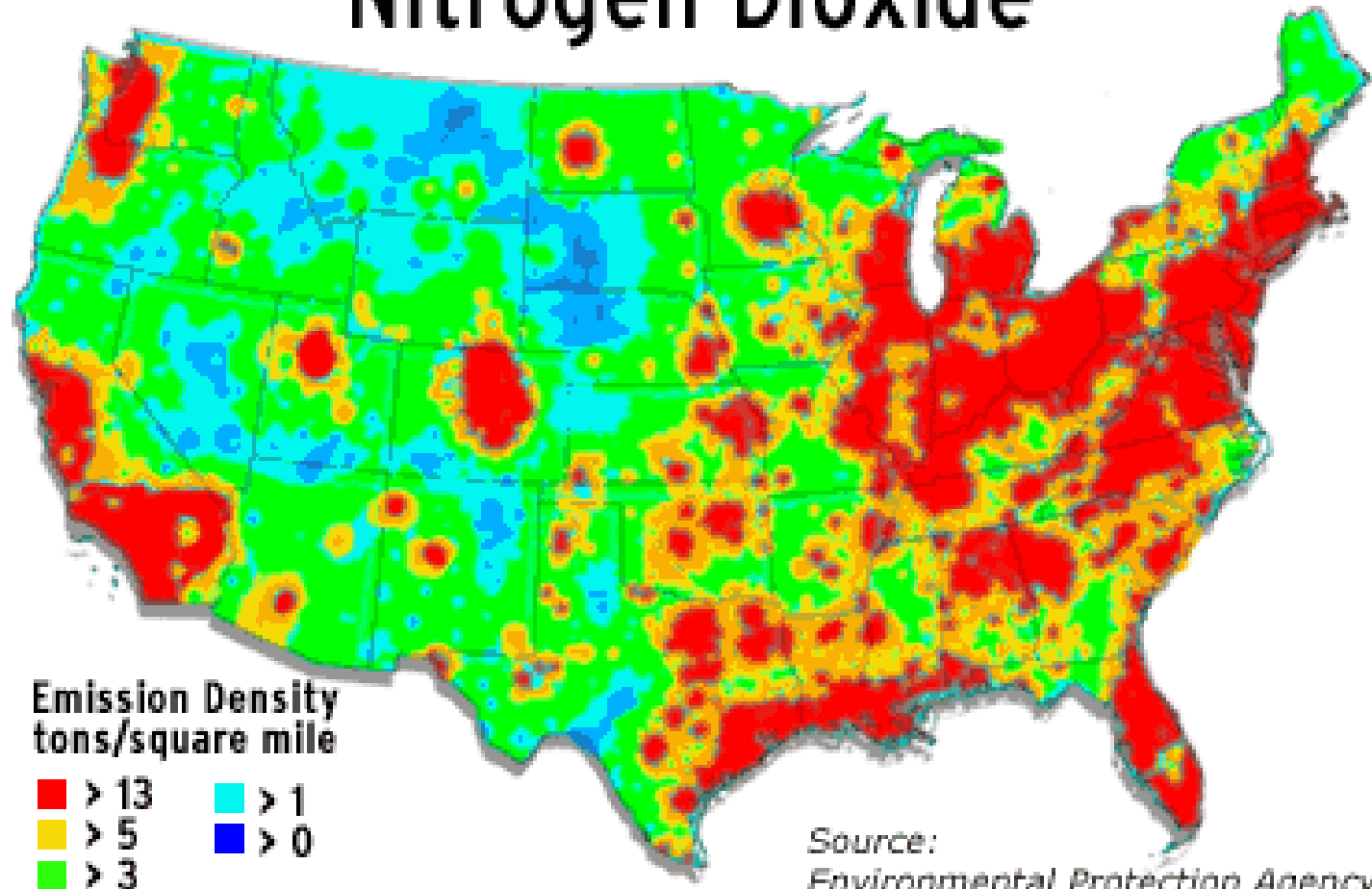
Primary pollutants then give birth to...

Primary pollutants mix with air and sun to form secondary pollutants, like dreaded ground level ozone



U.S. NO₂ emission density

Nitrogen Dioxide



NO_x per capita, worldwide



London, UK

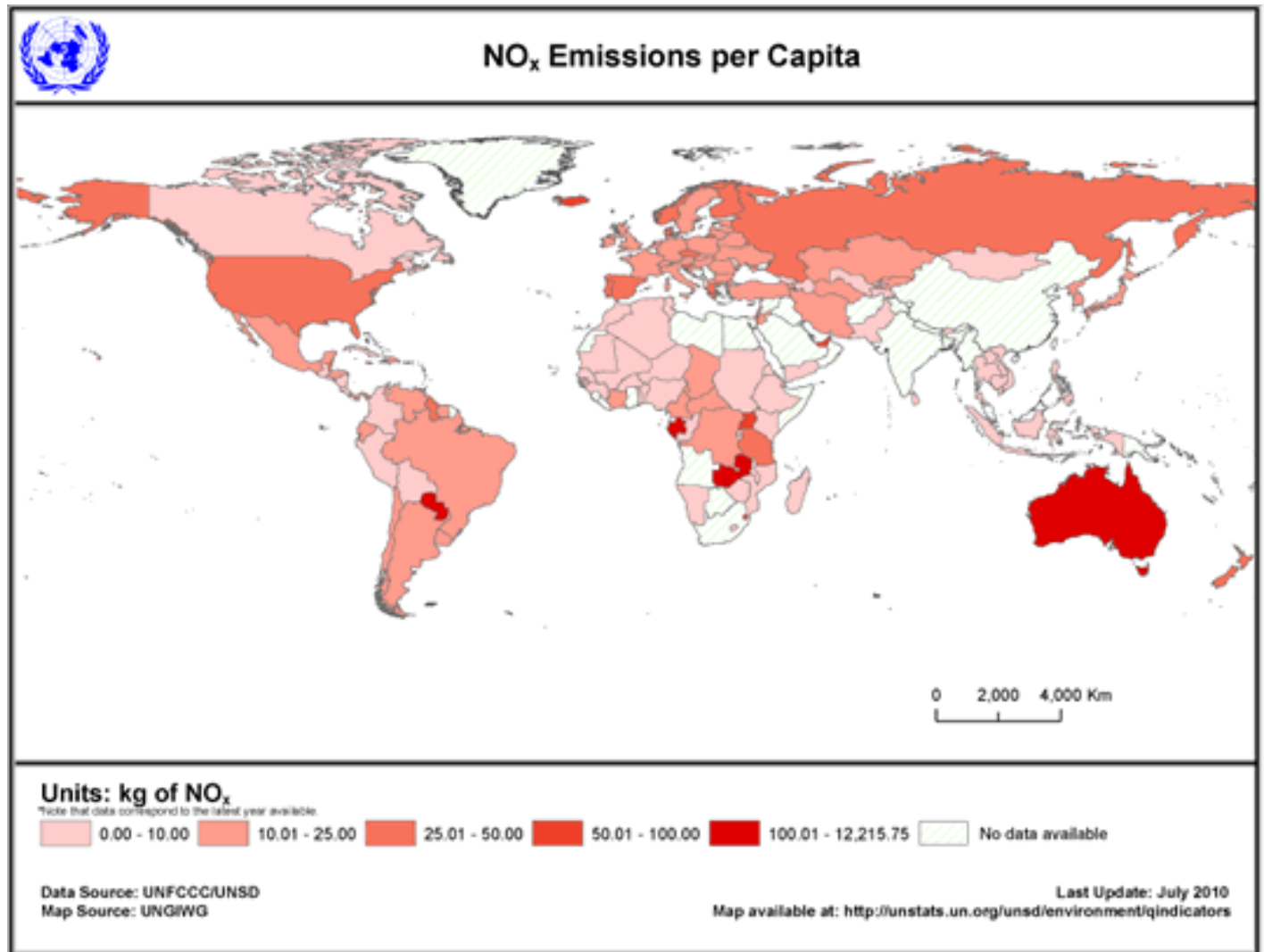


Beijing, China



Los Angeles, US

NO_x per capita





Effect of air pollution on public health

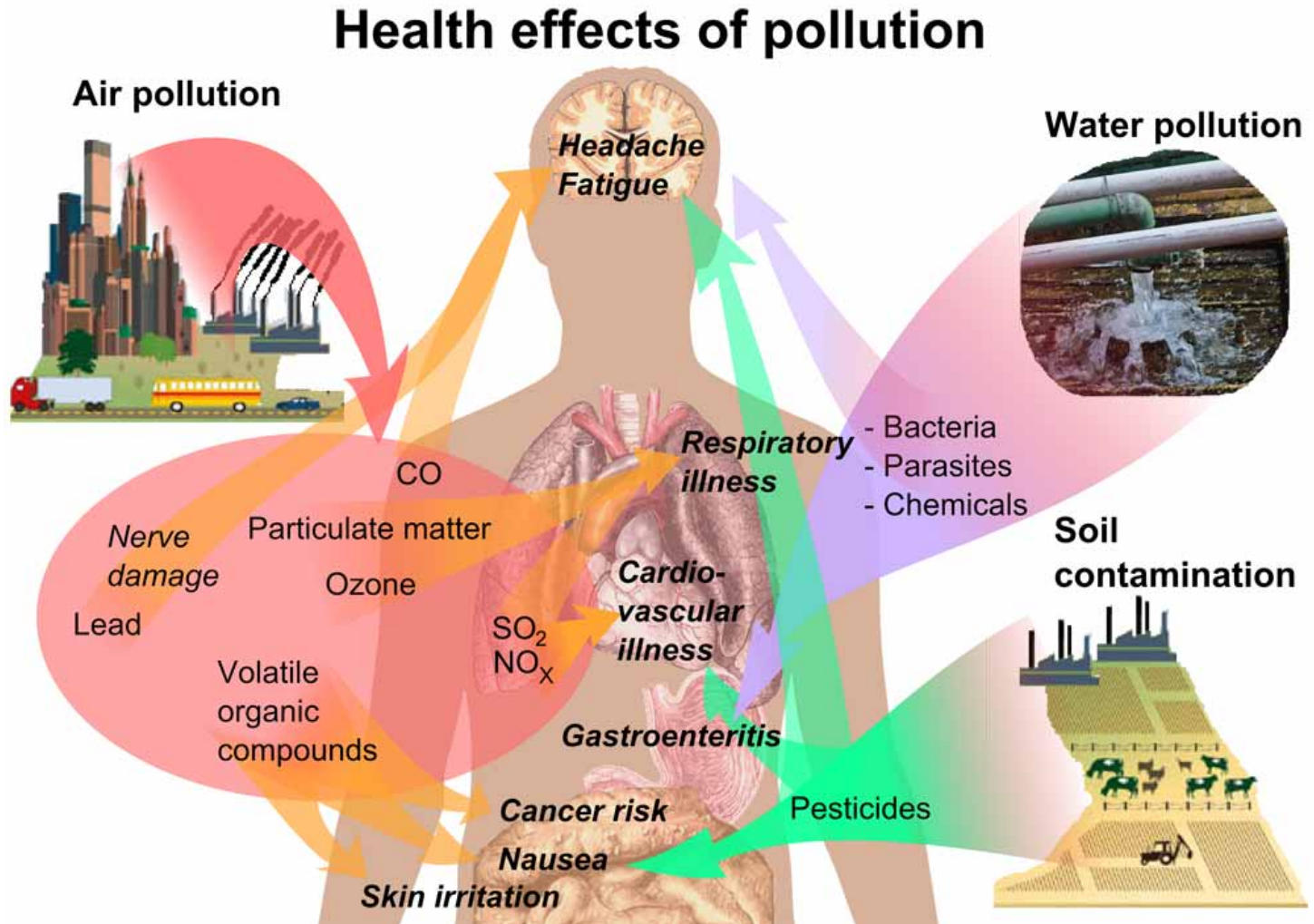
The World Health Organization (WHO) estimates there are 3.7 million premature fatalities worldwide due to poor outdoor air quality

Study shows 200,000 premature deaths in US due to combustion emissions

Bad air has shortened average life expectancy in China by over 2 years



Health effects



Health effects

SoCal hit with worst smog in years as hot, stagnant weather brings surge in hospital visits



Smog descends on downtown Los Angeles during a November afternoon in 2015. (Los Angeles Times)

By **Tony Barboza**

AUGUST 11, 2016, 9:00 AM

Southern California is experiencing its worst smog in years this summer as heat and stagnant weather increase the number of bad air days and drive up ozone pollution to levels not seen since 2009.

Where pollution is worst, in the Inland Empire, hospitals and asthma clinics are reporting increases in patients seeking treatment for respiratory illness, their breathing difficulties exacerbated by the persistent heat and pollution.

Ozone, the lung-searing gas in smog that triggers asthma and other health problems, has exceeded federal standards on 91 days so far this year compared to 67 days over the same period last year, according to South Coast Air Quality Management District data through Monday.

In June, only four days had healthy air across the South Coast basin, which spans Los Angeles, Orange, Riverside and San Bernardino counties. In July, ozone levels violated federal health standards every day except July 31.

Health effects

China Faces More Air Pollution Deaths

An analysis by
Michael Lelyveld
2016-07-18

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Pupils from an elementary school cover their mouths and noses as they leave the schoolyard after classes were suspended because of a "red alert" for heavy smog in Binzhou, east China's Shandong province, Dec. 23, 2015.

Despite a strong push to improve air quality, China's citizens will suffer over 2 million premature deaths annually due to pollution for decades to come, according to a recent report.

The study released last month by the Paris-based International Energy Agency (IEA) follows World Health Organization (WHO) estimates that air pollution causes at least 6.5 million premature deaths a year worldwide.

AFP

In 2014, the WHO put the death toll from air pollution for 2012 at 7 million, calling it "the world's largest single environmental health risk."

The new IEA estimate includes 3 million fatalities due to outdoor air pollution and 3.5 million more from poor indoor air quality, largely from cooking and heating with wood, coal and biomass fuels.

One-third of the deaths are occurring in China, including 1 million from outdoor pollutants and 1.2 million indoors, the IEA said in its 266-page study, which also profiled other countries and regions including India, Africa and the United States.

Bad air has shortened the average life expectancy in China by over two years, it said.



*...n (top C) walks along an overpass amid heavy smog in Beijing
...the Chinese capital's first-ever red alert for air pollution, Dec.
Credit: AFP*

...ss effective substitution opportunity," said Herberg, adding that large-scale
...n of transport is still a long way off.

...dards are expected to cut NOx emissions from passenger cars by 45 percent, the

...egacities have tried to control the exhaust problem by slowing the growth of
Beijing's current five-year plan would limit the number of cars on the road to
...t of next year, rising to 6.3 million in 2020, state-run ECNS news said.

...orts to curb indoor air pollution will succeed in reducing premature deaths
70,000 in 2040 with demographic shifts, safer stoves and cleaner fuels,
...will still be using biomass for cooking and heat.

...ts, the bottom line is that reductions in indoor pollution deaths will not
...ses in outdoor pollution fatalities with policies that have been laid out

Controlling
exhaust

Transport
emissions may
prove tougher to
reduce than
emissions from
coal, which is
expected to cover
less than half of
China's total
energy needs by
2040.

"I think it's easier
to make progress
on the coal side
than it will be on
the transportation
side because

Air pollution linked to breast cancer?

Breast Cancer Possibly Linked to Air Pollution

Share on Facebook

 Michael Graham Richard (@Michael_GR)
Living / Green Food
October 12, 2010



"Across Montreal, levels of NO₂ varied between 5 ppb to over 30 ppb. We found that risk increased by about 25 per cent with every increase of NO₂ of five parts per billion. Another way of saying this is that women living in the areas with the highest levels of pollution were almost twice as likely to develop breast cancer as those living in the least polluted areas."

A study recently found a worrying correlation between markers of air pollution and breast cancer. The study used detailed historical air-pollution map tracking nitrogen dioxide, a marker for air quality, and the home addresses of women diagnosed with breast cancer in a 1996-97 -- something that hadn't been done before.

What is the cost of air pollution?



The World Bank estimates air pollution costs the global economy more than \$5 trillion annually in welfare costs

The International Energy Agency (IEA) estimates the cost of major life-saving advances are available at an additional:

1. \$2.3 trillion in advance pollution control mostly for vehicles
2. \$2.5 trillion for energy sector advances



Air pollution is blamed for increases in road accidents

Oliver Moody, Science Correspondent

October 3 2016, 12:01am, The Times



A PhD student at the London School of Economics found that the number of accidents on British roads fluctuated in line with levels of nitrogen dioxide

PETER MACDIARMID/GETTY IMAGES

Heavy pollution makes people drive more dangerously, according to the first study to link dirty air with road accidents.

Scientists have already established that being exposed to airborne pollutants such as ozone and microparticles of soot even for a few hours can harm children's test scores at school and make workers in factories and call centres less productive.

Now Lutz Sager, a PhD student at the London School of Economics (LSE), has shown that breathing in air pollution has a similar judgment-impairing effect on drivers



The Solutions: Walking, biking, EV etc?

In Paris, the Mayor restricted car traffic to license plates ending in even or odd #'s

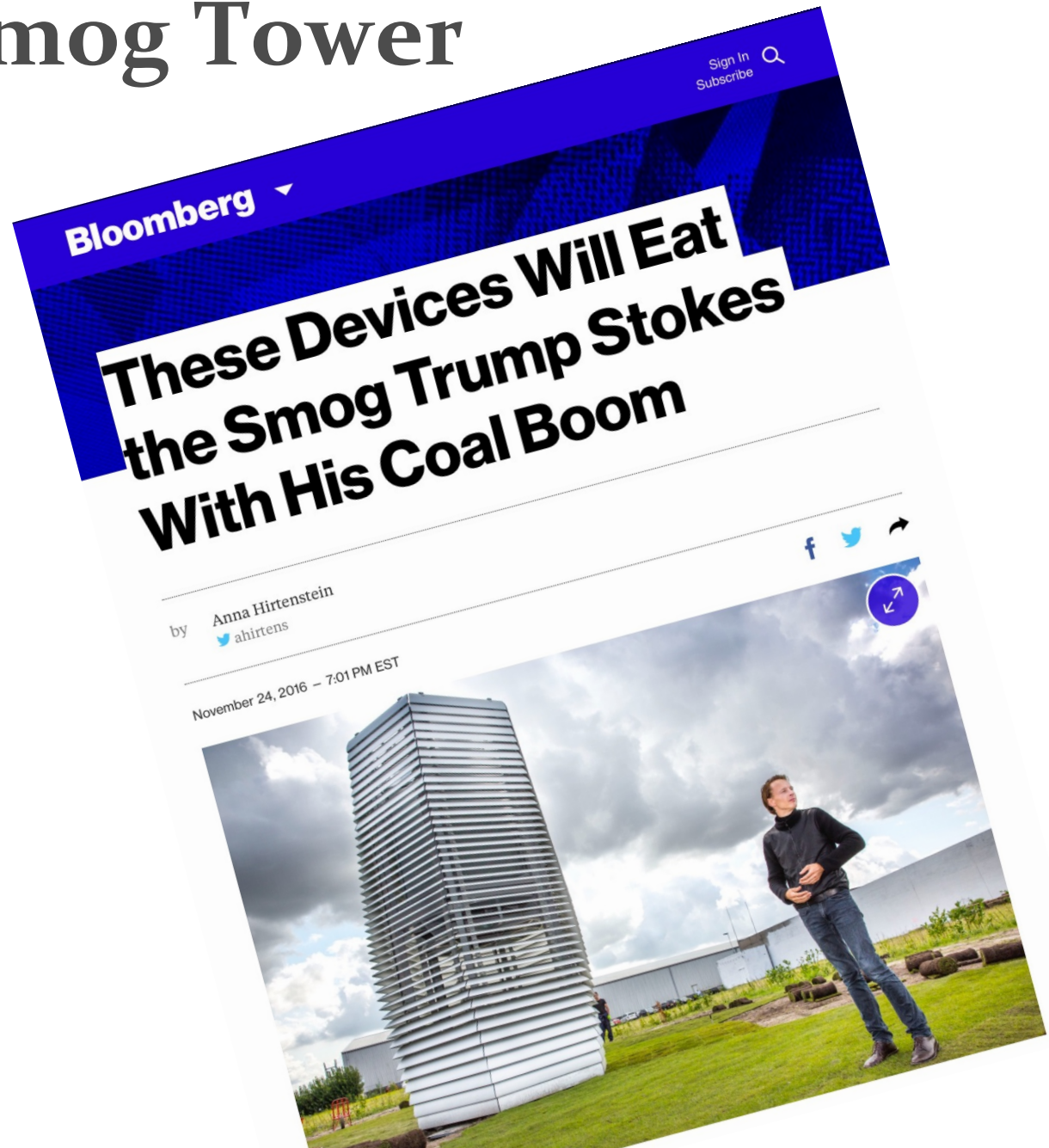
China routinely shuts down factories, power plants and restricts vehicular traffic

California has the strictest emissions standards in the Country, encourages EV/hybrid cars

India provides masks and pollution free signs to it's citizens



Smog Tower





The Solutions: Photocatalytic reactions

Many of the most promising pollution busting technology uses photocatalytic reactions created by the use of Titanium Dioxide TiO_2

Other technology's utilize bacteria and filtration however hazardous byproducts are one of the drawbacks

The advantage of using TiO_2 based strategies is the only byproduct is NO_3 or nitrates which are essentially harmless

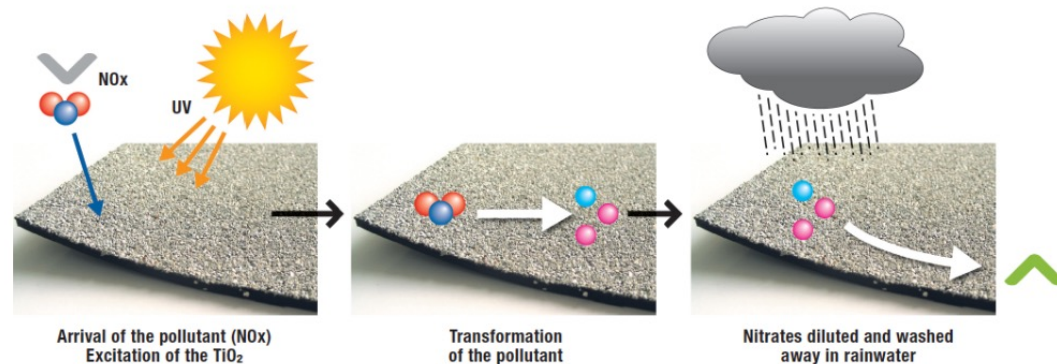
The Solutions: Roofs

Benefits:

- Air purifying effect
- NOx reduction
- Sustainable
- Multi - purpose solution
- Certified performance



The Noxite® Process

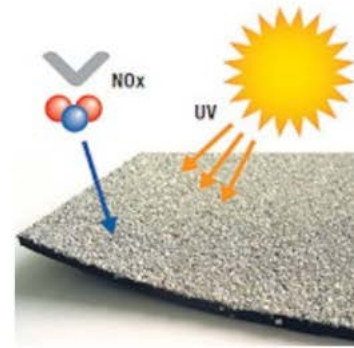


Eco-Activ® Noxite® membranes are self protected by granules based upon TiO_2 (titanium dioxide in its anatase form) which functions as a catalyst actuated by UV rays from sunlight. The granular make up of the membrane maximises the photocatalytic surface area and the efficiency of the NOx depolluting potential, neutralising more than 90% of the particles. On contact with the granule NOx is changed to form harmless levels of nitrates* which are washed away as a dilute solution in rainwater. The resulting depolluting effect is permanent throughout the life of the waterproofing membrane.

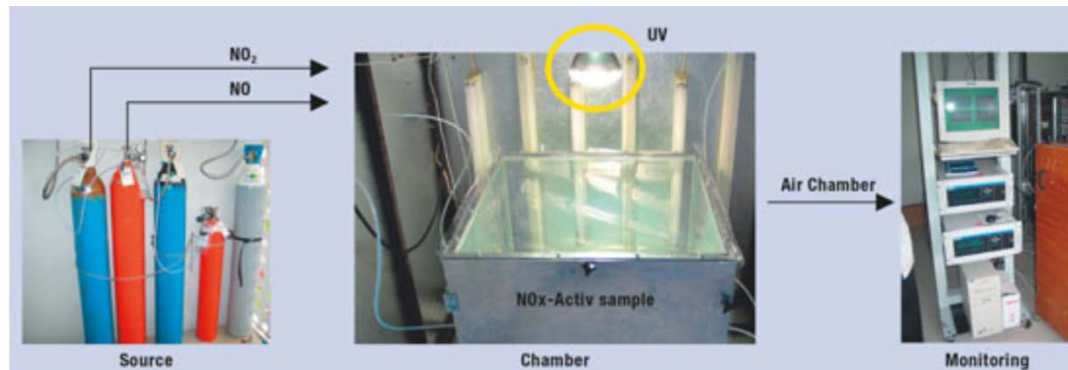
**Levels of nitrates are less than those found in bottled mineral water.*

The Solutions: Roofs

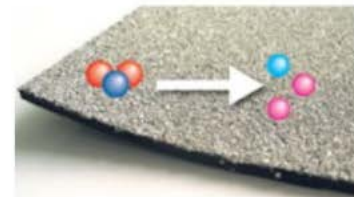
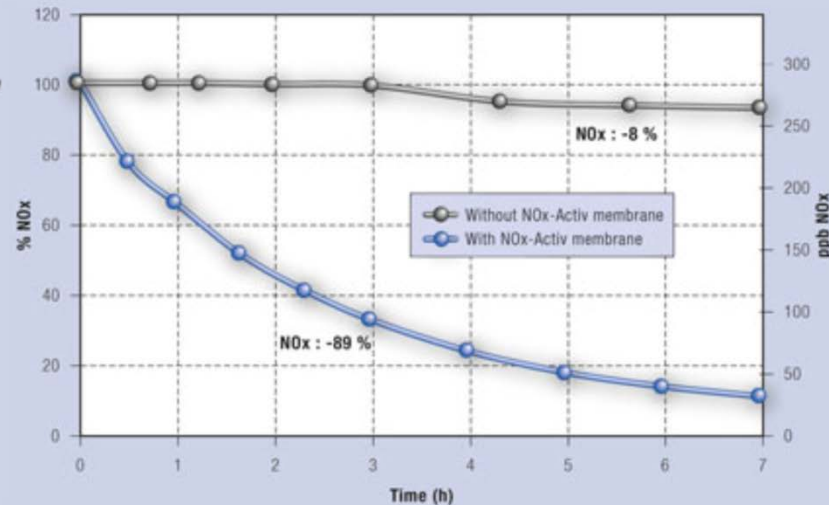
Noxite® roofing membrane use results in NOx reduction of 89% in CNRS study



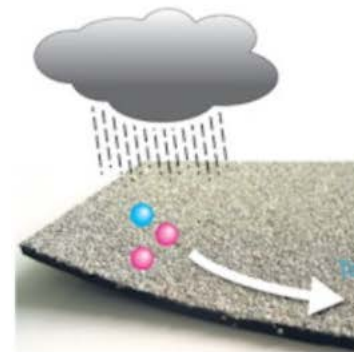
Arrival of the pollutant (NOx)
Excitation of the TiO_2



Study carried out in collaboration with the CNRS of Orléans (Institute of Combustion, Heat and Airflow Reaction, Reactivity and Environment).



Transformation of the pollutant



Nitrates diluted and washed away in rainwater

Case Study from Alachua County 911 Center



ico pal World Reference in Waterproofing Technology

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ROOFING CASE STUDIES

- Holcombe Brook Primary School, Bury, Lancashire
- St Martin's Special School - Gibraltar
- Jubilee House, Vancouver, Canada
- Alachua County 911, Florida, USA**
- Moorlands Junior School, Sale
- Morden Mount Primary School, Greenwich
- William Harvey Hospital

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Alachua County 911, Florida, USA

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Project Overview

Project: Alachua County 911 Centre
Location: Gainesville, Florida, USA
Area: 2,500 m²
Completion Date: May 2013
Contractor: Ferber & Osteen Roofing & Sheet Metal
Specifier: Paul Stresing Associates Inc
Client: Alachua County Sheriff's Office
System: Siplast Paradene System with [Noxite Eco-active capsheet](#)

[Download this case study](#)

Problem

The Alachua County Combined Communications Center houses 911 service technology for the city of Gainesville and the surrounding area, representing over 227,000 residents plus the population of the University of Florida.

When it was time to replace the building's old roof, the County's primary concern was reliability. But in addition, they approached the project from an environmentally conscious perspective, and wanted a system that would be sustainable and green.

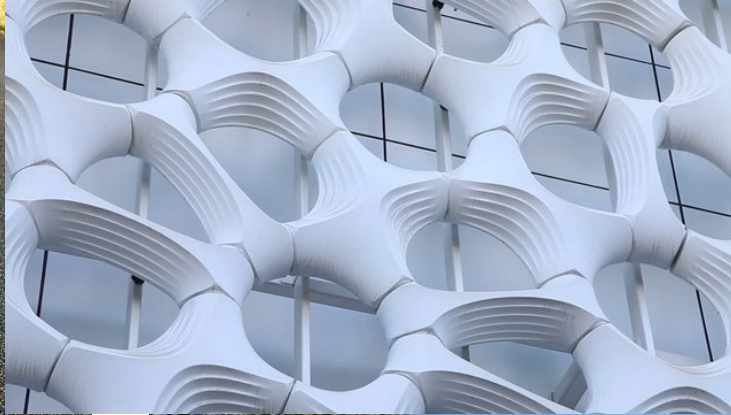
performance needs of this critical facility, the two-ply Icopal Siplast SBS- modified

Find Local Support
To discuss your project in more detail please contact
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Email: sales.uk@icopal.com

The Solution: Buildings



Torre de Especialidades
Hospital, Mexico City
Mexico

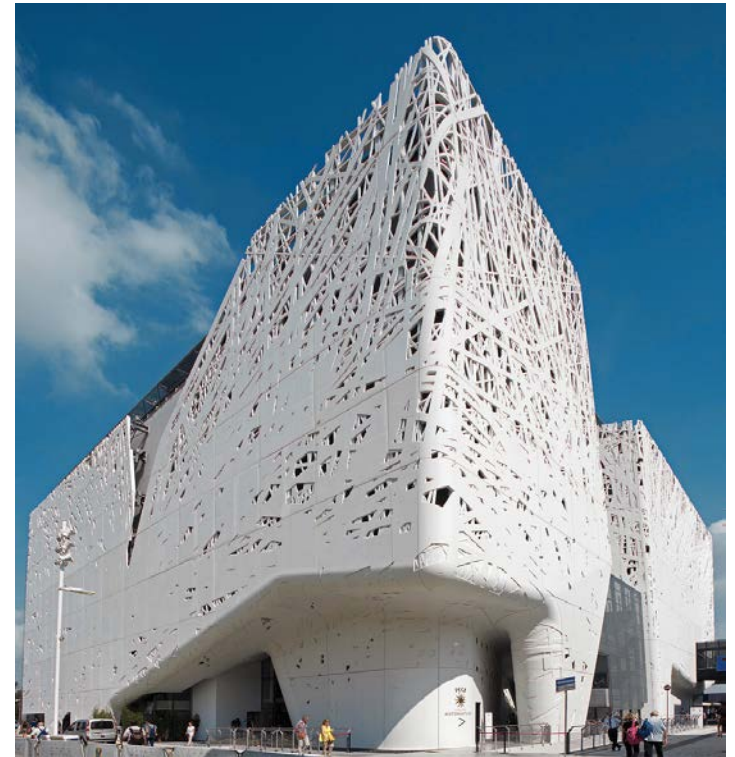
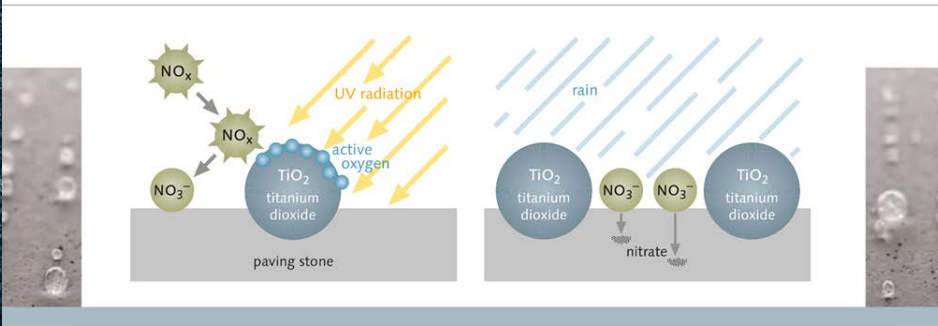


The Solution: Buildings

The Palazzo Italia built for the 2015 World's Fair was constructed using a type of concrete called Tiocem®

It used 9,000 square meters of photocatalytic concrete with titanium dioxide mixed in

Reaction process of NO_x reduction by TioCem®



Palazzo Italia, Milan Italy

The Solution: New Roads

Tiocem[®] has also been used to construct new concrete block roadways however the cost of reconstruction is a deterrent to rapid adoption

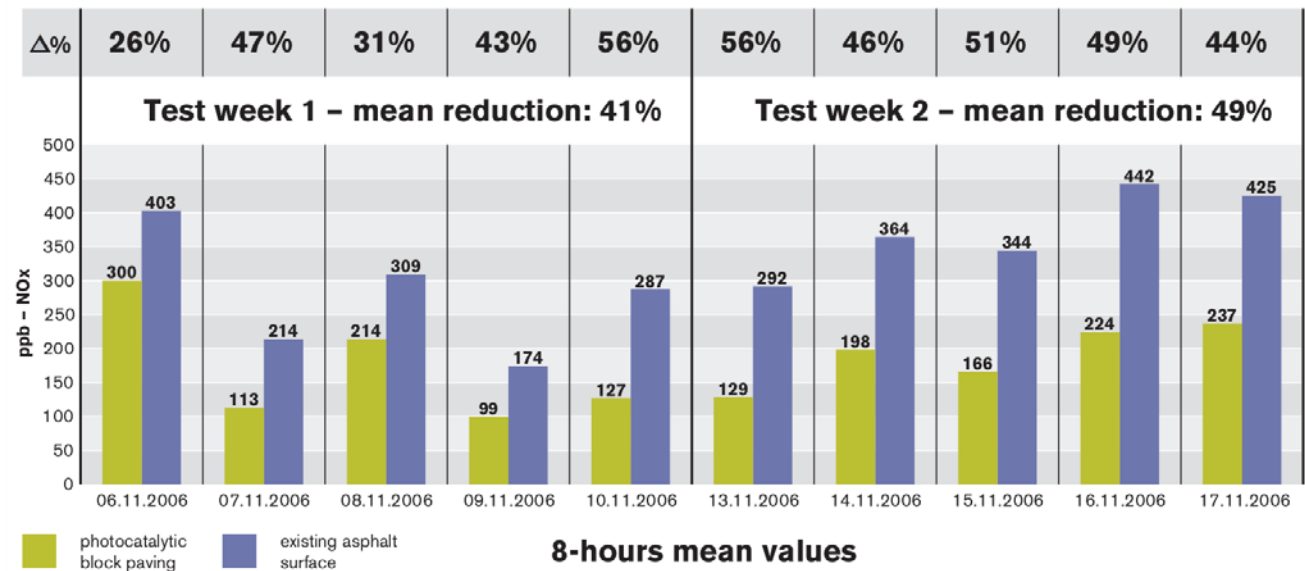


Borgo Palazzo Street,
Bergamo, Italy

The Solution: New Roads

Tiocem[®] was tested over a two week period in November 2006 with mean reductions ranging from 41% to 49%

Example of NO_x reduction – November 2006



The Solution: Roads

Charlotte County, Florida another worldwide first as PTI performed the first retrofit of an existing roadway using A.R.A.-1 Ti[®] which has photocatalytic properties



Asphalt Roads

A.R.A.-1 Ti[®] is a polymerized rejuvenating seal with TiO₂ added for air pollutant mediation

The air-purifying surface will perpetually regenerate itself throughout the life of the pavement

The A.R.A. – 1Ti[®] fully penetrates into the pavement and provides an in-depth seal as well as extending the life of the pavement



Concrete Roads

Tuesday in Austin, Texas PTI applied our Litho 1000 Ti[®] concrete sealer and hardening agent on I-35 as part of a two step process

1. Skidabrader – surface texturing
2. Application of the Litho 1000 Ti[®]



Concrete Roads

The Litho 1000 Ti[®] was specified to assist TxDOT with polishing that is common due to softer aggregates used in Texas PCC pavements which is why texturing was necessary as well



Before



After



Road Solutions

A.R.A.-1 Ti[®] and Litho 1000 Ti[®] cost only marginally more than regular “top of the curve” preservation strategies

What is it worth to you? Does your agency value air pollution mitigation?

The next step is to perform more A.R.A.-1 Ti[®] and Litho 1000 Ti[®] projects in Florida!



Conclusion

The best approach is likely a combination of all of these solutions

Whether it's pollution eating roofs, buildings or photocatalytic pavement solutions like A.R.A.-1Ti[®] and Litho 1000 Ti[®], these technology breakthroughs hold tremendous promise

We owe it to our children and grandchildren to help solve air pollution



NO_x it off now!

Air pollution mediation with photocatalytic pavements



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