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Oslo Effect 2

How air pollution harms your health

(An update to the original Oslo Effect report of 1988)

Does air quality matter?

Yes. Ambient (outdoor air pollution) in cities and rural areas caused three million premature deaths worldwide in 2012 – predominately in low- and middle-income countries. And the World Health Organisation (WHO) is confident that, if we reduce air pollution, it would cut rates of stroke, heart disease, lung cancer, asthma and respiratory disease. Researchers at King's College London (KCL) have recently confirmed that high levels of toxic air particles from traffic and combustion are associated with an increase in hospitalisations and deaths from heart and lung disease in children and younger adults.
But it is a huge task; in 2014, only 8% of the world's population lived in places where the WHO air quality guidelines were met.

Highlights

Outdoor air pollution caused three million premature deaths worldwide in 2012.
A positive relationship exists between vehicle weights and non exhaust emissions
Electric vehicle on average 24% heavier than their conventional counterparts
Electric PM emissions are comparable to those of conventional vehicles
Non-exhaust sources account for 90% of PM10 and 85% of PM2.5 from traffic
Future policy should focus on reducing vehicle weight
A dead end narrow Government policy
A link between Transport emissions and age related health problems 45 years +

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Original Study data From Passenger Transport In Oslo 1988

Particles are divided into five main categories

1. Exhaust from combustion engines
2. Asphalt wear
3. Tyre wear
4. Brake wear
5. Fine grinding of larger particles already torn loose from the road surface

1. Exhaust from combustion engines: - PM 2.5 + PM 10. 133 tons/year.
A total 75% (99.75tons/year) are from private cars,
and 25 (33.25ton/year) from buses and taxis.
A total of bus & taxi emissions of 332.5 tons by 2006

2. Asphalt wear: - PM 2.5+ PM 10: - 179 tons/year.
A total 93% (1 66.47tons) are from private cars, 12.53 tons (7%) from buses and taxis.
This type of emission is anticipated to drop, by 35-71% depending on how the modal split will be due to tyre dubs being banned or highly taxed in Oslo.
There will be no reduction in the bus calculation, as bus & trolley bus do not use dubbed tyres.
A total of bus & taxi emissions of 125.3 tons by 2006

3 . T y r e W e a r . The amount of airborne pollution caused by the wearing down of tyres amounts to a total of bus & taxi emissions of 81.20 tons by 2006
It wears out – where does it go?

4. Brake Wear.

The amount of airborne pollution caused by the wearing down of brake pads and associated equipment amounts to PM2.5+PM 10: 55 tons/year.
5. Fine grinding of larger particles already torn loose from the road surface: PM2.5+PM 10: 78 tons/year.

A total 94% (73.32tons) are from private cars, 4.68tons (6%) from buses and taxis.

The total tonnage for clean bus & taxi in the urban area by 2006 are as follows: - -
Exhaust from combustion engines 332.5 tons -
Asphalt wear 125.3 tons -
Tyre wear 81.20 tons -
Brake wear 55.0 tons -Fine grinding of larger particles already torn loose from the road surface 46.80 tons
Total Pollution 640.8 tons.
This summary does not give separate figures for buses and taxis.

A separate report from 2003 shows that private cars in Oslo made 3212 million person-km compared to taxis 175 million. Assuming the number of persons in private cars and taxis being the same and assuming taxis pollute the same as private cars, then taxis should add 5.2% to the private car figures (and reduce the same from buses only).
The direct pro rata costs incurred of Bus & Taxi pollution are apparently not included in full when the Cost Benefit Ratio (s) are calculated by DFT.
This has resulted in a bias toward bus based systems and not the level playing field that is currently claimed by the Department of Transport and the UK Government's statement that Trams & Light Rail are too expensive

The European Commission has told the UK to clean up its air. Levels of nitrogen dioxide – which is linked to heart and lung disease and contributes to the early deaths of 40,000 people a year in the UK – are particularly bad.
We're not the only ones with filthy air; the five most-developed countries in the EU (Germany, France, Italy, Spain and the UK) are all in breach of the recommended limits and have been given two months to take action.
Yet gone are the days of epic smogs, such as the great smog of 1952 that enveloped London in a thick fog for four days and killed an estimated 12,000 people.
That crisis led to a new awareness of the dangers of air pollution and the need to protect our air with legislation. So surely our health is less at risk now?

London breaches annual air pollution limit for 2017 in just five days

The vast majority of us are breathing sub-standard air. Yet change is possible. According to the Department for Environment, Food and Rural Affairs (Defra), between 1970 and 2015, there was a long-term decrease in UK emissions of all air pollutants (ammonia, nitrogen oxides, non-methane volatile organic compounds, particulate matter and sulphur dioxide).

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What is air pollution?

Air pollution has four key pollutants – particulate matter (PM), ozone, nitrogen dioxide and sulphur dioxide – can cause health risks if limits set by the WHO are exceeded. PM is a mix of solid and liquid particles suspended in the air and it affects more people than any other pollutant.

In 2012, there were 37,800 premature deaths in the UK attributed to PM exposure, compared with 14,100 premature deaths from nitrogen dioxide pollution. Size matters; the smaller the particle, the worse it is:

"The most health-damaging particles are those with a diameter of 10 microns or less, (PM10), which can penetrate and lodge deep inside the lungs. Chronic exposure to particles contributes to the risk of developing cardiovascular and respiratory diseases, as well as of lung cancer," says the WHO.
Ozone at ground level – which is different to the ozone layer in the atmosphere – forms when sunlight reacts with air pollutants. So, high ozone levels occur when it is sunny and can trigger asthma attacks and breathing problems in susceptible people.
Nitrogen dioxide is a product of combustion (burning fuel for heat, power, engines and ships) and has a negative effect on lung function, especially in children with asthma.
Sulphur dioxide is a colourless gas released when sulphur-containing fossil fuels are burned to produce heat and power.
High levels cause eye irritation, breathing difficulties and an increase in hospital admissions and mortality among people with heart disease and respiratory illness.

"The particles we found are strikingly similar to magnetite nanospheres that are abundant in the airborne pollution found in urban settings, especially next to busy roads and which are firmed by combustion or frictional heating from vehicle engines or brakes."

We know that air pollution can have a negative impact on certain aspects of human health, but we can't conclude from this study that magnetite carried in the air are harmful to brain health Dr David Reynolds Alzheimer's researcher Prof David Alsop of Lancaster University added: "This finding opens up a whole new avenue for research into a possible environmental risk factor for a range of brain diseases."

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Around 800,000 people in Britain suffer from dementia, mostly Alzheimer's disease, and the figure is expected to increase as the population grows older.
Tiny magnetic particles produced by car engines and brakes can travel into the human brain and may trigger Alzheimer's disease, scientists have warned.

Recently scientists reported that they have found a drug which appears to halt the progress of Alzheimer's by clearing the sticky plaques from the brain which prevent brain cells communicating.
But nobody knows what causes the plaques to form in the first place.

Air pollution has already been implicated in lung disease and heart attacks and recent studies have suggested that it could also be a factor in cognitive decline with a US study in 2014 showing that people in highly polluted areas were 50 per cent more likely to suffer mental decline.
But until now, nobody thought that the particles could reach the brain.
The new research suggests the particles can be inhaled and enter the brain through the olfactory nerve, which takes information about smells to the brain.
Prof Anthony Seaton, Emeritus professor of Environmental and Occupational Medicine at the University of Aberdeen said:
"This is an important study and adds to the body of evidence that the combustion of fossil fuels has widespread toxic effects on our health. "The solution to this is literally in our own hands as we take hold of the steering wheel."
Dementia charities said more research was needed to find out if air pollution could be responsible for conditions like Alzheimer's.
"We know that air pollution can have a negative impact on certain aspects of human health, but we can't conclude from this study that magnetite carried in the air are harmful to brain health," said Dr David Reynolds, Chief Scientific Officer at Alzheimer's Research UK.

Dr Clare Walton, Research Manager at The Alzheimer's Society, added: "Magnetite has previously been seen in the amyloid plaques in the brains of people who have died with Alzheimer's disease.
"This study offers convincing evidence that magnetite from air pollution can get into the brain, but it doesn't tell us what effect this has on brain health or conditions such as Alzheimer's disease."

Researchers at Lancaster, Oxford and Manchester Universities discovered microscopic spheres of the mineral magnetite in the brains of 37 people in Manchester and Mexico who had suffered neurodegenerative disease.

The mineral magnetite is known to be toxic and is linked to the production of free radicals which are associated with Alzheimer's Disease.

Researchers said the findings opened up a 'whole new avenue' into the causes of Alzheimer's disease

Although magnetite has previously been found in the brains of people who had died of Alzheimer's disease, it was thought it occurred naturally.
However the tiny balls spotted by the scientists had a fused surface suggesting they had been formed during extreme heat, such as in a car engine.

Magnetite - a form of iron oxide - is known to be produced in car engines - particularly diesel engines which can emit up to 22 times more particulates than petrol engines - as well as when brakes are used, both by cars and trains.
Researchers said the findings opened up a 'whole new avenue' into the causes of Alzheimer's disease, while charities said it offered 'convincing evidence' that the toxic particles could get into the brain.

"Our results indicate that magnetite nanoparticles in the atmosphere can enter the human brain where they might pose a risk to human health, including conditions such as Alzheimer's'" said lead author Professor Barbara Maher, of Lancaster University

The research was published in the journal Proceedings of the National Academy of Sciences

What can we do on bad air days?

The Daily Air Quality Index (Daqi) provides reliable information about levels of air pollution with recommended actions and health advice. resource says: "Air pollution has a range of effects on health. Clearly, if your breathing is already compromised by an underlying heart or lung problem (such as angina or asthma), you're more likely to suffer from the effects; those with asthma may need to increase their use of inhalers on days when levels of air pollution are higher than average.
Even the healthy general population may notice symptoms such as a dry throat, sore eyes and a tickly cough when pollution levels are very high,

When the air pollution banding is rated as very high, the advice to adults and children with lung problems, adults with heart problems and older people is to avoid strenuous physical activity and, for people with asthma, to use their reliever inhaler more often. The general population are advised to "reduce physical exertion, particularly outdoors, especially if you experience symptoms such as cough or sore throat".

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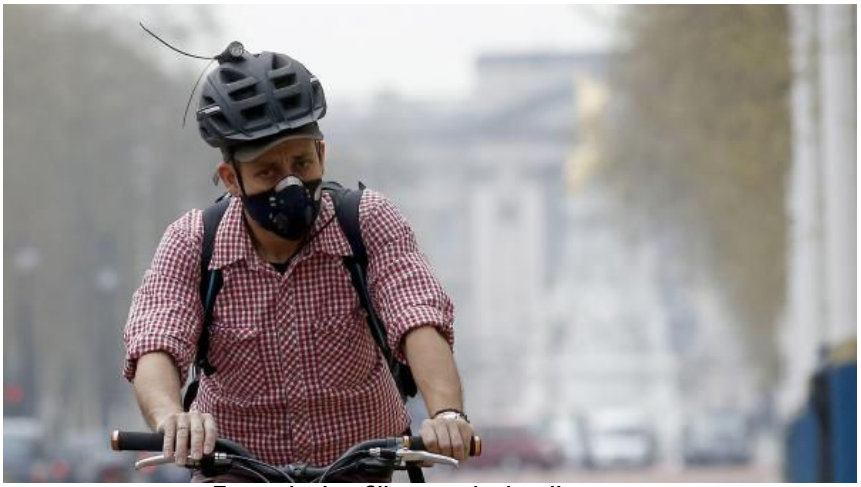
Millions of premature births could be linked to air pollution, study finds

Are babies at risk?

Air pollution has a small but significant impact on pregnancy and the health of babies and young children, according to a report from UCLA. It is not as bad as smoking during pregnancy or near your newborn baby, because the air pollutants are relatively diluted. But developing lungs are more susceptible to the damaging effects of air pollution and further study into the effects on pregnant women and infants are needed, says the report.

It is not clear whether cyclists are particularly at risk from pollution. KCL air quality experts have suggested that urban cyclists could be exposed to lower levels of particulates than average; either because their journeys tend to be short or because being on the move outdoors means you are not trapped in smog. However logic dictates that cycling in a heavily polluted transport corridor by rubber wheeled buses and truck will significant raise the risk level to a dangerous level. How many cycle lanes have been built in exactly these corridors?

A small study of pedestrians in an area of high air pollution in China showed lower blood pressure in mask wearers than non mask wearers, possibly indicating less strain on the heart when exposed to pollution. Masks need to fit snugly and have sub-micron filters to filter out the small particles but most are not capable of filtering out the "Oslo Effect" PM 2.5's
The trouble is that these masks that are not comfortable enough to cycle in are probably not effective.



Eco-vehicles fill air with deadly toxins

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A study found only a third of particles produced by cars came from Tail Pipe Emissions
Scientists have found electric, hybrid and other supposedly eco-friendly cars produce as much toxic particulate pollution as the "deadly diesels NOx & Soxs" they are meant to be replacing by creating more "Oslo Effect"

These tiny particles are produced by Road, Tyre and Brake wear.

This happens in all rubber wheeled vehicles, including diesel and petrol, but *eco-vehicles produce more because they are on average 24% heavier,* owing to the batteries and other parts needed to propel them.

They unfortunately produce *37% extra emissions in the form of the "Oslo Effect" with PM2.5's*
The added weight of rubber wheeled eco-vehicles means that when they accelerate or slow down, the tyres and brakes wear faster, producing more particulates with a high volume of PM2.5s.
The bigger and heaver weight the vehicle the bigger the following wake which whips the up more particles from the road surface and on a still day can remain suspended as high as 25 feet+. (8 metre +)
"We found that non-exhaust emissions, from brakes, tyres and the road, are far larger than exhaust emissions in all modern cars," said Peter Achten, whose research is published in the journal Atmospheric Environment.
"These are more toxic than emissions from modern engines so they are likely to be key factors in the extra heart attacks, strokes and asthma attacks seen when air pollution levels surge."
Achten, who runs a scientific consultancy in Holland, and his co-author Victor Timmers, of Edinburgh University, used technical data from the motor industry and government research agencies, including direct tests of brake, tyre and road wear rates, to show that the non-exhaust emissions produced by a vehicle are directly related to its weight.

"We found that electric and eco-friendly cars typically weigh 24% more than conventional cars," said Achten.

The findings fit with anecdotal complaints from electric and hybrid car owners that their tyres wear out faster than on conventional vehicles.

The impact of non-exhaust emissions has long been suspected but is hard to measure.

Scientists at Hertfordshire University overcame this problem by installing particulate air pollution monitors in the southbound Hatfield tunnel on the A1(M), which carries up to 49,000 vehicles a day.
They found each vehicle produced 34-39 micrograms of particles per kilometre but only a third came from the engine.

The rest comprised mainly tiny pieces of bitumen whipped up from the road, rubber from tyres and brake dust. In towns — where cars brake and accelerate more often — this proportion may reach 90%.
Such findings are a problem for policy-makers whose anti-pollution efforts have been focused on regulating engines.

Professor Ranjeet Sokhi, of Hertfordshire University, who led the study, said: "This highlights the significance of non-exhaust emissions and a need for legislation."

The Society of Motor Manufacturers and Traders said the industry was working to make eco-friendly cars lighter. "Such vehicles have zero or ultra-low tailpipe emissions and have energy recovery systems, which limit the need for active braking, reducing brake and tyre friction that may contribute to particulate emissions."
Toyota, a market leader in hybrid, plug-in hybrid and fuel-cell cars, said the firm had no data on particulate emissions from brakes and tyres
Frank Kelly, professor of environmental health at King's College London, said one hope lay in changing the composition of tyres and road surfaces.
"Non-exhaust PM [particulate matter] emissions are greater than exhaust and we do not have regulations to deal with these emissions."

A Department for Transport spokesman said eco-vehicles still had huge benefits in cutting CO2 emissions but no comment on the "Oslo Effects"

It is doubtful that most rubber wheeled, either IC or Non IC vehicles above push bikes or trikes will be in compliance with the new Clean Air Zones (CAZ) which are being revised possibly to take into account the higher levels of PM2.5+ pollutions being experienced other than just Tail Pipe Emissions to meet the Gothenburg 2020 Protocols

UK annual emissions and Targets 2010 - 2020 (ktonnes)

	Nox	SO2	NH3	NMVOC	PM2.5
2014 emissions	949	308	281	819	105
2010 Gothenburg Protocol Ceiling	1181	625	297	1200	n/a
2020 Gothenburg Protocol ERC	728	292	282	773	76

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A mother whose daughter died from an asthma attack wants an investigation to find out whether worsening air pollution in London contributed to the death.

Ella Kissi-Debrah, nine, from Hither Green near the capital's busy south circular road, died in February 2013.

Through a lawyer, her mother, Rosamund, is calling on the attorney general to order a second inquest or to set up an independent inquiry to determine the impact of pollution on her child's asthma and death. She is also calling for immediate action to reduce exposure to toxic air for children such as her son, Robert, whose lives she believes, remain at risk.

Kissi-Debrah's nine-year-old daughter Ella died four years ago (2013), after repeated asthma attacks and seizures brought on by a lack of oxygen left her in a coma.
The pathologist at Ella's inquest said her death may have been due to airborne particles.
Her mother believes the capital's illegal levels of air pollution are responsible.
Kissi-Debrah said she was asking for Great Ormond Street Hospital to examine her daughter's remains to determine what levels of pollution particles were in her body.
"It's incredibly hard. It's been four years and still we've had no answers.

The doctor in Ella's case has now retired, but it's always going to be hanging over me until these questions are answered," she said.
"Scientists say thousands of people die due to air pollution. The problem is, all these people in the studies are faceless, but Ella is a person.
"She wanted to know why she was having such bad attacks, and we promised we would find an answer for her."
The moves could pave the way for ground-breaking legal action against the Greater London Authority and other government bodies for failing to protect her child and others from air pollution.

Jocelyn Cockburn, a human rights lawyer who is working with the family, said: "There are strong grounds to believe that our government may be in breach of its duty to protect life in Ella's case."
Concern is growing about air pollution in London, which is currently ranked 15 out of 36 world cities, behind Paris, Berlin and Chicago.

According to City Hall, almost 10,000 Londoners die every year because of polluted air and the capital does not meet the legal requirements for pollutants such as nitrogen dioxide.

Research published by the World Health Organisation in May showed that London has breached safe levels of pollutant particles known as PM10.

Dirty diesel and heavier E vehicles 'doubles risk of dementia'

New evidence has emerged to show that diesel pollution can double the risk of getting dementia and may be responsible for as many as a fifth of cases worldwide.

It adds to the growing list of medical conditions linked to air pollution and comes as the government faces legal action for allowing nitrogen dioxide levels repeatedly to breach EU limits around the country.

Poor air quality has previously been more associated with health conditions with sudden onset, such as heart attacks and strokes.
The new research shows the consequences of this pollution could be far more long term.

Researchers at the University of Southern California (USC) analysed health data collected over a decade from 3,647 women across America aged between 65 and 79.

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The new evidence on pollution

It found that those exposed to levels of air pollution above US legal limits were 81% more at risk of global cognitive decline and 92% more likely to develop dementia-related diseases including Alzheimer's.

If the scientists' findings are replicated in men and women of all ages, air pollution could also be responsible for about 21% of dementia cases, according to the study, published in the Nature journal Translational Psychiatry.

"Air pollution is a global public health issue," said Jiu-Chiuan Chen, lead author of the paper. "It is well known that outdoor air pollutants kill people and increase the risk of asthma and heart disease.

Our study greatly strengthens the emerging evidence that the hazards of air particles extend to brain health, including the dementia risk."

Dementia and Alzheimer's have overtaken heart disease as the biggest killers in England and Wales, according to ONS figures released last year.

We do have more people these days with dementia and other so called age related disease and illness. However, the incidence also increases with age, and there are more older people than ever before, so an increase is to be expected

However there is anecdotal evidence emerging that the high cost to the NHS of illness to an aging population are not just "age related" but in actual fact are transport pollution related and the age profile of those affected seems to start earlier at around 45 years old and not at 65 years old as stated masking the success of public health services.

A further study to confirm this link is required.

The USC study focused on the smallest particles in air pollution, called PM2.5s.
Scientists say these are the most dangerous, as they are small enough to cross from the lungs into the blood and then travel around the body, lodging in organs such as the heart, liver and brain.

The paper prompted concerns from British scientists, who found air pollution levels in London last month were worse than in the notoriously smog-prone Chinese capital, Beijing.

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Readings from the air quality index on January 23 showed 197 micrograms of particulate matter per cubic metre of air (µg/m3), compared to 190µg/m3 in Beijing.

The UK capital's air pollution levels are so high that in the first week of January they breached EU limits so many times that they exceeded the quota for breaches allowed for the entire year.

When released into the atmosphere air quality pollutants can have a transboundary and/or local impact. Transboundary impacts occur when a pollutant from one area (or country) impacts on another after being transported by weather systems.

Examples of transboundary pollutants are acidifying pollutants such as nitrogen oxides (NOx) and sulphur dioxide (SO2) as well as ozone (O3) which is not emitted directly into the atmosphere but may be formed over a large distance by reactions of emitted non-methane volatile organic compounds (NMVOC) with NOx in sunlight.

Acidifying pollutants can adversely affect buildings, vegetation and aquatic systems, whilst ozone formed in the lower atmosphere (the troposphere) can be damaging to human health, materials, crops and plants.

Particulate matter (PM) is formed from chemical reactions in the atmosphere involving NOx, SO2 and ammonia (NH3), as well as being directly emitted from human activities, and is damaging to health.

Atmospheric pollution can also impact on local air quality. Where high concentrations occur, there can be a wide range of negative impacts to human health or ecosystems.1

At the national level, the Department for the Environment, Food and Rural Affairs is responsible for the national programme of policies and measures that help to ensure that air quality standards are met. However, the development and implementation of air quality policies is the responsibility of the devolved administrations and maybe liable in court in the event of a prosecution

See outcome of the Kissi-Debrah case

Meeting the air quality standards can be achieved in different ways, and controlling emissions is one of several options.
The continued breaches led to the European Commission issuing the government with a "final warning" recently threatening to launch a case in the European Court of Justice if air pollution levels were not substantially reduced within two months.

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Recently the London mayor, Sadiq Khan, announced a £10 "toxicity charge" to be introduced on October 23 for drivers of the most polluting vehicles.
The fee will be on top of the £11.50 congestion charge, and will affect up to 10,000 vehicles in the capital that do not meet Euro 4 emission standards.

Rosamund Kissi-Debrah, a south London mother who plans to sue the mayor's office for failing to achieve safe pollution levels after her daughter died from a severe asthma attack, said she was unsure how effective the policy would be.
"The £10 charge is great, but from my point of view if you look at what Paris and Madrid are doing, we're miles behind," she said.
"I don't know how many people are going to be deterred by the charge. As long as they continue to produce diesel cars, people are going to buy them."

This "toxicity charge" is a very small plaster on a very large wound and could be viewed as a revenue raising charge

Particulates and NOX emissions are completely different; they were known to be dangerous to humans in high concentrations years ago, but by the mid-90s diesels were believed to have become so clean and efficient that they emitted too little to be a problem - and they've become cleaner since.
Sadly, we now know that the airflow in urban areas concentrates pollutants, so that the lower amounts emitted by more modern diesels remain a problem in cities.
The most modern electric engines in cars and buses and so on are almost totally tail pipe emissions clean but unfortunate by encouraging this switch, the effects of unintended consequences have created an emerging greater, more toxic pollution problem in the "Oslo Effect"

The "Oslo Effect " is very much the "Elephant in the Room" problem and will only be solved by a significant step change in thinking by all concerned and will need to grasp such measures that have been adopted by a growing number of cities around the world with measures such as time slot banning rubber tyred vehicles from the urban area, the increase use of steel on steel vehicles which have no pollution at point of use as the power generation can be scrubbed elsewhere, achieving a high modal switch out of cars into rail vehicles.
Possible additional solutions are reformulation tyres and road surfaces, the latter are extremely expensive and short lived, regular street washing. It is interesting that the first generation trams performed this function as the Edwardians recognised the "Oslo Effect" from the horse pollution of the day!
There is a significant danger that singular drive for EV and similar vehicles will create a bigger problem than the current diesel cul-de-sac Governments has caused

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The core solution is that severe restriction of rubber wheeled vehicles from the urban area are introduced, a start on significantly increasing the role and use of steel on steel vehicles i.e. Suburban rail, TramTrain, Light Rail and Tramways.
This is not a cheap or quick solution most of which have been tried but a generational solution, Manchester Metrolink started with converting two end of life heavy rail lines and now have almost 100km of lines carrying 31 million passengers for only 200 - 250 vehicles.
A start must be made now!

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Glossary

AQPI	Air Quality Pollutant Inventory
CEIP	Centre on Emission Inventories and Projections
CLRTAP	Convention on Long-Range Transboundary Air Pollution
DECC	Department of Energy and Climate Change
Defra	Department for Environment, Food and Rural Affairs
NAEI	National Air Emissions Inventory Spatial disaggregation
UN/ECE	United Nations Economic Commission for Europe

The process by which information at a coarse spatial scale is translated to finer scales while maintaining consistency with the original dataset
Transboundary pollution Transboundary pollution is pollution that originates in one City/County/Country but, by crossing the border through pathways of water or air, is able to cause damage to the environment in another City/County/Country.

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