

Black Carbon Campaign Briefing Sheet 1

Introducing Black Carbon

An introduction to the health and climate impacts of black carbon



What is Black Carbon?

Black carbon is an air pollutant that is harmful to our health and artificially warms our climate. It is emitted in the form of tiny particles when fuels such as coal, diesel and wood are burnt. Most of these particles are very small (only a fraction of the diameter of a human hair) and cannot be seen by the naked eye.

Although black carbon particles are invisible they have a big impact on our lives. For many years scientists have known that breathing in particles causes heart and lung disease which shortens many people's lives by months or years. In more recent years scientists have also realised that black carbon has a warming impact on the Earth's climate.

Reducing black carbon emissions would therefore improve our health and help slow the warming of the planet caused by gases such as carbon dioxide.

Where Does Black Carbon Come From?

Black carbon is produced when fuels fail to burn completely. Most fuels, such as coal, oil and wood, contain carbon. In ideal conditions all of the carbon in the fuel would react with oxygen in the air to form carbon dioxide. In the real world though some of the carbon always fails to combust and is emitted from the exhaust pipe or chimney as tiny particles.

In the UK most black carbon particles are produced by diesel vehicles and equipment. Filters to collect black carbon and other tiny particles are now fitted as standard to most diesel vehicles and equipment. However, this is only a recent requirement and there is still a vast amount of diesel lorries, buses, cars, agricultural equipment, construction machinery, ships and other types of equipment in use in the UK that do not have a filter. Black carbon is also emitted by coal burning and, to a lesser extent, wood burning.

In other countries sources of black carbon are many and varied. In developed countries diesel vehicles and equipment tend to be the biggest sources, whilst in developing countries cooking stoves and coal burning tend to be the dominant sources. Some countries still allow open burning (for example of agricultural waste) which can create a great deal of black carbon.

How Does Black Carbon Affect the Climate?

Darker objects absorb more heat from the sun than lighter ones, something most of us know through painful experience! This simple property is behind black carbon's warming impact on the climate. It works through three different mechanisms:

- Black carbon absorbs heat from the sun and warms its immediate environment – the 'direct effect'
- Black carbon falling onto snow and ice darkens the surface, reducing the amount of heat reflected and can cause melting –the 'albedo effect'
- Black carbon in the air can also interfere with clouds and rainfall patterns – the 'indirect effect'

Black carbon belongs to a group of pollutants known as 'short lived climate forcers'; other pollutants in this group include ground level ozone and methane. These pollutants differ from long lived climate gases (such as CO₂) in two distinct ways:

- They have a short lifespan in the atmosphere of only weeks or days. This means that the climate benefits of cutting emissions are seen very quickly, as atmospheric concentrations fall quickly once emissions are cut. By contrast cuts in emissions of long lived climate gases take decades to have an impact

We are feeling the impacts of short lived climate forcers now. By contrast the main impacts of long lived climate gases are something that we will see in coming years as concentrations of gases such as carbon dioxide (CO₂) continue to build up in the atmosphere

These two properties mean that cutting emissions of black carbon and other short lived climate forcers can complement action on long lived gases such as CO₂. Current and historic emissions of CO₂ mean that global temperature is set to climb to a dangerous level; action on black carbon can throw on a climate 'emergency brake' that would give cuts in emissions of CO₂ time to have an impact.

What Does the Science Say?

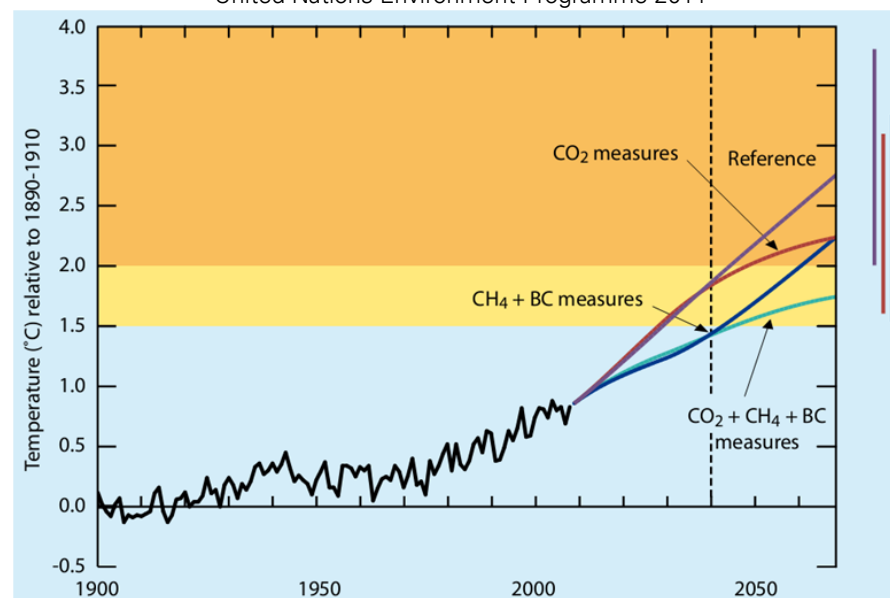
The most up to date science around black carbon and other short lived climate forcers is contained in a recent United Nations Environment Programme report 'Integrated Assessment of Black Carbon and Tropospheric Ozone'. The report concludes that 20-35% of global warming we are currently experiencing (from human activities) is due to short lived climate forcers such as black carbon.

Impacts in the Arctic are especially pronounced due to the impact of black carbon falling on ice and snow. Scientists have calculated that warming (due to CO₂) can be reduced by two thirds over the next 30 years if rapid action is taken to reduce short lived climate forcers.

Climate modellers have investigated a range of climate scenarios involving cuts in emissions of CO₂, of short lived climate forcers (BC and CH₄ below) and 'business as usual'. The results are shown in graph 1 below. Note that only action on both sets of emissions is likely to keep global temperature rise under the 2°C limit widely accepted to represent a dangerous level of warming.

Projections of global temperature change

Source – Integrated Assessment of Black Carbon and Tropospheric Ozone, United Nations Environment Programme 2011



How Does Black Carbon Affect Our Health?

Black carbon particles belong to a pollutant group known as 'particulate matter'. This pollutant, known as PM₁₀ or PM_{2.5} depending on the size of the particles, is highly damaging to our health. Tiny particles are absorbed deep into our lungs, with the very smallest able to cross over into our blood stream.

Particulate matter is strongly associated with heart and lung disease, and is thought to shorten the lives of 200,000 people annually in the UK. Recent studies also suggest that diesel exhaust (which can contain large amounts of particulate matter) is a direct cause of cancer. Reducing black carbon emissions is therefore highly beneficial to our health, especially for people that live and work in busy urban centres where particulate matter concentrations are highest.

More Information

For general information about black carbon visit the Black Carbon Campaign website:

<http://blackcarbon.org.uk>

A summary of black carbon science is contained in the United Nations Environment Programme report 'Integrated Assessment of Black Carbon and Tropospheric Ozone':

www.unep.org/dewa/Portals/67/pdf/Black_Carbon.pdf

For information on the health impacts of black carbon and particulate matter visit the Healthy Air Campaign website:

<http://healthyair.org.uk/>

About The Black Carbon Campaign



The Black Carbon Campaign is raising awareness of the need to reduce black carbon emissions to help achieve rapid climate change mitigation and slow the rate of Arctic melting. In the UK it is headed by the NGO ClientEarth and forms part of the wider European Soot Free for the Climate alliance.

www.clientearth.org