

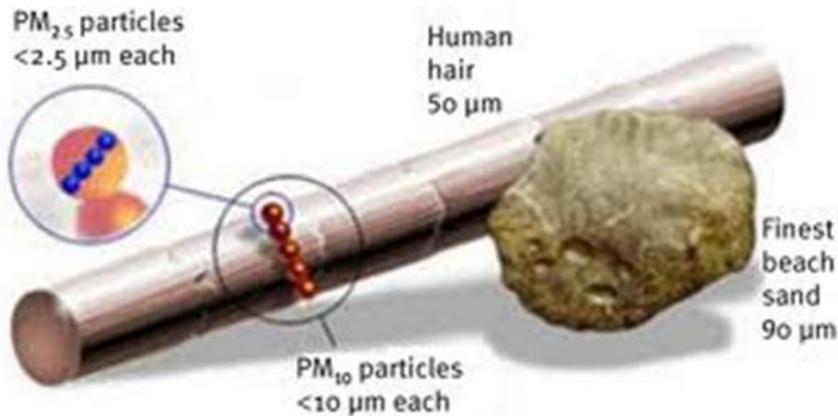
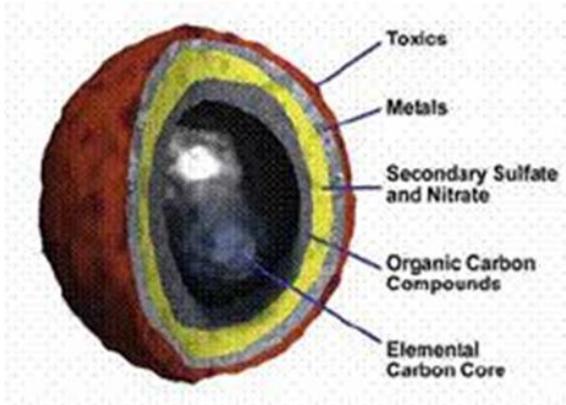
Health impacts of diesel emissions

13 June 2014

Christine Cowie

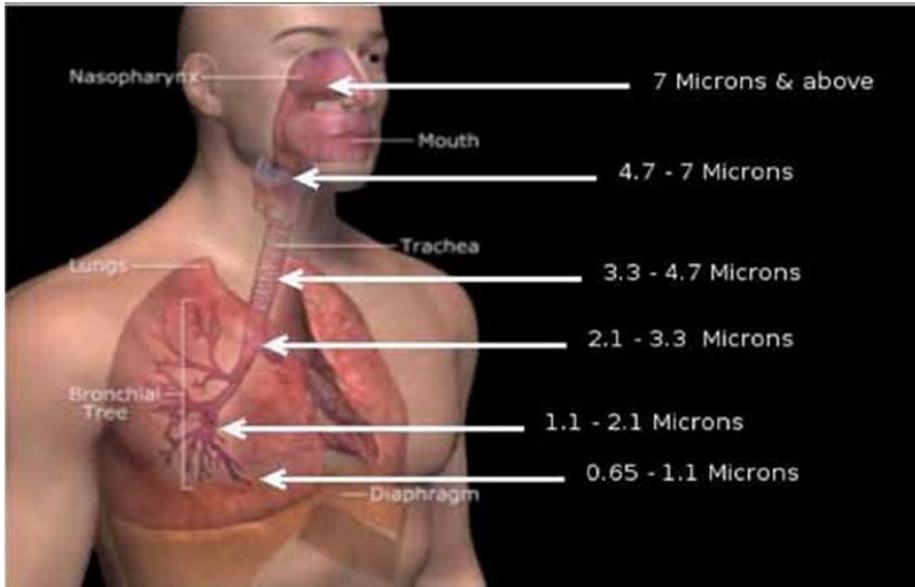


Diesel exhaust particles



- DEP consist of a carbon core surrounded by trace metals, quinones, VOCs
- The solid particulate fraction consists mainly of very small particles typically $<1 \mu\text{m}$ in size
- Fine and ultrafine particles (UFP)
- Elemental carbon or organic carbon or soot used as a surrogate for diesel in epi studies

Concern with diesel exhaust particles



- Small size allows for high deposition rate into the airways
- High surface area allows better adsorption of other chemicals

How important are diesel emissions to health?

IARC, 2013

Major report deeming ambient air pollution as a cause of cancer (Group 1)

PM also separately classified as carcinogenic to humans (Group 1)

IARC, 2012

Reclassified diesel exhaust as a carcinogen



NEWS

Just In Australia World Business Sport Analysis & Opinion Fact Check More

Print Email Facebook Twitter More

WHO confirms diesel fumes carcinogenic

The World Today | By Lexi Metherell
Updated Wed 13 Jun 2012, 7:43pm AEST

Experts at the World Health Organisation (WHO) say diesel engine exhaust fumes can cause cancer in humans.

They say they belong in the same potentially deadly category as asbestos, arsenic and mustard gas.

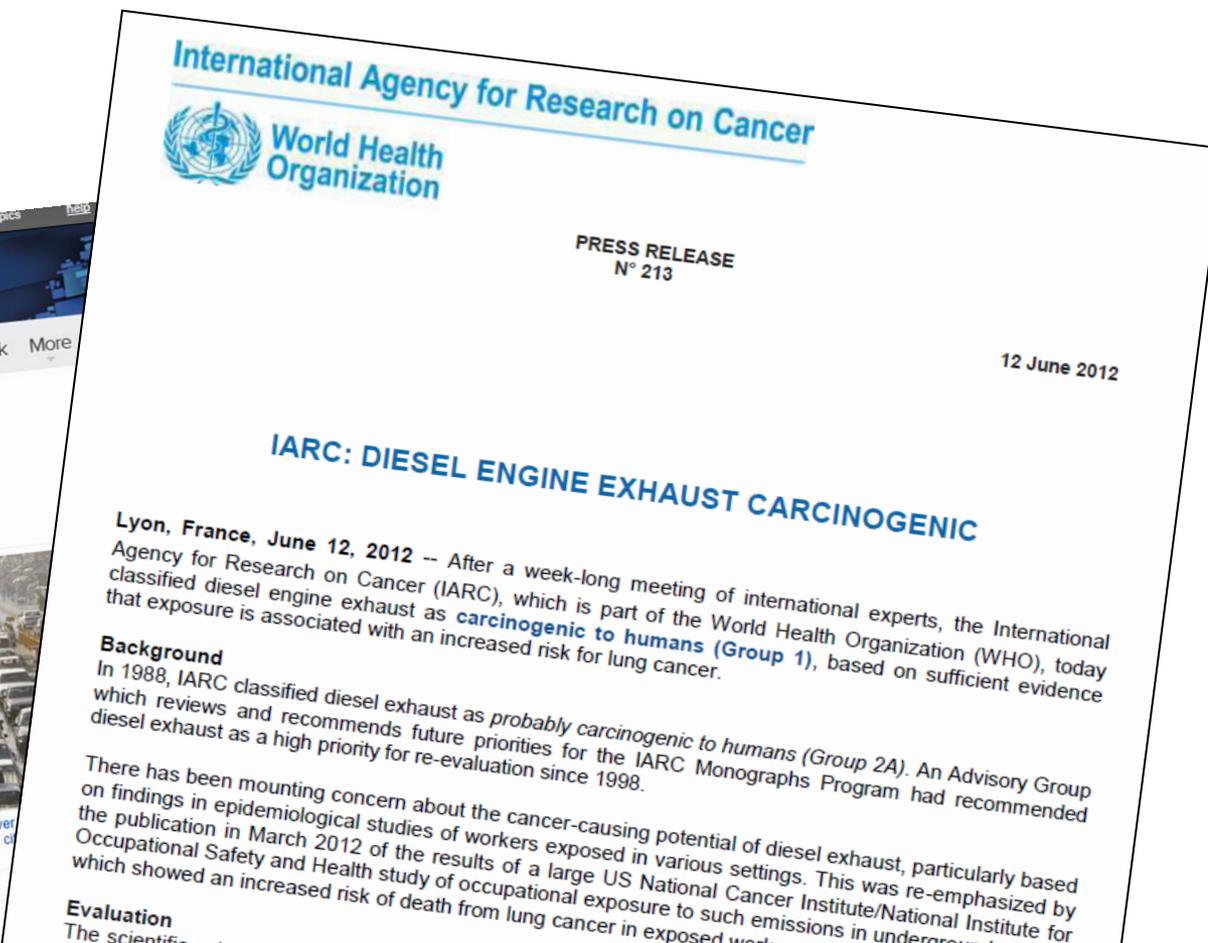
After a week-long meeting, the International Agency for Research on Cancer reclassified diesel exhausts from its group of probable carcinogens, to its group of substances that have definite links to cancer.

It says diesel emissions cause lung cancer and increase the risk of bladder cancer.



PHOTO: The Cancer Council's Ian Oliver available for the levels of exposure in of (Namiir Noor-Eldeen: Reuters)

MAP: Australia



International Agency for Research on Cancer
World Health Organization

PRESS RELEASE
N° 213

12 June 2012

IARC: DIESEL ENGINE EXHAUST CARCINOGENIC

Lyon, France, June 12, 2012 -- After a week-long meeting of international experts, the International Agency for Research on Cancer (IARC), which is part of the World Health Organization (WHO), today classified diesel engine exhaust as **carcinogenic to humans (Group 1)**, based on sufficient evidence that exposure is associated with an increased risk for lung cancer.

Background

In 1988, IARC classified diesel exhaust as *probably carcinogenic to humans (Group 2A)*. An Advisory Group which reviews and recommends future priorities for the IARC Monographs Program had recommended diesel exhaust as a high priority for re-evaluation since 1998.

There has been mounting concern about the cancer-causing potential of diesel exhaust, particularly based on findings in epidemiological studies of workers exposed in various settings. This was re-emphasized by the publication in March 2012 of the results of a large US National Cancer Institute/National Institute for Occupational Safety and Health study of occupational exposure to such emissions in underground mines, which showed an increased risk of death from lung cancer in exposed workers.

Evaluation

The scientific...

What does this mean?

The WHO classifies the cancer-causing potential of various substances into four groups, depending on the evidence available in both humans (epidemiological and chamber studies) and animals (toxicological studies):

Group 1 is used when a substance **causes** cancer in humans

Group 2A is used when a substance **'probably'** causes cancer in humans

Group 2B is used when a substance **'possibly'** causes cancer in humans

Group 3 is used when a substance is **not classifiable** in terms of its cancer-causing properties in humans because the evidence is inadequate

Group 4 is used when a substance is **'probably not'** a cause of cancer in humans

Why?

- Decision based on findings from epidemiological studies of workers exposed to diesel fumes.
- Recent large cohort study (US National Cancer Institute and NIOSH), published in March 2012, of occupational exposure to diesel exhaust in 12,315 US miners.
- Increased the risk of dying from lung cancer (1.26, 95% CI: 1.09 to 1.44).
- Case-control study, in this group (comparing 198 miners who had died from lung cancer with 562 miners who were alive at the time the 'case' died), found risk of lung cancer in workers increased with the length of exposure time – dose response.
- Studies were in heavily exposed workers to diesel fumes, however WHO recommends action to reduce exposure to diesel exhaust fumes should encompass both highly exposed workers and the general population.

Other views?

- **National Toxicology Program (NTP)** (US) (includes the National Institutes of Health (NIH), the Centers for Disease Control and Prevention (CDC), and the Food and Drug Administration (FDA). Classified exposure to diesel exhaust particulates as “reasonably anticipated to be a human carcinogen,” based on limited evidence from studies in humans and supporting evidence from lab studies.
- The **US Environmental Protection Agency (EPA)** classifies diesel exhaust as “likely to be carcinogenic to humans.”
- The **National Institute for Occupational Safety and Health (NIOSH)** has determined that diesel exhaust is a “potential occupational carcinogen.”

Other health effects?

- **Acute exposures:**
 - can cause irritation to the eyes, nose throat and lungs, nausea
 - cough, lung function changes and asthma exacerbations
 - increase in inflammatory markers
 - act as adjuvants to allergen to increase allergic response (chamber studies)
- **Chronic exposures**
 - Cough, sputum production, lung function decrements
 - increased lung cancer risk
- USEPA has set a Reference Concentration for diesel exhaust (includes DPM) of 5 ug/m³.
- The US Health Effects Institute-Panel (2014) to report (in 18 mths time) on whether there is sufficient data form the recent studies to conduct a quantitative risk assessment for general exposures (that is lower dose levels)

How important is air pollution to health?

BOD 2010 Comparative risk assessment of BOD project (Lim et al, 2012, The Lancet):

DALYs-includes mortality and morbidity effects

Notable in that it is an unavoidable exposure & relevant to the whole population

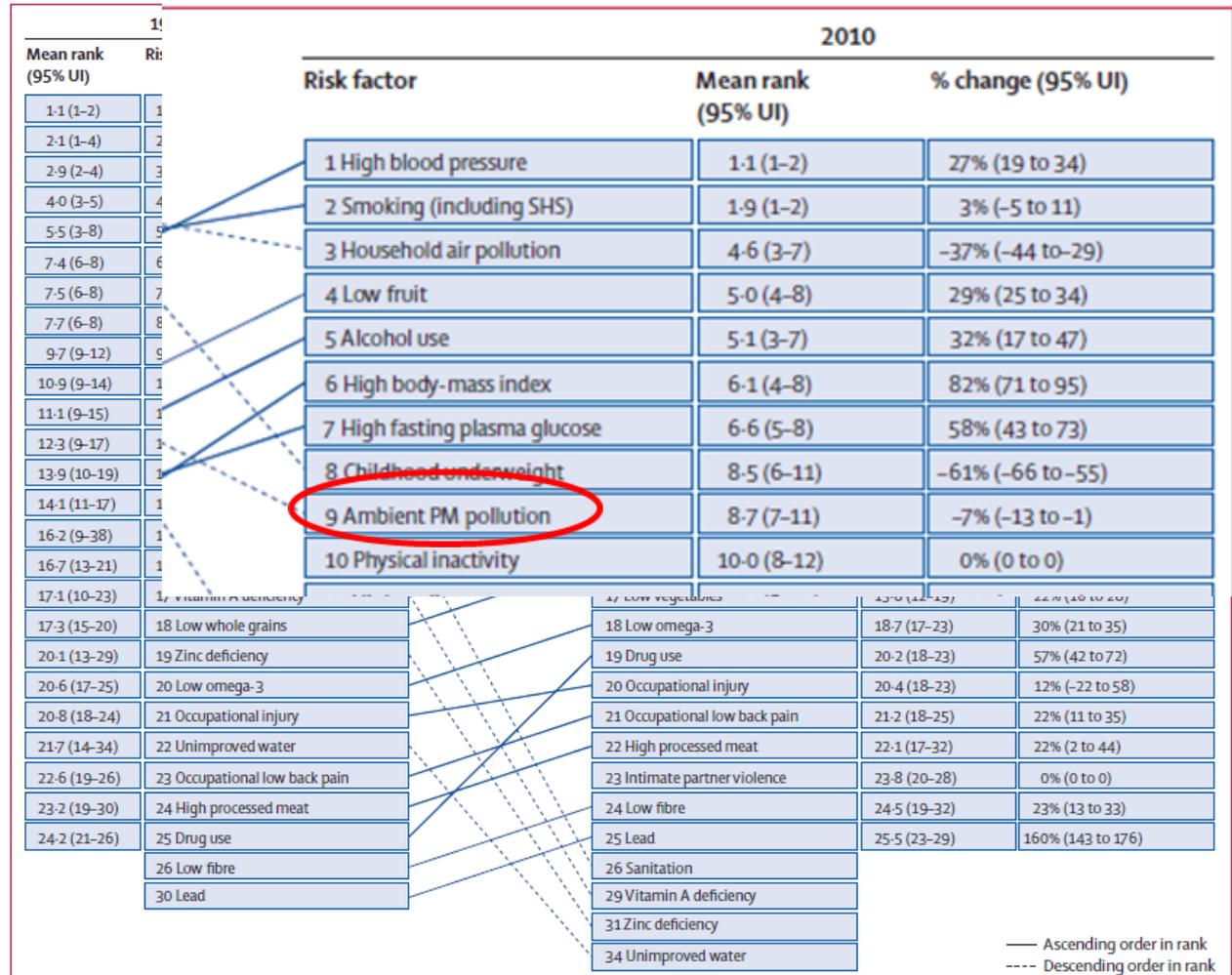


Figure 3: Global risk factor ranks with 95% UI for all ages and sexes combined in 1990, and 2010, and percentage change. PM=particulate matter. UI=uncertainty interval. SHS=second-hand smoke. An interactive version of this figure is available online at <http://healthmetricsandevaluation.org/gbd/visualizations/regional>.

Knowledge gaps: concentration response functions (CRFs) of particulate matter (PM) at low and at very high (peak) levels

- Is there a threshold of effect to $PM_{2.5}$?

$PM_{2.5}$ short-term effects

- Substantial evidence of associations at very low levels of $PM_{2.5}$
- No observed threshold of effect

Concentration-response Relation Between $PM_{2.5}$ and Daily Deaths

