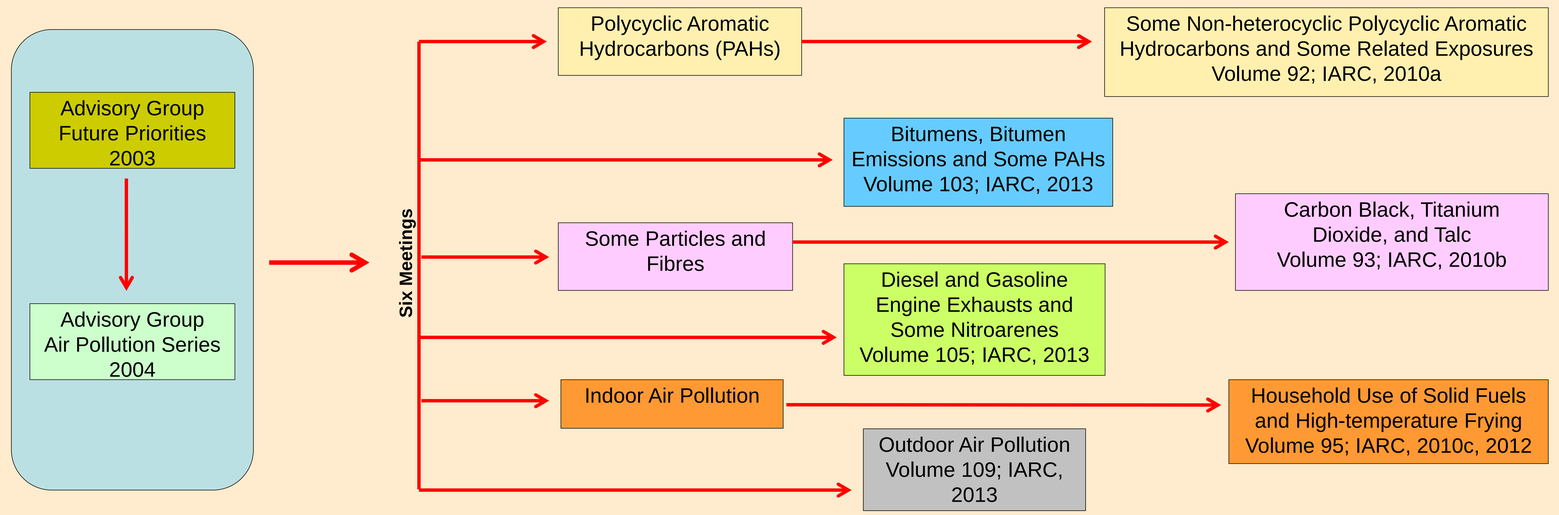
Evaluation of Air Pollution: Rationale, Development, Outcomes, and Impact

Lamia Benbrahim-Tallaa on behalf of the IARC Monographs Programme

Introduction

- Air pollution is a major environmental risk to health.
- Exposure to air pollution has increased significantly in recent years in some parts of the world, particularly in rapidly industrializing countries with large populations.
- Air pollutants have been linked to many adverse health effects, including respiratory infections, heart disease and lung cancer. More than half of the global burden of disease attributable to air pollution is borne by people in developing countries.
- Ambient air pollution causes an estimated 15% of lung cancers.
  - The 2010 estimates of the Global Burden of Disease programme covered both outdoor and indoor air pollution (1).
    - ❖ Ambient air pollution was responsible for about 223 000 deaths from lung cancer worldwide in 2010.
    - ❖ Indoor smoke from solid fuel combustion caused about 3% of deaths from lung cancer worldwide.

Six Monographs on Air Pollution



Overall Evaluations

Some Non-heterocyclic Polycyclic Aromatic Hydrocarbons and Some Related Exposures

Overall evaluation of occupational exposures to PAH mixtures

Carcinogenic to humans, Group 1
Coal-tar distillation
Coal gasification
Coke production
Paving & roofing
Aluminum production
Chimney sweeping

Probably carcinogenic to humans, Group 2A
Carbon-electrode manufacturing
Creosote

Not classifiable, Group 3
Calcium carbide production

Overall evaluation of occupational exposures to PAH mixtures

Sufficient evidence in experimental animals and mechanistic upgrade

Benzo[a]pyrene	Group 1
Cyclopenta[cd]pyrene	Group 2A
Dibenz[a,h]anthracene	Group 2A
Dibenzo[a,l]pyrene	Group 2A

Limited evidence in experimental animals and mechanistic upgrade

Benz[j]aceanthrylene	Group 2B
Benzo[c]phenanthrene	Group 2B

59 individual PAHs have been evaluated during this meeting.

Diesel and Gasoline Engine Exhausts and Some Nitroarenes

Overall evaluation of diesel and gasoline engine exhausts

Carcinogenic to humans, Group 1
Diesel engine exhaust

Possibly carcinogenic to humans, Group 2B
Gasoline engine exhaust

The most influential epidemiological studies assessing cancer risks associated with diesel-engine exhausts considered in this monograph included:
- A study on U.S. miners included a cohort analysis and a nested case–control analysis that was adjusted for tobacco smoking (2, 3).
- A study on U.S. railroad workers exposed to diesel exhaust compared with individuals exposed to low levels or no emissions (4, 5).
- - A cohort study in the US trucking industry on drivers and dockworkers with regular exposure to diesel exhaust (6, 7).

Overall evaluation of some nitroarenes

Possibly carcinogenic to humans, Group 2B
3,7-Dinitrofluoranthene
3,9-Dinitrofluoranthene
1,3-Dinitropyrene
1,6-Dinitropyrene
1,8-Dinitropyrene
2-Nitrofluorene
4-Nitropyrene

Limited evidence in experimental animals and mechanistic upgrade

1-Nitropyrene	Group 2A
6-Nitrochrysene	Group 2A
3-Nitrobenzanthrone	Group 2B

Bitumens, Bitumen Emissions and Some PAHs

Overall evaluation of occupational exposures to bitumens and bitumen emissions

Probably carcinogenic to humans, Group 2A
Oxidized bitumens and their emissions during roofing

Possibly carcinogenic to humans, Group 2B
Hard bitumens and their emissions during mastic-asphalt work

Limited evidence in experimental animals and mechanistic upgrade
Straight-run bitumens and their emissions during road paving

Overall evaluation of some *N*- and *S*-heterocyclic PAHs

Possibly carcinogenic to humans, Group 2B
Dibenz[*a*,*h*]acridine
Carbazole
7*H*-Dibenzo[*c*,*g*]carbazole

Not classifiable, Group 3
Benz[*a*]acridine
Benz[*c*]acridine
Dibenzothiophene
Benzo[*b*]naphtho[2,1-*d*]thiophene

Limited evidence in experimental animals and mechanistic upgrade

Dibenz[*a*,*j*]acridine	Group 2A
Dibenz[*c*,*h*]acridine	Group 2B

Carbon Black, Titanium Dioxide, and Talc

Overall evaluation of carbon black, titanium dioxide, and talc

Possibly carcinogenic to humans, Group 2B
Carbon black
Titanium dioxide
Perineal use of talc-based body powder

Not classifiable, Group 3
Inhaled talc not containing asbestos or asbestiform fibres

Outdoor Air Pollution

Overall evaluation of outdoor air pollution

Carcinogenic to humans, Group 1
Outdoor air pollution and particulate matter in outdoor air pollution

Sufficient evidence for lung cancer (humans & animals)
Limited evidence for bladder cancer (outdoor air pollution, humans)

Household Use of Solid Fuels and High-temperature Frying

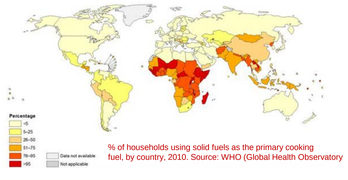
Overall evaluation of household combustion of coal, biomass fuel, and Emissions from high-temperature frying

Carcinogenic to humans, Group 1
Household combustion of coal

Limited evidence in humans and limited evidence in experimental animals and mechanistic upgrade

Household combustion of biomass fuel (primarily wood)	Group 2A

Probably carcinogenic to humans, Group 2A
Emissions from high-temperature frying



% of households using solid fuels as the primary cooking fuel, by country, 2010. Source: WHO (Global Health Observatory

References
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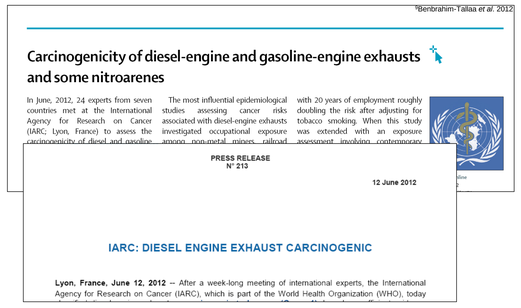
International Agency for Research on Cancer

World Health Organization

Section of the IARC Monographs (IMO)
http://monographs.iarc.fr

Dissemination and Impact

- **Open-access summary reports of new Monographs published in *The Lancet Oncology* after each meeting (e.g. the summary report for Diesel and Gasoline Engine Exhausts, published three days after the meeting), the summaries also appear in the first available print issue (usually about six weeks later). .**
- **Press releases including a link to the summary report in *The Lancet Oncology* and additional information is provided on the IARC website**


*Benbrahim-Tallaa *et al.* 2012

Carcinogenicity of diesel-engine and gasoline-engine exhausts and some nitroarenes

In June, 2012, 24 experts from seven countries met at the International Agency for Research on Cancer (IARC; Lyon, France) to assess the carcinogenicity of diesel and gasoline

The most influential epidemiological studies assessing cancer risks associated with diesel-engine exhausts investigated occupational exposure among non-metal mines, railroad

with 20 years of employment roughly doubling the risk after adjusting for tobacco smoking. When this study was extended with an exposure assessment involving contemporary

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

- **"Question-and-Answer" materials are developed for each Monograph and circulated to news agencies and available to the public through the IARC homepage.**
- **The *Monographs* programme website:**
  - **Free download from the *Monographs* website of the full text of all *Monographs***
  - **visited by people from approximately 125 countries**
  - **more than 150 000 distinct visitors each year**
  - **more than 70 000 downloads of the List of Classifications estimated for 2013**

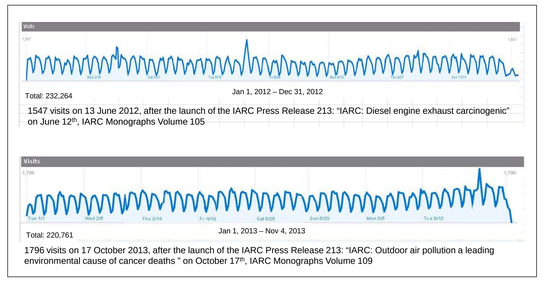


Figure 1. Visits to the IARC website after publication of press releases on *IARC Monographs* Volumes 105 and 109

- **Reception of regular requests from journalists when certain topics of general interest emerge.**


The China Post

Health

WHO agency classifies diesel exhaust as carcinogen

LONDON – Diesel fumes cause cancer, the World Health Organization's cancer agency declared Tuesday, a ruling it said could make exhaust as important a public health threat as secondhand smoke.

The risk of getting cancer from diesel fumes is small, but since so many people breathe in the fumes in some way, the science panel said raising the status of diesel exhaust to carcinogen from "probable carcinogen" was an important shift.

"It's on the same order of magnitude as passive smoking," said Kurt Straif, director of the International Agency for Research on Cancer (IARC) department that evaluates cancer risks.

"This could be another big push for countries to clean up exhaust from diesel engines."

- **Highlighted in documentaries on television and other media on the scientific evaluation of cancer hazards in general, or on specific topics.**
- **Advise National and International Agencies (e.g. French Ministry of Health,…)**

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- **Working Group publications after the IARC Monograph meeting**


Environ Health Perspect. 2013 Nov 22. [Epub ahead of print]

Exposure-Response Estimates for Diesel Engine Exhaust and Lung Cancer Mortality Based on Data from Three Occupational Cohorts.

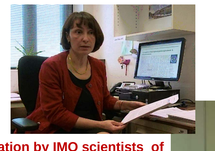
Vermeulen R, Silverman DT, Garshick E, Vlaanderen J, Portengen L, Steenland K.

Author information

Abstract

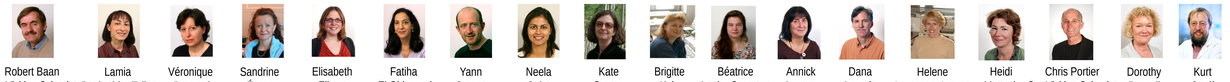
BACKGROUND: Diesel engine exhaust (DEE) has recently been classified as a known human carcinogen.

- **Follow up publication to the 2004 Advisory Group meeting on air pollution**



- **Presentation by IMO scientists of details of specific evaluations to important global and national policy-makers or expert committees.**

The *IARC Monographs* Programme staff



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