



OUTDOOR AIR POLLUTION

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This publication represents the views and expert opinions of an IARC Working Group on the Evaluation of Carcinogenic Risks to Humans, which met in Lyon, 8–15 October 2013

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TO HUMANS

6. EVALUATION

6.1 Cancer in humans

There is *sufficient evidence* in humans for the carcinogenicity of outdoor air pollution. Outdoor air pollution causes cancer of the lung. A positive association has been observed between exposure to outdoor air pollution and cancer of the urinary bladder.

There is *sufficient evidence* in humans for the carcinogenicity of particulate matter in outdoor air pollution. Particulate matter in outdoor air pollution causes cancer of the lung.

6.2 Cancer in experimental animals

There is *sufficient evidence* in experimental animals for the carcinogenicity of organic solvent-extracted material from particles collected from outdoor air.

There is *sufficient evidence* in experimental animals for the carcinogenicity of particulate matter in outdoor air pollution.

There is *sufficient evidence* in experimental animals for the carcinogenicity of outdoor air pollution.

For the second evaluation, the Working Group considered the data on solvent-extracted material from particles collected from outdoor air and the evidence on the carcinogenicity of diesel engine exhaust particles. The third evaluation was based on findings of studies in experimental animals exposed to polluted outdoor air (in São Paulo, Brazil) in conjunction with updating and confirming the following evaluations:

There is *sufficient evidence* in experimental animals for the carcinogenicity of whole diesel engine exhaust, *sufficient evidence* in experimental animals for the carcinogenicity of emissions from combustion of coal, and *limited evidence* in experimental animals for the carcinogenicity of emissions from combustion of wood; and there is *sufficient evidence* in experimental animals for the carcinogenicity of diesel engine exhaust particles and of extracts of diesel engine exhaust particles, *sufficient evidence* in experimental animals for the carcinogenicity of condensates of gasoline engine exhaust, *sufficient evidence* in experimental animals for the carcinogenicity of extracts from coal-derived soot, and *sufficient evidence* in experimental animals for the carcinogenicity of wood smoke extracts.

6.3 Overall evaluation

Outdoor air pollution is *carcinogenic to humans* (Group 1).

Particulate matter in outdoor air pollution is *carcinogenic to humans* (Group 1).

The sufficient evidence in humans and experimental animals was also strongly supported by the multiplicity of documented genetic and related effects in humans and experimental systems. This strong mechanistic evidence indicated that outdoor air pollution worldwide is mutagenic and is carcinogenic to humans via genotoxicity. Human exposures to outdoor air pollution or particulate matter in polluted outdoor air are

associated with increases in genetic damage that have been shown to be predictive of cancer in humans. Moreover, exposure to outdoor air pollution can promote cancer progression via oxidative stress, responses to oxidative stress, and sustained inflammation.