

REVIEW OF SKIN PERMEATION HAZARD OF BITUMEN FUMES

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SOME HISTORY

1999 US ACGIH: 'Skin notation not justified'
2000 US NIOSH: no conclusion on skin notation
2001 German MAK : assigns 'H-notation' to bitumen fumes.
2006 Dutch DECOS: 'available data on skin carcinogenesis may warrant skin notation'
Assignment of a skin notation to bitumen fumes is under debate.

QUESTION

What do we know about the skin permeation hazard of bitumen fumes?

SCREENED SOURCES

Previous reviews

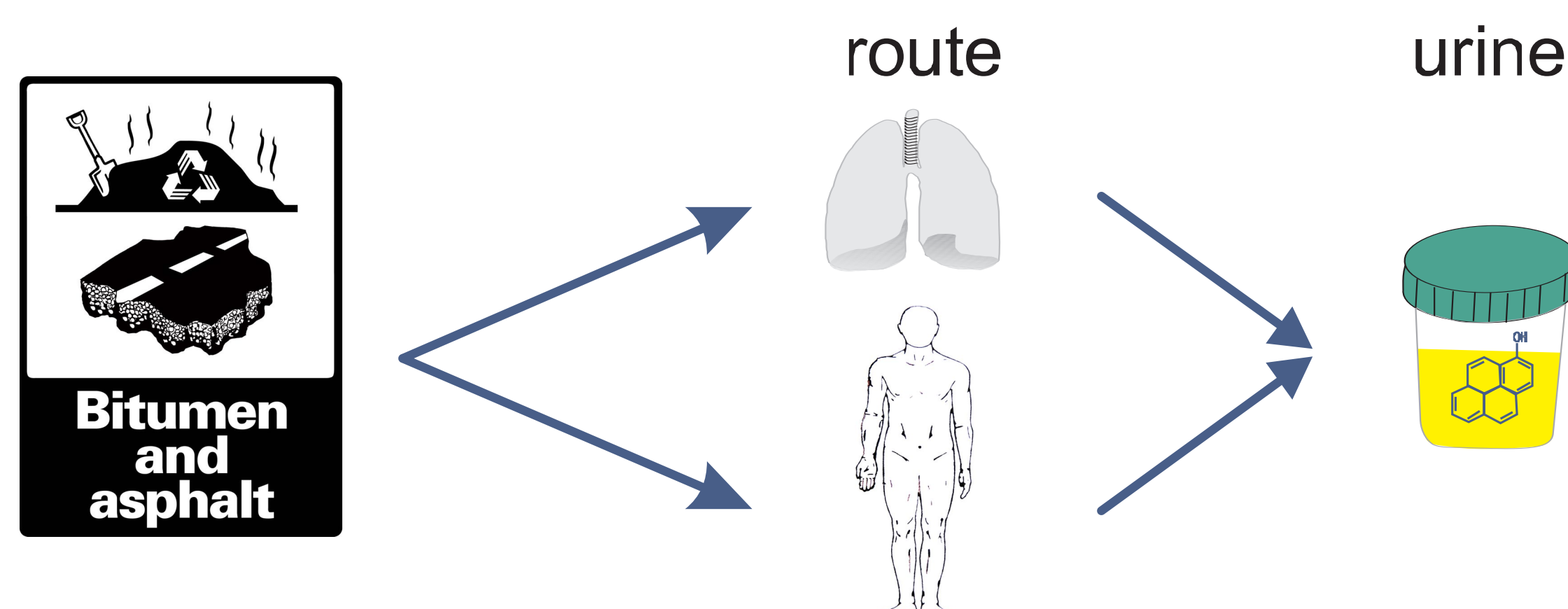
ACGIH, 1999: 'TLV-documentation: Asphalt (Petroleum; Bitumen) Fumes'
NIOSH, 2000: 'Hazard Review- Health Effects of Occupational exposure to Asphalt'.
MAK, 2001: 'Bitumen - Dampf und Aerosol'.
DECOS, 2005: 'Bitumen (vapour and aerosol) - Health-based recommended occupational exposure limit' (draft).

Recent studies and reports

- a human volunteer study: Knecht, 2001
- five cross-sectional studies on skin exposure among road-pavers:
Sciarra, 2002; McClean, 2004a/b; Cirla, 2005; Väänänen, 2005, 2006.



¿ CANCER ?



WHAT DO WE KNOW?

Animal experiments show that compounds in bitumen may permeate the skin and can cause genotoxic effects in the skin and other tissues.

Genotoxic effects are not clearly confirmed in workers dermally exposed to bitumen fume, due to concomitant exposure to coal-tar products and/or limitations in study design.

Animal data on skin carcinogenesis indicate that chronic exposure to bitumen fume may cause skin cancer. However, available epidemiological data reveal no suggestion of an association between bitumen exposure and skin cancer in workers.

Five studies report a 2-fold increase of urinary 1-hydroxypyrene in post-shift urine of workers exposed to bitumen fume. These levels are low compared to other industries with PAH exposures.

An exposure chamber study with volunteers wearing only shorts shows that about 50% of the uptake of 3-4 ring PAH from bitumen fume may have been absorbed through skin. This study underlines the potential for dermal uptake of bitumen fume components.

Recent cross-sectional field studies do not present conclusive data that confirm the significance of skin absorption of pyrene in bitumen fume exposed workers.

Pyrene as a marker compound may overestimate the dermal absorption of PAH with a higher molecular weight, such as benzo(a)pyrene, 7 to 100 fold.

In risk assessment of PAH exposure, it is generally accepted that PAH mainly act as local carcinogens and primarily induce tumours at the site of contact.



WHAT IS MISSING?

As long as there is no international consensus on the criteria, the debate on assigning a skin notation to bitumen fume will continue.

The relation between urinary 1-hydroxypyrene and genotoxic responses in bitumen fume exposed workers is not yet known.

The methods for the determination of the actual dose rate due to dermal exposure of workers are not yet validated.

Quantitative data of the dermal uptake of bitumen fume among exposed workers, relative to the inhalatory dose, are still lacking.

A route specific cancer potency estimate for dermal exposure to bitumen fume is not yet available.

