



**ANTHRACENE,  
2-BROMOPROPANE,  
BUTYL METHACRYLATE,  
AND DIMETHYL  
HYDROGEN PHOSPHITE**

VOLUME 133

This publication represents the views and expert opinions of an IARC Working Group on the Identification of Carcinogenic Hazards to Humans, which met in Lyon, France, 28 February to 7 March 2023

LYON, FRANCE - 2024

IARC MONOGRAPHS  
ON THE IDENTIFICATION  
OF CARCINOGENIC HAZARDS  
TO HUMANS

**Table S1.12 Exposure assessment review and critique for mechanistic studies on cancer and exposure to anthracene**

Reference and mechanistic end-point	What was the study design? ( <i>n</i> )	What methods were used for the exposure assessment? (incl. data source, environmental and biological measurements etc.)	Was the exposure defined well, and what was the definition?	Was exposure assessment qualitative, semiquantitative or quantitative?	Were sampling and collection protocols for chemical measurements appropriate?	What routes of exposure were assessed?	How was the intensity of exposure assessed?	How was the duration of exposure assessed?	Was cumulative exposure assessed?	Was exposure assessed before outcome being ascertained?	What was the timing of exposure relative to the outcome?	Was there known exposure to any other carcinogens?	Could the “unexposed” group have included exposed?
Herbert et al. (1990) DNA adducts	Cross-sectional study among roofers ( <i>n</i> = 12) and controls ( <i>n</i> = 12)	Personal breathing zone air sampling, forehead skin wipes and blood sampling	Yes, occupational exposures to anthracene, fluoranthene, pyrene, benzo[ <i>a</i> ]pyrene, benzo[ <i>b</i> ]fluoranthene, benzo[ <i>g,h,i</i> ]perylene and benzo[ <i>k</i> ]fluoranthene during removal, or tear-off, of sequential sections of an old pitch roof followed by replacement of each section with a new asphalt roof.	Quantitative	Yes, air samples and skin wipes via NIOSH method 5506 using HPLC-FD.  <sup>32</sup> P-postlabelling was used for the detection of hydrophobic DNA adducts.	Inhalation and dermal	Chemical analysis of personal breathing zone air samples (Thursday and Monday) and skin wipes (Monday)  Blood sample (Tuesday)	Detailed information about occupational history (past and present); history of occupational, environmental and dietary exposure to PAHs	No	Yes	One day to a few days before	Unknown, but other PAHs were present	Not likely
Singh et al. (2008b) Oxidative stress	Cross-sectional study among children (2–10 years) ( <i>n</i> = 50)	Blood biomonitoring	Yes, levels naphthalene, acenaphthylene, phenanthrene, anthracene, fluoranthene, pyrene, benzo[ <i>k</i> ]fluoranthene, benzo[ <i>b</i> ]fluoranthene, benzo[ <i>a</i> ]pyrene, in blood	Quantitative	Yes blood levels of PAHs were determined by HPLC-FD/UV	All implicitly by performing biomonitoring	Blood sample collected at the time of enrolment	Interviewing children and parents on smoking behaviour and other exposures in the house	No	No	Same time	Unknown, but most likely other PAHs were present	NA
Hanchi et al. (2017) Oxidative DNA damage	Cross-sectional study among steelworkers ( <i>n</i> = 93)	Urine spot samples from each subject were collected on the third day of a workweek at the end of an 8-hour work shift	Yes, urinary naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benz[ <i>a</i> ]anthracene, chrysene, benzo[ <i>k</i> ]fluoranthene, benzo[ <i>b</i> ]fluoranthene, benzo[ <i>a</i> ]pyrene, dibenzo[ <i>a,h</i> ]anthracene, indeno[1,2,3- <i>cd</i> ]pyrene (U-IP) and benzo[ <i>g,h,i</i> ]perylene  1-hydroxynaphthalene, 2-hydroxynaphthalene, 1-hydroxyphenanthrene, 2-hydroxyphenanthrene, 3-hydroxyphenanthrene, 4-hydroxyphenanthrene, 9-hydroxyphenanthrene, and 1-hydroxypyrene	Quantitative	Urinary PAHs by GC-MS/MS and OH-PAHs by LC-MS/MS	All implicitly by performing biomonitoring	Urine sample collected on third day of a workweek at the end of an 8-hour work shift	No	No	No	Same time	Unknown, but other PAHs were present	NA
Agarwal et al. (2018) Redox status (GSH/MDA)	Case-control study (post-hoc case-definition)  Control group ( <i>n</i> = 55) gestational age 36 weeks and Case group ( <i>n</i> = 29) gestational age < 36 weeks	Placental biomonitoring at the time of delivery	Yes, placental levels of PAHs: naphthalene, acenaphthene, acenaphthylene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benzo[ <i>a</i> ]anthracene, chrysene, benzo[ <i>b</i> ]fluoranthene, benzo[ <i>k</i> ]fluoranthene, benzo[ <i>a</i> ]pyrene, indeno[1,2,3- <i>CD</i> ]pyrene, dibenzo[ <i>ah</i> ]anthracene, and benzo[ <i>ghi</i> ]perylene	Quantitative	Yes, all placental samples were analysed for 16 PAHs using gas chromatograph-flame ionization detector (GC-FID). For further confirmation, a few samples from each batch were randomly analysed on gas chromatography-mass spectrometer (GC-MS)	All implicitly by performing biomonitoring	Placental sample at the time of delivery	No	No	No	Same time	Unknown, but other PAHs were present	NA

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Jeng et al. (2022, 2023) Sperm oxidative DNA damage	Cross-sectional study coke-oven workers ( <i>n</i> = 38) and control subjects ( <i>n</i> = 24 or 22) [different numbers stated in the article] (Jeng et al., 2022)  Cross-sectional study coke-oven workers ( <i>n</i> = 54; 31 topside-oven workers and 23 side-oven workers) (Jeng et al., 2023)	Personal breathing zone air sampling. Glass fibre filter for particulate PAHs, XAD-2 sorbent for gaseous PAHs	Yes, 16 PAHs in personal breathing zone air samples:  naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, pyrene, fluoranthene, benzo[a]anthracene, chrysene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, indeno[1,2,3-cd]pyrene, dibenzo[a,h]anthracene, andbenzo[ghi]perylene	Quantitative	Yes, by using a gas chromatogram quadruple mass spectrometer (GC-MS)	Only inhalation route	Coke-oven workers worked 8 hours for 6 continuous days and had 2 days off. Two personal air samplers for 7 hours on 1st and 6th workday. One sampler to collect particulate PAHs and other sampler to collect gaseous PAHs.	No	No	Yes	Most likely at same time, but it is unclear when semen sample was collected	Unknown, but other PAHs were present	Not likely

FD, fluorescence detection; GC-FID, gas chromatography-flame ionization detection; GC-MS, gas chromatography-mass spectrometry; GSH, glutathione; HPLC, high-performance liquid chromatography; MDA, malondialdehyde; NIOSH, National Institute for Occupational Safety and Health; PAH, polycyclic aromatic hydrocarbon; UV, ultraviolet.

### References

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