

# Bulletin Board

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## Technical

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## CHEMICAL EFFECTS

### The impact of genetic polymorphism for detecting genotoxicity in workers occupationally exposed to formaldehyde: A systematic review

2024-09-08

Formaldehyde is a chemical compound capable of preserving cells and tissue morphology, being extensively used worldwide in industrial and medical processes. However, due to the many biological effects that take place after an individual is chronically exposed to formaldehyde, this compound poses a greater cancer risk for workers under its occupational exposure, even at lower concentrations. Thus, the present systematic review aimed to understand whether there may be a positive relation between polymorphism (in terms of individual susceptibility) and genotoxicity in individuals occupationally exposed to formaldehyde. For this purpose, a total of eight selected studies were carefully analyzed by two reviewers, who attributed scores to each study according to the used analysis parameters. First, all studies investigated either pathologists under formaldehyde exposure or anatomical laboratory pathology workers. In addition, the majority of studies were categorized as moderate or strong in the quality assessment. The results revealed a positive association between some polymorphism and genotoxicity in individuals exposed to formaldehyde, since more than half of the studies observed positive relations between genotoxicity and polymorphisms in xenobiotics metabolizing genes. We understand such parameters influence individuals' susceptibility to genomic damage induced by formaldehyde in peripheral blood. In conclusion, individuals with certain genotypes may show higher or lower DNA damage and/or lower or higher DNA repair potential.

Authors: Thiago Guedes Pinto, Ana Claudia Muniz Renno, Patricia Ramos Cury, Daniel Araki Ribeiro

Full Source: Toxicology and industrial health 2024 Sep 8:7482337241279894. doi: 10.1177/07482337241279894.

### Assessing the fate, toxicity, and ecological risk of mixtures of di(2-ethylhexyl)phthalate and di-n-butylphthalate using aquatic and terrestrial microcosms

2024-09-05

Di(2-ethylhexyl)phthalate (DEHP) and di-n-butylphthalate (DBP) frequently coexist in different environmental compartments. Thus, in this study, model aquatic and terrestrial microcosms were prepared to analyze the

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combined effect of DEHP and DBP on their fate, toxicity, and ecological risk. In the aquatic microcosms, with the addition of the same amount of DEHP and DBP, a higher total amount of DEHP was detected in water, suspended particles, and sediment than DBP due to the higher  $K_{ow}$  and half-life of DEHP than DBP. Sediment was the major sink of both phthalates, as the highest percentages of DEHP (90.0 % ~ 95.6 %) and DBP (68.7 % ~ 78.1 %) were found in the sediment. The results of the whole sediment toxicity test showed that DBP (LC50/LC10: 6.75/1.171  $\mu\text{g/g dw}$ ) was more toxic than DEHP (LC50/LC10: 158.75/27.25  $\mu\text{g/g dw}$ ) to the tubificid oligochaete *Monopylephorus limosus*, with a synergistic toxic effect of the mixture of DEHP and DBP (LC50/LC10: 100.3/4.6  $\mu\text{g/g dw}$ ). The mobility of DEHP and DBP in soil was low during irrigation, with the release of 0.054 % ~ 2.29 % DEHP and 0.097 % ~ 1.86 % DBP. The bioconcentration factors/biota-sediment accumulation factors for DEHP (70.8-145 L/kg/0.093-0.359) in the muscle of the fish *Carassius auratus* were lower than those for DBP (82.2-300 L/kg/0.514-1.625). The bioaccumulation factors of DEHP and DBP for earthworms were 0.373 and 0.682, respectively. The levels of DEHP and DBP in the water and sediment of aquatic systems and in the soil of terrestrial systems might pose high ecological risks to some fish species, *M. limosus* and earthworms, according to the risk quotient values. These data provide valuable insights for the development of government control strategies to minimize the ecological risks of DEHP and DBP.

Authors: Ching-Chang Lee, Wei-Ling Chen, Colin S Chen, Chien-Jung Tien  
Full Source: The Science of the total environment 2024 Sep 5:176070. doi: 10.1016/j.scitotenv.2024.176070.

### Rapid screening of volatile chemicals in surface water samples from the East Palestine, Ohio chemical disaster site with proton transfer reaction mass spectrometry

2024-09-05

The increasing prevalence of hazardous chemical incidents in the United States necessitates the implementation of analytically robust, rapid, and reliable screening techniques for toxicant mixture analysis to understand short- and long-term health impacts of environmental exposures. A recent chemical disaster in East Palestine, Ohio has underscored the importance of thorough contamination assessment. On February 03, 2023, a Norfolk Southern train derailment prompted a chemical spill and fires. An open burn involving over 100,000 gal of vinyl chloride was conducted three days later. Hazardous compounds were released into air, water, and soil. To provide time-sensitive exposure data for emergency response,

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this study outlines a novel methodology for rapid characterization of chemical contamination of environmental media to support disaster response efforts. A controlled static headspace sampling system, in conjunction with a high-resolution proton transfer reaction time-of-flight mass spectrometer (PTR-TOF-MS), was developed to characterize volatile organic compounds (VOCs) in surface water samples collected near the East Palestine train derailment site. Spatial variations were observed in the chemical composition of surface water samples collected at different locations. Hydrocarbons were found to be the most abundant chemical group of all surface water samples, contributing 50 % to 97 % to the total headspace VOC mass. Compounds commonly detected in surface water samples, including benzene, styrene, xylene, and methyl tert-butyl ether (MTBE) were also observed in most surface water samples, with aqueous concentrations typically at ng/L levels. This study demonstrated the potential of the proposed methodology to be applied for rapid field screening of volatile chemicals in water samples in order to enable fast emergency response to chemical disasters and environmental hazards.

Authors: Jinglin Jiang, Xiaosu Ding, Paula Coelho, Grayson Wittbrod, Andrew J Whelton, Brandon E Boor, Nusrat Jung  
Full Source: The Science of the total environment 2024 Sep 5:176056. doi: 10.1016/j.scitotenv.2024.176056.

## ENVIRONMENTAL RESEARCH

## Chemical mechanisms of hexachlorobutadiene reactions in the environment

2024-09-05

Hexachloro-1,3-butadiene (HCBD) has received increasing attention because of its adverse effects on human health. Although HCBD is regulated under the Stockholm Convention, it is still widely detected in the environment. However, detailed reports on the chemical mechanisms of HCBD reactions in the environment are lacking. This review comprehensively summarizes HCBD's unintentional industrial sources and formation mechanisms, and chemical reactions and transformations in different media (gas, water, and biological phases). Photochemical reactions in the atmosphere can degrade and transform HCBD and potentially form other toxic compounds, such as phosgene. Aerobic

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pyrolysis of HCBD can generate complex byproducts. Further research is essential to fully understand the environmental behavior of HCBD.

Authors: Yuyan Luo, Guorui Liu

Full Source: Environmental pollution (Barking, Essex : 1987) 2024 Sep 5:361:124893. doi: 10.1016/j.envpol.2024.124893.

## Temporal variations in the short-term effects of ambient air pollution on cardiovascular and respiratory mortality: a pooled analysis of 380 urban areas over a 22-year period

2024-09

Background: Ambient air pollution, including particulate matter (such as PM10 and PM2.5) and nitrogen dioxide (NO2), has been linked to increases in mortality. Whether populations' vulnerability to these pollutants has changed over time is unclear, and studies on this topic do not include multicountry analysis. We evaluated whether changes in exposure to air pollutants were associated with changes in mortality effect estimates over time.

Methods: We extracted cause-specific mortality and air pollution data collected between 1995 and 2016 from the Multi-Country Multi-City (MCC) Collaborative Research Network database. We applied a two-stage approach to analyse the short-term effects of NO2, PM10, and PM2.5 on cause-specific mortality using city-specific time series regression analyses and multilevel random-effects meta-analysis. We assessed changes over time using a longitudinal meta-regression with time as a linear fixed term and explored potential sources of heterogeneity and two-pollutant models.

Findings: Over 21.6 million cardiovascular and 7.7 million respiratory deaths in 380 cities across 24 countries over the study period were included in the analysis. All three air pollutants showed decreasing concentrations over time. The pooled results suggested no significant temporal change in the effect estimates per unit exposure of PM10, PM2.5, or NO2 and mortality. However, the risk of cardiovascular mortality increased from 0.37% (95% CI -0.05 to 0.80) in 1998 to 0.85% (0.55 to 1.16) in 2012 with a 10 µg/m3 increase in PM2.5. Two-pollutant models generally showed similar results to single-pollutant models for PM fractions and indicated temporal differences for NO2.

Interpretation: Although air pollution levels decreased during the study period, the effect sizes per unit increase in air pollution concentration have not changed. This observation might be due to the composition, toxicity, and sources of air pollution, as well as other factors, such as

Background: Ambient air pollution, including particulate matter (such as PM10 and PM2.5) and nitrogen dioxide (NO2), has been linked to increases in mortality.

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socioeconomic determinants or changes in population distribution and susceptibility.

Funding: None.

Authors: Maximilian Schwarz, Annette Peters, Massimo Stafoggia, Francesca de' Donato, Francesco Sera, Michelle L Bell, Yuming Guo, Yasushi Honda, Veronika Huber, Jouni J K Jaakkola, Aleš Urban, Ana Maria Vicedo-Cabrera, Pierre Masselot, Eric Lavigne, Souzana Achilleos, Jan Kyselý, Evangelia Samoli, Masahiro Hashizume, Chris Fook Sheng Ng, Susana das Neves Pereira da Silva, Joana Madureira, Rebecca M Garland, Aurelio Tobias, Ben Armstrong, Joel Schwartz, Antonio Gasparini, Alexandra Schneider, Susanne Breitner, MCC Collaborative Research Network, Haidong Kan, Samuel Osorio, Hans Orru, Ene Indermitte, Marek Maasikmets, Niilo Rytö, Mathilde Pascal, Klea Katsouyanni, Antonis Analitis, Alireza Entezari, Fatemeh Mayvaneh, Yoonhee Kim, Barrak Alahmad, Magali Hurtado Diaz, Eunice Elizabeth Félix Arellano, Shilpa Rao, Alfonso Diz-Lois Palomares, Noah Scovronick, Fiorella Acquaotta, Ho Kim, Whanhee Lee, Carmen Íñiguez, Bertil Forsberg, Martina S Ragetti, Yue Leon Guo, Shih-Chun Pan, Shanshan Li, Antonella Zanobetti

Full Source: The Lancet. Planetary health 2024 Sep;8(9):e657-e665. doi: 10.1016/S2542-5196(24)00168-2.

### Native polycyclic aromatic hydrocarbons (PAHs) in coal and its preparation products-A mixed source of environmental contamination

2024-09-05

Polycyclic aromatic hydrocarbons (PAHs) are environmental pollutants and inherent components of coal and coal gangue. The similarities and differences in PAH characteristics between these two source materials are largely unknown. In this study, raw coal, cleaned coal, slime, middlings, and gangue from the Wangjialing Coal Preparation Plant in China were analyzed to determine the concentration and distribution of extractable PAHs. The total concentrations of 41 PAHs ( $\Sigma 41 \text{ PAH}$ ), US EPA 16 priority parent PAHs ( $\Sigma 16 \text{ PAH}$ ), and their alkylated derivatives ( $\Sigma a \text{ PAH}$ ) ranged from 18.3 to 89.6, 8.70 to 34.5, and 8.40 to 48.0 mg/kg, respectively, and were ranked as raw coal > cleaned coal > slime > middlings > gangue. The PAH characteristics of raw coal and its preparation products were consistent, with predominant 2-3-ring PAHs and similar PAH isomer ratio distributions. The distribution of conventional PAH isomer ratios for different ranks of coal and coal gangue from different origins was compiled from the literature. The resulting distribution was consistent and overlapped with both petrogenic and pyrogenic sources defined by the ratios. Therefore,

Polycyclic aromatic hydrocarbons (PAHs) are environmental pollutants and inherent components of coal and coal gangue.

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coal and coal gangue should be considered one category and classified as a mixed source (mixture of petrogenic and pyrogenic sources). To accurately identify environmental PAH sources, investigations of aPAHs in the environment and PAH characteristics in coal and coal gangue should be expanded.

Authors: Shan Li, Ziqi Xu, Peng Wu, Shuquan Zhu, Handong Liang  
Full Source: Environmental pollution (Barking, Essex : 1987) 2024 Sep 5:124894. doi: 10.1016/j.envpol.2024.124894.

### PHARMACEUTICAL/TOXICOLOGY

#### Per- and polyfluoroalkyl substances (PFAS) in drinking water in Southeast Los Angeles: Industrial legacy and environmental justice

2024-09-05

Per- and polyfluoroalkyl substances (PFAS) are persistent chemicals of increasing concern to human health. PFAS contamination in water systems has been linked to a variety of sources including hydrocarbon fire suppression activities, industrial and military land uses, agricultural applications of biosolids, and consumer products. To assess PFAS in California tap water, we collected 60 water samples from inside homes in four different geographic regions, both urban and rural. We selected mostly small water systems with known history of industrial chemical or pesticide contamination and that served socioeconomically disadvantaged communities. Thirty percent of the tap water samples (18) had a detection of at least one of the 32 targeted PFAS and most detections (89 %) occurred in heavily industrialized Southeast Los Angeles (SELA). The residents of SELA are predominately Latino and low-income. Concentrations of perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS) ranged from 6.8 to 13.6 ng/L and 9.4-17.8 ng/L, respectively in SELA and were higher than State (PFOA: 0.007 ng/L; PFOS: 1.0 ng/L) and national health-based goals (zero). To look for geographic patterns, we mapped potential sources of PFAS contamination, such as chrome plating facilities, airports, landfills, and refineries, located near the SELA water systems; consistent with the multiple potential sources in the area, no clear spatial associations were observed. The results indicate the importance of systematic testing of PFAS in tap water, continued development of PFAS regulatory standards and advisories for a greater number of compounds, improved drinking-

Per- and polyfluoroalkyl substances (PFAS) are persistent chemicals of increasing concern to human health.

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water treatments to mitigate potential health threats to communities, especially in socioeconomically disadvantaged and industrialized areas.  
 Authors: Julie Von Behren, Peggy Reynolds, Paul M Bradley, James L Gray, Dana W Kolpin, Kristin M Romanok, Kelly L Smalling, Catherine Carpenter, Wendy Avila, Andria Ventura, Paul B English, Rena R Jones, Gina M Solomon  
 Full Source: The Science of the total environment 2024 Sep 5:176067. doi: 10.1016/j.scitotenv.2024.176067.

## OCCUPATIONAL

## Applying cell painting in non-tumorigenic breast cells to understand impacts of common chemical exposures

2024-09-05

The general population is exposed to many chemicals which have putative, but incompletely understood, links to breast cancer. Cell Painting is a high-content imaging-based in vitro assay that allows for unbiased measurements of concentration-dependent effects of chemical exposures on cellular morphology. We used Cell Painting to measure effects of 16 human exposure relevant chemicals, along with 21 small molecules with known mechanisms of action, in non-tumorigenic mammary epithelial cells, the MCF10A cell line. Using CellProfiler image analysis software, we quantified 3042 morphological features across approximately 1.2 million cells. We used benchmark concentration modeling to identify features both conserved and different across chemicals. Benchmark concentrations were compared to exposure biomarker concentration measurements from the National Health and Nutrition Examination Survey to assess which chemicals induce morphological alterations at human-relevant concentrations. We found significant feature overlaps between chemicals, including similarities between the organochlorine pesticide DDT metabolite p,p'-DDE and an activator of Wnt signaling CHIR99201. We validated these findings by assaying the activation of Wnt, as reflected by translocation of  $\beta$ -catenin, following p'-p' DDE exposure. Consistent with Wnt signaling activation, low concentration p',p'-DDE (25 nM) significantly enhanced the nuclear translocation of  $\beta$ -catenin. Overall, these findings highlight the ability of Cell Painting to enhance mode-of-action studies

The general population is exposed to many chemicals which have putative, but incompletely understood, links to breast cancer.

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for toxicants which are common in our environment but incompletely characterized with respect to breast cancer risk.  
 Authors: Anagha Tapaswi, Nicholas Cemalovic, Katelyn M Polemi, Jonathan Z Sexton, Justin A Colacino  
 Full Source: Toxicology in vitro: an international journal published in association with BIBRA 2024 Sep 5:105935. doi: 10.1016/j.tiv.2024.105935.

## Occupational lead exposure and amyotrophic lateral sclerosis survival in the Danish National Patient Registry

2024-09-08

Objectives: We investigated the relationship between occupational lead exposure and amyotrophic lateral sclerosis (ALS) survival in Denmark.  
 Methods: We identified 2,161 ALS cases diagnosed from 1982 to 2013 with at least 5 years of employment history before ALS diagnosis, via the Danish National Patient Registry. Cases were followed until March 2017. We defined lead exposure as never employed in a lead job, ever employed in a lead job, and ever employed in a lead job by exposure probability (<50% vs.  $\geq$ 50%), excluding jobs held in the 5 years before diagnosis in main analyses. Survival was evaluated using Cox proportional hazards models and stratified by sex and age of diagnosis.  
 Results: Median age of diagnosis was 63.5 years, and individuals in lead-exposed jobs were diagnosed at a younger age. Adjusted hazard ratios (aHR) were slightly decreased for men ever lead-exposed (aHR:0.92, 95%CI: 0.80, 1.05) and more so among those diagnosed at age 60-69 (lead  $\geq$  50% aHR: 0.66, 95%CI: 0.45, 0.98), but reversed for men diagnosed at age 70 and later (aHR: 2.03, 95%CI: 1.13, 3.64). No apparent pattern was observed among women.  
 Conclusions: Occupational lead exposure contributed to shorter survival among men diagnosed at older ages. The inverse associations observed for men diagnosed earlier could relate to possible healthy worker hire effect or health advantages of working in lead-exposed jobs. Our results are consistent with an adverse impact of lead exposure on ALS survival at older ages, with the age at which lead's effects on survival worsen later on among those in lead-exposed jobs.  
 Authors: Ian W Tang, Johnni Hansen, Aisha S Dickerson, Marc G Weisskopf  
 Full Source: Amyotrophic lateral sclerosis & frontotemporal degeneration 2024 Sep 8:1-8. doi: 10.1080/21678421.2024.2399155.

Objectives: We investigated the relationship between occupational lead exposure and amyotrophic lateral sclerosis (ALS) survival in Denmark.

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### Long-term effects of an early-life exposure of fathead minnows to sediments containing bitumen. Part II: Behaviour, reproduction, and gonad histopathology

2024-09-04

The oil sands area of northern Alberta has river sediments that contain natural bitumen. Eggs and fish in these rivers may be exposed to bitumen-related chemicals early in life. This paper assesses a short embryo-larval fish exposure to oil sands sediment and follows the fish behaviour as they mature in clean water and examines their breeding success as adults (5 months afterwards). The three different oil sands river sediments tested were: a sediment collected outside of the bitumen deposit (tested at 3 g/L, Reference sediment from upstream Steepbank River site), and two sediments collected within the deposit (each tested at low (1 g/L) and high (3 g/L) concentrations). The sediments within the bitumen deposit were from the Ells and Steepbank (Stp) Rivers, and both contained significant total PAHs (>170 ng/g wet weight sediment) and alkylated PAHs (>4480 ng/g). Fish were exposed to these sediments for 21 days (as eggs and larval fish), and then transferred permanently to clean water to mature and breed. There was a significant decrease in the number of egg clutches produced by fish exposed early in life to Stp downstream high sediment (compared to Reference sediment). There was also a decrease in overall cumulative egg production, with fish from Stp downstream high sediment producing just over 1000 eggs in total while fish exposed to Ref sediment produced nearly 6900 eggs. The fish with reduced egg production were also less social than expected as they matured, and they had a lower % of early vitellogenic eggs in their ovaries. Overall, the exposure shows that a single, brief exposure during early life stages to natural bitumen can affect fish in adulthood. Naturally occurring bitumen-derived PAHs can reduce fish reproductive output by complex mechanisms, measurable as lower ovary maturity and changes in social behaviour.

Authors: C Vignet, R A Frank, C Yang, K Shires, M Bree, C Sullivan, W P Norwood, L M Hewitt, M E McMaster, J L Parrott

Full Source: Environmental pollution (Barking, Essex : 1987) 2024 Sep 4:124840. doi: 10.1016/j.envpol.2024.124840.

The oil sands area of northern Alberta has river sediments that contain natural bitumen.