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CHEMICAL EFFECTS

Profiling aerosol Polycyclic Aromatic Compounds (PACs) in a severely polluted European city: A comprehensive assessment of the residential biomass burning impact on atmospheric toxicity

2025-04-28

Fine aerosol Polycyclic Aromatic Hydrocarbons (PAHs), Oxygenated Polycyclic Aromatic Hydrocarbons (OPAHs) and other PM2.5 components were quantified in Ioannina, a Southeastern European city facing severe air quality degradation due to residential biomass burning (BB). Polycyclic Aromatic Compound (PAC) seasonal means were extremely enhanced in winter compared to summer (by 98 and 88 times for PAHs and OPAHs, respectively). Benzo(a)pyrene (BaP) registered a 347-fold winter increase, and its estimated annual mean was 2.4 times higher than the EU standard. Medium- and high-molecular weight PAC species correlated well with PM2.5 DTTv activity (R2: 0.48 and 0.54, respectively), suggesting also their significant non-carcinogenic potential. These PAC groups were strongly associated with methanol- and water-soluble Brown Carbon absorption (R2 > 0.7). Source apportionment by Positive Matrix Factorization (PMF) on the speciation dataset indicated BB as the major aerosol source, contributing > 80 % to average Σ-PAC concentrations and their carcinogenic potential during the study period. The PAC carcinogenic risk assessment highlighted the importance of considering the inclusion of not only legacy PAHs but also emerging species with very high estimated toxicity, such as Benzo(c)fluorene and Dibenzo-pyrenes. Observed concentrations were alarming, posing substantial short- and especially long-term risks. Therefore, there is an urgent need to regulate residential BB in Ioannina and similar urban environments in SE Europe.

Authors: Irini Tsiodra, Georgios Grivas, Kalliopi Tavernaraki, Despina Paraskevopoulou, Constantine Parinos, Maria Tsagkaraki, Eleni Liakakou, Aikaterini Bougiatioti, Evangelos Gerasopoulos, Nikolaos Mihalopoulos

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Imbalance of phosphoric acid homeostasis in alveolar macrophages mediates lung toxicity of rare earth oxide nanoparticles

2025-05-03

Recent advancements in the application of rare earth elements (REEs) and the rapidly expanding field of nanotechnology have raised growing concerns over the potential health impacts associated with rare earth oxide nanoparticles (REO NPs). Despite an increasing interest, a comprehensive understanding of the toxicity of REO NPs remains elusive. While some REO NPs, such as La2O3 and CeO2, have been shown to induce pulmonary injury to different degree, the mechanisms underlying these effects are not fully clear. In this study, we evaluated the cytotoxicity of sixteen REO NPs by CCK-8 assay in murine alveolar macrophages (MH-S), which revealed considerable heterogeneity (viability ranging from 34.7 % to 105.7 % at 50 μg/mL). Correlation analyses showed that the cytotoxicity was strongly associated with the capacity of REO NPs to adsorb phosphate and alter pH levels (R2 = 0.37 and 0.56), whereas parameters such as hydrodynamic size, zeta (ζ)-potential, and extracellular release of RE ions did not correlate with cytotoxicity. Consistent with these findings, variations in intracellular phosphate depletion and lysosomal pH shifts were observed in MH-S. Moreover, phosphate starvation exacerbated cytotoxicity, while pre-treatment with phosphoric acid mitigated these effects. These findings were corroborated by in vivo test, which showed that REO NPs exhibiting higher reactivity with phosphoric acid also caused more severe lung damage, including impaired lung function and increased collagen deposition. Notably, phosphoric acid modification significantly alleviated lung injury. Collectively, these findings suggest that lung toxicity induced by REO NPs may be mediated by disruption of phosphoric acid homeostasis within macrophages, which offers critical insights into the mechanisms underlying the toxicity of REO NPs and potential health risks.

Authors: Haonan Li, Jianzhong Zhang, Zihao Han, Wanjun Zhang, Dandan Song, Lin Zhang, Yuxin Zheng, Jinglong Tang, Shuhan Tian

Full Source: Ecotoxicology and environmental safety 2025 May 3:297:118265. doi: 10.1016/j.ecoenv.2025.118265.

Human sperm as an in vitro toxicity model: a versatile tool for assessing the risk of environmental contaminants

2025-05-03

Contaminants of emerging concern (CECs) pose a significant threat to human and ecosystem health due to their persistence, bioaccumulation

in higher trophic levels, and potential toxicity. While in vivo models are commonly used for toxicity screening, developing alternative in vitro techniques for rapid environmental risk assessment is essential. Spermatozoa, with their compartmentalized structure, measurable characteristics and sensitivity to environmental changes, offer potential as an in vitro model for toxicity screening. We evaluated the impact of selected CECs, including pharmaceuticals and pesticides, on sperm function in highly motile sperm subpopulations selected from donor semen. Standardised protocols were applied to assess various sperm functional parameters after 1-4 h of exposure to either individual or a mixture of chemicals. Our findings revealed that total motility is insufficient to detect subtle toxic effect. More responsive measures, such as sperm kinematics, induced hyperactivation, viability, mitochondrial membrane potential (MMP) and presence of reactive oxygen species (ROS) should be assessed to elucidate the effect of a toxic environment on sperm function. Most chemicals exerted a dose-response effect on sperm parameters, with the higher concentrations resulting in the most negative effects. The inherent sensitivity of human spermatozoa to oxidative stress, mitochondrial damage and energy metabolism, makes them a robust model for assessing toxicity. These features highlight their utility as an alternative cellular model for evaluating CECs and advancing risk assessment methodologies.

Authors: Shannen Keyser, Daniel Marcu, Morgan T D Davidse, Monique Bennett, Leslie Petrik, Liana Maree

Full Source: Archives of toxicology 2025 May 3. doi: 10.1007/s00204-025-04035-x.

ENVIRONMENTAL RESEARCH

Personal exposures to air pollutants and respiratory health among brick kiln workers and household members

2025-05-01

Background: Brick kiln workers (BKWs) may be exposed to high levels of respirable silica and other pollutants; however, few studies have measured personal exposures and health impacts in BKWs. We characterized exposures to brick kiln pollution and respiratory health among BKWs in Bhaktapur, Nepal.

Methods: We identified 64 brick kilns and selected a random sample of ten to conduct a household census and select a stratified random sample of 60 BKWs (makers, stackers, and haulers) aged ≥14 years with ≥10 years of kiln work, and household members aged ≥9 years. We measured personal

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exposures to kiln pollutants, and conducted sociodemographic and health questionnaires, spirometry, and chest imaging.

Results: We enrolled 88 participants (mean age 31.0±11.3 years, 77% male, 35% current smokers); 69% of 8-hour time-weighted average respirable silica exposures during work hours exceeded 25 µg/m3. Exposures were highest among stackers (117.9 µg/m3) and haulers (98.8 µg/m3) compared to makers (16.0 µg/m3). Work exposures to SO2 exceeded 2 ppm in 45% of stackers and 48% of haulers. All non-work hour PM2.5 exposures exceeded 15 µg/m3. While the prevalence of reported respiratory symptoms was low, 8% of participants had a post-bronchodilator FEV1/FVC ratio below the 5th percentile. We identified diffuse centrilobular nodularity and mediastinal lymph node calcification in 66% (19/29) and 24% (7/29), and 35% (9/26) with >15% of functional small airways disease on computed tomography. In contrast, none of the chest X-rays were consistent with silicosis.

Conclusion: Our findings highlight the need for occupational health interventions to protect brick kiln workers and residents from the effects of brick kiln pollution.

Authors: Laura Nicolaou, Evelyn Rowell, Chelsea Gaviola, Ram K Chandyo, Arun K Sharma, Laxman P Shrestha, Santa Das, David L Parker, Steven M Thygerson, Joseph Jacob, Bojidar Rangelov, Ryoko Egashira, Samir Dawadi, Gaurab Shrestha, Kenneth D Rosenman, Gurumurthy Ramachandran, William Checkley

Full Source: Environmental research 2025 May 1:121760. doi: 10.1016/j.envres.2025.121760.

Association of ambient air pollution with hospital admissions for major osteoarthritis diseases: A national case-crossover study in China

2025-05-02

Objectives: To investigate the acute effects of short-term exposure to ambient air pollution on the risk of hospital admissions for osteoarthritis (OA) and its major subtypes.

Methods: Hospital admission data on OA and its major subtypes were sourced from two major urban medical insurance systems in China, covering the period from 2013 to 2017. A two-stage, time-stratified case-crossover design was used to investigate the acute effects of short-term exposure to ambient air pollutants on hospital admissions for OA across 278 Chinese cities with available hospital admission data over 50 cases. The conditional logistic regression model was utilized to assess city-

specific associations, which were subsequently pooled by employing a random-effects model.
Results: A total of 1,404,095 OA-related hospital admissions were included. At the main time windows, per interquartile range increases in PM2.5 (particulate matter with an aerodynamic diameter of ≤ 2.5 μm), PM10 (particulate matter with an aerodynamic diameter of ≤ 10 μm), NO2 (nitrogen dioxide), SO2 (sulfur dioxide), O3 (ozone), and CO (carbon monoxide) were associated with significant increases in OA-related admissions by 0.70 % (95 % CI: 0.12 %, 1.28 %), 1.08 % (95 % CI: 0.47 %, 1.69 %), 4.50 % (95 % CI: 3.36 %, 5.65 %), 2.75 % (95 % CI: 1.79 %, 3.72 %), 1.33 % (95 % CI: 0.57 %, 2.10 %) and 1.77 % (95 % CI: 0.76 %, 2.79 %), respectively. Short-term exposures to ambient air pollutants were also associated with increased hospital admissions for major OA subtypes, especially gonarthrosis. The attributable fractions of OA admissions ranged from 0.87 % for PM2.5 to 6.22 % for NO2.
Conclusions: Short-term exposure to ambient air pollution is significantly associated with an increased risk and burden of OA admissions.
Authors: Ge Li, Chao Li, Huimeng Liu, Yunlong Song, Yuchen Zhang, Ping Chen, Hong Zhang, Shaowei Wu
Full Source: Ecotoxicology and environmental safety 2025 May 2:297:118255. doi: 10.1016/j.ecoenv.2025.118255.

PHARMACEUTICAL/TOXICOLOGY

Power Outages and Carbon Monoxide Poisoning in Children

2025-05-05
Introduction: Carbon monoxide (CO) is a colorless, odorless, and nonirritating gas that can result in health impacts ranging from mild headaches to death. Children are uniquely vulnerable to CO poisoning. Power outages may increase the risk of CO exposure through improper generator use.
Methods: We used community-level power outage data from 2017 to 2020 and CO emergency department visits among children <18 from the Statewide Planning and Research Cooperative System (SPARCS) in New York State (NYS). We evaluated all-scale (≥1% of a community without power) and large-scale (≥20% of a community without power) outages and their impact on CO poisoning on the day of initial outage exposure and the 3 following days (lag day 0 through lag day 3) in a case-crossover study design.

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Results: We identified 917 cases of CO poisoning and an incidence rate of 5.6 per 100 000 person-years in NYS from 2017 to 2020. The incidence rate of CO poisoning was highest among children aged 5 years or younger (7.8 per 100 0000 person-years) and among Black children (9.1 per 100 000 person-years). Four hours without power increased the odds of a pediatric CO poisoning ED visit on the day of exposure by ≥50% for all-scale and ≥150% for large-scale outages. Associations were stronger in urban vs rural areas.
Conclusion: Although CO poisoning is a rare cause of pediatric ED visits in NYS, it is preventable. Outages substantially increased the odds of CO poisoning-related ED visits among children and should be regarded as an important CO poisoning risk factor.
Authors: Alexander J Northrop, Vivian Do, Nina M Flores, Lauren Blair Wilner, Perry E Sheffield, Joan A Casey
Full Source: Pediatrics 2025 May 5:e2024068213. doi: 10.1542/peds.2024-068213.

Incidence of respiratory diseases associated with per- and polyfluoroalkyl substances (PFAS) in PM2.5: New evidence from a population-based survey of Pearl River Delta (PRD), China

2025-05-02
Epidemiological studies have evinced that particulate matter (PM) is linked to respiratory diseases, but the relationship between the specific constituents of PM and respiratory diseases remains scarce. Here, we evaluated the relationship between PFAS in PM2.5 with respiratory diseases. In this study, from May 2016 to May 2018, we recruited 131,346 school-aged children and adolescents living in Pearl River Delta, Guangdong Province, China. Participants self-reported the respiratory diseases, including asthma, wheezing, phlegm, cough and rhinitis. Logistic regression and qg-comp models were used to analyze the relationship between PFAS exposure and respiratory diseases. We found several PFAS were significantly associated with higher prevalence of respiratory diseases. For instance, higher quintiles of PFSA exposure (Q2-Q4), as compared to Q1, were associated with greater odds of respiratory diseases: 1.35 (95 %CI: 1.23, 1.48) in Q2, 1.95 (95 %CI: 1.78, 2.14) in Q3 and 2.83 (95 %CI: 2.76, 3.11) in Q4. Furthermore, qg-comp model analysis revealed PFCA as the most important weight in respiratory diseases. Moreover, the effect estimates were higher in boys, older children (>12 years old) and overweight/obesity, indicating the vulnerability of these subpopulations. In summary, exposure to PFAS, a specific PM2.5 constituent, potentially

increases the risk of respiratory diseases among school-aged children and adolescents.
Authors: Lu-Yin Wu, Wan-Ting He, Mohammed Zeeshan, Yang Zhou, Yun-Ting Zhang, Li-Xia Liang, Jing-Wen Huang, Jia-Xin Zhou, Kun Zhao, Wen-Wen Bao, Li-Zi Lin, Zhao-Huan Gui, Ru-Qing Liu, Li-Wen Hu, Zhi Wang, Guang-Hui Dong
Full Source: Journal of hazardous materials 2025 May 2:494:138485. doi: 10.1016/j.jhazmat.2025.138485.

OCCUPATIONAL

Associations between long-term exposure to particulate matter and mortality from multiple causes among the oldest-old people

2025-04-29
Older people are considered more vulnerable to particulate matter (PM) exposure in terms of mortality risk. However, little is known about the associations among the oldest-old people in the era of rapid ageing. Thus, the objective of this study was to estimate the associations between long-term exposure to PM and the risk of mortality from multiple causes among the oldest-old people (aged over 80). In total, all-cause mortality and mortality from eight broad and 23 specific causes were estimated on the basis of 7-year cohort data for almost 10 thousand oldest-old people in China. Moreover, time-dependent characteristics of the associations were determined. PM exposure was associated with increased mortality risks for a wide range of causes, including neoplasms and nervous system diseases, which have rarely been assessed before. With respect to specific causes, pulmonary heart diseases and diseases of pulmonary circulation was more affected by PM exposure. Notably, the impacts on some diseases, such as the circulatory system and hypertensive diseases, decreased during the COVID-19 pandemic. The effect may be modified by some social factors during the pandemic. Understanding the dynamic associations between PM exposure and mortality from multiple causes is highly important for identifying sensitive cause-specific deaths.
Authors: Haiyang Yu, Jingyi Zhao, Yunquan Zhang, Meng Zhang, Xiaofeng Sun, Xiaowei Hao, Qing Wang
Full Source: Journal of hazardous materials 2025 Apr 29:494:138434. doi: 10.1016/j.jhazmat.2025.138434.

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Agricultural Supervisors' Perspectives on Occupational Wildfire Smoke Rules

2025-05-03
Objectives: The purpose of this study was to 1) explore perceptions of air quality (AQ) monitoring, hazard communication, health impacts of smoke exposure, protective controls and training needs among agricultural supervisors in alignment with the major elements of the wildfire smoke rule, and 2) compare survey responses by the language in which the survey was completed to identify training needs by group.
Methods: Bilingual personnel administered a 29-question survey in Spanish and English to agricultural supervisors and crew chiefs at two industry trainings in Washington (WA) State (12/2023, 1/2024). Data were analyzed in SPSS. Descriptive statistics were used to summarize the data with chi-squared tests for group comparisons by language.
Results: A total of 116 surveys were collected, with 61% completed in Spanish. Almost one-fifth (18%) of respondents reported "hypertension/cardiovascular disease" as a condition that impacts their own health, and 19% reported "asthma/respiratory disease." Of respondents, 80% agreed they have been exposed to wildfire smoke at work, and 77% reported they supervised workers who have been exposed to smoke. A significantly greater proportion of completers in Spanish (90%) reported being concerned with their own health and their workers' health in relation to smoke exposure than those completing in English (64%). Most (81%) respondents agreed they can recognize signs/symptoms when a worker is not feeling well due to smoke exposure, but only 63% reported having had training on managing workers with smoke-related symptoms. N95 masks were identified as the most realistic protective control to implement when wildfire smoke is present. There were significant differences by language group regarding what resources respondents identified as accurate for AQ monitoring at work. Most respondents (79%) had heard of the wildfire smoke rule in Washington.
Conclusion: Wildfire smoke is an occupational health threat for outdoors workers that is expected to increase. Supervisors who work in agricultural workplaces are required by law in Washington, Oregon, and California to monitor AQ, manage workers' symptoms, and implement protective controls at certain AQ thresholds. Study findings identify gaps in these

areas and will support ongoing training of a critical subsector of the agricultural workforce.
Authors: Julie Postma, Molly Parker, Sheila Hurst, Juliana Romo, Janessa M Graves
Full Source: Journal of agromedicine 2025 May 3:1-12. doi: 10.1080/1059924X.2025.2498342.

Long-term exposure to smoke PM2.5 and COPD caused mortality for elderly people in the contiguous United States

2025-05-01
Wildfire events in the US are becoming more frequent and more intensive due to climate change. Fire smoke can significantly contribute to ambient PM2.5 (PM2.5, particles smaller than 2.5 μm in diameter) levels and alter its chemical composition. An emerging body of literature has linked COPD mortality and episodic wildfire smoke exposure, but studies on the effect of long-term fire smoke exposure is lacking. We aimed to evaluate how long-term exposure to smoke PM2.5 can affect COPD mortality among elderly people and to explore the spatial variability in this effect. We investigated all elderly people aged 65-100 years in the contiguous United States using Medicare and National Death Index data from 2008 to 2016. We identified three subregions based on wildfire smoke risk to indicate spatial differences in smoke exposure. We used time-varying Cox Proportional Hazards Models to explore the effect of smoke PM2.5 on COPD mortality. We found that smoke PM2.5 is strongly associated with COPD mortality. An increase of 1 μg/m3 in smoke PM2.5 was associated with a 9.2 % increase in COPD mortality among elderly people (95 % CI: 8.8 %-9.7 %). Specifically, A 1 μg/m3 increase in smoke PM2.5 may increase deaths by 40.4 %, 9.6 % and 3.9 % in low, moderate, and high wildfire risk areas, respectively. Our study reveals that long-term exposure to smoke PM2.5 significantly contributes to COPD mortality among elderly people. Notably, those living in regions with relatively lower wildfire risk appear vulnerable. Therefore, wildfire prevention should be emphasized in areas that are not typically wildfire active.
Authors: Ke Xu, Hua Hao, Danlu Zhang, Wenhao Wang, Haomin Li, Yanling Deng, Tszshan Ma, Kyle Steenland, Howard Chang, Yang Liu
Full Source: Environment international 2025 May 1:199:109513. doi: 10.1016/j.envint.2025.109513.