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CONTACT US

subscribers@chemwatch.net
tel +61 3 9572 4700
fax +61 3 9572 4777

1227 Glen Huntly Rd
Glen Huntly
Victoria 3163 Australia

CHEMICAL EFFECTS

Transcriptomic dose response assessment of PFAS chemicals 3:3 fluorotelomer carboxylic acid, 7:3 fluorotelomer alcohol, and perfluorohexanesulfonamide

2025-06-20

Per- and polyfluoroalkyl substances (PFAS) are a diverse class of anthropogenic chemicals, and their widespread use in manufacturing and commerce has led to introduction of these chemicals into the environment. Owing to the lack of traditional toxicology data on the majority of PFAS, novel testing methods that provide supporting information to inform human health impacts in a relatively short time frame will be increasingly important. The US Environmental Protection Agency's (EPA) Transcriptomic Assessment Process (ETAP) was recently implemented by the Agency as an efficient and cost-effective method to begin assessing potential human health impacts of chemicals that lack traditional toxicity testing data. The method involves short-term oral dosing in male and female adult rats over a five-day interval, followed by transcriptomic dose-response assessment in twelve tissues to determine a point of departure. The ETAP point of departure identifies the dose at which there are no coordinated transcriptional changes that would indicate a potential toxicity of concern. However, this approach does not explore any specific association with hazard or mechanism. Reported here are ETAP results for three PFAS chemicals: 3:3 fluorotelomer carboxylic acid (3:3 FTCA), 7:3 fluorotelomer alcohol (7:3 FTOH), and perfluorohexanesulfonamide (PFHxSA). The transcriptomic points of departure associated with the tested chemicals, as assessed via ETAP and allometrically scaled to human equivalent doses, were 0.00235 (3:3 FTCA), 0.0152 (7:3 FTOH), and 0.00358 (PFHxSA) mg/kg-day.

Authors: Esra Mutlu, Leah Wehmas, Alison H Harrill, Michael Devito, Russell S Thomas, Michael F Hughes, Denise Macmillan, Amanda Brennan, Jackson Bounds, Chelsea A Weitekamp, Logan J Everett

Full Source: Toxicology 2025 Jun 20:154223. doi: 10.1016/j.tox.2025.154223.

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Characterizing volatile organic compounds from personal protective equipment users: Implications to cleanroom air quality and occupational health

2025-06-14

Human-related contaminants are the primary pollution source in cleanrooms. This study employed time-of-flight mass spectrometry (PTR-ToF-MS) to characterize volatile organic compound (VOC) emissions from breath and skin under different activity levels and personal protective equipment (PPE) conditions in a climatic chamber. The results show that, without PPE, breath and skin emission rates were 968.2 ± 350.8 μg h-1p-1 and 2115.8 ± 1813.7 μg h-1p-1, respectively. With PPE, breath emissions slightly increased to 1068.6 ± 472.7 μg h-1p-1, while skin emissions stabilized at 2181.1 ± 1302.5 μg h-1p-1. Key VOCs included acetone, isoprene, and ethanol from breath, and propanamide, acetone, and isoprene from skin. Activity levels increased skin emissions, but prolonged PPE use reduced them. Females showed higher sensitivity to PPE in breath emissions, while males were more sensitive in skin emissions. PPE had minimal efficacy in mitigating the outward emission of skin VOCs into the ambient environment. The hydroxyl radical reactivity and secondary organic aerosol formation potential from human-related VOCs were 0.27 ± 0.08 s-1 and 2.13 ± 0.51 μg m-3, respectively. Breath VOCs, especially acrolein and acetaldehyde, pose significant health risks to users and may affect industrial processes. These findings highlight the importance of human activities in VOC emissions, crucial for contaminant control, health assessments, and industrial processes like semiconductor cleanrooms.

Authors: Zhongjian Jia, Zitian Zhang, Haihong Tan, Jianmin Chen, Liang Zhu, Lina Wang, Wen Tan, Zhengtao Ai

Full Source: Journal of hazardous materials 2025 Jun 14:495:138938. doi: 10.1016/j.jhazmat.2025.138938.

Radiological and chemical hazards of persistent organic pollutants in the textile sector

2025-06-20

The textile industry exposes people to various harmful and allergenic compounds, with dye wastewater being a significant source of persistent organic pollutants (chemical substances accumulate in living organisms and pose risks to human health and ecosystems) in the environment. This study aimed to measure the activity concentrations of radionuclides, specifically 238U, 226Ra, 232Th, and 40K, in different types of textile dyes (disperse, direct, and reactive) and dye wastewater from the cities of Abour

and Badr, using gamma spectrometry with a Hyper Pure Germanium detector. Additionally, heavy metal concentrations (Zn, Cd, Fe, Pb, Co, and K) were analyzed through Atomic Absorption Spectroscopy. The results indicated that the average specific activities of 238U, 226Ra, 232Th, and 40K were higher in disperse dyes compared to direct and reactive dyes. Potential radiation hazards were evaluated, revealing detectable levels of radioactivity in some textile dyes. This underscores the need for safety protocols and preventive measures for workers in the textile industry and those handling these dyes.
Authors: Sameh H Fouda, E S Abd El-Halim, H A Abdel Ghany
Full Source: Scientific reports 2025 Jun 20;15(1):20102. doi: 10.1038/s41598-025-03581-9.

ENVIRONMENTAL RESEARCH

The impacts of long-term carbon disulfide exposure on glucose homeostasis and type 2 diabetes: a multifaceted gene-environment-lifestyle interaction study of Chinese adults

2025-06-18
Introduction: The long-term impacts of exposure to carbon disulfide (CS2), a highly concerning air toxicant listed by the Clean Air Act, and its interactions with genetic susceptibility and lifestyle on glucose homeostasis and type 2 diabetes (T2D) in the general population remain unclear and require urgent clarification.
Objectives: To investigate the interactions of CS2 exposure, genetic susceptibility, and lifestyle on glucose homeostasis and T2D.
Methods: In this prospective study, urinary CS2 metabolite (2-Thiothiazolidine-4-carboxylic acid, TTCA) and fasting plasma glucose (FPG) and insulin (FPI) for 5294 observations from 2523 participants were repeatedly measured to examine the cross-sectional and longitudinal associations of CS2 exposure with glucose homeostasis and T2D by performing generalized linear mixed models or COX models. Polygenic risk score (PRS) and healthy lifestyle index (HLI) were constructed to evaluate their cross-sectional and longitudinal interactions with TTCA and to assess gene-CS2-lifestyle interactions.
Results: TTCA was cross-sectionally and longitudinally related to glucose dyshomeostasis and T2D risk elevation. Longitudinally, compared to subjects with persistently low TTCA, those with persistently high TTCA had 0.350 (95 % CI: 0.060 0.640) mmol/L, 0.197 (0.097 0.297) ln-unit, 0.236 (0.120 0.351) ln-unit, and 56.3 % (HR: 1.563; 95 % CI: 1.018 2.401) risk increments in FPG, FPI, HOMA-IR, and T2D incidence, respectively. Cross-sectional and longitudinal interactions of TTCA with PRS and HLI were uncovered (P for interaction < 0.05). Subjects with persistently low TTCA, healthy lifestyle, and low PRS longitudinally manifested the greatest reductions in FPG (β: -0.609; 95 % CI: -1.108 --0.108), FPI (-0.357; -0.479 --0.236), HOMA-IR (-0.358; -0.498 --0.219), and incident T2D risk (HR: 0.228; 95 % CI: 0.091 0.574).
Conclusion: Long-term CS2 exposure was related to glucose dyshomeostasis and increased T2D risk, which might be exacerbated by high genetic susceptibility while mitigated by healthy lifestyle, highlighting the significance of reducing CS2 exposure and improving lifestyle in preventing glucose dyshomeostasis and T2D, particularly among individuals with high genetic risk.
Authors: Yueru Yang, Jiahao Song, Yongfang Zhang, Shuhui Wan, Zhiying Huo, Qing Liu, Le Hong, Linling Yu, Wei Liu, Ruyi Liang, Bin Wang, Weihong Chen
Full Source: Journal of advanced research 2025 Jun 18:S2090-1232(25)00448-5. doi: 10.1016/j.jare.2025.06.039.

Exploring the Nutrient Nexus in Environmental Systems: Nitrogen and Phosphorus Cycling, Removal, Recovery, and Management

2025-06-19
Nitrogen (N) and phosphorus (P) are essential macronutrients that underpin critical biogeochemical processes, sustaining ecosystem functionality and productivity. However, anthropogenic activities, including agricultural intensification, industrial expansion, and urban development, have substantially disrupted their natural cycles. This disruption has led to the excessive accumulation of N and P across environmental matrices such as soil, water, and the atmosphere, resulting in significant ecological degradation. Consequences include eutrophication, harmful algal blooms, hypoxia, and biodiversity loss in aquatic ecosystems. Additionally, surplus N and P contribute to greenhouse gas emissions, soil acidification, and declining soil fertility, thereby impairing agricultural sustainability. Human health is also at risk due to nitrate-contaminated drinking water and exposure to algal toxins, while emissions of ammonia (NH3), nitric oxide (NO), and nitrous oxide (N2O) further degrade air quality. The economic burdens associated with these impacts are substantial, affecting sectors such as agriculture, fisheries, and tourism. Addressing these challenges necessitates

technological innovation in nutrient removal, recovery, and recycling, aligned with the principles of a circular economy. Established approaches include physical, chemical, and biological treatment methods. Emerging technologies, such as nanotechnology and synergistic applications of metal-organic frameworks (MOFs) with biochar, offer promising, sustainable alternatives, though they entail economic and operational considerations. Transitioning from nutrient removal to resource recovery and reuse encapsulates the circular economy's goal of closing nutrient loops, offering both environmental and economic co-benefits. Effective nutrient management necessitates interdisciplinary collaboration, drawing on expertise from ecology, agriculture, environmental engineering, economics, and policy. Such integrative approaches are essential for developing scalable and sustainable solutions to nutrient pollution and promoting long-term ecosystem restoration.

Authors: Sikandar Hayat, Peng Li, Saiqa Menhas, Weiping Liu, Kashif Hayat

Full Source: Environmental research 2025 Jun 19:122162. doi: 10.1016/j.envres.2025.122162.

Comprehensive Profiling of Phthalic Acid Esters (PAEs) in Air-Conditioning Filters from Diverse Indoor Environments Across 12 Major Cities in China

2025-06-20

Phthalic acid esters (PAEs), commonly used as plasticizers, primarily through airborne exposure. Unlike settling dust, air conditioning filters can effectively capture suspended particles and are an important source of indoor pollutants. This study analyzed 94 air-conditioning filter samples collected from five room types: bedrooms, living rooms, kitchens, mahjong rooms, and cloakrooms, across summer, autumn, and winter in 12 major Chinese cities. Using target LC-MS/MS combined with custom database, 22 PAEs were identified, and the detection rate of 19 PAEs was 100%. Principal component analysis showed that season had more influence on the distribution of indoor PAEs than room type, and there were obvious differences between summer and winter samples. Among PAEs, dioctyl phthalate (DOP) dominates (44.28%-96.22%), and the toxic metabolites it generates through lipase activity cause serious health problems. The chemical composition analysis showed that the DBE value of 81.82% PAEs was 6, the H/C value of 45.45% PAEs was 1.35-1.65, and the O/C value was 0.15-0.25, including several PAEs with the highest peak force ratio. This finding suggests that many PAEs have similar properties and may have similar chemical behavior. Correlation analysis showed that there was more positive correlation among PAEs, and the correlation

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increased in autumn. Spatial-temporal analysis revealed that peak PAE intensities varied significantly, by over 15-fold geographically and 1.53-fold seasonally. These findings underscore the pronounced spatial and temporal variability in PAE concentrations, highlighting the complexity of exposure patterns across different environments and time frames.

Authors: Jiaqian Yan, Bailiang Liu, Boyue Jia, Ke Zhu, Zelong Wu, Haihong Tan, Lidia Morawska, Lina Wang, Jianmin Chen

Full Source: Environmental pollution (Barking, Essex : 1987) 2025 Jun 20:126714. doi: 10.1016/j.envpol.2025.126714.

PHARMACEUTICAL/TOXICOLOGY

Effects of web-based behavioral intervention on fine particulate matter, pulmonary function, and airway inflammation in children: The COCOA randomized controlled trial

2025-06-19

Background: Although web-based intervention programs are effective in changing health behavior, evidence of their effectiveness in relation to air pollution and respiratory health in children is lacking. We assessed the effects of web-based behavioral intervention on exposure to fine particulate matter (PM ≤2.5μm in diameter [PM2.5]), lung function, and airway inflammation in children.

Methods: We randomized 80 mother-child pairs into intervention or control groups (two arms, 1:1 allocation). Personal and indoor PM2.5 concentrations over a sampling period of 24 hour up to four occasions during the study period were measured in participants' homes. We used linear mixed models to assess the intervention effects on PM2.5 concentration, lung function parameters including forced vital capacity (FVC), forced-expiratory volume in 1 second (FEV1), FEV1/FVC, and forced-expiratory flow at 25-75% (FEF25%-75%), and the airway inflammation marker, fractional exhaled nitric oxide (FeNO), as well as the association of PM2.5 with lung function and airway inflammation. Quantile regression was also used to examine the effects of PM2.5 exposure at different quantiles of the outcome distribution.

Results: In comparison with the control group, the intervention group showed reduction in indoor and personal PM2.5 concentrations by 20.5 % (95% confidence interval [CI]: -30.7, -8.7) and 12.9% (95% CI: -20.1, -5.1), respectively. Lung function parameters such as FVC, FEV1, and FEF25%-75% were higher in the intervention group, with greater benefits observed

for children at the lower end of these parameters. Higher levels of outdoor and personal PM2.5 (≥90th percentile) were negatively associated with these lung function parameters at the lower quantiles, whereas the higher level of outdoor PM2.5 concentration was positively associated with FeNO at the lower quantile.
Conclusions: The behavioral intervention reduced PM2.5 concentration in the homes, which was linked to markers of lung function and airway inflammation in children, particularly at the lower quantiles.
Authors: Dirga Kumar Lamichhane, Bo-Mee Kim, Jungyun Bae, Hea Young Oh, Dong In Suh, Youn Ho Shin, Kyung Won Kim, Kangmo Ahn, Hyo-Bin Kim, Song-I Yang, So-Yeon Lee, Soo-Jong Hong, Hwan-Cheol Kim
Full Source: Environmental research 2025 Jun 19:122200. doi: 10.1016/j.envres.2025.122200.

Short Communication: Simultaneous Removal of Co-occurring Contaminants Reduces Drinking Water-Attributed Cancer Risk: A United States Case Study

2025-06-18
Introduction: Removal of co-occurring contaminants produces significantly greater potential benefit estimates compared to evaluation of one contaminant at a time. Here we present a framework for calculating avoidable lifetime cancer cases from simultaneously reducing hexavalent chromium and arsenic concentrations in drinking water using U.S. data as a case study.
Methods: We analyzed contaminant occurrence data from 2011 to 2023 in 6,831 U.S. community water systems for which testing data for Cr(VI) were available. We also extrapolated potential Cr(VI) concentrations for an additional 10,893 groundwater systems in the U.S. where total chromium test data were available. To estimate potential reductions in the theoretical lifetime cancer risk from Cr(VI) and arsenic pollution, we evaluated water quality improvement scenarios for the subset of community water systems where inorganic arsenic and Cr(VI) co-occur.
Results: For the entire U.S., an estimated 7,410 lifetime cancer cases from Cr(VI) exposure and 43,418 from arsenic exposure could be avoided if drinking water concentrations were reduced to their respective one-in-a-million cancer risk levels in systems with Cr(VI) detections. For hypothetical maximum contaminant levels of Cr(VI) at 10 and 5 µg/L, estimated avoidable lifetime cancer cases for the entire United States are 575 and 1,320, respectively. At these same hypothetical limits for Cr(VI), simultaneously reducing arsenic by 42% and 28%, would double the number of lifetime cases avoided.

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Discussion: Analysis of decreased cancer risk associated with the simultaneous reduction of co-occurring drinking water contaminants provides information for establishing new frameworks for mitigating contaminants and protecting public health from pollution. Consideration of the health and economic benefits associated with removal of co-occurring contaminants may help underscore the value of regulations that encourage the use of such technologies. It could also support the development of more efficient approaches for drinking water treatment.
Authors: Tasha Stoiber, Sydney Evans, Chris Campbell, David Q Andrews, Olga V Naidenko
Full Source: Environmental research 2025 Jun 18:122125. doi: 10.1016/j.envres.2025.122125.

OCCUPATIONAL

An evaluation of potential sources of toxic metals in the poultry industry in Bangladesh: Dietary exposure and toxicological implications

2025-06-18
Ongoing industrial development, coupled with rising concerns about the quality of poultry products, highlights an urgent need for careful monitoring of vital sectors, especially the poultry industry, which serves as an important source of protein for many families. In our study, we analyzed 45 real samples from five zones in the heavily industrialized area around Dhaka. We utilized advanced techniques such as graphite furnace atomic absorption spectrometry (GF-AAS), hydride generation (HG)-AAS, and flame (F)-AAS methods to assess the presence of toxic heavy metals (HMs), including Pb, Cd, Cr, As, and Ni, as well as essential trace elements such as Mn, Cu, and Zn, which may become harmful when present at elevated levels. The concentration ranges in poultry meat and egg samples were as follows (mg/kg-fw): Pb (1.215-5.66), Cd (0.01-0.019), Cr (0.199-14.58), As (0.01-0.2), Ni (1.69-10.55), and Mn (0.22-6.47). Furthermore, the poultry feed samples presented varying concentrations (mg/kg): Pb (4.53-6.14), Cd (0.17-0.2), Cr (20.4-516.62), As (0.27-0.39), Ni (35.17-66.06), Mn (11.65-84.39), Cu (2.43-7.09), and Zn (17.38-56.38). Some components (Cr, Ni, and Pb) were found in similar ratios in chicken feed samples and poultry products, indicating that poultry feed is a potential source of such elements in poultry products. Newly identified higher levels of Ni demand further investigation into this sector and how it incorporates the studied components. The mean concentrations of most elements

in foods exceeded the maximum allowable concentration (MAC), which indicates that some other sources were involved. Furthermore, the dietary and toxicological assessment highlighted concerns related to Cr, Pb, and Ni exposure, indicating a possible serious toxicological impact (CR index for Cr: 0.0014) on human health. Therefore, it is imperative to acknowledge the potential health risks posed to consumers through chemical exposure to chicken meat and eggs. These issues must be addressed to ensure food safety and protect public health.

Authors: Tasrina Rabia Choudhury, Faria Jahan, M Nur E Alam, L N Lutfa, Tanzina Iveen Chowdhury, M Safiur Rahman, Shafi Mohammad Tareq

Full Source: Journal of food protection 2025 Jun 18:100565. doi: 10.1016/j.jfp.2025.100565.

Trends in occupational radiation dose of health practitioners in the Eastern Province of Saudi Arabia

2025-06-14

Monitoring the Effective Dose (ED) among occupationally exposed healthcare workers is crucial to keeping exposure within acceptable limits and minimizing radiation-induced health risks. This study investigates the Ionizing Radiation Exposure (IRE) among 1,117 healthcare workers from the Eastern Province of Saudi Arabia from 2016 to 2022. Utilizing Thermoluminescent Dosimeters (TLDs) in 26 hospitals conducting diagnostic and interventional radiology, a Harshaw 6600 TLD Reader was used to extract the ED, and the Annual Mean, Standard deviation, and Range (AMSR) were analyzed. The ED of staff was also gleaned for Dental and Cardiac Catheterization departments separately. Results show that the ED across the different departments remain below the recommended annual dose limit of 20 (mSv). The social impact of COVID-19 pandemic, such as reduced patient volume, adoption of telehealth services, and strict safety protocols, contributed to decreased ED, before the easing of lockdown restrictions in June 2021. The overall declining trend of AMSR values over the seven years indicates successful adherence to radiation protection principles notably the As Low As Reasonably Achievable (ALARA) principle. This study advocates optimizing radiation safety measures and contributes to the continual enhancement of occupational safety protocols in the healthcare sector.

Authors: Abdulrahman Aliyu, Luai M Alhems, Mohammed Abbas

Full Source: Applied radiation and isotopes : including data, instrumentation and methods for use in agriculture, industry and medicine 2025 Jun 14:225:111937. doi: 10.1016/j.apradiso.2025.111937.