Investigating Polychlorinated Naphthalenes (PCNs) in Asia Pacific regions: A Review of Sources, Occurrences and Health Impacts.

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Abstract

Polychlorinated naphthalenes (PCNs) are a class of persistent organic pollutants (POPs) exhibiting high environmental persistency, bioaccumulation properties and significant toxicological effects. Historically, PCNs have been used as insulators and fire retardants in various electrical and industrial applications due to their stability and compatibility. Despite the implementation of global regulatory initiatives such as the 'phase-out policy' and Stockholm Convention on POPs, their legacy contamination and ongoing emissions continue to pose environmental and public health risks, especially in Asia. This review investigated current knowledge on the sources, occurrences and health impacts of PCNs in rapidly developing and densely populated urban Asian regions. Metallurgy industries are identified as the major source of PCNs, contributing over 97% of total emissions, followed by thermal processes, historical usage and emerging concern of electronic waste recycling activities. Lower chlorinated PCN congeners (mono- to tetra-) levels were found to vary significantly from fg to ng levels in environmental distribution, contributing to the extensive contamination of air, soil, water, sediments and biota samples in proximity to industrial areas. Occupational exposure was associated with increased cancer risks (CR), while elevated non-CR were observed in vulnerable populations such as infants and children. Ingestion was the primary exposure route, occurring through consumption of PCNs contaminated food. PCNs exposure showed potential health risks including carcinogenicity, neurotoxicity, endocrine disruption and reproductive disorders. This review highlights the need for further research on emerging sources, longitudinal environmental monitoring and epidemiological studies to evaluate health impacts of PCNs exposure in Asian regions.

Keywords: PCNs; Asian regions; Emerging sources; Health risks.