

Deposition and Source Identification of Nitrogen Heterocyclic Polycyclic Aromatic Compounds in Snow, Sediment, and Air Samples from the Athabasca Oil Sands Region

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Polycyclic aromatic compounds (PACs) can have multiple sources in the Athabasca Oil Sands Region (AOSR). The current study was designed to identify and explore the potential of nitrogen heterocyclic PACs (NPACs) as source indicators in snowpack, lake sediment and passive air samples from the AOSR during 2014-2015. Source samples including petroleum coke (petcoke), haul road dust, and unprocessed oil sands were also analyzed. Samples were analyzed using comprehensive two-dimensional gas chromatography time-of-flight mass spectrometry, and liquid chromatography-high resolution Orbitrap mass spectrometry. Over 200 NPACs were identified and classified into at least 24 isomer groups, including alkylated carbazoles, benzocarbazoles, and indenoquinolines. Levels of NPACs in environmental samples decreased with distance from the main developments and with increasing depth in lake sediments but were detected within 50 km from the major developments. Th