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Necessity for Establishment of Inventories for Persistent Organic Pollutants (POPs) in Landfills and Contaminated Sites for an Evaluation of Mobilisation Risk by Climate Change

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The landfilling of persistent hazardous compounds with a tendency to migrate, such as Hexachlorocyclohexane (HCH), polychlorinated biphenyls (PCBs), Hexachlorobenzene (HCB) or Hexachlorobutadiene (HCBD) is a major pollution challenge. Historic dumping and landfilling in badly engineered and unsuitably located sites has resulted in widespread contamination from the landfilling of HCH, HCB and PCB wastes around former production sites. In the case of PCBs this has been exacerbated by subsequent landfilling of contaminated products (oils, capacitors, sealants and other building residues). In most cases locations and amounts are not or vaguely known but impacts are increasingly discovered by monitoring in the most advanced countries with sophisticated monitoring schemes in place. These reveal that entire river systems are being contaminated by these old dumps and contaminated sites and that expensive remediation work is required for to reduce further contamination.
In addition more recently other (halogenated) chemicals exhibiting the characteristics of POPs have emerged including e.g. brominated aromatic compounds (e.g. Polybrominated diphenylethers (PBDEs) and other brominated flame retardants) widely used as flame retardants for electronics; textiles, furniture; upholstery; insulation foam etc.) and fluorinated organic pollutants (e.g. PFOS or PFOA used in carpets, textiles, furniture, paper coating etc.). As products containing these chemicals reach the end of their life these hazardous compounds increasingly ended and end up in the waste stream. In most countries a large proportion of these wastes are disposed to landfills. In developing countries and those with economies in transition almost all this waste is landfilled. Consequently the quantities of POPs in municipal waste landfills have increased the last two decades. Therefore in addition to chemical landfills also municipal landfills increasingly become POPs deposits and sources.
Because of their persistence and relative mobility, these compounds will persist in landfills for many decades and probably centuries. Over these extended time frames landfill engineering systems, including basal and capping liners, gas and leachate collection systems will inevitably degrade and loose their abilities to contain contamination. Furthermore consideration must now be given to the impacts of climate change and extreme weather events. This is likely to result in higher temperatures with increased volatalisation of semi-volatile compounds; longer dry periods with drying of surface caps; together with higher intensity rainfall events and increased flooding risks. These effects will impact on the integrity of the containment systems. It is therefore inevitable that more of the deposited POPs will leach into rivers, lakes and the larger environment via escaping leachate, ground or surface water as well as escaping to atmosphere by volatilisation. At the same time our reliance on water resources is likely to increase. In order to evaluate the associated risks for human exposure and biodiversity, inventories of deposited POPs and other PBTs need to be established, their locations comprehensively mapped and linked to future flooding scenarios for prediction of contamination of the precious water resources. This interdisciplinary task will require the cooperation between POPs experts, geotechnical engineers, contaminated site/landfill experts, water management specialists and geoscientists working on climate change and flooding.