

Landfill water treatment plants (WTP) permeates vs EU Directive 2000/60/CE: a case study of PAHs

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Extended abstract

The starting point of this research is the EU directive 2000/60/EC^[1] which establishes a framework for a EU policy of water management. The decision 2455/2001/EC^[2] modifies this Directive, defining a list of 33 priority substances in the field of water policy. In this list, PAHs hold an important place. For example, 6-Borneff-PAH is placed in the group of 10 priority dangerous substances. This paper presents a study, carried out by ISSeP, on PAH emitted by WTP of Belgian landfills in surface water. The aim of this study is double: assessing the total amount of PAH released by the municipal solid waste (MSW) sector during a large observation period and controlling the impact of WTP permeates on surface water quality.

The work focuses mainly on MSW landfills, with 11 plants being controlled. In order to compare the released of MSW sector, with the one of others industrial water treatment plants, it also includes 3 other sites. The first is a solid waste landfill for iron industry (Arcelor). The second one is the WTP of an important paper industry (Burgo-Ardenne) which purifies process water mixed with landfill leachate. The last one is the water released by large decantation basins collecting process water of a PVC plant (Solvay).

Wallonia's domestic landfills are equipped with various water treatment processes: physical or biological treatments; Membrane Bio-Reactor (MBR) process; reverse osmosis process; activated carbon adsorption; and often various combinations of these elements.

During 4 years, leachates and worn waters entering each WTP was sampled every 6 month, as well as exiting treated waters. In each sample, 15 PAH were analysed by HPLC following NBN EN ISO 17993. In addition, monthly flows passing through WTP were recorded. The total amount of PAH released in surface water is roughly obtained by multiplying the instantaneous concentrations (measured once) by the total water volume rejected during the whole semester. Such a computation assumes that PAH concentrations do not vary during the six-month period. As it is well known, leachate composition shows high seasonal variations. Such a hypothesis constitutes a serious limitation, computed PAH fluxes should not be used as quantitative measurements.

Especially on MSW landfills, there is a strong relation between WTP exit flows and pluviometry. Furthermore, these flows are influenced by landfill size, capping nature, and eventual use of recirculation process. Such interactions are often lower or negligible on industrial sites, where worn water flows primarily depend on production requirements.

Except for naphthalene, the compositions of every studied leachates show very low rates compared to published values^[3]. Most PAH molecules are very well retained by the WTP's. From 95% to 100% of entering PAH total amount is fixed on mud, adsorbed on activated carbon or retained by osmotic membranes. As a consequence, measured total-PAH concentrations in released water are often very low (< 0,1 µg/L). Among the 15 analysed PAH, only 6 are usually detected in released waters: naphthalene, fluoranthene, phenanthrene, fluorene, acenaphthene and pyrene. However, naphthalene (and in a lower extend fluorene and phenanthrene) shows quite lower retention rates, except when activated carbon module is present at the end of water treatment process. Naphthalene is the most concentrated species in leachate. It is also the most difficult to eliminate. It is a light, soluble and volatile compound. It is able to cross osmotic membranes. In summary, it is the most problematic one. Borneff-6 PAH's are rarely detected in significant amounts. In average, their total concentration remains lower than 0,05 µg/L. Among the 6 molecules of the Borneff group, fluoranthene is the most frequently detected. Measurements show neither a general rise nor fall of the average concentrations during the 4 years of the study. However, significant reductions of flow were observed during the study at some places where technical improvements had been performed. Regarding fluxes, MSW landfills release all together approximately 5 g PAH in surface waters each year. In comparison, only two industrial water treatment plants (Burgo and Solvay) reject 55 kg a year. In Wallonia, The emission of PAH from municipal solid waste sector in surface waters seems to be negligible compared to the one of other industrial sectors.

References

[1] DIRECTIVE 2000/60/EC of 23/10/2000 establishing a framework for Community action in the field of water policy. O.J.E.C. L 327 of 12.22.2000.

[2] DECISION No 2455/2001/EC of 20/11/2001 establishing the list of priority substances in the field of water policy.

[3] ANDREOTTOLA G. AND CANNAS P. (1997) *Chemical and biological characteristics of landfill leachate*. in *Landfilling of waste : leachate*. pp 65-88 ; edited by Christensen T.H., Cossu R., Stegmann R. (1997) ; Ed. : Chapman & Hall, London ; 520 p ; ISBN 0 419 161406