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INVESTIGATION ON PFAS SOURCES AND REMOVAL IN A MUNICIPAL WASTEWATER TREATMENT PLANT

Valeria MEZZANOTTE[1]*, Emilio BRIVIO SFORZA[2]

[1, 2] *Università degli Studi di Milano-Bicocca, DISAT, Piazza della Scienza, 1, 2026 Milano, Italy*

* ***Corresponding author.*** *Email address: valeria.mezzanotte@unimib.it*

Abstract – PFAS (per- and poly-fluoroalkyl substances) is a complex family of manmade highly fluorinated aliphatic organic chemicals including thousands of chemical structures identified. PFASs were first synthesized in the 1940s and their physical and chemical properties such as oil and water repellency, temperature resistance, and friction reduction were then used in a wide range of products and industrial applications. Awareness about the possible health and environmental risks related to exposure to these substances has only risen in recent years and is resulting in the inclusion of such compounds in the Proposal for the recast of the Directive of the European Parliament and of the Council concerning urban wastewater treatment. Research was carried out at a municipal wastewater treatment plant (MWWTP) in Northern Italy to define the inflowing load of PFAS, the main load sources and the removal efficiency of the treatment processes. First, the contribution of the water supplied to the local population was excluded by means of specific chemical analyses. Then, the 100 industrial settlements served by the MWWTP were examined for the raw materials used, the final products and the productive cycle and 8 of them were selected as potential sources. A sampling campaign was carried out and the specific PFAS load was calculated. The total PFAS load entering the MWWTP was calculated from the analytical results and the flow. The percent contribution of each of the selected settlements to the total PFAS load was then calculated. 40 % derives from a textile dyeing industry and 32 % from a waste platform receiving also landfill leachates. 89 % of the total PFAS load comes from the sum of such contributions and two other activities: the processing of slaughterhouse wastes and the production of chemicals for agriculture. Specific investigations lead to attribute an important role also to fire drills and fire extinguishing, using Aqueous Film Forming Foams (AFFF) containing PFAS. Therefore, domestic contribution can be held as negligible. The removal in the WWTP was null and, in some cases, negative. As also reported in the literature, some precursors can be transformed in PFAS during the biological process and some sludge accumulated compounds can be released.

Keywords – AFFF; industrial contribution; PFAS load; PFAS removal