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PFAS—Intersections with the pulp and paper industry

At the 2019 PEERS Conference in St. Louis, I sat in on a talk concerning the use of fluoropolymers for welding and repairing of flexible pipe. Fluoropolymers are well-known for their chemical resistance, a property important in such applications. At the end of the presentation, I asked if the research described had considered the potential for fluoropolymers to contribute per- and polyfluoroalkyl substances (PFAS) to process wastewaters. The response was one of confusion wherein the speaker and apparently much of the audience were either unaware of the notoriety PFAS were receiving in the environmental community or at least unaware of how this family of chemicals intersect with the pulp and paper industry.

The prevalence of PFAS

PFAS are a broad group of durable chemicals used in products to enhance resistance to oil, water, temperature, and attack by other chemicals. The PFAS chemistry has been common in anti-stick coatings and stain- and water-resistant fabrics. Some high-performance paper products, such as those requiring oil, grease, and/or moisture resistance, have been approved to contain some PFAS.

While PFAS have been extensively used in high-performance firefighting foams, practice with these products is widely known to have caused PFAS contamination of groundwater, particularly around airports and military bases. The number of chemicals in the PFAS family is variously quoted but measures in the thousands, though fewer than 100 individual substances are currently analytically measurable. Environmental and toxicological characteristics of individual PFAS chemicals vary widely, and those considered the most troublesome (e.g., perfluorooctanoic acid [PFOA] and perfluorooctanesulfonic acid [PFOS]) are

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no longer manufactured in North America. Nonetheless, this family of substances has come under scrutiny due to properties related to environmental persistence, bioaccumulation, and potential toxicity. Because these chemicals have been and continue to be used extensively in commerce, they can frequently be found in environmental samples, such as surface water supplies, shallow groundwater, and soils.

Those following the current environmental literature know that management of PFAS contamination is among the most significant environmental challenges discussed by industry, the regulatory community, and non-governmental environmental organizations. The pulp and paper industry is frequently mentioned in these discussions mostly, but not exclusively, because of past use of these chemicals in products. So, where does the discussion about PFAS intersect with the pulp and paper industry?

PFAS and the pulp and paper industry

Matters related to the management of PFAS are important to the industry in at least four ways. Each would be expected to be very facility-specific, owing to current and past production practices, management of wastewaters, and residuals.

First, past use of PFAS in the manufacturing of certain paper products can result in PFAS being detected in mill wastewaters. Further, recovery of those products, as well as exposure of paper in the environment where PFAS are widely distributed, can result in PFAS

being present in recovered paper supplies.

Second, the fate of those PFAS during the recycling process have not been reported in the literature nor has the fate of PFAS in mill wastewater treatment systems been extensively researched. However, limited data have shown that a fraction of these substances present in untreated wastewater would be expected to partition to primary and secondary wastewater residuals. Where residuals containing PFAS have historically been landfilled, leachates have sometimes been found to be enriched with PFAS. In a few locations, mill residuals that have been beneficially used in compost or for soil enrichment on agricultural lands have been implicated in local PFAS contamination of groundwater.

Because PFAS are ubiquitous in the environment, some are commonly measured in numerous environmental matrices. It is not unexpected, therefore, that some PFAS would be found at measurable concentrations in treated mill effluents, even if no PFAS has been used in mill processes. Thus, a third intersection

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of PFAS with the industry is related to whether concentrations of PFAS in treated effluents are compatible with the water quality targets set by individual states.

While the U.S. Environmental Protection Agency has provided limited guidance on safe targets for drinking water, most states are acting independently to establish surface water quality criteria for individual PFAS, and these are likely to vary, perhaps substantially, between states, owing to different interpretations of substance toxicity and behavior in the environment. Relatedly, the science around technologies to remove PFAS from wastewater is at its early stages, with granular activated carbon, ion exchange, and reverse osmosis being the

leading candidates. Unfortunately, costs for installing and operating such systems at pulp and paper mills would likely be prohibitive for many facilities.

Finally, a number of states are pursuing bans on the intentional addition of PFAS to paper products, particularly where effective substitutes are found to exist. Among the more active states is Washington where a report was prepared, in response to legislation, that would ban the use of PFAS in certain products sold in Washington by 2023.

Management of PFAS

Management of matters related to PFAS are among the most complicated encountered by environmental professionals in this and other industries owing to the persistence of many PFAS, their widespread distribution in the environment, significant challenges in measuring them analytically, and the difficulty associated with implementing treatment technologies. And, to close the loop, it turns out that the fluoropolymers that were being discussed at the 2019 PEERS conference are of generally low concern from a toxicity standpoint, but the overall footprint associated with their production and use might be more significant.

Special PEERS issue of *TAPPI Journal*

The 2019 PEERS presentation resulted in a beneficial conversation on PFAS. We hope that readers also gain import insights from the papers in this month's special issue of *TAPPI Journal*. Organized by Editor-in-Chief Peter Hart and Editorial Board Member Brian Brogdon, the issue features papers from the 2020 PEERS Conference that have been peer-reviewed for publication in *TAPPI Journal*. **TJ**

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