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PFAS and International Water Law: Implications for the Prevention, Reduction, and Control of Pollution under Art. 21 of the 1997 UN Watercourses Convention

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ABSTRACT: *Discovered in the 1930s, per- and polyfluoroalkyl substances (PFAS) are a family of thousands of human-made chemicals that are attractive for many applications. The persistence of PFAS in the environment has led to PFAS to bioconcentrate, bioaccumulate, and biomagnify in human beings and the environment. Recent studies have determined potential and actual adverse impacts on human health and the environment as a result of such exposure to PFAS. Water is believed to be the main pathway by which PFAS is transferred and diffused into the environment and ultimately entering into contact with human beings. Where these waters are a watercourse and shared by more than one State, there exists an international watercourse and international obligations. This article explores the implications of pollution from PFAS in the use of international watercourses under Art. 21 of the 1997 UN Watercourses Convention.*

KEYWORDS: international, watercourses, PFAS, environment

INTRODUCTION

First discovered in the 1930s, PFAS are a family of thousands of human-made chemicals that vary in physical and chemical properties that are attractive for many applications (Center for Food Safety and Applied Nutrition, 2022; The Interstate Technology & Regulatory Council, PFAS Team, 2020). These physical and chemical properties include, "oil, water, stain, and soil repellency, chemical and thermal stability, and friction reduction" (The Interstate Technology & Regulatory Council, PFAS Team, 2020, p. 5). Since the 1950s, firms in many States have produced products that have been made with or from PFAS such as semiconductors, implantable medical devices, automotive and aerospace insulation, fire suppressants, paints, cleaning products, carpets, clothes, appliances, furniture, food packaging, cookware, and cosmetics (Center for Food Safety and Applied Nutrition, 2022; The Interstate Technology & Regulatory Council, PFAS Team, 2020). Without PFAS, many basic and life-preserving products may not exist or may be less effective.

The persistence of PFAS in the environment has led to PFAS to bioconcentrate, bioaccumulate, and biomagnify in human beings and the environment. Recent research has focused on the impacts to human health and the environment from such exposure to PFAS and several potential and actual adverse impacts to human health and the environment have been determined.

Water is believed to be the main pathway by which PFAS is transferred and diffused into the environment. Where PFAS are introduced or transferred via an international watercourse, the 1997 Convention on the Law of the Non-Navigation Uses of International Watercourses ("1997 UNWC") is a codification that reflects international obligations resulting from such uses. Among those obligations are the prevention, reduction and control of pollution under Art. 21 of the 1997 UNWC. Under Art. 21, there is an obligation of due diligence and precaution in carrying out the prevention, reduction and control of pollution of an international watercourse that may be triggered by the production, use, and disposal of PFAS. Future harmonization of policies and continuing research related to the production, use, and disposal of PFAS and the uses of international watercourses will modulate these obligations.

Statement of Problem

PFAS have been found in most environmental media (air, soil, water, biota) all over the world as a result of its decades of production, use, and disposal (e.g. emission and wastewater from manufacturing and leaching from landfills), even in areas where there is no obvious point source (The Interstate Technology & Regulatory Council, PFAS Team, 2020). The most commonly detected PFAS in the environment are persistent perfluoroalkyl acids (PFAA), which are PFAS that will no longer degrade under ambient environmental conditions (The Interstate Technology & Regulatory Council, PFAS Team, 2020). The most studied PFAAs are perfluorooctanoic acids (PFOA) and perfluorooctanesulfonic acids (PFOS) (U.S. EPA, 2017). Examples of industrial and consumer products that have been made with these PFAS are:

> [Water-proofing, stain resistance, and non-stick coating for textiles and cookware]; coating for paper, furniture and some food packaging materials (e.g., microwave popcorn bags, fast food containers, candy wrapper and pizza boxes); and personal products like shampoo, dental floss, nail polish, eye make-up . . . photo imaging, metal plating, semiconductor coatings, aviation hydraulic fluids, medical devices, insect baits, printer and copy machine parts, chemically driven oil production, rubber and plastic industries (Pennsylvania Department of Health, 2018).

The persistence of PFAS in the environment has led to PFAS to bioconcentrate, bioaccumulate, and or biomagnify in human beings and the environment (Minnesota Pollution Control Agency, 2022; The Interstate Technology & Regulatory Council, PFAS Team, 2020). Several studies have determined potential and actual adverse impacts of such exposure to PFAS on human health and the environment. Impacts on human health include but are not limited to: increased cholesterol levels, changes in

liver enzymes, small decreases in infant birth weights, decreased vaccine response in children, increased risk of high blood, pressure or pre-eclampsia in pregnant women, increased risk of kidney or testicular cancer (Agency for Toxic Substances and Disease Registry, 2022). In the environment, animal life may suffer from "hepatotoxicity, tumor induction, developmental toxicity, immunotoxicity, neurotoxicity and endocrine disruption" (Ghisi, Vamerali, & Manzetti, 2018, p. 3) and plant life may suffer from growth inhibition (Sinclair, Long, & Jones, 2020, p. 6).

Water is believed to be the main pathway by which PFAS is transferred and diffused into the environment, linking contaminated environments with non-contaminated environments through the hydrologic cycle and ultimately entering into contact with human beings (e.g. drinking water and consumption of contaminated biota) (Ahrens & Bundschuh, 2014, pp. 1924-1925; Ghisi, Vamerali, & Manzetti, 2018, pp. 4-10; Kurwadkar, et al., 2022; Sinclair, Long, & Jones, 2020, pp. 3-4; Sunderland, et al., 2018, pp. 132-137).

All human enterprises (food and agriculture, energy, industry, and human settlement) (WWAP, 2012) require the use of water directly or indirectly (WWAP, 2009, p. 166), and the production, use, and disposal of PFAS is no different. States have imposed political borders upon water resources in such a way that at least 153 States share one or more water sources with another State (UN-Water, 2018, p. 107), creating obligations of conduct and result with one another regarding shared water resources that may be triggered by the production, use, and disposal of PFAS. In the case of international watercourses and their uses, the 1997 UNWC is a codification that reflect these international obligations of conduct and result (Rahaman, 2009, p. 216; Rieu-Clarke, Moynihan, & Magsig, 2012, p. 97).

This raises the question, what are the obligation of States towards each other where PFAS are introduced or transferred via an international watercourse. In particular, the prevention, reduction, and control of pollution from PFAS under Art. 21 of the 1997 UNWC.

METHODOLOGY

This research will utilize primary sources such as treaties, customary international law, general principles of law and secondary sources such as the teachings of the most highly qualified publicists to make its analyses and conclusions (Koskenniemi, 2012).

The 1997 UNWC and the Prevention, Reduction, and Control of Pollution

Codified within the 1997 UNWC is Art. 21 regarding the prevention, reduction and control of pollution:

1. For the purpose of this article, "pollution of an international watercourse" means any detrimental alteration in the composition or quality of the waters of an international watercourse which results directly or indirectly from human conduct.

2. Watercourse States shall, individually and, where appropriate, jointly, prevent, reduce and control the pollution of an international watercourse that may cause significant harm to other watercourse States or to their environment, including harm to human health or safety, to the use of the waters for any beneficial purpose or to the living resources of the watercourse. Watercourse States shall take steps to harmonize their policies in this connection.

3. Watercourse States shall, at the request of any of them, consult with a view to arriving at mutually agreeable measures and methods to prevent, reduce and control pollution of an international watercourse, such as:

    (a) Setting joint water quality objectives and criteria;

    (b) Establishing techniques and practices to address pollution from point and non-point sources;

    (c) Establishing lists of substances the introduction of which into the waters of an international watercourse is to be prohibited, limited, investigated or monitored (Convention on the Law of the Non-Navigational Uses of International Watercourses, 1997).

Paragraph 1 defines pollution. The definition is a factual standard. There need only be a detrimental alteration in the composition or quality of the waters of an international watercourse as a direct or indirect result of human acts or omissions for pollution to have occurred (Rosenstock, 1996, pp. 121-122 para. 2).

Paragraph 2 establishes the "basic and general obligations with regard to pollution of international watercourses" (McCaffrey, 2007, p. 450). The commentary to the 1997 UNWC states that Paragraph 2 is a specific application of the general principle of equitable and reasonable utilization and no significant harm in the uses of international watercourses (Rosenstock, 1996, p. 122 para. 3). Under Paragraph 2, States are obliged to prevent new pollution as well as reduce and control existing pollution of an international watercourse that may cause significant harm to other States or their environment that share the international watercourse. This obligation is one of due diligence and takes into account the precautionary approach, particularly with respect to dangerous substances that are toxic, persistent or bioaccumulative (Rosenstock, 1996, p. 122 para. 4). The requirement to act individually or jointly is part of a State's obligations to utilize an international watercourse equitably and reasonably and its duty to cooperate, since protection of an international watercourse may require the participation of more than one State (Rosenstock, 1996, p. 122 para. 5). Paragraph 2 also establishes the threshold that obligations under Art. 21 apply to pollution that may cause "significant" harm and provides a non-exhaustive list of examples (Rosenstock,

1996, p. 122 para. 6). The type of harm covered under Art. 21 includes harm that may be caused to human health or safety or the environment (Rosenstock, 1996, pp. 122-123 para. 6). Finally, the harmonization of policies concerning the prevention, reduction, and control of pollution of an international watercourse is another application of the principle of equitable and reasonable utilization and duty to cooperate, due to the necessity of States to cooperate and work together in order to harmonize policies and maintain harmonization (Rieu-Clarke, Moynihan, & Magsig, 2012, pp. 176-177).

Paragraph 3 requires States to enter into consultation, if one or more States that share the international watercourse should request it, with a view at arriving at mutually agreeable measures and methods to prevent, reduce and control pollution of an international watercourse. This is consistent with the duty to cooperate (McCaffrey, 2007, pp. 452-453; Rieu-Clarke, Moynihan, & Magsig, 2012, p. 176).

Discussion and Implication for PFAS and the Uses of International Watercourses

Regarding Art. 21(1), PFAS are human-made (U.S. EPA, 2017, p. 1; The Interstate Technology & Regulatory Council, PFAS Team, 2020, p. 227). Its occurrence and persistence in the global environment is the result of direct or indirect human acts or omissions emanating from its production, use, and disposal (e.g. emission and wastewater from manufacturing and use, leaching from landfills). Several studies have also demonstrated the potential and actual adverse impacts the bioconcentration, bioaccumulation, and biomagnification of PFAS have on human health and the environment. The predominant nexus by which bioconcentration, bioaccumulation, and biomagnification of PFAS occurs in humans and the environment is water. Where these waters are a watercourse and shared by more than one State, there exists an international watercourse. These factors combined, tend to demonstrate that the direct and indirect introduction or transfer of PFAS into an international watercourse is a detrimental alteration in the composition or quality of its waters.

Under Art. 21(2), States are obliged to prevent the new introduction of PFAS into an international watercourse and reduce and control existing PFAS in an international watercourse that may cause significant harm to other States or their environment. This does not mean a hard-line prohibition on the production, use, and disposal of PFAS with regard to the use of an international watercourse. There are thousands of PFAS that are used in just as many applications that range from basic convenience to life-preserving that impact all human enterprises and the environment. A sudden halt of the PFAS industry or requirement for complete abatement to prevent, reduce, and control the pollution of an international watercourse may cause undue hardship which is grossly disproportionate to the benefit, particularly where there is limited or no alternative to the use of PFAS. On the other hand, given PFAS' known potential and actual adverse impacts on human health and the environment, the unrestricted introduction of PFAS into an international watercourse or lack of reduction and control to an acceptable level by a capable State may also cause undue hardship by depriving another State of their equitable and reasonable use of an international watercourse. Instead, States must exercise due diligence, "[a] standard of care that a state of similar standing in, for example, financial, legal, technical and administrative terms would adopt in similar

circumstances" (Rieu-Clarke, Moynihan, & Magsig, 2012, p. 273), in carrying out their obligations under Art. 21(2). This serves to promote equitable results and prevent grossly disproportionate outcomes (Rieu-Clarke, Moynihan, & Magsig, 2012, p. 176). Treaty obligations, as well as regional and sub-regional standards and practice aimed at preventing, reducing, and controlling pollution of water from PFAS may help guide States in exercising due diligence.

The term "may" also implicates a precautionary approach, "[w]here scientific understanding of a particular harm to the public or environment is not fully known, the burden of proof falls upon those seeking to take the action to prove that the harm will not be significant" (Rieu-Clarke, Moynihan, & Magsig, 2012, pp. 173, 273; *see also* Schroder, 2012). This approach is particularly applicable to PFAS where understanding of its harm to human health and the environment is not fully known. Increased research on the potential and actual adverse impacts of PFAS on human health and the environment has only recently received significant attention and has been limited to a very small portion of the thousands of chemicals that are considered PFAS (The Interstate Technology & Regulatory Council, PFAS Team, 2020, p. 5). Despite the limited knowledge on the potential and actual adverse impacts of PFAS, it has been established that PFAS are persistent, and can bioconcentrate, bioaccumulate, and biomagnify in human beings and the environment. These subtle characteristics are among the type a precautionary approach is intended address (Rosenstock, 1996, p. 122 para. 4) Furthermore, States are on notice regarding the production, use, and disposal of PFAS as data regarding the potential and actual adverse impacts of PFAS continues to be updated and released (Agency for Toxic Substances and Disease Registry, 2022).

Individual or joint conduct is necessary to fulfil a State's obligations under Art. 21(2). Individual legislative, executive, and judicial action on PFAS by a capable State may prevent, reduce, and control the pollution of an international watercourse that may cause significant harm to other States or to their environment. But joint action between States may also be necessary to realize mutually acceptable levels of prevention, reduction, and control of pollution in an international watercourse. For example, the exchange of data and information may serve as a basis for equitable results where there are conflicting claims of equitable and reasonable utilization and significant harm or where there is no obvious point source to explain PFAS pollution and cooperative management is necessary to maintain each State's right to equitably use the watercourse and prevent significant harm.

A "significant" harm may be defined as one "that is more than detectable but not necessarily to a level of serious or substantial. To be significant the harm must lead to a 'real detriment' to, for example human health, industry, property, environment or agriculture" (Rieu-Clarke, Moynihan, & Magsig, 2012, p. 273). As already mentioned, there are potential and actual adverse impacts of PFAS on human health and the environment. These types of adverse impacts are within the letter of the harm considered within the 1997 UNWC as evidenced by the non-exhaustive list of harms under Art. 21(2), "including harm to human health or safety, to the use of the waters for any beneficial purpose or to the living resources of the watercourse" (Convention on

the Law of the Non-Navigational Uses of International Watercourses, 1997, Art. 21(2)). However, general knowledge of potential and actual adverse impacts of PFAS does not automatically qualify every instance as a significant harm. Whether a harm is significant is dependent on the circumstances of each case and even where a particular harm is significant in one instance, it may not be considered so in another (McCaffrey, 2007, p. 435). Even when there is significant harm, the obligation to prevent, reduce, and control such pollution is still one of due diligence and precaution, and not necessarily an absolute prohibition or requirement of conduct (Rosenstock, 1996, pp. 121-123).

The final part of Art. 21(2) addresses instances in which policies differ. Due to the potential and actual adverse impacts of exposure to PFAS, there have been some international efforts by States to regulate the production, use, and disposal of PFAS.

The Stockholm Convention on Persistent Organic Pollutants is often cited as an international agreement that regulates the production, use, and disposal of PFAS (Brennan, Evans, Fritz, Peak, & von Holst, 2021, p. 7). The Stockholm Convention's objective is "to protect human health and the environment from persistent organic pollutants" (Stockholm Convention on Persistent Organic Pollutants, 2001, Art. 1) and has been acceded to by over 150 States (Stockholm Convention on Persistent Organic Pollutants, 2001). The Stockholm Convention achieves its objective by requiring parties to restrict or eliminate chemicals listed as persistent organic pollutants (Art. 3 & 5 & 6). PFOS was added in 2009 and PFOA in 2019, however both have certain exemptions from restriction and elimination (The Interstate Technology & Regulatory Council, PFAS Team, 2020, p. 29).

The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal ("Basel Convention") is an international agreement that complements the Stockholm Convention. Whereas the Stockholm Convention regulates production, use, and disposal, the Basel Convention regulates the international movement of hazardous and other wastes (Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, 1989, Art. 1). The Basel Convention has been acceded to by over 180 States (Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, 1989) and achieves its objectives through the establishment of international standards for the movement of listed hazardous and other wastes (Hackett, 1989, pp. 312-313). Hazardous and other wastes are determined by the procedures in Art. 17 – 18 (UNEP, 2011). To date, the Basel Convention continues to be amended and further guidance provided to address PFAS (UNEP, 2011).

Despite international efforts, these regulations have not been ratified by all States or are limited in reach and scope. The plethora of regional and sub-regional regulations also add to the diversity and inconsistency in regulating PFAS. Hence, the necessity to harmonize and maintain harmonization of policies.

Art. 21(3) expands on the harmonization of policies by serving as a mechanism to achieve cooperation among States as to mutually agreeable measures and methods to prevent, reduce and control pollution of an international watercourse. How these consultations take place is up to the States and fulfilment of any agreed upon measures and methods to achieve the objectives of Art. 21 is presumed in good faith.

CONCLUSION

In conclusion, when PFAS are introduced or transferred via an international watercourse, there exist an obligation between the States that share the international watercourse under Art. 21 of the 1997 UNWC to prevent, control, and reduce such pollution when it may cause significant harm to other States or to their environment. The obligation is not necessarily an absolute bar on conduct or an absolute requirement for abatement. The obligation is one of due diligence and precaution with the aim of achieving equitable results and avoiding grossly disproportionate outcomes. Fulfilment of a State's obligation under this Art. 21 can be achieved individually and jointly where necessary. However, since PFAS do not respect political boundaries once introduced or transferred via an international watercourse, joint action may be necessary to realize mutually acceptable levels of prevention, reduction, and control of pollution from PFAS that may cause significant harm. The harmonization of States' policies on the production, use, and disposal of PFAS and the use of international watercourses, will also help achieve the obligations under Art. 21.

Future Research

In light of the discussion and conclusion, there are three recommended areas for future research.

The first, is more research on the potential and adverse impacts of PFAS on human health and the environment. As mentioned earlier, research on this particular area has only recently received significant attention and has been limited to only a small portion of the thousands of chemicals that make up the family of PFAS. New research will provide more data for informed developments on policy, such as clearer guidance on the production, use, and disposal of PFAS. New research will also improve the understanding of how to achieve obligations under international law, such as what may or may not amount to due diligence and precautionary conduct or significant harm.

The second, is the development of specific harmonized guidelines for regulating PFAS. Despite international efforts, the plethora or lack of international, regional, and sub-regional regulations add to the diversity and inconsistency in regulating PFAS. Development of harmonized guidelines specifically for PFAS that take into account existing and ongoing developments in policy and law will provide frameworks that may form the basis of equitable results and avoid grossly disproportionate outcomes.

The third, is research on other obligations under the 1997 UNWC that would be applicable to the production, use, and disposal of PFAS and the use of international watercourses. For example, if the introduction or transfer of PFAS via an international

watercourse is not considered a significant harm or is considered permissible despite being a significant harm, what other obligations must States observe in order to achieve equitable and reasonable utilization and prevent significant harm.

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