Petr JIMRAMOVSKÝ[1]

Freshwater Pollution by Plastics – Transboundary Pollution and Liability[2]

Abstract

This study examines the environmental and health risks posed by microplastics and plastics and analyses the existing legal framework addressing their impact. Microplastics are widespread pollutants affecting water sources, ecosystems, and potentially human health. Their presence in the freshwater and marine environments disrupts biodiversity, contaminates drinking water, and introduces toxic substances into food chains. Despite growing concerns, regulation remains challenging due to their mobility and persistence, as well as the lack of relevant data. This article thus analyses the legal liability for plastic pollution in view of international, European, and Czech environmental law. It also evaluates whether current regulations address the threats posed by microplastics adequately and explores possible legal measures to enhance environmental protection and liability.
Keywords: Plastics, Microplastics, Freshwater, International Law, European Law, Czech Law, Liability, Inspections

1. Introduction to the Issue

Plastic pollution presents distinct challenges for both environmental protection and public health. The production of plastics has become inextricably linked to basic human necessities, which has led to their ubiquity, despite their environmental impacts. This problem extends beyond visible plastic waste. The literature has increasingly highlighted the dangers of microplastics, which researchers have

1 | Mgr., Masaryk University, PhD student; ORCID: https://orcid.org/0009-0004-2642-2989; e-mail: 407884@mail.muni.cz
2 | *The research and preparation of this study was supported by the Central European Academy.*

Petr JIMRAMOVSKÝ: Freshwater Pollution by Plastics – Transboundary Pollution and Liability. *Journal of Agricultural and Environmental Law* ISSN 1788-6171, 2025 Vol. XX No. 39 pp. 169–204

https://doi.org/10.21029/JAEL.2025.39.169

detected in freshwater and marine environments, the atmosphere, soil,[3] and even protected areas within the Natura 2000 network, which are territories of exceptional environmental value and fragility.

Microplastic concentration in freshwater bodies is increasing in correlation with increased macroplastic production. This is particularly concerning, as natural freshwater resources are primary drinking water sources and microplastic contamination may compromise their quality.[4] Notably, groundwater reserves constitute a global drinking water source and are vulnerable to microplastic pollution.[5]

Controlling microplastic circulation in the environment presents significantly more challenges than managing the more considerable plastic waste, primarily due to microplastics' high mobility and difficulty of detection.[6] Furthermore, neither living organisms nor natural processes readily absorb plastic materials, thus facilitating their transfer through food chains across diverse species.[7] The movement of microplastics demonstrates the interconnected nature of environmental systems. When examining their presence in marine environments, this contamination often originates in freshwater sources that flow into oceans. Consequently, the water quality protection measures implemented by landlocked countries can significantly affect marine ecosystems.

As a landlocked state whose river systems contribute to three European watersheds, the Czech Republic exemplifies this dynamic. The Morava River basin, part of the more extensive Danube system, flows to the Black Sea. The Oder basin drains to the Baltic Sea, while the Elbe and Vltava basins connect to the North Sea. Therefore, the water quality in these rivers and their tributaries affects the Czech environment, downstream countries, and, ultimately, the marine biomes of the three seas.

Extant research has not yet fully characterised the environmental impacts of microplastics, although the scientific literature consistently indicates adverse effects. Microplastics disrupt soil physicochemical parameters, reducing fertility and water retention capacity and impairing plant growth. They enter the soil through various pathways, including freshwater contamination and the application of wastewater sludge.[8] Studies have documented the adverse effects on aquatic environments, mainly marine biodiversity. Researchers have found microplastics in the digestive systems of more than 100 marine species across the food chain, from zooplankton to fish, turtles, birds, and large mammals. These particles have been found to disrupt animal behaviour, reproduction, feeding habits, and growth, ultimately contributing to mortality. Additionally, microplastics act as catalysts

3 | Impact assessment report accompanying the Proposal for a Regulation on preventing plastic pellet losses to reduce microplastic pollution, 138.
4 | Penn State 2024.
5 | Singh & Bhagwat 2022 or Mintenig et al. 2019.
6 | Impact assessment report accompanying the Proposal for a Regulation on preventing plastic pellet losses to reduce microplastic pollution, 153.
7 | Bhardwaj et al. 2024.
8 | Wimmerová, Henzlová & Lexa 2020.

for climate change, magnifying their impact across all biotopes.[9] These ecological consequences generate significant economic repercussions for agriculture, fisheries, consumer behaviour, and tourism.[10]

The harmful effects of microplastics stem from their fundamental physical and chemical characteristics. Their physical properties – size, shape, and surface profile – enable them to obstruct biological processes in small animals, similar to how more considerable plastic waste affects more prominent species.[11] These particles also provide surfaces for harmful microorganism colonisation. Their chemical composition creates additional hazards through the substances they contain and release (e.g. toluene and ethylbenzene) or through chemicals that attach to them as carriers (including pesticides, phthalates, and bisphenols).[12] Furthermore, microplastic chemicals can react with other environmental substances, including heavy metals, creating new toxic compounds.

These aspects mainly affect freshwater ecosystems. Small, highly mobile plastic particles float on the water surface, where freshwater fish and aquatic invertebrates inadvertently consume them. These microplastics subsequently trigger oxidative effects on white blood cells, compromising immune system function.[13]

Scientists have hitherto neither confirmed nor refuted the adverse effects of microplastics on human health. The current knowledge about potential threats to humans derives primarily from the empirical findings in animal studies. While the reliable data on specific human health impacts remain limited, researchers hypothesise that microplastics may contribute to infertility, genetic disruption, digestive disorders, various poisoning types, and chronic inflammation, leading to tumours, cardiac diseases, or diabetes. These hypotheses derive from observations in smaller animals but also suggest that adverse effects in humans would likely require higher concentrations of microplastics. Some studies have confirmed that elevated airborne microplastic concentrations can contribute to chronic respiratory disease development.[14]

According to conservative estimates, each person inhales and ingests annually between 70,000 and 120,000 microplastic particles from drinking water and food, depending on various factors.[15] Some sources suggest that by examining just 15%

9 | Impact assessment report accompanying the Proposal for a Regulation on preventing plastic pellet losses to reduce microplastic pollution, 139–140.
10 | Para. 1 of the preamble to the Proposal for a Regulation on preventing plastic pellet losses to reduce microplastic pollution.
11 | They can, for example, obstruct fish gills, which has also been observed in freshwater fish. See Azevedo-Santos et al. 2021.
12 | Impact assessment report accompanying the Proposal for a Regulation on preventing plastic pellet losses to reduce microplastic pollution, 139 or Bhardwaj et al. 2024.
13 | Bhardwaj et al. 2024.
14 | Opinion of the Committee for Risk Assessment and Opinion of the Committee for Socio-Economic Analysis on an Annex XV dossier proposing restrictions on intentionally-added microplastics, 31.
15 | Impact assessment report accompanying the Proposal for a Regulation on preventing plastic pellet losses to reduce microplastic pollution, 143.

of the average American's caloric intake, researchers found that they consume between 39,000 and 52,000 microplastic particles per year.[16] Due to comparable cultural practices and lifestyles, European consumption patterns likely show a similar trend.

Primary microplastic sources for the human body include seafood, plants that have absorbed soil microplastics, synthetic clothing fibres, and dyes. Other significant sources include plastic packaging that releases microplastics into food[17] and beverages, including tap water. Researchers have detected microplastics in human faeces and blood and, according to some studies, even in the placenta. Additional research suggests these particles may function as cytotoxins – a particularly alarming finding given that microplastics appear to more severely impact developing organs, creating heightened vulnerability in children. More importantly, microplastics can serve as carriers for various microbes, facilitating pathogen transmission.[18]

The evidence indicates that microplastics are ubiquitous, transcend national boundaries, negatively affect aquatic ecosystems and the broader environment, and potentially harm human health while also generating significant economic costs. Addressing microplastic pollution thus requires comprehensive, transnational approaches guided by the precautionary principle.[19] This necessitates appropriate national, European, and international regulatory frameworks, including provisions establishing liability for the entities whose activities release plastics into the environment.[20]

In the following analysis, I examine the current legal framework for environmental liability regarding the impacts of plastic pollution, particularly regarding Czech regulations.[21] My approach is based on the premise that freshwater plastic pollution must be understood comprehensively in terms of both causes and consequences, thus extending beyond conventional water law. I assess the substantive and procedural aspects of existing regulations, evaluate their adequacy

16 | Kožíšek & Kazmarová 2019.

17 | Microplastics have been found even in salt and honey. See European Strategy for Plastics in a Circular Economy, 4.

18 | Impact assessment report accompanying the Proposal for a Regulation on preventing plastic pellet losses to reduce microplastic pollution, 144–145.

19 | Under Czech law, expressed in Art. 13 of Act No. 17/1992 Coll., on the Environment, states that "if, about all circumstances, it can be assumed that there is a danger of irreversible or serious damage to the environment, doubt about whether such damage will occur may not be a reason for postponing measures to prevent the damage".

20 | For understanding of the precautionary principle in European and international practice, see Bándi 2020, Olajos-Mercz 2022, Damohorský et al. 2010, or Jančářová et al. 2015.

21 | In this study, I will not focus on any national law other than Czech law. The primary focus is on the international and European aspects of the issue, while the discussion of relevant Czech regulations serves as an illustrative insight into national legal frameworks, more precisely, as an example of the need for harmonisation in certain areas of environmental law. Since I am from the Czech Republic and have the best knowledge of Czech national law, the choice of this legal system for the purposes of this study was a natural one.

in addressing threats that plastics pose to freshwater resources and the broader environment, and propose potential enhancements to protective measures.

2. (Micro)plastics and their sources

Defining plastic from a legal perspective is essential, as the legal definition differs from its chemical counterpart. EU law essentially harmonises plastic regulation, with European regulations defining plastics through reference to the polymer definition in Article 3 of the REACH Regulation.[22] However, from a chemical perspective, not all polymers qualify as plastics. Polymers that can be deformed under normal conditions and return to their original form, known as elastomers, are scientifically different from plastics. Elastomers are divided into synthetic rubbers (used in tyre production) and thermoplastic isomers (used in 3D printing, roofing materials, and automotive components). Chemically, plastics can be divided into thermosets (epoxy and polystyrene resins) and thermoplastics (including polyethylene, polypropylene, and PVC).[23]

In its regulatory definitions, EU law does not distinguish between plastics and other polymers, primarily because of their common chemical origin and similar environmental impacts, including their capacity to release microplastics.[24] The Single-Use Plastics Directive excludes chemically unmodified natural polymers from its plastic definition.[25] This directive also establishes the concept of "biodegradable plastic".[26]

The regulatory framework further distinguishes between macroplastics and microplastics. Currently, two European legal instruments provide comprehensive microplastic definitions as follows. First, Annex XVII of the REACH Regulation[27] defines microplastics as solid polymers forming at least 1% of a material's particles or creating continuous surface coatings on particles, with maximum dimensions of 5 mm. The regulation specifies maximum lengths of 15 mm and length-to-diameter ratios not exceeding 3 for polymeric fibres. Second, the European Commission's methodological decision on the Water Quality Directive defines microplastics similarly. However, it applies the maximum height-to-width ratio to fibres and particles and also addresses concentration in drinking water rather

22 | Organic chemical substance consisting of "molecules characterised by a sequence of one or more types of monomer units. These molecules must have a distribution of molecular weights, with differences in molecular weight primarily caused by differences in the number of monomer units".
23 | Novák 2023, 17–18.
24 | Impact assessment report accompanying the Proposal for a Regulation on preventing plastic pellet losses to reduce microplastic pollution, 245.
25 | Art. 3(1) of the Single-Use Plastics Directive.
26 | Art. 3(16) of the Single-Use Plastics Directive.
27 | Point 78 of the Annex XVII of the REACH Regulation.

than material composition.[28] These definitional variations relate to the different regulatory purposes and have minimal substantive impact on environmental protection objectives.

The comprehensive analysis of microplastic regulation requires understanding their environmental pathways. The literature typically categorises them as primary or secondary microplastics. Primary microplastics enter the environment directly as microparticles or microfibres, either from manufacturing processes or products containing intentionally added plastic microparticles or microfibres. Secondary microplastics result from macroplastic fragmentation.[29] This classification is helpful but not decisive, particularly as the literature lacks consensus on precise definitions and source categorisation for these groups.[30]

A more practical approach identifies specific microplastic sources and release mechanisms. Key sources include larger plastic items that release microplastics through mechanical wear, light exposure, heat, oxygen, biological processes, and water interaction. These larger items primarily comprise tyres and common plastic waste.[31] At the boundary between microplastics and macroplastics are pellets – small plastic pieces used as manufacturing precursors that enter the environment through improper handling throughout their lifecycle from production and processing to distribution, transport, and disposal.[32] These pellets vary in size and can function as primary and secondary microplastic sources. Both macroplastics and pellets contribute to microplastic contamination across virtually all ecosystems, with distribution patterns that reflect where wear or loss occurs.

Additional microplastic sources include cleaning products with intentionally added microplastics for abrasion purposes. These products release microplastics into sewage and stormwater during use or production, contaminating the freshwater, oceans, and soil.[33] Pharmaceutical products intentionally incorporate microplastics as active ingredient carriers. These enter the environment through similar pathways as the cleaning products, while those in veterinary pharmaceuticals can transfer directly from animals to surface water and soil. The absence of studies quantifying pharmaceutical-derived microplastics in environmental waters and soils is concerning, particularly given the limited understanding of their impacts on human and animal tissue and natural ecosystems.[34]

Further microplastic sources include cosmetics, paints, and varnishes that incorporate such particles to enhance product performance.[35] European regu-

28 | Part 1 of the Annex to the Commission Delegated Decision (EU) 2024/1441.
29 | Ústav pro hydrodynamiku AV ČR.
30 | Novák 2023, 25–29.
31 | Ibid., 27.
32 | Para. 3 of the preamble to the Proposal for a Regulation on preventing plastic pellet losses to reduce microplastic pollution.
33 | Browne 2015, 233.
34 | Ibid., 234.
35 | Novák 2023, 27–28.

latory attention has specifically targeted microplastics found in products such as dishwasher capsules.[36] Synthetic textiles (polyester and acrylic fibres) are another significant source that releases microplastics during washing, wearing, and disposal. These textile-derived microplastics contaminate aquatic, terrestrial, and soil ecosystems. The research had indicated that textile products constitute the primary source of microplastics in marine environments, released during washing and transported through wastewater systems.[37] Similar mechanisms apply to freshwater contamination, being particularly relevant for landlocked countries like the Czech Republic.

By definition, biodegradable plastics cannot generate microplastics because they naturally decompose into water, carbon dioxide, and biomass. The European legislation appropriately favours biodegradable plastic production as environmentally preferable, particularly given their compatibility with composting systems. As such, Annex XVII of the REACH Regulation excludes biodegradable plastics and natural, chemically unmodified polymers from its definition of microplastic sources.[38]

Macroplastics comprise all plastic materials that do not meet the definitional criteria for microplastics. Their negative environmental impacts manifest in two primary ways. First, they serve as microplastic sources through degradation. Second, they directly damage the ecosystem. The literature highlights marine pollution, where plastic waste accumulates on surface waters and seabeds, especially near densely populated areas such as the Mediterranean.[39] This waste negatively affects fish, birds, mammals, sea turtles, and smaller aquatic organisms through ingestion, physical injury, and entrapment.[40]

The research also confirms that most ocean plastic pollution is via river systems. Studies indicate that approximately 90% of this pollution originates from just 10 rivers, eight in Asia (Mekong, Amur, Yangtze, Hai, Pearl River, Yellow River, Indus, and Ganges) and two in Africa (Nile and Niger).[41] This pattern reflects the fundamentally different waste management approaches between Europe and developing regions. Nevertheless, this issue remains relevant to Europe because ocean currents distribute plastic pollution through the marine ecosystems regardless of origin. Notably, the Nile River flows into the Mediterranean Sea, affecting the environmental quality of EU member states' marine and coastal ecosystems. Some studies confirm that approximately half of Mediterranean Sea plastic pollution comes from waterways, with over 40% originating from Egypt.[42]

36 | Commission Decision (EU) 2017/1216.
37 | Browne 2015, 233–239.
38 | Art. 15(2)(d) of the Single-Use Plastics Directive, new Annex XVII to REACH Regulation, point 78.
39 | Chiba et al. 2018.
40 | Hammer, Kraak & Parsons 2012.
41 | Schmidt, Krauth & Wagner 2017.
42 | Liubartseva et al. 2018.

This analysis would be incomplete without considering plastic manufacturing facilities that discharge industrial waste into surface waters.[43] These operations directly affect freshwater quality when their emissions contain microplastics or comparable organic substances with similar environmental effects.

3. Fundamentals of water protection against plastics in legal regulations

The above analysis demonstrates the necessity for legal instruments at the international and national levels to address plastic water pollution. International and global regulatory frameworks establish foundational legal and normative parameters that inform domestic regulations. The national frameworks better reflect specific environmental conditions and socio-legal contexts while establishing the pollution liability rules that national authorities enforce. European law has a distinctive unifying function within this regulatory landscape, harmonising national legal systems and efficiently addressing transboundary pollution challenges.

3.1. International treaties

International law addresses freshwater transboundary pollution protection in a fragmented manner, primarily through the extension of marine water protection or broader environmental protection frameworks. These instruments generally lack specific provisions on the impacts of plastic pollution and maintain a relatively general character.

At the UN level, the Rio Declaration establishes the basic framework for state utilisation of natural resources through 27 broadly applicable principles. Notable provisions include principles directing countries to prevent transboundary pollution,[44] requirements for national regulatory modification,[45] international cooperation obligations,[46] and the precautionary principle.[47] Principle 13 addresses pollution responsibility and compensation as a general requirement for implementing enforceable regulatory frameworks.

The Economic Commission Convention on the Protection and Use of Transboundary Watercourses and International Lakes provides more specific guidance. European nations have ratified this convention, including the EU as a party.[48] The convention establishes transboundary water resource management

43 | Zębek 2024, 12.
44 | Principles 2 and 14 of the Rio Declaration.
45 | Principles 8, 11, and 17 of the Rio Declaration.
46 | Principles 9 and 12 of the Rio Declaration.
47 | Principles 15 of the Rio Declaration.
48 | UNTC 2024.

requirements, covering pollution prevention, control and reduction, monitoring, research and development, and information exchange, thus emphasising transnational cooperation among countries sharing freshwater boundaries. The convention also directs these nations to establish joint bodies overseeing water resources in specific regions according to their characteristics.[49] The International Commission for the Protection of the Danube River exemplifies this approach, operating under the Convention on Cooperation for the Protection of the Sustainable Use of the Danube River, ratified by 15 parties, including the Czech Republic. This organisation implements the EU Water Framework Directive and Floods Directive,[50] which extends the European legal standards beyond EU boundaries to non-member countries, including Moldova, Ukraine, and Serbia. The Czech Republic participates in similar regional bodies, including the International Commission for the Protection of the Oder and the International Commission for the Protection of the Elbe, which operate under comparable international agreements. These bodies primarily monitor point pollution sources, including those generating microplastics.[51]

The Convention on the Protection and Use of Transboundary Watercourses and International Lakes additionally requires developing criteria and rules for transboundary freshwater pollution liability, although in general terms. In 2003, the UN Economic Commission for Europe adopted the Protocol on Civil Liability and Compensation for Damage Caused by the Transboundary Effects of Industrial Accidents on Transboundary Waters, which remains unenforceable, as only Hungary has ratified it.[52]

The Convention and Rio Declaration generated the Protocol on Water and Health, which directs states to implement legislative measures by ensuring appropriate drinking water quality, bathing water standards, effective wastewater management, economically appropriate water utilisation, and reducing waterborne diseases.[53] The contracting countries implement the Protocol through self-defined national targets, which the Czech Republic most recently updated in 2019.[54] While the Protocol does not explicitly address microplastics, the EU Drinking Water Directive[55] incorporates its standards and acknowledged microplastic hazards. The Protocol's focus on protecting drinking water from microbial contamination has particular relevance, given that microplastics can serve as microbial carriers. The Protocol thus holds the potential for the synergistic integration with future environmental protection against microplastic impacts.

49 | Art. 9 of the Transboundary Watercourses and International Lakes Convention.
50 | ICPDR 2025.
51 | Novák 2023, 46.
52 | ECOLEX 2025.
53 | Dudová 2014, 164–165.
54 | Státní zdravotní ústav v Praze SZÚ (2023).
55 | Para. 34 of the preamble to the Drinking Water Directive.

Another significant UN instrument is the Convention on the Non-navigational Uses of International Watercourses. Article 21 explicitly addresses watercourse pollution protection by requiring the affected countries to cooperate on pollution prevention, establish prohibited or restricted substance lists, and develop water quality standards. However, its effectiveness remains limited, with only 36 ratifying countries, excluding most major stakeholders. Neither the EU nor the Czech Republic have ratified this convention.

Article 194 of the UN Convention on the Law of the Sea contains a general obligation for the contracting parties to prevent marine environment pollution. The International Convention for the Prevention of Pollution from Ships (MARPOL) provides more specific prohibitions against disposing of plastic waste and incinerated plastic ash in the marine environments. However, MARPOL's scope remains limited to ship-generated waste, excluding freshwater pollution sources. Similarly, the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (the London Convention) excludes mainland pollution sources. The Convention on Biological Diversity has a broader application potential through its general provisions for protecting natural resources from biodiversity degradation.[56]

Several non-UN international conventions influence EU regulatory development. The Convention for the Protection of the Marine Environment of the North-East Atlantic, to which the EU is party, establishes requirements protecting marine environments from inland-originating pollution transmitted through water systems.[57] This convention's non-binding recommendation on plastic pellet loss prevention informed EU's proposed plastic pellet regulation.[58] Similar instruments include the Barcelona Convention for the Protection of the Mediterranean Sea Against Pollution and its protocols, Helsinki Convention on the Protection of the Baltic Sea, and Convention on the Protection of the Black Sea Against Pollution. While these conventions do not specifically address plastic pollution, they establish general requirements for preventing watercourse-transmitted seawater pollution.[59]

The Czech Republic has concluded intergovernmental and international agreements on transboundary water management with all neighbouring countries.[60] While these agreements address joint surface water protection in declaratory

56 | Art. 6 of the CBD.

57 | Arts. 3 and 1(e) of the OSPAR Convention.

58 | OSPAR Recommendation 2021/06 on the reduction of plastic pellet loss into the marine environment.

59 | For example, Art. 2(2) of the Helsinki Convention on the Protection of the Baltic Sea, Art. 8 of the Barcelona Convention, or the Protocol on the Protection of the Black Sea Against Pollution from Land-based Sources.

60 | Communication No. 54/2015 Coll. of Int. Treaties, Communication No. 7/2000 Coll. of Int. Treaties, Communication No. 66/1998 Coll. of Int. Treaties and Decree No. 57/1970 Coll.

terms, without specific plastic pollution provisions, they establish frameworks for cross-border regulatory cooperation.

This analysis reveals the absence of a comprehensive legal instrument addressing environmental plastic pollution. The International Law Commission's Draft Articles on the Prevention of Transboundary Harm from Hazardous Activities and Draft Principles on the Allocation of Loss in the Case of Transboundary Harm Arising out of Hazardous Activities, prepared in 2001 and 2006, respectively, and noted by the UN General Assembly, have not generated specific binding instruments.

The UN Environment Assembly Resolution 5/14 (March 2022) directly addresses plastic pollution by calling for binding international environmental protection standards, referencing UN General Assembly Resolution 70/1 (2015) on the 2030 Sustainable Development Agenda. Resolution 6/15 (March 2024) reaffirms this commitment, with a particular focus on marine biome protection, establishing December 2024 as the target for completing environmental protection regulations against plastic pollution. The Intergovernmental Negotiating Committee's first meeting in Busan, South Korea (November–December 2024) produced a preliminary convention on environmental and human health protection against plastic pollution. This draft will inform the final convention negotiations scheduled for August 2025,[61] indicating that the deadline for the Resolution 6/15 will not be met. The EU actively participates in these negotiations by developing a plastic pellet regulation proposal to inform microplastic provisions in the forthcoming convention.[62]

The literature suggests that this future convention may incorporate elements from the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal and the Stockholm Convention on Persistent Organic Pollutants in its microplastic regulatory approach.[63] Resolution 5/14 references both instruments. The Basel Convention effectively regulates plastic waste transport and, thus, prevents secondary microplastic generation, while the Stockholm Convention provides a framework for primary microplastic regulation. However, these conventions do not constitute a comprehensive microplastic regulatory system, even together. Both the literature and European regulatory development experiences indicate that comprehensive microplastic regulation faces significant challenges due to source diversity[64] and data limitations.[65]

61 | Draft report of the intergovernmental negotiating committee to develop an international legally binding instrument on plastic pollution, including in the marine environment, on the work of the first part of its fifth session – Busan, Republic of Korea, 25 November–1 December 2024.

62 | Proposal for a Regulation on preventing plastic pellet losses to reduce microplastic pollution, 4.

63 | Novák 2023, 43, 69.

64 | Ibid., 71.

65 | Impact assessment report accompanying the Proposal for a Regulation on preventing plastic pellet losses to reduce microplastic pollution, 447–448.

This analysis demonstrates that the existing international legal instruments primarily establish fundamental water protection principles that inform European and national regulations and potentially motivate new regulatory initiatives and cross-border cooperation. However, their effectiveness in addressing microplastic pollution remains limited by the failure to identify and target these issues explicitly.

International consensus on combating waterborne plastic pollution faces significant challenges, such as an incomplete understanding of microplastic effects on human health,[66] inconsistent application of the precautionary principle, and socioeconomic implementation barriers. Therefore, the Intergovernmental Negotiating Committee's ongoing discussions merit close attention.

3.2. EU Law

The above analysis characterises waterborne plastic pollution as a global challenge. The EU approaches plastic economy regulation and water protection more comprehensively than other international efforts, reflecting deeper member-state integration, stronger enforcement mechanisms, and longer environmental protection traditions. Recently, the EU has seen increased efforts to regulate environmental and drinking water microplastic contamination, although these initiatives remain relatively nascent.

The current EU legislation addresses freshwater plastic pollution indirectly through plastic economy and water protection regulations. While both regulatory streams have established histories, active microplastic management emerged only with the 2018 Plastics Strategy.[67] This conceptual framework committed the EU to regulating environmental microplastic releases, microplastic additions to industrial products, monitoring programmes, and research supporting microplastic alternatives. The Strategy addresses all microplastic types and sources, while committing the EU to promoting global regulatory frameworks and supporting existing conventions that indirectly address microplastics.[68] It explicitly targets waterborne microplastics in both drinking water[69] and wastewater,[70] supporting voluntary industrial agreements that monitor and limit aquatic microplastic releases, such as the Cross-Industry Agreement between five significant European textile manufacturing associations.[71]

66 | Novák 2023, 43.
67 | COM/2018/028 final – European Strategy for Plastics.
68 | Annex II of the European Strategy for Plastics.
69 | European Strategy for Plastics, 12.
70 | Ibid., 14.
71 | EURATEX 2023.

The 2019 European Green Deal and subsequent Circular Economy Action Plan[72] advances these objectives by establishing clear commitments to regulate intentional environmental microplastic releases and limit secondary microplastic sources. The 2021 Zero Pollution Action Plan[73] further aims to reduce environmental microplastic releases by 30% by 2030 compared to baseline levels. This Plan proposes revising directives on bathing water, groundwater, wastewater, and wastewater treatment plant sludge, while supporting the implementation of the new drinking water directive. It established extensive water pollution monitoring programmes and the Destination Earth initiative[74] to enhance monitoring capabilities.[75] The Action Plan addresses microplastic sources through proposed regulatory interventions, including strengthening waste management hierarchies through the 2023 Waste Framework Directive review and creating specific measures targeting intentionally added product microplastics and those released from pellets, tyres, and textiles.

The Single-Use Plastics Directive reinforced the calls for European regulation of primary product microplastics, while acknowledging its importance for secondary microplastic reduction from plastic waste.[76] This directive regulates plastic-containing products designed or marketed as non-reusable, primarily through market restrictions. These restrictions initially targeted products with non-plastic alternatives, although the literature criticises the selection criteria as inconsistent, with some products assessed against plastic alternatives during directive development.[77] Moreover, specific prohibitions apply exclusively within EU territories,[78] while some other products face only vaguely defined "ambitious and sustained reduction in consumption" requirements without specific implementing regulations.[79] The Commission has only established a methodology for measuring compliance with these consumption reduction commitments.[80] Additional measures include labelling requirements for standard single-use plastic products and providing disposal instructions and environmental impact information.[81]

The objectives of the Action Plan have only seen partial implementation. Key microplastic regulatory developments include amending the REACH Regulation Annex XVII, implementing the EURO 7 regulation, and proposing plastic pellet loss prevention regulations.

72 | COM/2020/98 final – Circular Economy Action Plan For a cleaner and more competitive Europe.
73 | COM/2021/400 final – EU Action Plan: 'Towards Zero Pollution for Air, Water and Soil'.
74 | Launched on 10 June 2024, see Destination Earth.
75 | Annex I of the EU Action Plan: 'Towards Zero Pollution for Air, Water and Soil'.
76 | Paras. 8 and 9 of the preamble to the Single-Use Plastics Directive.
77 | Novák 2023, 135–136.
78 | Oxo-degradable plastics according to part B of the Annex of the Directive.
79 | Part A of the Annex of the Directive.
80 | Commission Implementing Decision (EU) 2022/162.
81 | Art. 7 of the Single-Use Plastics Directive.

The REACH Regulation amendment directly regulates the microplastics intentionally added to products, mainly cosmetics, cleaning agents, medicines, and fertilisers. Following a phased implementation,[82] it will prohibit marketing products containing at least 0.01% microplastics by weight or products explicitly marketed as microplastics.[83] Despite numerous exceptions,[84] this regulation imposes information requirements on entities marketing exception-covered products and their users by establishing consumer and European Chemicals Agency notification obligations.[85] The REACH Regulation itself requires member states to establish sanctions for regulation violations, including new microplastic marketing restrictions.[86]

The EURO 7 Regulation addresses tyre-released microplastics by establishing tyre abrasion measurement methods and category-specific abrasion limits.[87] The tyre labelling regulation previously acknowledged tyre abrasion's significance for microplastic pollution through preambular statements, establishing a normative foundation for the EURO 7' more comprehensive approach.[88]

The proposed plastic pellet regulation, which is still going through the legislative processes, aims to prevent environmental releases through accidents or mishandling. This regulation imposes obligations on carriers and "economic operators" (manufacturers and processors), establishing general pellet loss prevention requirements and extensive member state authority notification obligations.[89] Economic operators should develop facility-specific risk management plans guiding operations according to Annex I measures, with regular updates and certification requirements.[90] As specified in Annex III, carriers need to implement preventive measures during transport and related activities. Following accidents or regulatory violations, the obligated entities notify the relevant national authorities and implement human health and environmental protection measures, including preventative actions and additional authority-mandated interventions. The authorities can then suspend affected facility operations in justified circumstances.[91]

The proposed regulation establishes direct member state obligations, including compliance monitoring and regular Commission reporting on inspections,

82 | Para. 6 of the REACH Regulation Annex XVII amendment.
83 | Para. 1 of the REACH Regulation Annex XVII amendment.
84 | Paras. 4 and 5 of the REACH Regulation Annex XVII amendment.
85 | Paras. 8 to 12, 14, and 15 of the REACH Regulation Annex XVII amendment.
86 | Art. 126 of the REACH Regulation.
87 | Art. 15 of the EURO 7 Regulation.
88 | Arts. 4 and 5 of the EURO 7 Regulation.
89 | Art. 3 of the Proposal for a Regulation on preventing plastic pellet losses to reduce microplastic pollution.
90 | Arts. 4 and 5 of the Proposal for a Regulation on preventing plastic pellet losses to reduce microplastic pollution.
91 | Arts. 9 and 10 of the Proposal for a Regulation on preventing plastic pellet losses to reduce microplastic pollution.

risk management plans, and certification.[92] Member states enforce the regulation through sanctions[93] scaled to individual or corporate income/turnover, with escalating penalties for repeated violations. Maximum corporate fines constitute at least 4% of the previous financial year's annual turnover. The regulation further requires member states to establish compensation mechanisms for health-affected individuals, ensuring non-governmental health organisation assistance, including through collective actions.[94]

The regulation's impact assessment reveals that the Commission initially intended the comprehensive regulation of all secondary microplastic sources[95] before adopting a sequential approach addressing individual sources progressively. The eco-design and sustainable products regulation intentionally deferred paint-contained microplastic regulation, identifying paints as priority products for future intervention.[96] This framework regulation does not directly address microplastics but establishes that microplastic releases may trigger product improvement requirements in Annex I. The Commission cited insufficient scientific data on paint microplastic properties and environmental impacts as justification for this deferral. Similar data limitations affected washing capsules and geotextile microplastic regulation. Textile product regulation faces additional challenges from predominant non-EU manufacturing, creating knowledge gaps regarding synthetic fibre profiles. The EU Strategy for Sustainable Textiles proposes standardises textile microplastic release measurements to address these gaps. The Commission indicates that research and development programmes alongside standardised measurements can resolve data inconsistencies across microplastic sources.[97]

Agricultural water management regulations also address microplastics. The water reuse requirements establish safe agricultural water reuse standards addressing drought while protecting soil and food quality. This regulation enables additional water quality requirements regarding substances of concern, explicitly including microplastics.[98] The Sewage Sludge Directive does not explicitly regulate microplastics and requires regular sludge analysis, including organic substance testing.[99]

92 | Art. 8 of the Proposal for a Regulation on preventing plastic pellet losses to reduce microplastic pollution.
93 | Arts. 11 and 15 of the Proposal for a Regulation on preventing plastic pellet losses to reduce microplastic pollution.
94 | Art. 16 of the Proposal for a Regulation on preventing plastic pellet losses to reduce microplastic pollution.
95 | Impact assessment report accompanying the Proposal for a Regulation on preventing plastic pellet losses to reduce microplastic pollution, 447–448.
96 | Art. 18 of the Ecodesign Regulation.
97 | Impact assessment report accompanying the Proposal for a Regulation on preventing plastic pellet losses to reduce microplastic pollution, 262, 448.
98 | Annex II B) 6. e) of the Water Reuse Regulation.
99 | Annex II A) 3 of the Sewage Sludge Directive.

The Urban Wastewater Treatment Directive also lacks explicit microplastic provisions but establishes sewage organic substance limits.[100] Facilities subject to integrated permits[101] may release microplastics or chemically similar substances into freshwater. The subsequent section addresses water pollution liability from urban and industrial emissions.

The Marine Strategy Framework Directive regulates "micro-littering" (micro-waste introduction into marine environments). Member states must implement and report measures preventing marine micro-waste introduction, with cooperation obligations extending to landlocked states.[102] However, this directive's practical impact remains limited due to inconsistent member-state reporting.[103]

The Drinking Water Directive establishes drinking water quality requirements, including pollution indicators. While microplastics are excluded from these indicators, the directive requires member states to measure microplastic content in water intended for human consumption according to established methodologies.[104] By 12 January 2029, the Commission must report to the Parliament and Council regarding potential microplastic threats to drinking water sources,[105] indicating that direct drinking water microplastic regulation remains forthcoming.

The Bathing Water Quality Directive does not directly address microplastic pollution threats. Article 9 establishes only visual plastic pollution monitoring, primarily targeting macroplastics.

The Waste Framework Directive review introduces no microplastic regulatory innovations but maintains basic waste management requirements influencing plastic waste handling, secondary microplastic formation prevention, and waterborne plastic containment. Additional regulations indirectly affecting waterborne microplastic pollution include the Packaging Directive, Plastic Bags Directive (to be replaced by the Packaging Waste Regulation effective 12 August 2026, which explicitly requires producing packaging that minimises environmental microplastic impacts), and Water Framework Directive. The latter requires member states to implement surface water quality programme monitoring and limiting anthropogenic influences, including plastic-contained substances, with clear connections to the Drinking Water Directive objectives.[106] The Fertilisers Regulation references the REACH Regulation, while the Sustainable Investment Regulation establishes economic activity financing rules with indirect effects on microplastic management.

100 | Art. 2(6) of the Urban Wastewater Treatment Directive.
101 | According to IPPC Directive.
102 | Arts. 5 and 6 of the Marine Strategy Framework Directive.
103 | Novák 2023, 52–53.
104 | Commission Delegated Decision (EU) 2024/1441.
105 | Arts. 13(6) and 18 of the Drinking Water Directive.
106 | Zębek 2024, 16.

4. Liability for pollution

Environmental protection frameworks necessarily include pollution liability rules and enforcement mechanisms. EU law primarily establishes general liability enforcement requirements, leaving specific parameters to national regulations. The following analysis, referencing the Czech legal framework, summarises the potential approaches for establishing various liability types for waterborne microplastic contamination. These enforcement mechanisms directly correlate with water protection, microplastics, and plastic economy regulatory quality and scope and, thus, remain relatively underdeveloped or indirectly supported by regulations not specifically targeting waterborne microplastic protection.

4.1. Basic types of liability

In environmental law, liability frameworks can take multiple forms. The primary distinction between civil and public liability, which is subdivided into administrative liability (*misdemeanour liability* in Czech legal terminology), criminal liability, and specific ecological damage liability. Here, I focus exclusively on public liability regimes.

The distinction between liability types corresponds to different fault requirements and consequent enforcement approaches. Administrative and criminal liability represent fault-based liability types, typically resulting in sanctions when established. However, the liability for ecological damage caused by water pollution follows strict liability principles (*objective liability*), thus not requiring fault determination.[107] Under strict liability regimes, polluters must implement remedial measures at their own expense, voluntarily or under administrative orders. Czech law establishes this obligation through two parallel systems[108]: the general Water Act provisions regarding unauthorised wastewater discharge into surface or groundwater, accidents, or improper handling of hazardous substances[109] and the special Environmental Damage Act,[110] which implements the relevant EU directive.[111] Fault establishment does not preclude ecological damage liability application; authorities may combine sanctions with remedial measures or prioritise remedial measures over sanctions or reduced sanction amounts. The appropriate response – sanctions, remedial measures, or combinations – should

107 | Humlíčková 2014, 192.
108 | Ibid., 195.
109 | Arts. 40 to 42 of the Water Act; for better understanding of the liability according to Czech Water Act, see Horáček 2015 or Strnad 2015.
110 | Arts. 7 and 8 of the Environmental Damage Act; for better understanding of the Czech Environmental Damage Act see Stejskal & Vícha 2009.
111 | The Environmental Liability Directive.

reflect specific factual circumstances to ensure that disproportionate sanctions do not impede effective remediation.

Liability regimes further differentiate between actual environmental pollution penalties and other regulatory violations. While the first category directly addresses existing pollution or remediation, the second (generally limited to administrative violations) target situations where pollution has not yet occurred. These provisions typically enforce preventive requirements, such as operator obligations to implement harmful substance containment measures or formal documentation and reporting requirements facilitating potential pollution monitoring.[112] Key European regulations establishing general pollution prevention frameworks that may address organic substance pollution and polluter liability include the Industrial Emissions Directive, SEVESO Directive,[113] and Environmental Liability Directive. Czech law incorporates all these directives, including provisions establishing liability for preventive requirement violations.[114] Market restrictions on products with specific compositions, such as REACH Regulation prohibitions, represent a special case of indirect environmental pollution prevention.

Waste management systems operate on prevention principles, establishing predominantly preventive entity obligations. Czech law establishes entity liability through the Waste Act,[115] Act on Limiting the Impact of Selected Plastic Products on the Environment,[116] and Packaging Act,[117] which penalise both actual pollution and prevention non-compliance. As previously noted, waste management already regulates secondary microplastics. The proposed plastic pellets regulation also incorporates mostly preventive principles.

4.2. Administrative and criminal liability

Czech law establishes partially overlapping frameworks for protecting waters from harmful substance discharges through water law and integrated prevention. The integrated permitting system replaces multiple authorisations for high-pollution potential operations, including numerous water protection permits.[118] Relevant authorisations include permits for surface and groundwater wastewater discharge, particularly dangerous or priority hazardous substance wastewater discharge into sewage systems, and emergency plan approvals for operations

112 | For example, Art. 122(2) of the Water Act.
113 | The Major-Accident Hazard Directive.
114 | For example, Art. 19(1)(a) of the Environmental Damage, Art. 37(1)(a) of the Integrated Prevention Act, Art. 51 of the Major-Accident Prevention Act.
115 | Provisions of Arts. 117 to 125 of Act on Waste.
116 | Provisions of Arts. 25 to 28 of Act on Limiting the Impact of Selected Plastic Products on the Environment.
117 | Provisions of Arts. 44 to 46 of Act on Packaging.
118 | Under Czech law, reference can be made to the definition in Art. 48 of the Integrated Prevention Act, in conjunction with Art. 126 of the Water Act.

handling harmful substances.[119] The Czech Integrated Prevention Act establishes the pollutant categories subject to integrated permit emission limits, specifically identifying persistent hydrocarbons, persistent bioaccumulative toxic organic substances, oxygen balance-affecting substances (measurable through chemical and biological oxygen demand), and substances defined in the government regulation establishing permissible surface water and wastewater pollution values, discharge permit requirements, and sensitive area designations.[120] This regulation establishes the monitored industrial operation categories and discharge pollutant threshold values as reference standards for specific permit emission limits.[121] The IPPC regime and water law emission limit use consistent indicators and premises.[122] Both legal regimes establish administrative liability for threshold exceedances or unauthorised harmful substance discharges.[123]

Organically defined substances within these regulations can, under certain conditions, qualify as microplastics. The permissible pollution value regulation establishes wastewater pollution thresholds for certain operations, including plastic surface treatment and primary form plastic production.[124] The Integrated Prevention Directive similarly covers polymeric material production, although the BREF reference document for polymer production excludes certain polymer handling aspects, including plastic pellet losses.[125] These provisions establish that waterborne microplastic pollution can constitute administrative violations of underwater protection and the integrated prevention frameworks, thus potentially activating ecological damage liability.[126]

However, although the Act on Environmental Damage is, in formal terms, a complete and proper transposition of the relevant directive, the concept of liability for environmental damage has long remained an underutilised legal instrument in the Czech Republic. The problem lies in the unclear delineation of the Act's applicability in relation to sectoral environmental laws, including the Water Act, which stems mainly from the vague legal definition of the term "environmental damage". This ambiguity effectively leads to a preference for procedures under sectoral regulations. However, these do not provide a sufficiently comprehensive

119 | Art. 8(1)(c) in conjunction with Art. 38 of the Water Act and Art. 16(1) in conjunction with Art. 39 of the Water Act, Art. 39(2) of the Water Act.
120 | Government Regulation No. 401/2015 Coll. and the WATERS section of the Integrated Prevention Act.
121 | Art. 38(9) of the Water Act.
122 | Art. 38(9) of the Water Act, Art. 14(1) of the IPPC Act.
123 | Art. 37(3) of the IPPC Act, Art. 122, Art. 125a(1)(d) of the Water Act, etc.
124 | Annex I. B. point 25.61 and 20.16 of the Regulation No. 401/2015 Coll.
125 | Impact assessment report accompanying the Proposal for a Regulation on preventing plastic pellet losses to reduce microplastic pollution, 27, 36.
126 | In the sense of Art. 2 of the Environmental Liability Directive, which defines environmental damage to waters as damage that has significant adverse effects on the ecological, chemical, or quantitative status or ecological potential of the waters concerned, as defined by Water Framework Directive.

framework to ensure effective remediation, especially when multiple components of the environment are affected. The practical shortcomings of this situation manifest in the inability to carry out certain necessary remedial measures or in difficulties with securing the effective financing of remediation when the originator of the damage is unknown or does not carry out remediation promptly, thereby posing a delay risk. The current definition of environmental damage to waters is linked to an adverse effect on the status of surface or groundwater bodies. However, the assessment of their status takes 3 or 6 years, respectively,[127] which in practice precludes the effective application of environmental damage liability. This was demonstrated, for example, by the 2020 Bečva River accident, where an extensive catastrophe could not formally be classified as environmental damage.

Currently, an amendment to the Act on Environmental Damage (and related regulations) is undergoing the legislative process, with the potential to rectify this situation. Among the proposed changes, environmental damage would also include the deterioration of the quality of surface water or water sources as a result of an accident or operational activity, in which the maximum allowable concentrations of priority substances in waters (according to Annex No. 3 of the aforementioned government regulation[128]) are exceeded. This would also apply if, due to the release of the substances listed in Annexes No. 1 and 3 of this regulation or due to a decrease in the flow rate of surface water, fish or other aquatic organisms die. Furthermore, environmental damage would also include the deterioration or threat to the quality of drinking water sources in parts of catchment areas related to sites of water abstraction for human consumption, natural healing springs, or sources of natural mineral water, as well as the ecological status of surface waters used for bathing. The result would be a terminological alignment of the term “environmental damage” with the definitions of adverse states found in sectoral regulations (e.g. the so-called “harmful state” under the Water Act). In addition, the amendment would streamline the relevant procedural provisions and clarify the system for financing remedial measures.[129]

For combating microplastics in the environment, the proposed legal regulation can be assessed positively. It is likely that it would eliminate the current ineffectiveness of the Act on Environmental Damage and ensure an effective response to situations where multiple components of the environment are affected simultaneously. This can easily occur in the case of microplastic pollution, particularly due to their high mobility and natural synergistic interactions between various elements of the environment.

127 | Decrees No. 5/2011 Coll. and No. 98/2011 Coll.
128 | Government Regulation No. 401/2015 Coll.
129 | Parliamentary Press No. 870.

Waterborne plastic pollution may simultaneously violate water protection or the integrated prevention requirements, alongside waste management or other regulatory provisions. This pollution may damage significant landscape elements, protected species habitats, or individuals. These natural elements often receive additional protection under the EU frameworks, particularly the Natura 2000 network and unique species protection systems.[130]

The Czech Republic enforces drinking water quality standards through the Public Health Act, which holds particular significance, given the new Drinking Water Directive's anticipated microplastic inclusion among harmful substances.

The Czech legal system maintains clear distinctions between administrative and criminal liability. The "social danger" criterion[131] primarily differentiates these frameworks, with environmental crimes further distinguished by territorial consequence scope, damage remediation costs, and human health or life threats.[132] Consequently, administrative and criminal law address similar prohibited activities but at different intensity thresholds. Several Criminal Code provisions can theoretically apply to waterborne microplastic pollution, including intentional or negligent environmental damage and endangerment,[133] water source damage,[134] unauthorised waste handling,[135] intentional or negligent unauthorised protected wild animal and plant handling,[136] and protected nature component damage.[137]

4.3. Issues of evidence

In the Czech Republic, environmental crime enforcement faces significant challenges, including low case resolution rates and disproportionately minimal penalties. These inefficiencies stem from enforcement authority underfunding, insufficient training, limited public environmental crime awareness, and low social recognition of environmental crime severity.[138]

These factors highlight the evidentiary challenges in environmental liability establishment. Evidence collection deficiencies potentially result from inadequate legislative authority allocation among relevant agencies and from the resulting coordination failures, combined with previously identified challenges to prevent accurate environmental damage assessment and specific polluter identification.

130 | The Natural Habitats Directive and The Wild Birds Conservation Directive.
131 | Art. 12(2) of the Criminal Code.
132 | Art. 296, Art. 138, and Arts. 293 to 301 of the Criminal Code.
133 | Arts. 293 and 294 of the Criminal Code.
134 | Art. 294a of the Criminal Code.
135 | Art. 298 of the Criminal Code.
136 | Arts. 299 and 300 of the Criminal Code.
137 | Art. 301 of the Criminal Code.
138 | Tomoszková, Zębek & Židek 2024, 52.

The Czech Republic's 2020 Bečva River disaster investigation illustrates these systemic failures.[139]

Environmental inspections represent critical evidence collection tools for polluter liability determination. In the Czech Republic, inspections follow the Control Code, which establishes general public administration inspection standards.[140] The Czech Environmental Inspectorate serves as the primary environmental enforcement authority. The inspections produce control protocols that constitute public documents under Section 53(3) of the Czech Administrative Code[141] and may independently support administrative violation determinations.[142] However, they lack public document status in criminal proceedings. While Czech environmental inspectorates do not conduct criminal investigations, their activities significantly influence criminal proceeding outcomes. These technically sophisticated agencies typically receive initial environmental law violation notifications and conduct preliminary measurements. Inspection deficiencies can, thus, undermine subsequent criminal proceedings.[143]

These considerations hold European legal significance because national environmental regulations frequently implement EU directives, establishing EU interests by their enforcement through liability provisions, including criminal sanctions.[144] The new Environmental Crimes Directive establishes enhanced environmental crime liability enforcement requirements, including provisions addressing ecocide (qualified criminal actions) and formally permitted activities. Given inspection agencies' central role in European environmental criminal law enforcement, the directive establishes new requirements for environmental crime investigator professional development and inter-agency coordination.[145] The explanatory memorandum of the directive identifies enforcement deficiencies across member states and throughout enforcement chains, including inspections, citing resource limitations, training and expertise deficits, awareness and prioritisation inadequacies, and insufficient national and cross-border cooperation and information sharing. Future EU environmental crime enforcement requirements will likely incorporate waterborne microplastic pollution.

The significance of environmental inspection in transboundary pollution investigations relates particularly to the *ne bis in idem* principle application. Combined with this principle, inspection inefficiency in one member state may

139 | Ibid., 27, 53, 57.
140 | Jelínková 2023, 12.
141 | See Case No. 4 As 409/2019-46.
142 | Art. 81 of the Misdemeanor Act.
143 | This role of the Czech Environmental Inspectorate is also illustrated by the recent case of the Bečva River poisoning. See Final Report of the Investigative Commission of the Parliament of the Czech Republic on the Ecological Catastrophe on the Bečva River, 2021.
144 | Directive 2008/99/ES now replaced by Directive (EU) 2024/1203.
145 | Arts. 18 and 19 of the Environmental Crime Directive.

prevent appropriate public authority remediation in another affected state. The European Court of Justice's *Nordzucker* judgment,[146] addressing cross-border competition distortion sanctions, establishes principles applicable to cross-border pollution enforcement.[147] In other words, when member state A's public authority accounts for harmful conduct consequences arising in member state B, member state B's authorities cannot reconsider these issues even when capable of more effective or accurate investigation.

Despite the importance of national inspections in EU environmental interest enforcement, including environmental crimes and cross-border pollution, harmonised environmental control regulations remain undeveloped.[148] European institutions recognise that persistent national inspection system differences, which affect inspection quality, undermine European environmental law enforcement.[149] Non-profit organisation IMPEL has advanced national inspection body cooperation by coordinating activities, facilitating Commission-member state communication, and developing environmental inspection minimum standards.[150] These standards constitute the non-binding *soft law*[151] allowing member states to implement recommendations inconsistently in scope and methodology. Consequently, national system inspection performance differences persist,[152] despite Commission resolution efforts.[153]

Therefore, European law addresses environmental controls through fragmentary and general provisions in specific directives and regulations. Relevant instruments include the SEVESO Directive,[154] Industrial Emissions Directive,[155] Waste Framework Directive,[156] and Birds Directive.[157]

Commission-conducted inspections without member state consent, such as competition law, *dawn raids* under TFEU Articles 101 and 102, customs inspections, or economic crime investigations, may indirectly support EU environmental interest enforcement. The Commission may conduct consent-contingent *fact-finding missions* clarifying specific case circumstances, although these remain relatively infrequent.[158]

146 | Case C-151/20.
147 | Vomáčka 2022.
148 | Vomáčka & Strouhal 2017.
149 | Impact assessment study into possible options for revising RMCEI.
150 | RMCEI.
151 | However, some component directives refer to the minimum standards, thereby giving them a certain dimension of bindingness. See recital 23 of the preamble to the Ozone-Layer Depleting Substances.
152 | Hedemann-Robinson 2016, 4.
153 | Impact assessment study into possible options for revising RMCEI, 10.
154 | Art. 20 of the Major-Accident Hazards Directive.
155 | Art. 23 of the Integrated Pollution Prevention and Control Directive.
156 | Art. 34 of the Waste Framework Directive.
157 | Art. 9 (1) (e) of the Wild Birds Conservation Directive.
158 | Vomáčka & Strouhal 2017, 38–43.

5. Conclusions

Microplastic pollution presents extensive challenges, with interdisciplinary implications and global consequences. The current scientific understanding of microplastic impacts on human health and environmental systems justifies the application of the precautionary principle. As such, the international, European, and national legislation must acknowledge these complexities, incorporate current scientific understanding, and effectively address emerging challenges.

Given the potential severity of this problem, a comprehensive international legal instrument addressing environmental plastic pollution can provide significant benefits. This instrument should exhaustively identify and describe all relevant issues with scientific substantiation, while establishing effective resolution frameworks. It should also specifically evaluate microplastic significance and establish fundamental standards for preventing its formation, environmental release, and impacts on ecological systems and human health, including basic liability frameworks. Moreover, such an instrument should emphasise the importance of freshwater resources as drinking water sources and primary marine pollution contributors. It also needs to establish or modify regional organisations monitoring cross-border environmental plastic releases, mainly through waterways, and provide sufficient enforcement authority, potentially through national inspection integration and participation.

European legal frameworks demonstrate increasing commitment to environmental plastic pollution regulation, although water-specific plastic impact regulations remain limited and indirect. The current regulatory gaps include comprehensive regulation of textile-released microplastics, which, according to extant studies, constitute the primary freshwater and subsequent marine microplastic sources. Research and development programmes might be the most promising approach to addressing data deficiencies. Specifically, European regulatory development could benefit from additional research on microplastic human health impacts, citizen initiatives, and educational programmes raising public awareness and stimulating political discourse.

Until scientific and legal frameworks fully address microplastics and their sources, neither water-specific regulations nor comprehensive environmental liability provisions will achieve optimal effectiveness. Liability frameworks build upon substantive entity obligations. As previously noted, the scientific understanding and legal microplastic regulation are still developing, indirectly providing protection through existing frameworks. Progress in these areas must precede advancement in the liability doctrine.

If the EU intends to enforce environmental protection interests comprehensively, it cannot, particularly given the expanding environmental legislation, continue neglecting the essential role of environmental inspections in environmental liability enforcement. As the EU increasingly regulates environmental microplastics, the absence of harmonised environmental controls will become increasingly problematic. Effective waterborne microplastic management requires addressing cross-border aspects, which remains impractical without clarifying member-state inspection body competencies, ensuring effective coordination, and standardising inspection quality across member states.

The water accident investigation regulatory improvements in the Czech Republic following the Bečva River disaster[159] are an important reminder that postponing adequate regulatory frameworks until cross-border catastrophes necessitate intervention represents poor policy.

159 | Act No. 182/2024 Coll.

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1. 5/14. End Plastic Pollution: Towards an International Legally Binding Instrument – Resolution adopted by the United Nations Environment Assembly on 2 March 2022 [UNEP/EA.5/Res.14]
2. 6/15. Strengthening ocean efforts to tackle climate change, marine biodiversity loss and pollution – Resolution adopted by the United Nations Environment Assembly on 1 March 2024 [UNEP/EA.6/Res.15]
3. Convention on Biological Diversity (CBD), 1992
4. Convention on Cooperation for the Protection and Sustainable Use of the River Danube (Danube River Protection Convention), 1994
5. Convention on the Law of Non-Navigational Uses of International Watercourses, 1997
6. Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (known as “London convention”), 1972
7. Convention on the Protection of the Black Sea Against Pollution (known as “Bucharest convention”), 1992

8. Convention on the Protection of the Marine Environment of the Baltic Sea Area, 1992 (Helsinki Convention revised in 1992)
9. Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (known as "Barcelona convention"), 1976
10. Convention on the Protection and Use of Transboundary Watercourses and International Lakes, 1996
11. Draft report of the intergovernmental negotiating committee to develop an international legally binding instrument on plastic pollution, including in the marine environment, on the work of the first part of its fifth session – Busan, Republic of Korea, 25 November–1 December 2024
12. ILC – Draft Principles on the Allocation of Loss in the Case of Transboundary Harm Arising out of Hazardous Activities
13. ILC – The International Law Commission's Draft Articles on Prevention of Transboundary Harm from Hazardous Activities
14. International Convention for the Prevention of Pollution from Ships (MARPOL), 1973 as modified by the Protocol of 1978
15. OSPAR Convention for the protection of the marine environment of the North-East Atlantic, 1992
16. OSPAR Recommendation 2021/06 on the reduction of plastic pellet loss into the marine environment
17. Protocol on Civil Liability and Compensation for Damage Caused by the Transboundary Effects of Industrial Accidents on Transboundary Waters to the 1992 Convention on the Protection and use of Transboundary Watercourses and International Lakes and to the 1992 Convention on the Transboundary Effects of Industrial Accidents
18. Rio Declaration on Environment and Development (Report of the United Nations Conference on Environment and Development), 1992
19. The United Nations Convention on the Law of the Sea (UNCLOS), 1982

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2. COM/2020/98 final – Communication from the Commission to the European parliament, the council, the European economic and social committee and the Committee of the regions A new Circular Economy Action Plan For a cleaner and more competitive Europe
3. COM/2021/400 final – Communication from the commission to the European parliament, the council, the European economic and social committee and the Committee of the regions Pathway to a Healthy Planet for All EU Action Plan: "Towards Zero Pollution for Air, Water and Soil"
4. COM(2022) 141 final – Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: EU Strategy for Sustainable and Circular Textiles
5. COM(2023)645 – Proposal for a Regulation of the European parliament and of the Council on preventing plastic pellet losses to reduce microplastic pollution
6. Commission Decision (EU) 2017/1216 of 23 June 2017 establishing the EU Ecolabel criteria for dishwasher detergents (notified under document C(2017) 4240)
7. Commission Delegated Decision (EU) 2024/1441 of 11 March 2024 supplementing Directive (EU) 2020/2184 of the European Parliament and of the Council by laying down a methodology to measure microplastics in water intended for human consumption
8. Commission Implementing Decision (EU) 2022/162 of 4 February 2022 laying down rules for the application of Directive (EU) 2019/904 of the European Parliament and of the Council as regards the calculation, verification and reporting of data on the reduction in the consumption of certain single-use plastic products and the measures taken by Member States to achieve such reduction
9. Commission Regulation (EU) 2023/2055 of 25 September 2023 amending Annex XVII to Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) as regards synthetic polymer microparticles
10. Council Directive of 12 June 1986 on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture
11. Council Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment
12. Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora
13. Directive 94/62/EC of the European Parliament and of the Council of 20 December 1994 on packaging and packaging waste

14. Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy
15. Directive 2004/35/EC of the European Parliament and of the Council of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage
16. Directive 2006/7/EC of the European Parliament and of the Council of 15 February 2006 concerning the management of bathing water quality and repealing Directive 76/160/EEC
17. Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy
18. Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives
19. Directive 2008/99/ES of the European Parliament and of the Council of 19 November 2008 on the protection of the environment through criminal law
20. Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds
21. Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control)
22. Directive 2012/18/EU of the European Parliament and of the Council of 4 July 2012 on the control of major-accident hazards involving dangerous substances, amending and subsequently repealing Council Directive 96/82/EC
23. Directive (EU) 2015/720 of the European Parliament and of the Council of 29 April 2015 amending Directive 94/62/EC as regards reducing the consumption of lightweight plastic carrier bags
24. Directive (EU) 2019/904 of the European Parliament and of the Council of 5 June 2019 on the reduction of the impact of certain plastic products on the environment
25. Directive (EU) 2020/2184 of the European Parliament and of the Council of 16 December 2020 on the quality of water intended for human consumption
26. Directive (EU) 2024/1203 of the European Parliament and of the Council of 11 April 2024 on the protection of the environment through criminal law and replacing Directives 2008/99/EC and 2009/123/EC

27. European Chemicals Agency, Opinion of the Committee for Risk Assessment and Opinion of the Committee for Socio-Economic Analysis on an Annex XV dossier proposing restrictions on intentionally-added microplastics, ECHA/RAC/RES-O-0000006790-71-01/F and ECHA/SEAC/RES-O-0000006901-74-01/F, 2020
28. Impact assessment study into possible options for revising Recommendation 2001/331/EC providing for minimum criteria for environmental inspections (RMCEI) Final Report ENV.G.1/FRA/2006/0073. 2011
29. Impact assessment report on Combatting microplastic pollution in the European Union accompanying the document Proposal for a Regulation Of The European Parliament And Of The Council on preventing plastic pellet losses to reduce microplastic pollution.
30. Judgment of the Court of Justice (Grand Chamber) of 22 February 2022, *Bundeswettbewerbsbehörde v Nordzucker AG, Südzucker AG, Agrana Zucker GmbH*, Case C-151/20.
31. Proposal for a Directive of the European Parliament and of the Council (EU) on the criminal-law protection of the environment and replacing Directives 2008/99/EC and 2009/123/EC
32. Recommendation of the Parliament and of the Council of 4 April 2001 providing for minimum criteria for environmental inspections in the Member States. OJ L 118, 27.4.2001
33. Regulation (EC) No 1005/2009 of the European Parliament and of the Council of 16 September 2009 on substances that deplete the ozone layer
34. Regulation (EU) 2019/1009 of the European Parliament and of the Council of 5 June 2019 laying down rules on the making available on the market of EU fertilising products.
35. Regulation (EU) 2020/740 of the European Parliament and of the Council of 25 May 2020 on the labelling of tyres with respect to fuel efficiency and other parameters.
36. Regulation (EU) 2020/741 of the European Parliament and of the Council of 25 May 2020 on minimum requirements for water reuse.
37. Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 on the establishment of a framework to facilitate sustainable investment.

38. Regulation (EU) 2024/1257 of the European Parliament and of the Council of 24 April 2024 on type-approval of motor vehicles and engines and of systems, components and separate technical units intended for such vehicles, with respect to their emissions and battery durability (Euro 7), amending Regulation (EU) 2018/858 of the European Parliament and of the Council and repealing Regulations (EC) No 715/2007 and (EC) No 595/2009 of the European Parliament and of the Council, Commission Regulation (EU) No 582/2011, Commission Regulation (EU) 2017/1151, Commission Regulation (EU) 2017/2400 and Commission Implementing Regulation (EU) 2022/1362
39. Regulation (EU) 2024/1781 of the European Parliament and of the Council of 13 June 2024 establishing a framework for setting ecodesign requirements for sustainable products, amending Directive (EU) 2020/1828 and Regulation (EU) 2023/1542 and repealing Directive 2009/125/EC
40. Regulation (EU) 2025/40 of the European Parliament and of the Council of 19 December 2024 on packaging and packaging waste, amending Regulation (EU) 2019/1020 and Directive (EU) 2019/904 and repealing Directive 94/62/EC

Czech legal documents and acts (cited in the current version)

1. Act No. 182/2024 Coll., Amending Act No. 254/2001 Coll., on Waters and on Amendments to Certain Acts (the Water Act), as amended, Act No. 114/1992 Coll., on the Protection of Nature and the Landscape, as amended, and Act No. 465/2023 Coll., Amending Act No. 416/2009 Coll., on the Acceleration of the Construction of Transport, Water, Energy and Electronic Communications Infrastructure (the Linear Infrastructure Act), as amended, and Other Related Acts
2. Act No. 255/2012 Coll., on Control (Control Code)
3. Act No. 40/2009 Coll., Criminal Code
4. Act No. 17/1992 Coll., on the Environment
5. Act No. 167/2008 Coll., on the Prevention and Remediation of Environmental Damage and on Amendments to Certain Acts (Environmental Damage Act)
6. Act No. 76/2002 Coll, on Integrated Pollution Prevention and Control, on the Integrated Pollution Register, and on Amendments to Certain Acts (Integrated Prevention Act)
7. Act No. 243/2022 Coll., on Limiting the Impact of Selected Plastic Products on the Environment

8. Act No. 224/2015 Coll., the Prevention of Major Accidents Caused by Selected Hazardous Chemical Substances or Chemical Mixtures and on the Amendment of Act No. 634/2004 Coll., on Administrative Fees, as amended (Major-Accident Prevention Act)
9. Act No. 250/2016 Coll., Act on Liability for Administrative Offences and Proceedings (Misdemeanor Act)
10. Act No. 477/2001 Coll., Act on Packaging and on Amendments to Certain Acts (Act on Packaging)
11. Act No. 258/2000 Coll., on the Protection of Public Health and on Amendments to Certain Related Acts (Public Health Act)
12. Act No. 541/2020 Coll., on Waste
13. Act No. 254/2001 Coll., Act on Waters and on Amendments to Certain Acts (Water Act)
14. Communication No. 66/1998 Coll. of Int. Treaties, on the conclusion of the Treaty between the Czech Republic and the Federal Republic of Germany on Cooperation on Transboundary Waters in the Field of Water Management.
15. Communication No. 54/2015 Coll. of Int. Treaties on the conclusion of the Agreement between the Government of the Czech Republic and the Government of the Republic of Poland on Cooperation on Transboundary Waters in the Field of Water Management.
16. Communication No. 7/2000 Coll. of Int. Treaties on the conclusion of the Agreement between the Government of the Czech Republic and the Government of the Slovak Republic on Cooperation on Transboundary Waters, as amended by Communication No. 73/2008 Coll. of Int. Treaties
17. Decree No. 5/2011 Coll. on the Delimitation of Hydrogeological Regions and Groundwater Bodies, the Method of Assessing the Status of Groundwater, and the Requirements for Programs for Monitoring and Assessing the Status of Groundwater
18. Decree No. 98/2011 Coll. on the Method of Assessing the Status of Surface Water Bodies, the Method of Assessing the Ecological Potential of Heavily Modified and Artificial Surface Water Bodies, and the Requirements for Programs for Monitoring and Assessing the Status of Surface Waters
19. Decree No. 57/1970 Coll., on the Treaty between the Czechoslovak Socialist Republic and the Republic of Austria on the Regulation of Water Management Issues on Transboundary Waters.

20. Final Report of the Investigative Commission of the Parliament of the Czech republic on the Ecological Catastrophe on the Bečva River, 2021
21. Government Bill Amending Act No. 167/2008 Coll., on the Prevention and Remediation of Environmental Damage and on Amendments to Certain Acts, as amended, and Other Related Acts (Parliamentary Press No. 870)
22. Government Regulation No. 401/2015 Coll., establishing permissible surface water and wastewater pollution values, discharge permit requirements, and sensitive area designations
23. Judgment of the Supreme Administrative Court of 12 March 2020, Case No. 4 As 409/2019-46