CENTER for INTERNATIONAL ENVIRONMENTAL LAW

Plastic Polymers under the Full Life Cycle Approach:

Key Considerations on the Scope of the Future Plastics Treaty

Introduction

United Nations Environmental Assembly (UNEA) Resolution 5/14[1] mandating the establishment of an intergovernmental negotiating committee (INC) tasked with developing a legally binding instrument to end plastic pollution, including in the marine environment, was adopted at the 5th meeting of UNEA. The mandate outlines the scope of the future instrument, indicating that it should adopt a comprehensive approach addressing the full life cycle of plastic. In the negotiations that have since followed, Member States participating in the INC have expressed varying understandings of what the full life cycle approach entails, particularly concerning measures related to the production of plastic polymers.

Such political statements disregard the scientific evidence and established practices that ascertain the fact that the full life cycle of plastics starts with the sourcing stage, encompassing the extraction of both fossil fuels and bio-based raw materials.[2] Based on scientific definitions, plastic polymers and their production processes constitute a crucial part of the full life cycle approach and are included in the treaty's scope. Critically, plastic polymers are used almost exclusively for the production of plastics materials and products. The production processes and the polymers themselves contribute significantly to pollution. Without recognizing and addressing plastic polymers, the future treaty will fall short of fulfilling the mandate outlined in UNEA Resolution 5/14.

This brief demonstrates the central role of plastic polymers in the full life cycle of plastics from supply chain and pollution perspectives. It looks at precedents to establish that the full life cycle approach mandated in UNEA Resolution 5/14 encompasses the production of plastics, understood as transforming raw materials into a specific substance — in this case, plastic polymers. Finally, it provides recommendations for negotiators about operationalizing a full life cycle approach by including obligations and controls in the future treaty.

The Plastics Life Cycle Begins with the Extraction and Refining of the Raw Materials and Feedstocks that Make Up Plastics

While there is no legally established definition of a full life cycle approach for plastics, scientific evidence and existing practices demonstrate that the full life cycle begins at the sourcing of raw materials stage, regardless of whether plastics are fossil fuel or bio-based, and goes all the way through to the removal of plastics from the environment and the remediation of contaminated ecosystems.[3]

This approach to the full life cycle has already been acknowledged in the context of the INC. Before the meeting of the Open-Ended Working Group (OEWG) that prepared the INC, UNEP released a Glossary of Key Terms[4] that defined the 'full life cycle approach' as inclusive of all aspects of plastic production and consumption, commencing with raw material extraction. The Secretariat once again included this definition in the Plastics Science Note[5] generated after this preparatory meeting to inform INC-1. Later, it resurfaced in Appendix II, paragraph 5 of the Options Paper[6] drafted by the Secretariat before INC-2.[i]

Following this definition, a full life cycle approach inherently encompasses the extraction of raw materials and the stages that follow. These involve transforming oil, gas, and coal, and a small portion of bio-based materials, such as corn, sugar cane, cassava, etc., into plastics through highly complex chemical processes. In broad brushstrokes, plastic production occurs in three main stages: the production and refining of feedstocks from raw materials, the production of monomers and other chemicals, and the polymerization of those monomers, where plastic polymers ultimately come into existence.[7]

Plastic polymers are large synthetic molecules composed of smaller units called monomers. They are bonded together with the help of chemicals. To put it another way, plastic polymers are macromolecules characterized by the sequence of one or more types of monomer units. These polymers, as well as the monomers and other chemicals used in their production, are manufactured from either fossil-based or bio-based feedstocks.[8] Plastic polymers serve as the fundamental building blocks for every plastic material and form the basis of every known plastic product.[9, 10] Plastic materials are composed of plastic polymers, chemical additives (which are often highly toxic), and non-intentionally added substances (NIAS).[11]

Differences among Plastic Polymers, Primary Plastics, and Secondary Plastics

The term 'plastic polymers' describes polymers that have not been used or processed before and are manufactured directly from fossil- or bio-based feedstocks. These have been also referred to as 'polymers in primary forms'[12] or 'primary plastic polymers.'[ii]

Primary plastics, also known as 'virgin plastics,' refer to materials, meaning that they are a mix of these plastic polymers with chemical additives and NIAS, which will then be molded into various products.

i. For further information on definitions to inform the plastics treaty negotiations refer to this compilation prepared by CIEL.

ii. The Zero Draft Text prepared ahead of INC3 and the Revised Draft Text of the International Legally Binding Instrument on Plastic Pollution, including in the marine environment use the term 'primary plastic polymers.'

Plastic polymers emerge from the factory in various forms — predominantly pellets, powders, and flakes though sometimes fibers, pastes, or liquids. These forms typically consist solely of polymers, with a minor addition of other chemicals, possibly NIAS. Alternatively, they may already be materials, indicating a blend of plastic polymers with chemical additives. In other cases, materials come into existence in the factories that mold products and applications by mixing the plastic polymers with additives.

Secondary plastics, also called 'recycled plastics' or 'recycled resins,' are materials as well, but in this case, they are formed by reshaping plastic waste. However, it is important to note that the polymers in secondary plastics remain the same as those used in the original material; no new polymers are created.

The term 'resin' has been used interchangeably to refer to plastic polymers upon exiting the factory, whether in practical pure form or mixed with additives, to secondary plastics derived from plastic waste, and to the materials used in product manufacturing. Given this interchangeable usage, the future plastics treaty should use the term 'primary plastic polymers' or 'polymers in primary forms' when developing production obligations.

In rare cases, polymers can be derived from plastic waste. However, this process is economically, environmentally, and technically unviable.[13]

Some polymers can occur naturally. While all plastic materials and products are composed of polymers, not all polymers are plastics. Some polymers, such as silk, wool, cotton, and even DNA, occur organically.[14] One of the fundamental characteristics that differentiates plastic polymers from naturally occurring polymers is their intricate production through highly complex chemical processes.

Extraction of Raw Materials

In 99% of cases, plastics come from oil, gas, and coal. Oil and gas are extracted through conventional methods, like pumping and drilling, but also through non-conventional methods, like hydraulic fracturing (fracking). It is worth noting that this technique has boosted gas supply in some countries over the past two decades in some regions of the world.[15] Coal extraction

occurs through surface or underground mining methods. Bio-based raw materials, although present, constitute only 1% of the plastics universe.[16] These include corn, sugarcane, starch, and cassava, among others.[17]

Plastic polymers will lock in fossil fuel production in the years ahead. They already account for 8% to 14% of oil demand, and with current trends, this percentage will rise significantly.[18] By 2028, plastic polymers will become the primary driver of oil demand growth, while demand decreases in traditional sectors like energy and transportation.[19] Petrochemicals, mostly driven by the production of plastic polymers, contribute significantly to natural gas consumption. By 2030, their demand is projected to increase by 56 billion cubic meters, equivalent to half of Canada's current total gas consumption.[20] Furthermore, some countries are actively pursuing efforts to increase the production of coal-based plastics, which will also drive up coal demand globally.[21]

Despite plastics being a key driver of fossil fuel production, oil, gas, coal, and bio-based materials have diverse uses in various sectors. Therefore, limiting the production of raw materials under the plastics treaty remains unviable. Additionally, the extraction of fossil fuels potentially falls under other multilateral environmental agreements (MEAs).

Production and Refining of Feedstocks from Raw Materials

Raw materials undergo refinement and transformation into various hydrocarbons in refineries. These processes entail converting coal into methanol, separating the gas stream to obtain natural gas liquids (NGL), and refining crude oil to produce naphtha. Bio-based raw materials are converted into ethanol. Refineries are typically situated at extraction sites and are increasingly integrated with other stages of the petrochemical process. Currently, around one-third of global refineries built are integrated with petrochemical facilities.[22]

The aromatic chemicals benzene, toluene, and xylenes (also referred to as BTX) are also produced in this stage. They emerge as byproducts from oil refining. Usually, they are produced from naphtha, meaning they come into existence after initial oil refinement. Yet, they precede the production of monomers.[23] BTX are used both as feedstocks and processing aids for producing plastic polymers.

Despite the crucial role of these hydrocarbons in producing plastic polymers, some have other uses. For instance, naphtha has non-plastic applications, including solvents, laundry soaps, and cleaning fluids.[24] At the same time, NGL can be a heating fuel,[25] and BTX are also used for solvents and pesticides.[26] Consequently, due to their diverse applications beyond the plastics life cycle, including control measures in the future plastics treaty to limit the production and consumption of these hydrocarbons presents significant challenges.

Monomer and Other Chemicals Production

Hydrocarbons (NGL, naphtha, BTX, etc.) undergo transformation processes through steam cracking and other methods, breaking them down into simpler chemical units that constitute the essential building blocks of plastic polymers: monomers. These hydrocarbons are also used to make processing aids, additives, and intermediate chemicals for producing plastics. These monomers and other chemicals have also been referred to as precursors.[iii]

iii. The Zero Draft Text prepared ahead of INC-3 and the Revised Draft Text of the International Legally Binding Instrument on Plastic Pollution, including in the marine environment uses this term.

Monomers can be produced from a single transformation of a single chemical or a combination of several chemicals and multiple transformations. By this point, the plastics life cycle is well underway. Unlike the stages detailed above, the interdependence between the production of monomers and plastic polymers is significant: The vast majority of the monomers produced in these processes are used for plastics.[27]

Although the universe of monomers and chemicals is vast, two key monomers, ethylene and propylene, are the primary basis for the majority of plastic polymers. Nearly two-thirds of the total propylene and ethylene production is used directly to make plastic.[28] As for propylene, 68% is directly polymerized to produce polypropylene,[29] highlighting its key role in the plastics life cycle.

Ethylene is even more significant. **Approximately 90% of ethylene is used for plastic production, either by directly being polymerized or by producing other monomers and chemicals.**[30] More than 60% of ethylene is directly polymerized to produce polyethylene.[31] Most of the remainder of global ethylene is used to create other monomers for plastic production.[iv] About 15% of ethylene is converted to ethylene oxide, much of which is converted into ethylene glycol and, when combined with xylene, creates terephthalic acid, the platform monomer of polyethylene terephthalate (PET). Another 8.5% of ethylene is combined with chlorine to create ethylene dichloride, which is converted into vinyl chloride, the platform monomer for polyvinyl chloride (PVC).[32] Finally, approximately 5% of ethylene is combined with benzene to make ethylbenzene, roughly half of which is used to produce styrene, the monomer of polystyrene.[33]

The production capacity for ethylene, meaning the amount of steam cracking plants, has grown exponentially over the past decade.[34] The sole viable method to keep these plants operational is by using virtually all their ethylene to produce plastic polymers, resulting in two consequences. First, it has significantly increased plastic polymer production.[35] Second, it has caused an overcapacity issue due to lower demand than ethylene supply.[36] Despite this scenario, numerous capacity additions are still scheduled in the coming years,[37] posing risks of stranded assets and economic losses in addition to health and environmental challenges.

iv. Three primary monomers derived from ethylene– styrene, vinyl chloride, and terephthalic acid – are almost exclusively used to make plastic polymers - polystyrene, polyvinyl chloride, and polyethylene terephthalate (PET), respectively.

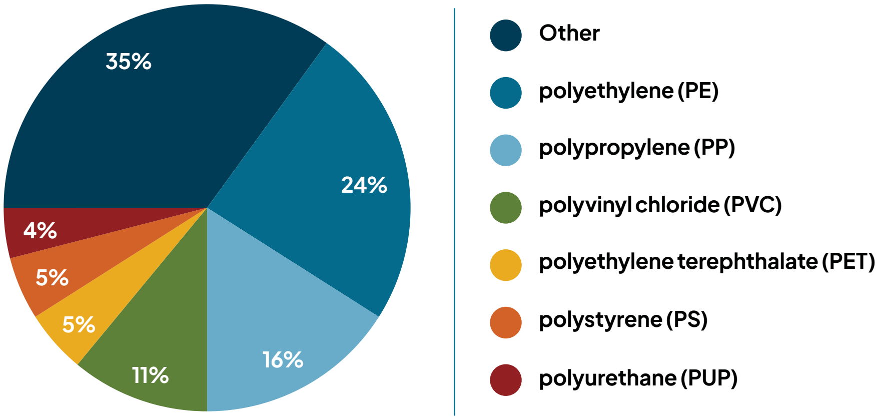
This underscores that monomers are already deeply integrated into the plastics life cycle and are therefore captured under the mandate of UNEA Resolution 5/14. Consequently, they should be subject to obligations and controls under the future plastics treaty. Specifically, regulations should commence with ethylene, initially focusing on preventing any further capacity additions.

Polymerization

Plastic polymers are formed in polymerization plants by combining monomers and other chemicals.[38] All plastic materials are composed of plastic polymers, and virtually all plastic polymers are used to fabricate plastics. That is why plastic products are often primarily defined by the specific polymer from which they are made.

Polymer Use

Most plastics on the market are made out of just a few polymers. Six polymers constitute approximately 65% of all plastics.



Source: Data from OECD

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While many plastic products and applications are on the market, most are made from just a few polymers. By 2019, six polymers constituted 65% by weight of all plastics: polyethylene (24%), polypropylene (16%), PVC (11%), PET (5%), polystyrene (5%), and polyurethane (4%).[v, 39] Of these six, all but polypropylene and polyurethane are derived from ethylene.

From a supply chain perspective, plastic polymers are integral to the plastics life cycle. Consequently, they fall within the scope of the full life cycle approach, as defined by UNEA Resolution 5/14, and should be subject to controls under the forthcoming instrument. Polymerization plants are integrated with monomer production plants (such as steam crackers), making it logical to regulate them together.

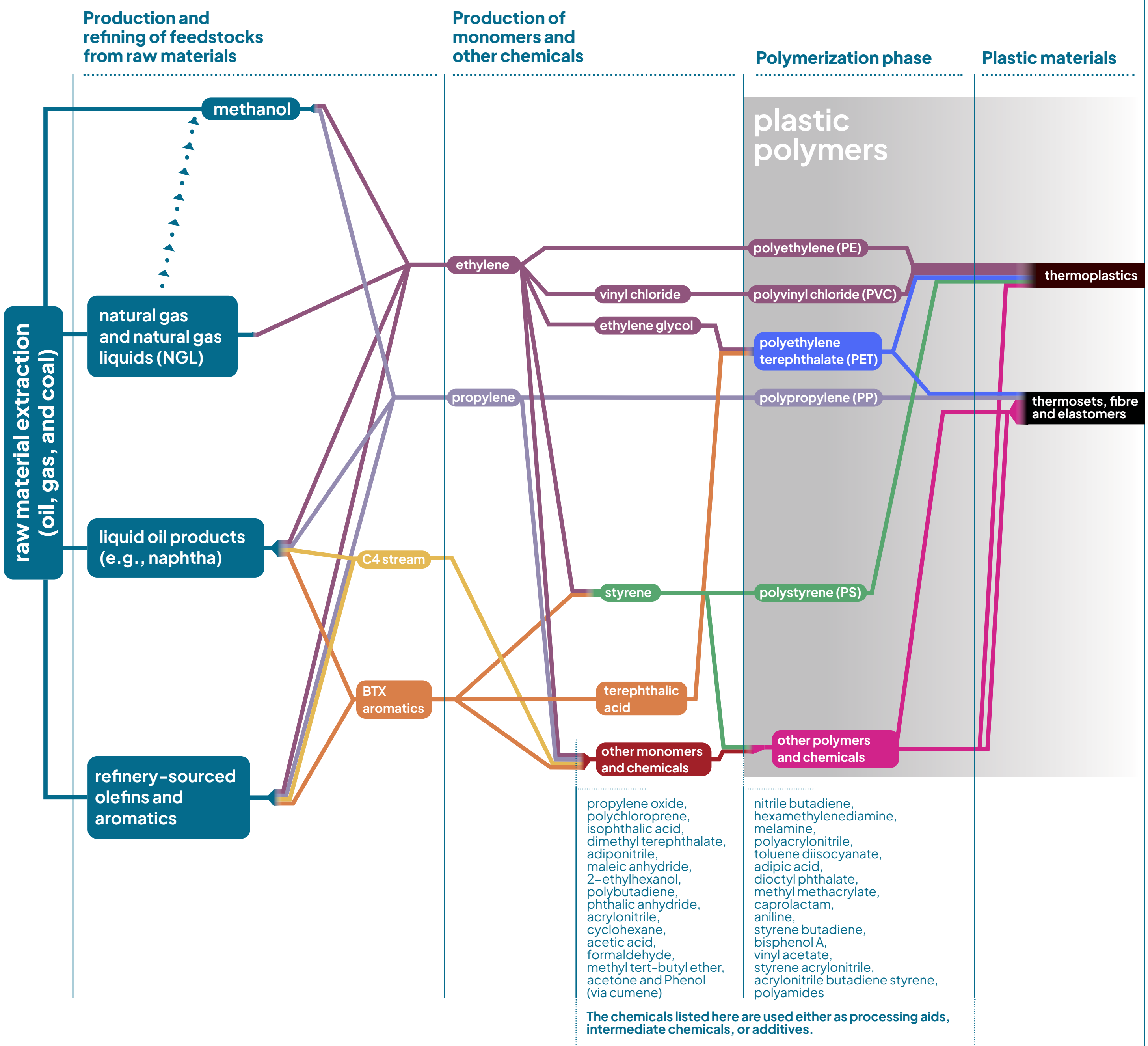
It is important to note that despite a few polymers covering the majority of the market, the universe of plastic polymers is vast. As of the time of writing (March 2024), there are more than 200,000 different polymers and counting.[40] Therefore, obligations and regulations under the plastics treaty should consider the risk of substitution. Reducing plastic polymer production to enable effective solutions in the rest of the life cycle is a pressing need. Attempting to reduce production by targeting specific polymers might not effectively lower overall production levels.

Producers may potentially substitute regulated polymers with those possessing similar characteristics, thereby risking failure to achieve the necessary reductions in overall production levels.

v. This distribution covers all plastics in the market, including fibers, coatings, elastomers, and other applications. It is important to note that 70% of all fibers are made out of polyester, a polymer derived from PET, potentially making its use even more significant than what's indicated here.

Plastic Polymers Production [vi]

The petrochemical industry conducts a complex chemical processes to create plastic polymers. Simplified, this process consists of three highly integrated stages: the production and refining feedstocks from raw materials, the production of monomers and other chemicals, and the polymerization of those monomers.



Source: Based on visuals and data from the University of Cambridge

vi. This infographic does not cover the production of plastic polymers from biobased feedstocks. However, it is important to note that this process yields polymers with the same chemical structure as those produced from fossil fuels. The chemical processes and the chemical agents used are often similar as well. This infographic does not highlight the proportions of each of these chemicals going into plastics. As mentioned in the sections above, raw materials, both fossil fuels and biobased, have several other uses besides plastics. NGL, Liquid Oil Products, Methanol, Refinery-Sourced Olefins and Aromatics, C4 and BTX, have other multiple applications as well. However, when it comes to monomers, the situation changes. Although the universe of monomers and other chemicals is vast, the majority of ethylene and propylene, the two most important building blocks, are used for plastics. Approximately 90% of ethylene and 68% of propylene are dedicated to plastic production. Some monomers derived from these, including styrene, terephthalic acid, and vinyl chloride, are almost exclusively used for plastics as well.

Plastic Polymers Production Is a Significant Source of Pollution

Plastic polymers constitute a pivotal component of the plastics life cycle, and they are a significant source of pollution,[vii] encompassing adverse impacts on human health, the environment, and human rights.[41] As the production of plastic polymers is expected to increase exponentially, so are their associated toxic impacts. Plastic polymer production is expected to nearly triple from 2019 to 2050, going from 460 million tonnes (Mt) per year to approximately 1000 million tonnes (Mt) per year.[42]

In a time when we urgently need to cut down on greenhouse gas (GHG) emissions, plastics already account for 3% to 8% of global GHG,[43] with 90% of these stemming from the production of plastic polymers, including the production of monomers and other chemicals, and the extraction of raw materials.[44] If production stays at current levels or continues to increase as expected, it will pose a significant challenge in keeping global temperature rise below 1.5ºC.

The production of plastic polymers, which includes the production of feedstocks, monomers, and other chemicals, also releases toxic substances at every stage, adversely impacting human health and the environment. Front- and fenceline communities living near production sites and workers employed in production facilities disproportionately experience toxic impacts.[45] For instance, refining raw materials to produce feedstocks like naphtha, NGL, and BTX releases carcinogenic chemicals, including, but not limited to, polycyclic aromatic hydrocarbons (PAHS) and benzene.[46]

Monomer production releases highly toxic chemicals like propylene and styrene monomers, 1,3-butadiene, sulfur dioxide, and propylene oxide, among others.[47] Health impacts of such releases include but are not limited to headaches, allergies, respiratory problems, mild central nervous system affectations, lung, breast, liver, and brain cancers, and reproductive alterations.[48] Their presence in air, water, and soils affects a variety of organisms and is also well documented.[49]

The polymerization stage emits solvents, initiators, catalysts, and other additives into the environment.[50] For example, stabilizers and flame-retardants, known for their toxicity to human health, are discharged into soil, water, and air.[51] Solvents such as hexane and toluene are also released, which exert toxic effects on the human body, leading to symptoms such as dizziness, giddiness, nausea, and headaches,[52] as well as anxiety, nerve damage, and other health issues.[53]

The impact of plastic polymer production on the enjoyment of human rights is also well documented. The primary chemical production stage, where hydrocarbons are generated, leads to air quality issues that heighten the risks of asthma and lung, bladder, and lymphohematopoietic cancers,[54] significantly compromising the right to health. Additionally, toxic emissions released during the secondary chemical and polymerization stages affect the right to life, health, and a safe working environment for fenceline communities and workers.[55]

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vii. Plastic pollution is understood as "broadly, all emissions and risks resulting from plastics production, use, waste management and leakage," following the OECD definition. Building on this, any risk or emission associated with PPPs and its production process falls under this scope.

viii. Pellets can be manufactured from primary plastic polymers derived from fossil fuel-based or bio-based feedstocks, as well as from recycled resins, or a combination of both. Given the relatively low rates of recycling, the majority of the pellets referenced in this context are likely composed of primary plastic polymers. However, it is possible that a fraction of them could consist of secondary resin or a blend of primary plastic polymers and secondary resin.

Additionally, plastic polymers are pollutants themselves. Most of the time, they enter the market as pellets (sometimes called 'nurdles'). Pellets are primary microplastics, which are intentionally fabricated small particles. There are estimates that up to 22 trillion pellets are released into the environment every year.[viii, 56] These pellets enter the environment through spills occurring directly in polymerization facilities or during transportation.[57] Most of the spills happen during sea shipments, but they also occur during land transportation via railroads and other systems.[58]

Pellets also have a profound effect on the environment. They are responsible for animal death and starvation,[59] reduced productivity in coral reef and mangrove ecosystems,[60] impacts on zooplankton that reduce the ocean's ability to serve as a carbon sink,[61] and alterations of species' ecological and functional roles. Additionally, all microplastics, including pellets, act as vectors, transporting pathogens and toxins into multiple organisms.[62]

As the production of plastic polymers increases, so does the release of microplastics into the environment and the human body. Current production levels result in humans' ingestion of tens to hundreds of thousands of secondary microplastics on an annual basis.[63] Secondary microplastics are tiny particles resulting from the degradation and breakdown of plastics. They differ from primary microplastics because they are not intentionally fabricated in a microscale.

By their very nature, all plastic polymers experience fragmentation and break down into smaller pieces that pollute the environment and enter human bodies.[64] Even though plastics degrade, they cannot biodegrade or be removed. Instead, plastics accumulate. As the production of plastic polymers escalates, so does the manufacturing of plastic products, leading to an increased presence of secondary microplastics in the food we consume, the water we drink, and the air we breathe. Consequently, these microplastics find their way into our bodies, posing health risks that include disturbances in gastrointestinal functions and inflammatory diseases.[65]

Case Studies: Pellet Disasters in Galicia and Sri Lanka

The Sri Lanka Disaster

In May 2021, the cargo ship X-Press Pearl caught fire off the Sri Lankan coast, resulting in the spillage of billions of pellets into the sea, along with other metals and toxic chemicals that the ship was transporting.[66] The pellets involved in the disaster were primarily made out of polyethylene polymers but also included polystyrene, polypropylene, polybutadiene rubber, expandable polymeric beads, and polycarbonates.[67]

While the toxicity of some of these polymers is not fully established, the environmental and health impacts of the disaster have been catastrophic for biodiversity, health, and the local economy. Local fishermen have reported decreased catches, changes in the sea, and, in some cases, allergic symptoms following the accident.[68]

The Galicia Accident

On December 8, 2023, the Toconao, a Liberia-registered vessel, spilled more than 20 tons of pellets made out of plastic polymers off the coast of Portugal.[69] Subsequently, these pellets were carried onto the beaches of Galicia in northern Spain. The pellets involved in the spill comprised a mixture of polyethylene and a masterbatch, a blend of polyethylene mixed with a common light stabilizer known as Tinuvin 622.[70]

While current standards may not classify the polyethylene involved in the disaster as a toxic polymer, it still presents substantial toxic risks that could result in catastrophic consequences from the spill. Previous spills illuminate the myriad impacts a region such as Galicia can experience following a pellet discharge. Marine species face potential fatalities upon ingesting these pellets, subsequently jeopardizing the ecological balance.[71] Spills also result in elevated human exposure to microplastics in nearby communities, affecting their right to health.[72]

Although the Galicia disaster is one incident, spills and other discharges have a cumulative impact on marine life. Evidence suggests that the pellets involved in spills could pose a significant threat to the ocean's climate benefits.[73] Furthermore, polyethylene pellets are a vector for transporting pollutants that negatively impact biodiversity and human health.

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Furthermore, both current and projected levels of plastic polymer production exacerbate plastic pollution and hinder potential solutions throughout the plastics life cycle. The more plastic production there is, the greater the exposure to toxic impacts, which cannot be fully eliminated. Existing production rates already surpass the capacity of waste management systems, rendering waste management approaches, including recycling, ineffective.[74] Evidence also indicates that approaches that focus on demand (e.g., bans on single-use plastic products) rather than on the supply of plastic polymers have proven largely inadequate in achieving the goal set forth by UNEA Resolution 5/14 to end plastic pollution.[75]

Legal Precedents for a Full Life Cycle Approach That Includes Plastic Polymers

Legal definitions are critical in helping to advance a treaty's goals. At the time of publication (March 2024), there are relatively few legal definitions pertaining to parts of the plastic life cycle. Rather than craft new definitions, negotiators can — and should — look to documents such as agreed regional instruments. For example, the 27 Member States of the European Union have adopted a shared and legally binding definition of the life cycle as "the consecutive and interlinked stages of a product from raw material use to disposal."[76]

Regarding the interpretation of the term **'raw material,'** the Cambridge Dictionary[77] defines a raw material as any material in its natural condition that has never been processed or used before. Plastic polymers cannot be considered raw materials as they result from a highly complex chemical transformation.

Other definitions of the life cycle, although not legally binding, encompass the extraction of raw materials,[78] going further upstream than the definition provided by the EU directive,[79] which begins with their use. Examples of such definitions include those outlined in ISO 14040:2006,[ix, 80] a standard for environmental management, and in the Plastics Science Note prepared by the Secretariat for the INC.[81] The definition provided by the Scientists' Coalition for an Effective Plastics Treaty also follows this approach. Expanding the definition to include raw material extraction reinforces the thorough coverage of plastic polymers and their production process within the scope of the future instrument.

ix. According to the ISO 14040:2006 standard, the life cycle is the consecutive and interlinked stages of a product system, from raw material acquisition or generation from natural resources to final disposal.

Legal, Technical, and Scientific Definitions for the Full Life Cycle Approach

Source	Life Cycle Definition
European Union Directive 2009/125/EC	"The consecutive and interlinked stages of a product from raw material use to disposal."[82]
ISO 14040:2006	"The consecutive and interlinked stages of a product system, from raw material acquisition or generation from natural resources to final disposal."[83]
Scientists' Coalition for an Effective Plastics Treaty	"The Scientists' Coalition envisions a comprehensive global plastics treaty that acknowledges the intricate, interconnected relationships within the entire lifecycle of plastics, starting from the extraction of feedstocks for their production, passing through the synthetic production, formulation with additives, product development, manufacture, consumption, function and service modalities, and ending with ensuring that unavoidable waste materials and additive chemicals are not released to the environment in unsafe and unsustainable ways."[84]
Plastics Science Note	"A life cycle approach to plastic considers the impact of all the activities and outcomes associated with the production and consumption of plastic materials, products and related services – from raw material extraction and processing (refining, processing, cracking, polymerization) to design, manufacturing, packaging, distribution, use (and reuse), maintenance and end of life management, including segregation, collection, sorting, recycling and disposal."[85]

The INC should embrace the most comprehensive definition of the full life cycle approach and, in alignment with calls for a science-based treaty, adopt definitions such as the one provided by the Scientists' Coalition for an Effective Plastics Treaty. Such an approach aligns with the economic and supply chain dynamics of plastics, where production is intricately linked to the extraction of its primary raw material — fossil fuels. Production plants are frequently located in areas of fossil fuel extraction and expansion, and there is heavy reliance on fossil fuels either as feedstocks or energy sources.

Other MEAs that have implemented a full life cycle approach confirm that the production of plastic polymers is within the scope of the future instrument. The Minamata Convention on Mercury[86] serves as an example. It begins with obligations on the extraction of raw materials (such as banning new primary mercury mining), includes provisions on the production of mercury-added products and substances, and extends throughout waste management and disposal. The Stockholm Convention[87] and the Rotterdam Convention[88] are other examples. They address the impacts of specific substances throughout their life cycle, as delineated in their preamble and Articles 11 and 16, respectively. While not explicitly addressing raw material extraction, they impose restrictions, regulations, and requirements on producing these substances.

Within these MEAs, the production process **is subject to a combination of obligations and control measures.** Obligations specify the 'what' in terms of actions that Parties should take, while control measures detail 'how' those commitments can be fulfilled. The Minamata Convention aims to protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds (Article 1). Specifically, as a control measure for production, it either restricts or bans the use of mercury or mercury compounds in designated production processes outlined in one of its Annexes (Articles 5.2 and 5.3). Similarly, the Stockholm Convention mandates Parties to safeguard human health and the environment from persistent organic pollutants (Article 1). The Convention imposes bans or restrictions on the production of specified substances listed in an Annex (Article 3), among other measures to achieve this objective.

Key Recommendations for the Plastics Treaty Negotiations

Scope and the definition of the full life cycle approach

- The INC must adhere to the scope indicated by Parties in UNEA Resolution 5/14, which mandates the future treaty adopt a comprehensive life cycle approach. Any interpretation that excludes plastic polymers and their production process from the treaty scope would contradict the reality of the plastic life cycle, its economic dynamics, and its human and environmental impacts and would disregard UNEA Resolution 5/14.

- Following numerous calls for the future treaty to be grounded in science, the INC should embrace a science-based definition of a full life cycle approach, such as the one put forth by the Scientist's Coalition for an Effective Plastics Treaty and the UNEP-produced Plastics Science Note. Such a definition commences from raw material extraction without excluding any stage of the life cycle.

Operationalize obligations and control measures for the production of plastic polymers under the full life cycle approach

The INC must operationalize the comprehensive approach that addresses the full life cycle of plastic mandated by UNEA Resolution 5/14 by incorporating both obligations and control measures for the production of plastic polymers in the future instrument. This entails:

- Incorporating an **overarching obligation** for future Parties to prevent adverse impacts on human health and the environment as well as on human rights arising from the production of plastic polymers, including monomers and other intermediate chemicals and their feedstocks. This overarching obligation should be independent of national capabilities and should not be subject to specific measures for its achievement, including those related to secondary plastics and waste management, staying as general as possible.
- The overarching obligation **should cover the three phases of the production process,** meaning the production of feedstocks, monomers and other chemicals, and polymers.
- To implement this overarching obligation, **the INC should agree on control measures aimed at phasing down the overall production of plastic polymers.** Member States are encouraged to support options that allow for a 'start and strengthen' approach, including those that:
    - Agree on a legally binding mechanism to phase down production at the national level, like globally agreed national reduction targets (a successful model implemented by the Montreal Protocol).
    - Establish a global target to progressively reduce the production of plastic polymers that serves as a benchmark for the effectiveness of treaty obligations.
    - Phase-out subsidies for the production of plastic polymers.
    - Include a moratorium on new production facilities or capacity above baselines, with baselines defined no later than the end of negotiations.[x]
- The production of monomers, especially ethylene, is well interlinked with the life cycle of plastics and, therefore, should be subject to control measures. As a starter, **Member States should place a control measure to stop further capacity additions for ethylene production.** Additionally, they should establish mandatory reporting requirements on production levels and trade of various other monomers primarily designated for plastics, such as propylene, terephthalic acid, vinyl chloride, and styrene.
- **Extracting raw materials — fossil- and bio-based — for plastic polymers production should be covered within the overarching obligation to prevent adverse impacts on human and environmental health, as well as on human rights.** However, controls and limits on the production of raw materials remain unfeasible, given the multiple purposes beyond plastics production. Member States should also take into consideration the interconnectedness with other existing or future MEAs.

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x. For more detailed guidance on structuring these controls, consult pages 6 to 10 of CIEL's Reducing Plastic Production to Achieve Climate Goals: Key Considerations for the Plastics Treaty Negotiations issue brief.

Endnotes

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