



Minderoo Foundation submission to the Intergovernmental Negotiating Committee (INC) to develop an international legally binding instrument to end plastic pollution, including the marine environment

Name of country (for Members of the committee)	
Name of organization (for observers to the committee)	Minderoo Foundation
Contact person and contact information for the submission	Lizzie Fuller lfuller@minderoo.org
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I. Substantive elements

1. Objective(s)

a) *What objective(s) could be set out in the instrument?*

Proposed Objective:

Ending plastic pollution and protecting human health and the environment from the adverse impacts of plastic pollution in all its forms.

In so doing:

- recognising the importance and utility of plastic materials and products in society and the imperative for a safe and circular economy for plastics that contributes to achieving the instrument's objective;
- taking a whole of life cycle approach, including:
 - addressing the adverse impacts to human health and the environment in connection with the production, consumption and management of plastic materials and products across the life cycle (including in connection with raw material extraction, monomer production, polymerisation, product and material manufacture, use, re-use, recycling and disposal); and
 - addressing all pollutants which may result from or arise in connection with the production, consumption and management of materials and products across the life cycle, including macro- and micro-plastic pollution and leakage, toxic and hazardous chemicals and emissions; and
- including in scope: polymers, additives, chemical components, primary microplastics, intermediate and final plastic products, breakdown (including secondary microplastics) and transformation products associated with plastic materials and products, as well as materials

and components that are developed or introduced as substitutes for fossil-fuel based plastic materials and components (on the basis of their similar material properties).

Proposed sub-objectives:

We highlight the following five interconnected sub-objectives or goals that will support achievement of the overall objective:

- 1) Limiting fossil-fuel plastic production and consumption;
- 2) Supporting transition to a safe and just circular economy for plastics, including by ensuring that plastic products and materials are designed to enable circularity and are circulated in practice;
- 3) Eliminating problematic and harmful substances and materials;
- 4) Eliminating plastic leakage to the environment across the life cycle, including through environmentally sound plastic waste management; and
- 5) Aligning all public and private financial flows with the instrument’s objectives, such that harmful flows are eliminated, and resources for transition to a safe and just circular plastics economy are increased.

Explanatory Text:

This section provides explanatory comments on the proposed overall objective.

Section II makes recommendations on the core obligations and control measures that would make for a comprehensive approach to achieving the overall objective, organised under each of the five sub-objectives. We provide further explanatory comments on the sub-objectives in that section.

Addressing plastic pollution in all its forms

The adverse effects of the production and consumption of plastic on the environment and human health occur at every stage of the plastics life cycle and “plastic pollution” takes many forms.

- **Macroplastic waste** leakage into the environment in 2019 amounted to 19.4 million metric tonnes.ⁱ In the marine environment, plastic accounts for at least 85% of wasteⁱⁱ and plastic waste is projected to nearly triple in aquatic ecosystems by 2040.ⁱⁱⁱ Terrestrial plastic waste sites are visible from space (see: [Global Plastic Watch](#)).
- **All plastic in the environment ultimately breaks down into microplastics (secondary microplastics)**. As it does, microfibrils, hazardous chemicals, metals and micropollutants are also released.^{iv} **Leakage of primary microplastics** – which are manufactured to carry out a specific function – also occurs along the entire plastics life cycle. Microplastic leakage is projected to more than double globally by 2060.^v
- The impacts of **chemical pollution** and the presence of **novel entities in the environment** are also significant and receiving increasing attention.^{vi} The chemical components of plastic pollution and the **human health impacts of exposure to toxic and hazardous chemicals** in plastics during production, use and waste management are discussed below. Plastic chemicals and particles within the human body are an invisible form of plastic pollution.

- The contribution of plastics production to global **carbon emissions** is also of growing concern. Throughout the supply chain, plastic contributes approximately 4.5% of total global greenhouse gas (GHG) emissions.^{vii} If the plastics industry were a country, it would be the fifth largest emitter of GHG emissions.^{viii} These emissions are projected to double by 2060.^{ix}
- Plastics also contribute to **particulate air pollution**. There are multiple sources of airborne microplastics including microplastic fibres from synthetic textiles and microplastic degradation products from vehicle tyres. Airborne microplastics are modelled to be a major route of human exposure and have been detected even in remote planetary regions.^x

Addressing the human health impacts of plastics

Plastic is not inert. Chemical additives are usually not chemically bonded to the polymer and leach from plastics during use and from waste.^{xi} They can enter the human body through ingestion, inhalation and/or skin absorption, as well as into the developing foetus through maternal blood supply.^{xii} There is increasing evidence of human health impacts related to plastic chemical exposure.^{xiii} ^{xiv xv xvi} More than 2,400 of the approximately 10,500 substances used in plastics are identified as substances of potential concern.^{xvii}

Microplastics have also now been shown to be detected in human colon, lung, liver, blood and placenta.^{xviii} Even smaller particles – nanoplastics – are probably also entering the body,^{xix} and blood^{xx} but accurate detection methods that are also free from sample contamination still need to be developed.^{xxi} (The work is underway to do this).^{xxii}

In our assessment, the global social cost resulting from plastic-related human health effects are significant. A [recent study](#) conducted by Minderoo Foundation in partnership with UNEP's Principles of Sustainable Insurance, law firm Clyde & Co., and risk analytics experts Praedicat, examined the social costs and potential corporate liabilities associated with plastic pollution. It was estimated that the global social costs from plastic-related pollution already amount to hundreds of billions of dollars each year.^{xxiii} Much of the estimated costs are driven by bodily harm from exposure to plastic chemicals. Certain harms – including the impacts from micro- and nano-plastic^{xxiv} - while not yet fully understood, are potentially catastrophic in the long term.^{xxv} Please see the Annexure for Minderoo Foundation's supplementary submission on the social costs of plastic pollution.

Comments on scope

To effectively address all forms of plastic pollution and leakage, it is important that the instrument is informed by a comprehensive understanding of “plastics”, addressing: polymers, additives, chemical components, primary micro-plastics, as well as intermediate and final plastic products, breakdown products (including secondary micro-plastics) as well as biotransformation products and metabolites.

To ensure that efforts to address the environmental and human health impacts of plastics do not have unintended negative effects, certain provisions of the instrument - such as any design criteria developed for safety and circularity of plastic components and materials - should also apply to substances and materials introduced as direct substitutes for fossil-fuel plastics or components. Experience indicates that as plastic chemicals have proliferated over the past decades, regulation has struggled to keep pace with the quantity of new chemicals and the complexity of determining their potential health impacts.^{xxvi} Restricted and banned chemicals have historically been replaced by

alternatives that are structurally similar and/or carry the same or other unknown hazards.^{xxvii} To avoid regrettable substitution, we recommend that relevant provisions of the instrument apply to materials and components that are developed or introduced as direct substitutes for fossil-fuel based plastic materials and components (on the basis of their similar material properties).

2. Core obligations, control measures and voluntary approaches

- a) *What core obligations, control measures and voluntary approaches would provide a comprehensive approach to addressing plastic pollution, including in the marine environment, throughout the full life cycle in line with the future objective(s) of the instrument?*

The unifying substantive provisions (core obligations and control measures) of the instrument are at the heart of ensuring an effective global response to a global problem and will guide harmonised action at global and national level. It is crucial that these core obligations and control measures sufficiently operationalise the objective and any sub-objectives of the instrument, such that their implementation at national level addresses existing regulatory fragmentation and limited transparency across the plastics value chain, both of which currently hamper effective responses to what is a deeply interconnected and transboundary problem. By virtue of the direction setting they provide, the common and binding measures provide the clarity around which a multi-stakeholder action agenda can coalesce, including greater certainty for business innovation and investment that can contribute substantially to the effectiveness of the instrument and its implementation.

Our comments on potential specific core obligations and control measures are structured around the five sub-objectives identified in Section I.1 above. There are various ways these objectives could be achieved, and policy packages will need to be assessed for their overall and combined impact towards achieving the interlinked goals, as well as considered for their differential impact in different regional and national settings and circumstances.

1) Limiting fossil-fuel plastic production and consumption

The instrument must first and foremost aim to limit fossil-fuel plastic production and consumption and support an urgent transition to a safe and just circular plastics economy.

In 2019, annual plastic production was around 460 million metric tons, and single-use plastics – the primary source of plastic leakage into the environment – accounted for approximately 130 million metric tons, with 98 per cent made from fossil fuels.^{xxviii} The most significant source of GHG emissions in the plastics value chain (90%) is attributable to the production and conversion stages of the plastic life cycle.^{xxix}

In a business-as-usual scenario, plastic production figures are set to exponentially increase. Global plastic production is projected to triple to 1,231 million metric tonnes by 2060.^{xxx} Production capacity for virgin single-use plastic polymers alone could grow by 30% before 2025.^{xxxi} The projected rate of growth in the supply of these polymers is in line with the historical rate of growth in demand for single-use plastics – which, without regulatory intervention, will likely keep new, circular models of production and re-use “out of the money”.^{xxxii} The Breaking the Plastic Wave report found that ambitiously scaling up recycling, coupled with design for recycling, would only reduce 2040 leakage by 38% relative to business as usual.^{xxxiii}

Measures that address the market failures that favour production of virgin fossil fuel plastics over circular plastic material management are imperative and should be guided by the polluter pays principle, with funds generated contributing to achieving the instrument's objectives. These must be coupled with specific controls and reduction targets relating to the production and consumption of virgin fossil fuel plastics, to address unsustainable levels of production and consumption and support the transition to a circular economy for plastics, as well as to directly address the sources of pollution that occur at the production and conversion stages of the life cycle. In defining specific control measures, Minderoo Foundation suggests prioritised focus be given to single-use plastics, plastic packaging, non-recyclable plastics, and the elimination of problematic and harmful materials (in alignment with sub-objective 3).

Proposed core obligations and control measures:

- a) **Global fossil fuel plastic reduction targets:** Phased and time-bound reduction targets for global fossil fuel plastic production and consumption, achievement of which is supported by specific control mechanisms to eliminate and reduce specified polymers, single and short use plastics and non-recyclable plastics (measures (d), (e), (f) and (g)) and binding national virgin fossil fuel plastic reduction targets (measure (b)).
- b) **Obligation to set and report on binding targets for the reduction in virgin fossil fuel plastic production and consumption at national level.**
- c) **Fiscal measures that address market failures that favour production and consumption of virgin fossil fuel plastics:** These measures should be guided by the 'polluter pays' principle. Potential measures include mandatory contributions from polymer producers, and levies, taxes or duties on virgin fossil fuel plastic product manufacture that does not meet sustainable feedstock or recycled content targets. Fiscal measures directly targeting production of virgin fossil fuel plastics could be supplemented by requirements to introduce Extended Producer Responsibility schemes that meet minimum global criteria.
- d) **Mechanism for the elimination of specified (problematic) polymers,** such as polymers that adsorb harmful chemicals, present high leakage risk or are difficult to recycle (with the capacity to apply for specific exemption).
- e) **Mechanism for the adoption of production limits on specified polymers.**
- f) **Mechanism for the elimination of specified single and short use plastics:** Bans or phase out of specified single and short use plastic product applications, prioritising those with high leakage risk or which are difficult to recycle.
- g) **Mechanism for the adoption of production limits on non-recyclable polymers, products and packaging** (including both fossil-fuel and bio-derived) that it is not viable to recycle at scale. Non-recyclable plastics should be limited to essential applications only, where the composition which determines non-recyclability is necessary for the given application, with no viable alternatives.

2) Supporting transition to a safe and just circular economy for plastics

A circular economy is one in which products and materials are designed in such a way that they can be recovered, re-used or recycled and thus maintained in the economy for as long as possible, while minimising the generation of waste and pollution (throughout the life cycle). A circular economy for plastics is essential to achieve the objective of ending plastic pollution while allowing society to continue to derive benefit from the utility of plastic materials and products.

Importantly, a circular economy for plastics must:

- be safe, i.e. minimise the circulation of toxic substances, including in secondary (recycled or re-used) materials; and
- be just, i.e. safeguard the rights of those impacted by and engaged in the plastics economy at all stages of the life cycle, including communities impacted by plastic infrastructure sites and workers from production through to waste management, and notably those participating in the informal sector.

Safeguarding human health throughout the plastics life cycle contributes to a safe and just circular economy and to ensuring the universal human rights to a safe and healthy working environment and to a clean, healthy and sustainable environment. Lack of traceability of substances of concern is a material issue that limits the potential to transition to a safe circular economy and the safety of the recovered materials. Toxic plastic chemicals and their transformation products, particularly from e-waste, have been found as non-intentionally added substances in recycled plastics.^{xxxiv} The instrument presents an opportunity to institute greater transparency and traceability at global scale and to develop precautionary standards that guide the safety of plastic material composition (see sub-objective 3).

Minderoo Foundation also calls for attention to justice considerations associated with the global transition to a circular economy, including that different countries and regions have different capacities to transition at speed. The instrument should include appropriate financial assistance, capacity building and technology transfer to assist with this and should not increase the debt burden for developing countries or exacerbate economic or social inequity in other ways.

Proposed core obligations and control measures:

- a) **Global circularity target:** Phased and time-bound target for overall plastic material circularity globally (i.e. combined mass of re-used, recycled, and sustainable plastics put on the market relative to virgin fossil-fuel plastics put on the market per year), achievement of which is supported by binding circularity targets at national level (measure (b)) and the specific control measures in sub-objective 1.
- b) **Obligation to set and report on binding circularity targets at national level**, which could include a combination of nationally-appropriate targets in keeping with harmonised metrics established by the instrument.
- c) **Fiscal measures that support transition to a circular economy for plastics and incentivise progress towards circularity targets.** Potential measures include requirements to introduce Extended Producer Responsibility schemes that meet minimum global criteria. These could be

supplemented at national level by incentive measures such as subsidies for circular material management.

- d) **Harmonised design standards** to maximise plastic re-use, recycling and product safety. Standards should ensure plastics and plastic products that are safe and compatible with a circular economy, and/or meet defined essentiality criteria. Standards should also reduce environmental leakage during use (including addressing micro- and nano-plastics released during use) and consider safe ultimate end-of-life management (including with respect to hazardous chemical loads).
- e) **Harmonised labelling requirements** addressing circularity metrics (such as recycled content), information that enables safe and effective recycling (addressing chemical composition and health hazards) and public safety messaging (see comments on public health awareness-raising in Section III).
- f) **Adopting and upholding fair principles for circularity**^{xxxv} that safeguard the rights of those impacted by and engaged in the plastics economy.

3) Eliminating problematic and harmful substances and materials

Elimination efforts should focus on substances and materials that are: (i) harmful to human or environmental health and safety, (ii) problematic for recyclability, including having regard to toxicity or (iii) present high leakage potential. These focus areas are complementary to achieving impact on the other sub-objectives identified.

Proposed core obligations and control measures:

- a) **Precautionary standards:** Robust global precautionary standards and controls for the use of chemicals and additives in plastics. Minderoo Foundation recommends these precautionary standards acknowledge that the full scope of adverse human health impacts associated with plastic chemicals are unknown, and that the risks need to be mitigated accordingly, including by adopting a presumption that plastic chemicals belonging to the same class as chemicals associated with harmful effects also carry a risk to human health. These standards can be supplemented by:
 - i. **Elimination of chemicals and additives with known harmful associations for human health**, prioritising high-risk and high-risk-of-leakage applications, including consumer goods and food contact materials applications; and
 - ii. **Mechanism for the elimination of additional chemicals and additives as harmful associations become known.** We recommend considering grouping approaches to chemical assessment, to ensure that the mechanism keeps step with emerging knowledge, responds to industry innovation and avoids the problems of regrettable substitution.
- b) **Mechanism for the elimination of non-essential intentionally added primary micro-plastics.**
- c) **Establishment of a dedicated science and technical body** within the instrument infrastructure that is tasked with ensuring that the instrument remains responsive to emerging research and

policy needs as they relate specifically to plastic pollution, including plastic chemicals, and micro- and nano-plastics (discussed in Section III).

- d) **Establishment of monitoring frameworks** that enable evaluation of human exposure, health effects and environmental leakage of plastic chemicals and additives and micro and nanoplastics.

4) Eliminating plastic leakage to the environment across the life cycle, including through environmentally sound plastic waste management

The instrument must ensure that leakage of plastic waste and pollutants are minimised across the life cycle, and that all plastic that is not either recycled or composted is disposed of and managed in the most efficient, safe and sustainable way to minimise environmental impact. To enable achievement of this objective, countries in transition should be supported to strengthen domestic waste management systems, with the support of financing, capacity building and technology transfer.

The UNEA mandate 5/14 also calls for the INC to consider measures to reduce plastic pollution in the marine environment, including existing plastic pollution. We recommend that efforts focused on existing plastic pollution be targeted to priority forms and locations of legacy waste, for example, discarded fishing gear and waste sites close to rivers. We stress that remediation efforts should not detract resources and attention from curtailing future plastic pollution (in all its forms, across the life cycle).

Proposed core obligations and control measures:

- a) **Strict controls on leakage at production, conversion and manufacture** to ensure all pollution sources associated with plastic production are minimised to the greatest extent (including leakage of nurdles, chemical pollution and emissions).
- b) **Strict controls on and measures addressing leakage during use:** E.g an obligation to set and report on binding collection targets at national level, maximum shedding rates for tyres, Extended Producer Responsibility obligations for fishing gear implemented at national level.
- c) **Coordinated remediation of priority legacy waste:** Coordination of national and international efforts to address legacy plastic waste, prioritising highest impact remediation efforts such as waste sites near rivers.

5) Aligning public and private financial flows with the instrument's objectives

Finance will play a critical role in supporting the outcomes of the future agreement. The instrument should include an explicit goal of making financial flows consistent with ending plastic pollution, such that harmful flows are reduced and resources for transition to a safe and just circular plastics economy are increased.

Much work has taken place since the ratification of the Paris Agreement to develop corporate reporting standards on climate related financial risks (with current efforts to harmonise and align existing standards). Inclusion of a provision like that in Article 2.1(c) of the Paris Agreement could assist with further strengthening the global response to plastic pollution by making finance flows

consistent with a pathway towards ending plastic pollution and supporting transition to a circular economy for plastics.

Achieving the goal of aligning finance flows with the instrument’s objectives will be supported by transparency throughout the life cycle (see cross-cutting core obligations below) as well as corporate disclosure of business risks from the impacts of plastic pollution and risks and opportunities associated with the transition to a circular economy. It will be important to build on the work that has taken place with respect to climate related financial and risk disclosures, and that is currently taking place with respect to biodiversity impacts, to include plastics related risks and disclosures.

Proposed core obligations and control measures:

- a) **Obligation to set and report on targets to increase financial flows to achieve the instrument’s objectives including targets to eliminate and reverse/repurpose harmful financial flows:** These could include targets for finance from private as well as public sources and could encourage innovative schemes such as concessional finance/blended finance to leverage private finance.
- b) **Targets to optimise co-benefits and synergies of finance targeting the biodiversity and climate crises with finance targeting plastic pollution and a transition to a circular economy for plastics.** A similar target is included in the First Draft of the Post-2020 Global Biodiversity Framework (Target 19).

6) Cross-cutting core obligations – increasing transparency across the life cycle

Increased transparency throughout the life cycle will support better management of plastic pollution throughout the life cycle as well as enable the identification of emerging risks and appropriate prioritisation of ongoing monitoring and research. Industry cooperation is essential to contribute to the development and implementation of disclosure schemes that facilitate transparency on plastic product composition and traceability of plastic chemicals, and to support the development of common, robust, reliable and practical methods for detecting and quantifying human exposure to all plastic chemicals that are available on-market and to which humans are exposed.

We recommend cross-cutting core obligations in support of transparency, such as the requirement to implement mandatory disclosure regimes at national level to require disclosure: (i) by polymer producers, of the volume of virgin plastic polymers produced and their composition (including chemical and additive components) and the use of recycled or bio-based materials and recycled content; and (ii) by plastic product and packaging manufacturers, of product composition.

7) Supporting provisions

The proposed core obligations and control measures will be supported by:

- harmonised definitions of key terms and concepts; and
- taxonomies and criteria that guide material and product development, such as:
 - design standards for safe circularity (sub-objective 2);
 - precautionary standards and elimination criteria for chemicals and additives (sub-objective 3); and/or
 - criteria for what is considered sustainable plastic and feedstock (addressing sustainable sourcing, biodegradability in the marine environment, non-hazardous properties).

II. Implementation elements

1. Implementation measures

- a) *How to ensure implementation of the instrument at the national level (eg. Role national action plans contribute to meeting the objectives and obligations of the instrument?)*
- b) *How to ensure effectiveness of the instrument and have efficient national reporting?*
- c) *Please provide any other relevant proposals or priorities here on implementation measures (for example for scientific and technical cooperation and coordination as well as compliance).*

Implementation at the national level

Effective implementation at national level is critical to achieving impact against the instrument’s objective. To ensure accountability and support technical and expertise sharing, the instrument should require that national action plans are submitted routinely, and reported on and strengthened periodically. To ensure consistency of approach, the instrument could specify guidelines for inclusions in national action plans (set a baseline) and provide reporting templates.

Ensuring efficient national reporting

Effective implementation and monitoring of compliance with the instrument requires the creation of a robust reporting and monitoring mechanism that generates an evidence base of consistent, reliable, and high-quality information to set baselines, monitor progress against the instrument’s objectives, and strengthen accountability and compliance.^{xxxvi} To this end, globally harmonised definitions, metrics and methodologies – as well as associated data collection and distribution systems – will need to be developed.

In recognition of the critical importance of reporting and monitoring data to inform ongoing implementation and policy evolution, Minderoo Foundation suggests that dedicated funding be available to support developing countries and countries with economies in transition to meet reporting and monitoring obligations under the instrument.

Comments on specific reporting metrics

In accordance with UNEA Resolution 5/14,^{xxxvii} reporting under the instrument should cover the entire plastic life cycle, enabling the collection of current and future data points on production, use, waste and pollution. Key monitoring metrics include both “upstream” material input data (e.g. total plastic production per polymer type and application, volume of recycled content) as well as “downstream” waste and fate data (e.g. total plastic waste recycled).^{xxxviii}

Minderoo Foundation points in particular to the need for harmonised reporting standards addressing plastic production and consumption that:

- measure total national plastic and polymer production, broken down by polymer type and application;
- measure total national plastic consumption (national production less exports plus imports), broken down by polymer type and application;

- report on greenhouse gas emissions (aligned with the Paris Agreement) associated with national plastic production and consumption;
- enable visibility on plastic material composition, including additives and other chemicals used to make plastics;
- measure recycled and/or bio-based inputs, including their composition (polymers, additives and other chemicals used to make plastic);
- report on recycling and re-use rates; and
- report on national progress against the targets the instrument includes (by reporting on specific target metrics).

Ways that reporting by other stakeholder segments can inform and be informed by national reporting

We refer to the joint submission made by CDP, Ellen MacArthur Foundation, Minderoo Foundation and The Pew Charitable Trusts for comments on ways that existing initiatives – such as the Global Commitment or CDP’s Plastic Disclosure Mechanism – can contribute to the development of a comprehensive reporting framework.

Globally consistent reporting standards, harmonised metrics and quality data, including data derived from national reporting under the instrument, will also support other stakeholder segments to contribute materially to the achievement of the instrument’s objectives. For example, greater transparency throughout the plastics value chain will allow companies to better understand and address their plastic footprints, can support investors and financiers to direct capital towards sustainable activities, and can catalyse investment in infrastructure supporting circularity.

Ensuring effectiveness of the instrument

Minderoo Foundation calls for the instrument to provide for periodic comprehensive assessments that evaluate progress toward the instrument’s objective and against key indicator metrics (including targets that are set) and provide a mechanism for course correction if evaluations indicate that progress is not on track. A mirror approach could be required at national level to feed into global comprehensive reviews. These could also provide a basis for re-evaluation and strengthening of national action plans over time.

Other relevant priorities for implementation

See Section III for comments on scientific cooperation and coordination, particularly regarding addressing remaining knowledge gaps and ensuring a sound science-policy interface for the instrument.

2. Means of Implementation

Capacity-building, technical assistance, technology transfer and financial assistance are not the focus of this submission, however Minderoo Foundation will provide comments on these areas in future submissions.

III. Additional input

Please provide any other relevant proposals or priorities here (for example introductory elements; awareness-raising, education and exchange of information; research; stakeholder engagement; institutional arrangements and final provisions).

In this section, we provide comments on:

- 1) priorities for research with respect to the human health impacts of plastic pollution across the plastics life cycle;
- 2) the institutional arrangements for the prospective instrument, focusing on the science-policy interface;
- 3) awareness-raising and education, focusing on public health communication and consumer information; and
- 4) priorities for a multi-stakeholder action agenda.

1) Priorities for research on human health impacts

Plastics are composite materials containing a carbon-based polymer matrix to which chemicals are added (“additives”) to give a wide range of properties such as strength, flexibility, rigidity, flame resistance, durability and colour. Over 10,500+ substances (monomers, additives and processing agents) have been identified as used in plastics.^{xxxix} Only a small proportion of the 10,500+ substances used to make plastic have been evaluated for human health impacts, and there is limited research examining the health impacts of plastic polymers, and micro or nanoplastics.^{xl} We do not know the full range of impacts on human health of any of the substances currently in plastics on the market.

Minderoo Foundation has recently conducted a number of reviews of the peer-literature examining impacts to human health (in preparation for publication). We highlight the following gaps in the knowledge base that we have identified in our reviews:

- many plastic chemicals that have known hazard concerns have not been investigated for impacts on human health. Of those chemicals that have been investigated, many have not been researched more than once, or in relation to a suitably broad range of human health outcomes that are sensitive to chemical exposure;
- studies on the human health impacts of plastics have far more commonly been conducted in high-income countries, and there are minimal studies of plastic exposure in lower-income countries where potentially higher or, in any case, different kinds of exposures can occur (for example, by waste-pickers);
- some population age-groups are under-studied (for example, older populations);
- the breakdown products, contaminants and transformation products that can be in plastics^{xli} have rarely been investigated for their human health effects;
- there is insufficient understanding of the effects of combined exposure to a mixture of chemicals;
- health impacts of micro- and/or nanoplastics in the human body are not yet fully understood.

We make the following recommendations for prioritising how these knowledge gaps are addressed:

- prioritising large-scale population-representative human biomonitoring with linkage to health data, and human observational cohort studies, including longitudinal cohorts. This will expand the plastic chemical exposures and health outcomes assessed and is important to ensure that the absence of human evaluation for safety is not interpreted as safety;

- ensuring equity in primary research on the human health impacts of plastics in under-studied population groups, such as low-income countries and older populations;
- urgently expanding the breadth of plastic chemicals that can be studied for human exposure and human health effects. This is dependent on the development of analytical methods for measurement of those chemicals and/or their metabolites;
- improving methods to evaluate the impact of mixtures of plastic chemicals on human health; and
- prioritising primary research on micro- and nanoplastics in humans by developing accurate and reliable measurement techniques in order to undertake high quality clinical studies.

Comments on how the plastics treaty can best respond to, and in the face of, these gaps:

- There is an unprecedented opportunity to develop global precautionary standards for the management of chemicals in plastics under the instrument. These standards must take account of the fact that the full scope of adverse impacts to human health will remain unknown for some time and that it is necessary to mitigate risks accordingly for the protection of human health.
- Mandatory disclosure and transparency on plastic composition will enable more effective management of the risks associated with plastic chemicals throughout their life cycle as well as the appropriate prioritisation of ongoing biomonitoring and human health research. Effective management and appropriate transparency require industry engagement and cooperation, to contribute to the development and implementation of common, robust, reliable and practical methods for identifying and tracking chemicals in products as well as for detecting and quantifying human exposure to all plastic chemicals that are available on-market.
- Developing a strong and dedicated science-policy interface within the plastics treaty infrastructure (as below).

2) Science-policy interface

Recognising that we do not yet know the full scope of the human health and environmental impacts of plastics, the instrument should be structured in a way that enables it to respond swiftly to emerging knowledge without the need for amendment. The responsiveness of the instrument to new scientific research and findings can be strengthened by: (i) a dedicated science-technical body under the instrument itself; and (ii) a clear interface with other relevant science policy bodies, in particular the Science Policy Panel to contribute further to the sound management of chemicals and waste and to prevent pollution, being developed pursuant to UNEA Resolution 5/8.

The science-technical body could be tasked with ensuring that the instrument remains responsive to emerging research and policy needs as they relate specifically to plastic pollution, including plastic chemicals, and micro- and nano-plastics. This is important given the significant knowledge gaps which remain in relation to plastic pollution, exposure and impacts in all their forms. The body could:

- support effective prioritisation of research to address critical knowledge gaps as well as research needs highlighted by monitoring and reporting outputs;
- conduct periodic and ongoing re-reviews and re-evaluation of plastic chemicals and additives, assessing human epidemiological data, long-term low dose exposure patterns, and complex human health outcomes such as neurodevelopment or chronic disease;
- ensure the swift integration of emerging knowledge (for example, by making recommendations for reduction and/or elimination of certain polymers, chemicals or additives by decision);

- conduct horizon scanning for issues of relevance to addressing plastic pollution in all its forms and for emerging public health issues associated with plastics, making recommendations as to the associated precautionary measures required; and
- contribute to effectiveness evaluation of measures introduced under the instrument.

Minderoo Foundation would welcome the opportunity to provide a supplementary submission with recommendations on the interface between this dedicated science-technical body on plastics and the Science Policy Panel, following our participation as an observer at the Open-Ended Working Group 1.2 for the Science Policy Panel (to be held in Bangkok 29 January – 3 February 2023).

3) Awareness-raising and education

Public awareness about the effects of plastic on human health remains limited, even within the medical profession.^{xliii} In light of this, we recommend that the instrument encourages public (national and international) health campaigns to raise awareness that plastic pollution is a health issue as well as a waste issue. Requirements for public health warning labels on products and packaging could be considered where there is a high risk of chemical leaching.

4) Priorities for a multi-stakeholder action agenda

UNEA Resolution 5/14 mandated the INC to explore binding as well as voluntary approaches under the instrument, including the initiation of a multi-stakeholder action agenda.^{xliiii} Voluntary approaches can be used to supplement core obligations and control measures, allowing for a higher level of ambition that would enhance the effectiveness of meeting the objectives of the instrument.^{xliiv}

We refer to the joint submission made by CDP, Ellen MacArthur Foundation, Minderoo Foundation and The Pew Charitable Trusts and emphasise that given the tight timetable to which the INC is working, the development of a voluntary multi-stakeholder action agenda at this point in time should not distract from the efforts to negotiate the core obligations and binding provisions of the instrument. Instead, we suggest that stakeholder engagement focus on engaging wide input on targeted actions that accelerate the immediate work of the INC.

We note that efforts to align and harmonise existing approaches and methodologies for data collection and reporting could be usefully prioritised. As well as contributing to the development of baselines and indicators for monitoring under the instrument, harmonised and strengthened reporting frameworks can encourage continuing advancements in ambition by enhancing the information that is available to inform policy responses and catalysing stakeholder action.

In an effort to accelerate wider global harmonisation and adoption of plastic reporting, CDP, The Pew Charitable Trusts, Minderoo Foundation, and Ellen MacArthur Foundation in September 2022 announced a new project expand CDP's global environmental disclosure system to include plastics reporting. We refer to the joint submission made by CDP, Ellen MacArthur Foundation, Minderoo Foundation and The Pew Charitable Trusts to INC 2 for further details.^{xliv}

Finally, we note that there is a need for engagement, education and capability-building efforts to ensure the finance sector both contributes effectively to support the INC process and is ready to support implementation of its outcomes. We lend our strong, public support to the UNEP FI initiative (supported by Minderoo) to further this aim.

Annexure – Supplementary submission highlighting key findings from the *Price of Plastic Pollution: social costs and corporate liabilities*

The “[The Price of Plastic Pollution: Social Costs and Corporate Liabilities](#)” report provides quantitative estimates of both the social costs and the corporate liabilities emerging from all forms of plastic-related pollution. The study was undertaken by Minderoo Foundation with legal firm Clyde & Co and liability risk consultancy Praedicat, and supported by the UN Environment Program’s Principles for Sustainable Insurance.

Social Costs

We estimate the social costs from plastic-related pollution to be in the hundreds of billions of dollars each year, much of it driven by harms to human health. For context, in 2021, the global plastics market was worth approximately US\$600 billion. The focus is on the harms and costs of plastic-related pollution to society. The report does not consider the benefits of plastics or estimate their net value, based on the assumption that the harms of plastic-related pollution can be solved or mitigated without eradicating plastics altogether.

Current and emerging science provides robust evidence that exposure to plastic (macroplastic, micro/nanoplastics (MNP), associated chemicals and carbon emissions) harms human health, nature, and economies and ecosystem services. Journal publications on plastic-related risks are proliferating. In addition, more than 5,000 papers describe harms to human health from plastic-related chemicals. These papers are almost equally divided into coverage of phthalates, flame retardants, and bisphenols.

While the science is increasingly converging, analytical uncertainties remain, especially concerning the attribution of plastic-related exposures to harms (“causation”). These include harms caused by multiple and compounding chemicals, the absence and difficulty of controlled studies on human exposure, and the lack of detailed toxicologies for many of the chemicals routinely used in plastic.

Acknowledging the science on plastic-related pollution is highly dynamic, we undertook a rigorous meta-analytical approach to assessing each harm’s size (in dollar terms) and its probability of occurrence, and the degree to which our understanding of these two might change over time. A long-list of individual harms was prepared by reviewing the academic literature on sources and receptors, followed by a systematic ranking of the size, probability and time dimensions of harms. The analysis yielded four clusters which provide the basis for analysing the many harms and risks associated with plastic-related pollution, with distinctly different outlooks for corporate liabilities and implications for policy-makers (**Figure 1**). The clusters include:

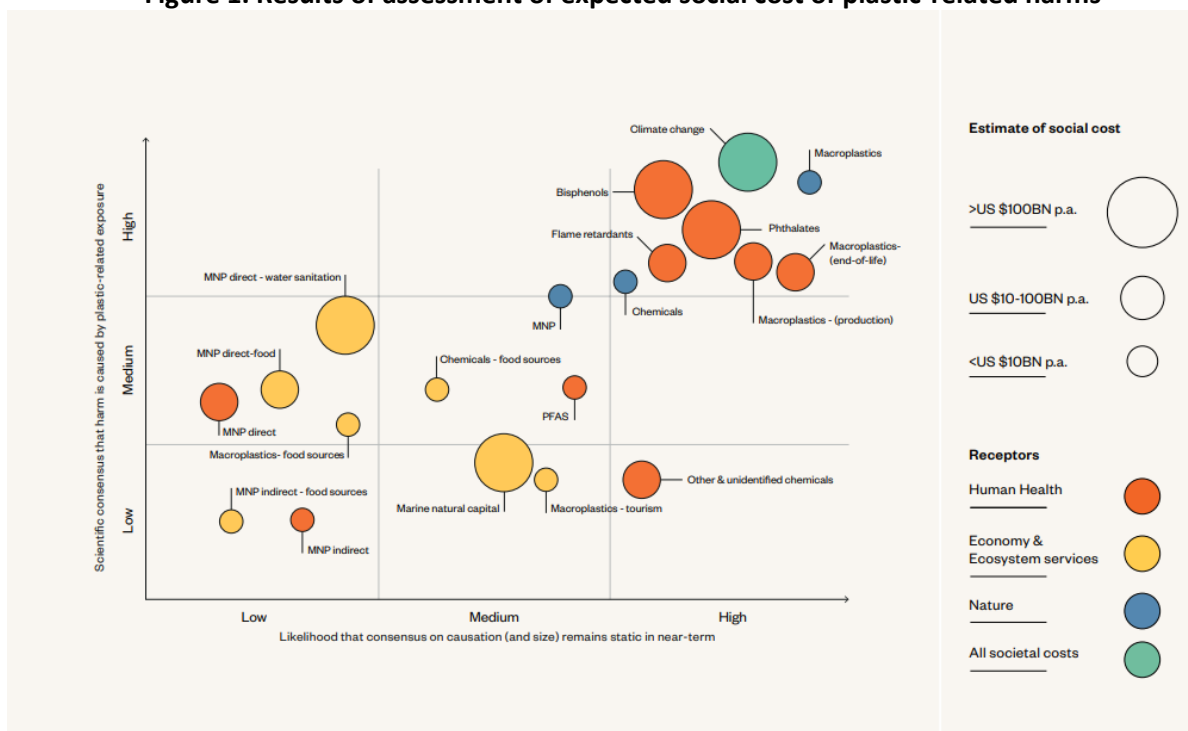
1) Known harms. This cluster, defined by a mature scientific consensus on causation, includes:

- a) **Harms to human health.** Sources include chemicals/additives (phthalates, fire retardants, and bisphenols) and the informal burning of plastic waste in emerging economies. The social cost of harm to human health from phthalates and bisphenols is estimated to exceed US\$100 billion per annum. Regulation of these chemicals is evolving, heterogeneous, and rarely precautionary.
- b) **Harms to nature.** Nature’s intrinsic or “heritage” value to society is harmed by macroplastics, chemical additives and MNPs. Nature’s intrinsic value is inherently difficult to value, with methods ranging from “willingness to pay” to “remedial costs”. Willingness to pay estimates are low (less

than US\$10 billion per annum), while remediation costs are potentially so high as to be economically infeasible.

- c) Climate-related harms from plastics-mediated greenhouse gas emissions. Total climate-related social costs due to plastic-related pollution are likely to exceed US\$100 billion per annum.
- 2) **Emerging harms**. This cluster, defined by emerging scientific consensus on causation, is dominated by MNPs. Their direct effects on human health include inflammatory responses, intracellular responses (nanoplastics), or potentially mechanical damage (microplastics). Calculation of social costs is based on gastro-intestinal health harms – where the only epidemiological research on MNP exists – and estimated between US\$10 and \$100 billion per annum. Potential MNP-related water remediation costs are also expected to significantly exceed US\$100 billion per annum.
- 3) **Immature harms**. This cluster, defined by immature, likely-to-change scientific consensus on causation, features harms indirectly caused by MNPs acting as vectors for other contaminants (e.g., heavy metals, pharmaceuticals). There is considerable research underway on their effect on human health and on food sources and production, with expected potential social costs on each of less than US\$10 billion per annum.
- 4) **Indeterminate harms**. This cluster, defined by incomplete scientific understanding of causation, includes i) harms to marine natural capital (ecosystem services) from macro and microplastics and associated chemicals, ii) harms to human health from chemicals other than bisphenols and phthalates, and iii) harms to tourism from macroplastics. Social costs associated with marine natural capital (more than US\$100 billion per annum) dominate this category, while harms to human health are estimated at US\$10-100 billion per annum and harms to tourism up to US\$10 billion per annum ranges.

Figure 1. Results of assessment of expected social cost of plastic-related harms



Corporate Liabilities

Corporate liabilities from plastics litigation are emerging from a subset of harms. In the near term, we expect claims relating to human exposures to chemical additives to predominate in terms of activity and severity. We also expect claims to emerge from environmental damage, and potentially from human exposures to micro and nano-plastics (“MNP”). Near-term corporate liabilities may exceed US\$20 bn in the US alone, which will be the centre of claims activity.

The discrepancy between massive social costs and the material, but far lower, corporate liabilities is driven, in part, by the immaturity of plastics litigation activity, and by the prevailing approach to legal theories of causation. We expect that systems of justice will catch up as advances are made in the science of attributing specific causes to complex outcomes.

However, we cannot rely exclusively on legal channels to compensate society for the harms caused by the plastics industry. There are damaging – and, in the long-term, potentially catastrophic – harms from plastic pollution that as yet have no legal pathway for redress. How these risks and harms are prevented and mitigated must be considered in the ongoing negotiations for a global plastic treaty.

Recommendations: core obligations and control measures aimed at reducing the social costs associated with plastic pollution

With reference to Minderoo Foundation’s primary submission, we underscore the importance of the instrument including the following core obligations and control measures that will support management, mitigation and reduction of social costs of plastic pollution:

- Establishment of a dedicated science and technical body and science-policy interface, to advance understanding of plastic-related harms to human health (but also economies & ecosystem services, and nature), their social costs, and to support the co-evolution of policy-making and scientific understanding.
- Precautionary standards for chemicals and additives in plastics that take account of the known and emerging risks to human health.
- Elimination of chemicals and additives with known harmful associations for human health, and establishment of a mechanism for the elimination of additional chemicals and additives as harmful associations become known.
- Establishment of a mechanism for the elimination of non-essential intentionally-added MNP.
- Obligation to set and report on targets to increase financial flows to achieve the instrument’s objectives, including targets to eliminate and reverse/repurpose harmful financial flows.
- Targets to optimise co-benefits and synergies of finance targeting the biodiversity and climate crises with finance targeting plastic pollution and a transition to a circular economy for plastics.

Minderoo Foundation’s primary submission also includes a number of additional recommendations for core obligations and control measures that can advance efforts on reduce/reuse/recycle in ways that increase safety and promote effective circular plastic management practices.

- ⁱ OECD, [Global Plastics Outlook: Policy Scenarios to 2060](#), 2022.
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- ⁱⁱⁱ UNEP, [From Pollution to Solution: A global assessment of marine litter and plastic pollution](#), 2021.
- ^{iv} UNEP/PP/INC.1.7 Plastic Science (September 2022), para 53.
- ^v UNEP/PP/INC.1.7 Plastic Science (September 2022), para 37.
- ^{vi} L. Persson, B. M. Carney Almroth, C. D. Collins, S. Cornell, C. A. de Wit, M. L. Diamond, P. Fantke, M. Hassellöv, M. MacLeod, M. W. Ryberg, P. Sjøgaard Jørgensen, P. Villarrubia-Gómez, Z. Wang, and M. Zwicky Hauschild, Outside the Safe Operating Space of the Planetary Boundary for Novel Entities, *Environmental Science & Technology* 2022 56 (3), 1510-1521. DOI: 10.1021/acs.est.1c04158.
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- ^{viii} Beyond Plastics, The New Coal: Plastics and Climate Change, 2021.
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- ^x Reviewed in: C Symeonides, M Brunner, Y Mulders, P Toshniwal, M Cantrell, L Mofflin, S Dunlop, [‘Buy now, pay later: Hazards to human and planetary health from plastics production, use and waste’](#), *Journal of Paediatric and Child Health* 2021 57 (11), 1795-1804..
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- ^{xviii} Symeonides et al, op cit.
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