EXECUTIVE SUMMARY

Plastic & Health

THE HIDDEN COSTS OF A PLASTIC PLANET

Plastic is a global health crisis hiding in plain sight.

Despite being one of the most pervasive materials on the planet, plastic and its impact on human health remain poorly understood. Yet exposure to plastic is expanding into new areas of the environment and food chain as existing plastic products fragment into smaller particles and concentrate toxic chemicals. As plastic production increases, this exposure will only grow.

To date, research into the human health impacts of plastic have focused narrowly on specific moments in the plastic lifecycle, often on single products, processes, or exposure pathways. This approach fails to recognize that significant, complex, and intersecting human health impacts occur at every stage of the plastic lifecycle: from wellhead to refinery, from store shelves to human bodies, and from waste management to ongoing impacts as air, water, and soil pollution.

Together, the lifecycle impacts of plastic paint a clear and troubling picture: plastic threatens human health on a global scale. Reducing those threats will demand stopping and reversing the growth in plastics production, use, and disposal worldwide.

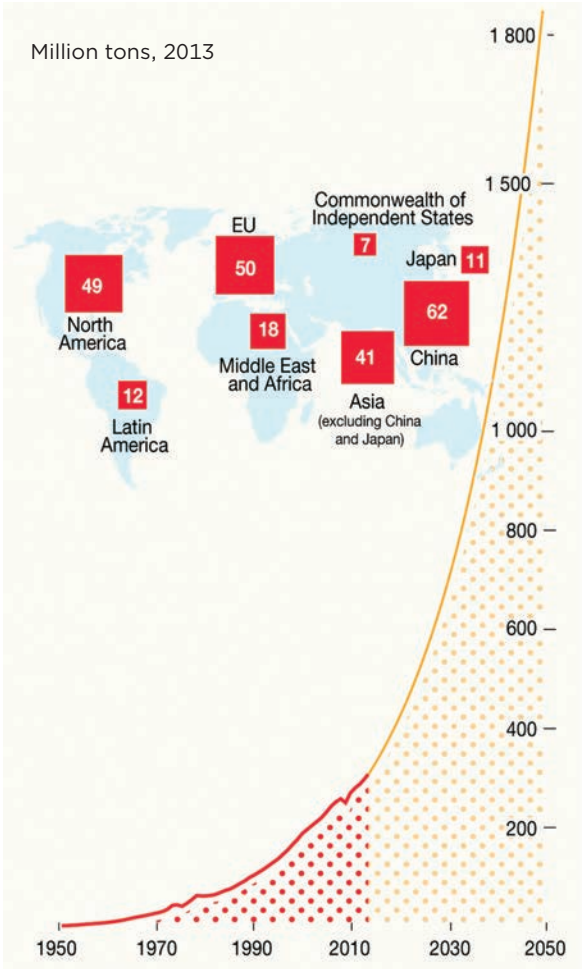
KEY FINDINGS

Plastic requires a lifecycle approach. The narrow approaches to assessing and addressing plastic impacts to date are inadequate and inappropriate. Making informed decisions that address plastic risks demands a full lifecycle approach to understand the full scope of its toxic impacts on human health. It is also required to ensure that yet more and increasingly complex environmental problems are not created in the attempt to address this one.

At every stage of its lifecycle, plastic poses distinct risks to human health, arising from both exposure to plastic particles themselves and associated chemicals. The majority of people worldwide are exposed at multiple stages of this lifecycle.

FIGURE 1

Global Plastic Production and Future Trends



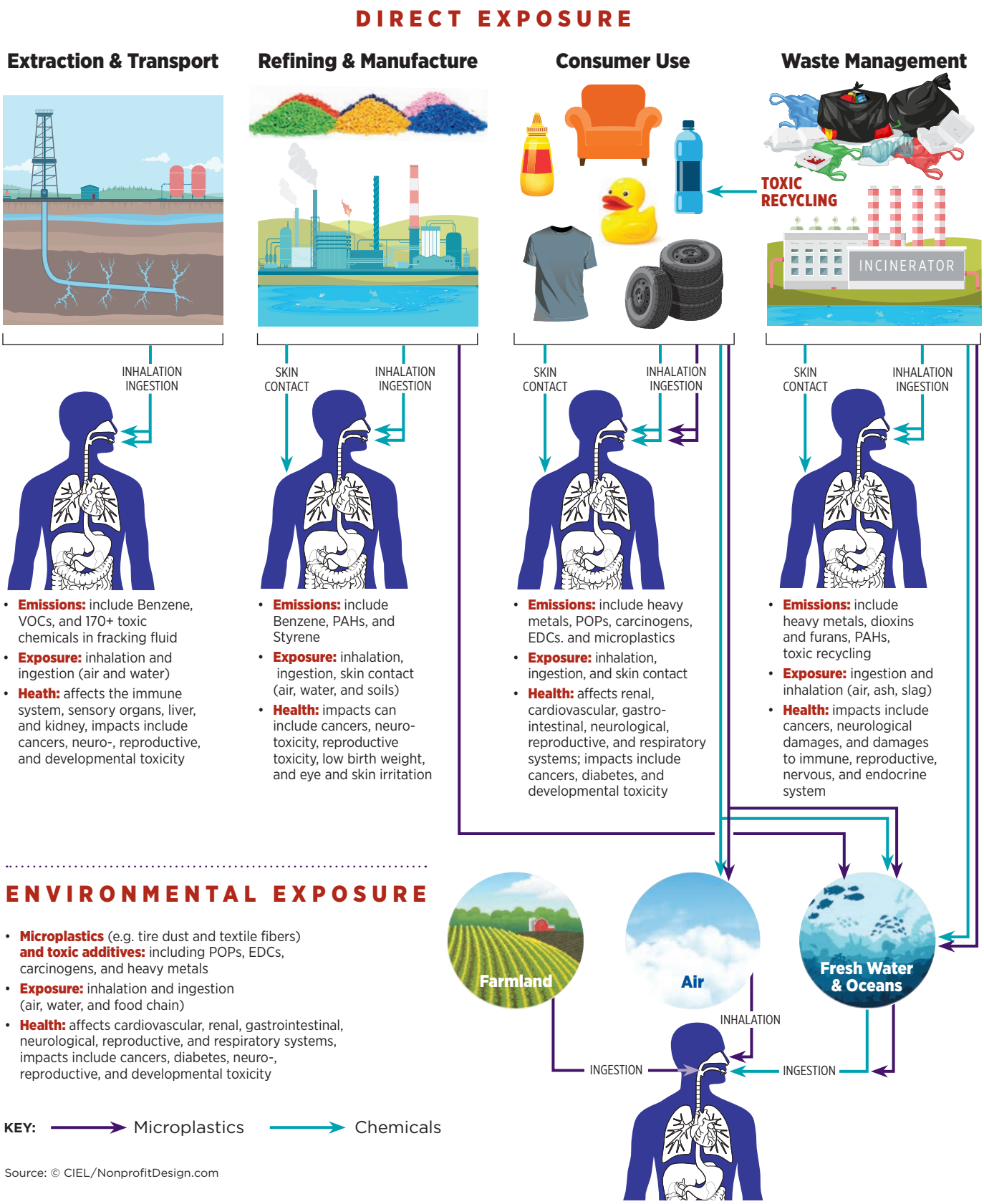
Source: Ryan, A Brief History of Marine Litter Research, in M. Bergmann, L. Gutow, M. Klages (Eds.), Marine Anthropogenic Litter, Berling Springer, 2015; Plastics Europe

Photo: © Les Stone/Greenpeace

FIGURE 2

Plastic & Health: The Hidden Costs of a Plastic Planet

Humans are exposed to a large variety of toxic chemicals and microplastics through inhalation, ingestion, and direct skin contact, all along the plastic lifecycle.



Source: © CIEL/NonprofitDesign.com

Extraction and Transport

99% of plastic comes from fossil fuels. The extraction of oil and gas, particularly hydraulic fracturing for natural gas, releases an array of toxic substances into the air and water, often in significant volumes. Over 170 fracking chemicals that are used to produce the main feedstocks for plastic have known human health impacts, including cancer, neurological, reproductive, and developmental toxicity, impairment of the immune system, and more. These toxins have direct and documented impacts on skin, eyes, and other sensory organs, the respiratory, nervous, and gastrointestinal systems, liver, and brain.

Refining and Manufacture

Transforming fossil fuel into plastic resins and additives releases carcinogenic and other highly toxic substances into the air. Documented effects of exposure to these substances include impairment of the nervous system, reproductive and developmental problems, cancer, leukemia, and genetic impacts like low birth weight. Industry workers and communities neighboring refining facilities are at greatest risk and face both chronic and acute exposures during uncontrolled releases and emergencies.

Consumer Products and Packaging

Use of plastic products leads to ingestion and/or inhalation of large amounts of both microplastic particles and hundreds of toxic substances with known or suspected carcinogenic, developmental, or endocrine-disrupting impacts.

Waste Management

All plastic waste management technologies (including incineration, co-incineration, gasification, and pyrolysis) result in the release of toxic metals, such as lead and mercury, organic substances (dioxins and furans), acid gases, and other toxic substances to the air, water, and soils. All such technologies lead to direct and indirect exposure to toxic substances for workers and nearby communities, including through inhalation of contaminated air, direct contact with contaminated soil or water, and ingestion of foods that were grown in an environment polluted with these substances. Toxins from emissions, fly ash, and slag in a burn pile can travel long distances and deposit in soil and water, eventually entering human bodies after being accumulated in the tissues of plants and animals.

Plastic in the Environment

Once plastic reaches the environment in the form of macro- or microplastics, it contaminates and accumulates in food chains through agricultural soils, terrestrial and aquatic food chains, and the water supply. This environmental plastic can easily leach toxic additives or concentrate toxins already in the environment, making them bioavailable again for direct or indirect human

Opposite: © iStockphoto/George Clerk

exposure. As plastic particles degrade, new surface areas are exposed, allowing continued leaching of additives from the core to the surface of the particle in the environment and the human body. Microplastics entering the human body via direct exposures through ingestion or inhalation can lead to an array of health impacts, including inflammation, genotoxicity, oxidative stress, apoptosis, and necrosis, which are linked to an array of negative health outcomes including cancer, cardiovascular diseases, inflammatory bowel disease, diabetes, rheumatoid arthritis, chronic inflammation, autoimmune conditions, neurodegenerative diseases, and stroke.

Uncertainties and knowledge gaps undermine the full evaluation of both acute and long-term health risks at all stages of the plastic lifecycle, and limit the ability of consumers, communities, and regulators to make informed choices.

- Lack of transparency of the chemicals in plastic and its production processes prevents a full assessment of its impacts, reduces the ability of regulators to develop adequate safeguards; consumers to make informed choices; and fenceline communities to limit their exposure.

- Further research is urgently needed to: evaluate intersecting exposures, synergistic effects, and cumulative impacts of the mixtures of thousands of chemicals used in consumer goods; understand the potential transfer of microplastics and associated toxic chemicals to crops and animals; and understand the toxic impacts of microfibers and other plastic microparticles increasingly documented in human tissues.

Photo: © Nandakumar S. Haridas/Greenpeace. Inset: © Marco Garcia/Greenpeace

Reducing toxic exposure to plastic will require a variety of solutions and options because plastic has a complex lifecycle with a diverse universe of actors.

- At every stage of the plastic lifecycle and across those stages, solutions should be guided by respect for human health and the right to a healthy environment. Despite remaining uncertainties, existing information about the severe health impacts of the plastic lifecycle justifies the application of a strong precautionary approach to the lifecycle of plastic and the overall reduction of plastic production and uses.

- Health impact assessments that focus solely on the plastic components of products while ignoring thousands of additives and their behavior at every stage of the plastic lifecycle are incomplete.

- Addressing plastic pollution requires adapting and adopting legal frameworks to ensure access to information regarding the petrochemical substances in products and processes, as well as increased independent research to fill existing and future knowledge gaps.

- Solutions must be built on transparency, participation, and the right to remedy. Transparency is required to identify the nature and breadth of exposure to toxic material, as well to assess possible health and environmental impacts of technologies touted as "solutions," such as incineration and plastic-to-fuel technologies. Solutions must integrate the right to meaningful participation in decision-making about plastic-related risks, and access to justice when harms arise.

- Measures that succeed at a local level or with respect to a single product stream are often undermined or offset by the emergence of new plastic, new additives, and new exposure pathways that are interwoven in supply chains that cross and recross borders, continents, and oceans. Until we confront the impacts of the full plastic lifecycle, the current piecemeal approach to addressing the plastic pollution crisis will not succeed.

The findings of this report are clear. Even with the limited data available, the health impacts of plastic throughout its lifecycle are overwhelming. Many actions and solutions are needed to confront this threat to human life and human rights. To be effective, they must ultimately reduce the production, use, and disposal of plastic and associated toxic chemicals.

This report was made possible through the generous support of the 11th Hour Foundation, Broad Reach Fund of the Maine Community Trust, Gallifrey Foundation, Heinrich Böll Stiftung, Leonardo DiCaprio Foundation, Marisla Foundation, Passport Foundation, Plastic Solutions Fund, Threshold Foundation, and Wallace Global Foundation.

The full report is available online at **www.ciel.org/plasticandhealth**

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