National Strategy to Prevent Plastic Pollution

Part Three of a Series on Building a Circular Economy for All

November 2024

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Executive Summary

The *National Strategy to Prevent Plastic Pollution: Part Three of a Series on Building a Circular Economy for All* provides an ambitious, equitable approach to reduce and recover plastics and other materials,[1] as well as prevent plastic pollution from harming human health and the environment. Plastic pollution has accumulated over time and will continue to grow as plastic production increases. The Organization for Economic Cooperation and Development (OECD) projects that, without interventions, global plastic use and waste will almost triple by 2060. Because most plastic products are not reused or recycled, many will end up incinerated, disposed of in landfills, or leaked into the environment, negatively impacting terrestrial, aquatic and marine ecosystems. The production, use and disposal of plastic products also contribute to global greenhouse gas emissions, and there are significant human health concerns associated with plastic pollution across the lifecycle of plastic products. For decades, EPA has worked to protect human health and the environment from air and water pollution and solid and hazardous waste created throughout this lifecycle. Recognizing the need to take further action to address plastic pollution, Congress passed the Save Our Seas 2.0 Act in December 2020. The Act directed EPA to develop a national strategy to address this problem.

EPA developed the *National Strategy to Prevent Plastic Pollution* drawing on decades of efforts to conserve materials and resources and prevent and reduce pollution. These efforts were made possible by the Resource Conservation and Recovery Act and other statutes designed to protect human health and the environment. Together with EPA's *National Recycling Strategy*, the *National Strategy to Prevent Plastic Pollution* presents a 10-year vision of opportunities for voluntary and regulatory actions that can be taken by businesses; nongovernmental organizations; federal, Tribal, state, local and territorial governments; academia; and consumers. Together, these U.S. entities could eliminate the release of plastic waste from land and sea-based sources into the environment by 2040.[2] These opportunities consist of interventions across the entire plastics lifecycle to reduce the U.S. contribution of plastic pollution into the environment, including the air, land and ocean. In July 2024, the White House released *Mobilizing Federal Action on Plastic Pollution: Progress, Principles, and Priorities*, a government-wide report on combatting plastic pollution at production, processing, use and disposal that puts forth a number of opportunities for federal action at the programmatic and operational levels to reduce plastic pollution. The report and EPA's national strategy work together to reduce plastic pollution from the United States throughout the plastics lifecycle.

1 For the purposes of this strategy, the phrase "other materials" is used to refer to any non-plastic material that may pollute waterways and the ocean.

2 See the U.S. submission for the second session of the United Nations Environment Programme's (UNEP) Intergovernmental Negotiating Committee on plastic pollution: https://wedocs.unep.org/bitstream/handle/20.500.11822/41810/USsubmission.pdf?sequence=1&isAllowed=y.

EPA conducted public outreach and engagement activities to inform the development of this strategy, including issuing a draft for public comment in April 2023. EPA received almost 92,000 comments on the draft strategy. With this input, EPA identified six objectives that aim to prevent plastic pollution throughout the entire plastics lifecycle:

- **Objective A:** Reduce Pollution from Plastic Production
- **Objective B:** Innovate Material and Product Design
- **Objective C:** Decrease Waste Generation
- **Objective D:** Improve Waste Management
- **Objective E:** Improve Capture and Removal of Plastic Pollution
- **Objective F:** Minimize Loadings and Impacts to Waterways and the Ocean

Each objective is followed by opportunities for action that support the United States' shift to a circular approach to materials management, which is restorative or regenerative by design, enables resources to maintain their highest value for as long as possible and aims to eliminate waste in the management of plastic products.

Objective A: Reduce Pollution from Plastic Production

Reducing pollution from plastic production operations in the United States is essential to minimize the environmental and human health impacts of plastic on communities, particularly those with environmental justice concerns.

A1. Conduct evaluations to ensure that fossil fuel extraction as well as petrochemical and plastic production facilities comply with regulatory requirements.

A2. Continue to make progress reviewing and, where appropriate, updating regulations for fossil fuel extraction, petrochemical and plastic production facilities, and transporters of plastic pellets and plastic additives.

A3. Explore creating a voluntary certification to recognize plastic products that are manufactured under rigorous environmental standards.

A4. Identify and reduce environmental injustice and public health impacts from fossil fuel extraction, petrochemical and plastic production facilities.

Objective B: Innovate Material and Product Design

Plastic products and packaging have become increasingly complex and are not always designed to be sustainably managed once they become waste. Products and systems should be designed to minimize negative human health and environmental impacts.

B1. Identify alternative materials, products or systems that can minimize impacts on human health and the environment.

B2. Review, develop, update and use sustainability standards, ecolabels, certifications and design guidelines that can minimize the negative impacts to human health and the environment from plastic products across their lifecycle.

Objective C: Decrease Waste Generation

Circular approaches are needed to reduce the rates of plastic production and consumption and decrease waste generation to reduce the human health and environmental impacts of plastic products throughout the plastics lifecycle.

C1. Reduce the production and consumption of single use plastic products.

C2. Enhance the effectiveness of existing public policies and incentives for decreasing waste generation.

C3. Develop and/or expand the capacity to reuse materials.

C4. Increase public understanding about the impacts of plastic pollution (including on waterways and the ocean) and how to appropriately manage plastics and other materials.

Objective D: Improve Waste Management

Improvements to the collection, transportation and/or export of waste are needed so that it does not enter the environment.

D1. Explore possible ratification of the Basel Convention and encourage environmentally sound management of scrap and recyclables traded with other countries.

D2. Support state, local, Tribal and territorial governments in their efforts to improve waste management to avoid adverse human health and environmental impacts, especially for communities with environmental justice concerns.

D3. Develop a national extended producer responsibility (EPR) framework.

D4. Facilitate more effective composting of certified compostable products.

Objective E: Improve Capture and Removal of Plastic Pollution

Interventions to capture and remove plastic pollution, including micro/nanoplastic pollution, from wastewater, stormwater and surface waters are needed to help address potential risks to human and ecosystem health. Such interventions are especially important given the expected increase in plastic production over the coming years.

- **E1.** Identify and implement policies and programs that effectively remove plastics and other materials from the environment, including waterways and the ocean.
- **E2.** Improve water management to increase the capture and removal of plastics and other materials from waterways, the ocean and stormwater/wastewater systems.

Objective F: Minimize Loadings and Impacts to Waterways and the Ocean

Research and increased access to public and private funding are needed to measure the contributions of plastic pollution, including micro/nanoplastics, into waterways and the ocean and study the potential human health impacts of exposure to plastic pollution. Reliable baseline measurements of plastics and other materials in waterways and the ocean can be used to measure the success of mitigation efforts over time.

- **F1.** Increase and improve measurement of plastic and other material loadings into waterways and the ocean to inform management interventions.
- **F2.** Increase and coordinate research on methods to determine micro/nanoplastic prevalence, impacts and mitigation.
- **F3.** Increase and coordinate research on macroplastic transport, degradation and impacts in waterways and the ocean.

Next Steps

Implementation of this strategy is expected to be an iterative process as resources, entities leading efforts, and needs change over time. EPA will continue to enable and implement this strategy and EPA-specific opportunities for action in the White House's *Mobilizing Federal Action on Plastic Pollution: Progress, Principles, and Priorities*, using both voluntary efforts and regulatory approaches, where appropriate. This includes, for example, utilizing the Solid Waste Infrastructure for Recycling (SWIFR) grant program to support implementation of this strategy, as required by the Save Our Seas 2.0 Act. EPA will also provide periodic updates on the implementation of this strategy.

Introduction

In the United States and around the world, plastic pollution presents complex challenges to protecting human health and the environment. When considered outside the context of their broader environmental and human health impacts, plastic products[3] are both versatile and inexpensive. Because they are durable and lightweight, plastic products are widely used in packaging, construction and transportation applications (OECD, 2022a). The unique characteristics of plastics have also had a significant impact on the health care industry. Sterile, disposable plastic products have increased worker and patient safety, and plastics have been integral in advancing many health care treatments (NASEM, 2022).

Although there are benefits, pollution from plastic production, use and disposal also contributes to climate change, increases pollution in overburdened communities, and poses risks to human health and the environment. While regulatory and solid waste management programs have shown substantial success in addressing emissions and reducing plastic waste, fully addressing plastic pollution will require a collaborative effort across the lifecycle of plastic products, including circular economy approaches by businesses; nongovernmental organizations; federal, Tribal, state, local and territorial governments; academia; and consumers.

Plastic pollution is broadly defined by the United Nations Environment Programme (UNEP) as the negative effects and emissions resulting from the production and consumption of plastic materials and products across their entire lifecycle. This definition includes plastic waste that is mismanaged (e.g., open-burned and dumped in uncontrolled dumpsites) and leakage and accumulation of plastic objects and particles that can adversely affect humans and the living and non-living environment.

Circular economy is defined in the Save Our Seas 2.0 Act as "a systems-focused approach and involves industrial processes and economic activities that are restorative or regenerative by design, enable resources used in such processes and activities to maintain their highest values for as long as possible, and aim for the elimination of waste through superior design of materials, products and systems (including business models)."

A circular economy approach under EPA's sustainable materials management umbrella demonstrates continuity in our emphasis on reducing lifecycle impacts of materials, including climate impacts; reducing the use of harmful materials; and decoupling materials use from economic growth. A circular economy reduces materials use, redesigns materials to be less resource intensive, and recaptures "waste" as a resource that can serve as feedstock to manufacture new materials and products.

3 For this strategy, polymers and resins are included under plastic products.

The United States is both a major producer and consumer of plastic products.[4] The United States also had the largest plastic waste footprint of any country in 2019, generating about 486 pounds of plastic waste per capita,[5] as described by the Organization for Economic Cooperation and Development (OECD, 2022a) and shown in Figure 1.

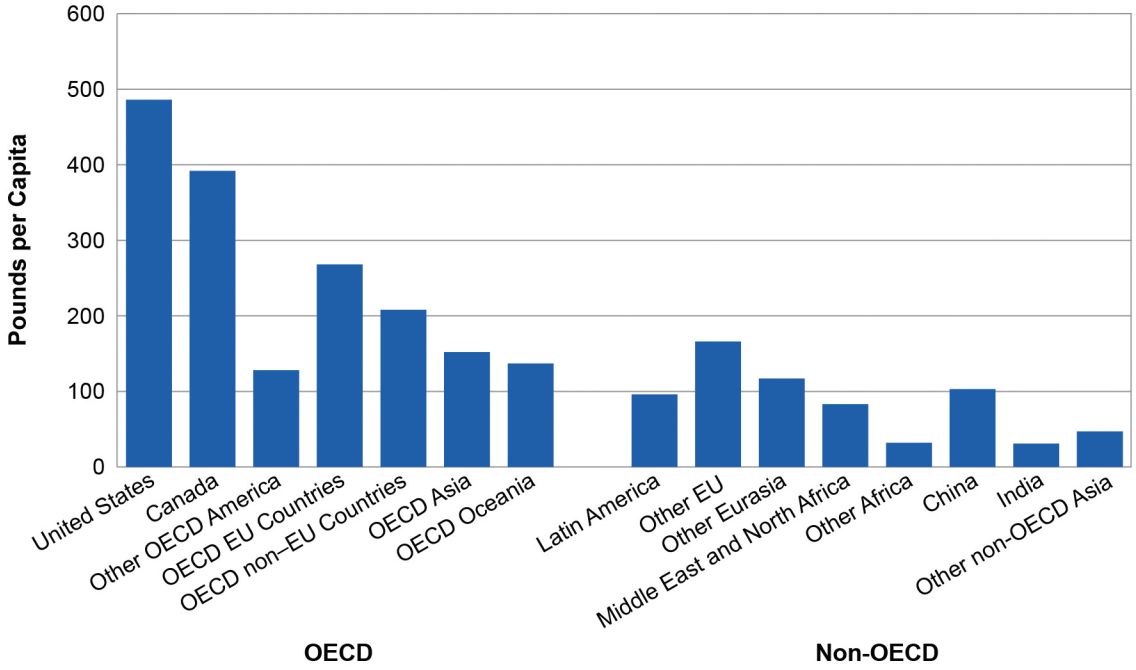


Figure 1. Plastic waste generation per capita by region or country in 2019 (OECD, 2022a).

According to EPA estimates, plastic waste generation has increased continuously in the U.S. municipal solid waste system since 1960, with the greatest increases occurring between 1980 and 2000 (see Figure 2).[6] Plastic containers and packaging, including single use[7] products (e.g., bags, wraps and bottles), constitute the majority of plastic waste in the U.S. municipal solid waste system. In 2018, only 9 percent of plastic waste generated in the U.S. municipal solid waste stream was recycled (U.S. EPA, 2020).

4 In 2015, North America produced 19 percent of global plastic products (UNEP, 2018). In 2019, the United States consumed 18 percent of global plastic products, making U.S. plastic use per capita higher than in any other country (OECD, 2022a).

5 Converted from 220.5 kilograms per capita (OECD, 2022a).

6 Research suggests that, between 1960 and 2018, plastic waste generation in the United States increased from 0.4 percent of total municipal solid waste generated to 12.2 percent, reaching 13.2 percent in 2017 (U.S. EPA, 2020). These estimates do not include plastic waste from other sources, such as agricultural waste.

7 Also sometimes referred to as "problematic," "unnecessary," "avoidable," "disposable," "mismanaged," "unrecyclable," "non-durable" or "short-lived" plastics.

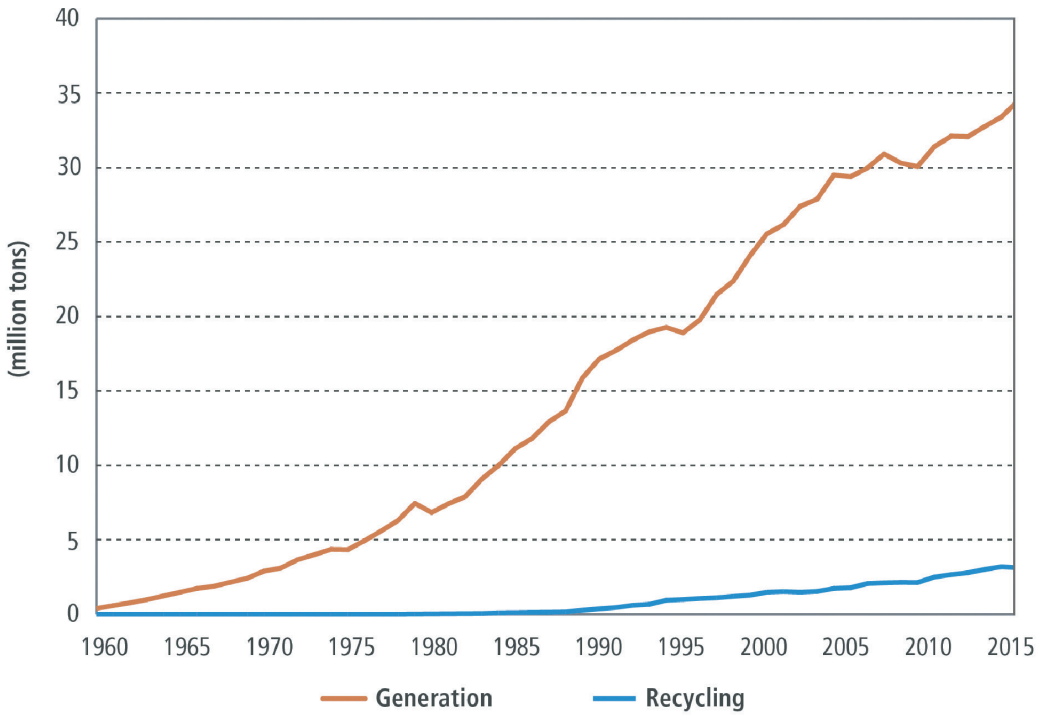


Figure 2. Estimated amount of plastic waste generated and recycled in the U.S. municipal solid waste system from 1960 to 2015 (U.S. EPA, 2020).

Globally, the annual production of plastic products has more than doubled over the last 20 years. Plastic waste generation has similarly doubled during that time. OECD projects that, without interventions, global plastic use and waste will almost triple by 2060. OECD also estimates that leakage into the environment will double to almost 49 million tons per year by 2060 (OECD, 2022b).

OECD (2022a) estimates that, in 2019, 24 million tons of plastics leaked into the environment globally (see Figure 3). Of these leaked plastics, OECD estimates that 88 percent were macroplastics from mismanaged waste, litter and fishing gear, while 12 percent were microplastics from transport, dust, wastewater sludge and other sources. Plastic leakage into the environment has profound impacts on ecosystem and human health. Plastic products constitute a significant portion of marine litter, with estimates suggesting that, globally, nearly 9 million tons of plastic enter the ocean every year (Jambeck et al., 2015). Marine and freshwater life become entangled in and ingest plastic materials leading to injury or death. Plastics are also colonized by microbes, and these microbial communities may serve as disease or pollutant vectors (Zhai et al., 2023). Once in the environment, plastic products tend to break down over time to form very small pieces called microplastics, which can pose serious threats to human health and wildlife. For example, they may be present in fish later consumed by humans and other apex predators (NASEM, 2022) or may be inhaled or consumed in drinking water and through other routes of exposure (Cox et al., 2019; Jenner et al., 2022; Prata, 2018). Plastic waste, ranging from microplastics to large debris, continues to accumulate in marine environments as plastics may take hundreds of years to degrade, exacerbating the long-term environmental impact (UNEP, 2021; OECD, 2019).

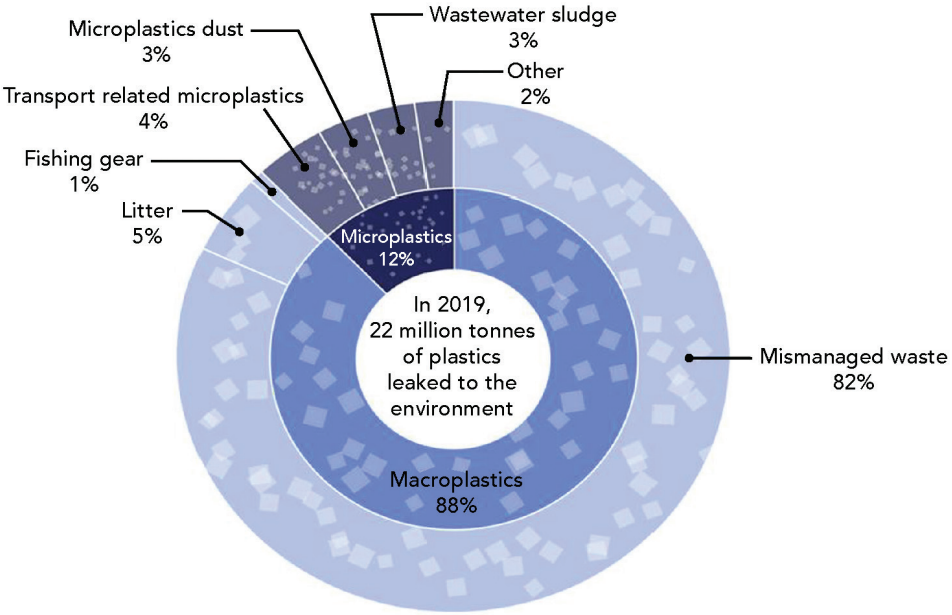


Image adapted from OECD, 2022a.

Figure 3. An estimated 24 million tons of macro- and microplastics leaked into the environment globally in 2019.[8]

The primary sources of plastic from the United States that end up in domestic waterways and the ocean include:

- Plastic that is littered or has otherwise escaped the solid waste management system.
- Plastic waste that is exported from the United States to other countries for recycling and is subsequently mismanaged.
- Micro/nanoplastics from particular products (e.g., microbeads), plastic production (e.g., nurdles), transportation (e.g., tire wear particles) and various microfiber sources (e.g., textiles).
- Sea-based sources (e.g., abandoned, lost or otherwise discarded boating, fishing or aquaculture gear).

8 According to OECD (2022a), mismanaged waste "is a wide category that includes waste that has not been collected and is therefore 'self-managed' by generators who resort to dumping on land, in rivers and lakes or by burning in open uncontrolled fires. Mismanaged waste can also include waste that has been collected but which is then subsequently deposited in dumpsites that do not have sufficient controls to protect its interaction with the natural environment or human receptors."

An analysis by Law et al. (2020) estimates that the United States contributed between 0.56 and 1.60 million tons[9] of plastic waste to the global coastal environment in 2016.[10] This estimate includes domestic litter (0.34 million tons), domestic illegal dumping (0.06 to 0.17 million tons), and inadequate management of plastic waste generated during the processing of imported U.S. plastic and paper scrap in other countries (0.17 to 1.09 million tons).

Plastic products also contribute to global greenhouse gas emissions. In 2019, plastic products were responsible for 3.4 percent of global greenhouse gas emissions (OECD, 2022a), with 90 percent of these emissions coming from their production and conversion from fossil fuels. If current rates of global plastic production, use and disposal continue, greenhouse gas emissions associated with the lifecycle of plastic products are expected to double by 2060 (OECD, 2022b).

There are growing human health concerns associated with the lifecycle of plastic products, including potential threats to children's health from micro- and nanoplastics (Sripada et al., 2022). Microplastics have been found in human placentas after birth, even when a plastic-free birthing protocol was used (Ragusa et al., 2021; Garcia et al., 2024). Researchers have also found microplastics in human breastmilk (Ragusa et al., 2022) and in male and female human reproductive organs, with potential consequences for fertility and reproductive health (Hu et al., 2024; Qin et al., 2024). In addition, some studies have raised potential concerns about endocrine-disrupting effects from chemicals that leach out of plastic products, and whether some plastic polymers can cross the blood-brain barrier (NASEM, 2022; Kopatz et al., 2023). Recent studies have found that patients with some micro- and nanoplastics in their carotid plaque were potentially at a higher risk for heart attack, stroke or death and that some micro- and nanoplastics may play a role in contributing to the progression of colorectal cancer (Marfella et al., 2024; Brynzak-Schreiber et al., 2024). Researchers also have raised public health concerns about microplastics found in the upper airways and lungs, as well as higher levels of microplastics in lower regions of the lungs (Jenner et al., 2022; Prata, 2018).

Children's environmental health refers to the effect of the environment on an individual's growth, wellness, development and risk of disease at all life stages. Childhood is a sequence of life stages, from conception through infancy and adolescence to early adulthood. During each life stage, there may be considerations that put the child at greater risk than an adult to environmental contaminants, such as those found in plastic products, when compared to adults. Children may also experience greater exposure to plastic pollution than adults as they eat more, drink more and breathe more in proportion to their body size and due to their unique behaviors, such as breast feeding, crawling and hand-to-mouth activity. Finally, the effects of early life exposures to non-chemical and chemical stressors, including those found in plastics, may become apparent during childhood and/or may not arise until adulthood or in later generations. Considering life stages is an important part of understanding the impact of the lifecycle of plastic products on human health.

Communities with environmental justice concerns may experience disproportionate burdens at several points of the plastics lifecycle, including during oil extraction, petrochemical production and waste management processes. Oil drilling and well fields have negative impacts on the natural

9 Converted to short tons from the metric tons reported in Law et al. (2020).

10 The Law et al. (2020) article did not look at microplastics from transportation, wastewater and other sources.

resources that Tribal communities rely on for sustenance and livelihoods (NASEM, 2022). Extracted oil is then sent to petrochemical processing and refining facilities. Fenceline communities—those near facilities that produce and process chemicals, such as the chemicals used to make plastics—also may have environmental justice concerns (NASEM, 2022). Many fenceline communities in the United States consist disproportionately of communities with environmental justice concerns. Pollutants from chemical processing facilities can have serious consequences for human health, including increased heart disease risk and intensified respiratory illnesses such as asthma and emphysema (NASEM, 2022). Studies on fenceline communities in Louisiana's "Cancer Alley," where there are petrochemical facilities in addition to other industry, have found that these communities have higher lung cancer risk compared to other parts of the state (Gottlieb et al., 1982; James et al., 2012; Terrell & St. Julien, 2022). Communities with environmental justice concerns are also disproportionately impacted by waste management facilities (NASEM, 2022). Risks at each point of the plastics lifecycle add stressors to the social, economic and ecological burdens already prevalent in these communities.

In addition to environmental and human health risks, plastic pollution also presents economic risks. An estimated 95 percent of material value from plastic packaging alone, or $80 billion to $120 billion, is lost annually because the material is used and disposed of in a short time period (Ellen MacArthur Foundation, 2017). Ocean plastic pollution can cause physical damage to ships and fishing assets, a reduction in fish catches or fish stocks, declining property values, and reduced income to the tourism industry (Pew Charitable Trusts and SYSTEMIQ, 2020).

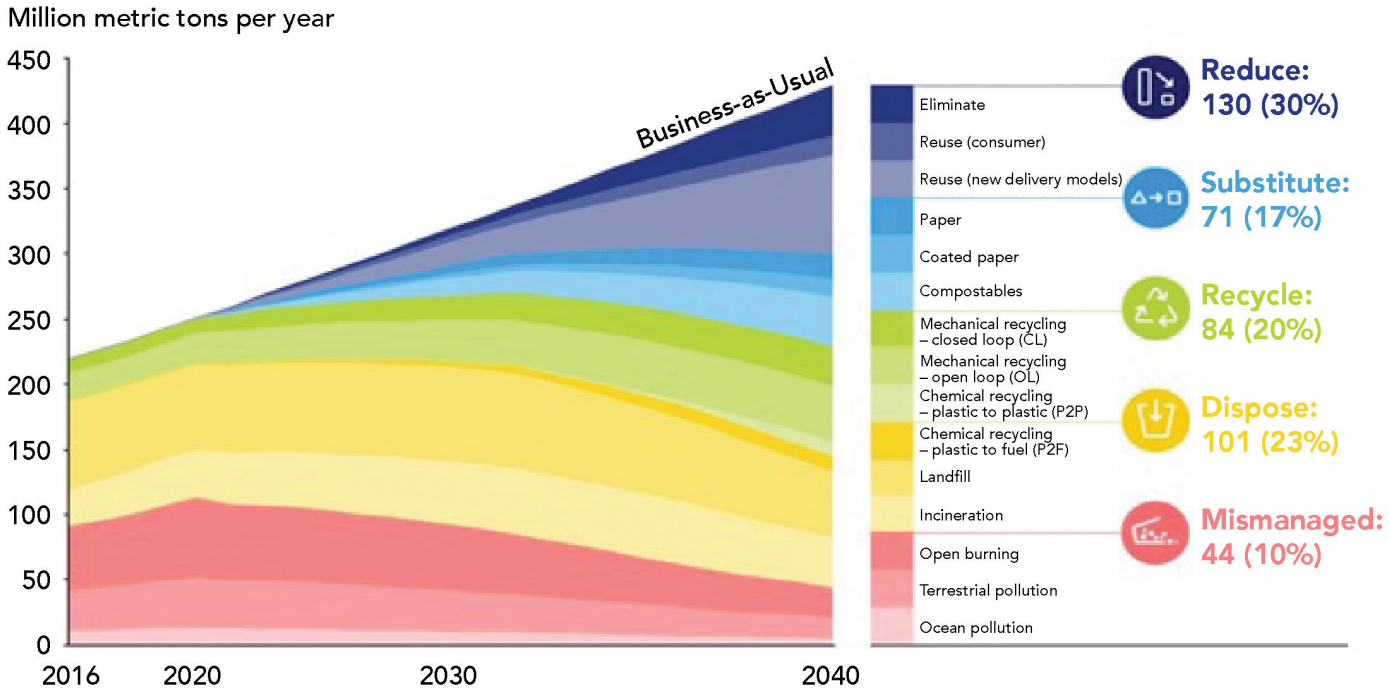
According to the Pew Charitable Trusts' 2020 report *Breaking the Plastics Wave*, plastic pollution could be reduced by about 80 percent through circular solutions, reducing plastic waste management costs by about $70 billion globally (Pew Charitable Trusts and SYSTEMIQ, 2020). As shown in Figure 4, this scenario requires the implementation of multiple solutions with varying levels of impact, from reducing plastic consumption to identifying substitute materials, recycling, and properly disposing of plastic waste (Pew Charitable Trusts and SYSTEMIQ, 2020). EPA intends to use such a multiple-solutions approach

Environmental justice as defined by Executive Order 14096, is the just treatment and meaningful involvement of all people regardless of income, race, color, national origin, Tribal affiliation or disability in agency decision-making and other federal activities that affect human health and the environment so that people:

- Are fully protected from disproportionate and adverse human health and environmental effects (including risks) and hazards, including those related to climate change, the cumulative impacts of environmental and other burdens, and the legacy of racism or other structural or systemic barriers.
- Have equitable access to a healthy, sustainable and resilient environment in which to live, play, work, learn, grow, worship and engage in cultural and subsistence practices.

For the first time, EPA's 2022–2026 Strategic Plan (U.S. EPA, 2022) includes a new strategic goal focused solely on advancing environmental justice and civil rights. EPA will center its mission on integrating justice, equity and civil rights across the nation's environmental protection enterprise, including waste management. By doing so, EPA is advancing the promise of clean air, clean water and safe land to the many communities across the country that have not received the full benefits of EPA's decades of progress. Disparate impacts on communities affected by plastic, from production to waste, make environmental justice a central consideration within this strategy.

when protecting human health and the environment from plastic pollution. These solutions could include safeguards that EPA regularly uses to provide communities with clean air to breathe and clean water to drink, as well as actions to protect human health and the environment from potential risks from chemicals that people use every day. EPA has decades of experience applying pollution controls to facilities and recently strengthened authorities under the Toxic Substances Control Act to protect workers and community members from toxic chemicals.



This "wedges" figure shows the share treatment options for the plastic that enters the system over time under the System Change Scenario. Any plastic that enters the system has a single fate or a single "wedge." The numbers include macroplastic and microplastic.

Image from Pew Charitable Trusts and SYSTEMIQ, 2020, released under CC BY-NC 4.0.

Figure 4. Wedge analysis in the "System Change Scenario" shows up to an 80 percent reduction in plastic pollution.[11]

11 Pathways presented in Figure 4 were developed by Pew Charitable Trusts and are possible treatment options for plastics that enter the system over time. EPA provides these as illustrative examples only.

Developing the National Strategy to Prevent Plastic Pollution

In December 2020, the Save Our Seas 2.0 Act was signed into U.S. law in response to the growing local, national and international concerns over plastic pollution and marine debris. The Act defines a "circular economy" and directs EPA to develop a national strategy to improve post-consumer materials management and infrastructure to reduce plastic waste and other post-consumer materials in waterways and the ocean.

EPA developed the *National Strategy to Prevent Plastic Pollution* in response to the direction provided in the Save our Seas 2.0 Act, drawing on decades of efforts to conserve and recover resources under the Resource Conservation and Recovery Act (U.S. EPA, 2003). This strategy serves as a complement to EPA's 2021 *National Recycling Strategy: Part One of a Series on Building a Circular Economy for All*, which focuses on recycling municipal solid waste. The *National Strategy to Prevent Plastic Pollution* is a national strategy for action by a wide range of U.S. actors. It aligns with the White House's 2024 *Mobilizing Federal Action on Plastic Pollution: Progress, Principles, and Priorities*, which presents a plan for federal action. The circular economy strategy series lays out a vision for a U.S. circular economy that keeps materials in circulation as long as possible, maintains their highest value, and eliminates waste (see Figure 5).

Figure 5. The Series of Strategies on Building a Circular Economy for All.

The Series of Strategies on Building a Circular Economy for All outlines a transformative 10-year vision that embraces circularity and sustainable materials management and addresses climate change and environmental justice (U.S. EPA, 2009). Each strategy in the series provides voluntary and regulatory actions that can be taken by businesses; industry; nonprofits; and federal, Tribal, state, local and territorial governments to build a circular economy for all. Current and future strategies focus on food waste and organics, plastics, electronics, textiles, and cement and concrete; they identify pathways to circularity such as recycling, product redesign, source reduction and reuse. See www.epa.gov/circulareconomy for more information.

EPA sought input from federal, Tribal, territorial, state and local governments; industry and trade organizations; community and national nongovernmental organizations, and academia to inform the development of this strategy. In April 2023, EPA released a draft version of this strategy for public comment through a federal docket (EPA-HQ-OLEM-2023-0228). See Appendix A for an overview of the public engagement activities, comments received during the public comment period, and how EPA addressed the comments.

Several major global and national policy discussions also informed the development and finalization of this strategy, including the Intergovernmental Negotiating Committee on Plastic Pollution, established by the UN Environment Programme in 2022 (UNEP, 2022); the Interagency Policy Committee on Plastic Pollution and a Circular Economy, established by the White House in April 2023; the NASEM (2022) report *Reckoning with the U.S. Role in Global Ocean Plastic Waste*, mandated by the Save Our Seas 2.0 Act; and the Interagency Marine Debris Coordinating Committee's 2024 *Recommendations and Metrics Report*.

The goal of the *National Strategy to Prevent Plastic Pollution* is to motivate actions that a wide range of U.S. entities can take to prevent plastic pollution and eliminate the release of plastic waste from land- and sea-based sources into the environment by 2040. The *National Strategy to Prevent Plastic Pollution* has six main objectives to address plastic pollution along the lifecycle of plastic products:

- **Objective A:** Reduce Pollution from Plastic Production
- **Objective B:** Innovate Material and Product Design
- **Objective C:** Decrease Waste Generation
- **Objective D:** Improve Waste Management
- **Objective E:** Improve Capture and Removal of Plastic Pollution
- **Objective F:** Minimize Loadings and Impacts to Waterways and the Ocean

There are multiple opportunities for action identified under each objective that are intended to create opportunities to shift from a linear approach in plastic materials management to a circular system.

The scope of this strategy includes only opportunities for action that promote circularity, including those actions that are anticipated to reduce plastic product use. Processes that convert solid waste and feedstocks derived from secondary plastics to fuels, fuel ingredients or energy are not within the scope of the *National Strategy to Prevent Plastic Pollution* and the *National Recycling Strategy*. The *National Recycling Strategy* primarily focused on mechanical recycling of municipal solid waste but welcomed further discussion on technologies that use thermal and chemical treatments to process plastic waste, often referred to as "chemical recycling."[12] Since its publication, EPA determined that some of these technologies produce fuels and/or intermediate materials used in the manufacturing or processing of fuel or fuel substitutes.

EPA reaffirms a long-standing position that the Agency does not consider activities that convert non-hazardous solid waste to fuels or fuel substitutes ("plastics-to-fuel") or for energy production to be "recycling" activities (U.S. EPA, 1997). Therefore, such activities that convert plastic waste to fuel or fuel substitutes are not considered part of the scope of either strategy. Additionally, EPA is aware of concerns about the health and environmental risks that may be posed by impurities that may be present in pyrolysis oils generated from plastic waste. EPA is working to better understand which impurities may be present. In 2023, EPA proposed a rule under the Toxics Substances Control Act that would require companies producing pyrolysis oil-based feedstocks for use in fuel to conduct testing for certain impurities. Agency review of the test results would be required prior to use in the manufacture of fuels (U.S. EPA, 2023a).

EPA aims to ensure that a U.S. circular economy approach for all products, including plastic products, reduces greenhouse gas emissions and protects overburdened communities from increased hazardous waste generation and other forms of pollution. Public commenters on the draft strategy have noted the importance of material retention thresholds, proven scalability, and analysis of cumulative impacts when considering chemical and thermal processing technologies for making new plastics. EPA will consider these criteria when evaluating such technologies' role in a circular economy. EPA intends to prioritize approaches that have the highest potential for reducing impacts to the environment and human health and approaches that generally receive less economic support such as reduction, reuse and mechanical recycling.

12 Note that the *National Recycling Strategy* uses the term "chemical recycling," but the *National Strategy to Prevent Plastic Pollution* refers to these technologies as "thermal and chemical processing or treatment of plastic waste."

Objective A. Reduce Pollution from Plastic Production

Consistent implementation and enforcement of regulations at all levels of government can reduce or prevent environmental and human health risks posed by fossil fuel extraction and existing or proposed petrochemical and plastic production facilities. Consistent implementation and enforcement of regulations is especially needed at regulated facilities that are near fenceline communities. Federal agencies are taking steps to reduce pollution from the extraction of fossil fuels and from petrochemical and plastic production facilities. Manufacturers must ensure that their plastic production operations meet relevant environmental regulatory requirements at the federal, Tribal, state, territorial and local government levels. Manufacturers also have an opportunity to further reduce pollution from plastic production operations beyond what is required by regulations. Voluntary certification efforts can be explored to help ensure plastic products that meet such higher standards are not replaced with products that might be manufactured under less rigorous environmental standards.

A1. Conduct evaluations to ensure that fossil fuel extraction as well as petrochemical and plastic production facilities comply with regulatory requirements.

Governments at all levels can use various instruments and approaches to ensure compliance with regulatory requirements for existing or proposed facilities. For decades, EPA has used its regulatory authorities and the best available science to develop, implement and enforce rules for public health and the environment that prevent or reduce pollution across the plastics lifecycle. EPA continues to do this important work. For example, EPA includes upstream pollution associated with plastic manufacturing in reporting requirements under its Toxics Release Inventory Program to track progress in eliminating or reducing specific chemicals used in plastic manufacturing. Through the National Enforcement and Compliance Initiative for FY2024–2027 on Reducing Air Toxics in Overburdened Communities, EPA also will target, investigate and address noncompliance regarding hazardous air pollutants in communities highly burdened with unlawful emissions of toxic and harmful pollutants (U.S. EPA, 2023b).

A2. Continue to make progress reviewing and, where appropriate, updating regulations for fossil fuel extraction, petrochemical and plastic production facilities, and transporters of plastic pellets and plastic additives.

Federal, Tribal, state, local and territorial governments could review and update, as appropriate, regulations relating to air emissions, water discharges of pollutants, and waste disposal from plastic production and recycling facilities. These governments could also examine existing authorities, policies and actions to determine how they could be adjusted or built upon to avoid and reduce risks

to environmental and human health, including safety threats like chemical leaks, fires and explosions. Consistent with its authorities, the federal government could also review and (as appropriate) update regulations on the production and transport of plastic pellets and plastic additives used in plastic production to prevent accidental releases into the environment during transit.

In 2023, EPA issued a final rule to reduce harmful air pollutants from the oil and natural gas industry. The rule is expected to prevent the release of 1.5 billion metric tons of greenhouse gas equivalents by 2038 (Standards of Performance for New, Reconstructed, and Modified Sources and Emissions Guidelines for Existing Sources: Oil and Natural Gas Sector Climate Review, 2024). In May 2024, EPA issued a final rule to reduce hazardous air emissions from roughly 200 petrochemical facilities across the country. That rule is expected to reduce the number of people who have elevated air toxics-related cancer risk by 96 percent in communities located near plants. In July 2024, EPA proposed to designate five chemicals as High-Priority Substances for risk evaluation under the nation's chemical safety law, the Toxic Substances Control Act. All five chemicals, including vinyl chloride, have been linked to cancer and are used to make plastics. If unreasonable risks are found during risk evaluation, EPA will address those risks by proposing risk management actions that will provide critical public health and environmental protections to communities across the country.

A3. Explore creating a voluntary certification to recognize plastic products that are manufactured under rigorous environmental standards.

Standards-setting or certification organizations could explore creating a voluntary certification program for plastic products to help ensure that plastic products are manufactured under rigorous environmental standards and are not replaced with products that are manufactured under less rigorous environmental standards. The certification could encourage the use of products that conform to high-quality environmental standards, whether the products are domestically manufactured or imported.

A4. Identify and reduce environmental injustice and public health impacts from fossil fuel extraction, petrochemical and plastic production facilities.

EPA and/or state, Tribal, local and territorial governments could map locations of existing and proposed fossil fuel extraction, petrochemical and plastic production facilities, as well as major hubs and corridors for the transportation of plastic pellets and chemicals, to analyze potential disproportionate impacts on disadvantaged and vulnerable communities.[13] Communities should be engaged and supported throughout the process of identifying impacts and reducing pollution. EPA's Environmental Justice Grants and Technical Assistance Program[14] offers a variety of opportunities for projects that focus on plastic pollution reduction. These opportunities are available primarily for community-based organizations working on environmental justice challenges, but also for state, local, Tribal and territorial governments, as well as academic institutions working in partnership with those entities.

> On February 3, 2023, a train carrying vinyl chloride derailed in East Palestine, Ohio, releasing approximately 1 million pounds of vinyl chloride and other chemicals into the environment. Vinyl chloride is used to make polyvinyl chloride (PVC), a plastic product commonly used for pipes, wires, and cable coatings and for some packaging. Vinyl chloride has both short- and long-term effects on human health. Mapping transportation hubs used for plastic production could help identify and minimize the potential human health risks of transporting plastic products and materials used for plastic production. EPA has been at the East Palestine site since the spill occurred and is committed to protecting the health and safety of the community.

13 Available tools to accomplish this action include EPA's Environmental Justice Screening and Mapping Tool (EJScreen 2.3), the Council on Environmental Quality's Climate and Economic Justice Screening Tool (CEJST) and the Centers for Disease Control and Prevention's Social Vulnerability Index. Further analysis of potential impacts could make use of other tools, research, information from environmental monitoring, and feedback from impacted or potentially impacted communities.

14 This program advances the Justice40 Initiative, which set a goal that 40 percent of the overall benefits of certain federal climate, clean energy and other investments flow to disadvantaged communities that are marginalized by underinvestment and overburdened by pollution.

Objective B. Innovate Material and Product Design

Plastic products and packaging have become increasingly complex and are not always designed to be sustainably managed once they become waste (U.S. GAO, 2020; NASEM, 2022). This complexity can lead to challenges with reducing or sustainably managing plastic waste, such as recycling stream contamination and damage to recycling infrastructure. Manufacturers at all stages of plastic product production have a pivotal opportunity to design products and systems that result in fewer negative human health and environmental impacts throughout the product lifecycle, including during end-of-life management. In addition, methods need to be developed to better understand and measure greenhouse gas emissions associated with the use of alternative materials or products. More greenhouse gas data need to be made available to inform decision-making.

Relevant *National Recycling Strategy* (NRS) Actions for Objective B1

NRS Objective B: *Increase Collection and Improve Materials Management Infrastructure*

B4. Increase consideration of recoverability and sustainability in the design of new products.

NRS Objective D: *Enhance Policies and Programs to Support Circularity*

D3. Conduct a study on reflecting environmental and social costs in product pricing.

D4. Increase awareness of and continue voluntary public-private partnerships.

B1. Identify alternative materials, products or systems that can minimize impacts on human health and the environment.

Manufacturers, procurement/purchasing managers and third-party certification bodies could identify and design products and systems that minimize waste and apply reuse systems or alternative disposable materials (e.g., paper, glass, cardboard, metal) that reduce lifecycle environmental and human health impacts. Preferences for these alternative materials or systems could be built into corporate, government and organizational purchasing policies and procurement guidelines, similar to the reduction preferences described in Action C1.1. Policymakers also will benefit from improved understanding of environmental trade-offs that could result from the use of alternative materials. This action is aligned with Action B4 in EPA's 2021 *National Recycling Strategy*, "Increase consideration of recoverability and sustainability in the design of new products."

B1.1: Improve understanding of the human health, environmental, social and economic impacts of plastic products and their alternatives.

Academia; manufacturers; federal, Tribal, state, local and territorial governments; nongovernmental organizations; and/or consumer advocacy groups could undertake assessments and gap analyses to improve understanding of the human health, environmental, social and economic impacts across a product's lifespan (including impacts from production, use and end of life). These organizations could evaluate exposures across all life stages to the chemical components used in plastic products and their alternatives, especially chemicals such as endocrine disruptors that have shown the ability to disrupt sensitive systems in the human body. Assessments, such as risk assessments, lifecycle

assessments (LCAs), economic assessments and social cost assessments, can be helpful tools in this area. For example, one study indicates that there may be significant health care costs related to adverse birth outcomes from prenatal phthalate exposure (Trasande et al., 2024). Researchers could analyze social costs of plastics and other materials to assess causes, health outcomes and potential waste reduction solutions. Researchers could make data from LCAs and social cost assessments publicly available to companies, communities and other organizations for consideration and decision-making.

Researchers could give specific attention to areas where gaps exist in our understanding of plastic products; the primary polymers, materials and chemicals used to produce plastic products; and alternative materials (e.g., paper, glass, cardboard, metal). Researchers should identify additional data needed to determine potential environmental and human health impacts from plastic additives and contaminants in U.S. recycled plastic, including human health impacts during susceptible life stages (e.g., infants, children and pregnant individuals). Manufacturers and/or federal, Tribal, state, local and territorial governments could also use these assessments to address concerns related to environmental justice, including locations where vulnerable communities may be impacted.

The UN Environment Programme has identified 10 groups of chemicals (based on chemistry, uses or sources) as being of concern in terms of their toxicity and potential to migrate or be released from plastics (UNEP, 2023). Researchers could explore whether these or other such chemicals are present in plastic products and assess whether further test methods or standards are needed to address any contaminants of concern and protect human health and the environment.

B1.2: Develop methods to measure greenhouse gas emissions from the lifecycle of plastic products and alternative materials as part of meeting global, national and state greenhouse gas emissions reduction goals.

EPA and/or academia could measure the lifecycle emissions of U.S. plastic products and their alternatives. These organizations could explore whether existing models, such as the U.S. Environmentally-Extended Input-Output Model, EPA's Waste Reduction Model (WARM) and the Federal LCA Commons, could support lifecycle analyses of greenhouse gas emissions from plastic products and their alternatives. Policymakers would also benefit from improved understanding of environmental trade-offs that could result from the use of alternative materials.

B1.3: Build upon existing research on the human health and environmental impacts of certified compostable products across their lifecycle.

Policymakers and consumers need additional research on the human health and environmental impacts of certified compostable products, from cradle to grave. These include impacts from the sourcing or production of raw materials, manufacturing, distribution, use and end-of-life management, as well as impacts of micro/nanoplastic particles in the environment and on human health. Current and ongoing research, including field studies and lab testing, supports this goal. Researchers could build upon this research to account for the diversity of conditions at composting facilities and the behavior of certified products leaked into the environment. Research also can help identify product design, collection or policy changes needed to reduce the lifecycle environmental and human health impacts and ensure sound management of certified compostable products.

Certified compostable products meet performance standards and have been demonstrated to decompose under controlled conditions, such as in industrial or commercial composting facilities. Several organizations develop standardized test protocols or provide third-party certifications. Certified compostable products can be made from materials including compostable bioplastic, paper, plant materials, fungi or molded fiber. Certified compostable products are often used as alternatives to fossil fuel–based plastic products, and it is important to assess the human health and environmental impacts across their lifecycle. Despite being compostable, they may still present environmental risks, including when they are littered or leaked into the environment.

B1.4: Create an innovation challenge program to develop alternative materials, products or systems to avoid plastic pollution.

The federal government, industry or a nongovernmental organization could create an innovation challenge program to promote and encourage the development of improvements to product and system design. Such a program could encourage innovators to design materials, products and systems for a circular economy and ensure innovations minimize environmental and human health impacts throughout their lifecycle. Section C of the Save Our Seas 2.0 Act authorizes the Genius Prize for Save Our Seas Innovations (Save Our Seas 2.0 Act, 2020), which prioritizes projects that can potentially decrease and prevent plastic marine debris. The Genius Prize (or a similar innovation challenge program) could fulfill this action and could be a result of a partnership across the federal government or a public-private partnership.

B2. Review, develop, update and use sustainability standards, ecolabels, certifications and design guidelines that can minimize the negative impacts to human health and the environment from plastic products across their lifecycle.

Product standards often include product labeling, which can be an important lever for communicating product recyclability and transparency about chemicals in products. Standards, ecolabels, certifications and design guidelines can promote circularity and decrease negative environmental and human health impacts. Standards-setting and certification organizations could review existing standards, ecolabels, certifications and design guidelines to identify where additional standards or revisions are necessary to decrease negative environmental and human health impacts across the lifecycle of plastic products. Adopting and further refining international standards for circularity will help support more environmentally sound trade and reduce barriers to achieving a more circular economy. Federal, Tribal, state, local

Relevant *National Recycling Strategy* (NRS) Actions for Objective B2

NRS Objective B: *Increase Collection and Improve Materials Management* Infrastructure

B4. Increase consideration of recoverability and sustainability in the design of new products.

NRS Objective C: *Reduce Contamination in the Recycled Materials Stream*

C1. Enhance education and outreach to the public on the value of recycling and how to recycle properly.

NRS Objective E: *Standardize Measurement and Increase Data Collection*

E5. Increase data availability and transparency about recyclable materials generated and the materials manufacturers need.

and territorial governments; industry; and nongovernmental organizations could increase awareness among businesses of the Federal Trade Commission's *Guides for the Use of Environmental Marketing Claims* ("Green Guides"). Compostable product standards would benefit from review and updates to ensure that certified and labeled products fully decompose in different types of composting systems.

B2.1: Conduct a review and gap analysis of existing standards, ecolabels and certifications.

Academia, a standards-setting or certification organization, or a nongovernmental organization could conduct a review and gap analysis to accurately identify products that meet the standards, ecolabels, certifications and design guidelines. Such an analysis would help mitigate greenwashing and inaccurate labeling on online purchasing platforms.

B2.2: Design guidelines and establish test methods and/or standards for the detection of additives and contaminants.

Academia and standards-setting or certification organizations could establish appropriate test methods and/or standards for the detection of additives and contaminants (including PFAS) in plastics, to ensure protection of human health and the environment.

B2.3: Coordinate domestic and international interests to support the development of international standards to increase the circularity of plastic products.

U.S. businesses, nongovernmental organizations and the federal government could continue to engage in and support the development of international standards to increase the circularity of plastic products, including through improved product labeling. This engagement will help promote trade that supports circularity.

B2.4: Increase awareness among businesses of the Federal Trade Commission's *Guides for the Use of Environmental Marketing Claims* ("Green Guides") and evaluate marketing claims about the compostability and degradability of products to reduce "greenwashing" and misleading claims.

Federal, Tribal, state, local and territorial governments; industry; and nongovernmental organizations could initiate discussions with businesses, including federal suppliers, to increase awareness of the Federal Trade Commission's *Guides for the Use of Environmental Marketing Claims* ("Green Guides") and the consequences of deceptive environmental claims. The Green Guides provide guidance to businesses on how to make non-deceptive environmental claims with considerations for consumer perception of those claims. Specifically, the Green Guides state that marketers should clearly and prominently qualify a claim that their product is "compostable" if composting facilities for that product are not available to a substantial majority of consumers or communities where the item is sold.[15] Few U.S. consumers and communities currently have access to commercial composting infrastructure for processing certified compostable products, as shown in EPA's Excess Food Opportunities Map, which was developed to support nationwide diversion of excess food from landfills. Claims could be

15 Businesses should use the Green Guides to ensure they are making truthful environmental claims. For example, compostability and degradability claims are sometimes included on products that are not actually compostable or degradable. Concerns related to inadequate documentary standards and definitions in such claims need to be appropriately addressed to ensure greater accountability.

evaluated in conjunction with "truth in labeling" efforts addressed in the Green Guides.

B2.5: Review plastic resin identification codes to determine if changes are needed to reduce confusion about the recyclability of plastic products.

Governments and organizations at different levels could continue to review plastic resin identification codes to ensure the codes are useful and do not perpetuate consumer confusion about what is and is not recyclable.

B2.6: Examine and, if necessary, update plastics degradability standards to ensure they reduce negative impacts to human health and the environment.

EPA and standards-setting organizations could analyze existing standards for plastics degradability to determine if they reduce or increase negative impacts to human health and the environment. For example, some plastic products are designed to degrade in certain environments, such as marine environments; however, designing plastic products to degrade faster may still result in the creation of micro/nanoplastics, which potentially can impact human health and the environment. EPA is currently researching plastics degradability in different environments.

B2.7: Review and, if needed, update compostable product standards to ensure that certified and labeled products fully decompose in composting systems and do not negatively impact the composting process or the quality of the final compost product.

Standards-setting and certification organizations could review and update compostable product standards to ensure that products meeting these standards fully decompose in different types of composting systems or provide clear information to consumers on the type of composting system for which the product is designed.[16] Because standards have largely been developed based on conditions at industrial or commercial composting facilities, consumers would benefit from additional or revised standards for certified products that break down in home composting systems and across system types and climate regions. A review of existing standards could help standards-setting bodies ensure that their standards and certifications are effective. Expanded field and lab testing could inform standards reviews and ensure that certified compostable products will break down as intended in a variety of composting systems. In addition, certification organizations could conduct a review of barriers to composting certified products to inform future updates to compostable product standards.

16 Compostable product standards and certifications are intended to ensure that certified products (including those made solely from materials other than plastic, such as paper or molded fiber) will fully break down in composting systems. However, real-world composting conditions vary depending on a composting facility's operations, end markets and surrounding climate.

B2.8: Identify additional standards, research and development needed to facilitate system-wide shifts to reuse.

Standards help businesses and communities develop and install interoperable infrastructure to facilitate system-wide shifts to reusable products. Building on existing efforts to identify standards for reuse systems, standards-setting organizations could identify gaps in current standards and opportunities to expand adoption across states and countries and potentially at the regional and international levels. Industry, academia and nongovernmental organizations could conduct further research and development to help determine best practices for designing and operating efficient and safe reuse infrastructure and reusable products.

Objective C. Decrease Waste Generation

EPA's estimates show that plastic waste generation in the United States increased from 0.4 percent of total municipal solid waste generated in 1960 to 12.2 percent in 2018, reaching 13.2 percent in 2017 (U.S. EPA, 2020). While recycling is an important action to address the waste that is generated, decoupling materials use from economic growth in the United States is essential to reducing waste generation and minimizing the environmental and human health impacts of plastic on communities, particularly those with environmental justice concerns (U.S. EPA, 2021). Various policy approaches can be employed to encourage producers and consumers to reduce the production and use of single use plastic products. These policies can move consumers away from the linear "take-make-waste" economy, where materials are not used to their full potential (Ellen MacArthur Foundation, 2024). Further steps toward circularity can be achieved by enhancing the effectiveness of public policies and incentives for decreasing waste generation, establishing reuse systems, and increasing public outreach and education on proper management of end-of-life plastics and other materials. Reducing waste generation can create cost savings for consumers and decrease greenhouse gas emissions from the production of new products.

C1. Reduce the production and consumption of single use plastic products.

Identifying and communicating the types of products that have adverse environmental and human health impacts could help reduce consumption of these products. Setting a national goal to reduce the production of single use plastic products could help inspire action across the country to reduce consumption of single use products. Policymakers at all levels of government can benefit from information about how various policy tools and approaches influence the production of single use plastic products, as well as about the resulting human health, environmental, economic and social impacts. The federal government can lead by example and drive development of alternatives through its plan to reduce single use plastics across the federal government.

C1.1: Identify single use plastic products to be reduced or eliminated in procurement.

Businesses; nongovernmental organizations; and federal, Tribal, state, local and territorial governments could develop a list identifying single use plastic products that may be targeted for reduction or elimination in procurement, while also taking into consideration existing lists. This list could be integrated within corporate, government and organizational purchasing policies and procurement guidelines and could be shared widely for public use.

C1.2: Set a goal to reduce the production of single use plastic products.

EPA could set a new national voluntary goal to reduce the production of single use plastic products. This new goal would help galvanize action across the country and encourage reduction and reuse programs, as well as support and promote the use of sustainable alternative products. It would complement the National Recycling Goal by going beyond recycling to support the important work to reduce and reuse waste. Lists developed under Action C1.1 could be taken into consideration when developing the goal.

C1.3: Identify effective policies and approaches to reduce production of single use plastic products.

EPA, working with state governments and relevant parts of the federal government, could conduct a study or literature review to identify effective policies and approaches and share the results broadly. Policymakers can benefit from information about how various policies and approaches impact the production of single use plastic products, as well as about the resulting human health, environmental, economic and social impacts.

C1.4: Reduce single use plastic products across the federal government.

In July 2024, the White House announced a goal to phase out federal procurement of single use plastics from food services operations, events and packaging by 2027, and from all federal operations by 2035 (The White House, 2024b). Implementation of this goal will minimize waste, advance pollution prevention and environmental justice, and promote circular economy approaches. The federal government could consider the following steps as part of its plan to meet the goal:

- Update procurement policies for government-wide implementation of priority strategies to reduce purchase and use of single use plastic.
- Create a new sustainable purchasing tool, or update an existing tool, to identify sustainable products or delivery systems that can replace single use plastic products.
- Review government purchasing criteria to ensure that the government is purchasing products that contain recycled content, can be reused, or that minimize or restrict single use plastics and additives and contaminants.[17]

17 Some criteria are already evaluated via private sector standards and ecolabels included in EPA's Recommendations of Specifications, Standards, and Ecolabels for Federal Purchasing.

- Review EPA's Comprehensive Procurement Guidelines (CPG) Program,[18] as directed in the 2021 Infrastructure Investment and Jobs Act, for potential updates to recommended product categories or recycled content levels and consider developing a registry of compliant products.
- Develop additional EPA Recommendations of Specifications, Standards, and Ecolabels for Federal Purchasing, or other mechanisms that the federal government can leverage in the acquisition process focused on reducing the federal government's plastics footprint.
- Explore reduction approaches (e.g., product take-back) in procurement contracts to incentivize producers to use more sustainable or less packaging.

C1.5: Expand reuse and refill in federal procurement.

The federal government could identify additional opportunities and pathways to promote procurement of reuse and refill products and packaging. This approach seeks to implement the Council on Environmental Quality's implementing instructions for E.O. 14057, Executive Order on Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability, which state: "To minimize waste, advance pollution prevention, and promote a transition to circular economy approaches, agencies should take actions to reduce and phase out procurement of single use plastic products, to the maximum extent practicable." Additional opportunities and pathways could include the following:

- Explore reuse approaches in procurement contracts to incentivize producers to use reusable and refillable packaging.
- Develop new product categories under EPA's Recommendations of Specifications, Standards, and Ecolabels for Federal Purchasing for products that promote reuse and refill.
- Identify best practices and model contract language for agency implementation.

C2. Enhance the effectiveness of existing public policies and incentives for decreasing waste generation.

Federal, Tribal, territorial, state and local governments have implemented policies that have shown to be effective at decreasing waste generation and increasing material reuse, collection, recycling and conservation. Efforts to enhance the effectiveness of these policies should aim to fill knowledge gaps, provide guidance, explore policy needs and share best practices. EPA's 2021 *National Recycling Strategy* identified

Relevant *National Recycling Strategy* (NRS) Actions for Objective C2

NRS Objective D: *Enhance Policies and Programs to Support Circularity*

D1. Strengthen federal coordination to support and encourage actions to improve the U.S. recycling system.

D2. Conduct an analysis of different policies that could address recycling challenges.

18 EPA's CPG program establishes recommended minimum recycled content levels for certain categories of products purchased by the federal government (U.S. EPA, 2023c).

several actions to support circularity that are focused on enhancing policies and programs; these actions also are emphasized in this strategy.

EPA, academia and/or nongovernmental organizations could study existing public policies and programs to investigate, identify and share best practices for decreasing waste generation. This study should examine material reuse, refill, collection, recycling and conservation; build on existing knowledge; and include recommended actions to enhance program and policy effectiveness. EPA is already contributing to this action as part of the *National Recycling Strategy*. As directed by the Government Accountability Office, EPA is studying the effectiveness of existing public policies on the reuse, recycling and conservation of materials (U.S. GAO, 2020).

C3. Develop and/or expand the capacity to reuse materials.

Innovative systems need to be developed and/or expanded to help ensure existing products are reused as long as possible. Communities, states, Tribes and territories need financial support to update aging infrastructure and meet their circularity goals. EPA is supporting the development and improvement of reuse and refill systems with grant funding under the Solid Waste Infrastructure for Recycling (SWIFR) Grants funding opportunity. In addition, EPA provided approximately $32 million for states and territories to improve solid waste management planning, data collection and implementation of plans. However, additional funding is needed from both the public and private sectors to transform infrastructure to facilitate reuse around the country.

C3.1: Provide and expand funding to communities, states, Tribes and/or territories to create and implement plans that facilitate reuse systems and infrastructure.

Communities (including those with environmental justice concerns), states, Tribes and territories need financial support from both the public and private sectors to create and implement plans to improve local reuse systems and infrastructure. These plans should include a focus on reducing single use plastic products, while also providing job opportunities for local communities. Plans also should ensure that reuse and refill systems and infrastructure are equitably accessible across all communities. EPA created a new Pollution Prevention grant opportunity in 2023: Environmental Justice Through Safer and More Sustainable Products. EPA plans to continue offering grant opportunities that support reusable food ware and other packaging.

C3.2: Research and identify obstacles to reuse and propose innovative, viable solutions.

Academia, nongovernmental organizations and businesses could conduct research to identify obstacles and friction points that limit the viability of reuse systems and innovative solutions to address those obstacles. Faced with large volumes of mixed plastic waste that has little or no market value, many jurisdictions are assessing avenues to support reuse. New challenges to reuse have emerged, particularly since the COVID-19 pandemic. Innovative solutions must be developed to further advance reuse systems in the United States.

C3.3: Develop best practices for incorporating reuse into state, territory, Tribal and other solid waste management plans.

EPA can convene states, territories and Tribes to discuss how to use the SWIFR grant funding to incorporate reuse into their solid waste management plans. Deliverables from such discussions could include 1) best practices for incorporating reuse into solid waste management plans, and 2) a guide for local governments on planning and implementing reuse projects, collecting data, measuring progress and recording lessons learned.

C4. Increase public understanding about the impacts of plastic pollution (including on waterways and the ocean) and how to appropriately manage plastics and other materials.

To encourage social and behavioral change, it is essential to increase public understanding about the impacts of plastic pollution on human health and the environment. Consumers play a pivotal role in determining how plastic products are used and how waste is managed. Community engagement can help develop clear and effective messaging that identifies local barriers to preventing litter and illegal dumping and presents locally appropriate solutions. Effective messaging can also prompt social and behavioral change by explaining the impacts of single use plastic products and ways to avoid those items.

Relevant *National Recycling Strategy* (NRS) Actions for Objective C4

NRS Objective C: *Reduce Contamination in the Recycled Materials Stream*

C1. Enhance education and outreach to the public on the value of recycling and how to recycle properly.

C2. Ensure resources are available for education and outreach initiatives.

C4.1: Identify effective ways to create social and behavioral change.

Academia; nongovernmental organizations; and federal, Tribal, state, local and territorial governments could research best practices for maximizing social and behavioral change on waste reduction, materials reuse and composting. These best practices could be shared with organizations that design and implement anti-littering campaigns or other campaigns aiming to reduce plastics and other materials in the environment. Academia or nongovernmental organizations could develop and maintain a searchable central repository of the best practices to facilitate dissemination. Building on Action C1 in the *National Recycling Strategy*, organizations can use this information to develop national and local messaging. EPA's Recycling Education and Outreach Grant Program, funded by the 2021 Infrastructure Investment and Jobs Act, also can help achieve actions on local messaging. In addition, EPA's Trash Free Waters program contains good information on best management practices and case studies for reducing the leakage of plastics and other materials into the environment.

C4.2: Develop educational materials about the nature of impacts and solutions to plastics and other materials in waterways and the ocean.

Federal, Tribal, state, local and territorial governments and nongovernmental organizations could develop public outreach and education materials to improve public understanding about the impacts of plastics and other materials in waterways and the ocean. These materials can promote material reduction and reuse and discourage littering and illegal dumping. High-quality, plain language education and outreach materials could be shared with educators, nongovernmental organizations and other collaborators to use across the country. These materials should be provided in a variety of languages using multiple delivery methods (e.g., print, television, radio, social media). Environmental justice concerns should be proactively addressed by engaging affected communities in the development of messaging appropriate for them.

C4.3: Develop national outreach and education campaigns to reduce plastic pollution.

EPA, in coordination with other federal agencies, industry or nongovernmental organizations, could develop a national outreach and education campaign to reduce plastic pollution. National outreach and education campaigns need to be driven by best practices in social and behavioral change research to maximize their effectiveness. Campaigns developed with an understanding of consumer behavior and motivation can more effectively achieve the desired outcomes, including consuming fewer single use plastic products, reusing products, using compostable and recyclable materials, properly disposing of waste, and refraining from littering and illegal dumping. Community-based social marketing and environmental justice considerations, including use of contextually relevant messaging across diverse groups and geographies, should be employed wherever possible. Partnerships with traditional and social media, schools, aquariums, museums, nongovernmental organizations, waste haulers and product manufacturers should also be considered, where appropriate, to support national outreach efforts.

Objective D. Improve Waste Management

Plastic waste should be managed in a manner that minimizes impacts to human health and the environment. EPA's 2021 *National Recycling Strategy* identified multiple actions that will improve the U.S. recycling system to better manage waste at end of life. The 2024 *National Strategy for Reducing Food Loss and Waste and Recycling Organics* also identifies key actions focused on the reduction and management of food waste and organics. This objective includes actions that are complementary to these strategies, focused on improving waste management systems, including recycling and composting systems. These actions present ways to improve the collection, transportation, management and/or export of plastic waste so that it does not enter the environment.

Relevant *National Recycling Strategy* (NRS) Actions for Objective D1

NRS Objective D: *Enhance Policies and Programs to Support Circularity*

D6. Coordinate domestic and international interests

D1. Explore possible ratification of the Basel Convention and encourage environmentally sound management of scrap and recyclables traded with other countries.

Controlling exports of plastic waste to ensure that those exports do not arrive in countries that are not able to manage it in an environmentally sound manner may be one action to achieve the greatest reductions to global plastic pollution that the U.S. government can take. Currently, EPA has authority under the Resource Conservation and Recovery Act to control transboundary movements of most hazardous recyclables and waste, but not all waste controlled under the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (the Basel Convention). The United States should explore possible ratification of the Basel Convention and encourage environmentally sound management of scrap and recyclables traded with other countries. Implementing legislation is required to ratify the Basel Convention.

The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal requires Parties to control the transboundary movements of certain materials and hazardous wastes covered by the treaty and to take measures to prohibit certain exports if Parties have reason to believe the exports would not be managed in an environmentally sound manner. Amendments to control exports and imports of most plastic scrap and waste were adopted by Parties to the Basel Convention in 2019 and took effect on January 1, 2021. As a result of these changes, transboundary movements of most plastic scrap and waste between countries that are Parties to the Convention are allowed only with the prior written consent of the importing country and any transit countries, a process known as prior informed consent. The United States signed the Basel Convention in 1990, and the Senate gave its advice and consent to ratification in 1992.

D1.1: Support the Basel Convention.

The United States should explore options for strengthening U.S. participation in the Basel Convention, including options that would enable ratification.

D1.2: Encourage environmentally sound management practices in other countries to support protection of human health and the environment.

Some countries continue to strengthen their recycling and waste management systems but still face challenges in ensuring that scrap and recyclables are managed in an environmentally sound manner, especially in communities with environmental justice concerns. Some countries also lack sufficient capacity for environmentally sound disposal of materials that cannot be recycled. In conjunction with exploring options for strengthening U.S. participation in the Basel Convention, EPA should identify ways to encourage environmentally sound management practices in other countries for scrap and recyclable materials to ensure such practices support circular economy approaches.

D2. Support state, local, Tribal and territorial governments in their efforts to improve waste management to avoid adverse human health and environmental impacts, especially for communities with environmental justice concerns.

State, local, Tribal and territorial governments continue to make improvements to waste management systems and programs. In 2023, 56 states and territories requested SWIFR grant funding to develop their solid waste management plans, and over 300 communities requested funding to improve local post-consumer materials management programs. These requests demonstrate the need across the country for additional public and private support to adopt circularity approaches when managing plastics and other materials. Federal agencies can explore opportunities to expand existing federal program support for state, local, Tribal and territorial governments. Industry and nongovernmental organizations could also provide funding and support to develop waste management infrastructure. Support is also vital to advance the research, development, demonstration and deployment of new technologies to ensure that collected waste enters and stays in the waste management system. EPA, working with other relevant federal agencies, academia, and state, territorial, and Tribal governments, could standardize measurement and increase data collection to further support state, local, Tribal and territorial governments with their waste management improvements.

Academia; nongovernmental organizations; state, Tribal, and territorial governments; and EPA and other relevant federal agencies could also study and communicate the environmental and health impacts that new and existing waste management facilities impose on surrounding communities. When potential impacts are known, communities are better able to identify waste management approaches that are best for their community. Understanding these impacts will also help EPA identify ways it can support state, local, Tribal and territorial governments and communities in their efforts to address environmental and health concerns. Results of the environmental justice analysis in Action D2.2 could be used to inform the design and implementation of Actions D2.1 through D2.8

to ensure that recycling and collection programs and municipal waste management systems do not adversely impact communities. Results of the environmental justice analysis could also be used to reduce disparities in materials management infrastructure, funding, technology and access.

D2.1: Explore expanded use of Clean Water Act and Safe Drinking Water Act authorities related to assessing plastic pollution and preventing plastics and other materials from getting into waterways and the ocean.

EPA is already using its Clean Water Act authorities to help prevent plastic from getting into rivers, lakes and streams. For example, federal regulations require permitting of stormwater discharges from the Plastic Materials, Synthetic Resins and Nonvulcanizable Elastomers sector. EPA's "Multi-Sector General Permit for Stormwater Discharges Associated with Industrial Activity" requires facilities that handle pre-production plastic to implement control measures to reduce and eliminate discharges of plastic in stormwater. EPA's stormwater permits for municipal separate storm sewer systems (MS4) can also include measures to reduce or prevent discharges of plastics into waterbodies.

EPA, in collaboration with relevant partners, should build on these efforts by analyzing how effectively and comprehensively relevant water programs are used to address plastic and other material pollution in waterways and the ocean. EPA could start by relying on sources such as the 2021 *Trash Stormwater Permit Compendium*, published by EPA's Trash Free Waters program, which highlights examples of how state governments have used MS4 provisions to reduce discharges of plastics into waterbodies. The results of this analysis could be used to modify (as needed) how these programs are implemented. Multiple federal water programs could be used more expansively and effectively to address plastic pollution.[19]

D2.2: Perform an environmental justice assessment for non-hazardous solid waste management facilities, including recycling facilities, incinerators, landfills, facilities that chemically and thermally process plastic waste, and emerging or novel processes.

EPA could perform an environmental justice assessment for non-hazardous solid waste management facilities to improve understanding of the economic, social, environmental and human health impacts such facilities have on the surrounding communities. This analysis, which should include recycling facilities, incinerators, landfills, and facilities that chemically and thermally process plastic waste, could be conducted in conjunction with *National Recycling Strategy* Action B1.3 ("Conduct an environmental justice assessment of non-hazardous solid waste management infrastructure in the United States"). Tools available to support the analysis include EPA's Environmental Justice Screening and Mapping Tool, the Climate and Economic Justice Screening Tool, and the Centers for Disease Control and Prevention's Social Vulnerability Index. Such an assessment also would consult existing research and information from environmental monitoring and obtain feedback from impacted or

19 Such programs may include 1) conditions related to plastics and other materials for National Pollutant Discharge Elimination System permits, 2) requiring states to perform plastic and other material assessments to ascertain whether listings are merited for waterbodies impaired by plastics and other materials, 3) Total Maximum Daily Load development for plastics and other materials, 4) surface water quality standards for plastics and other materials, 5) drinking water standards for microplastics, 6) effluent limitation guidelines for microplastics in industrial wastewater, 7) pretreatment standards for wastewater, and 8) guidance on including plastic and other material mitigation priorities in state nonpoint source management plans.

potentially impacted communities. This assessment could also include an analysis of chemical and non-chemical stressors and cumulative impacts on community members, including people in communities already overburdened by pollution.

D2.3: Increase awareness and availability of public and private sector funding for improvements to recycling and collection programs and municipal waste management systems.

Both public and private sector funding could increase the effective collection of municipal solid waste in communities with low recycling collection rates and support improvements to solid waste management systems and programs. For example, local authorities can use available funding to improve solid waste collection bins and trucks to ensure plastics and other materials do not leak into the environment after collection. Grants, such as those provided by the SWIFR grant program authorized by the Save Our Seas 2.0 Act, can be used to support local authorities and Tribes in making improvements to municipal solid waste collection and recycling programs and infrastructure. Additionally, EPA's Environmental Justice Grants and Technical Assistance Program offers a variety of funding opportunities for projects that focus on plastic pollution reduction. This action will be implemented in coordination with Objective B2 of the *National Recycling Strategy*.

D2.4: Support the development of management practices and technologies that prevent collected waste from leaking into the environment.

Public and private funding could support the development of technologies and management practices that keep collected waste contained within waste management systems so that it does not leak into the environment. Funding for technological research could be used to develop and innovate improvements to waste containment equipment. Social and behavioral research could identify ways to design equipment that is easier to use and effectively educate communities on how to use it.

Relevant *National Recycling Strategy* (NRS) Actions for Objective D2

NRS Objective A: *Improve Markets for Recycled Commodities*

A2. Produce an analysis of different types of end markets that considers recycled material consumption, resilience, environmental benefits and other relevant factors for decision makers.

NRS Objective B: *Increase Collection and Improve Materials Management Infrastructure*

B1. Improve understanding of available recycling infrastructure and needs.

B2. Increase awareness and availability of public and private funding and incentives and effective strategies to access the funding.

B6. Increase collection of recyclable materials.

NRS Objective D: *Enhance Policies and Programs to Support Circularity*

D1. Strengthen federal coordination to support and encourage actions to improve the U.S. recycling system.

D2. Conduct an analysis of different policies that could address recycling challenges.

D5. Share best practices on policies, programs, funding opportunities and outreach through a free, publicly accessible online clearinghouse.

D2.5: Develop guidance and recommendations for efficient, cost-effective and locally appropriate waste collection techniques.

Nongovernmental and industry organizations could develop guidance and recommendations for efficient, cost-effective and locally appropriate solid waste collection techniques that encourage proper disposal of plastic waste and prevent leakage into the environment. Recommendations could pertain to bin placement, bin containment systems and bin labeling.

D2.6: Standardize measurement, increase data collection and develop a national measurement plan.

EPA, working with other relevant agencies, academia, and state, Tribal, and territorial governments, could develop standardized measurement methods, standardized definitions and additional data to improve estimates of how much waste is collected, managed, imported, exported and leaked into the environment. EPA could develop a national measurement plan for achieving the goals of this strategy, including actions on standardizing measurement and data collection. This action could be performed in conjunction with Objective E of the *National Recycling Strategy* ("Standardize Measurement and Increase Data Collection").

Relevant *National Recycling Strategy* (NRS) Actions for Objective D2, continued

NRS Objective E: *Standardize Measurement and Increase Data Collection*

E1. Develop and implement national recycling system definitions, measures, targets and performance indicators.

E2. Create a tracking and reporting plan.

E3. Create recycled content measures.

E4. Coordinate domestic and international measurement efforts.

E5. Increase data availability and transparency about recyclable materials generated and the materials manufacturers need.

D2.7: Explore the development of an accredited, voluntary third-party certification program for plastic recyclers to increase the safe and effective management of recyclable plastic in the United States.

Nongovernmental and industry organizations could develop an accredited, voluntary third-party certification program for plastic recyclers to help increase the safe and effective management of recyclable plastic in the United States. Certification programs have been successful in increasing the environmentally sound recycling and/or repair of other materials, such as used electronics. Such a certification program for plastic recyclers could address multiple aspects of recycling and ensure exports of plastic waste and scrap follow applicable domestic and international law. States, territories, Tribes and nongovernmental organizations should be engaged to inform the development of this certification program. Once a certification system is launched, the certification developer could publish tools and materials to encourage the public, businesses, states, Tribes and territories to use certified recyclers.

D2.8: Conduct analyses on the cost, effectiveness and equity of policies and programs addressing litter, illegal dumping and unintentional spillage of materials, particularly in communities with environmental justice concerns.

EPA, academia or nongovernmental organizations could examine federal, Tribal, territorial, state and local government policies and programs that address litter, illegal dumping and unintentional spillage of plastics and other materials into the environment. Such an analysis could assess the potential cost and effectiveness of these policies and programs as well as their projected effects on communities with environmental justice concerns. By clarifying the implications of various policy options, such an analysis would help decision-makers make more effective, fair and efficient policy choices to reduce litter, illegal dumping and plastics leakage into the environment.

D3. Develop a national extended producer responsibility (EPR) framework.

EPA recognizes EPR as an example of a policy approach that has been effective at achieving circularity goals, including reduction and reuse goals, in other countries at the national and subnational levels. As more states and communities consider EPR policies for managing a variety of materials, EPA can work with Tribal, territorial, state and local governments; nongovernmental organizations; and other relevant partners to develop a national EPR framework to help increase the efficiency and effectiveness of these policies. Such a framework could identify best practices and align EPR requirements, where practical. Another policy approach, deposit refund systems (DRS), commonly known as "bottle bills," have yielded high product return rates in U.S. states such as Oregon. With thoughtful policy alignment, DRS can complement EPR programs to further boost recycling rates and incentivize consumer behavior change (Laubinger et al., 2022). A national EPR framework could consider best practices for aligning DRS with EPR programs.

D4. Facilitate more effective composting of certified compostable products.

Certified compostable products can replace plastic products in some cases, making them an important tool in efforts to reduce plastic waste. However, composting programs and infrastructure are not readily available across the United States, and not all composting facilities accept or can effectively process certified compostable products. In addition, more research is needed to ensure that certified compostable plastic products do not adversely impact human health and the environment (see Action B1.3). Consumers and businesses need to be educated on how to properly source and separate certified compostable products and where they can effectively compost those products. More actions focused on supporting composting can be found in the *National Strategy for Reducing Food Loss and Waste and Recycling Organics*.

D4.1: Improve data and evaluate maps of available composting infrastructure and determine infrastructure needs, including considerations for communities with environmental justice concerns.

EPA and state, Tribal and territorial governments could examine existing data sets and available composting infrastructure to conduct a gap and needs assessment with the goal of expanding composting access. The assessment should include considerations for the needs of communities with environmental justice concerns. Several resource maps that show both opportunities and constraints in composting capabilities and capacities have been developed by public and private entities and are publicly available (GreenBlue, 2023; U.S. Composting Council, 2023). Some national data sets of composting infrastructure are also available and should be improved to facilitate better understanding of existing composting programs and infrastructure. Specifically, data sets and maps should be developed or expanded to include information about where certified compostable products are accepted.

D4.2: Continue to provide funding to improve composting capacity and infrastructure in the United States.

Both public and private sector funding are needed to establish and expand composting capacity and infrastructure. Funding should support the scaling up of existing composting infrastructure to increase capacity for processing additional feedstocks and higher volumes of organic materials. Funding opportunities should focus on providing support for disadvantaged and rural communities with an interest in developing or expanding composting. EPA's SWIFR grant program addresses composting infrastructure capacity, but additional funds are required to match community need and interest.

Relevant *National Recycling Strategy for Reducing Food Loss and Waste and Recycling* Organics Actions for Objective D4

Objective 1: *Prevent food loss*

Objective 2: *Prevent food waste*

Objective 3: *Increase the recycling rate for all organic waste*

Objective 4: *Support policies that incentivize and encourage the prevention of food loss and waste and organics recycling*

D4.3: Improve tracking of end-of-life management of certified compostable products to help identify gaps in infrastructure, outreach and education.

Academia and producers and certifiers of compostable products could improve methodologies and measurements to determine how much of the certified compostable product stream gets composted. Helpful measurements would include the amount of each material type (e.g., paper, molded fiber, plastic, a combination of materials) in the certified compostable product stream and the amount of each material type that is actually composted. Such data could support a composting infrastructure gap and needs assessment as described in Action D4.1. The data could also help to determine which material types are most compostable under various conditions and identify needs for consumer and business outreach and education.

Objective E. Improve Capture and Removal of Plastic Pollution

Interventions to capture and remove plastics and other materials, including micro/nanoplastics, from wastewater, stormwater and surface waters are needed to help address potential risks to human and ecosystem health. Such interventions are especially important given the expected increase in plastic production over the coming years. Interventions could include:

- Installing capture technologies to collect and remove plastics and other materials from stormwater, wastewater and surface waters.
- Using green infrastructure to decrease stormwater flow, which would help keep micro/nanoplastics from washing into surface waters.
- Implementing roadside and waterway manual cleanup efforts.

E1. Identify and implement policies and programs that effectively remove plastics and other materials from the environment, including waterways and the ocean.

Existing policies, programs, technical assistance opportunities and compliance assurance actions can be used more effectively and comprehensively to address plastics and other materials in the environment. New policies, programs, technical assistance opportunities and compliance assurance actions can be considered to optimize the ability of federal, Tribal, state, local and territorial governments to address the problem.

E1.1: Explore expanded use of Clean Water Act authorities related to capture and removal of plastic and other material loadings into waterways and the ocean.

Parallel to Action D2.1 (which focuses on use of Clean Water Act programs to support assessment and prevention work), EPA, in collaboration with interested partners, can comprehensively assess how existing Clean Water Act programs can be utilized more effectively and expansively to capture and remove plastics and other materials that may enter, or are already in, waterways and the ocean. Any assessment should include a baseline of current Clean Water Act program performance so that potential changes can be evaluated on how they might affect programmatic and/or environmental results. Such program initiatives may include recommendations for material capture mandates for National Pollutant Discharge Elimination System

permits and Nonpoint Source program guidance on including material capture and removal priorities in state nonpoint source management programs. EPA can also consider guidance for place-based programs (such as the National Estuary Program and EPA geographic programs) to potentially develop and fund more trash capture and removal projects. Program usage and effectiveness for capture and removal activities could be analyzed and the results implemented by program administrators to the extent practicable.

E1.2: Provide technical assistance to include new or improved reduction/removal actions and provisions in relevant management plans.

State, Tribal, territorial and local governments could incorporate provisions in their watershed, stormwater and other management plans to more effectively reduce and remove plastics and other materials. Plan developers could improve plan actions and provisions by seeking assistance from organizations with knowledge about local issues related to plastic and other material pollution, or from state, Tribal, territorial and local governments that have already included such actions and provisions in their own plans. Technical assistance for financial planning could identify funding options and incorporate investments in capture infrastructure into asset management plans. Communities already overburdened by plastic and other material pollution may need further support to incorporate effective mitigation actions into their management plans.

E2. Improve water management to increase the capture and removal of plastics and other materials from waterways, the ocean and stormwater/wastewater systems.

Even though assessment and prevention efforts are critical to effectively mitigating the plastic pollution problem, capture and removal efforts will still be necessary for the foreseeable future to address existing pollution from plastics and other materials in the environment, including in waterways and the ocean. Efforts on this front must be improved and increased, given the extent of the problem.

E2.1: Identify and address potential barriers to installing and maintaining effective capture systems.

Many "upstream" factors can change the volume and nature of plastic and other material loadings into waterways and the ocean. Therefore, projects must be designed to adapt equipment siting, capture technology type or other factors to changing conditions over a project's life. To install and maintain effective capture technologies in waterways, the ocean, and wastewater treatment and stormwater conveyance systems, decision-makers need information about various financial, technical and environmental factors. This information includes capital and operational costs, installation and maintenance needs (including operator training), device siting, hydrology, ecological impacts and other variables. Businesses, academia and nongovernmental organizations could analyze these factors to ensure that capture solutions are appropriate for local conditions. Economic, ecological, recreational, equity and other benefits from effective capture systems should be articulated and quantified where possible to help justify funding.

E2.2: Fund research, development, demonstration, deployment and maintenance of existing and new technologies and processes that capture or remove plastics and other materials in waterways, the ocean, stormwater and wastewater.

One of the most significant barriers to implementing effective capture systems is a lack of dedicated funding. The National Oceanic and Atmospheric Administration's (NOAA's) Marine Debris Removal Program, subject to the availability of appropriations, and the Marine Debris Foundation (the latter established by the Save Our Seas 2.0 Act) offer several nationwide, competitive funding opportunities for marine debris removal, prevention and research projects. Other public and private funding could support similar projects and research focused on detecting, capturing and removing plastics and other materials in stormwater, wastewater, surface waters and the ocean. Funding priorities include capital, equipment operation and maintenance costs for capture technologies. For larger plastics and other materials, increased funding could focus on especially problematic items such as derelict fishing gear, which poses an entanglement risk for aquatic life. Funding could also support research and development of technologies addressing specific important pathways through which micro/nanoplastics are released into the environment, such as microfiber capture technologies in commercial and residential washing machines and technologies to filter microplastics out of wastewater.

Objective F. Minimize Loadings and Impacts to Waterways and the Ocean

An innovative approach for measuring and monitoring plastic and other material loadings into waterways and the ocean could support the development of mitigation strategies. Baseline measurements of plastics and other materials in waterways and the ocean can be used to measure the success of mitigation efforts over time.[20]

Furthermore, research and funding are needed to measure the relative contributions of plastics and other materials into waterways and the ocean from different sources and economic sectors as well as the human health impacts of exposure to plastic pollution from waterways and the ocean (e.g., fish consumption and drinking water).

F1. Increase and improve measurement of plastic and other material loadings into waterways and the ocean to inform management interventions.

Improved information on the type, scale and location of plastic and other material pollution can help decision-makers implement more appropriate management efforts and save costs on mitigation efforts.

F1.1: Explore a potential national tracking and reporting plan that would produce estimates of the amounts, types and locations of materials that enter waterways or the ocean.

An innovative approach to measuring and monitoring plastic and other material loadings in waterways and the ocean is vital to support the development of mitigation strategies. Federal agencies that fund, support or conduct monitoring of plastics and other materials could collaborate with academia, industry and nongovernmental organizations to lead efforts to design a plan for tracking and reporting loadings of plastics (and other materials, potentially) into waterways and the ocean from both land- and sea-based sources. U.S. government agencies could coordinate with international bodies, as appropriate, to ensure that a national tracking and reporting plan produces data that are consistent with international efforts. A national tracking and reporting plan could also address monitoring micro/nanoplastic pollution, streamlining sampling and assessment methods, increasing sampling and analysis of micro/nanoplastic pollution found in inland and marine waters, and storing data. This action is consistent with IMDCC's 2024 *Recommendations and Metrics* report, which calls for coordination among federal agencies on monitoring of marine debris, among other things. The National Aeronautics and Space Administration (NASA) already has invested in fundamental research related to the remote sensing of marine debris, which is advancing understanding of how to apply this technology to identification and tracking of marine debris. NOAA also monitors marine debris on shorelines, including plastic marine debris, and tracks aggregated global data on micro/nanoplastic pollution in marine environments.

20 Such measurements could be taken near, at or below the surface of waterways and the ocean.

F1.2: Evaluate opportunities to use more precise modeling approaches to establish a baseline and measure trends for the amounts and types of plastics and other materials that escape into waterways and the ocean.

Relevant federal agencies and academia could work to establish baseline measurements of plastics and other materials in waterways and the ocean. These measurements could help show the extent of the problem and then measure the success of mitigation efforts over time. More accurate modeling approaches and higher-quality empirical data could improve existing models that estimate the amounts and types of materials that escape into waterways and the ocean. To the extent possible, models should consider sea-based sources. As appropriate, an approved national modeling approach could be incorporated into the plan for tracking and reporting plastic and other material loadings into waterways and the ocean, as described in Action F1.1.

F1.3: Disseminate information on assessment protocols and the appropriate usage of these protocols.

Many researchers, community groups, volunteers and other groups collect data on plastics and other materials in the environment as a standard part of their cleanup and capture efforts. The resulting data could inform potential future interventions. However, these groups may not be aware of the most appropriate assessment protocol to use, given their time constraints and specific goals. EPA and its partners could inform groups about available assessment protocols, including when and how to use each protocol.

F2. Increase and coordinate research on methods to determine micro/nanoplastic prevalence, impacts and mitigation.

Despite the abundance of research on micro/nanoplastics, there is still much to be learned about them. Further research could provide information about methods for finding and identifying micro/nanoplastics and determining whether micro-sized particles are plastic. Other studies could examine the prevalence of micro/nanoplastics in different locations around the country, their potential impacts on human health and other forms of life, and the most effective ways of addressing micro/nanoplastic pollution.

F2.1: Develop government-wide definitions for micro/nanoplastics and standardized methods for the collection, extraction, quantification and characterization of micro/nanoplastics.

Many entities define microplastics as plastic particles over 1 nanometer but under 5 millimeters long in any dimension, and nanoplastics as particles under 1 nanometer long in any dimension. However, these are not universally accepted definitions. Government agencies should work together to come up with uniform definitions and disseminate that information to state agencies, researchers and other interested parties. This should include modifying as needed and finalizing the proposed definition of "microfiber" from the 2024 *Report on Microfiber Pollution*.[21] Relevant parties could also work together to develop and validate fit-for-purpose, standardized methods for collecting, extracting, quantifying and characterizing micro/nanoplastic pollution in waterways, both in the water column and in sediment, and in various media (e.g., drinking water, surface water, indoor/outdoor air, soil, biota). Researchers should use established EPA guidelines for quality assurance/quality control, sample representation and repeatability to help address high error rates and uncertainties associated with using small sample volumes to quantify micro/nanoplastics.

F2.2: Design micro/nanoplastic research and monitoring plans to address relevant management questions.

Prior to conducting research, it is important to establish suitable management goals and long-term monitoring methods. Researchers from federal and state agencies, industry, and academia could conduct evaluations of appropriate environmental monitoring methods and laboratory capability to conduct micro/nanoplastic monitoring. Such evaluations should consider methods for sample collection, preparation, analysis and reporting, as well as data interpretation appropriate for the specific matrix of interest (e.g., sediment, water, etc.). Chosen methods need to be feasible for laboratories to conduct. The chosen methods also should control quality, eliminate sources of contamination, yield repeatable results and enable practical long-term monitoring.

F2.3: Prioritize research on the potential human health and environmental impacts and mitigation of micro/nanoplastic pollution.

Micro/nanoplastics have been found in the human body, but not enough is known about how they may affect human health. For example, some studies have raised concerns about endocrine-disrupting effects from chemicals that leach out of plastic products and about whether some plastic polymers can cross the blood-brain barrier. Other concerns include potential threats to food safety as nanoplastics enter food production throughout supply chains. Academia, relevant federal agencies and other relevant parties could conduct research to determine if nanoplastics in food pose potential human health impacts. Further research and funding are needed to study the potential human health impacts of exposure to micro/nanoplastic pollution and associated additives. Studies that assess impacts on susceptible human life stages and communities with environmental justice concerns could address knowledge gaps on health hazards and help identify potential solutions.

21 Page 16 of the *Report on Microfiber Pollution* gives a proposed definition for microfibers as "Solid, polymeric, fibrous materials that include plastic and non-plastic fibers less than 5 millimeters in all dimensions."

Researchers from academia, federal agencies and nongovernmental organizations could continue to prioritize research on the environmental impacts of micro/nanoplastic pollution. For remediation, control efforts should consider important micro/nanoplastic sources such as tires, cigarette butts, paint, synthetic turf and textiles. Mitigation efforts should also focus on important micro/nanoplastic pathways that can be reasonably addressed, such as stormwater, wastewater and agriculture.

F2.4: Conduct research and disseminate information on the sources, pathways, fate and concentrations of micro/nanoplastic pollution.

Academia and relevant federal agencies could research and disseminate information about the contributions of major sources and pathways that release micro/nanoplastics into waterways and the ocean, such as those sources and pathways listed in Action F2.3. They also could examine factors affecting the decomposition of macroplastics into micro/nanoplastics and the aggregation of micro/nanoplastics with each other and with natural particles. Funding and research can prioritize addressing data gaps. Public sharing of data can further advance research on this issue.

F2.5: Support the development of management practices and technologies to prevent micro/nanoplastics (including microfibers) from getting into waterways and the ocean.

Public-private partnerships can support the development of best management practices and technologies to prevent micro/nanoplastics from getting into waterways and the ocean. For example, such partnerships could develop a standard test method for capturing micro/nanoplastics to help determine the effectiveness of relevant technologies. The federal government is already contributing to these efforts through the *Report on Microfiber Pollution*. The report, which was mandated by the Save Our Seas 2.0 Act, includes a 5-year federal plan with actions that identify management practices the federal government should research, fund or promote to address microfiber pollution.

F3. Increase and coordinate research on macroplastic transport, degradation and impacts in waterways and the ocean.

Similar to micro/nanoplastics, more research on macroplastics is needed to develop and prioritize interventions. More information is needed to fully understand how macroplastics move and degrade within waterways and the ocean and how they impact aquatic life.

F3.1: Increase and analyze research on processes influencing macroplastic transport to and in water.

Academia and relevant federal agencies could increase and analyze research on processes that transport macroplastics to, and move them within, waterways and the ocean. Such research would need to gather or consider existing data to assess macroplastic movement over time and space. Regional ocean transportation models and NASA satellite data may help identify transport pathways. A better understanding of such processes could help develop and prioritize effective interventions to prevent ocean plastic pollution.

F3.2: Prioritize research on the rate at which macroplastics degrade in waterways and the ocean.

Researchers could study how various environmental and physical conditions, including pH, temperature, biologic activity, sunlight exposure and pressure, affect the rate at which different plastic polymers degrade in waterways and the ocean. This research can inform potential material improvements and other possible mitigation measures. More research and wider dissemination of data in this area can help improve understanding of how plastic degradation may contribute to greenhouse gas emissions and ocean acidification, as well as when and where degradation into micro/nanoplastics will occur.

F3.3: Increase research on how larger plastic fragments affect aquatic organisms, including residence time, digestive degradation and excretion rates.

While understanding the impacts of micro/nanoplastic ingestion on aquatic life is critical, it is also important to better comprehend how marine and freshwater biota are impacted by the ingestion of plastic fragments that are larger than microplastics. Researchers could study residence time, digestive degradation and excretion rates of larger plastic fragments in a wide variety of species, and then widely disseminate the research results.

Next Steps: Implementing the Actions Identified as Opportunities

Implementation of this strategy is expected to be an iterative process as resources, entities leading efforts, and needs change over time. EPA is already implementing actions within this strategy in collaboration with academia; industry; nongovernmental organizations; federal agencies; and Tribal, state, local and territorial governments. For example:

- EPA selected states, territories, Tribes and communities to receive over $160 million to support solid waste infrastructure through the SWIFR grant program in 2023.
- EPA selected recipients for over $33 million in 2023 through the Recycling Education and Outreach (REO) grant program to projects that inform the public about residential or community recycling programs, provide information about the recycled materials accepted through these programs, and/or increase collection rates and decrease contamination in the programs.
- EPA continues to implement the 2021 Memorandum of Understanding with the Mississippi River Cities and Towns Initiative to collaborate on plastic waste source reduction, litter prevention and solid waste infrastructure improvements and to assist underserved communities with solid waste concerns along the Mississippi River.
- EPA continues to develop and finalize several reports on plastic pollution as directed by the Save Our Seas 2.0 Act, including reports focused on identifying innovative uses of plastic waste, eliminating barriers to plastics recycling, identifying economic incentives to develop new end-use markets for recycled plastics, and minimizing the creation of new plastic waste.
- EPA's Trash Free Waters Program will strengthen its existing emphasis on preventing trash from entering the environment, removing trash in and around waterways, and disseminating research findings. Furthermore, the program will expand its project work mitigating loadings of plastics and other materials to waterways in specific locations, with special emphasis on EPA-designated place-based programs (such as the National Estuary Program and the Urban Waters Program) and on areas with high litter densities.

EPA is also administering and enforcing many regulations that address pollution across the lifecycle of plastics. Examples of regulatory activities aligned with the objectives of this strategy are provided below.

- EPA sets enforceable wastewater standards for industry and has developed national water quality criteria recommendations for pollutants in surface waters. In 2024, EPA finalized new requirements for facilities to develop and submit response plans for worst-case discharges of hazardous substances under the Clean Water Act, including many chemicals used in plastic manufacturing (Clean Water Act Hazardous Substance Facility Response Plans, 2024).

- EPA finalized rules in 2024 to reduce emissions of toxic air pollutants including ethylene oxide and chloroprene, which will result in significant reductions in harmful air pollution in local communities near plastic production facilities, including communities with environmental justice concerns.
- EPA finalized rules in 2023 to sharply reduce emissions of methane and other harmful air pollution from oil and natural gas operations.
- EPA conducts risk evaluations of chemicals under the Toxic Substances Control Act. Currently, the Agency is reviewing a number of chemicals (in both the prioritization and risk evaluation processes) that are used in plastic manufacturing, including vinyl chloride, seven phthalate chemicals, 1,3 butadiene and several flame retardants used in plastics (U.S. EPA, 2023b).
- EPA includes upstream pollution associated with plastic manufacturing in reporting requirements under its Toxics Release Inventory Program. This enables the Agency to track progress in eliminating or reducing specific chemicals used in plastic manufacturing.
- EPA's Risk Management Program rule sets requirements to protect vulnerable communities from chemical accidents, especially those living near facilities in industry sectors with high accident rates, including certain plastic manufacturing facilities (Clean Air Act Part 68—Chemical Accident Prevention Provisions, 1994). In the spring of 2024, EPA finalized the Safer Communities by Chemical Accident Prevention rule.[22]

EPA also intends to engage interested parties as it leads implementation of specific actions in the strategy, and the Agency will continue to pursue regulatory approaches to environmental challenges associated with plastic use where needed and as appropriate. EPA will provide periodic updates about the projects implemented under this strategy. In doing so, EPA will engage with the Interagency Policy Committee on Plastic Pollution and a Circular Economy, co-chaired by the White House Council on Environmental Quality and the Domestic Climate Policy Office, to consider implementation of the voluntary and regulatory opportunities for federal action identified in the report *Mobilizing Federal Action on Plastic Pollution: Progress, Principles, and Priorities*. By coordinating with the Interagency Policy Committee on Plastic Pollution and a Circular Economy, EPA will help ensure alignment among the actions outlined in both documents. EPA also intends to develop and finalize additional strategies to complete the series on building a circular economy for all, including a strategy to address textiles.

22 On February 27, 2024, EPA Administrator Michael S. Regan signed the Safer Communities by Chemical Accident Prevention rule, which finalizes revisions to the Risk Management Program to further protect vulnerable communities from chemical accidents, especially those living near facilities in industry sectors with high accident rates.

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Appendix: Summary of Public Outreach, Comments and EPA Response

EPA undertook several public engagement and outreach activities to inform the development of this strategy. In August 2021, EPA engaged with Tribes at the 2021 Tribal Land and Environment Forum to obtain initial ideas. EPA then held several additional engagement meetings in November 2021 and received input from the following organizations:

- **State, Tribal and local agencies.** The Association of State and Territorial Solid Waste Management Officials (ASTSWMO), the Eastern Band of Cherokee Indians, the Environmental Council of the States (ECOS), the Mississippi River Cities and Towns Initiative, the St. Louis Civil Rights Enforcement Agency, the National Tribal Caucus, the Santee Sioux Nation, the Nez Perce Tribe, the Sac and Fox Nation of Missouri, the Tribal Waste and Response Steering Committee, and the U.S. Conference of Mayors.
- **Nonprofit organizations/nongovernmental organizations.** Beyond Plastics, the Center for Biological Diversity, the Ellen MacArthur Foundation, Five Gyres, Keep America Beautiful, the Manufacturing Communities Collaborative, the Ocean Conservancy, the Pew Charitable Trusts, the National Environmental Justice Advisory Council, and the U.S. Plastics Pact.
- **Private sector/industry.** AMERIPEN, the American Chemistry Council, Closed Loop Partners, Patagonia, and the Sustainable Packaging Coalition.
- **Academia.** Duke University; Iowa State University; the Sea Education Association; the University of California, Davis; the University of Cincinnati; the University of Georgia; and the University of Massachusetts Lowell.

Throughout the development of the strategy, EPA coordinated with the following **federal agencies**:

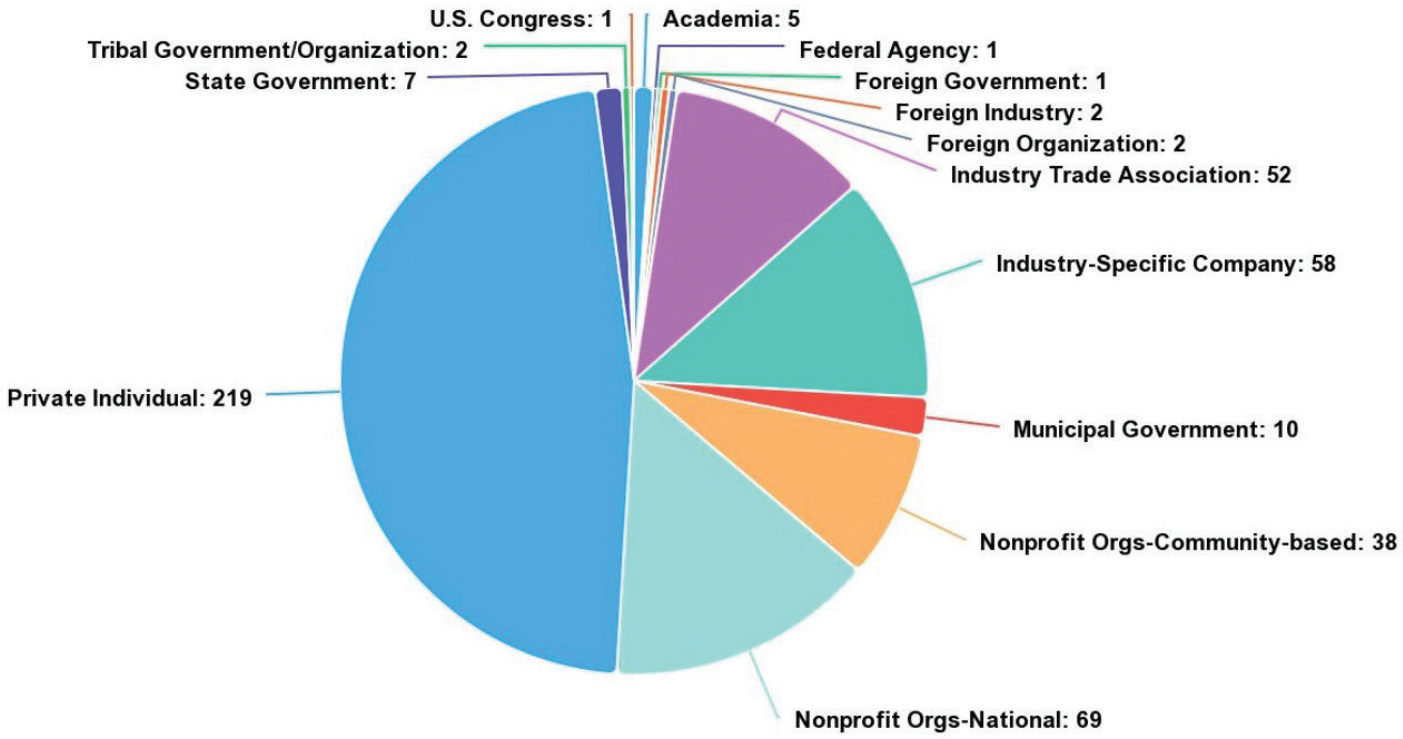
- Federal Trade Commission
- National Aeronautics and Space Administration
- National Science Foundation
- Office of the U.S. Trade Representative
- U.S. Agency for International Development
- U.S. Department of Agriculture
- U.S. Department of Commerce (including the International Trade Administration; the National Oceanic and Atmospheric Administration, and the National Institute of Standards and Technology)
- U.S. Department of Defense
- U.S. Department of Energy
- U.S. General Services Administration
- U.S. Department of Health and Human Services (including the Food and Drug Administration)
- U.S. Department of the Interior (including the National Park Service)
- U.S. Department of State
- U.S. Department of Treasury

Between November 2021 and July 2022, EPA hosted virtual meetings across the country to inform the development of new grant programs established and funded by the Infrastructure Investment and Jobs Act, which further informed the development of this strategy.

EPA sought input from the public on the draft *National Strategy to Prevent Plastic Pollution* through a federal docket (EPA-HQ-OLEM-2023-0228) during a 90-day public comment period in April 2023. Outreach also included a publicly accessible, recorded webinar providing an overview of the draft strategy in May 2023. EPA received almost 92,000 comment letters from federal, Tribal, territorial, state and local governments; industry and trade organizations; community and national nongovernmental organizations (NGOs); academia and private individuals. Among the letters were six form letters received from the following organizations: Environment America, Environmental Action and PIRG (42,376 duplicates); anonymous organizations (35,979 duplicates); Oceana (7,841 duplicates); Earthday.org (4,110 duplicates); Catholic Climate Covenant (651 duplicates); and Break Free from Plastic (117 duplicates). EPA met with form letter writers who expressed interest in discussing their comments in more detail.

Multiple government organizations provided input. Sixty-six members of Congress signed a letter from the Office of Congressman Lloyd Doggett (Texas). Fifteen state attorney generals signed a letter prepared by the Louisiana Department of Justice and 13 state attorney generals signed a letter prepared by the California Department of Justice. State environmental offices from New York, New Jersey, Oregon and Washington submitted additional letters. EPA received more than 450 unique comments, as follows:

Count of Unique Comments by Commenter Type



Generally, commenters supported the National Strategy to Prevent Plastic Pollution. Other common points of agreement among commenters included:

- There is concern that plastic pollution negatively impacts the environment and potentially human health.
- More information is needed to understand the movement and impacts of micro/nanoplastics in the environment.
- The United States should ratify the Basel Convention to ensure that global norms are employed to prevent the mismanagement of waste,
- More funding is needed for research and improved materials management infrastructure.
- EPA should consider creating guidelines for EPR and DRS policies.
- Reuse should be strongly employed as one of the solutions to plastic pollution.

Common points of disagreement among commenters included:

- The role of chemical and thermal processing in reducing plastic waste.
- Which plastics should be targeted for reduction.
- The role of plastic alternatives in reducing plastic pollution (including biodegradables and biobased plastics).
- Whether strategy actions should be mandatory versus voluntary.
- Whether actions should include production caps.
- Whether EPA has authorities under existing law to take certain actions.

EPA also followed up on comments submitted by U.S. states at a meeting with state officials in January 2024. EPA sought local government feedback through members of its Local Government Advisory Committee.

Responses to the Key Questions

EPA asked commenters eight key questions during the comment period. Summaries of responses to these questions are provided here.

Q1: Which actions are the most important and would have the greatest positive impact at the local, regional, national and global levels?

More than 54,000 commenters identified actions that would create the largest positive impact at the local, regional, national and global levels. Commenters expressed general support for the three overarching objectives and identified the following actions as priorities:[23]

- Action A1: Reduce the production and consumption of single use, unrecyclable or frequently littered plastic products.
- Action A1.1: Identify single use, unrecyclable or frequently littered plastic products and identify alternative materials, products or systems with fewer impacts on the environment.
- Action A1.4: Identify effective policy tools and approaches to reduce production of single use, unrecyclable or frequently littered plastic products.
- Action A2.1: Increase the availability of data on plastic products produced and perform life cycle assessments to better understand the health, environmental, social and economic impacts of plastic products and their alternatives.
- Action A2.2: Review, develop, update, and use sustainability standards, ecolabels, certifications, and design guidelines that decrease the environmental impacts of plastic products across their lifecycle.
- Action A2.3: Review and improve government purchasing criteria to reduce lifecycle environmental impacts from plastic products in government purchasing.
- Action A2.5: Map existing and proposed plastic production facilities, as well as evaluate their environmental justice and public health impacts on neighboring communities.
- Action B2.1: Provide funding to communities to create and implement plans to facilitate reuse that have a greater need for support.
- Action B4: Increase solid waste collection and ensure that solid waste management does not adversely impact communities, including those overburdened by pollution.
- Action B4.2: Fund research, development, demonstration and deployment of technologies and processes that ensure that collected waste enters and stays in the waste management system.
- Action B6: Explore ratification of the Basel Convention and encourage environmentally sound management of scrap and recyclables traded with other countries.

23 The objective and action titles referred to here are those used in the draft strategy. These actions are not in order of priority.

Q1a: Which actions can best protect human health and environmental quality?

Nearly 8,000 commenters identified actions or expressed concerns about how to best protect human health and environmental quality. Commenters identified toxic chemicals or additives in plastic production and single use plastic products as the main threats to human health and/or environmental quality. They suggested the following actions to address these concerns:

- Address health concerns by targeting polymers with the greatest health risks.
- Reduce the overall production of single use plastics.
- Transition from single use to reuse systems.
- Use policies or regulations to tax, ban or eliminate single use plastics.

Commenters also emphasized the need to prevent microplastics from entering waterways to protect human health and identified the following actions to do so:

- Include monitoring and various methods of prevention or removal of microplastics from waterways, such as filtration improvements at recycling facilities and the use of solid waste trapping systems.
- Provide additional funding to educate municipalities and the public about microplastic pollution, circular economy, reuse and recycling.
- Fund research and encourage technological advances.

Q1b: Which actions are most important to address environmental justice and climate impacts?

Nearly 200 commenters identified actions they considered the most important to address environmental justice and climate impacts. Half of these commenters were concerned about production, noting the negative impacts on overburdened communities and specifically requesting a reduction in plastic production. Commenters prioritized the following actions to address environmental justice and climate impacts:

- Action A2.4: Conduct evaluations to ensure that production facilities within the plastic sector are in compliance with applicable federal, state, Tribal and local regulatory requirements.
- Action A2.5: Map existing and proposed plastic production facilities, as well as evaluate their environmental justice and public health impacts on neighboring communities.
- Action A2.6: Develop methods to measure reductions in greenhouse gas emissions from the lifecycle of plastic products and alternative materials as part of meeting global, national and state greenhouse gas emissions goals.
- Action B4: Increase solid waste collection and ensure that solid waste management does not adversely impact communities, including those overburdened by pollution.

- Action B4.4: Perform an environmental justice assessment for non-hazardous solid waste management facilities, including recycling facilities, incinerators, landfills and chemical recycling facilities, and for other emerging or novel processes.
- Action B4.5: Assess the social costs of plastic waste (including litter cleanup) and how those costs could be reduced via reduction/prevention solutions.

Q1c: Which actions are the most important and would have the greatest positive impact at the local, regional, national and global levels?

More than 50,000 commenters identified key steps and milestones to successfully implement the actions in the draft strategy. Overall, commenters identified actions to develop regulations, conduct research and collaborate with partners, including:

- Ratify the Basel Convention.
- Regulate and enforce standards to manage plastics, focusing on microplastics, surface or drinking water limits, regulating plastic as a pollutant and EPR. Ensure that EPA has the authority to enforce standards.
- Provide guidelines and standards for chemical additives, contamination levels and emission levels in plastic production and end-of-life management.
- Use a data-driven approach to quantify and identify significant contributors to plastic pollution and set clear reduction goals and timelines.
- Fund research to develop innovative technologies, including less harmful and more sustainable alternatives. Capitalize on existing research and experts.
- Fund reuse systems.
- Build a collaborative network of interested parties to implement the strategy.

Q2: What are the most important roles and/or actions for federal agencies to lead?

More than 130 commenters noted important roles federal agencies should hold, as well as actions they should lead. Overall, commenters requested clear standardization of actions, messaging, methodology and guidance across the federal government. Most comments were directed toward EPA, but commenters also identified roles and actions for other federal agencies, including the Department of Defense, the Department of Energy, the Department of the Interior, the National Oceanic and Atmospheric Administration, and the Department of Agriculture. Recommended actions include:

- Develop and enforce consistent regulations and policies to reduce plastic production and corresponding impacts along the plastics lifecycle, including EPR; reuse and refill; and policies to address chemical and thermal processing of plastic waste, microplastics and microfibers. Commenters emphasized that voluntary actions are not effective.

- Ensure a consistent nationwide approach to improve compliance with existing and new regulations to reduce pollutants and emissions from the plastics lifecycle. Prioritize national approaches, rather than trying to harmonize state and local policies retroactively.
- Provide financial incentives for manufacturers to use alternative materials and reduce plastic waste. Impose financial consequences on manufacturers that produce plastic waste.
- Provide funding for research and program implementation at the state and local levels, including support for overburdened communities. EPA should lead federal agencies by eliminating waste and reducing single use, unrecyclable or frequently littered plastic products from its offices, programs and activities.

Q3: Is your organization willing to lead an action or collaborate with others to implement the actions?

More than 200 commenters are willing to lead or collaborate on all objectives and most proposed actions. Commenters offered expertise or experience in multiple areas, including education and outreach, plastics recycling technology and better product and packaging design. Commenters proposed activities such as sharing reports or developing databases to facilitate reducing plastic waste.

Q3a: What factors would your organization consider when determining whether to lead an action?

Commenters mentioned they would consider the following factors when determining whether to lead an action:

- Funding.
- Receiving clear expectations from EPA.
- Whether there are clearly defined roles, targets and action steps.
- Policy approaches or regulations that might hamper or shape their engagement.
- Their own capacity.
- The overall value they could add.

Q4: What are potential unintended consequences of the proposed actions that could impact communities considered overburdened or vulnerable, such as shifts in production or management methods?

About 75 commenters expressed concern that regulations decreasing access to single use plastic packaging could result in negative consequences. Potential unintended consequences included:

- Job losses due to production shifts.
- Reduced access to fresh food for overburdened communities.
- Ability of alternatives to meet the requirements of specialized food and medical packaging.

- Additional greenhouse gas emissions and other pollution affecting the health of overburdened communities.

Commenters also identified potential unintended consequences of regulations, bans and the transition from single use plastics, including potential conflict with state and local laws; manufacturing moving to other countries; and potentially limiting materials and products for emergency services, disaster recovery or other vital public services in overburdened or vulnerable communities.

Q5: What key metrics and indicators should EPA use to measure progress in reducing plastic and other waste in waterways and the ocean?

More than 50 commenters identified metrics or indicators EPA could use to measure progress in reducing plastic and other waste in waterways and the ocean. Commenters called for a standardized approach for data comparison and tracking and emphasized the need to establish a baseline to measure progress. Commenters identified specific metrics and analyses, including:

- Reducing plastic volume, specifically reducing demand for virgin plastic.
- Conducting LCAs.
- Assessing polymer and fragment size and type.
- Measuring community health concerns associated with plastic production.

Q6: What criteria should processes other than mechanical recycling meet to be considered "recycling activities" (e.g., "plastics-to-plastics outputs are 'recycling' if the output is a product that could again be recycled into another product or to the extent that it can achieve viable feedstock for new plastic materials")?

More than 50,000 commenters offered criteria for processes other than mechanical recycling to be considered "recycling activities," and many requested a definition of "recycling activities." Commenters communicated concerns about thermal and chemical processing of plastic waste (also known as chemical recycling), including pyrolysis and gasification, being considered as recycling activities: they cited toxic emissions as the primary reason to exclude these processes. Commenters also referred to additional criteria, including quality retention and the need to outperform virgin materials, as well as economic conditions, such as market viability of recycling activities. Some commenters supported chemical and thermal processing of plastic waste and felt it should be considered recycling when it yields plastics-to-plastics outputs. Some commenters asked EPA to consider plastics-to-fuel as a form of recycling. Commenters had conflicting views on what criteria processes must meet to be considered "recycling activities." Some commenters generally felt that processes should be considered recycling when they yield plastic-to-plastic outputs. To a lesser extent, some commenters also requested EPA consider plastics-to-fuel as a form of recycling. Other commenters stated that processes should not be considered recycling if they produce toxic emissions, and if resulting outputs lack quality retention, market viability or the ability to outperform virgin materials.

Q6a: How should health and environmental impacts be considered in these criteria?

More than 50 commenters provided suggestions on how health and environmental impacts should be considered in these criteria. Commenters stressed that recycling plastics must have a zero or net positive impact on the environment. One commenter stated that EPA should consider more specific criteria for measuring environmental impacts, such as lower contribution to air, water and hazardous waste pollution and decreasing water usage.

Q7: Are there other actions that should be included in the strategy?

More than 70 commenters suggested actions that could be added to the strategy. Those actions included:

- Prioritize upstream plastics management.
- Include post-consumer management strategies.
- Include deposit refund and reuse systems at local, state and national levels.
- Prioritize EPR policies at local, state and national levels.
- Use economic incentives across the lifecycle of plastics to help decrease the amount of plastic entering the environment.
- Consider sustainable alternatives to plastic products, such as biodegradable polymers.
- Perform environmental justice and human health assessments to measure and reduce the impacts on overburdened communities.
- Focus actions on cooperation and education-related initiatives, including setting up working groups and leveraging K–12 and higher education to educate the workforce on plastics.

Q7a: Should EPA expand the scope of the strategy to include sea-based sources?

More than 30 commenters supported expanding the strategy to include sea-based sources. Commenters recommended that EPA collaborate with NOAA and tap its expertise as a means to expand the strategy. Commenters want to expand the strategy to reduce entanglement from lost or discarded fishing gear and microplastics debris. Commenters cited the importance of international involvement and regulation of marine plastics pollution to address sea-based sources. Several commenters emphasized that although sea-based sources of plastics pollution are important, other plastics sources should be prioritized.

Q7b: Should specific types of plastic products be targeted for reduction or reuse in this strategy?

About 60 commenters identified which types of plastic products should be targeted for reduction or reuse. Commenters suggested focusing on single use plastic products and packaging, food ware and beverage containers, and specific plastic types and additives. Some proposals advocated banning toxic chemicals in plastics and reducing plastics with no recycling market. Other commenters noted sector-specific plastics to target for reduction, including chemical containers, synthetic turf, water filters and the textile industry. Other commenters cautioned that plastics are a

crucial part to society, and that plastics should not be banned or reduced without a coordinated plan to increase recycling infrastructure. Furthermore, some commenters wanted the strategy to include actions on recycling or requested that EPA address all single use materials instead of focusing on plastics.

Q8: Do you have any additional information or recommendations for EPA regarding these or other proposed actions in the draft strategy?

More than 40,000 commenters provided additional information or recommendations for EPA about these or other proposed actions in the strategy. Commenters recommended that EPA develop a more ambitious and comprehensive plan for battling the plastics crisis and to include mandatory actions. Commenters stressed the need to incorporate science-based approaches when making decisions about plastics regulations and encouraged incentivizing innovation to find solutions. Commenters called for more explicit strategies to decrease plastic production. Some commenters supported a whole government approach, coordinating between research, funding and regulatory agencies—with input from environmental justice communities.

How EPA Addressed Comments

EPA received public comment requests that strategy objectives reflect the lifecycle of plastic products, and that they reflect the calls for action in NASEM's 2022 report *Reckoning with the U.S. Role in Global Ocean Plastic Waste* (which was also mandated by the Save Our Seas 2.0 Act). EPA reviewed the report and changed the objectives in the strategy to reflect the lifecycle stages identified in the report, and further considered the report's U.S. plan of action and federal leadership when finalizing the actions in the strategy. The White House's report *Mobilizing Federal Action on Plastic Pollution: Progress, Principles, and Priorities*, released in July 2024, was also informed by NASEM's report; the use of the same organizational system will allow for a harmonized federal approach.

Many commenters were concerned about the lack of regulatory action mentioned in the strategy and wondered whether this issue is a priority for the Agency. EPA is taking appropriate measures to address this issue within its authority and budget. To complement the *National Strategy to Prevent Plastic Pollution*, EPA may also work on regulatory efforts that address plastic pollution where appropriate and as needed. EPA does not typically announce these efforts through strategies and did not include those efforts within this strategy.

Some commenters asked EPA for stronger actions to reduce exposure to pollution in communities near plastic production facilities. In addition to several existing actions that address environmental justice, EPA added or strengthened actions to address pollution from fossil fuel extraction, petrochemical and plastic production facilities and to incentivize sustainable and less toxic alternatives to plastics.

Changes were also made to clarify that the strategy contains voluntary and regulatory actions meant for both U.S. public and private partners. The *National Strategy to Prevent Plastic Pollution* frames the actions necessary to prevent plastic pollution, including actions that EPA and other federal agencies can implement. However, EPA envisions that the strategy's actions are not for the federal

government alone, but for entities across the value chain. Collaboration among industry, national and community-based nonprofit organizations, government agencies (e.g., federal, Tribal, state, local and territorial), and private individuals can achieve the strategy's goals to create a more circular economy and prevent plastic pollution.

Some public comment letters requested more actions on recycling in the *National Strategy to Prevent Plastic Pollution*. Such actions are already covered in EPA's 2021 *National Recycling Strategy*, which focuses on enhancing and advancing the national municipal solid waste recycling system and identifies strategic objectives and actions to create a stronger, more resilient, cost-effective domestic municipal solid waste recycling system. The *National Recycling Strategy* is linked to the *National Strategy to Prevent Plastic Pollution* under EPA's Series on Building a Circular Economy for All. To clarify the relationship between the two strategies, text boxes were added to show where certain National Recycling Strategy actions fit in the *National Strategy to Prevent Plastic Pollution*.

EPA considered the comments supporting and opposing chemical and thermal processing of plastic waste. As mentioned in the strategy's introduction, EPA does not consider any process that converts plastic waste into fuel or fuel components to be recycling.[24] EPA also aims to ensure that a U.S. circular economy approach for all products, including plastic products, reduces greenhouse gas emissions and protects overburdened communities from increases in the generation of hazardous waste and other forms of pollution. EPA intends to prioritize its resources on approaches that have the highest potential for reducing impacts to the environment and human health and approaches that generally receive less economic support, such as reduction, reuse and mechanical recycling.

Many commenters stated that the strategy should include sea-based sources of plastic pollution. The scope of the final strategy includes sea-based sources. However, new actions specific to addressing sea-based sources are not needed because existing actions in the draft strategy already apply to addressing sea-based sources of plastic pollution.

Many commenters were concerned that EPA may decide to ban or cap plastic production. The strategy does not propose actions to ban or cap plastic production. Many plastics are important for medical and safety purposes. Additionally, many durable plastics are not the main source of plastic pollution. Instead, strategy actions aim to identify and reduce the production and consumption of single use plastic products that are often found in the environment.

There were many concerns that compostable products and other alternative materials might have more environmental and human health impacts than conventional single use plastic products. In response to these concerns, the final strategy includes an action to build upon existing research on the human health and environmental impacts of certified compostable products across their lifecycles. In addition, the action pertaining to a proposed innovation prize on plastic alternatives has been changed to an innovation prize to develop alternative materials, products or systems to avoid

24 EPA is aware of concerns about the potential health and environmental risks posed by impurities that may be present in fuels generated from the thermal and chemical treatment of plastic waste. In June 2023, EPA issued proposed rules under the Toxic Substances Control Act for 18 chemicals made from plastic waste-derived feedstocks that would ensure they are free from unsafe contaminants before they can be used to make transportation fuels. The proposed Significant New Use Rules would require notification to and review by EPA before these fuels could be made using plastic waste-derived feedstocks that contain impurities.

plastic pollution. Note that actions to encourage composting are not targeted at increasing the use of compostable plastics, but rather meant to ensure the sound composting of any compostable products, including fiber-based products, that people elect to use in the place of single use plastics. It is important that all products being used and disposed of in the United States are managed in an environmentally sound manner.

EPA, along with many commenters, agrees that the Basel Convention is very important, so it remains an action in the *National Strategy to Prevent Plastic Pollution*. Recognizing that ratifying the convention requires Congressional action, EPA ensured the actions in this strategy and in the National Recycling Strategy are intended to support work under the Basel Convention.

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