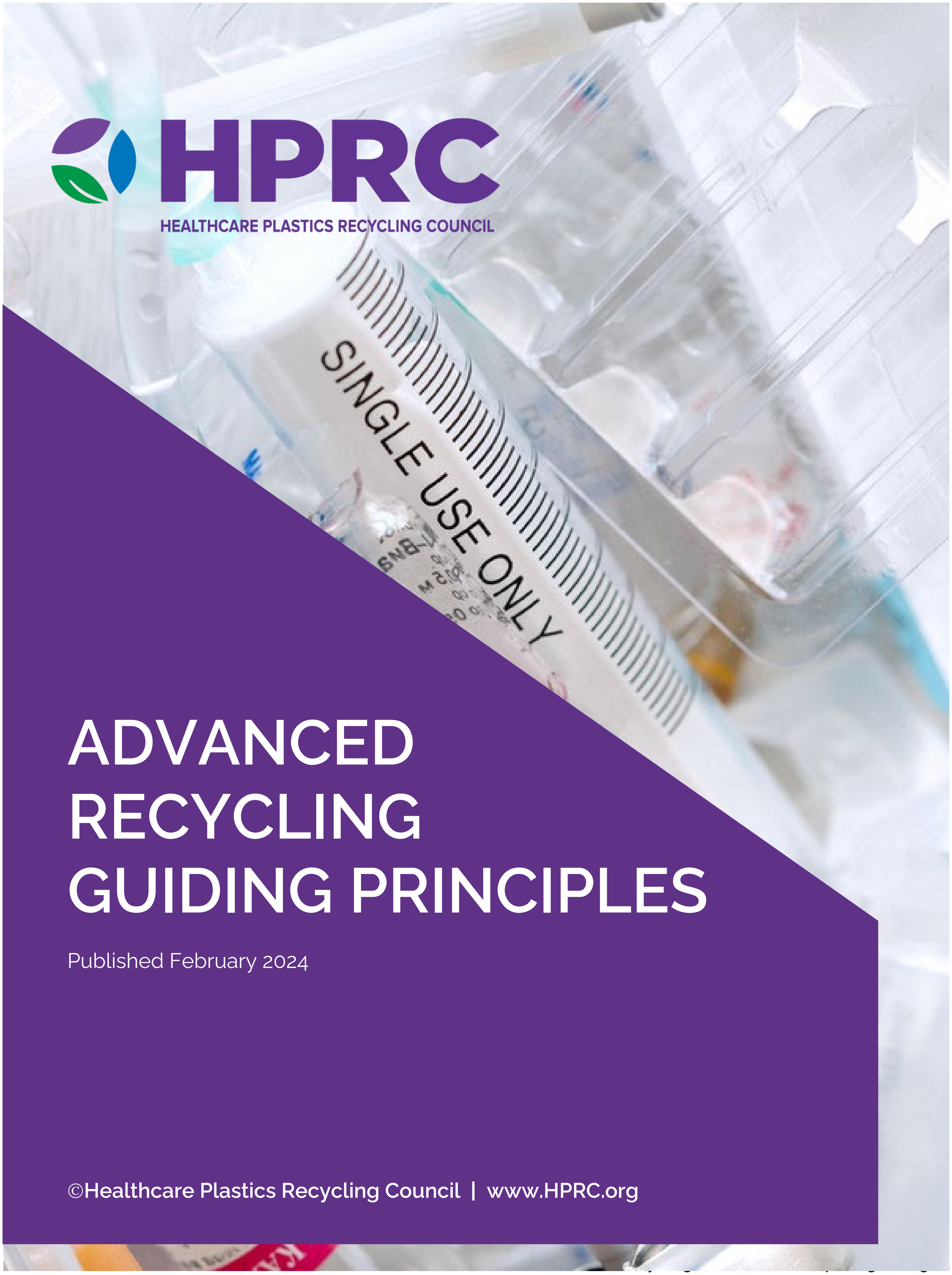

HPRC

HEALTHCARE PLASTICS RECYCLING COUNCIL

ADVANCED RECYCLING GUIDING PRINCIPLES

Published February 2024

Contents

Introduction

The modern healthcare industry heavily relies on the use of plastic, a versatile material that has evolved alongside the dynamic nature of healthcare. Plastic brings numerous advantages such as sterility, quality, durability, and, most importantly, the safety of patients, their families, and healthcare workers. However, the benefits of plastic are juxtaposed with unintended environmental consequences, particularly the proliferation of waste. In 2020, the global healthcare sector produced over 32 billion pounds of plastic, a figure projected to rise to 48 billion pounds by 2025[1]. A significant portion of this plastic waste ends up in landfills or incinerated, despite much of it being uncontaminated and recyclable.

The Healthcare Plastics Recycling Council (HPRC) is a private consortium comprising industry leaders from manufacturing, healthcare, and recycling sectors with a shared vision that all healthcare plastics are safely and effectively recycled and widely accepted as a valuable resource that supports a circular economy. Founded in 2010, HPRC is comprised of globally recognized members collaborating across the value chain and engaging in pioneering projects to inspire and enable the healthcare community to implement viable, safe, cost-effective, and circularity-advancing recycling solutions for plastics used in the delivery of healthcare.

While HPRC's project work has demonstrated the efficacy of traditional mechanical recycling processes for many healthcare plastic waste streams, these methods have limitations, particularly in processing multi-laminate plastics and supporting circular solutions. Mechanical recycling of multi-laminate plastics falls short of replicating the performance characteristics of virgin plastics[2] and lacks the traceability required for recycled content in healthcare products and sterile barrier packaging. Faced with these limitations, HPRC embarked on project work exploring advanced recycling technologies (also known as chemical recycling or molecular recycling) to determine if multi-laminate plastic waste common in healthcare settings and mixed healthcare plastics would be suitable feedstocks and could support a circular plastics supply chain for the healthcare industry.

Our work since 2020 has consisted of extensive research and interviews with advanced recycling companies to evaluate various advanced recycling technologies and their applicability to healthcare plastics waste streams; partnering with select advanced recyclers to process and test a simulated waste stream consisting of post-industrial scrap healthcare packaging materials; and expanding this effort by processing healthcare packaging materials collected directly from hospitals. Detailed results and insights are available on the HPRC website.

From our recent advanced recycling work supplemented with our years of learnings since 2010, HPRC firmly asserts that advanced recycling technologies offer a viable solution for recycling challenging healthcare plastics that would otherwise be destined for landfills or incineration. Moreover, these technologies present an opportunity to support a circular economy for healthcare plastics, reduce reliance on virgin plastic made from fossil fuels, and mitigate greenhouse gas emissions.

This document defines HPRC's guiding principles regarding the use of advanced recycling technologies for healthcare plastics. These principles align with the World Wildlife Fund's (WWF) Chemical Recycling Implementation Principles and encompass topics such as the most efficient use of technology, environment and human health safeguards, claims and chain of custody, complementary relationship with mechanical recycling, and circular enablement.

---

[1] www.bccresearch.com/market-research/plastics/medical-plastics-global-markets.html, www.bccresearch.com/market-research/plastics/healthcare-plastic-packaging.html

[2] Common plastics used in healthcare packaging include polypropylene (PP), polyethylene (PE), polystyrene (PS), polyethylene terephthalate (PET), and polyethylene terephthalate glycol (PETG).

Guiding Principle 1: Utilize the Most Efficient Technology with Reduced Carbon Footprint

Healthcare plastics derived from advanced recycling technologies should demonstrate a reduction in greenhouse gas emissions compared to traditional fossil-based plastics.

The healthcare sector acknowledges the urgency of addressing climate change, particularly concerning greenhouse gas (GHG) emissions and their associated detrimental impact on human health. Hospitals have made commitments in line with initiatives such as the Healthcare Sector Climate Pledge and the Paris Agreement to curtail GHG emissions and enhance climate resilience.

Given these commitments, it is imperative for the healthcare industry to take transformative measures to minimize and control GHG emissions, particularly in the production of plastic healthcare packaging and devices.

Research demonstrates that advanced recycling technologies can achieve superior carbon dioxide (CO_2) reductions compared to virgin fossil-based plastics, substantiated by robust life cycle assessment[3] (LCA) methodologies (see Table 2 in the Appendix). LCA provides a quantitative approach for comparing GHG reductions and should support other sustainability claims. Additionally, a thorough understanding and transparency of the scope of an LCA is crucial for informed decision-making within the healthcare industry.

To minimize environmental impact, advanced recycling technologies should prioritize feedstocks that optimize efficiency and yield for each process, further contributing to reduced carbon footprints. Refer to the Appendix for an overview of advanced recycling technologies and their suitability for various plastics.

To demonstrate sustainability leadership, the healthcare industry must prioritize CO_2 reduction in materials usage. Healthcare plastics derived from advanced recycling technologies should unequivocally exhibit lower GHG emissions than their virgin fossil-based counterparts. Leveraging advanced recycling technologies holds the potential to establish a cleaner and more sustainable healthcare ecosystem.

[3] ISO standards for life cycle assessment to promote sustainable development

Guiding Principle 2: Prioritize Human Safety and Safeguard Nature

Advanced recycling of healthcare plastics must not compromise healthcare operations, patient safety, workplace safety, environmental integrity, or the adjacent communities during collection and processing of non-infectious materials.

Collection and processing of healthcare plastics for advanced recycling should adhere to national and international occupational safety and human health standards. The unique challenge of segregating contaminated from non-contaminated healthcare waste necessitates policies to prevent hazardous waste from reaching advanced recycling facilities.

Healthcare organizations must ensure due diligence for advanced recycling operators and facilities. Advanced recyclers should adhere to the U.S. Clean Air Act, U.S. Clean Water Act, U.S. Occupational Safety and Health Administration (OSHA) guidelines, and other applicable regulations. This adherence helps ensure that advanced recycling operators maintain a high level of responsibility, minimizing potential environmental impacts, safeguarding worker safety, and fostering trust with healthcare organizations and neighboring communities. Advanced recyclers should also take actions to avoid placing a disproportionate burden on communities with environmental justice concerns, through fair treatment and meaningful involvement with the communities where the facilities and business activities will be located.

Guiding Principle 3: Ensure Truthful Claims Supported by a Chain of Custody

Claims regarding the benefits of advanced recycling must be grounded in scientifically sound research, supported by robust data from reliable sources, and verified with a chain of custody.

The healthcare industry should uphold the highest standards of integrity and transparency when making claims about advanced recycling. Ensuring the accuracy of claims builds trust with consumers, regulators, and the wider public, facilitating the sustainable transformation of healthcare plastics.

Claims about advanced recycling's role in healthcare plastics waste management should align with broader sustainability goals within the healthcare sector, including reducing the environmental footprint and promoting circular economy practices. Substantiation of claims should involve a chain of custody, as defined by the ISO 22095 standard, documenting and tracking plastic waste through the recycling process to new materials.

HPRC encourages collaboration among healthcare facilities, recyclers, manufacturers, and regulatory bodies to adopt effective procedures and guidelines, such as ISCC PLUS certification, for tracking plastic waste from collection to reincarnation into new products. Third-party audited systems enhance transparency, consistency, and credibility while promoting globally accepted practices.

Guiding Principle 4: Complement Mechanical Recycling

Advanced recycling for healthcare plastics should complement existing mechanical recycling systems, focusing on plastics that are challenging for mechanical recycling.

Mechanical recycling is an established industry continually innovating to address environmental sustainability concerns. However, mechanical recycling has limitations, including difficulties in achieving 100% purity, the inability to remove existing additives, thermal degradation during extrusion, and infrastructure challenges with processing flexible materials.

Advanced recycling can address these limitations, particularly in recycling flexible materials, multi-laminate plastics, and colored and opaque plastics. It can provide recycled plastics with properties akin to new plastics derived from virgin fossil raw materials, meeting the stringent material and performance requirements of medical plastics.

Examples illustrating the synergy between advanced and mechanical recycling include flexible blue wrap and multilayered sterile barrier packaging, which are traditionally challenging materials for mechanical recycling but are ideal for some advanced recycling technologies.

An effective circular approach will require the application of a suite of recycling technologies which are fit for purpose. Both advanced and mechanical recycling technologies have strengths and limitations, and their utilization should maximize their relative advantages while ensuring the highest quantity and quality of recycled plastics.

Guiding Principle 5: Promote Material-to-Material Recycling for Circularity

Advanced recycling should be viewed as a material-to-material process to enable circularity in healthcare plastics.

While energy recovery and waste-to-fuel options may be appropriate for some healthcare waste plastics, they do not constitute recycling as they result in material loss through combustion, necessitating the continued extraction of virgin resources to produce new materials.

In contrast, recycling maintains materials or their molecular integrity for use in applications like medical plastic, reducing the need for new material extraction.

HPRC endorses the waste hierarchy for waste management decision-making and promotes the need to engage in advanced recycling for non-hazardous healthcare plastics in order to further circularity. While energy recovery and waste-to-fuel have traditionally been used due to contamination concerns, a study by the World Health Organization found that 85% of hospital waste is non-hazardous, leaving only 15% that is infectious, toxic, or radioactive.

Continued research and advocacy in the medical plastics community aim to demonstrate the equivalence of advanced recycled materials to virgin fossil-based materials, facilitating material-to-material advanced recycling for circularity in healthcare plastics.

Appendix

Table 1: Potential Recycling Pathways for Common Healthcare Packaging Materials

Plastic Type	Mechanical Recycling	Advanced Recycling – Purification	Advanced Recycling – Depolymerization	Advanced Recycling – Gasification	Advanced Recycling - Pyrolysis
PP	√	√		√	√
HDPE	√	√		√	√
LDPE	√	√		√	√
LLDPE	√	√		√	√
PET	√	√	√	√	
PETG	√	√	√	√	
PS (GPPS, HIPS)	√	√		√	√

Table 2: CO2/GHG Reduction Potential and Properties Comparison by Recycling Pathway
This data is a snapshot in time; data continues to evolve with the advancement of the technology.

Examples of CO2/GHG Reduction Potential	Mechanical Recycling	Advanced Recycling – Purification	Advanced Recycling – Depolymerization	Advanced Recycling – Gasification	Advanced Recycling - Pyrolysis
≈67-71% Reference: APR LCI Report	√				
≈35% Reference: PureCycle		√			
≈29% Reference: Eastman Chemical			√		
≈20-50% Reference: Eastman Chemical				√	
≈19-63% Reference: Argonne National Lab Pyrolysis LCA					√

About HPRC

HPRC is a private technical coalition of industry peers across healthcare, recycling, and waste management industries seeking to improve the recyclability of plastic products within healthcare. Made up of brand-leading and globally recognized members, HPRC explores ways to enhance the economics, efficiency, and ultimately the quality and quantity of healthcare plastics collected for recycling. HPRC is active across the United States and Europe working with key stakeholders, identifying opportunities for collaboration, and participating in industry events and forums.

For more information, visit www.hprc.org and follow HPRC on LinkedIn.

HPRC
HEALTHCARE PLASTICS RECYCLING COUNCIL