

# The limits of plastics recycling

Why we need to reject false solutions and reduce plastic

**BRIEFING**

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environmental  
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## Recycling will not solve the plastic pollution crisis

Some 4.4 million tonnes of plastic are discarded in Canada every year, more than half of which is packaging. Only 400,000 tonnes of discarded plastic, or less than 10 per cent, is turned into pellets or flake that can be made into new plastic products.<sup>1</sup>

Conventional mechanical recycling involves sorting and pelletizing discarded plastic into a recycled raw material that can then be mixed with virgin plastic and turned into a new product. The polymers from which the plastic is made are maintained in the process. Plastic products can have labels to identify the polymer they're made from. PET (resin code 1) – often used for water and soft drink bottles – and HDPE (resin code 2) – often used for milk and liquid detergent jugs – are the two types of plastic that are the most likely to be recycled.

But recycled plastic is not generally turned back into the same discarded product.<sup>2</sup> It is even considered unadvisable to use recycled plastic for new plastic food packaging, with the exception of PET beverage containers.<sup>3</sup> Because discarded plastic is not turned back into packaging in any significant amount, recycling does little to reduce the growing amount of new, or virgin, plastic used for the ever-growing manufacture of packaging and other products or the environmental impacts of plastic production and waste.

For recycling to eliminate plastic waste, all plastic discards must be collected and appropriately sorted for effective recycling. However, even the most efficient collection and recycling system, such as the Alberta deposit-return system for beverage containers, only collects and recycles 85 to 88 per cent of containers put on the market. The rest are lost as litter and landfill.<sup>4</sup>

The chemical and plastics lobbies are now promoting “chemical recycling” (also known as “advanced” or “molecular recycling”) and new technologies to suggest they can address the 40-year failure to recycle even 10 per cent of plastic waste worldwide.

## **“Chemical recycling” is an especially false solution**

- It creates a new mix of chemicals, not plastic
- It’s energy intensive and inefficient
- It produces toxic substances and environmental racism
- It’s smoke and mirrors: a lack of transparency
- The books must be cooked to make it appear a success

### **It creates a new mix of chemicals, not plastic**

“Chemical” or “advanced” or “molecular” recycling generally refers to processes that use heat and/or catalysts to undo the chemical bonds that form the polymers in the discarded plastic. The most common “chemical recycling” in practice today involves pyrolysis or gasification, which are forms of waste incineration that can produce chemicals or fuels from plastic waste. The result of these energy-intensive processes is not plastic polymers, but rather a new mix of chemicals that requires further refining to be useful.

There is no “chemical recycling” facility in operation at a commercial scale today in Canada that produces recycled plastic polymers. Green Mantra in Brantford, Ontario, processes waste plastic into asphalt additives and lubricants. Enerkem built a plant to gasify mixed municipal waste, including plastics, to produce fuel in Edmonton, Alberta. However, that plant – which never operated to its planned capacity – shut down in early 2021 “due to major equipment failure on the site.”<sup>5</sup>

A survey of the six “chemical recycling” facilities that were operating in the United States in 2022 revealed a combined capacity of 97,000 tonnes, or 0.21 per cent of the household plastic waste generated in the US every year.<sup>6</sup> Further, there is no evidence any of these facilities produce recycled plastic, despite decades of research and development on plastics recycling.

### **It’s energy intensive and inefficient:**

“Chemical recycling” of plastic can result in even more greenhouse emissions than producing virgin plastic. Processes like pyrolysis and gasification require significant energy inputs to undo the chemical bonds that were created to produce plastic polymers in the first place. Assuming the process produces some chemicals that could be used to make new plastics, yet another energy-intensive process would be required to re-polymerize them into plastic. One study concluded that gasification of polyolefins (polyethylene and polypropylene — polymers often used for single-use plastics) can generate seven times the global warming potential of producing the same plastics from virgin crude oil.<sup>7</sup> Pyrolysis has been found to destroy between 86 and 99 per cent of the plastic treated during processing.<sup>8</sup>

## **It produces toxic substances and environmental racism**

In addition to climate-warming emissions, the International Pollution Elimination Network has sounded the alarm about the toxic substances that are created and emitted through “chemical recycling” of plastic. A 2022 report notes that toxic substances are not only released as waste byproducts into the air and as ash and/or tar that require disposal, they are also present in the products generated, such as fuel.<sup>9</sup> Pyrolysis and gasification of plastic waste in particular generate persistent organic pollutants (POPs) that remain in the fuel product and are released when that fuel is burned, posing a hazard to human health and the environment.

Direct emissions from “chemical recycling” impact workers and communities who live near the facilities. A 2022 survey of US-based facilities showed that six of the eight were located in communities that had higher than average populations of people of colour and five of the eight were in communities more likely than average to have households living on incomes of less than \$25,000 USD per year.<sup>10</sup>

Imperial Oil has announced it is evaluating whether to establish an “advanced recycling” facility for plastic at its petrochemical site<sup>11</sup> in Sarnia, Ontario, adjacent to the Aamjiwnaang First Nation. Imperial Oil, located 2 kilometres from Aamjiwnaang, is already the largest industrial emitter of air pollution in the area.<sup>12</sup> Adding a further petrochemical process on the site will only increase the pollution that affects Aamjiwnaang and nearby residents of Sarnia.

## **It’s smoke and mirrors: a lack of transparency**

Information is scant on the workings and yields of existing facilities that claim to chemically process plastics, including the energy inputs needed to power the process and the toxic emissions that result.<sup>13</sup> Proponents commonly refer to their processes as proprietary or patented, as if to suggest the public doesn’t have a right to know what is actually happening in these facilities.

The lack of transparency means that unproven or unsuccessful projects can nonetheless be used to support new applications. This was the case in Indiana, where the state EPA cited the as-yet unsuccessful Canadian Enerkem project noted above as “proof of success” in granting a permit to Fulcrum Centerpoint LLC for a large waste gasification plant in the state.<sup>14</sup>

One US-based plant held up by proponents of chemical recycling as a successful plastic recycling plant — Agilyx — has instead sent significant amounts of toxic waste for incineration.<sup>15</sup>

Another company — Brightmark — described the type and proportion of outputs from its “chemical recycling” process in a regulatory submission to the US EPA in 2021. It reported

that its pyrolysis process yields 70 per cent syngas, of which the majority is burned on site to help power the process and the rest flared off into the local airshed; 10 per cent char, in the form of a powdery residue that must be disposed of; and only 20 per cent liquid fuel product that requires further refining.<sup>16</sup> This suggests that the final fuel product represents less than one-fifth of the waste input. The rest — some 80 per cent — is burned in the process, emitted into the air, or disposed of in a landfill or incinerator.

### **The books must be cooked to make it appear a success**

Consulting firm Eunomia has noted that small quantities of the chemicals produced from pyrolysis or gasification are “diluted with high concentrations of virgin material,”<sup>17</sup> in the production of new plastic. Therefore, measurements that count the amount of recycled content in any particular batch of new plastic material from these processes would reveal a very small percentage.

It’s not surprising, then, that “chemical recycling” proponents advocate for the use of the least traceable standard for certifying recycled content in new products: the ISCC standard.<sup>18</sup>

ISCC counts fuel as a recycled material from plastics and allows a company to apply the weight of the full variety of chemical products that might result from “chemical recycling,” including fuel, to a single product that results from the process. Further, the standard allows material created in one facility to count towards plastic produced in another facility from different feedstocks.

That means if a process in Sarnia produced 1 kg of useable product, of which recycled plastic polymers weigh 100 grams and fuel weighs 900 grams, the company could apply the full kilogram of “recycled” material to new plastic produced, **with or without the recycled product**, at its other facility in Alberta. In other words, the new kilogram of plastic might not have any recycled plastic in it, or have as little as 10 per cent, but would still be counted as 100 per cent recycled content under the ISCC standard.

Eunomia points out that the question of whether a standard allows for allocating recycled content freely among different products and even different sites is “particularly relevant for chemical recyclers.”<sup>19</sup> In other words, mechanical recyclers don’t require this type of fancy bookkeeping.

## **Recommendations for the federal government**

1. Define recycling for waste and pollution reduction. Recycling must involve:
  - a. widespread collection, sorting and cost-effective processing of plastic discards, with an effective recycling rate of 80 per cent or better (or less than 20 per cent loss during all steps combined); and

- b. production of post-consumer plastic feedstock suitable for use in identifiable new products.
2. Ensure traceability of recycled content in new products. Reject “book and claim” methods and ensure that recycled content is measured according to how much is in each package or product.
3. Eliminate subsidies for inefficient and polluting forms of waste processing, particularly those that involve intense heat and toxic catalysts and/or waste byproducts.
4. Require public reporting on greenhouse gas emissions and releases of toxic substances from all facilities that process plastics, including waste.

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## Contact Information

**Karen Wirsig, Senior Program Manager, Plastics**

[kwirsig@environmentaldefence.ca](mailto:kwirsig@environmentaldefence.ca)

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