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ISSUE BRIEF

RECYCLING LIES:

"CHEMICAL RECYCLING" OF PLASTIC IS JUST GREENWASHING INCINERATION

Plastic waste is everywhere in the modern world. An estimated 242 million metric tons of it is generated globally every year, polluting our cities and clogging the oceans, and the United States is one of the top generators.[1] However, America recycles only about 8.7 percent of its plastic waste.[2] This small percentage is recycled by mechanical means: sorted by type, cleaned, shredded, and then processed into plastic pellets used to generate new products. The other 90 percent or so is incinerated or landfilled or ends up in the environment.[3]

As public concern grows about mountains of plastic trash, the plastics industry is promoting technologies that it misleadingly calls "chemical recycling" (also known as advanced recycling, molecular recycling, and chemical conversion) and touts as a solution to the plastic crisis. But it is a false solution.

A bulldozer pushes a pile of waste, including plastic trash.

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The term "chemical recycling" encompasses many processes that fall into two categories: plastic-to-fuel and plastic-to-chemical components. Plastic-to-fuel conversion is done using pyrolysis or gasification, both of which use heat and chemical processes to break plastic waste down into products that are turned into fuels (see "Terminology" text box).[4] Plastic-to-chemical components uses treatments such as heat and solvents to create feedstocks that proponents claim can be further processed into other chemicals or new plastics.[5] Methods used include solvent-based processes and depolymerization (see "Terminology"); proponents claim pyrolysis and gasification can also be used to convert plastic waste to chemical components. Both categories of "chemical recycling" are fraught with health, environmental, social, and economic concerns (Table 1).

TERMINOLOGY

Pyrolysis: Categorized as a type of "thermal depolymerization." Uses high temperatures and low-oxygen conditions to thermally degrade plastic. The primary product is a liquid/oil that can be refined into fuels or further processed to create chemicals or plastic.[6]

Gasification: Categorized as a type of "thermal depolymerization." Uses high temperatures with air or steam to degrade plastic. The primary product is a gas called "synthesis gas" (or "syngas") that can be processed into fuels or chemicals.[7]

Solvent-based processes: Also called solvent-based purification or recycling. Uses solvents and other chemicals to dissolve plastics and separate polymers from other components. Recovered polymers must be further processed to create new plastics.[8]

Chemical depolymerization: Uses thermal and chemical reactions to break the plastic polymer chain into individual units (monomers). The monomers are recovered and purified and can be made into new plastic. The process is currently applicable only to certain types of plastic. It is distinct from solvent-based processes because the polymers are broken down.[9]

TABLE 1: ISSUES BOTH SHARED AND UNIQUE TO DIFFERENT "CHEMICAL RECYCLING" TECHNOLOGIES
Pyrolysis and gasification can be used to convert plastic to fuel, while proponents claim that pyrolysis, gasification, solvent-based processes, and chemical depolymerization can be used to convert plastic to chemical components.

Issue	Pyrolysis, gasification	Solvent-based processes, chemical depolymerization
Generates large quantity of hazardous waste	X	X
Stores or releases hazardous chemicals on site	X	X
May be sited in low-income communities or communities of color	X	X
May encounter difficulty scaling up[10]	X	X
May produce contaminated end products[11]	X	X
Creates fuels whose burning generates the same harmful air pollutants as burning fossil fuels[12]	X	
Has large carbon footprint[13]	X	?
Requires ongoing virgin plastic production, with its associated harms	X	X
May cause fires at plants due to high heat	X	
Exists primarily at the lab or pilot scale		X

Producing fuel from plastic waste does not qualify as recycling by international standards.[14] Additionally, it requires continued plastic inputs to create fuels that, just like typical fossil fuels, produce harmful air pollution and greenhouse gases when burned; thus, plastic-to-fuel is incompatible with circular-economy or zero-carbon goals.[15] Previous analyses have found that plastic-to-chemical components "recycling" is barely present on a commercial scale in the United States; plastic-to-fuel processes are more common.[16]

To understand more about "chemical recycling" facilities in this country that are operational or may become operational, we reviewed reports to generate an initial list of facilities. We then narrowed that list to facilities about which we could find information in one or more U.S. Environmental Protection Agency (EPA) databases, environmental permit information, and/or other relevant information (see Appendix).[17] While a lack of information and transparency on these facilities made it difficult to determine their operational status or capacity, we found eight that met these criteria, most of which fall into the plastic-to-fuel category (Figure 1). We also found that numerous facilities had opened and then shut down a short time later, consistent with what we had learned from previous reports.[18]

FIGURE I: CHEMICAL RECYCLING FACILITIES WE IDENTIFIED IN THE UNITED STATES. THE MAJORITY ARE PLASTIC-TO-FUEL

*Though Agilyx states it produces material that is used to make new plastic, data indicate that a high volume of its outputs are burned (more below).[19]

Our review of the eight selected "chemical recycling" facilities in the United States revealed that:

- the majority of facilities are not recycling any plastic;
- the facilities generate large quantities of hazardous waste;
- they release hazardous air pollutants; and
- they are often sited in communities that are disproportionately low income, people of color, or both.

Given these issues, "chemical recycling" cannot be the solution to our plastic problem—no matter how the plastic industry tries to spin it.

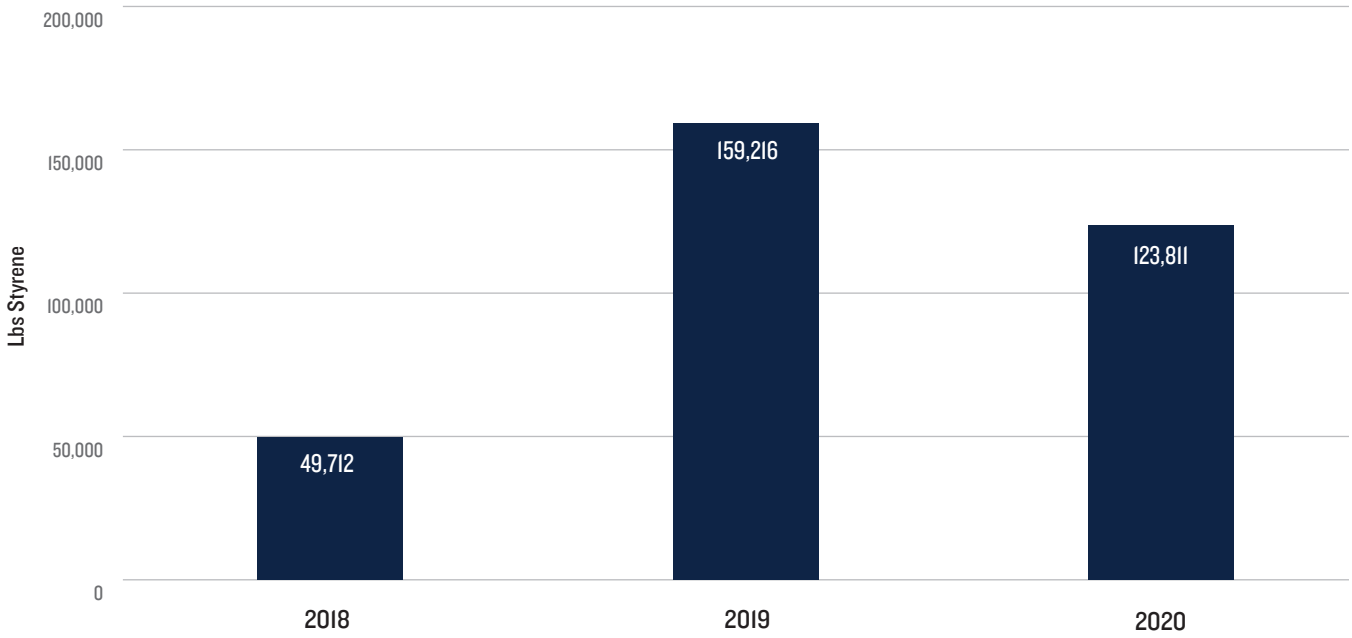
MOST "CHEMICAL RECYCLING" FACILITIES IN THE UNITED STATES ARE NOT RECYCLING ANY PLASTIC.

"Chemical recycling" most often creates materials that are burned—not turned into new plastic—and thus is not recycling at all.

Agilyx, a polystyrene pyrolysis plant in Tigard, Oregon, is held up by industry as a prime example of commercial-scale "chemical recycling." In theory, Agilyx takes waste polystyrene, a common type of plastic, and uses pyrolysis to turn it back into styrene, which is then used to make new polystyrene.[20] However, this facility in fact produces a large volume of styrene that is shipped off site to be burned instead of being converted into new plastic. Since 2018, Agilyx has shipped hundreds of thousands of pounds of styrene across the country to be burned (Figure 2).[21]

FIGURE 2: STYRENE SENT OFF SITE BY AGILYX TO BE BURNED, 2018–20

This amount has nearly tripled from 2018 to 2019. 2018 is the the first year in which the company focused on polystyrene.[22] Agilyx reported this styrene as sent to "energy recovery," which is the term used when an incinerator converts heat from the burning of waste materials into electricity; this is still incineration. In 2020, Agilyx reported implementing pollution prevention measures for onsite styrene releases.



Burning, or incineration, of chemicals and wastes has major climate, public health, and environmental justice impacts. Even if incinerators can convert some amount of the released heat into electricity (called "energy recovery"), the process still emits more greenhouse gases than fossil fuel–fired power plants and releases harmful air pollution and toxic chemicals.[23] Moreover, incineration sites are disproportionately located in communities where more than 25 percent of people identify as a racial minority, live below the federal poverty level, or both.[24]

Agilyx is not an outlier in this regard; since most facilities are creating fuel rather than new plastic, the outputs of all their intensive processing will ultimately be burned.

BOTH PLASTIC-TO-FUEL AND PLASTIC-TO-CHEMICAL COMPONENTS "CHEMICAL RECYCLING" FACILITIES GENERATE HAZARDOUS AIR POLLUTANTS AND LARGE QUANTITIES OF HAZARDOUS WASTE.

Nearly 500,000 pounds of hazardous waste were reported in 2019 from one "chemical recycling" facility alone.

Data from the EPA shows that Agilyx generated nearly 500,000 pounds of hazardous waste in 2019 alone, sending most of it off site to be burned (Table 2). This waste consisted primarily of benzene, along with other toxics such as lead, cadmium, and chromium (Table 2).[25]

TABLE 2: BURNING HAZARDOUS WASTE FROM AGILYX IN 2019
Agilyx sent hazardous waste to six locations across the United States for disposal.[26] The disposal methods all involve burning, though they may be called "incineration," "energy recovery," or "fuel blending"; the latter refers to mixing the hazardous waste with commercial fuel that is burned to power incinerators or cement kilns.

Where was hazardous waste disposed of?	Chemicals sent to this location	Total pounds sent (2019)
Tacoma, WA	Ignitable waste, benzene, and corrosive waste	353,292
Henderson, CO	Ignitable waste, benzene, barium, cadmium, chromium, lead, and selenium	66,190
Hannibal, MO	Ignitable waste, corrosive waste, cadmium, chromium, benzene, and 1,2-dichloroethane	64,122
Kimball, NE	Ignitable waste, corrosive waste, cadmium, chromium, benzene, and vinyl chloride	990
Arlington, OR	Benzene and 1,2-dichloroethane	66
East Chicago, IN	Ignitable waste and benzene	30
		Total: 484,690

Hazardous waste generation does not appear to be limited to pyrolysis facilities like Agilyx. PureCycle Technologies in Ohio states it will perform plastic-to-chemical components "chemical recycling" with solvent-based purification, employing solvents strong enough to break plastic waste down into its chemical components and separate it from contaminants.[27] PureCycle is registered as a large-quantity hazardous waste generator, meaning it plans to generate more than 2,200 pounds of hazardous waste per month in total.[28] We do not currently have details on the exact contents of PureCycle's hazardous waste, though permits indicate the facility plans to store toxic metals and solvents at its Hanging Rock, OH site, which is located in a community that is disproportionately low-income (Table 4).[29]

Hazardous waste and air pollutants generated by "chemical recycling" facilities are toxic chemicals that can cause cancer, harm the developing fetus, damage the reproductive system, and lead to other serious health problems.

The chemicals in the hazardous waste generated by Agilyx are toxic—many are carcinogens and/or neurotoxicants (Table 3). Much of this waste is benzene, a known cancer-causing chemical that can also be harmful to reproduction and the developing fetus.[30]

State-level permit data for Agilyx, Alterra Energy, Braven Environmental, Brightmark, Nexus Fuels, and PureCycle Technologies indicate that "chemical recycling" facilities release or are permitted to release hazardous air pollutants (HAPs), chemicals known or suspected to cause cancer or other serious health effects like birth defects (Table 3).[31] These chemicals are released directly from "chemical recycling" facilities as a by-product of the production process and can impact people living in proximity to the facility (Table 4).

TABLE 3: HEALTH HAZARDS OF CHEMICALS GENERATED BY "CHEMICAL RECYCLING" FACILITIES
(1) Health hazards of chemicals sent off site as hazardous waste by Agilyx and (2) hazardous air pollutants (HAPs) listed in Agilyx's Air Toxics Emissions Inventory and in air permits for Agilyx, Alterra Energy, Braven Environmental, Brightmark, Nexus Fuels, and PureCycle Technologies.[32] Data on hazard traits from California Safer Consumer Products Candidate Chemicals list.[33]

Chemical	Carcinogen	Reproductive toxicant	Developmental toxicant	Neurotoxicant	Persistent	Bioaccumulative	Liver toxicant	Cardiovascular toxicant	Respiratory toxicant	Kidney toxicant	Skin toxicant	Eye toxicant
(1) Hazardous waste sent offsite by Agilyx												
Lead	X	X	X	X	X	X	X	X		X		
Cadmium	X	X	X	X	X	X			X	X		
Selenium			X	X	X	X	X	X	X		X	
Benzene	X	X	X	X			X	X	X			
1,2-dichloroethane	X			X			X	X		X	X	
Chromium	X											
Vinyl chloride	X			X					X			
Barium				X			X	X				
(2) Hazardous air pollutants (HAPs) associated with multiple facilities												
Styrene	X	X	X	X			X					X
Benzene	X	X	X	X			X	X	X			
Toluene			X	X			X	X	X	X		X
Mercury	X			X	X	X	X	X	X		X	
Arsenic	X		X	X			X	X	X		X	
Dioxins	X	X			X	X	X				X	
Ethyl benzene	X		X	X			X		X	X		X
Xylenes			X	X			X		X	X		X
Naphthalene	X			X	X	X	X		X			X
Acetaldehyde	X								X		X	X
Formaldehyde	X						X		X			X
Hydrochloric acid									X		X	X
Methanol			X	X								
Hexane		X		X								

Moreover, according to EPA data, both Agilyx and Nexus were out of compliance with relevant HAP or hazardous waste regulations at least once during the past three years. Agilyx was in violation during 8 out of 12 quarters, with violations relating to pre-transport storage of hazardous waste and record-keeping, while Nexus's violation concerned the release of hazardous air pollutants.[34]

"CHEMICAL RECYCLING" FACILITIES ARE LOCATED IN COMMUNITIES THAT ARE DISPROPORTIONATELY LOW INCOME, PEOPLE OF COLOR, OR BOTH.

Communities of color already disproportionately bear the burden of health risks from plastics manufacturing, a process that releases highly toxic chemicals, because these facilities are often located in their neighborhoods.[35] There is a similar pattern of unequal impacts when it comes to "chemical recycling" facilities (Table 4). Of the eight facilities researched, six are in communities that are disproportionately Black or brown, and five are in communities where a disproportionate percentage of households have an income below $25,000, relative to national averages.[36] A combined total of about 380,000 people currently live within three miles of the eight facilities and could be impacted by their toxic emissions.

TABLE 4: DEMOGRAPHIC ANALYSIS OF COMMUNITIES WITHIN A THREE-MILE RADIUS OF IDENTIFIED "CHEMICAL RECYCLING" FACILITIES
Seven of the eight plants are in communities that are disproportionately low income, people of color, or both.[37] Orange highlights indicate where the percentage of people of color or percentage of people with a yearly household income below $25,000 was greater than the national average. *Represents population of all census block groups intersecting with the three-mile buffer around the facility.

Facility	Agilyx	Alterra	Aquafil	Braven	Brightmark	New Hope	Nexus Fuels	PureCycle	U.S. Average
Location of facility	Tigard, OR	Akron, OH	Phoenix, AZ	Eagle Rock, NC	Ashley, IN	Tyler, TX	Atlanta, GA	Hanging Rock, OH	
Population within 3-mile radius of facility*	119,130	63,396	97,114	13,072	2,499	38,275	50,100	3,602	
Percentage with household income below $25,000	15%	31%	38%	17%	17%	37%	29%	29%	20%
Hispanic or Latino	10%	2%	79%	14%	2%	41%	13%	2%	18%
Non-Hispanic or Latino									
White alone	77%	70%	12%	60%	96%	26%	8%	91%	61%
Asian/ Pacific Islander	7%	2%	1%	0%	0%	0%	1%	0%	5.6%
Black or African American alone	2%	21%	5%	23%	0%	31%	77%	4%	12%
American Indian	>1%	>1%	2%	0%	0%	0%	>1%	0%	>1%
Other/multiracial	4%	4%	1%	2%	1%	1%	1%	4%	2.4%

POLICY RECOMMENDATIONS

Overall, it is clear that all forms of "chemical recycling" are plagued with problems and do not represent a solution to the plastic waste crisis. We need policies that reduce plastic production and waste, promote greater transparency about "chemical recycling," ensure the protection of environmental justice communities that are disproportionately impacted by these facilities, and do not greenwash the plastic-to-fuel processes as recycling.

Ensure comprehensive regulatory safeguards. Maintain health protections, and do not exempt "chemical recycling" facilities from solid waste permitting and regulations.

Multiple states have recently introduced or passed legislation to change the classification of "chemical recycling" plants so they are no longer considered solid waste facilities—and thus would be subject to weaker regulations related to reporting air and water pollution as well as waste.[38] However, because "chemical recycling" facilities handle discarded plastic waste, they should be treated and regulated as solid waste facilities. These facilities are expected to generate hazardous air pollutants and large quantities of hazardous waste—information that would not be public if the facilities were exempt from reporting requirements.

Additionally, two of the eight plants we researched had fires on site within their first year of operation: Fires occurred at New Hope Energy in Tyler, Texas, in May 2020 and at Brightmark in Ashley, Indiana, in May 2021.[39] Such accidents indicate that safety laws need to be enforced more, not less, at "chemical recycling" facilities to protect workers and nearby communities. Classifying "chemical recycling" facilities as solid waste facilities is necessary to ensure transparency and data access and to protect environmental and human health, particularly in the overburdened communities where these facilities are often located.

Maintain robust recycling definitions and standards that continue to exclude plastic-to-fuel processes.

Using pyrolysis and gasification to convert plastic into fuel should not be considered recycling, and recycling standards must continue to exclude such processes. Plastic-to-fuel is not considered recycling by ISO standards, the EU Environmental Commission, the Ellen MacArthur Foundation, and many other groups.[40]

Despite the fact that plastic-to-fuel does not recycle plastic, the industry continues to strongly support it.[41] This is likely because plastic-to-fuel creates a mirage of "recycling" to assuage public concerns about increased plastic use and waste but does not disrupt new plastic production. This paves the way for continued profits and the expansion of plastic production facilities.[42] Ensuring that plastic-to-fuel remains excluded from official definitions of recycling will make it difficult for plastic manufacturers to succeed in this greenwashing.

Reusable and refillable products are key to reducing plastic waste. Zylaa, 10, filling a water bottle in the kitchen sink at her home in Washington, DC.

Invest taxpayer dollars in real solutions that reduce plastic production and waste. Do not support federal loan guarantees for "chemical recycling" facilities.

The plastics industry is attempting to secure federal loan guarantees for "chemical recycling" facilities, but this cannot be allowed. Supporting "chemical recycling" facilities with taxpayer dollars is unconscionable given the hazardous chemicals stored on site, the large amounts of hazardous waste generated, and the potential to disproportionately impact environmental justice communities. The current administration has prioritized advancing environmental justice and economic opportunities for disadvantaged communities and investing in these facilities runs directly counter to those commitments. Instead, real solutions include:

- eliminating problematic and unnecessary plastics, such as single-use plastics;
- innovating and scaling up reuse and refill models;[43]
- creating nontoxic materials to replace fossil fuel–derived plastics; and
- scaling up proven mechanical recycling or composting solutions.

The world is drowning in plastic, and we need to turn off the tap. "Chemical recycling" is a false solution that doesn't halt the deluge of plastic waste and creates new harms—it's a toxic distraction.

APPENDIX

TABLE A1: DATA SOURCES IDENTIFIED FOR EACH FACILITY
ECHO = Enforcement and Compliance History Online; TRI = Toxics Release Inventory; RCRA = Resource Conservation and Recovery Act.

Facility	Permit Data	ECHO Data	TRI Data	RCRA Data	Other Evidence re. Operational Status	EJScreen Analysis[44]	Address Used for EJScreen Analysis
Agilyx	X[45]	X[46]	X[47]	X[48]		X	13240 SW Wall Street, Tigard, OR, 97223
Nexus Fuels	X[49]	X[50]				X	500 Waterfront Dr. SW, Atlanta, GA 30336
Alterra Energy	X[51]	X[52]				X	1200 E Waterloo Rd., Akron, OH 44306
Brightmark	X[53]					X	3240 W 800 S, Ashley, IN 46705
Braven Environmental	X[54]					X	517 Industrial Dr., Eagle Rock, NC 27591
PureCycle	X[55]			X[56]		X	1125 County Rd. 1-A, Hanging Rock, OH
New Hope Energy	X[57]					X	1775 Duncan St., Tyler, TX 75702
Aquafil					X[58]	X	3555 W. Washington St., Phoenix, AZ 85009

ENDNOTES

1 National Academies of Sciences, Engineering and Medicine, *Reckoning With the U.S. Role in Global Ocean Plastic Waste*, 2021, https://www.nap.edu/catalog/26132/reckoning-with-the-us-role-in-global-ocean-plastic-waste.

2 U.S. Environmental Protection Agency (hereinafter EPA), "Plastics: Material-Specific Data," September 12, 2017, https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/plastics-material-specific-data.

3 National Academies of Sciences, Engineering and Medicine, *Reckoning with the U.S. Role*.

4 Tariq Maqsood et al., "Pyrolysis of Plastic Species: A Review of Resources and Products," *Journal of Analytical and Applied Pyrolysis* 159 (October 1, 2021): 105295, https://doi.org/10.1016/j.jaap.2021.105295. S. A. Salaudeen, P. Arku, and Animesh Dutta, "Gasification of Plastic Solid Waste and Competitive Technologies," chapter 10 in *Plastics to Energy*, S. M. Al-Salem, ed. (Norwich, NY: William Andrew Publishing, 2019), https://doi.org/10.1016/B978-0-12-813140-4.00010-8.

5 Dominik Triebert et al., "Solvent-Based Recycling," chapter 3 in *Circular Economy of Polymers: Topics in Recycling Technologies*, ACS Symposium Series, vol. 1391, Dimitris Collias, Martin James, and John Layman, eds. (Washington, DC: American Chemical Society, 2021), https://pubs.acs.org/doi/pdf/10.1021/bk-2021-1391.ch003. Yu Miao, Annette von Jouanne, and Alexandre Yokochi, "Current Technologies in Depolymerization Process and the Road Ahead," *Polymers* 13, no. 3 (January 2021): 449, https://doi.org/10.3390/polym13030449.

6 Maqsood et al., "Pyrolysis of Plastic Species." Simon Hann and Toby Connock, "Chemical Recycling: State of Play," *Eunomia*, December 8, 2020, 74. https://www.sciencedirect.com/science/article/abs/pii/S0165237021002813

7 Salaudeen, Arku, and Dutta, "Gasification of Plastic Solid Waste." Hann and Connock, "Chemical Recycling: State of Play."

8 Triebert et al., "Solvent-Based Recycling."

9 Miao, von Jouanne, and Yokochi, "Current Technologies in Depolymerization."

10 Andrew N. Rollinson and Jumoke Oladejo, *Chemical Recycling: Status, Sustainability, and Environmental Impacts*, GAIA, 2020, https://www.no-burn.org/wp-content/uploads/CR-Technical-Assessment_June-2020.pdf.

11 Ibid.

12 Patel et al., *All Talk and No Recycling*.

13 Vallette, *The New Coal*.

14 European Union, "Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on Waste and Repealing Certain Directives," Pub. L. No. Article 3(17), https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32008L0098 (accessed November 15, 2021). Ameripen, *Packaging Materials Management Definitions: A Review of Varying Global Standards Guidance Document*, 2018, https://cdn.ymaws.com/www.ameripen.org/resource/resmgr/pdfs/AMERIPEN-Report-RecyclingDef.pdf. EPA, "Sustainable Materials Management: Non-Hazardous Materials and Waste Management Hierarchy," September 11, 2015, https://www.epa.gov/smm/sustainable-materials-management-non-hazardous-materials-and-waste-management-hierarchy. EPA, "Definitions Utilized in the Re-TRAC Connect™ State Measurement Template," https://www.epa.gov/sites/default/files/2015-09/documents/smp_definitions.pdf (accessed December 15, 2021).

15 Jim Vallette, *The New Coal: Plastics and Climate Change*, Beyond Plastics at Bennington College, October 2021, https://static1.squarespace.com/static/5eda91260bbb7e7a4bf528d8/t/616ef2922198531961la64e0/1634661022294/REPORT_The_New-Coal_Plastics_and_Climate-Change_10-21-2021.pdf. Denise Patel et al., *All Talk and No Recycling: An Investigation of the U.S. "Chemical Recycling" Industry*, Global Alliance for Incinerator Alternatives (hereinafter GAIA), 2020, https://www.no-burn.org/wp-content/uploads/All-Talk-and-No-Recycling_July-28.pdf.

16 Patel et al., *All Talk and No Recycling*.

17 Ibid. P. Patel and A. Tullo, *The Future of Plastic*, *Chemical & Engineering News* Discovery Report, 2020, https://cen.acs.org/sections/discovery-reports/the-future-of-plastic.html.

18 Patel et al., *All Talk and No Recycling*. Joe Brock, Valerie Volcovici, and John Geddie, "The Recycling Myth: A Plastic Waste Solution Littered With Failure," Reuters, July 29, 2021, https://www.reuters.com/investigates/special-report/environment-plastic-oil-recycling/.

19 Patel et al., *All Talk and No Recycling*.

20 Agilyx, "Agilyx Technology in Action: A cooperative venture that is changing the way we recycle polystyrene plastic," https://www.agilyx.com/regenyx/ (accessed February 22, 2022).

21 EPA, "Toxics Release Inventory, 2020 Preliminary Dataset" (released July 2021), https://enviro.epa.gov/enviro/tris_control_v2.tris_print?pPrev=1&tris_id=9722WGLYXT794SW.

22 Ibid.

23 GAIA, "Pollution and Health Impacts of Waste-to-Energy Incineration," 2019, https://www.no-burn.org/wp-content/uploads/Pollution-Health_final-Nov-14-2019.pdf. GAIA, "Facts About 'Waste-to-Energy' Incinerators," 2018, https://www.no-burn.org/wp-content/uploads/GAIA-Facts-about-WTE-incinerators-Jan2018-1.pdf. Brenda Platt, "Stop Trashing the Climate: Full Report," Institute for Local Self-Reliance, June 2008, https://ilsr.org/wp-content/uploads/2008/06/fullreport_stoptrashingtheclimate.pdf.

24 Ana Isabel Baptista and Adrienne Perovich, *U.S. Municipal Solid Waste Incinerators: An Industry in Decline*, GAIA, May 2019, https://www.no-burn.org/u-s-municipal-solid-waste-incinerators-an-industry-in-decline/.

25 EPA, "BR Facility Summary Report—Agilyx," 2019, https://enviro.epa.gov/enviro/brs_report_v2.get_data?hand_id=ORQ000029621&rep_year=2019&naic_code=&naic_code_desc=&yvalue=2019&mopt=0&mmopt=&wst_search=0&keyword1=&keyword2=&keyword3=&rvalue1=&rvalue2=&rvalue3=&cvalue1=&cvalue2=&cvalue3=.

26 Ibid.

27 Reuters, "PCT.OQ—Purecycle Technologies Inc. Profile," https://www.reuters.com/companies/PCT.OQ (accessed December 15, 2021).

28 EPA, "Categories of Hazardous Waste Generators," January 27, 2015, https://www.epa.gov/hwgenerators/categories-hazardous-waste-generators. Ohio Environmental Protection Agency, "PureCycle RCRA Subtitle C Site Identification Form," March 15, 2019, http://edocpub.epa.ohio.gov/publicportal/ViewDocument.aspx?docid=1046080.

29 Ohio Environmental Protection Agency, "PureCycle RCRA Subtitle C Site Identification Form."

30 CalSAFER, "Candidate Chemical: Benzene," https://calsafer.dtsc.ca.gov/cms/candidatechemical/?rid=22033 (accessed December 4, 2021).

31 Agilyx 2020 Annual Report for the Regenyx Tigard Facility, submitted to the Oregon Department of Environmental Quality, February 5, 2021, https://www.deq.state.or.us/AQPermitsonline/34-9514-SI-01_AR_2020.PDF. Ohio Environmental Protection Agency, "Final Air Pollution Permit-to-Install and Operate—Alterra," July 5, 2017, http://edocpub.epa.ohio.gov/publicportal/ViewDocument.aspx?docid=648016. North Carolina Department of Environmental Quality, "Braven Environmental Air Permit," September 25, 2020, https://xapps.ncdenr.org/aq/FDocsServlet. Indiana Department of Environmental Management, Permits Branch Office of Air Quality, "Brightmark Permit Renewal," June 22, 2021, https://permits.air.idem.in.gov/43439f.pdf. Georgia Department of Natural Resources, Environmental Protection Division, "Nexus Air Permit," July 17, 2017, https://permitsearch.gaepd.org/permit.aspx?id=PDF-ON-24218. Ohio Environmental Protection Agency, "PureCycle Technologies Final Air Pollution Permit-to-Install and Operate," September 8, 2018, http://edocpub.epa.ohio.gov/publicportal/ViewDocument.aspx?docid=900987.

32 Ibid.

33 California Code of Regulations Division 4.5, Title 22, Chapter 55, 69502.2 § (2013).

34 EPA Enforcement and Compliance History Online, "Detailed Facility Report—Agilyx," 2021, https://echo.epa.gov/detailed-facility-report?fid=110045561441. EPA Enforcement and Compliance History Online, "Detailed Facility Report—Nexus Fuels," 2020, https://echo.epa.gov/detailed-facility-report?fid=110070063470.

35 David Azoulay et al., *Plastic & Health: The Hidden Costs of a Plastic Planet*, Center for International Environmental Law, February 2019, https://www.ciel.org/wp-content/uploads/2019/02/Plastic-and-Health-The-Hidden-Costs-of-a-Plastic-Planet-February-2019.pdf. Robert D. Bullard and Beverly Wright, *Race, Place, and Environmental Justice After Hurricane Katrina: Struggles to Reclaim, Rebuild, and Revitalize New Orleans and the Gulf Coast* (New York: Avalon, 2009).

36 EPA and U.S. Census Bureau, "EJ Screen ACS Summary Report," 2014-2018, https://ejscreen.epa.gov/mapper/.

37 Ibid.

38 GAIA, "State Legislation Alert," December 18, 2019, https://www.no-burn.org/wp-content/uploads/US-ACC-State-Legislation-Alert-2019_Dec-18.pdf. Johnna Crider, "Louisiana Passed Legislation to Allow for Chemical Recycling, AKA 'Advanced Recycling,'" CleanTechnica, July 6, 2021, https://cleantechnica.com/2021/07/06/louisiana-passed-legislation-to-allow-for-chemical-recycling-aka-advanced-recycling/.

39 Reagan Roy, "Officials Investigating After Fire Breaks Out at Tyler Plastics Plant," CBS19.tv, May 11, 2020, https://www.cbs19.tv/article/news/local/officials-investigating-after-fire-breaks-out-at-tyler-plastics-plant/501-1ef6227f-d020-43cb-a6fe-37c0540de298. Taylor Williams, "Steuben County Fire Crews Battle Fire at Plastic Renewal Company for Multiple Hours," Wane 15 News, May 14, 2021, https://www.wane.com/news/local-news/steuben-county-fire-crews-battle-fire-at-plastic-renewal-company/.

40 European Union, Directive 2008/98/EC." Ameripen, *Packaging Materials Management Definitions*. Stephanie Kersten-Johnston, *The Bridge to Circularity: Putting the New Plastics Economy Into Practice in the U.S.*, Recycling Partnership, October 2019, https://recyclingpartnership.org/wp-content/uploads/dlm_uploads/2019/10/BridgetoCircularity_10.28.19-1.pdf.

41 Patel et al., *All Talk and No Recycling*. Stetson Miller, "Maryland Bill Would Ban Chemical Conversion of Plastic Into Fuel," CBS Baltimore, February 24, 2021, https://baltimore.cbslocal.com/2021/02/24/maryland-bill-would-ban-chemical-conversion-of-plastic-into-fuel/.

42 Marty Mulvihill, Gretta Goldenman, and Arlene Blum, "The Proliferation of Plastics and Toxic Chemicals Must End," *New York TImes*, August 27, 2021, https://www.nytimes.com/2021/08/27/opinion/plastics-fossil-fuels.html.

43 Upstream, "Reuse Acceleration Policies," https://upstreamsolutions.org/reuse-acceleration-policies (accessed November 16, 2021).

44 U.S. Environmental Protection Agency (hereinafter EPA) and U.S. Census Bureau, "EJScreen ACS Summary Report," 2014-2018, https://ejscreen.epa.gov/mapper/.

45 Oregon Department of Environmental Quality, "2016 Air Toxics Emissions Inventory—Agilyx," April 17, 2020, https://www.deq.state.or.us/AQPermitsonline/34-9514-SI-01_ATEI_2016.PDF. Agilyx 2020 Annual Report for the Regenyx Tigard Facility, submitted to the Oregon Department of Environmental Quality, February 5, 2021, https://www.deq.state.or.us/AQPermitsonline/34-9514-SI-01_AR_2020.PDF.

46 EPA Enforcement and Compliance History Online, "Detailed Facility Report—Agilyx," 2021, https://echo.epa.gov/detailed-facility-report?fid=110045561441.

47 EPA, "Toxics Release Inventory, 2020 Preliminary Dataset" (released July 2021), https://enviro.epa.gov/enviro/tris_control_v2.tris_print?pPrev=1&tris_id=9722WGLYXT794SW.

48 EPA, "BR Facility Summary Report—Agilyx," 2019, https://enviro.epa.gov/enviro/brs_report_v2.get_data?hand_id=ORQ000029621&rep_year=2019&naic_code=&naic_code_desc=&yvalue=2019&mopt=0&mmopt=&wst_search=0&keyword1=&keyword2=&keyword3=&rvalue1=&rvalue2=&rvalue3=&cvalue1=&cvalue2=&cvalue3=.

49 Georgia Department of Natural Resources, Environmental Protection Division, "Nexus Air Permit," July 17, 2017, https://permitsearch.gaepd.org/permit.aspx?id=PDF-ON-24218.

50 EPA Enforcement and Compliance History Online, "Detailed Facility Report—Nexus Fuels," 2020, https://echo.epa.gov/detailed-facility-report?fid=110070063470.

51 Ohio Environmental Protection Agency, "Final Air Pollution Permit-to-Install and Operate—Alterra," July 5, 2017), http://edocpub.epa.ohio.gov/publicportal/ViewDocument.aspx?docid=648016.

52 EPA Enforcement and Compliance History Online, "Alterra Detailed Facility Report," https://echo.epa.gov/, /detailed-facility-report (accessed November 16, 2021).

53 Indiana Department of Environmental Management, Permits Branch Office of Air Quality, "Brightmark Permit Renewal," June 22, 2021, https://permits.air.idem.in.gov/43439f.pdf.

54 North Carolina Department of Environmental Quality, "Braven Environmental Air Permit," September 25, 2020, https://xapps.ncdenr.org/aq/FDocsServlet.

55 Ohio Environmental Protection Agency, "PureCycle Technologies Final Air Pollution Permit-to-Install and Operate," September 8, 2018, http://edocpub.epa.ohio.gov/publicportal/ViewDocument.aspx?docid=900987.

56 Ohio Environmental Protection Agency, "PureCycle RCRA Subtitle C Site Identification Form," March 15, 2019, http://edocpub.epa.ohio.gov/publicportal/ViewDocument.aspx?docid=1046080.

57 Texas Commission on Environmental Quality, "Certification and Registration for Permits by Rule Form PI-7-CERT (New Hope Energy)," March 2019, https://records.tceq.texas.gov/cs/idcplg?IdcService=TCEQ_PERFORM_SEARCH&xIdcProfile=Record&IsExternalSearch=1&sortSearch=false&newSearch=true&accessID=1767427&xRecordSeries=0&xInsightDocumentType=0&xMedia=0&select0=&input0=&select1=&input1=&select2=&input2=&select3=&input3=&operator=AND&ftx=%22new+hope+energy%22.

58 Aquafil, "ACR No. 1 Starts Initial Operations," March 5, 2018, https://www.aquafil.com/newsmedia/acr-no-1-starts-initial-operations/.