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ISSUE BRIEF

MORE RECYCLING LIES:

WHAT THE PLASTICS INDUSTRY ISN'T TELLING YOU ABOUT "CHEMICAL RECYCLING"

Plastic is polluting our bodies, trashing our cities, and fouling the oceans. For decades, the plastic industry has promised that recycling would solve the problem of plastic waste, yet the plastic crisis continues to grow. A definitive report from the National Academy of Sciences found that the United States is the largest generator of plastic waste in the world.[1] Yet the dismal U.S. plastic recycling rate continues to hover around 5 percent.[2] Globally, plastic use is projected to almost *triple* by 2060, relative to a 2019 baseline.[3]

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Now the plastic industry is doubling down on its misleading recycling claims by promoting incineration, the use of highly toxic solvents, and other toxic methods for end-of-life plastic management as "chemical recycling" (also greenwashed as "advanced recycling" and "molecular recycling").[4] The truth is, these approaches largely fail to recycle plastic. Their expanded use will only lead to more toxic pollution of our air and water and more plastic waste sent to landfills and incinerators. Meanwhile, the production of new plastic will continue to grow.

In 2022 NRDC released "Recycling Lies," a report that revealed that most of the "chemical recycling" facilities in operation at the time were creating materials to be burned—not turned into new plastic—and therefore weren't actually recycling the plastic they received.[5] In the three years since, the plastic industry has proposed building dozens more such facilities across the country—and is ramping up its greenwashing efforts to try to sell this false solution to the public.

NRDC's updated analysis of the industry finds that:

- **Pyrolysis, which is a type of incineration, accounts for 80 percent of both proposed and operating "chemical recycling" facilities in the United States.**[a] Yet pyrolysis actually can't recycle much, if any, plastic. What it mostly produces instead is dirty fuels—and fuel production and use do not constitute "recycling."
- **All forms of "chemical recycling" produce hazardous waste, generate hazardous air pollutants, and/or use toxic solvents.** Just three pyrolysis facilities alone sent more than 2 million pounds of hazardous waste to off-site disposal locations between 2021 and 2024. Other chemical and solvent-based methods of "chemical recycling" have their own highly toxic footprints.
- **While there are very few operational "chemical recycling" facilities in the United States, more than a third of all U.S. states have at least one proposed or currently operating facility.** These facilities tend to be sited in low-income communities and/or communities of color.
- **Even communities and states without "chemical recycling" facilities could still be impacted due to the transportation of hazardous waste.** Hazardous waste generated by just three pyrolysis facilities has traveled through 13 states on the way to disposal facilities, putting even more communities at risk.

"Chemical recycling" is a false solution to our plastic problem. It doesn't halt the deluge of plastic waste, and it creates new harms. Policymakers, companies, and the public should not fall for the rampant industry greenwashing and instead focus on real solutions to the plastics crisis: reducing plastic production and use, switching to more environmentally sound materials, eliminating the most toxic plastics and chemical additives, and building a robust infrastructure for nontoxic reuse/return systems.

TABLE 1: "CHEMICAL RECYCLING" TERMINOLOGY

Technology Category	Technology Type	Description
Plastic incineration	Pyrolysis	Uses high temperatures and low-oxygen conditions to thermally degrade plastic. The primary product is a liquid/oil (called "pyrolysis oil" or "pyoil") that can be refined into fuels or further processed to create chemicals or new plastic. Categorized as a type of "thermal depolymerization."[6]
	Gasification	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. Categorized as a type of "thermal depolymerization."[7]
Chemical and solvent-based processes	Solvolysis	Also called "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. Distinct from solvent-based purification because the polymers are broken down. Three major types of solvolysis are glycolysis, methanolysis, and hydrolysis.[8]
	Solvent-based purification	Also called "dissolution." Uses solvents and other chemicals to dissolve plastics and separate polymers from other components such as chemical additives. Recovered polymers must be further processed to create new plastics. Type of chemical-based process but is not depolymerization.[9]

a This percentage is actually an underestimate. In the time since NRDC finalized the data for this report and publication, we have become aware of several more proposed "chemical recycling" facilities and all of them use variations of pyrolysis. See the Appendix for more information.

PYROLYSIS ACCOUNTS FOR 80 PERCENT OF ALL PROPOSED AND OPERATING "CHEMICAL RECYCLING" FACILITIES

The term "chemical recycling" is used by the plastic industry to refer to a range of technologies that include pyrolysis, gasification, solvolysis, and solvent-based purification (Table 1). The plastic industry, however, is pushing one of these technologies above all others: pyrolysis. This single technology accounts for 80 percent of all currently operating and proposed "chemical recycling" facilities in the United States (Table 2). Pyrolysis (along with gasification) is a form of incineration with serious toxic impacts and is regulated as such under the federal Clean Air Act.[10]

Of course, just because a facility is proposed doesn't mean it will be built, and just because a facility is currently operating doesn't mean it will continue to run. In fact, during 2024, the Agilyx/AmSty (Regenyx) pyrolysis plant in Oregon, the Fulcrum Bioenergy (Sierra Biofuels) gasification plant in Nevada, and the New Hope (Trinity Oaks Tyler) pyrolysis plant in Texas all closed due to technical and financial difficulties.[11] The Prima America (Groveton) pyrolysis plant in New Hampshire also appears to be closed.[12] This is a significant number given that only eight "chemical recycling" facilities appear to be currently operating in the United States as of January 1, 2025.[13] Four proposed pyrolysis and gasification plants

TABLE 2: "CHEMICAL RECYCLING" FACILITIES BY TECHNOLOGY TYPE AND OPERATING STATUS

Data compiled by NRDC and Oil and Gas Watch; full list of facilities and detailed methods available in the Appendix. Asterisk (*) indicates that one operating facility (Eastman (Kingsport)) uses both solvolysis and gasification methods and therefore is listed in this table twice but is otherwise counted as a single facility in this report. Data current as of January 15, 2025.

Technology Type	Number of Facilities				Percentage of Total (excluding closed and canceled facilities)
	Operating or Partially Operating	Closed or Canceled	Proposed	Proposed, Under Moratorium	
Pyrolysis	6	5	24	2	80%
Gasification	1*	3	1	0	5%
Solvolysis	1*	0	3	0	10%
Solvent-based purification	1	0	1	0	5%

Local resident, Conrad Whyne, stands on a hill overlooking the site where Texas firm, Encina, plans to build a pyrolysis "chemical recycling" facility, in Point Township, Pennsylvania, on October 30, 2023.

were also canceled after strong community opposition and/or company failure, and two are in limbo after their local communities voted to impose a moratorium on the construction of such facilities.[14] (See the Appendix for a list of known operating, partially operating, proposed, closed, and canceled facilities in the United States.)

Given that 7 out of 8 currently operating or partially operating "chemical recycling" facilities and 26 out of 31 proposed facilities rely on pyrolysis, it is clear that the plastic industry's "chemical recycling" plans overwhelmingly lean on pyrolysis technology.

PYROLYSIS PRODUCES HAZARDOUS WASTE AND TOXIC FUELS, NOT RECYCLED PLASTIC

The chemical industry claims that pyrolysis can be used to create recycled plastic, but a 2023 study by U.S. Department of Energy (DOE) scientists found that only between 0.1 and 6 percent of the plastic waste entering a pyrolysis facility ends up as recycled plastic that could reenter the consumer chain, depending on the type of plastic being processed.[15] When pyrolysis is used to process plastic waste, it is most often creating fuels and other materials that are burned.[16] In fact, much of the plastic waste is actually burned as fuel during the pyrolysis process itself, since the technology requires very high temperatures to operate.

Fuel production is not considered recycling according to definitions established by the U.S. Environmental Protection Agency (EPA), the European Union, the state of California, and many other entities.[17] Nevertheless, the industry has devised highly deceptive "mass balance" credit accounting schemes to, among other things, make the creation of fuels (and the direct burning of plastic waste) appear to be recycling.[18]

At the same time, the pyrolysis process creates large amounts of hazardous waste. NRDC's analysis of EPA reporting data shows that between 2021 and 2024, three pyrolysis facilities generated more than 2 million pounds of hazardous waste and shipped it off-site for disposal (Table 3).[19] Incredibly, a 2023 analysis found that, before it closed, the Oregon Agilyx/AmSty (Regenyx) facility generated "one ton of hazardous waste for every three tons of waste processed."[20]

TABLE 3: JUST THREE PYROLYSIS FACILITIES GENERATED MORE THAN 2 MILLION POUNDS OF HAZARDOUS WASTE IN LESS THAN FOUR YEARS

Reflects hazardous waste that was produced by the Agilyx/AmSty (Regenyx), Alterra (Akron), and Braven (Zebulon) facilities and shipped off-site, according to the EPA's ECHO database.[21] At the time of this writing, the 2024 data were available through October 12, 2024.

Company/Facility Name	Pounds of Hazardous Waste Produced and Shipped Off-Site (by year)			
	2021	2022	2023	2024 (through October 12, 2024)
Agilyx/AmSty (Regenyx)[22]	416,766	326,564	224,723	113,547
Alterra (Akron)[23]	65,609	80,384	113,337	172,653
Braven (Zebulon)[24]	23,895	48,506	115,072	384,962
Total	**506,270**	**455,454**	**453,132**	**671,162**

Truck transporting hazardous chemicals.

Although only partial-year reporting was available for 2024 at the time of this writing, EPA data indicate that both Alterra (Akron) and Braven (Zebulon) had already generated far more hazardous waste in that year than in any previous year. For example, in the first 9.5 months of 2024, the Alterra (Akron) facility had shipped 172,653 pounds of hazardous waste off-site for disposal as compared with 113,337 pounds for the entire previous year; during that same 9.5-month period, the Braven (Zebulon) facility had shipped 384,962 pounds of hazardous waste off-site as compared with 115,072 pounds in 2023.[25]

The chemicals contained in hazardous waste produced by the Agilyx/AmSty (Regenyx), Alterra (Akron), and Braven (Zebulon) pyrolysis facilities are associated with a wide range of health hazards including cancer; reproductive and developmental harm; and impacts on the brain, liver, and cardiovascular and respiratory systems (Table 4).

Pyrolysis facilities also emit "hazardous air pollutants" (HAPs) such as benzene, formaldehyde, toluene, and vinyl chloride, as well as "criteria air pollutants" such as carbon monoxide and nitrogen dioxide. HAPs (also known as air toxics) are a group of air pollutants that are "known or suspected to cause cancer or other serious health effects, such as reproductive harm or birth defects, or adverse environmental effects."[26] Criteria air pollutants are six common air pollutants that are regulated by the federal government and can harm your health and the environment; some criteria pollutants can also damage crops and buildings.[27]

Table 5 shows selected HAPs and criteria air pollutants that have been released or are permitted to be released by one or more of the following six pyrolysis facilities: Agylix/AmSty (Regenyx), Alterra (Akron), Braven (Zebulon), Brightmark (Ashley), New Hope (Trinity Oaks Tyler), and Nexus (Atlanta).

TABLE 4: HEALTH HAZARDS OF CHEMICALS CONTAINED IN THE HAZARDOUS WASTE GENERATED BY PYROLYSIS FACILITIES

Reflects hazardous waste generated in 2021 by the Agilyx/AmSty (Regenyx), Alterra (Akron), and Braven (Zebulon) facilities, as reported in the EPA's Biennial Hazardous Waste Report (2021 is the most recent year for which such data are available).[28] Data on hazard traits from the California Safer Consumer Products Candidate Chemicals list.[29]

	Carcinogen	Reproductive toxicant	Developmental toxicant	Neurotoxicant	Persistent	Bioaccumulative	Liver toxicant	Cardiovascular toxicant	Respiratory toxicant	Kidney toxicant	Skin toxicant	Eye toxicant
Barium				X			X	X		X		
Benzene	X	X	X	X				X	X			
Cadmium	X	X	X		X	X			X	X		
Carbon disulfide		X	X	X								
Chlorobenzene		X		X			X			X		
Dichloroethane	X			X			X	X		X	X	
Ethyl benzene	X		X	X			X		X	X		X
Methanol			X	X								
Methyl ethyl ketone			X	X					X		X	X
Methyl isobutyl ketone	X		X	X			X			X		X
Methylene chloride	X			X			X	X	X			
Pyridine	X			X								
Tetrachloroethylene	X			X			X	X	X	X		X
Toluene			X	X			X	X	X			X
Trichloroethylene	X	X	X	X			X	X	X	X		X
Xylene				X					X			X
I,I,I-trichloroethane	X			X			X	X		X		
I,I,2-trichloro-I,2,2-trifluoroethane				X			X					
I,I,2, trichloroethane	X			X			X	X		X	X	
2-ethoxyethanol		X	X									
2-nitropropane	X			X			X			X		

TABLE 5: HEALTH HAZARDS OF AIR POLLUTANTS EMITTED BY PYROLYSIS FACILITIES

Reflects hazardous air pollutants and criteria air pollutants emitted and/or permitted to be emitted by at least one pyrolysis facility. A single asterisk (*) indicates that this toxic chemical is known to be emitted by at least one pyrolysis facility according to state regulatory data; such data are available for Agilyx/AmSty (Regenyx) for 2020 and 2023, Alterra (Akron) for 2022, and Braven (Zebulon) for 2020.[30] A double asterisk (**) indicates that this toxic chemical is permitted to be released by at least one pyrolysis facility according to state facility permits; such data are available for Alterra (Akron) for 2022, Brightmark (Ashley) for 2023, New Hope (Trinity Oaks Tyler) for 2019, and Nexus (Atlanta) for 2023.[31] Data on hazard traits from California Safer Consumer Products Candidate Chemicals list along with additional sources.[32]

	Carcinogen	Reproductive toxicant	Developmental toxicant	Neurotoxicant	Persistent	Bioaccumulative	Liver toxicant	Cardiovascular toxicant	Respiratory toxicant	Kidney toxicant	Skin toxicant	Eye toxicant
Hazardous Air Pollutants												
Acetaldehyde*	X			X					X		X	X
Acetophenone*									X		X	X
Benzene*	X	X	X	X				X	X			
Cadmium**	X	X	X		X	X			X	X		
Chlorine*									X			X
Chlorobenzene*		X		X			X			X		
Chloroform*	X	X	X	X			X	X	X	X		
Chromium**	X						X		X			
Dichlorobenzene**	X			X			X		X	X	X	X
Dioxins/furans*	X	X			X	X	X				X	
Ethyl benzene*	X		X	X			X		X	X		X
Ethyl chloride*	X		X	X								
Ethylene dibromide*	X	X	X				X			X		
Ethylene dichloride*	X			X			X	X		X	X	
Formaldehyde*	X			X			X		X			X
Hexachlorobutadiene*	X				X	X	X		X	X		
Hexane*		X		X								
Hydrochloric acid*									X		X	X
Hydrogen fluoride*									X			X
Methyl bromide*		X	X	X					X	X		
Methyl chloride*		X	X	X			X			X		
Naphthalene*	X			X	X	X	X		X			X
Nickel**	X	X							X	X		
Styrene*	X	X	X	X			X		X			X
Toluene*			X	X			X	X	X			X
Trichloroethylene*	X	X	X	X			X	X	X	X		X
Vinyl chloride*	X			X					X			X
Vinylidene chloride*	X			X			X	X		X		
Xylene*				X					X			X
Criteria Air Pollutants												
Carbon monoxide*		X	X	X				X				
Lead**	X	X	X	X	X	X				X		
Nitrogen dioxide*									X			
Particulate matter*	X	X						X	X			
Sulfur dioxide*			X						X			

Emissions rising from a petroleum refinery in Corpus Christi, Texas.

In addition to the hazardous waste and hazardous air pollutants created during the pyrolysis process, it is becoming increasingly clear that the fuel products produced by plastic pyrolysis are also highly toxic. In 2023, ProPublica reported that the EPA had approved 18 new chemical mixtures derived from plastic waste processed for use as fuels with no restrictions or limitations on environmental releases, even though EPA scientists had also determined that these chemicals posed astronomically high risks for cancer and other non-cancer health effects.[33]

One of these chemical mixtures, intended to be used as jet fuel, was estimated to pose a 1 in 4 cancer risk (meaning that 1 in every 4 people regularly exposed to it throughout their life would be likely to develop cancer). A second chemical mixture derived from plastic waste, approved to be used as a boat fuel, posed a 1 in 1 cancer risk—meaning that *every* person regularly exposed to it throughout their life would be likely to develop cancer.[34] In September 2024, after being sued by a citizen group living near the Chevron refinery where the plastic-derived fuels were to be produced, the EPA announced that it would at least temporarily withdraw its approval for these 18 plastic-based fuels while the agency reassesses them.[35]

CHEMICAL AND SOLVENT-BASED "CHEMICAL RECYCLING" PROCESSES ALSO POSE SERIOUS TOXIC CONCERNS

While chemical and solvent-based methods of "chemical recycling" are more likely than pyrolysis to actually recycle some amount of plastic (as opposed to burning it or turning it into fuels), these processes also pose serious health and environmental concerns. Not only do they often use toxic solvents and chemical agents (Table 6), but in some cases they can also generate significant quantities of hazardous waste.

Solvent-based purification and solvolysis, for example, use chemicals linked to neurotoxicity and respiratory toxicity; Chemicals linked to cancer, developmental harm, and other health hazards are also commonly used. There is still much we don't know about the solvents and chemicals being used in these processes, so the chemicals listed below may be only the tip of the iceberg.

TABLE 6: HEALTH HAZARDS OF CHEMICALS AND SOLVENTS USED FOR SOLVENT-BASED PURIFICATION AND SOLVOLYSIS

Data compiled from the scientific literature and a report from the Swiss Federal Office for the Environment.[36] Data on hazard traits from California Safer Consumer Products Candidate Chemicals list and additional sources.[37]

	Carcinogen	Reproductive toxicant	Developmental toxicant	Neurotoxicant	Liver/digestive toxicant	Cardiovascular toxicant	Respiratory toxicant	Kidney toxicant	Skin toxicant	Eye toxicant
Solvent-based purification										
Benzene	X	X	X	X		X	X			
Butane	X									
Cymene		X					X		X	X
Dichloromethane	X			X	X	X	X			
Hexane		X		X						
Methanol			X	X						
Methyl ethyl ketone			X	X			X		X	X
N-methylpyrrolidone		X	X							
Tetrachloroethylene	X			X	X	X	X	X		
Toluene			X	X	X	X	X			X
Xylene				X			X			X
Alkaline hydrolysis										
Ethylene glycol			X	X			X	X		X
Sodium hydroxide							X		X	X
Sulfuric acid	X						X			
Methanolysis										
Dichloromethane	X			X	X	X	X			
Methanol			X	X						
Glycolysis										
Ethylene glycol			X	X			X	X		X

EPA data for the PureCycle (Ironton) facility also demonstrate that solvent-based purification methods can generate significant quantities of hazardous waste. EPA records show that in the first 9.5 months of 2024, the PureCycle (Ironton) facility shipped 3,199 pounds of hazardous waste off-site.[38] Accurate data on hazardous waste production are not available for the only operating facility that uses solvolysis.[39]

INDUSTRY HAS PROPOSED BUILDING TOXIC "CHEMICAL RECYCLING" FACILITIES ACROSS THE COUNTRY, MOSTLY IN LOW-INCOME COMMUNITIES AND COMMUNITIES OF COLOR

As of January 1, 2025, there were only eight currently operating "chemical recycling" facilities in the United States, in seven states. (Figure 1). An additional 31 facilities have been proposed.[40] If the industry is successful in its greenwashing campaigns and all of the 31 proposed facilities are built, this would bring the total number of states affected to 18: Arizona, California, Colorado, Georgia, Illinois, Indiana, Louisiana, Maryland, Massachusetts, Michigan, Mississippi, New Hampshire, North Carolina, Ohio, Tennessee, Texas, Washington, and West Virginia.

Additionally, current and proposed "chemical recycling" facilities tend to be sited in low-income communities and communities of color (Table 8). Of the 36 operating and proposed facilities with available demographic data, 20 are located in areas where the population of people of color is higher than the national average, and 29 are located in areas where the low-income population is higher than the national average.

FIGURE 1: GEOGRAPHIC DISTRIBUTION OF OPERATING, PROPOSED, CLOSED, AND CANCELED "CHEMICAL RECYCLING" FACILITIES

Data compiled by NRDC and Oil and Gas Watch; full list of facilities and detailed methods is available in Appendix.

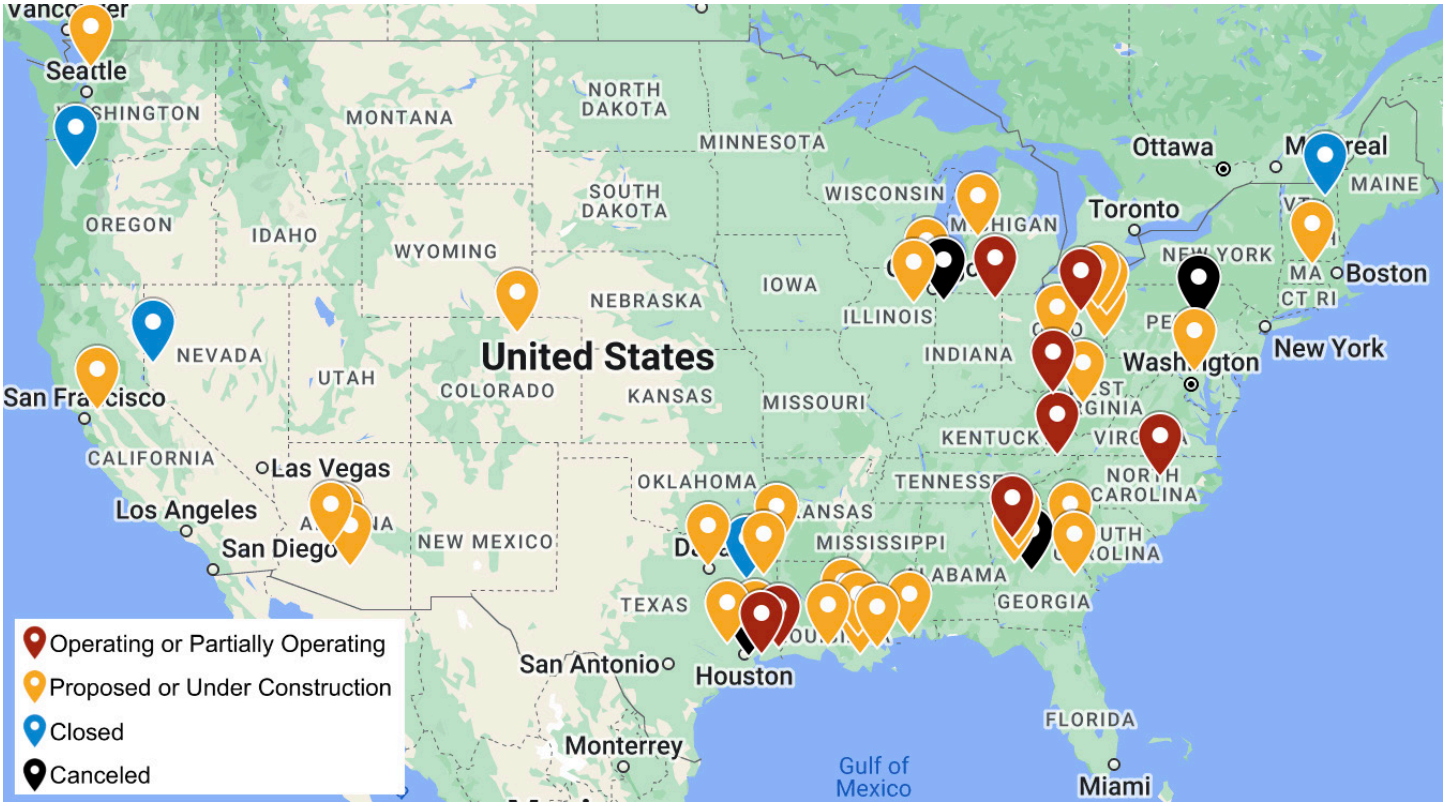


TABLE 8: DEMOGRAPHIC ANALYSIS OF COMMUNITIES WITH OPERATING AND PROPOSED FACILITIES

Based on the demographics of the population living within three miles of the facility, with demographic data obtained from EPA's Environmental Justice Screening and Mapping Tool. In the EPA data, "People of Color" is defined as individuals who list their racial status as a race other than white alone and/or list their ethnicity as Hispanic or Latino. "Low-income population" is defined as individuals in households where the household income is less than or equal to twice the federal "poverty level."[41] The "proposed or under construction" category includes facilities that have been proposed but are currently not moving forward because the local community has adopted a moratorium on construction.

Operating Status	Percentage of facilities in areas with above-average populations of people of color	Percentage of facilities in areas with above-average low-income population
Currently operating or partially operating	45%	100%
Proposed or under construction	55%	72%

Luckily, while the industry is pushing to expand "chemical recycling," other forces are countering this effort. Georgia, Indiana, and Pennsylvania have had facilities proposed and then later canceled due to community opposition.[42] In addition, four operating facilities in Oregon, Nevada, Texas, and New Hampshire shut down in 2024, and a proposed facility in Texas was canceled due to bankruptcy.[43] Two other proposed plants, in Ohio and Massachusetts, are also on hold after the communities where they were to be sited passed ordinances that placed moratoriums on the building of such facilities.[44]

LONG-DISTANCE TRANSPORTATION OF HAZARDOUS WASTE MEANS MANY MORE COMMUNITIES COULD BE ENDANGERED

In addition to impacting local communities through the emission of harmful pollutants, "chemical recycling" facilities also send hazardous waste to management sites in other locations, endangering the communities that live along the transportation routes as well as people who live near the disposal facilities.

As discussed above, "chemical recycling" facilities can generate tens of thousands or even hundreds of thousands of pounds of hazardous waste every year. This waste can take the form of solids, liquids, or sludge and may be classified by the EPA as ignitable, reactive, or corrosive.[45] This waste

is usually shipped via truck from the source "chemical recycling" facilities to other sites for "management," though it may also travel via train, boat, or airplane.[46]

In 2021 the EPA recorded that three pyrolysis facilities sent hazardous waste to six facilities for disposal.[47] NRDC analysis showed that three of these disposal facilities were sited in predominantly Hispanic/Latino communities with at least 49 percent of the population being Hispanic/Latino (compared with the national average of 19 percent).[48] Five out of these six disposal facilities engaged in some form of burning of their hazardous waste.[49]

According to EPA data, the most common form of waste "management" is burning, though this may be called "energy recovery" or "fuel blending."[50] "Energy recovery" is the term used when an incinerator converts heat from the burning of waste materials into electricity; this is still incineration.[51] "Fuel blending" refers to mixing the hazardous waste with commercial fuel that is burned to power incinerators or cement kilns; this is also incineration.[52] Studies find that proximity to waste incineration may increase risks of cancer, birth defects, and other adverse health impacts.[53]

It is not just the communities where the hazardous waste is generated and disposed that are in the path of harm, since the hazardous waste from "chemical recycling" plants is commonly transported across state lines.[54] This means that many more communities could be impacted in the event of an accident during transit.

Given that more than 80 percent of all hazardous materials in the United States (by weight) is transported via truck, NRDC used Google Maps to analyze the most likely routes taken by the hazardous waste generated by the three pyrolysis facilities.[55] At least one state requires hazardous waste to be transported via the most direct route, using state or interstate highways whenever possible; this is also the most logical route to follow for speed and efficiency.[56] Following that guidance, NRDC found that the hazardous waste likely traveled almost 4,500 miles through 13 states (Figure 2).

The most direct routes for the hazardous waste pass through several highly populated cities including Portland, Oregon; Boise, Idaho; Salt Lake City, Utah; Fort Collins, Colorado; Richmond, Virginia; Washington, D.C.; and Baltimore, Maryland, as well as several Native American reservations.

EPA data indicate that a single pyrolysis facility can generate between about 24,000 and 417,000 pounds of hazardous waste a year (Table 3). If all 26 of the pyrolysis facilities that are currently proposed or under construction are actually built and put into operation, this could mean between 624,000 and 10.8 million *additional* pounds of hazardous waste generated in, transported through, and disposed of in communities across the country.

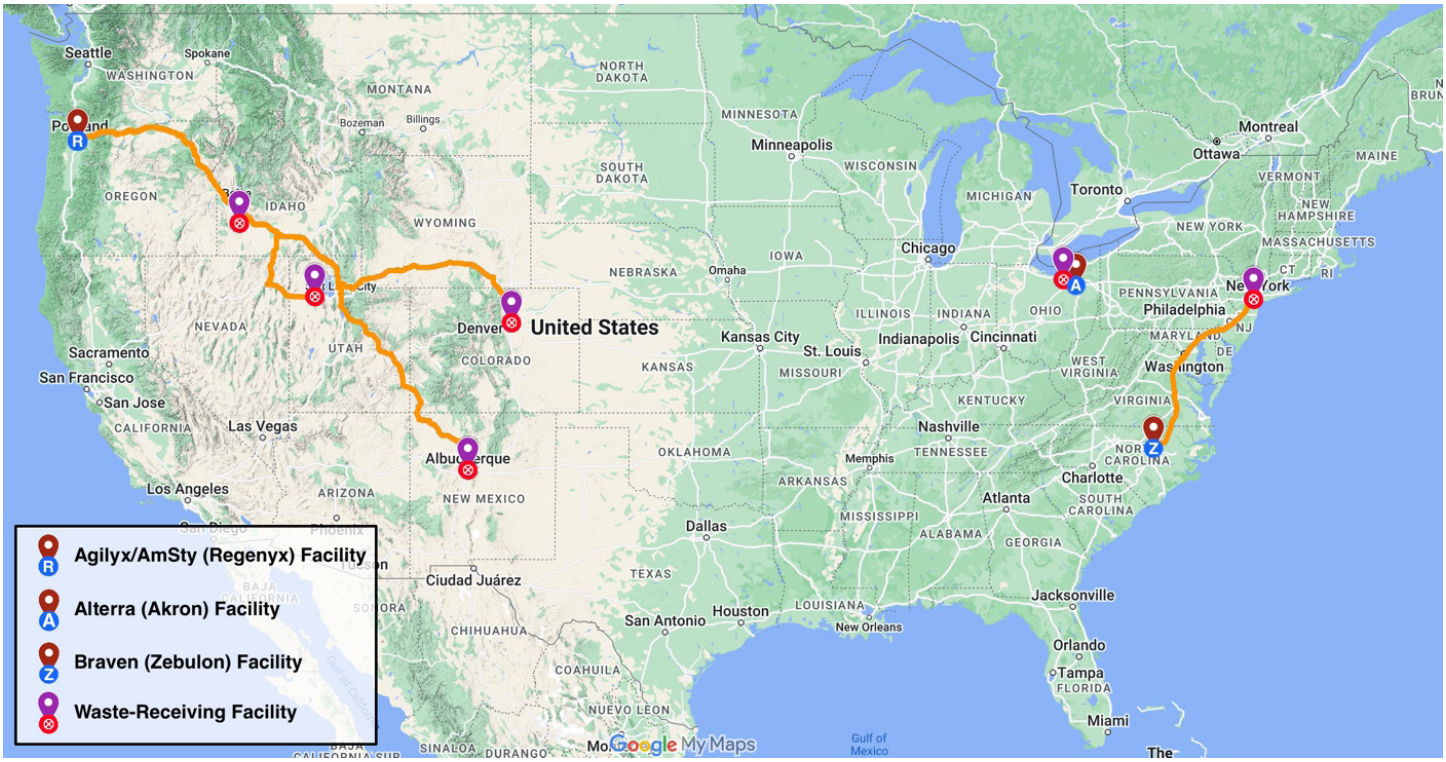
According to the Federal Bureau of Transportation Statistics, between 2014 and 2023 there were 1,811 reported hazardous waste transportation "incidents" (accidents, derailments, fires, or other causes of an unintentional release of a hazardous waste) that resulted in harmful chemical discharges to the air, water, or ground.[57] These incidents caused more than $16.6 million in property damage.[58] Ninety-three percent of them took place on highways, and most of the remainder were rail incidents.[59]

The dangers of accidents, derailments, and other transportation-related releases of hazardous materials should be clear to the public given the February 2023 train derailment in East Palestine, Ohio. The crash of the Norfolk Southern train released several highly toxic chemicals used to make plastics into the air, water and soil, with impacts measured in 16 states. This public and environmental health disaster is still being felt by many communities today.[60] More recently, in September 2024, a railcar traveling through Cleaves, Ohio, leaked the known carcinogen and plastic building block styrene.[61]

Portions of a Norfolk Southern freight train carrying plastics chemicals and other hazardous materials derailed and caught on fire on February 4, 2023 in East Palestine, Ohio.

FIGURE 2: HAZARDOUS WASTE FROM THREE PYROLYSIS FACILITIES LIKELY TRAVELED THROUGH 13 STATES ON ITS WAY TO DISPOSAL

Reflects hazardous waste data from three pyrolysis facilities: Agilyx/AmSty (Regenyx), Alterra (Akron), and Braven (Zebulon). Hazardous waste disposal information and location obtained from EPA's RCRAInfo website.[62] NRDC used Google Maps to identify likely routes that the hazardous waste traveled from the "chemical recycling" facility to the final disposal site(s).



U.S. GOVERNMENT SCIENTISTS EXPOSE FLAWS IN INDUSTRY'S FALSE NARRATIVE ON THE PROMISE OF "CHEMICAL RECYCLING" FOR PLASTIC-TO-PLASTIC RECYCLING

When it comes to creating recycled plastic, "chemical recycling" technologies are more expensive and have significantly higher environmental impacts than mechanical recycling. Some of them even perform worse than making plastic out of virgin fossil fuels.

In 2023 scientists from the DOE's National Renewable Energy Laboratory (NREL) published a peer-reviewed study that compared the technical, economic, and environmental metrics for mechanical recycling and "chemical recycling" when attempting to recycle waste plastic into new plastic.[63] The study concluded that "mechanical recycling offers energy use and [greenhouse gas] emissions an order of magnitude lower than the other recycling technologies for all plastics, as well as low [energy usage], land use, toxicity, and water use" (Table 9). The study authors also found that mechanical recycling "economically outcompetes all other options."[64]

TABLE 9: MECHANICAL RECYCLING PRODUCES FAR FEWER GREENHOUSE GAS EMISSIONS AND USES FAR LESS WATER THAN "CHEMICAL RECYCLING" TECHNOLOGIES

Using mechanical recycling as the baseline, this table shows how many times greater the greenhouse gas (GHG) emissions and water usage rates are for "chemical recycling" technologies during plastic-to-plastic recycling. Data adapted from supplemental information (Table S27) provided by the Uekert et al. (2023) study and averaged across different polymer types.[65]

"Chemical recycling" technology	GHG emissions (number of times higher than mechanical recycling)	Water use (number of times higher than mechanical recycling)
Pyrolysis	55x	1,694x
Gasification	238x	2,598x
Solvolysis	11x	84x
Solvent-based purification	2x	46x

Pyrolysis and gasification—which make up 85 percent of proposed and operating facilities—even came out looking terrible compared with the production of virgin plastic, with NREL finding that "the economic and environmental metrics of pyrolysis and gasification are currently 10–100 times higher than virgin polymers."[66] In other words, it would be cheaper and environmentally preferable to make plastic from virgin fossil fuels than to try to use pyrolysis or gasification to turn plastic waste into new plastic products.

One of the NREL scientists' key findings related to material retention (or "yield"), which is the amount of new plastic that can be made from waste plastic when processed using different technologies. According to NREL's analysis, an average of 79 percent of plastic waste that is processed through mechanical recycling actually ends up as new plastic.[67] In contrast, only 2 to 14 percent of plastic waste processed using gasification can end up being incorporated into new plastic products.[68] The yields for pyrolysis are even lower: only 0.1 to 6 percent of plastic waste can become new plastic, on average.[69]

These findings only underscore that "chemical recycling" is a false solution to the plastics crisis.

POLICY RECOMMENDATIONS

All forms of "chemical recycling" are plagued with problems and do not represent a solution to the plastic waste crisis. Instead we need local, state, and federal policies that reduce plastic production and waste, promote greater transparency around "chemical recycling," ensure the protection of environmental justice communities that are disproportionately impacted by these facilities, and do not greenwash plastic-to-fuel processes as recycling.

NRDC's policy recommendations include the following:

- Maintain or enact robust recycling definitions and standards that exclude plastic-to-fuel processes and other forms of "chemical recycling."
- Preserve state and federal regulatory health and pollution safeguards. Do not exempt "chemical recycling" facilities from solid waste permitting and regulations, which would weaken protections, transparency, and oversight. Continue to regulate pyrolysis and gasification plants as incinerators under Section 129 of the federal Clean Air Act, and continue to regulate plastic waste as waste under federal and state laws.

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- Stop industry greenwashing. Do not allow a mass balance credit approach for recycled content, including in the Federal Trade Commission (FTC) Green Guides or any federal or state extended producer responsibility (EPR) legislation, regulations, or programs.[70] Require recycled-content claims to correspond to the physical quantity of recycled material contained in the product.
- Do not provide tax credits, loan guarantees, or other financial subsidies or incentives for "chemical recycling" facilities or technologies. Allow only truly green technologies to count toward low-carbon fuel and clean energy standards, and exclude pyrolysis, gasification, waste-to-hydrogen, and other plastic-to-fuel or waste-to-energy processes.
- Adopt state and federal legislation that reduces plastic production and waste, such as phase-outs of single-use plastics, bans on the most toxic forms of plastics and chemical additives, investment in nontoxic reuse/refill/return infrastructure, creation of nontoxic materials to replace fossil fuel–derived plastics, and plans to scale 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: SURVEY OF OPERATING, PROPOSED, CANCELED AND CLOSED "CHEMICAL RECYCLING" FACILITIES IN THE U.S.

	Company/Facility name	State	City or County	Technology Used	Operating Status
1	Agilyx and AmSty Louisiana Chemical Recycling Plant	LA	St. James Parish	Pyrolysis	Proposed
2	Agilyx and AmSty Regenyx Chemical Recycling Facility	OR	Tigard	Pyrolysis	Closed
3	Agilyx and INEOS Styrolution TruStyrenyx Channahon Plant	IL	Channahon	Pyrolysis	Proposed
4	Alterra Akron Plastic Recycling Facility	OH	Akron	Pyrolysis	Operating (Pilot)
5	ARCH2 Empire Green Follansbee Plant	WV	Follansbee	Pyrolysis	Proposed
6	BASF/Total Port Arthur Olefins Complex - TOTAL ChemCycling Unit	TX	Port Arthur	Pyrolysis	Operating
7	Braven Environmental Texarkana Chemical Recycling Plant	TX	Texarkana	Pyrolysis	Proposed
8	Braven Environmental Zebulon Chemical Recycling Plant	NC	Zebulon	Pyrolysis	Operating
9	Brightmark Macon-Bibb Plastics Renewal Facility	GA	Macon	Pyrolysis	Canceled
10	Brightmark Plastics Renewal IN - Ashley Facility	IN	Ashley	Pyrolysis	Partially Operating
11	Brightmark Plastics Renewal TX - Dayton Yard Facility	TX	Dayton	Pyrolysis	Proposed
12	Brightmark Thomaston Plastics Renewal Facility	GA	Thomaston	Pyrolysis	Proposed
13	Chevron Pascagoula Refinery	MS	Pascagoula	Pyrolysis	Proposed
14	Clean-Seas Newaygo Chemical Recycling Facility	MI	Newaygo	Pyrolysis	Proposed
15	Clean-Seas Phoenix Chemical Recycling Facility	AZ	Phoenix	Pyrolysis	Proposed
16	Clean-Seas Quincy Chemical Recycling Facility	WV	Quincy	Pyrolysis	Proposed
17	Clean-Seas Templeton Chemical Recycling Facility	MA	Templeton	Pyrolysis	Proposed (Under Moratorium)
18	Eastman Chemical Longview Operations	TX	Longview	Solvolysis (Methanolysis)	Proposed
19	Eastman Chemical Tennessee Operations	TN	Kingsport	Gasification, Solvolysis (Glycolysis, Methanolysis)	Operating
20	Encina Point Township Circular Manufacturing Facility	PA	Point Township	Pyrolysis	Canceled
21	ExxonMobil Baton Rouge Polyolefins Plant	LA	Baton Rouge	Pyrolysis	Proposed
22	ExxonMobil Baytown Chemical Plant	TX	Baytown	Pyrolysis	Operating
23	Freepoint Eloy Chemical Recycling Plant	AZ	Eloy	Pyrolysis	Proposed
24	Freepoint Gulf Coast Chemical Recycling Facility	LA	Ascension Parish	Pyrolysis	Proposed
25	Freepoint Hebron Chemical Recycling Plant	OH	Hebron	Pyrolysis	Under Construction
26	Fulcrum Bioenergy Centerpoint BioFuels Plant	IN	Gary	Gasification	Canceled
27	Fulcrum Bioenergy Sierra BioFuels Plant	NV	McCarran	Gasification	Closed
28	Fulcrum Bioenergy Trinity Fuels Biorefinery	TX	Baytown	Gasification	Canceled
29	FusionOne New Iberia Hydrogen Plant	LA	New Iberia	Pyrolysis*	Proposed
30	FusionOne New Orleans Hydrogen Plant	LA	New Orleans	Pyrolysis	Proposed
31	Greeley Project Energy	CO	Greeley	Pyrolysis	Proposed
32	H Cycle Pittsburg Hydrogen Project	CA	Pittsburg	Gasification	Proposed
33	Honeywell Upcycle Plant	TX	Waller	Pyrolysis	Proposed
34	Mura Cascade ELP	WA	Arlington	Solvolysis (Hydrolysis)	Proposed
35	New Hope Trinity Oaks Tyler Facility	TX	Tyler	Pyrolysis	Closed
36	Nexus Circular Chicago Plant	IL	Cook County	Pyrolysis	Proposed
37	Nexus Circular Dallas Chemical Recycling Plant	TX	Dallas County	Pyrolysis	Proposed
38	Nexus Circular Fuels Atlanta Plant	GA	Atlanta	Pyrolysis	Partially Operating

	Company/Facility name	State	City or County	Technology Used	Operating Status
39	Nexus Circular McDonough Facility	GA	McDonough	Pyrolysis	Proposed
40	Prima America Groveton Plastics Recycling Facility	NH	Groveton	Pyrolysis	Closed
41	PureCycle Augusta Plant	GA	Augusta	Solvent-based purification	Under Construction
42	PureCycle Ironton Plant	OH	Ironton	Solvent-based purification	Operating
43	Renew One Phoenix Plastics Renewal Plant	AZ	Phoenix	Pyrolysis	Under Construction
44	Revalyu Statesboro Plant	GA	Statesboro	Solvolysis (Glycolysis)	Proposed
45	SOBE Lowellville Plant	OH	Lowellville	Pyrolysis	Proposed
46	SOBE Youngstown Chemical Recycling Plant	OH	Youngstown	Pyrolysis	Proposed (Under Moratorium)
47	W.R. Grace Chemical Recycling Plant	MD	Columbia	Pyrolysis*	Proposed

*NRDC review of proposed process strongly suggests that the technology is a variation of pyrolysis

Methodology: NRDC requested data on "chemical recycling" facilities from Oil and Gas Watch (OGW), which included information on facility name, location, and operating status, among other information.[71] OGW is a public inventory that tracks oil, gas, and petrochemical infrastructure in the United States, drawing from government records, news articles, and corporate findings and disclosures.

Because the "chemical recycling" technology used by the facilities was often not included in the OGW database, NRDC combed through publicly available information to determine what type of technology was being used or proposed to be used by each facility.[72] For two proposed facilities, NRDC's review of the proposed process strongly suggested that the technology was a variation of pyrolysis and therefore assumed this to be the case for the purposes of our analysis; these two facilities are designated by an asterisk (*).

NRDC updated the names of many of the facilities in the OGW database to reflect both the company and specific facility names. We included proposed facilities in our analysis only when a specific city or county had been identified, as some more general proposals may reflect the hopes of a company more than actual specific plans.[73]

NRDC added one proposed facility that was not included in the OGW database (H Cycle (Pittsburg)), as it was similar to other facilities that were included.[74] We also excluded one facility (Aquafil (Phoenix)), which is not in the OGW database but was included in NRDC's 2022 Recycling Lies report, because we determined that the "chemical recycling" processing is taking place overseas.[75] In a few cases, we also excluded proposed facilities in the OGW database where we could determine that they were duplicates or appeared to be performing mechanical recycling activities rather than "chemical recycling."

Please note that in some cases, OGW listed facilities as being operating or partially operating when it may not be fully clear that they actually are operating; NRDC assumed these facilities were operating or partially operating unless we could identify definitive information to the contrary.

Addendum: After the finalization of the data contained in this report, but prior to publication, NRDC became aware of several additional proposed "chemical recycling" facilities. They include seven new or expanded facilities which have been proposed by Abundia, Astera, ExxonMobil, Continental Carbon, PlastikGas, and Resynergi to be operated in AL, CA, CO, NM and TX.[76] Notably, *all* of these proposed facilities would employ variations of pyrolysis—further underscoring the findings of this report.[77] We also learned that the proposed facility in Greeley, CO may be cancelled, but this has not been fully confirmed.[78]

ENDNOTES

1 National Academies of Sciences, Engineering, and Medicine, *Reckoning with the U.S. Role in Global Ocean Plastic Waste* (Washington, D.C.: National Academies Press, 2022), https://doi.org/10.17226/26132.

2 Anelia Milbrandt et al., "Quantification and Evaluation of Plastic Waste in the United States," *Resources, Conservation and Recycling* 183 (August 2022): 106363, https://doi.org/10.1016/j.resconrec.2022.106363; Beyond Plastics and the Last Beach Cleanup, "The Real Truth About the U.S. Plastics Recycling Rate," May 4, 2022, https://www.beyondplastics.org/reports/the-real-truth-about-the-us-plastics-recycling-rate. Note: The plastic industry is highly intertwined with the chemical industry, but we use the term *plastic industry* for the sake of simplicity here.

3 Organization for Economic Cooperation and Development, *Global Plastics Outlook: Policy Scenarios to 2060*, June 2022, https://doi.org/10.1787/aa1edf33-en.

4 Laura Paddison, "The Plastics Industry Says This Technology Could Help Banish Pollution. It's 'an Illusion,' Critics Say," CNN, May 31, 2024, https://www.cnn.com/2024/05/30/climate/chemical-recycling-plastic-pollution-climate/index.html#; American Chemistry Council, "Advanced Recycling," 2024, https://www.americanchemistry.com/better-policy-regulation/plastics/advanced-recycling.

5 Veena Singla and Tessa Wardle, "Recycling Lies: 'Chemical Recycling' of Plastic Is Just Greenwashing Incineration," NRDC, September 7, 2022, https://www.nrdc.org/sites/default/files/chemical-recycling-greenwashing-incineration-ib.pdf.

6 Tariq Maqsood et al., "Pyrolysis of Plastic Species: A Review of Resources and Products," *Journal of Analytical and Applied Pyrolysis* 159 (October 2021): 105295, https://doi.org/10.1016/j.jaap.2021.105295; Simon Hann and Toby Connock, "Chemical Recycling: State of Play," Eunomia, December 8, 2020, https://chemtrust.org/wp-content/uploads/Chemical-Recycling-Eunomia.pdf.

7 S. A. Salaudeen, P. Arku, and Animesh Dutta, "Gasification of Plastic Solid Waste and Competitive Technologies," chapter 10 in *Plastics to Energy*, Sultan al-Salem, ed. (New York: Elsevier, 2019), 269–93, https://doi.org/10.1016/B978-0-12-813140-4.00010-8; Hann and Connock, "Chemical Recycling: State of Play."

8 Dominik Triebert et al., "Solvent-Based Recycling," in *ACS Symposium Series*, Dimitris I. Collias, Martin I. James, and John M. Layman, eds. (Washington, D.C.: American Chemical Society, 2021) 1391:33–59, https://doi.org/10.1021/bk-2021-1391.ch003.

9 Hann and Connock, "Chemical Recycling: State of Play."

10 Jacob Wallace, "EPA Withdraws Proposal to Drop Pyrolysis from Regulation Following Criticism," *WasteDive* (blog), June 6, 2023, https://www.wastedive.com/news/epa-pyrolysis-emissions-clean-air-act-decision/652153/.

11 In the text of this report, we identify facilities with the company name first and the plant name in parentheses. Jacob Wallace, "Fulcrum BioEnergy Shutters Nevada Waste-to-SAF Facility, CEO Departs," *WasteDive* (blog), June 5, 2024, https://www.wastedive.com/news/fulcrum-bioenergy-sierra-biofuels-reno-nevada-shutdown-eric-pryor/717916/; Ben Seal, "Latest Chemical Recycling Plant Closing Spurs Concern over the Industry's Viability," *EHN* (blog), April 8, 2024, https://www.ehn.org/chemical-recycling-plant-closing-2667655935.html; Oil & Gas Watch, "Despite Big Growth Plans, Chemical Plastics Recycling Plant in East Texas Unexpectedly Stops Operating," October 29, 2024, https://news.oilandgaswatch.org/template/brief/despite-big-growth-plans-chemical-plastics-recycling-plant-in-east-texas-unexpectedly-stops-operating.

12 In early December 2024, NRDC noted that Google Maps included a "permanently closed" label on the Prima America facility. On December 10, 2024, we conducted a business record search on the New Hampshire secretary of state's website and sent an email to the contact listed there asking if the facility was still operating but received no response as of January 13, 2025. NRDC also left a voicemail message on the listed phone line on December 10 and also received no response as of January 13, 2025. We thus concluded that the facility does indeed appear to be closed.

13 As noted in Table 2, one operating facility uses both solvolysis and gasification methods. It therefore is listed in this table twice but is otherwise counted as a single facility in this report.

14 Jacob Wallace. "Fulcrum BioEnergy Files for Chapter 11 Bankruptcy Protection," *WasteDive* (blog), September 10, 2024, https://www.wastedive.com/news/fulcrum-bioenergy-chapter-11-bankruptcy-nevada/726555/; James Bruggers, "A Giant Plastics Chemical Recycling Plant Planned for Pennsylvania Died After Two Years. What Happened?" *Inside Climate News*, April 26, 2024, https://insideclimatenews.org/news/26042024/encina-pennsylvania-chemical-recycling-plant-canceled/; *Recycling Today*, "Brightmark Scraps Plans for Georgia Plant," April 12, 2022, https://www.recyclingtoday.com/news/brightmark-georgia-advanced-plastic-recycling-plant-discussions-end/; Haley Rischar, "Clean Fuels Company Verges on Collapse After Financial Troubles, Layoffs," *Waste Today*, June 5, 2024, https://www.wastetodaymagazine.com/news/clean-fuels-company-verges-on-collapse-after-financial-troubles-layoffs-fulcrum-bionergy/; Violet Comber-Wilen, "Waste-to-Jet Fuel Company Likely Won't Place Plant in Gary, After Years of Plans," WFYI Indianapolis, June 21, 2024, https://www.wfyi.org/news/articles/waste-to-jet-fuel-company-likely-wont-place-plant-in-gary-after-years-of-plans; Stan Boney, "Council Votes to Extend Moratorium Preventing SOBE's Pyrolysis Process," WKBN 27, November 21, 2024, https://www.wkbn.com/news/local-news/sharon-news/council-votes-to-extend-moratorium-preventing-sobes-pyrolysis-process/; Oil & Gas Watch, "Massachusetts Town Targeted for Waste Plastics Processing Plant Passes One-Year Moratorium," December 11, 2024, https://news.oilandgaswatch.org/template/brief/massachusetts-town-targeted-for-waste-plastics-processing-plant-passes-one-year-moratorium.

15 Taylor Uekert et al., "Technical, Economic, and Environmental Comparison of Closed-Loop Recycling Technologies for Common Plastics," *ACS Sustainable Chemistry & Engineering* 11, no. 3 (January 23, 2023): 965–78, https://doi.org/10.1021/acssuschemeng.2c05497. See Table S29 in the "supporting information" file associated with the paper, available at https://pubs.acs.org/doi/suppl/10.1021/acssuschemeng.2c05497/suppl_file/sc2c05497_si_001.pdf.

16 Singla and Wardle, "Recycling Lies."

17 U.S. Environmental Protection Agency (hereinafter EPA), Office of Resource Conservation and Recovery, *Draft National Strategy to Prevent Plastic Pollution*, EPA 530-R-23-006, April 2023, https://www.epa.gov/system/files/documents/2023-04/Draft_National_Strategy_to_Prevent_Plastic_Pollution.pdf; European Parliament and Council of the European Union, "Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on Waste and Repealing Certain Directives," *Official Journal of the European Union*, November 22, 2008, https://eur-lex.europa.eu/eli/dir/2008/98/oj; California Department of Tax and Fee Administration, "Laws, Regulations and Annotations," 2024, https://www.cdtfa.ca.gov/lawguides/vol4/iwmfl/iwmfl-40180.html#:~:text=Chapter%202.&text=40180.,Section%2040201%20or%20EMSW%20conversion.

18 Renee Sharp and Veena Singla, "The Plastics Industry's Latest Deception: 'Mass Balance.'" NRDC *Expert Blog*, September 9, 2024, https://www.nrdc.org/bio/renee-sharp/plastics-industrys-latest-deception-mass-balance.

19 Hazardous waste data for the other four operating pyrolysis facilities either are obscured by the fact that they are part of larger chemical plants that also produce hazardous waste (in the case of ExxonMobil (Baytown) and BASF/Total (Port Arthur)), or are not reported to the EPA (in the case of Brightmark (Ashley) and Nexus (Atlanta)), likely because they are not processing much plastic. See EPA, "Enforcement and Compliance History Online," 2024, https://echo.epa.gov/.; Beyond Plastics and IPEN. "Chemical Recycling: A Dangerous Deception," October 2023. https://static1.squarespace.com/static/5eda91260bbb7e7a4bf528d8/t/655791f76ad9bb07d10e1290/1700237880522/10-30-23_Chemical-Recycling-Report_web.pdf.; James Bruggers, "Inside Indiana's 'Advanced' Plastics Recycling Plant: Dangerous Vapors, Oil Spills and Life-Threatening Fires," *Inside Climate News*, June 16, 2023, https://insideclimatenews.org/news/16062023/indiana-advanced-plastics-recycling-vapors-spills-fires/.

20 Beyond Plastics and IPEN, "Chemical Recycling."

21 EPA, "Enforcement and Compliance History Online," 2024, https://echo.epa.gov/.

22 EPA, "Detailed Facility Report: Agilyx," January 1, 2025, https://echo.epa.gov/detailed-facility-report?fid=110045561441.

23 EPA, "Detailed Facility Report: Alterra," EPA, January 1, 2025, https://echo.epa.gov/detailed-facility-report?fid=110063893461.

24 EPA, "Detailed Facility Report: Braven," January 1, 2025, https://echo.epa.gov/detailed-facility-report?fid=110070864905.

25 Reporting time period was from January 1, 2024, to October 12, 2024. EPA, "Facility Report: Alterra"; EPA, "Facility Report: Braven."

26 EPA, "Hazardous Air Pollutants," accessed September 5, 2024, https://www.epa.gov/haps.

27 EPA, "Criteria Air Pollutants," accessed July 31, 2024, https://www.epa.gov/criteria-air-pollutants; New Hampshire Department of Environmental Services, "EPA Criteria Air Pollutants," 2020, https://www.des.nh.gov/sites/g/files/ehbemt341/files/documents/ard-41.pdf.

28 EPA, "Biennial Hazardous Waste Report," last updated November 25,2024, https://www.epa.gov/hwgenerators/biennial-hazardous-waste-report.

29 California Department of Toxic Substances Control, "CalSAFER," 2024, https://calsafer.dtsc.ca.gov/cms/search/.

30 Fredric Rosqvist, "Regenyx Tigard Facility ACDP No. 34-9514-SI-01 Annual Report–2023," Oregon Department of Environmental Quality, February 1, 2024, https://www.deq.state.or.us/AQPermitsonline/34-9514-SI-01_AR_2023.PDF; Clara Funk, "2020 Air Toxics Emissions Inventory," Oregon Department of Environmental Quality, August 10, 2022, https://www.deq.state.or.us/AQPermitsonline/34-9514-SI-01_ATEI_2020.PDF; Laura Miracle, "Alterra Energy, LLC Compliance Review Air Permit Summit County 1677011258," Akron Regional Air Quality Management District, August 2, 2022, https://edocpub.epa.ohio.gov/publicportal/ViewDocument.aspx?docid=1958708; Air Compliance Engineering, "Emissions Test Report: Particulate Matter, Sulfur Dioxide, Oxides of Nitrogen, Carbon Monoxide, and Volatile Organic Compounds from Waste Plastic Pyrolysis Process/Flare," March 2020, https://edocs.deq.nc.gov/AirQuality/DocView.aspx?id=424705&dbid=0&repo=AirQuality&searchid=3e2c92dd-b632-48fe-b1df-60bf304a2707&cr=1.

31 Angie Johnson, "PTI/PTIO Application A0072225 Alterra Energy, LLC 1677011258," Ohio Division of Pollution Control, October 15, 2022, https://us-east-1.storage.xata.sh/cvacamc5o55sfestd50pimrt24; Jenny Acker, "Notice of Decision: Approval—Effective Immediately," Indiana Department of Environmental Management, May 1, 2024, https://permits.air.idem.in.gov/46837f.pdf; Johnny Combs, "Permits by Rule 30 TAC Chapter 106, Section 106.4 Quick-Check Applicability Checklist Instructions and Guidance for Using the 'Quick-Check' Checklist," Texas Commission on Environmental Quality, May 10, 2019, https://records.tceq.texas.gov/cs/idcplg?IdcService=TCEQ_PERFORM_SEARCH&QueryText=((xCityName%20%3Ccontains%3E%20`tyler`))%20%20%3CAND%3E%20%20(dSecurityGroup%20%3Cmatches%3E%20`Public`%3CAND%3E(xRegEntName%20%3Csubstring%3E%20`trinity%20oaks`))&ResultCount=20&SortOrder=Desc&SortField=&columnsString=dDocName,xRecordSeries,xPrimaryID,xSecondaryID,xInsightDocumentType,dDocTitle,xBeginDate,xEndDate,xLitigationHold,xRegEntName,xMedia,xComments,dSecurityGroup&accessID=4759538&IsExternalSearch=1; Richard E. Dunn, "Permit Amendment No. 2869-121-0946-S-01-1," Georgia Department of Natural Resources, April 12, 2023, https://permitsearch.gaepd.org/permit.aspx?id=PDF-OP-28615.

32 California Department of Toxic Substances Control, "CalSAFER"; Agency for Toxic Substances and Disease Registry, "Dichlorobenzenes," February 10, 2021, https://wwwn.cdc.gov/TSP/substances/ToxSubstance.aspx?toxid=126; International Agency for Research on Cancer, "Q&As on Outdoor Air Pollution and Cancer," World Health Organization, 2013, https://www.iarc.who.int/wp-content/uploads/2018/07/pr221_QA.pdf; EPA, "Health and Environmental Effects of Particulate Matter (PM)," July 16, 2024, https://www.epa.gov/pm-pollution/health-and-environmental-effects-particulate-matter-pm; Christopher G. Nolte et al., "Air Quality," chapter 13 in *Impacts, Risks, and Adaptation in the United States: The Fourth National Climate Assessment*, Volume II, U.S. Global Change Research Program, 2018, https://doi.org/10.7930/NCA4.2018.CH13; Giuseppe Genchi et al., "Nickel: Human Health and Environmental Toxicology," *International Journal of Environmental Research and Public Health* 17, no. 3 (January 21, 2020): 679, https://doi.org/10.3390/ijerph17030679.

33 Sharon Lerner, "EPA Approved a Fuel Ingredient Even Though It Could Cause Cancer in Virtually Every Person Exposed Over a Lifetime." ProPublica, August 4, 2023, https://www.propublica.org/article/epa-approved-chevron-fuel-ingredient-cancer-risk-plastics-biofuel.

34 On April 7, 2023, Cherokee Concerned Citizens, a group living near the oil refinery where the chemicals were to be turned into fuels, sued the EPA, challenging its approval of the new chemicals for violating the Toxic Substances Control Act (TSCA). On September 20, 2024, the EPA filed a motion for remand on its approval of the 18 new chemicals, citing the agency's "substantial concerns" that the chemical approvals "may have been made in error."

35 Sharon Lerner, "EPA Will Withdraw Approval of Chevron Plastic-Based Fuels Likely to Cause Cancer," *The Guardian*, September 30, 2024, https://www.theguardian.com/environment/2024/sep/30/epa-withdraws-approval-chevron-fuels-causing-cancer.

36 Yi-Bo Zhao, Xu-Dong Lv, and Hong-Gang Ni, "Solvent-Based Separation and Recycling of Waste Plastics: A Review," *Chemosphere* 209 (October 2018): 707–20, https://doi.org/10.1016/j.chemosphere.2018.06.095; Austin L. Lehr et al., "Design of Solvent-Assisted Plastics Recycling: Integrated Economics and Environmental Impacts Analysis," *Frontiers in Sustainability* 3 (September 21, 2022): 989720, https://doi.org/10.3389/frsus.2022.989720; Ina Vollmer et al., "Beyond Mechanical Recycling: Giving New Life to Plastic Waste," *Angewandte Chemie (International Ed. in English)* 59, no. 36 (September 1, 2020): 15402–23, https://doi.org/10.1002/anie.201915651; Peter Quicker, *Status, Potentials and Risks of Chemical Recycling of Waste Plastics*, Swiss Federal Office for the Environment, October 31, 2023, https://www.bafu.admin.ch/dam/bafu/en/dokumente/international/externe-studien-berichte/status-potentials-and-risks-of-chemical-recycling-of-waste-plastics.pdf.download.pdf/risks-chemical-recycling-plastics.pdf; Mahsa Babaei, Milad Jalilian, and Kaveh Shahbaz, "Chemical Recycling of Polyethylene Terephthalate: A Mini-Review," *Journal of Environmental Chemical Engineering* 12, no. 3 (June 2024): 112507, https://doi.org/10.1016/j.jece.2024.112507.

37 California Department of Toxic Substances Control, "CalSAFER"; European Chemicals Agency, "P-Cymene," European Chemical Agency, September 6, 2023, https://echa.europa.eu/substance-information/-/substanceinfo/100.002.542#:~:text=Danger.

38 EPA, "Detailed Facility Report: PureCycle," January 1, 2025, https://echo.epa.gov/detailed-facility-report?fid=110070541374.

39 The Eastman (Kingsport) facility is registered with the EPA as a large-quantity generator of hazardous waste; however, due to the way the data are reported to the EPA, it is impossible to know how much of this hazardous waste is being generated by its "chemical recycling" activities.

40 We included proposed facilities only when a specific city or county was identified, as some more general proposals may reflect the hopes of a company more than actual specific plans. For more information on the methodology for identifying proposed facilities, please see the Appendix.

41 EPA, "EJScreen," 2024, https://ejscreen.epa.gov/mapper/; EPA, "Overview of Socioeconomic Indicators in EJScreen," January 9, 2024, https://www.epa.gov/ejscreen/overview-socioeconomic-indicators-ejscreen.

42 *Recycling Today*, "Brightmark Scraps Plans for Georgia Plant"; Bruggers, "A Giant Plastics Chemical Recycling Plant"; Comber-Wilen, "Waste-to-Jet Fuel Company."

43 Beatriz Santos, "Agilyx, AmSty Lost $4.5 Million in Polystyrene Chemical Recycling JV Since 2021," *Sustainable Plastics* (blog), March 7, 2024, https://www.sustainableplastics.com/news/agilyx-amsty-lost-45-million-polystyrene-chemical-recycling-jv-2021; Wallace, "Fulcrum BioEnergy Shutters Nevada Facility"; Wallace, "Fulcrum BioEnergy Files for Chapter 11 Bankruptcy Protection"; Haley Rischar, "Clean Fuels Company Verges on Collapse After Financial Troubles, Layoffs," *Waste Today*, June 5, 2024, https://www.wastetodaymagazine.com/news/clean-fuels-company-verges-on-collapse-after-financial-troubles-layoffs-fulcrum-bionergy/; Oil & Gas Watch, "Despite Big Growth Plans."

44 Boney, "Council Votes to Extend Moratorium"; Oil & Gas Watch, "Massachusetts Town."

45 EPA, "RCRAInfo Search," accessed November 7, 2024, https://enviro.epa.gov/envirofacts/rcrainfo/search.

46 EPA, "Hazardous Waste Transportation," EPA, May 9, 2024, https://www.epa.gov/hw/hazardous-waste-transportation; U.S. Department of Transportation (hereinafter DOT), Bureau of Transportation Statistics, "U.S. Hazardous Materials Shipments by Transportation Mode, 2017," 2017, https://www.bts.gov/content/us-hazardous-materials-shipments-transportation-mode-2007.

47 The three facilities are Agilyx/AmSty (Regenyx), Alterra (Akron), and Braven (Zebulon). EPA, "RCRAInfo Search," accessed November 15, 2024, https://enviro.epa.gov/envirofacts/rcrainfo/search.

48 Ibid.; EPA, "EJScreen."

49 EPA, "EJScreen," accessed November 7, 2024, https://ejscreen.epa.gov/mapper/.

50 EPA, "RCRAInfo Search," accessed November 7, 2024; Singla and Wardle, "Recycling Lies."

51 Singla and Wardle, "Recycling Lies."

52 Ibid.

53 P. W. Tait et al., "The Health Impacts of Waste Incineration: A Systematic Review," *Australian and New Zealand Journal of Public Health* 44, no. 1 (February 2020): 40-48, https://www.sciencedirect.com/science/article/pii/S132602002300732X.

54 EPA, "RCRAInfo Search," accessed November 7, 2024.

55 Excludes hazardous materials transported through pipelines since this is not a method used to transport hazardous waste. DOT, Bureau of Transportation Statistics, "U.S. Hazardous Materials Shipments."

56 California Department of Toxic Substances Control, "Managing Hazardous Waste," August 2007, https://dtsc.ca.gov/hazardous-waste-transporter-requirements-fact-sheet/.

57 DOT, Pipeline and Hazardous Materials Safety Administration, "Incident Statistics, 10 Year Incident Summary Reports, Hazardous Waste Incidents, https://www.phmsa.dot.gov/hazmat-program-management-data-and-statistics/data-operations/incident-statistics.

58 Ibid.

59 Ibid.

60 EPA, "East Palestine, Ohio Train Derailment," accessed August 23, 2024, https://www.epa.gov/east-palestine-oh-train-derailment; David A. Gay et al., "Widespread Impacts to Precipitation of the East Palestine Ohio Train Accident," *Environmental Research Letters* 19, no. 7 (July 1, 2024): 074022, https://doi.org/10.1088/1748-9326/ad52ac.

61 Artemis Moshtaghian, Melissa Alonso, and Taylor Romine, "Residents of Ohio Community Allowed to Return After Chemical Leak from Railroad Car Forced Evacuations." CNN, September 25, 2024, https://www.cnn.com/2024/09/24/us/ohio-train-chemical-leak-evacuation-order/index.html.

62 EPA, "RCRAInfo Search."

63 Uekert et al., "Comparison of Closed-Loop Recycling Technologies."

64 Ibid.

65 Ibid.

66 Ibid.

67 Ibid.

68 Ibid.

69 Ibid.

70 For information on "mass balance" credit approaches, see Renee Sharp and Veena Singla, "The Plastics Industry's Latest Deception: 'Mass Balance.'" NRDC *Expert Blog*, September 9, 2024, https://www.nrdc.org/bio/renee-sharp/plastics-industrys-latest-deception-mass-balance.

71 Oil & Gas Watch, "Search the Oil & Gas Watch Database," 2024, https://oilandgaswatch.org/search.

72 Bea Miñana, "Global Directory of Molecular Recycling Technologies," Closed Loop Partners, 2021, https://www.closedlooppartners.com/wp-content/uploads/2021/11/CLP_Molecular-Recycling-Directory-2021.pdf; Beyond Plastics and IPEN, "Chemical Recycling"; Kate Ringier and Josh Want, "AmSty and Agilyx Announce Collaboration to Build Advanced Recycling Facility," Agilyx, April 8, 2021, https://www.agilyx.com/amsty-and-agilyx-announce-collaboration-to-build-advanced-recycling-facility/; Kate Ringier and April Ludwikoski, "Agilyx and INEOS Styrolution Advance Development of Large Scale TruStyrenyxTM Plant," Agilyx, March 27, 2023, https://www.agilyx.com/agilyx-and-ineos-styrolution-advance-development-of-large-scale-trustyrenyx-plant/; Marissa Heffernan, "Illinois Chemical Recycling Plant Moving Forward," *Plastics Recycling Update*, April 18, 2023, https://resource-recycling.com/plastics/2023/04/18/illinois-chemical-recycling-plant-moving-forward/; Brightmark, "Plastics: Frequently Asked Questions (FAQs)," July 3, 2024, https://www.brightmark.com/plastics-renewal/faq; Emily Friedman, "ExxonMobil's Commercial-Scale Chemical Recycling Facility Begins Production," Independent Commodity Intelligence Services, December 14, 2022, https://www.icis.com/explore/resources/news/2022/12/14/10835695/exxonmobil-s-commercial-scale-chemical-recycling-facility-begins-production/; H Cycle, "H Cycle FAQ," 2024, https://hcycle.com/faq/; SOBE Energy Solutions LLC, "SOBE Energy Solutions (SES)," 2017, https://www.sobeenergysolns.com/; WR Grace & Company, "Maryland Department of the Environment Air and Radiation Administration Application for a Permit to Construct: Docket #16-23," Maryland Department of the Environment, 2023, https://mde.maryland.gov/programs/permits/AirManagementPermits/Documents/Public-Review/new%20public%20review%20documents/WR%20Grace%20Combined%20init%20and%20Sub%201%20and%202%2016-23.pdf; EIN Presswire, "Braven Environmental and W. R. Grace & Co. Collaborate on Renewable and Recyclable Feedstock from Advanced Recycling," KGET.com, July 18, 2024, https://www.kget.com/business/press-releases/ein-presswire/728608760/braven-environmental-and-w-r-grace-co-collaborate-on-renewable-and-recyclable-feedstock-from-advanced-recycling/; Stefan Brandt and Rafael Gonzalez, "Navigating the Energy Transition—Co-Processing of Chemical Recycling Products in Fluid Catalytic Cracking Units," *Asian Downstream Insights*, September 23, 2024, https://asiandownstreaminsights.com/energy-transition/navigating-the-energy-transition-co-processing-of-chemical-recycling-products-in-fluid-catalytic-cracking-units/.

73 Kate Ringier and April Ludwikoski, "Agilyx and INEOS Styrolution Advance Development of Large Scale TruStyrenyx™ Plant," Agilyx, March 27, 2023, https://www.agilyx.com/agilyx-and-ineos-styrolution-advance-development-of-large-scale-trustyrenyx-plant/.

74 Gregg Nudd, "Draft Environmental Impact Report for the H Cycle Pittsburg Renewable Hydrogen Project," Bay Area Air Quality Management District, March 18, 2024, https://www.baaqmd.gov/~/media/files/planning-and-research/ceqa-letters/2024/h-cycle-pitts-hydro-project-deir-air-district-ltr-pdf.pdf?rev=5a05cdb4b3804645b566cf9a68769bc0.

75 Aquafil, "Locations," 2022, https://www.aquafil.com/locations/.

76 Oil & Gas Watch. "Abundia Cedar Port Chemical Recycling Plant." Oil & Gas Watch, 2024, https://oilandgaswatch.org/facility/rec_ct90lsu4gbv0pl1nlt1g.; Wylee Mitchell. "Controversial Community Meeting on 19 Road Recycling Facility Proposal." KJCT News 8, March 7, 2025, https://www.kjct8.com/2025/03/07/controversial-community-meeting-19-road-recycling-facility/. Oil & Gas Watch. "ExxonMobil Baytown Chemical Plant." Oil & Gas Watch, 2024, https://oilandgaswatch.org/facility/6671.; Oil & Gas Watch. "ExxonMobil Beaumont Refinery." Oil & Gas Watch, 2024. https://oilandgaswatch.org/facility/761.; Oil & Gas Watch. "Continental Carbon Alabama Chemical Recycling Plant." Oil & Gas Watch, 2024. https://oilandgaswatch.org/facility/rec_ctrfiln86psc0rh9c1qg.; Oil & Gas Watch. "PlastikGas Los Lunas Plastics to Fuel Plant." Oil & Gas Watch, 2024. https://oilandgaswatch.org/facility/rec_cur9rg2b05cnm2fris7g.; Megan Quinn. "Chemical Recycler Resynergi Receives $18M for Decentralized Facility Plan." WasteDive (blog), February 24, 2025, https://www.wastedive.com/news/chemical-recycling-investment-resynergi-taranis-lummus/740722/.

77 Oil & Gas Watch, "Abundia Cedar Port."; Mitchell, "19 Road Recycling Facility."; EHN Curators. "Exxon Commits $200 Million to Texas Recycling Expansion." The Daily Climate, November 25, 2024, https://www.dailyclimate.org/exxon-chemical-recycling-2669996651.html.; Oil & Gas Watch, "Continental Carbon."; Erick Nicolás Caicedo Pazmiño and Carlos David Cumba Burgos. "Analysis of an alternative for the production of biofuel from the pyrolysis of post-consumer waste plastics from a banana plantation in Ecuador." Ecuador: Escuela Superior Politécnica del Litoral, 2021, https://www.dspace.espol.edu.ec/bitstream/123456789/54369/1/T-110333%20-%20ERICK%20CAICEDO%20Y%20CARLOS%20CUMBA%20.pdf.; Astera and Carbon Conversion Group. "Astera and Carbon Conversion Groups Innovative Plastic to Graphene Conversion Technology," 2024, https://pw.lacounty.gov/epd/tf/Attachments/Minutes_Attachments/2024_Attachments/Astera-lacountydeck.pdf.

78 Oil & Gas Watch. "Greeley Project Energy." Oil & Gas Watch, 2024, https://oilandgaswatch.org/facility/6140.