HB1092 - Oldenburg.pdf
Uploaded by: Aaron Oldenburg
Position: FAV

2025-02-24 Recycling

Dear Committee, I urge you to vote "yes" on HB1092 to prohibit the chemical conversion of plastic in the recycling process.

Most plastic recycling is not actually recycling. Plastics cannot be used over and over again in the same way as aluminum. The plastic industry, in a ploy to make people feel better about plastic consumption, has created a laundry list of codes for increasingly unfeasible and destructive methods for turning one plastic into another. Sometimes this works once before the plastic eventually needs to go to the landfill.

The process of chemical conversion to "recycle" plastic is incredibly polluting. In the process of breaking down the plastic and turning it into something else, a process that ends up reusing a maximum of 14% of the plastic involved, these factories pump out tons of hazardous waste into the air, land and water, including chemicals that have been found to cause damage to the nervous system.

Plastic "recycling" is a scam, and chemical conversion is a particularly nefarious form of it. Please vote "yes" on this bill so this destructive process is not lumped in with more environmentally friendly forms of recycling.

Thank you,

Aaron Oldenburg

HB1092_Prohibition_on_the_Chemical_Conversion_of_P
Uploaded by: Cecilia Plante
Position: FAV

MARYLAND LEGISLATIVE COALITION

TESTIMONY FOR HB1092
Recycling – Prohibition on the Chemical Conversion of Plastic

Bill Sponsor: Delegate Terrasa
Committee: Environment and Transportation
Organization Submitting: Maryland Legislative Coalition
Person Submitting: Cecilia Plante, co-chair
Position: FAVORABLE

I am submitting this testimony in favor of HB1092 on behalf of the Maryland Legislative Coalition. The Maryland Legislative Coalition is an association of activists - individuals and grassroots groups in every district in the state. We are unpaid citizen lobbyists and our Coalition supports well over 30,000 members.

Our Coalition members support the recycling of as much packaging waste as possible. We feel that waste materials, particularly plastics, are becoming a bigger and more expensive problem for the state. All plastics should be recyclable, but in many cases, the process of recycling them is more toxic than the plastics themselves.

This bill will prohibit some of the more toxic processes, including –

- Pyrolysis
- Hydropyrolysis
- Methanolysis
- Gassification
- Enzymatic Breakdown, or
- Similar processes

It also prohibits the state from building a facility that uses these processes to recycle plastics.

While we want to see plastics recycled, we acknowledge that some processes are too toxic. We support this bill and recommend a **FAVORABLE** report in committee.

HB1092test_022425.pdf
Uploaded by: Charlie Cooper
Position: FAV

Charlie Cooper

2359 Nutmeg Terrace

Baltimore, MD 21209

Testimony in Support of HB 1092 – Recycling - Prohibition on the Chemical Conversion of Plastic

To the Environment and Transportation Committee

February 26, 2025

Dear Chair Korman and members of the Committee. Industry continually comes up with new greenwashing schemes to claim that some industrial process is promoting a healthy environment. In the case of chemical conversion of plastic, a scientific analysis of the process indicates that this type of conversion creates too many toxic chemicals and too much air pollution to be considered environmentally constructive.

House Bill 1092 will legally establish that chemical conversion of plastics is not classified as recycling. Further, it will prohibit the construction or operation of certain types of chemical plants in Maryland that are, in fact, dangerous to our residents' health. Please issue a favorable report on this bill to keep yet another new source of dangerous pollutants out of our environment.

HB1092 Recycling - Prohibition on the Chemical Con

Uploaded by: Dave Arndt

Position: FAV

Committee: **Environment and Transportation**
Testimony on: **HB1092 Recycling - Prohibition on the Chemical Conversion of Plastic**
Submitting: **Dave Arndt, Co-Chair**
Position: **Favorable**
Hearing Date: **Feb. 26, 2025**

Dear Mr. Chair and Committee Members:

Thank you for allowing our testimony today in support of HB1092. I urge you to vote favorably on HB1092.

Around the world, companies are drawing up plans for pyrolysis plants, promising relief from the crushing problem of plastic pollution. Small startups and demonstration projects are joining with larger companies, including petroleum and chemical giants. Chevron Phillips was recently awarded a patent for its proprietary pyrolysis process, and ExxonMobil has a plant in Texas which the company claims will recycle 500,000 tons of plastic waste annually by 2026.

But what pyrolysis mostly does is make oil to be refined and then sold as fuel. An analysis by the Minderoo Foundation, an Australia-based philanthropic organization focused on the environment, calculated that of the roughly 2 million tons of advanced recycling capacity scheduled to come online over the next five years, less than half a million tons of this material will actually be recycled back into plastic goods. The rest of the output is destined to power airplanes, trucks, and other heavy transportation.

This is not recycling. The benefit of recycling comes when you return materials into the production cycle, which reduces the demand for virgin resources. If you are taking plastic and burning it as fuel, it's not feeding back into plastic production. And so, to keep making new plastic, you have to keep extracting fossil fuel.

However, even worse is that chemical conversion, advanced recycling or pyrolysis is actually an incineration process. Which have the same and greater pollution issues of other incinerators.

Here are the possible issues:

The materials that they are going to feed into their reactor are "hard to recycle" plastics, resin identification code 1-7. You might think, what is the big deal, we handle these plastic products daily. However, making things out of plastics is like playing a game with molecules. The aim is to re-organize them into new shapes without their changing color, sticking to the mold, or doing anything that could spoil the finished article. Additives help with all these problems. In fact, processing plastics without additives is virtually impossible. Additives come in 19 different categories defined by their purpose and in each category, there may be 100s of compounds. Examples of additives are: catalysts, lubricants, flame retardants and stabilizers, most are added at the request of customers.

Plastics included in code 1-7 have been found to include the following items which have been documented to be released in incineration emissions:

PFAS, Bisphenols, Phthalates, Chlorine, Florine, Lead, Cadmium, Selenium, Benzene, Chromium, Vinyl chloride, Benzene, Toluene, Mercury, Arsenic, Dioxins, Formaldehyde, Hexane and PM2.5. Please note that this is not an all-inclusive list, there may be other compounds released depending on the plastic feedstock being used. Many of these compounds are known carcinogens, others are known to cause brain development issues and items like PFAS, we are just beginning to understand their effects, the EPA is just now putting restriction on PFAS in drinking water.

Also, new data suggest that black plastic cookware, typically made in China has recycled plastic from computer circuit boards, making even cooking with them dangerous.

Even though companies tout that their process are oxygen free, oxygen is a key component of most plastics making their flameless oxidizer process by definition an incinerator.

Dioxins and furans are unavoidably created in the oxidation process. Unless they are further captured, they are emitted to the environment. Dioxins are highly toxic and can cause cancer, reproductive and developmental problems, damage to the immune system, and can interfere with hormones. Some dioxins and furans are toxic in the parts per trillion range.

Make no mistake, this is an incineration process that will produces deadly compounds, fires, explosions, accidents and leaks, can happen. Unfortunately, we all have seen that time and time again monitoring or using self-regulation does not work. There are just too many compounds to monitor and there is no way to know what if any this is being emitted is benign or cancerous.

For all of these reasons, I strongly support HB1092 and urge a **FAVORABLE** report in Committee.

Dave Arndt
Co-Chair Maryland Legislative Coalition – Climate Justice Wing

Testimony HB1092 E&T.pdf
Uploaded by: Debbie Cohn
Position: FAV

Committee: **Environment and Transportation**
Testimony on: **HB1092 – Recycling – Prohibition on the Chemical Conversion of Plastic**
Submitting: **Deborah A. Cohn**
Position: **Favorable**
Hearing Date: **February 26, 2025**

Dear Chair Korman and Committee Members:

Thank you for allowing my testimony today in strong support of HB1092.

HB1092 excludes from the definition of recycling various forms of chemical conversation of plastic and prohibits building in Maryland facilities that convert plastic to fuel or plastic feedstock.

Advanced plastic recycling, also known as chemical recycling, refers to several chemical or heat based processes that break down plastic into its raw materials which can then be used to make new plastic products. Advanced plastic recycling is marketed to the public as a miraculous technical advance to create a truly circular economy with respect to plastic.

As the General Assembly considers removing incineration from the renewable portfolio standard, legislators need to understand that these new technological processes, like incineration, emit harmful pollutants including dioxins, furans, benzene, polycyclic aromatic hydrocarbons (PAHs) and hazardous waste. Advanced chemical recycling needs extremely high temperatures to break the chemical bonds in plastic so that the end products can be used to create new plastics. The energy consumption and greenhouse gas emissions are typically higher than that needed to create plastic from virgin materials. The plastic created through advanced recycling typically is of much lower quality than virgin plastic so that the created plastic cannot be "recycled" in the same manner again and is simply burned to create electricity.

The more direct answer to plastic pollution is to reduce the consumption and thus the production of plastic in the first place. This General Assembly and local Maryland jurisdictions have considered many ways to reduce the demand for plastic, particularly certain types of extended producer responsibility laws directed to plastic packaging.

Given the tremendous externalities of advanced plastic recycling, and the opportunities to reduce plastic consumption, I urge this Committee to issue a favorable report on HB1092.

HB1092F Testimony_DMathew.pdf
Uploaded by: Denny Mathew
Position: FAV

I would like to voice my support for House Bill 1092. This will be a vital piece of legislation that prioritizes the health and well-being of Maryland families, especially in my River Hill neighborhood of Columbia. I have been a resident on this community since 2009, and cannot put a price on the community, the cleanliness and local feel for this neighborhood. This bill's proactive stance against plastic-to-fuel facilities safeguards communities from the harmful volatile organic compounds (VOCs) released during chemical conversion processes like pyrolysis and gasification. I am dumbfounded by claims by Grace corporation on the lack of incineration. There is definitely a conversion of plastics to VOCs and other fumes, despite a lack of visible flames or fires. Studies increasingly link VOC exposure to exacerbated asthma symptoms, respiratory illnesses, and other health problems, posing a significant threat to children living near such facilities. By prohibiting these facilities in Maryland, HB 1092 directly addresses the potential for increased pollution in residential areas and the detrimental impact on vulnerable young lungs.

Local authorities understand the unique needs and concerns of their communities better than anyone. HB 1092 will empower residents such as my family and neighbors to assess and decide on the negative health impacts caused by these new plants. This crucial aspect reinforces local Columbia autonomy and allows communities to prioritize the health and safety of our River Hill and Columbia residents over potentially misleading claims of "recycling."

I would also like to point out that chemical recycling is not a genuine solution to the plastic waste crisis. While proponents tout it as a way to handle difficult-to-recycle plastics, the processes themselves are energy-intensive, often produce hazardous byproducts, and have a questionable track record of effectively reducing plastic waste. This is especially true of the Grace corporation’s track record on prior environmental mishaps, including the ones in Libby, Montana, Woburn, Massachusetts, and the water-poisoning fine by the EPA. Instead of contributing to a circular economy, plastics “recycling” distracts from the real solutions: reducing plastic production, improving traditional recycling infrastructure, promoting reusable alternatives, and holding producers accountable for the end-of-life management of their products.

I endorse HB 1092 in protecting families of Columbia and River Hill, and empowering communities to prioritize public health. By banning the construction of plastic-to-fuel facilities and ensuring a more accurate definition of recycling, this bill will steer Maryland towards a truly sustainable approach to waste management.

HB1092_FAV_CleanWaterAction_EmilyRanson.pdf
Uploaded by: Emily Ranson
Position: FAV

HB1092 – Recycling - Prohibition on the Chemical Conversion of Plastic
February 26, 2025

Position: Favorable

Dear Chair Korman and Members of the Committee,

Clean Water Action supports HB1092 to ban chemical recycling in Maryland.

Although commonly called recycling, chemical conversion of plastic to fuel is not recycling. Plastic is created from fossil fuels – converting it back into fuel through pyrolysis, gasification, or other processes is fossil fuel intensive and does not fit the definition or intent of recycling.

These facilities emit hazardous chemicals into the air and water, putting the health of the environment and nearby communities at risk. They also produce large amounts of greenhouse gases, exacerbating the climate emergency.

When plastics are heated or burned in chemical recycling, they release a range of harmful pollutants into the atmosphere, including dioxins and volatile organic compounds, which are linked to serious health problems like cancer, respiratory issues, and developmental disorders.

Ultimately, we need to reduce our plastic use and use plastics that are easier to mechanically recycle. California sued ExxonMobil in September 2024 for deceiving the public on the recyclability of plastic products.

As Rob Bonta, the California Attorney General, laid out in his press release:

Under its "advanced recycling" program, ExxonMobil uses heat to break down plastic waste. ExxonMobil promotes its "advanced recycling" program as a breakthrough in technology that will make plastics sustainable but hides important truths about its technical limitations, including that:

145 W Ostend Street, Suite 600
Baltimore, MD 21230

- *The vast majority—92 percent—of plastic waste processed through ExxonMobil's "advanced recycling" technology does not become recycled plastic, but rather primarily fuels,*
- *The plastics that are produced through ExxonMobil's "advanced recycling" process contain so little plastic waste that they are effectively virgin plastics deceptively marketed as "circular" (co-opting a term typically understood as a full circle of sustainable reuse, where waste becomes raw material) and sold at a premium,*
- *ExxonMobil's "advanced recycling" process cannot handle large amounts of post-consumer plastic waste such as potato chip bags without risking the safety and performance of its equipment,*
- *Plastics produced through ExxonMobil's "advanced recycling" program, in ExxonMobil's best-case scenario, will only account for less than one percent of ExxonMobil's total virgin plastic production capacity, which continues to grow.*

Rob Bonta, California Attorney General. "Attorney General Bonta Sues ExxonMobil for Deceiving the Public on Recyclability of Plastic Products." Retrieved from: https://oag.ca.gov/news/press-releases/attorney-general-bonta-sues-exxonmobil-deceiving-public-recyclability-plastic

Chemical recycling is *not* recycling – creating fuel out of plastic is an expensive boondoggle that pollutes our communities.

For these reasons we urge a favorable report.

Best,

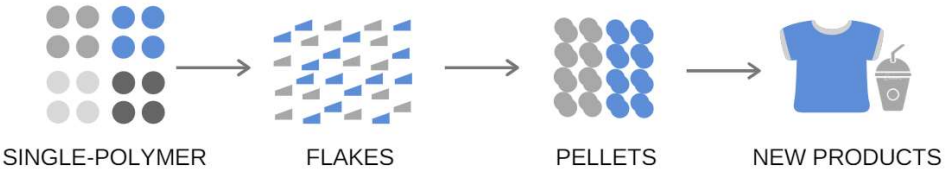
Emily Ranson
Chesapeake Regional Director
Clean Water Action
eranson@cleanwater.org

QUESTIONS AND ANSWERS: CHEMICAL RECYCLING

Q. How is plastic recycled?

A. Plastic is collected, sorted, washed, ground into flakes, sorted again, and then melted into pellets, which are used to make new products. This process is called "mechanical recycling." Recently, the plastics industry has been proposing the use of new technologies that they call "chemical recycling."

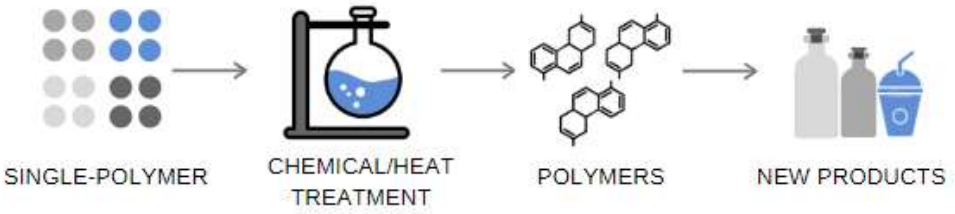
Mechanical Recycling:



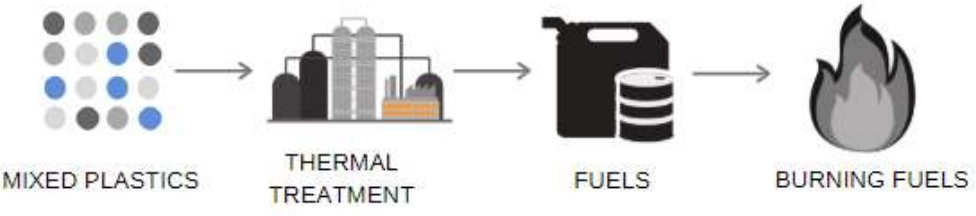
Q. What is chemical recycling?

A. "Chemical recycling" is an industry greenwash term used to lump together various plastic-to-fuel and plastic-to-plastic technologies. These processes turn plastic into liquids or gases which could be used to make new plastic but in practice are usually burned. The terms "pyrolysis", "solvolysis", and "depolymerization" are also used to refer to different technological variants of this process. **Whatever the process is called, if the end-products are burned, it's plastic-to-fuel.**

Repolymerization:



Plastic-to-Fuel:



Q. Why is it called recycling?

A. In principle, the liquids and gases can be turned back into plastic, a process which is better called "repolymerization." However, this is at present technically challenging and uneconomical. Industry uses the term "chemical recycling" to deliberately blur the distinction between recycling (plastic to plastic repolymerization) and incineration (plastic-to-fuel).

Q. Why is it important to distinguish plastic-to-plastic from plastic-to-fuel?

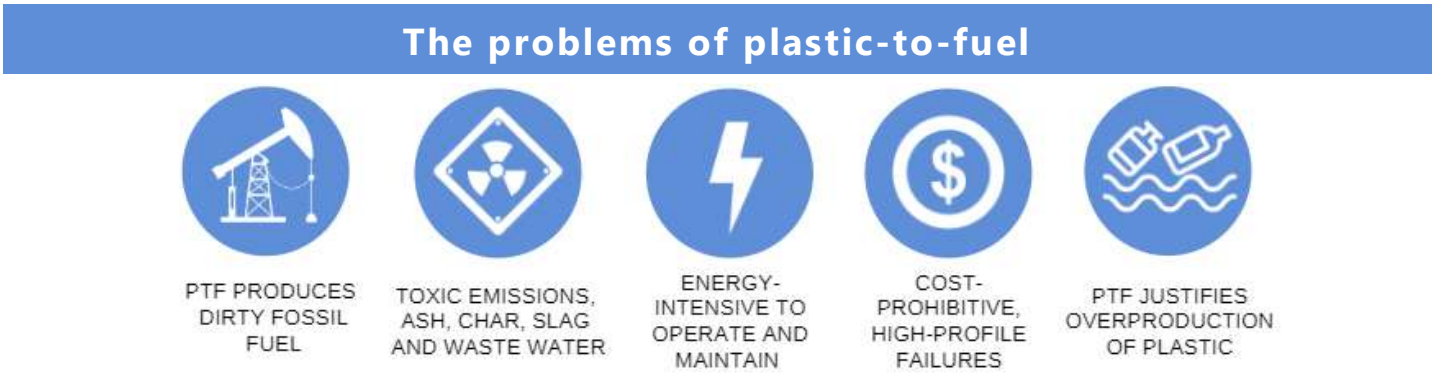
A. Repolymerization produces new plastic, which reduces the demand for fossil fuels, lessening the environmental impact of producing plastic. Turning plastic into fuel to be burned does nothing to address the many forms of pollution created by producing ever-increasing quantities of plastic. The European Union's Waste Framework Directive is crystal clear that producing fuels from waste cannot be labeled or counted as "recycling."

Q. Is plastic-to-fuel climate-friendly?

A. No, almost all plastic is made from oil and natural gas, so **it is still a fossil fuel**. Greenhouse gases are released in the production of plastic, in transforming it into fuel, and in burning the fuel.

Q. Are there other problems with plastic-to-fuel?

A. Plastic-to-fuel facilities are both waste and petrochemical factories, with the ensuing toxic emissions, liquid effluent, and solid waste. In addition, the plastic-derived fuel releases toxic substances when burned. Plastic-to-fuel technology is energy inefficient and costly, and has had several high-profile failures, including facility fires and explosions.



Q. Is repolymerization economical?

A. Repolymerization requires collecting post-consumer plastic, cleaning it, and sorting it according to polymer type and additives. This is highly expensive. Meanwhile, new polymer made from fracked natural gas is very cheap, so plastic manufacturers use new polymer rather than recycled polymer, further adding to the plastics and climate crises. Repolymerization is even more expensive than mechanical recycling, which is struggling to find markets.

Q. How does repolymerization compare with traditional (mechanical) recycling?

A. Both usually require input streams that consist of a single type of plastic (polymer). Mechanical recycling generally downgrades plastic by shortening the polymer length. It also has trouble with additives and contaminants in the plastic. Repolymerization can produce plastic that is similar in quality to new plastic. It is also more tolerant of some additives and contaminants. However, repolymerization is much more energy-intensive than mechanical recycling, resulting in greater greenhouse gas emissions.

Q. What is the operational history of "chemical recycling"?

A. Most plants that claim to do chemical recycling are turning plastic into fuel. A few pilot-scale projects do produce plastic, but they handle relatively limited inputs, not the full range of plastic waste. Many such plants use pyrolysis, which is not a new technology; it has been around for decades, but has never been technically or commercially successful. Despite the industry hype, the European Union Commission has said that repolymerization technology is at least ten years away from commercial application -- far too long to tackle the climate and pollution issues posed by plastics.

Q. What is the environmental track record for repolymerization?

A. Because the operators are not forthcoming with their emissions data, **little is known about these technologies' toxic air emissions, liquid effluent, or solid waste streams**, but they are probably comparable to other petrochemical facilities. A particular concern is the fate of contaminants and additives, including toxic metals, in the plastic, and their post-processing management. These questions will need to be impartially studied under real-world operating conditions to understand the full environmental impact of repolymerization.

Q. If "chemical recycling" is an immature technology, why are we hearing so much about it?

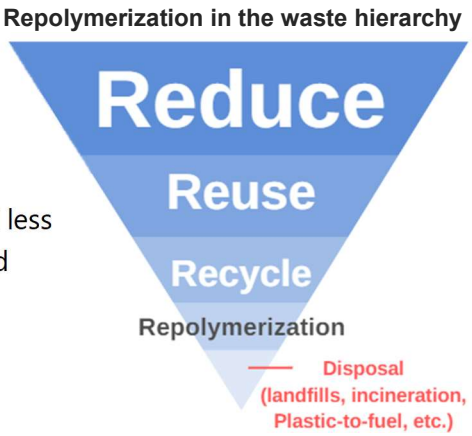
A. The oil, gas, and petrochemical industries are rapidly expanding plastic production; they aim to increase 40% in the next decade. To quell growing concern, they are trying to convince the public that they can clean up the plastic pollution problem with technology. This is a distraction tactic to avoid talking about the real solution, which is to stop fracking and produce less plastic, especially single-use plastic products.

Q. Who is promoting these technologies?

A. The chemical recycling companies are pretty small, but they are financially backed by the oil and gas majors, incineration giants, and large petrochemical firms. For example, a major promoter is the Alliance to End Plastic Waste, which includes BASF, ExxonMobil, Occidental Petroleum, PepsiCo, Reliance Industries, SABIC, Shell Oil, Suez, and Veolia among others.

Q. How should "chemical recycling" be regulated?

A. Regulations should clearly distinguish between repolymerization and plastic-to-fuel. Plastic-to-fuel should be phased out, along with other fossil fuels. Repolymerization should not benefit from subsidies, regulatory incentives, or environmental deregulation. These could help it compete against preferable activities including mechanical recycling, which has a smaller carbon footprint and less toxic byproducts. Such facilities must be carefully monitored for toxic and greenhouse gas emissions, waste and effluent handling.



Q. What should we do with plastics that cannot be safely recycled?

A. Landfilling plastic is the "least bad" option; plastics in landfills are relatively inert, as long as the landfills do not burn. Incineration and plastic-to-fuel are worse; they release large quantities of greenhouse gases and toxic air emissions. Open dumping of plastic is problematic for other reasons: it creates microplastics, threats to wildlife, water pollution, and more. The real solution is to stop making so much plastic, beginning with hard-to-recycle, disposable, and single-use plastics.

So what is the real solution to the plastic problem?

Make LESS Plastic. It's that simple.

Glossary

- **Depolymerization:** One of several technologies that breaks plastic down into its constituent building blocks.
- **Effluent:** Liquid waste, generally requiring wastewater treatment.
- **Plastic-to-fuel:** A process for turning plastic into a liquid or gas that is then burned for energy.
- **Polymer:** One of several distinct types of plastic, each with its own chemical structure. Different polymers generally cannot be recycled together.
- **Pyrolysis:** The process of heating waste in the absence of oxygen to produce a liquid or gas fuel.
- **Gasification:** Similar to pyrolysis, heating waste in a low-oxygen environment.
- **Repolymerization:** The process of turning plastic waste back into plastic by breaking it down into its constituents and reconstructing the plastic polymers.
- **Solvolysis:** Technologies that use solvents to depolymerize plastic.

Resources

- **[Report]** Zero Waste Europe. (2019). El Dorado of Chemical Recycling, State of play and policy challenges.
- **[Report]** GAIA. (2017). Waste Gasification & Pyrolysis: High Risk, Low Yield Processes for Waste Management
- **[Journal article]** Rollinson, A. (2018). Fire, explosion and chemical toxicity hazards of gasification energy from waste. Journal of Loss Prevention in the Process Industries, 54, pp.273-280.
- **[Journal article]** Rollinson, A. and Oladejo, J. (2019). 'Patented blunderings', efficiency awareness, and self-sustainability claims in the pyrolysis energy from waste sector. Resources, Conservation and Recycling, 141, pp.233-242.
- **[Briefing]** GAIA. (2018). False solutions to the plastic pollution crisis
- **[Campaign]** GAIA. (2018). Say NO to Dow's Dirty Energy Bag!

This publication was made possible in part through funding support from the Plastic Solutions Fund.

Testimony Supporting HB 1058 and HB 1092 odf.pdf
Uploaded by: Jennifer Robin Kulik
Position: FAV

Written Testimony in Support of HB 1058 and HB 1092
Submitted by: Jennifer Robin
Clarksville, Maryland Resident
Maryland House Environment and Transportation Committee
Hearing Date: Wednesday, February 26, 2025

Dear Chairperson, Vice Chair, and Members of the Committee,

I am writing as a **concerned resident of Clarksville, Maryland,** to strongly urge you to **support and pass HB 1058 and HB 1092.** These bills are critical to protecting the health and safety of our communities, ensuring stronger environmental regulations at the local level, and preventing dangerous and misleading waste management practices that threaten our air, water, and public well-being.

HB 1058 – The Emission Standards, Ambient Air Quality Standards, and Solid Waste Management – Local Authority Bill

HB 1058 is essential to reaffirm and clarify the authority of Maryland counties and municipalities to **enact air and waste management laws that go beyond federal and state minimums**—a right that has been recognized since 1957 at the state level and since 1970 under the federal Clean Air Act.

However, **poorly worded language in state law has put this authority at risk**, allowing opponents to challenge local clean air protections in court. This bill **corrects that ambiguity** and ensures that local governments retain the power to respond to their communities' unique environmental challenges.

Why HB 1058 is Necessary:

- Maryland residents **deserve a say** in the quality of the air they breathe.
- Federal environmental protections are **increasingly under attack**, and Maryland must ensure local governments can **act swiftly** to protect their communities when higher levels of government fail to do so.
- The ability for local governments to set stronger environmental protections has **existed for over 50 years** without causing chaos or excessive legal conflicts.
- A minor wording issue (such as "section" instead of "subsection") should not be a loophole that prevents localities from keeping their residents safe.

By passing HB 1058, Maryland will **eliminate legal uncertainty** and empower communities to **hold polluters accountable** while protecting public health.

HB 1092 – The Recycling – Prohibition on the Chemical Conversion of Plastic Bill

HB 1092 **prohibits so-called "chemical recycling" facilities in Maryland,** such as the one proposed by **W.R. Grace in Howard County.** These facilities do not truly recycle plastic but instead use **highly polluting processes like pyrolysis and gasification, which release hazardous toxins into the air and create harmful waste byproducts.**

The evidence against "chemical recycling" is overwhelming. A **U.S. Department of Energy study** found that these processes have extremely **low yields**, with only **0.1% to 14% of the original plastic** actually being reused to create new plastic. Instead, these operations function

more like waste incineration facilities—generating toxic emissions, polluting nearby communities, and contributing to environmental degradation.

Why HB 1092 Must Be Passed:

- **Chemical recycling is misleading and ineffective.** The majority of plastic processed in these facilities is **not actually recycled** into new plastic but instead turned into fuels that are burned, **worsening climate change** rather than reducing plastic waste.
- **These facilities release hazardous air pollution.** Studies have shown they emit **cancer-causing chemicals** such as benzene, toluene, ethylbenzene, xylenes, and dioxins—substances that **harm public health, damage the nervous system, and increase reproductive risks.**
- **Plastic combustion occurs even without visible flames.** The claim that these facilities do not "burn" plastics is false. Combustion can take place even in low-oxygen environments, releasing dangerous byproducts into the atmosphere.
- **Maryland should not be a dumping ground for toxic waste.** These facilities produce **large amounts of hazardous waste**, creating **long-term environmental and public health hazards** that disproportionately impact local communities.

Banning these facilities in Maryland is a **common-sense** measure that aligns with efforts in **Rhode Island and Colorado,** where lawmakers have already recognized the dangers of plastic pyrolysis and gasification.

Conclusion

Both **HB 1058** and **HB 1092** are necessary to **protect Marylanders from environmental harm, strengthen local governance, and prevent corporate polluters from undermining public health.**

I **urge you to vote in favor** of these bills to safeguard our air, water, and communities for future generations. Thank you for your time and consideration.

Sincerely,

Jennifer Robin
Clarksville, Maryland Resident
Stop Grace Team

022425 Beyond Plastics H 1092 Chemical Recycling M

Uploaded by: Johnathan Berard

Position: FAV

BEYOND PLASTICS

BENNINGTON COLLEGE

February 24, 2025

Honorable Marc Korman
Chair, House Committee on Environment and Transportation
6 Bladen Street
Annapolis, MD 21401

MEMORANDUM OF SUPPORT

Bill: **House Bill 1092, Recycling—Prohibition on the Chemical Conversion of Plastic**

Dear Chair Korman and Honorable Members of the Committee,

Thank you for the opportunity to submit this memorandum today. Beyond Plastics[1] **supports** the passage of House Bill 1092, which would amend the definition of recycling in state law to expressly exclude chemical recycling as well as prohibit the construction of chemical recycling facilities in the state of Maryland. We thank Delegate Terrasa and the bill cosponsors for their leadership on this timely issue and urge passage by the Committee.

Chemical recycling is an industry marketing term for a set of polluting technologies that mostly turn petrochemical-based plastic waste into fuels. It is not a novel or advanced approach as it is based primarily on technologies such as pyrolysis and gasification which have struggled technically and commercially to process plastic waste for decades. It is a dangerous deception pushed by the petrochemical industry that seeks to distract from the need to reduce plastic production.

Beyond Plastics and the International Pollutants Elimination Network (IPEN) published a report[2] on October 31, 2023 documenting the dangers of chemical recycling, how a buildout threatens environmental justice communities, and how the constraint failures and technical limits of this industry will prevent it from ever living up to the promises made by the petrochemical industry. (I have included the Key Findings and Executive Summary from the report with this memorandum).

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[1] Beyond Plastics is a national education and advocacy organization that works to end plastic pollution through policy change. Using deep policy and advocacy expertise, Beyond Plastics pursues the institutional, economic, and societal changes needed to save our planet and ourselves from plastic's harmful impacts on health, climate, and the environment. There are four Beyond Plastics grassroots local groups and affiliates (LGAs) in Maryland: Less Plastic Please, Plastic Free Queen Anne's County, Safe Healthy Playing Fields MD, and Beyond Plastics MoCo Maryland.

[2] https://www.beyondplastics.org/s/10-30-23_Chemical-Recycling-Report_web.pdf

For decades, plastics lobbyists have held up recycling—first mechanical recycling, and now chemical recycling—as the definitive solution for plastic pollution. Over the past fifty years, local, county, and state governments have invested massively into building out the infrastructure to collect, transport, and process recyclable plastics in addition to launching massive public outreach and education campaigns. The result: a plastics recycling rate of 5-6% in the United States as of 2021.[3] Now, the plastics industry is pushing chemical recycling as their preferred solution. The reality is that chemical recycling has failed for decades and it continues to fail. At the time of the publication of the Beyond Plastics/IPEN report in 2023, 11 chemical recycling facilities existed in the United States. In the ensuing 16 months, two facilities have completely shut down due to a combination of capacity, safety, and economic issues. The six that remain operational are running far below designed capacity. Together, they process 0.43% of plastic waste in the U.S.[4]

Plastics recycling has never lived up to the promises made by the plastics industry and there is no evidence to show that it ever will. In fact, the inviability of recycling—including chemical recycling—as a solution for plastic pollution was laid bare in California Attorney General Rob Bonta's 2024 lawsuit against ExxonMobil[5]. Specifically, the lawsuit found that plastic manufacturers never intended for most single-use plastics to ever be recycled—its support for recycling programs is instead a public relations effort waged to allow for the unchecked production of plastics, and single-use disposable products and packaging in particular.

The true solution to the plastic pollution crisis is not chemical recycling. The evidence on this is clear—it is very much a false solution. There are, however, policies that states can enact that have been proven to reduce plastic pollution. Strong packaging reduction and recycling laws (also known as *extended producer responsibility*, or EPR) give producers a financial stake in the end-of-management of their products. Strong packaging reduction and recycling programs encourage innovation in packaging design and product delivery, improve recycling programs, protect public health by prohibiting the use of toxic chemicals and heavy metals, and reduce the fiscal burdens of waste collection and management for local governments and taxpayers. Another proven solution is beverage container deposit programs, commonly known as bottle bills, which significantly improve the recovery of plastics that actually have valuable end-markets such as PET and HDPE; decades of evidence have proven that strong bottle bill programs have high recovery rates and can be successful in reducing plastic pollution in communities, the environment, and waterways. Finally, local, county, and state governments can invest in building and scaling up reuse and refill systems to replace single-use disposable products and packaging as well as their regrettable substitutions like bioplastics.

A huge—and critical—step towards tackling plastic pollution, though, is the one proposed in this legislation. By excluding chemical recycling from the legal definition of recycling and prohibiting the construction of chemical recycling facilities, Maryland is sending a clear signal to the plastics industry that it rejects their false-promise of chemical recycling's technical and economic viability. Chemical

[3] https://www.beyondplastics.org/s/The-Real-Truth-about-the-US-Plastic-Recycling-Rate-2021-Facts-and-Figures-_5-4-22.pdf
[4] https://www.lastbeachcleanup.org/globalchemicalrecyclingplantcounter
[5] https://oag.ca.gov/news/press-releases/attorney-general-bonta-sues-exxonmobil-deceiving-public-recyclability-plastic

recycling is a dirty, risky, and economically unsustainable technology that only exacerbates the underlying issue of plastic overproduction.

Beyond Plastics commends the bill sponsors for their leadership on this issue and **strongly supports House Bill 1092**.We urge the honorable members of this committee to do the same.

Best regards,

Johnathan Berard
Policy Director, Beyond Plastics

CHEMICAL RECYCLING: A DANGEROUS DECEPTION

WHY CHEMICAL RECYCLING WON'T SOLVE THE PLASTIC POLLUTION PROBLEM

October 2023

BEYOND PLASTICS
BENNINGTON COLLEGE

IPEN
for a toxics-free future

KEY FINDINGS

Chemical recycling is a false solution to plastic pollution. Chemical recycling has failed for decades, continues to fail, and there is no evidence that it will contribute to resolving the plastics pollution crisis.

Plastics are inherently risky to recycle. Plastics are made with toxic chemicals and when recycled, these chemicals go into the recycled plastic or product. Toxic chemicals can also be created in recycled plastics from cross contamination and heating, resulting in ongoing and often increased chemical threats to our health and the environment.

Chemical recycling is inefficient, energy-intensive, and contributes to climate change. According to U.S. government researchers, the energy needs (derived from plastic waste itself or additional fossil fuels) of chemical recycling can create as much as 100 times more damaging environmental and climate impacts than virgin plastic production.

Chemical recycling creates large amounts of toxic waste. Regardless of what products facilities are attempting to create, chemical recycling — at best — produces small amounts of usable products from large amounts of plastic waste. Typically, most of the plastics going into chemical recycling facilities will become waste (often hazardous waste), be burned as fuel, or be landfilled.

Chemical recycling is dangerous and dirty. Chemical recycling facilities release toxic emissions, create hazardous waste, and are prone to fires and explosions.

Chemical recycling will not supplement conventional (mechanical) recycling. Proponents say chemical recycling is needed for mixed plastics that are difficult to recycle mechanically, but there is no evidence that chemical recycling can economically or effectively recycle mixed plastic waste. To the extent it works at all, chemical recycling uses the same kinds of plastics as conventional recycling. Thus, chemical recycling will likely compete with, not supplement, conventional recycling.

Burning plastic as fuel is dirty and unsustainable from start to finish. These operations can create unacceptable risks to nearby communities, posing threats to environmental justice. Weak regulations will increase these health and environmental risks. Using chemical recycling to turn plastic waste into fuel creates a toxic, dirty fuel that is harmful to human health and disastrous for the climate.

Making plastic into fuel to burn is not recycling. According to internationally accepted definitions, plastic to fuel is not recycling. It is a dirty and dangerous disposal method.

Eliminating or relaxing regulations puts our health at risk. Chemical recycling facilities emit cancer-causing chemicals and substances that have been banned globally because they are among the most toxic chemicals known. Yet in the United States, many states eliminate or relax environmental and health rules to incentivize new plants, and the industry often evades federal clean air rules. Environmental justice communities that already face unequal health risks from toxic pollution will face the highest health risks from expansion of chemical recycling.

Public funds should support sustainable solutions, not chemical recycling. Government subsidies for chemical recycling are risky investments in a dirty, unproven technology. We need to support innovation for safe, clean materials to create sustainable alternatives that can replace plastics.

KEY FINDINGS FROM OUR CASE STUDIES

As of September 2023, 11 chemical recycling facilities have been constructed in the United States. Chapter 2 of this report provides a summary of findings, and a detailed case study of each facility can be found in Appendix 1. Just a few of the key facts include:

- In 2021, a Reuters special report profiled the demise of the Renewlogy chemical recycling project, a collaboration between Dow and Reynolds Consumer Products (the maker of Hefty plastic bags). The 2018 program instructed residents of Boise, Idaho, to place their hard-to-recycle plastics in "Hefty EnergyBags," which were then trucked 340 miles away to the Renewlogy pyrolysis plant in Salt Lake City, Utah. The program — which benefited from state and city loans totaling more than half a million dollars — failed in part because the plastic waste collected contained "10 times" the amount of contaminated garbage than was expected. Since March 2020, plastics collected in Boise's recycling program have been sent to a Utah cement plant to be burned.[4]
- In 2012, two companies, Agilyx and Americas Styrenics, opened a chemical recycling plant in Tigard, Oregon. After 12 years, the plant has yet to prove commercially viable and despite its low output, regulators say the operation is a "large quantity generator" of hazardous waste. In 2013, another Oregon chemical recycling plant owned by Agilyx opened to convert plastic to oil, after receiving a $577,255 tax credit from the state. The plant closed in 16 months.
- An Alterra company plant broke ground in 2014 in Akron, Ohio, but has only run as a "demonstration" plant. Despite its low output, regulators say it is a "large quantity generator" of hazardous waste.
- After 10 years of testing, a Braven chemical recycling facility in Zebulon, North Carolina, received a state air permit in 2020, though it remains unclear whether the plant is producing commercially viable amounts of outputs. Regulators say it is a "large quantity generator" of hazardous waste, and on at least two occasions state regulators cited the plant with a notice of violation for its mismanagement of hazardous waste.
- In June 2020, Brightmark Energy facility in Ashley, Indiana claimed its chemical recycling plant in Ashley, Indiana, would reach a yearly plastic waste recycling capacity of 100,000 tons by early 2021. But to date the plant remains at the "test" phase, has processed just 2,000 tons of plastic waste, and has been affected by fires, oil spills, and worker health and safety complaints. Brightmark has received $4 million in federal subsidies for the project. A Brightmark plan to build the nation's largest chemical recycling plant in Georgia was contingent on the company proving its Indiana plant could produce useful output, but in December 2021, Brightmark admitted it was unable to deliver recycled end-product, and the Georgia project was abandoned. There was strong opposition to the facility.

Brightmark Energy facility in Ashley, Indiana. Source: The Last Beach Cleanup

- A 2020 statement by New Hope Energy company claimed its chemical recycling plant would process 50,000 tons of plastic waste annually, but in June 2022, a company official optimistically noted the plant was "on track" to process about one-third of this amount by the year's end. No company data was found to confirm whether the plant reached even this low goal.
- A Nexus Circular company recycling plant in Atlanta, Georgia, has been operating since 2011 at "pilot" capacity, with latest figures showing the plant operating at between 6% and 13% of capacity. The plant sells oil from plastics certified as "sustainable" by ISCC. In 2020, Shell agreed to purchase 66,000 tons of Nexus' plastic waste oil over four years, but as of January 2023, the plant had processed just 4,000 tons of plastic waste.
- In 2010, a Prima America chemical recycling plant applied for a permit to make diesel fuel from plastic waste in Northumberland, New Hampshire. In March 2023, a plant manager admitted the facility was still in its "test" phase and noted its diesel fuel was too expensive to be sold economically. The plant shut down for about a year in 2019/2020 due to multiple issues with state environmental rules.
- In March 2023, PureCycle defaulted on its agreement with the Southern Ohio Port Authority and UMB Bank by failing to complete construction of its chemical recycling project before December 1, 2022, as called for in its financing agreement. UMB Bank and Southern Ohio Port Authority waived the default in exchange for a number of financial and performance-based conditions. In September 2023, the Ironton facility experienced a mechanical failure and its operations were halted. In filings to its bondholders and the Securities and Exchange Commission Purecycle claims that the mechanical failures were due to a power outage on August 7, 2023, caused by inclement weather affecting a third-party power supplier. After repairs and replacement of a faulty seal, restart procedures were initiated at the facility on September 11, 2023, but PureCycle could not guarantee that the restart would be successful or whether further mechanical failures would occur as the result of the August 7, 2023, power outage. Recognizing that the facility would not meet a key milestone as required in its default waiver, PureCycle filed a Notice of Force Majeure to release itself and its bondholders from their contractual obligations.

10 RECOMMENDATIONS

1. **Declare** a national moratorium on new chemical recycling plants.
2. **Require** extensive analyses and testing of existing chemical recycling plants' toxic emissions, releases, waste residues, wastewater, output contamination levels, and fire and explosion risks.
3. **Deny** approval or permitting of chemical recycling plants if risks from their emissions or products (for example, fuels) exceed a one in 1 million excess public cancer risk.
4. **Mandate** testing of oils and other outputs from chemical recycling before they can be used as fuel or plastic feedstock to prevent widespread contamination of products and human exposure to unacceptable toxic risks.
5. **End** all federal, state, and local incentives for establishing chemical recycling plants, including public funds, subsidies, tax breaks, investment bonds, carbon credits, landfill diversion credits, and other schemes.
6. **End** siting of chemical recycling plants in environmental justice communities.
7. **Prohibit** plastic-to-fuel projects, which recreate (rather than displace) fossil fuels that pose dangers to the climate and the environment.
8. **Implement** the "polluter pays" principle and ensure that the petrochemical industry bears all financial risks of chemical recycling and the manufacture, use, and disposal of plastics.
9. **Prohibit** chemical recycling of any form to count toward recycling targets or recycled content goals in any public policy or program, including but not limited to extended producer responsibility (EPR) programs.
10. **Prohibit** use of free-allocation mass balance accounting in determining recycled content of products that incorporate chemical recycling outputs.

EXECUTIVE SUMMARY

This report has been prepared to address the plastic industry's claims that chemical recycling, also known as "advanced recycling," can play a significant role in reducing global plastic pollution. The science and data currently available do not support this claim and actually point to the conclusion that chemical recycling would support expansion of plastic production, while potentially causing unacceptable levels of environmental and social harm — as well as impacts on human health — through emissions, waste generation, energy consumption, and contaminated outputs.

Highly informed and experienced delegates at the 2023 Conference of the Parties to the Basel Convention on the Control of Transboundary Movements of Hazardous Waste and Their Disposal (hereafter the Basel Convention) did not agree to include chemical recycling in the global technical guidance on the management of plastic waste. The delegates overwhelmingly rejected its inclusion because it could not be demonstrated that chemical recycling met the threshold of environmentally sound management (ESM). This report identifies many of the technical and economic reasons why chemical recycling is not considered environmentally sound, will not effectively address plastic pollution in any meaningful way, and should not be supported with public funds, subsidies, tax breaks, or similar instruments. Chemical recycling is not anticipated to be commercially viable, and any economic risks associated with its investment should be borne by those responsible for plastic production, not the public.

Chemical recycling is not new or advanced, as it is based primarily on technologies such as pyrolysis and gasification that have struggled technically and commercially to process such wastes for decades. The majority of the output is not feedstock for new "circular" or "green" plastic but petrochemical fuels that will be burned, creating toxic emissions and emitting greenhouse gases. Every step of these technologies is expensive, polluting, and energy-intensive, from pretreatment and thermal processes to output cleanup.

Many chemical recycling companies use fossil fuel energy to turn petrochemical-based plastics back into fossil-derived fuels to burn, creating a polluting, carbon-intensive merry-go-round. U.S. government researchers have concluded that the economic and environmental impacts of pyrolysis and gasification are likely to be 10 to 100 times higher than those of virgin polymer production, casting serious doubt on the environmental credentials of the sector (see Appendix 1: U.S. Case Studies on page 80).

Chapter 1 briefly summarizes the state of the global plastic pollution crisis and how that pollution has exceeded the Earth's limits for its ecosystems to function in a stable manner. Then it explores the reasons why conventional, mechanical recycling has failed to process more than 9% of all plastic ever produced. It includes the technical, economic, and policy limitations that prevent effective recycling and explains the plastic industry's awareness of this as it launched its recycling campaigns to head off plastic product bans in the 1980s.

Chapter 2 summarizes the 11 chemical recycling plants that were constructed, operating, or partially operating in the U.S. as of September 2023. It is supplemented by "Appendix 1: U.S. Case Studies," which details these plants' financing, investment and public subsidy status, outputs, if any, and whether they are situated in environmental justice communities. Environmental justice communities are communities where a high percentage of residents are low income or people of color. These communities often bear a disproportionate impact from heavy industries and are further burdened by the establishment of polluting chemical recycling plants.

Chapter 3 explores current attempts spearheaded by chemical industry lobbyists to deregulate the chemical recycling sector in the U.S. and reclassify its operations as manufacturing facilities, not solid-waste operations, in an attempt to reduce emissions monitoring and regulatory controls needed to protect workers and communities. Technical data on chemical recycling emissions, yield, and waste streams is generally not made public. That which is available, combined with research data, suggests that chemical recycling represents a significant threat to nearby communities and must be regulated at least as strictly as other incineration facilities. The issue of toxic plastic feedstock and its relation to toxic outputs and emissions from chemical recycling is also discussed.

Chapter 4 describes the international linkages to chemical recycling technology and policy, how it is regarded outside the U.S., and rejection of these technologies as environmentally sound management of plastic waste by the leading global hazardous waste decision-making body, the Basel Convention. It also examines the relevance of the Stockholm Convention on Persistent Organic Pollutants to chemical recycling in relation to toxic compounds contaminating feedstock, formed in the process, released in emissions, and contaminating outputs.

Chapter 5 establishes conclusions that can be drawn from the report research and recommendations with respect to chemical recycling and plastic pollution.

The Technical Addendum Part 1 details the myriad terms, definitions, and technologies that currently fall under the umbrella of chemical, or advanced, recycling. Many of these terms also have marketing synonyms that bear little resemblance to technical processes being proposed or used. The addendum also addresses the technical processes, principles underlying the processes, and feedstock types. Part 2 elaborates on the long history of chemical recycling and why its application to post-consumer waste has not been successful or viable, especially in relation to plastic waste. It addresses the problems encountered in the scaling-up processes from lab or pilot stage to commercial operations. It also explains that for regulatory purposes, pyrolysis and gasification are regarded as incineration technologies, requiring strict monitoring for and regulation of toxic emissions and releases. Finally, it refutes the claims that chemical recycling is suitable for mixed plastic waste recycling and that the process does not compete with conventional mechanical recycling for clean feedstock.

Ultimately, policymakers worldwide must decide whether they will engage in years of further delay, distracted by the promise of a technology "solution" that has failed before and will fail again, while the global plastic pollution crisis spirals out of control. Planetary toxic plastic waste pollution requires immediate action. The answer lies in producing a lot less plastic, making it significantly less toxic, and substituting other reusable or more sustainable materials for plastics wherever possible.

The cost of inaction, distraction, and delay will be terrible, and it will be paid by us all: by future generations, the environment, and especially by environmental justice communities. The myth of chemical recycling as a solution to plastic waste should be seen for what it is: a public relations distraction to prevent plastic regulation and prop up the profits of the petrochemical/plastics industry. We have lost nearly 40 years waiting for conventional plastic recycling to "work." We have waited decades for chemical recycling to work. We can no longer afford to waste more time waiting for mythical solutions. Plastic recycling simply does not work.

HB1092 Recycling - Prohibition on the Chemical Con

Uploaded by: Julia Lawrence

Position: FAV

HB1092
Recycling – Prohibition on the Chemical Conversion of Plastic
Testimony before The Environment and Transportation Committee
Hearing February 26, 2025
Position: Favorable

Dear Chair Delegate Korman and Vice Chair Delegate Boyce, and members of the committee, my name is Julia Lawrence, and I represent the 900+ members of Indivisible Howard County. Indivisible Howard County is an active member of the Maryland Legislative Coalition (with 30,000+ members).

We are providing written testimony today **in support of HB1092**. This bill would alter the definition of "recycling" to exclude certain processes relating to the chemical conversion of plastic such as pyrolysis, hydropyrolysis, methanolysis, gasification, enzymatic breakdown, and any similar chemical conversion process as determined by the Department of the Environment. HB1092 would prohibit a person from building in Maryland a facility that converts plastic to fuel or feedstock through chemical conversion processes.

We thank Delegate Terrasa and her colleagues for sponsoring this bill.

We are supporting HB1092, because it would ensure that the negative health and environmental impacts of operating a chemical conversion plant would be avoided in Maryland.

"Chemical recycling" is an umbrella term for a set of technologies that convert plastic waste either into fuel or raw materials, or "feedstock," [1] for new plastics. The term encompasses the process of conversion, decomposition, and purification [2] of plastic, which include the processes of pyrolysis, hydropyrolysis, methanolysis, gasification, and enzymatic breakdown. [3] [4] [5]

Chemical recycling is not considered by ISO, the EU Environmental Commission, the Ellen MacArthur Foundation, or many other groups [6], to be standard recycling which returns materials back into the consumer production cycle offering economic and ecological benefits. [7] Chemical recycling is considered by these groups to be plastic "incineration." [8]

Chemical recycling emissions cause serious health concerns like cancer, emit more pollution than regular recycling, and accelerate climate change. [9] Data from the EPA show that one chemical conversion plant can generate nearly 500,000 pounds of hazardous waste in one year

alone. [10] This waste consists primarily of benzene, along with other toxins such as lead, cadmium, and chromium, which are known carcinogens. [11] [12]

The rise of chemical recycling waste would lead to immense challenges for nearby and downwind communities in Maryland where these plastics are either produced, landfilled, or incinerated, and would frustrate efforts to reduce waste and greenhouse gas emissions. [13]

An alternative to creating fuel from chemical conversion plants is for Maryland to proceed to develop clean energy projects which would make affordable, accessible technologies available to all Marylanders. [14] Projects in clean energy can empower communities, boost economic growth, establish jobs, while continuing to protect the health of individuals and the environment of Maryland. [15]

Thank you for your consideration of this important legislation.

We respectfully urge a favorable report.

Julia Lawrence
Columbia, Maryland 21044

Sources and Notes:

[1] *In plastic chemical recycling, "feedstock" refers to solid plastic waste which is a raw material used to make a product in an industrial process.* What is feedstock in plastic chemical conversion process?

[2] *Chemical recycling can be divided into three general processes:*

1. *Conversion (sometimes referred to as "plastics-to-fuel") turns the polymers in plastic waste into smaller molecules that can be turned into fuel or used as feedstock for the creation of new products. Conversion is carried out via one of two main methods:*
    - *Pyrolysis subjects plastic waste to extreme heat in the absence of oxygen to create a synthetic crude oil that can be refined into diesel fuel, gasoline and other products.*
    - *Gasification uses extreme heat to convert plastic waste to synthesis gas: a fuel mixture mainly composed of hydrogen and carbon monoxide, which can then be turned into other fuels or chemicals, such as ethanol and methanol.*
2. *Decomposition uses either heat or chemicals to break down polymers in plastic into monomers to produce new plastics. Chemical decomposition uses powerful solvents to do this. Some decomposition technologies use enzymes.*
3. *Purification uses strong solvents to break plastic down into its chemical components and separate polymers from additives or contaminants. Unlike other types of chemical recycling, purification leaves the polymers themselves intact.*

"Chemical recycling": What you need to know.

[3] What Are The Differences Between Pyrolysis And Gasification? Key Insights for Energy Conversion - Kintek Solution

[4] Pyrolysis vs Hydropyrolysis - What's the difference? | WikiDiff

[5] Biodiesel production with immobilized lipase: A review - ScienceDirect

[6] “Chemical Recycling” Isn’t Actually Recycling.

[7] European Union Directive 2008/98/EC. Ameripen, Packaging Materials Management Definitions: “The Bridge to Circularity: Putting the New Plastics Economy into Practice in the U.S. Recycling Partnership,” Stephanie Kersten-Johnston, October 2019, https://recyclingpartnership.org/wp-content/uploads/dlm_ uploads/2019/10/BridgetoCircularity_10.28.19-1.pdf.

[8] Recycling Lies: “Chemical Recycling” of Plastic Is Just Greenwashing Incineration

[9] Americans Are Concerned about “Chemical Recycling” - Oceana USA

[10] 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=.

[11] Toxicity, mechanism and health effects of some heavy metals - PMC

[12] Toxic Mechanisms of Five Heavy Metals: Mercury, Lead, Chromium, Cadmium, and Arsenic - PMC

[13] Beyond Plastics, NYS Budget testimony, J Enck, Jan 2025.docx

[14] Making Maryland a Leader in Clean Energy and the Greenest State in the Country | MD Priorities

[15] Maryland Clean Energy Center (MCEC)

HB1092 Prohibition of Chemical Plastic Conversion.

Uploaded by: Kurt Schwarz

Position: FAV

February 24, 2025

Bill: https://mgaleg.maryland.gov/2025RS/bills/hb/hb1092F.pdf

Committee: Environment and Transportation

Testimony on HB1092—Recycling—Prohibition of Chemical Conversion of Plastic.

Position: Favorable

I support HB1092 which would prohibit the construction of any facilities that would convert plastics to fuel or feedstock. My reasons this bill are driven by the proposed Pilot Plastic Recycling Project by WR Grace in Columbia, Maryland. This pilot plant would release volatile compounds into the atmosphere in a densely populated residential area, full of children, the aged, and infirm.

Our home sits just two short exits east of the Grace facility. We are downwind of the proposed plant. We are both over 65 with the additional health vulnerabilities. We live in a 55+ community, so most of our neighbors share these vulnerabilities.

I feel that the State should ban plastic recycling plants to protect the health of their residents and urge the Committee to make a favorable report on HB1092.

Kurt R. Schwarz

HB1092_Krausz_FAV
Uploaded by: Lisa Krausz
Position: FAV

Testimony of Lisa Krausz

In Support of HB 1092 - Recycling - Prohibition on the Chemical Conversion of Plastic

Greetings. My name is Lisa Krausz. I am a resident of River Hill Village in Clarksville, Maryland, and I also suffer from a reactive pulmonary condition which limits my mobility and health. I have served as PTSA President for my kids' high school and also served at the county level promoting parent ed programs and school safety initiatives. I care deeply about the well being and health of Howard County children, families, and residents as well as throughout our state.

Like many of us speaking out in support of HB1092, I am gravely concerned about the advent of chemical recycling plants, facilities and research facilities in our state. Where I live, W.R. Grace's is proposing to initiate a plastic R&D facility smack-dab in the middle of our residential communities. I was so disturbed by this proposed project that back in August, I co-founded the Stop Grace Plastic Burning Project with other Howard County residents.

An online petition was created at that time opposing the Grace plastics project. Currently, the petition has approximately 815 signatures, over 50% of which represent households of 4 or more people, and within that number 15% represent households of 5 or more. I am submitting a copy of this petition for your information. The signatures accrue daily.

The fact is that when people learn about chemical recycling projects to be situated in their communities, they oppose it. Pulmonologists, pediatricians, oncologists, and environmental toxicologists know that this facility and those like it will negatively impact the health and safety of people residing even miles away from it whether from toxic emissions and the very real possibilities of fires and leaks, which are not uncommon.

We need our state legislators to stand up and take bold action to stop these polluting facilities which are springing up all over the country. Contrary to the PR efforts, chemical processing of plastic is NOT recycling; it simply creates a whole new stream of waste with horrible health implications for those living near and around these projects. This is not the solution to our plastic problem. Please support HB 1092 for the state of Maryland health and well-being.

Stop Grace Petition Signers 2-24-25.pdf
Uploaded by: Lisa Krausz
Position: FAV

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8/24/2024 18:11:31	My Family Household (i.e., Multiple Family Membe
8/27/2024 11:00:35	My Family Household (i.e., Multiple Family Membe
8/22/2024 17:00:26	My Family Household (i.e., Multiply Family Membe
9/2/2024 8:31:18	My Self (i.e., Single Person Household or Just You
2/18/2025 22:51:57	My Self (i.e., Single Person Household or Just You
8/26/2024 13:51:58	My Family Household (i.e., Multiple Family Membe
2/7/2025 13:46:11	My Family Household (i.e., Multiple Family Membe
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9/10/2024 13:09:17	My Family Household (i.e., Multiple Family Membe
9/3/2024 22:03:05	My Family Household (i.e., Multiple Family Membe
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9/15/2024 13:47:42	My Family Household (i.e., Multiple Family Membe
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8/15/2024 18:43:00	
8/15/2024 23:20:11	Linda Olson
8/15/2024 20:17:01	Jan Miller
8/15/2024 18:43:59	Lisa Krausz

Home Address	I do not support the Grace Chemical Company's attempt to cı
7936 lawndale cir columbia MD	
6723 Green Mill Way, Columbia, MD 21044	
11517 Manorstone Lane , Columbia MD 21043	
6420 Distant Melody Place	
Laureland Pl	
7571 weather worn way unit e Columbia md	
6308 last sunbeam pl Columbia Md 21044	
12745 Folly Quarter rd. Ellicott City, MD 21042	
10947 Eight Bells lane Columbia md 21044	
11837 Linden Chapel Road	
11662 foxspur ct., Ellicott city, MD 21042	
7984 Lawndale circle	
6065 Watch Chain Way	
7984 Lawndale circle Columbia md 21044	
5064 Lake Circle West, Columbia, MD. 21044	
Monarch mills way	
7654 Cross Creek Dr	
9324 Pilar ct	
7933 Lawndale Cir	
11700 Stonegate Ln Columbia, MD 21044	
6178 Flutie ln	
7663 Cross Creek Dr., Columbia, MD 21044	
10257 Wilde Lake Terrace	
12213 green shoot court, Columbia, Md 21044	
8141 Trotters Chase, Ellicott City, MD 21043	
6300 silvery star path	
Ellicott City	
1885 Norhurst Way N	
7925 Lawndale Circle	
7925 Lawndale Circle, Columbia MD 21044	
7648 cross creek drive	
7648 Cross Creek Drive	
7405 Plainview Ter, Columbia, MD 22044	
9455 Clocktower Lane, Columbia, MD 21046	
5665 Harper Farms Rd	
North Laurel	
10441 Sternwheel Place	
5093 Durham Rd W	
5093 Durham Road west Columbia MD 21044	
10215 Dottys Way, Columbia, MD 21044	
10401 Twin Rivers Road#412 Columbia, MD 21044	
6405 enchanted Solitude place, Columbia md	
6130 lily garden, Clarksville, MD 21029	

11927 gold needle way Columbia md
10826 Braeburn Road
5525 Adams Ridge Road Clarksville MD 21029
6624 Rising Waves Way, Columbia
8302 Spring Blossom Ct, Laurel MD 20723
12550 Vincents way, Clarksville MD 21029
6520 Hazel Thicket Drive
12942 Byefield Drive, Highland, MD
7107 Kings point Way
5717 Harper’s Farm RD Columbia MD
6440 Richardson Farm Ln Clarksville MD 21029
7238 Life Quest Lane, Columbia, MD 21045
6509 ranging hills gate Columbia Md 21044
10806 Dundee Dr. Columbia, MD 21044
7984 Lawndale CircleColumbia MD 21044-4480
7791 Cross Creek Drive Columbia MD 21044
6515 river run
Clarksville MD
5713 Harpers Farm Road
6300 Victorious Song Lane
7320 Shady Glen Drive Columbia md 21046
6305 Enchanted Key Gate
6305 Enchanted Key Gate
7244 Mainstream Way, Columbia, MD 21044
6309 Angel Rose Ct Columbia MD 21044
13054 Saint Patricks Ct
11863 Scaggsville Rd Fulton, MD 20759
3295 Roscommon Dr, Glenelg, MD 21737
5491 Wooded Way, Columbia Md 21044
14540 Dorsey Mill Rd. Glenwood MD 21738
Brighton Dam Rd
13135 Hutchinson Way, Silver Spring, MD 20906
6429 Empty Song Rd. 21044
Beaverbook Rd Columbia, MD 21044
14204 Pioneer Circle, Glenelg MD 21737
6513 Ocean Shore Lane
4277 Buckskin Wood Drive Ellicott City MD 21042
12301 Carol Drive, Fulton, MD. 20759
7252 Calm Sunset, Columbia, MD 21046
11782 Stonegate Lane, Columbia MD 21044
6448 Lochridge Road, Columbia, MD 21044
4989 Columbia Road, Unit 304
Mink Hollow Rd
5699 Trotter rd

10392 Derby Drive
9090 Tiber Ridge Ct, Ellicott City, MD
10915 Harmel Drive
11444 iager blvd
1530 Annapolis Road Odenton MD 21113
Ellicott City 21043
6119 minute hand Ct
10732 McGregor Drive
6388 Guilford Road, Clarksville, MD 21029
12654 Vincents away
6629 towering Oak Path , Columbia, Maryland 21044
4117 ten oaks rd
3982 Old Columbia Pike
3807 sand creek ct, Ellicott city, MD 21042
14908 Michele Dr Glenelg
10300 burnside dr ellicott city md 21042
3512 Lowlen Court
6208 Northrop Way Clarksville MD
5919 trumpet sound court clarksville 21029
6522 River Run, Columbia, MD. 21044
6522 River Run, Columbia, MD. 21044
6512 Langford Ct, Clarksville
7220 Mainstream Way, Columbia, MD 21044
4734 Woodland Rd, Ellicott City, MD 21042
7651 Mandrake Ct T04 Elkridge MD 21075
6521 WAVING TREE CT
7241 Mainstream Way, Columbia, MD 21044
8358 Academy Rd ECity Md 21043
10634 Glass Tumbler Path, Columbia, MD 21044-4144, USA
9260 Red Cart Ct, Columbia, MD 21045
6609 Towering Oak Path
13705 bold venture drive, Glenelg MD
12571 Vincents Way, Clarksville MD 21029
6106 Forestvale Court
13014 Highgrove Road, Highland, MD 20777
10943 Swansfield Road
7052 Garden Walk
5054 Durham Rd West, Columbia 21044
10600 Gorman Rd., Laurel, MD 20723
13712 Springdale Drive Clarksville MD 21029
6508 Early Lily Row, Columbia MD 21044
11741 Farside Rd
3665 Big Log
10400 Springtwig Ct , Woodstock MD 21163

6613 Rising Waves Way
5959 Autumn Spell
11808 New Country Lane
7678 Cross Creek Drive, Columbia MD 21044
6624 Towering Oak Path, Columbia, MD 21044
6413 Empty Song Rd
11853 Tall Timber Dr
123 don’t want to say columbia Md 21044
5421 TALON CT CLARKSVILLE MD 21029
12379 Pleasant view drive, Fulton, MD 20759
10033 Fox Den rd
6582 Guilford Rd, Clarksville MD 21029
7505 Overview Terrace Columbia MD
10179 Owen Brown Road
9346 Opal Chain
6605 Rising Waves Way
6620 Rising Waves Way, Columbia, MD 21044
6140 Cedar wood drive, Columbia MD
7253 Steamerbell Row, Columbia, MD 21045
7747 CROSS CREEK DRIVE
5072 Jericho Road Columbia MD 21044
6408 Galway Dr
5800 Clipper Lane Unit 406
6512 Evensong Mews
10806 Vista Rd. Columbia Md. 22044
6516 Ocean Shore Lane
6482 South Wind Circle
6482 South Wind Circle
6644 Towering Oak Path, Columbia
6644 Towering Oak Path, Columbia
6161 flutie Ln Clarksville md 21028
6453 River Run
10417 Blue Arrow Court
6729 Pyramid Way, Columbia MD 21044
7534 Broadcloth Way Columbia, MD 21046
6621 Rising Waves Way
6461 Empty Song Rd Columbia MD 21044
1280 Crows foot rd Marriottsville MD 21104
10110 wesleigh Dr
7510 Sweet Hours Way, Columbia, MD
11707 Lone Tree Ct
6400 Morning Time Lane
6517 GRAINGER CT
6429 River Run

9932 Carillon Dr.
7909 Lawndale Circle
10904 Harmel Drive Columbia Md 21044
6515 River Run Columbia MD 21044
3013 Quail Hollow terrace
5580 Vantage Point Rd. Columbia Md Apt.2
13419 Green Hill Court
13419 Green Hill Court
14371 Frederick rd Cooksville MD 21723
240 786 5747
16024 Fields End Ct
5421 Jamesway court
2875 Country Lane
9009 Labrador Lane
10792 folkestone way, woodstock, MD
12624 Springloch Ct
6514 Carlinda Ave. Columbia, MD 21046
3129 West Ivory Road, West Friendship, MD 21794
Cedar creek, Columbia, Maryland
6500 Ranging Hills Gate, Columbia, MD 21044
6405 mellow wine way Columbia Md 21044
6764 Green Mill Way, Columbia MD 21044
9345 Big River Run
3229 Ramblewood Rd, Ellicott City, MD 21042
6465 sundown trail Columbia 21044
7416 Cherry Tree Drive Clarksville
7416 Cherry Tree Dr, Clarksville, MD 21029
5792 Alderleaf pl, Columbia
5749 Whistling Winds Walk, Clarksville, MD 21029
23 Castlehill ct Lutherville 21093 MD
Eight Bells Lane, Columbia, MD 21044
7617 Weather Worn Way, Unit D
6525 Ocean Shore Ln, Columbia MD 21044
6444 South Wind Circle
3540 Countryside Drive, Glenwood MD
8656 Hines Circle, Laurel MD 20723
6506 River Run
6506 River Run Columbia MD 21044
3985 Sharp rd, Glenwood MD 21738
6542 South Wind Circle
123 Main St
6901 Timber Creek Court Clarksville MD 21029
12815 Hall Shop Rd
6016 Misty Arch Run

11216-1 Chase Street, Fulton, MD 20759
6416 DISTANT MELODY PLACE Columbia Maryland 21044
10431 Churchill Way, Laurel 20723
5801 Clipper Lane, #204
6405 Summer Sunrise dr 21044
3777 Plum Hill Ct, Ellicott City, MD 21042
3642 Grosvenor Dr, Ellicott City, MD 21042
5896 Indian Summer Drive, Clarksville, MD 21029
8994 Wetbanks Ct, Columbia, MD 21045
6417 Onward Trail
14080 Triadelphia rd
6239 Trotter Road
11013 Charles Way, Fulton, MD 20759
6486 River Run, Columbia, MD 21044
12317 Point Field Dr
6500 Waving Tree Cr 21044
6069 Watch Chain Way Columbia, MD 21044
9208 Connell Ct Columbia MD 21046
6632 Rising Waves Way, Columbia, MD 21044
10301 Wesleigh Drive, Columbia, MD
625 Sideling Ct Sykesville MD
6078 Covington Road Columbia, MD 21044
2746 Cheekwood Cir, Ellicott City, MD, 21042
5705 Trotter Road Clarksville, MD 21029
12120 Shining Stars Lane
8622 Far Fields Way
5908 Hay boat Court
1040 fairlane road woodbine
Greatnews Lane
6512 Hazel Thicket Drive Columbia MD 21044
7949 Lawndale Circle Columbia Md 21044
7651 cross creek drive Columbia MD 21044
7651 Cross Creek Drive
10829 Vista Road
4811 Manor Lane Ellicott City, MD
7731 Cross Creek Dr
6300 MELLOW TWILIGHT CT, COLUMBIA, MD 21044
12006 White Cord Way Columbia MD
5020 lake circle ct, Columbia, MD
10264 Shaker Dr Columbia md 21046
10263 Shaker Dr. Columbia md 21046
13454 Long Days court, Highland MD 20777
12183 Linden Linthicum Ln, Clarksville MD 21029
Silvery Star Path

1731 cattail meadows dr, Woodbine, md 21797
11408 Elfstone Way
6436 Quiet Night Ride, Columbia, MD 21044
6118 Tulane Rd, clarksville md 21029
3364 Burton Dr Ellicott City, MD 21042
5484 Harris Farm Lane
6401 RIVER RUN, Columbia, MD 21044
6416 Autumn Sky Way, Columbia 21044
12939 Triadelphia Mill Road
10645 Glen Hannah Dr., Laurel, MD
6410 Liquid Laughter Lane
12100 hidden waters way 21029
8511 Frederick Rd
10703 harding road laurel md 20723
6453 Coxwold Drive
6784 Athol Ave
5414 talon court Clarksville maryland 21029
6076 Cedar Wood Drive
5681 C Harpers Farm RdColumbia MD 21044
5622 Freshaire Lane
10512 Chesham Way Woodstock MD21163
6918 berry wood ct, Columbia Md 21044
14770 Triadelphia Mill Road
5436 dogwood Rd Gwynn Oak MD 21207
6705 Whitegate Road, Clarksville, MD 21029
6104 Trackless Sea Court
7519 overview terrace, columbia MD 21044
7631 Cross Creek Drive Columbia Md 21044
10070 colonial Dr., Ellicott City
5681 Columbia Rd. Apt 202 Columbia MD 21044
9429 dunloggin rd
6061 otterbein ln apt 303 Ellicott city MD 21243
6109 every sail path, Clarksville, md 21029
6518 River Run
10362 Whitewasher Way Columbia 21044
7612 Cross Creek Drive
10347 Champions Way
6518 South Wind Circle, Columbia, MD 21044
6425 grateful heart gate Columbia MD 21044
12100 Flowing Water Trl., Clarksville MD 21029
7763 cross creek Dr Columbia MD 21044
7763 Cross Creek Dr. Columbia MD 21044
12112 Trailing Moss Gate, Clarksville
11819 Far Edge Path

6504 Ocean Shore Ln., Columbia MD 21044
Allnutt Farm Highland MD
6008 Georgetown Ct Clarksville MD 21029
11085 Little Patuxent Parkway
7675 Cross Creek Drive
10557 Patuxent Ridge Way, Laurel, MD
5308 Nightshade Ct
5709 WHISTLING WINDS WALK
6914 Roslyn Court Columbia MD 21044
10763 Scaggsville Rd, Scaggsville MD 20723 (zip is Laurel)
10307 Paddock Place Laurel, MD 20723
7502 overview terrace columbia Maryland
7513 overview terrace, Columbia, MD 21044
1728 Willow Springs Drive, Sykesville, MD 21784
13713 Bold Venture dr
7936 lawndale circle columbia MD
8009 Roland Court, Elkridge MD
12325 pleasant view drive, Fulton
4085 Roxbury Mill Rd
12104 Early Lilacs Path
6214 Deep Earth ln, Columbia, MD 21045
15017 Rolling Hills DriveGlenwood, MD 21738
10101 Governor Warfield Pky #121 Columbia MD 21044
6004 Pure Sky Place, Clarksville MD 21029
11605 Dark Fire Way
4243 Ten Oaks Rd Dayton MD 21036
6932 DeerPasture Drive
6109 Trackless Sea Court
6109 Trackless Sea Court
6540 Autumn Wind Circle Clarksville Md 21029
6540 Autumn wind cir Clarksville Md 21029
6540 autumn wind circle
6308 ANGEL ROSE CT
7915 Maple Lawn Blvd
6428 grateful heart gate
6011 Helmsman Way
4994 Centaurus Ct, Dayton, MD 21036
8885 Warm Granite Drive
9334 Big River Run
4720 Woodland Rd, 21042
10623 Glen Hannah Dr, Laurel, MD 20723
5380 Green Bridge Road, Dayton MD 21036
14108 Burntwoods Rd Glenwood MD 21738
5920 Great Star Drive, Unit 304, Clarksville, MD 21029

10615 Millet Seed Hill
6117 Trackless Sea Ct. Clarksville, MD 21029
5527 Suffield Court
14820 Cemetery Road, Cooksville, Md 21723
14684 Mustang Path Glenwood Md 21738
12360 Pleasant view dr Fulton MD 20759
6513 Kells Ct Clarksville, MD 21029
9824 SNOW BIRD LN
6616 Oxhorn court
6315 Nodding Night Ct
6207 Northrop Way Clarksville MD 21029
6217 Waving Willow Path
3820 Championship Drive, Glenwood, MD 21738
6558 River Run, Columbia, MD 21044
6405 Fairest Dream Lane Columbia md 21044
10334 Champions Way Laurel MD
10334 Champions Way, Laurel, MD 20723
10606 Millet Seed Hl, Columbia, MD 21044
10304 pimlico pl
3935 Walt Ann Dr, Ellicott City, MD 21042
6305 Angel Rose Ct
5565 April Journey Columbia MD
7232 Mainstream Way Columbia MD 21044
7964 Lawndale Cir, Columbia MD 21044
7731 Cross Creek Drive
6533 limerick ct
clarksville md 21029
3308 Debra Ct, Ellicott City
6206 Bridget Way, Clarksville, MD 21029
11724 Trotter Crossing Lane
6776 Pyramid Way, Columbia, MD 21044-4119, USA
6409 Misty Top Pass Columbia MD 21044
6975 silent Dell lane, Columbia md 21044
7241 Mainstream Wy, Columbia, MD 21044
Scotts Landing Rd., Laurel MD
6428 Richardson farm ln, Clarksville, md 21029
6141 Starburn Path
3260 Saint Johns Lane
14114 Burntwoods Rd
7021 Jeweled Hand Circle, Columbia, MD 21044
3334 Sharp Road Glenwood MD 21748
7525 Yellow Bonnet PL
6629 Whitegate Rd, Clarksville
6072 Sunny Spring

4670 Woodland Road Ellicott City MD 21042
3625 Cragsmoor Road
12836 Macbath Farm Lane, Clarksville 21029
9317 Angelina Circle
6513 Kilkenny Ct. 21019
6513 Great Drum Circle
8638 Wellford Dr
6190 Flutie ln
7888 Savage Guilford Rd., Jessup MD 20794
13454 Long Days Ct
2126 Fernglen Way Catonsville MD 21228
7130 Moorland Drive
Dayton Md
10333 Breconshire Road
7320 Sanborn Way, Columbia MD 21044
4910 Harrogate Road Ellicott City MD 21043
7889 River Rock Way, Columbia, MD
14052 Gared Drive, Glenwood, MD
13327 ridgewood dr
3934 white rose way
6285 Hanover Road
6621 Rising Waves Way Columbia 21044
7124 Morning Light Trail, Columbia MD 21044
7236 mainstream way
12014 Triadelphia Road
5132 Bonnie Brae Ct Ellicott City, MD 21043
6405 Empty Song Road
9982 Cape Ann Dr
6048 Winter Grain Path Clarksville
12203 Green Shoot Ct
6445 Muster Ct
6328 Angel Rose Court Columbia, MD 21044
10919 Battersea lane
1328 broken land pkway
8710 Celita court Jessup md
4808 Circling Hunter Dr, Columbia MD
11975 Simpson Road
22100 New Hampshire Ave Brookeville MD
10775 Cordage Walk, Columbia, MD, USA
10296 Shaker Dr.
4321 Buckskin wood dr ellicott city md 21042
4614 Smokey Wreath Way
7121 Moorland Dr Clarksville, Md 21029
6437 Quiet Night Ride, Columbia MD 21044

779 chessie crossing way woodbine md 21797
11435 Ellington Street Fulton MD 20759
10478 Waterfowl Terrace, Columbia MD 21044
6470 Empty Song Rd, Columbia, MD, 21044
6500 Autumn Wind Circle
9310 Old Line Drive
14460 Triadelphia Mill Rd
12300 CAROL DRIVE
12300 Carol Drive, Fulton, MD 20759
6384 grateful heart gate Columbia, MD 20144
6981 Silent Dell Lane, Columbia, MD 21044
6076 Laurel Wreath Way
4906-1 Columbia Road
10697 Quarterstaff Rd
12172 Flowing Water Trail Clarksville MD 21029
7841 River Rock Way
7841 River Rock Way Columbia MD 21044
6505 Tender Mist Mews
6632 Towering Oak Path, Columbia, MD 21044
4975 morning star drive, suite 2, Dayton Maryland 21036
Diversified Lane
12750 Scaggsville rd Highland md
12335 Pleasant View Dr
7956 Lawndale Circlr
6505 Hazel Thicket Drive, Columbia, Md. 21044
6469 River Run, Columbia, MD. 21044
6469 River RunColumbia, MD
14578 Edgewoods way, Glenelg, MD 21737
5507 Green Bridge Road, Dayton MD 21036
11729 trotter point ct Clarksville md 21029
6008 Georgetown Ct. Clarksville, MD 21029
6131 Lily Garden
7014 Marabou Court Columbia, MD 21044
6441 Sundown Trail Columbia MD 21044
7502 Overview Terrace Columbia, Maryland 21044
5226 Harpers Farm Road
Countless Stars Run
5144 Celestial Way
11766 chapel Estates drive Clarksville MD 21029
6552 Ballymore Lane, Clarksville, MD 21029
10338 derby dr laurel 20723
7932 Lawndale circle
6818 Roslyn Court
6308 Silvery Star Path, Columbia, MD 21044

9466 Farewell Rd
13518 Allnutt Lane Highland MD 20777
7956 Lawndale Circle Columbia, Md 21044
8104 Elsie’s Way Laurel Md
12232 pleasant springs ct Fulton md 20759
1209 Emmaus Rd Woodbine MD
7409 Plainview Terrace
Centaurus Ct, Dayton
5414 talon court Clarksville md 21029
7511 Overview Terr, Columbia,MD
6500 Evensong Mews, Columbia, MD
14840 Bushy park Rd
10962 Trotting Ridge Way, Columbia, MD 21044
6317 Angel Rose CT
st Michaels road
Charmed Days, Laurel, MD
3155 Danmark Drive, West Friendship, MD, USA
3211 Vanborine Pl
10920 Kathleen Ct
5646 chamblis Dr
6434 South Trotter Rd
7649 Woodstream Way, Laurel MD 20723
12126 Fulton Ridge Drive
7643 cross creek dr
7639 cross creek drive, Columbia, Md, 21044
7933 Lawndale Cir
15146 sapling ridge dr
12351 PLEASANT VIEW DR, FULTON, MD 20759
2133 otter creek circle, Hanover md 21076
6056 Signal flame ln
7643 Cross Creek Drive, Columbia, MD 21044
5076 Dry Well
6308 Last Sunbeam Pl columbia Md 21044
7012 barnett lane
6107 Flutie Ln
6550 River Run Columbia MD 21044
11802 Far Edge Path Columbia MD 21044
6511 Barley Corn Row, Columbia MD
15429 Maple Ridge Rd, Woodbine, md 21797
6505 Drifting Cloud Mews
10300 Pimlico Pl LAurel, MD 20723
9236 Quick Fox Columbia MD 21045
10928 Tompkins Way Woodstock Md21163
12050 Broad Meadow Lane, Clarksville, MD 21029

14016 Castlebar Dr. Glenwood MD 21738
7146 Moorland Drive, Clarksville, MD
6509 Tender Mist Mews, Columbia MD 21044
8918 Tawes St, Fulton, MD 20759
6317 Morning Time Lane Columbia Md 21044
6318 Dewey Dr, Columbia MD 21066
7233 Wolverton Ct, Clarksville, MD 21029
1714 Oakdale Dr
6267 Audubon Drive Columbia Md 21044
11204 Avalanche Way
6323 Kiteline Court, Columbia, MD 21044
10688 Quarterstaff Rd Columbia MD
6546 South Wind Circle Columbia MD 21044
7948 Lawndale Circle
8490 roberts road
9323 Afyernoon Ln Columbia MD
6766 Green Mill Way
7949 Lawndale Cir
10719 Autumn Splendor Drive, Columbia, MD 21044
6726 Mink Hollow Road Highland MD
6726 Mink Hollow Road
6524 Waving Tree Court, Columbia, MD
7901 Olive Branch Lane, Laurel, MD 20723
6119 FLUTIE ln, Clarksville-21029
12150 scaggsville rd
10354 Whitewasher Way
6752 Green Mill Way
6803 Green Mill Way, Columbia, MD 21055
9558 Angelina Circle Columbia
9558 Angelina cir, columbia Md 21045
14825 Woodfield lane, Glenelg, md 21737
13299 Hunt Rdg, Ellicott City, MD 21042
13150 Deanmar Dr. Highland, MD20777
6416 ripe Apple Lane, columbia, md
6416 Ripe Apple Lane
12205 Green Shoot Court Columbia, MD 21044
6327 Loudon Avenue
14581 Edgewoods Way 21737
11884 Bright Passage
6608 Forest Shade Trail
6313 Mellow Twilight Court
10627 Millet Seed Hill
10627 Millet Seed Hill Columbia MD 21044
6428 Grateful Heart Gate

10705 Judy Lane Columbia, MD 21044
5369 Tarkington Pl, Columbia, MD 21044
6601 gleaming sand columbia MD 21044
6452 River Run Columbia MD 21044
7783 Cross Creek Drive Columbia MD 21044
6138 Flutie lane
7619 Cross Creek Drive
3447 Huntsmans Run
5840 Wild Orange Gate
Fulton, MD
5672 April Journey
9344 Cross Timbers Court, Laurel, MD 20723
7845 River Rock Way, Columbia, Maryland 21044
6621 Forest Shade Trail, Clarksville, MD, 21029
10736 Faulkner Ridge Cir Columbia, MD
11453 Iager Blvd
14261 Triadelphia Mill Rd Dayton, MD 21036
6035 Holland Ct Columbia md 21044
10043 Waterford Drive
10560 Hunters Way Laurel MD 20723
5494 Woodenhawk Cir
3920 Sharp Road, Glenwood, MD 21738
6317 Morning Time Lane Columbia MD 21044
5204 Woodam Ct-
11668 Dark Fire Way
7329 Wildwood Court
6425 Quiet Night Ride Columbia MD 21044
5312 Aerie ct Clarksville
13400 Rich Lynn Court, Highland, MD 20777
12661 Vincents Way Clarksville, MD 21784
11328 Castlewood Ct, Laurel, MD
12363 Pleasant View Dr
10702 Faulkner Ridge Cir
6676 Buttonhole Ct
6405 Misty Top Pass
7743 Cross Creek Drive, Columbia, MD 21044
10218 Sunway terrace, Ellicott City MD
6645 mink hollow rd highland Md 20777
2829 rolling fork way Glenwood md
7779 Cross Creek Drive Columbia, MD 21044
7779 Cross Creek Dr Columbia MD 21044
14553 Edgewoods Way
6436 Swimmer Row Way, Columbia, MD
6329 angel rose court, Columbia nd 21044

6122 flutie lane clarksville md 21029
6421 Distant Melody Pl
11825 Clarksville pike Clarksville MD 21029
6608 Gleaming Sand Chase Columbia, MD 21044
6421 Erin Drive, Clarksville
1885 Norhurst Way N, Catonsville, MD 21228
7220 Mainstream Way
6425 Dry Barley Ln, 21045
7936 lawndale circle Columbia MD
6517 Ocean Shore Lane
7124 Chilton Ct, Clarksville, MD 21029
7212 Mainstream Way
7711 Cross Creek Drive
12557 Vincents way Clarksville Md 20129
7589 weather worn way unit D Columbia Md 21046
13007 Red Maple Way, Clarksville
10309 Derby Dr laurel, MD 20723
4667 Willowgrove Drive
3630 Point Hitch Rd. Glenwood MD 21783
6016 Ascending Moon Path
7100 Ramsgate Court
12186 Hayland Farm Way
6505 Early Lily Row 21044
7513 Red Cravat Ct
12150 Fulton Estates, Fulton, MD
3922 Saint Johns Ln, Ellicott City MD 21042
9801 Diversified Lane
9801 Diversified Lane
11386 high hay
5008 Green Bridge Rd, Dayton, MD 21036
6421 River Run, Columbia, MD 21044
4998 Centaurus Court Dayton Maryland
7941 Lawndale Circle, MD
608 Sideling Court
11878 Simpson Rd, Clarksville, MD 21029-1717, USA
10444 Sternwheel Place
5288 Golden Sky Court. Columbia, MD 21045
7110 Rivers View Ct Columbia MD 21044
6408 empty song rd
6553 River Run
2124 Woodbine Rd
6465 Empty Song Road
7208 Wolverton Ct Clarksville MD 20129
4435 oakwood overlook ct

6845 Sewells Orchard Drive
10701 Quarterstaff Rd
10701 Quarterstaff Road Columbia, Md 21044
6320 Angel Rose Court Columbia MD
7911 Tilghman St
913 Nichols dr
6570 Woven Moonbeam
7945 Lawndale Circle
6006 Jerrys Drive
13913 Wayside Drive
7916 Lawndale Cir, Columbia, MD, 21044
7916 Lawndale Circle
5039 Crape Myrtle Ct, Ellicott City, MD, USA
6524 Waving Tree Court, Columbia, MD
11281 Barnsley Way, Marriottsville, Md. 21104
10521 Rossini Lane Ellicott City MD 21042
4333 Maisel Farm Lane
Unsure why you need to know this
6513 folded leaf sq, Columbia Md 21044
6455 South Wind Circle
8629 N Bali Ct
760 Howes Lane
7914 tilghman st. Fulton, md
11170 Chambers Court, Woodstock, MD 21163
6501 Langford ct.
6585 Autumn Wind Circle
6325 Angel Rose Ct
6204 Devon Dr

12256 Summer Sky Path, Clarksville, Maryland
12113 shining stars Ln, Clarksville, MD 21029
5720 western sea run
12309 Carol Dr
12339 Pleasant View Dr, Fulton, MD 20759
6166 Flutie Lane Clarksville MD 21029
12113 Sunlit Water Way Clarksville MD 21029
7744 Water Street Fulton MD 20759
7744 Water Street
10361 Whitewasher Way
3670 Cragsmoor Rd, Ellicott City,MD
7703 Cross Creek Drive
7111 Moorland Dr
900 S East Ave
6409 mellow wine way

7121 Chardon Court Clarksville MD 21029
6337 Departed Sunset Lane Columbia, MD 21044
10308 Winners Circle Way
5537 Green Mountain Circle #6Columbia, MD 21044
Scaggsville, MD
6500 Kells Court
10618 Hunting Lane, Columbia, MD 21044
Manor Lane, Ellicott City, MD 21042
7416 setting sun way, Columbia, md
6405 Grateful Heart Gate, Columbia, MD 21044
10516 Bill Lilly Ct Laurel MD
6406 Lochridge Rd
6360 Guilford Road
7727 Cross Creek Dr. Columbia MD 21044
10102 Colonial Dr., Ellicott City, MD 21042
10129 Bell Inn Ln 21042
8229 Hunterbrooke Ln, Fulton MD 20759
11332 Castlewood Ct
6223 Flutie Ln
6512 tipperary ct, clarksville, md
13838 Wayside Ct, clarksville MD 21029
6904 Sandy Creek Ct, Clarksville MD 21029
12488 East Nuggett Court
11748 Lone Tree Court
12217 Ioka Ct Ellicott City, MD
6449 Mellow Wine Way
Mellow Wine Way
10450 waterfowl ter
6508 Drifting Cloud Mews
5202 winding star circle Columbia md 21044
Fulton, Md
6469 Empty Song Rd
5208 Woodam Ct Columbia md 21045
3655 Paupers Folly Lane West Friendship MD 21784
12100 Trailing Moss Gate
5653 Harpers Farm Road
13150 Brighton Dam Road
12375 Pleasant View Drive Fulton, MD 20759
10750 Bridlerein Terrace
7193 Joshua Grayson Drive, jessup MD 20794
7964 lawndale cir
9800 Madelaine CT
10004 culverene Road, Ellicott City, 21042
Shannon Ct, Clarksville, MD21029

7762 Chatfield Ln	
14553 Edgewoods Way Glenelg MD 21737	
11539 Iager Blvd Fulton MD	
6105 Eternal Ocean Place Clarksville, MD 21029	
5930 Great Star Dr clarksville MD21029	
6804 Pyramid Way. Columbia	
10201 Breconshire Road	
6537 Ballymore Ln, Clarksville, MD 21029	
6448 River Run	
13155 Brighton Dam Road	
6514 River Run, Columbia MD 21044	
10213 clubhouse ct Ellicott city md 21042	
6425 Richardson Farm Ln, Clarksville MD 21029	
7523 Overview Terrace Columbia MD 21044	
11167 Wood Elves Way	
10886 Olde Woods Way	
10684 High Beam Ct	
6505 great drum circle, Columbia, me 21044	
10219 Ebb Tide Ln. Laurel, MD 20723	
9633 white acre rd	
10109 CARILLON DRIVE ,ELLICOTT CITY MD21042	
Grovenor Dr	
13300 Long Leaf Dr	
9679 Oak Hill Dr, Ellicott City, MD 21042	
9609 John Randolph court, Ellicott CIty, MD 21042	
7107 penny lane	
6507 River Run, Columbia, Md 21044	
6473 empty Song RD Columbia MD	
12635 Vincents Way	
5912 Trumpet sound ct	
Ellicott City, MD 21042	
14525 Edgewoods way, Glenelg, MD21737	
3810 Sand Creek Ct.	
8574 Autumn harvest	
5513 Woodenhawk Cir Columbia MD 21044	
11627 vixens path, Ellicott City, Md 21042	
12878 lime kiln rd, highland, md,.20777	
7320 Sanborn Way, Columbia, MD	
9059 Dunloggin rd, Ellicott City	
14517 Edgewoods Way, Glenelg Maryland 21737	
6105 Eternal Ocean Place	
6478 River Run	
7949 Lawndale Circle	I affirm and support the statement above.
7244 mainstream way Columbia 21044 Md	I affirm and support the statement above.

7248 Mainstream Way Columbia	I affirm and support the statement above.	
7941 Lawndale Circle	I affirm and support the statement above.	
7941 Lawndale Circle	I affirm and support the statement above.	
7956 Lawndale Circle Columbia, MD 21044	I affirm and support the statement above.	
7779 Cross creek dr Columbia Md 21044	I affirm and support the statement above.	
11861 Bright Passage	I affirm and support the statement above.	
7341 Wildwood Court, Columbia,MD 21046		
6136 Waiting Spring Columbia, MD 21045	I affirm and support the statement above.	
11824 Chapel Woods CtClarksville, MD 21029	I affirm and support the statement above.	
5333 Broadwater ln Clarksville md	I affirm and support the statement above.	
6937 Crossfield Ct	I affirm and support the statement above.	
6308 victorious song lane Clarksville	I affirm and support the statement above.	
5804 Silent Sun Places	I affirm and support the statement above.	
6312 Mellow Twilight Court	I affirm and support the statement above.	
6449 Mellow Wine Way 21044	I affirm and support the statement above.	
6500 Waving Tree Court Columbia MD 21044	I affirm and support the statement above.	
6608 Forest Shade Trail, Clarksville, MD 21029	I affirm and support the statement above.	
6445 Quiet Night Ride	I affirm and support the statement above.	
7124 Morning Light Trail	I affirm and support the statement above.	
7110 Newberry Drive, Columbia MD 21044	I affirm and support the statement above.	
7013 Long View Road	I affirm and support the statement above.	
6964 Silent Dell Lane	I affirm and support the statement above.	
6981 Silent Dell Lane	I affirm and support the statement above.	
12233 Summer Sky Path, Clarksville MD 21044		4108187178
8513 Ellicott View Road Ellicott City MD 21043	410-465-9647	
14460 Triadelphia Mill Rd	301-922-1326	
6109 Trackless Sea Court	415-717-7065	

I live in the following ne	If other above, where d	First Name	Last Name
Cedar Creek		Arundati	Kharel sigdel
Simpson Mill	Simpson Mill Townhom	Jennifer	Aballo
Harper's Choice		Heidi	Abdelhady
River Hill		Mary	Acker
Laurel	Laurel	Nina	Ad
Kings Contrivance	I also work in the Hicko	Ariel	Addy
River Hill		Vic	Agrawal
Glenelg Manor Estates	Glenelg Manor Estates	Saman	Ahmed
Harper's Choice		Tiffany	Ake
Chapel Woods		Alexandra	Aleshin-Guendel
Farside	Ellicott city	Hasnat	Ali
Cedar Creek		Farnoush	Allen
Hickory Ridge		Birchard	Allen
Cedar Creek		Richard	Allen
Beaverbrook		Maria	Alvare
Guilford		Muhammad	Alvi
Cedar Creek		Mariam	Ameri
Oakland Mills		Virginia	Amerman
Cedar Creek		Sima	Amin
Hickory Ridge		Erin	Anderson
River Hill		Madhavi	Annapureddy
Cedar Creek		Agata	Anthony
Wild Lake		Kaela	Arnest
Hickory Ridge		Karen Stop this potenti	Arnold
Trotters Chase	Trotters Chase	Alicia	Aronovich
River Hill		Margaret	Asher
Ellicott City	Ellicott City	Mohammed	Asif
Family members in cec	Catonsville	Hibah	Askari
Cedar Creek		David	Askwith
Cedar Creek		Frances	Askwith
Cedar Creek		Elaha	Atayee
Cedar Creek		Nawid	Atayee
Cedar Creek		Ugur	Ates
Kings Contrivance		Ruth	Auerbach
Harper's Choice		Rebecca	Bai
North Laurel	North Laurel, family me	Lorena	Baniqued
Hickory Ridge		Chloe	Banks
Beaverbrook	Beaverbrook	Debra	Barlly
Beaverbrook	Beaverbrook	Randolph	Barlly
Hickory Ridge		Sharon	Barnes
Wild Lake		Shalamar	Barnes
Hickory Ridge		Martha	Bartlett
River Hill		Najla	Barton

Hickory Ridge		Patricia	Bascietto
Braeburn Community A	Columbia, across from	Jacqueline	Bates
Clarksville	Clarksville	Cecelia	Battle
River Hill		Amy	Becker
Other Howard County	Other Howard County	Caitlin	Bender
River Hill		Henry	Berghoff
River Hill		Ilan	Berman
Highland	Highland, my kids atter	Kathryn	Bernas
Kings Contrivance		Melissa	Berry-Carolina
Harper's Choice		Suzanne	Bierer
Windy Knolls - Clarksvi	Richardson Farm Lane	SHEILA	BISHOFF
Owen Brown		Brooke	Blankenship
River Hill		Barbara	Block
Hickory Ridge		Kristine	BLOOM
Cedar Creek	No	Pouyan	Bokaei
Cedar Creek		Amina	Bokhari
River Hill		Anthony	Bolanos
Enclave at River Hill		Andrew	Bonic
Harper's Choice		Grace	Boudreau
River Hill		Michael	Boule
Clark’s Crossing (near	Clark’s Crossing- off O	Erin	Bounds
River Hill		Colin	Bowers
River Hill		Tina	Bowers
Cedar Creek		Leonard	Boyd
River Hill		Kiera	Boyle-Toledo
Highland, MD	Highland	Katie	Bozarth
Maple Lawn		Teresa	Bradford
Glenelg	Glenelg	Staci	Bradley
The Trails at Woodlot	The Trails at Woodlot	Susan	Brazzel
Glenwood	Glenwood	Daniel	Bregman
River Hill		Sara	Brenner
Silver Spring, MD	Silver Spring, MD	Gary	Brick
River Hill		Ron	Briggs
Beaverbook	Beaverbrook	Theresa	Brillant
Glenelg	Glenelg	Kathy	Broughton
River Hill		Martha	Brucato
I run thru River Hill and	Buckskin Woods	Dena	Brzezicki
Fulton Manor	Fulton Manor	Marlene	Buczynski
Guilford		Hajer	Buker
Hickory Ridge		Susan	Buningh
Braeburn	Braeburn, off of Cedar	Sebastian	Buonato
Dorsey's Search		Jake	Burdett
Highland	Highland	Katherine	Burke
clarksville md	clarksville md	dennis	burns

Hunters Creek in North	North Laurel	Karin	Cantrell
Ellicott City		JIANJING	Cao
Hickory Ridge		Nick	Caputo
Maple lawn	Maple lawn	Sarah	Casagrande
N/a	Down yonder	John	Cash
Ellicott City		Suzanne	Castner
Hickory Ridge		Laura	Cavanaugh
Scot's Glen	Scot's Glen	Grace	Chaisson
Guilford		Sarah	Chandler
River Hill		Ankita	Chandupatla
Pointlers run/Riverhill	Pointers run in the Rive	Shari	Chase
Dayton	Dayton	Amanda	Chaves
Ellicott City	Ellicott City	Haiyan	Chen
Ellicott city	Ellicott city	Wengen	Chen
Glenelg	Glenelg	Chun	Chen
Centennial		Meifeng	Chen
Plumtree Overlook		Shiowei	Cheng
Enclave at River Hill		Vishal	Chhikara
River Hill		Emily	Chikhaoui
River Hill		Rhonda	Chitwood
River Hill		Rhonda	Chitwood
Guilford		Li-Lin	Chiu
Cedar Creek		Aamir	Chowdhury
Dorsey's Search		Joya	Chowdhury
Elkridge, Deep Run	Elkridge/Jessup near M	Proma	Chowdhury
River Hill		Andrea	Chronis-Tuscano
Cedar Creek		Shirley	Chu
Worthington Fields	Worthington Fields	Wendi	Cichowicz
Hickory Ridge		Mikaela	Clark
Long Reach		Kim	Clarke
River Hill		Richard	Clayton
Paddocks, Glenelg	Glenelg.Paddock’s neig	Tracy	Cogdill
River Hill		Danielle	Cohe
Hickory Ridge		Rita	Cohen
Schooley Mill	Schooley Mill (near par	Elizabeth	Collins
Swansfield	Swansfield	Brynn	Conover
River Hill		Donna	Considine
Harper's Choice		Sarah	Cooke
Hammond Village	Hammond Village	Ellen	Cooper
Springdale		Jen	Cornell
River Hill		Barbara	Cosgrove
Farside	Farside	Debbie	Counts
Town Center		Adrian	Cox
Waverly	Waverly	Amy	Crouch

River Hill		Sandy	Cummings
Lyndwood	Lyndwood	Domonic	Cusimano
Hickory Ridge		Peter	D'Arpa
Cedar Creek		Christopher	Dailey
River Hill		Justin	Daniel
River Hill		Angela	Davis
River Hill		Scott	Davis
ML		Bita	Dayhoff
River Hill		Rakhi	De
Fulton Manor	Off Hallshop Road	Rukman	De Silva
Ellicott city	Work in guilford	Jennifer	Decker
River Hill		Eric	DeMenthon
Cedar Creek	Listed above	Aynur	Demirel
Hickory Ridge		Allison	Dennis
Hopewell	Hopewell	Rebecca	Detig
River Hill		Justin	Devlin
River Hill		Jennifer	Diamond
Hickory Ridge		Bridgette	Dibble
Owen Brown		Haiwen	Ding
Cedar Creek		Maria	Diwanji
River Hill		Kim	Doggette
River Hill		Aling	Dong
River Hill		Li Ming	Dong
River Hill		Colleen	Donovan
River's Edge		Emily	Downs
River Hill		Rosemary	Duncan
River Hill		Bernadette	Dunn
River Hill		Bernadette	Dunn
River Hill		Karen	Dwyer
River's Edge		Karen	Dwyer
River Hill		Magdy	Ebeid
River Hill		Gina	Egel
Hickory Ridge		Linda	Eisenberg
Hickory Ridge		Kira	Elbeyli
Kings Contrivance		Jacalyn	Ely
River Hill		Norman	Engelberg
River Hill	Pointers Run - 5 min V	Monica	Ennaciri
Meadowood	Marriottsville	Lauren	Erxleben
Allview Estates		Andrea	Estrada
Kings Contrivance		Tammy	Eves
Hickory Ridge		Calcifer	Fan
River Hill		Stephanie	Fang
Route 103		Hasan	Farook
River Hill		Bassam	Farroha

Dorsey's Search		Yan	Feng
Cedar Creek		Raymond	Ferrer
Hickory Ridge		María	Ferrucci
River Hill		Carla	Figueroa
In montgomery County	Brookeville Md	Elizabeth	Fishman
Town Center		Frances	Flannery
Highland		Hilda	Flike Jacobson
Highland	Highland	Cecilia	Flike Jacobson
Cooksville	Cooksville md	Kimberly	Ford
North Laurel	North Laurel	Bibi	Foston
Woodbine	Woodbine	Elizabeth	Franks
Dunfarmin		Scott	Freinberg
Ellicott City	Ellicott City	Amanda	Fries
Dunloggin	Dunloggin area	Junyan	Fu
woodstock		QIANG	FU
Meadowbrook	Meadow	Laurie	Gamble
Allview Estates		Art	Gamzon
Fox Valley	Fox Valley neighborhoc	Kathryn	Gandy
Cedar Creek		Mounika	Gangadi
River Hill		Md Osman	Gani
River Hill		George	Ganim
Simpsonmill Communit	Yes	Keerthi	Ganji
Oakland Mills		Jorge	Gao
Valley Mede	Ellicott City	Nicole	Garrett
River Hill		Kim	Garrison
Hopkins Meade		Diana	Gersuk
Hopkins Meade	Clarksville, near APL	Seth	Gersuk
Long Reach		Ragaey	Ghaleb
River Hill		Keivan	Ghoseiri
Timonium Lutherville	23 Castlehill CT Luther	Lili	Gibson
Harper's Choice		Keith	Gigliello
Kings Contrivance		Paul	Gionis
River Hill		Marc	Gittleman
River Hill		Sharon	Glazer
Glenwood	Glenwood	Emily	Godfrey
Enclave at Hines Farm		Wayne	Gold
River Hill		Jeffrey	Gold
River Hill		Robyn	Gold
Glenwood	Glenwood	Brittany	Goldberg
River Hill	Pheasant Ridge in Rive	Ruth	Goldberg
Other	Maryland	Dan	Gordon
Clarksville Hunt	Clarksville Hunt	Indranil	Goswami
Highland	Highland	Lisa	Gouner
Hickory Ridge		Laura	Grassi

Maple Lawn	Maple Lawn	Lauren	Graybeal
River Hill		Bryan	Grenn
Hunters Creek		Sandra	Griego
River Hill		Brian	Grodsky
River Hill		Tyler	Grossi
Dunloggin	Dunloggin near Long G	Kate	Gunther
Fonthill Community	Foothill Community	Jennifer	Guo
River Hill		Maria	Gutierrez
Long Reach		Pamela	Gutman
River Hill		Jennifer	Guy
Glenelg		Eric	Gwin
River Hill		Danielle	Haddy
Maple Lawn South	Maple Lawn South	Hiruy	Hadgu
River Hill		Anne	Hager
Fulton Manor	Fulton Manor	Jeff	Hahn
River Hill		Irene	Halkias
Hickory Ridge		Stephen	Hall
Guilford		Hameeda	Hameed
River Hill		Melissa	Hamet
Wesleigh Drive	10301 Wesleigh Drive	Holli	Hamilton
Gaither	Gaither	Jenna	Hammer
Hickory Ridge		Kristen	Hammill
Ellicott City	Ellicott City	Yi	Han
River Hill		Jacqueline	Handelman
River Hill		Lei	Hao
Emerson		Carissa	Harper
River Hill		Eileen	Harrity
Fairlane farm	Fairlane farm	Nina	Harry
Hickory Ridge		Kristin	Hartman
River Hill	N/A	Jill	Hartman
Cedar Creek		Aisha	Hasan
Cedar Creek		Anwer	Hasan
Cedar Creek		Roomina	Hasan
River's Edge		Amanda	Hatten
Hickory Ridge		Nicholas	Hawthorne
Cedar Creek		Jie	He
River Hill		Paula	Henry
Hickory Ridge		Mary	Hepple
Beaverbrook	Beaverbrook	Maria	Herold
Kings Contrivance	I am in between allview	Ina	Hersh
Kings Contrivance		Ina	Hersh
Allnutt Farms	Allnutt Farms	Jane	Hershey
River Hill		Eric	Herzig
River Hill		Julie	Hickey

Cattail woods	Cattail woods	Beth	Higgins
Harper's Choice		Christine	Hipple
River Hill		Diane	Hitch
River Hill		Michelle	Ho
Westmount	Westmount	Elizabeth	Hodnett
Clarksville,MD		Karen	Holloway
River Hill		Marlene	Holmes
River Hill		Sandra	Holt
River Hill		Lily	Hua
See below	North Laurel	Chenjie	Huang
River Hill		Aron	Hubbard
River Hill		Ruth	Huffman
Ellicott City		Carolyn	Hughes
Scott's cove	Scott's cove near mapl	Brenda	Hughes
Elkridge		Colleen	Hughes
Hardwood park	Elkridge MD	Heidi	Hughes
River Hill		Zarina	Hunt
Cedar Acres	Cedar Acres	Damon	Hurbon
Harper's Choice		Joel	Hurewitz
Harper's Choice		Carol	Hutchison
Woodstock		Ryejin	Hwang
Pointers overlook		Alan	Idoni
Dayton	Dayton	Cliff	Itwaru
I don't live in Howard c	Near Catonsville MD	Mikaela	Iwaskiw
Clarksville Ridge	Clarksville Ridge	Lauren	Jagtiani
River Hill		Samina	Jahangir
Cedar Creek		Vaishali	Jarral
Cedar Creek		Tashia	Jenkins
Dorsey's Search		Lei	Ji
Harper's Choice		Michael	Ji
Dorsey's Search		Jerry	Jiang
Woodland village	Near Woodland village	Ambar	Jimenez
River Hill		Yuezhou	Jing
River Hill		Scott	Johnson
Hickory Ridge		Fred	Johnston
Cedar Creek		Cherae	Jones
Hunters creek	Hunters Creek	Logan	Jones
River Hill		Mary	Jones
River Hill		Chris	Josey
River Hill		Jonathan	Jou
Cedar Creek		Francis	Jung
Cedar Creek		Hyonchu	Jung
River Hill		Swati	Kabaria
Hickory Ridge		Karen	Kaiser

River Hill		Maithili	Kale
Allnutt Farm		Mona	Kamal
River Hill		Murali	Kannan
Town Center		Luke	Kao
Cedar Creek		Kara	Karabias
Warfield’s Range		Tricia	Katebini
Glenmont	Glenmont	Melissa	Kay
River Hill		Phyllis	Kelley
River Hill		Lisa	Kelly
Scaggsville	Scaggsville	Catherine	Kemp
Hammond		Stephanie	Kenez
Cedar Creek		Krithika	Kesavan
Cedar Creek		Mustafa	Khaliqi
	Willow Springs	Saima	Khan
River Hill		Maarij	Khan
Cedar Creek		Arundati	Kharel sigdel
Arbor village		Aisha	Khetib
Fulton Manor	Fulton Manor	mari	kim
Glenwood area	Glenwood	Helen	Kim
River Hill		Cathryn	Kim
Long Reach		Anita	Kiran
Glenwood	Glenwood	Krista	Kirk
Town Center		Judith	Klee
River Hill		Alicia	Kohler
Clary’s	Clary’s Forest	Crystal	Konny
Dayton	Dayton Maryland	Tracee	Kramer
Owen Brown		Victoria	Kraushar-Plantholt
River Hill		David	Krausz
River Hill		Lisa	Krausz
River Hill		Jeff	Kulik
River Hill		Jennifer	Kulik
River Hill		Sharon	Kulik
River Hill		Kavitanjali	Kumar
Maple Lawn	Maple Lawn	Liz	Kundu
Pointers Run	Pointers run	Manasa	Kuppalli
River Hill		Lisa	Kurr
Dayton	Dayton	Virginia	Kwitkowski
Long Reach		Barbara	Lagas
Oakland Mills		Nicole	Lahman
Ellicott City	Ellicott City	Kasau	Lai
Leishear Village		Christina	Lambert
Dayton	Dayton	Lorie	Lana
Glenwood	Glewood	Emily	Lanciano
River Hill		Alan	Lane

Hickory Ridge		Shelley	Laub
River Hill		Stephanie	Lavner
Harper's Choice		Julia	Lawrence
No neighborhood	Cooksville	Beth	Lawson
Glenwood	Glenwood	Robert	Lebair
Fulton Manor	Fulton Manor	Cara	LeConte
Clark's Glen	Clark's Glen	Haena-Young	Lee
Emerson		Eunmyoung	Lee
Hickory Ridge		John	Lee
River Hill		Ja Hyung	Lee
River Hill		Pearl	Lee
River Hill		Somin	Lee
Cattail Creek Country C	Cattail Creek Country C	Hillary	Legrain
River Hill		Tammy	LeGrys
River Hill		Martha	Leibowitz
Hunters Creek	Hunters Creek	Jeff	Leikin
Hunters Creek, and we	have family friends whc	Sherry	Leikin
Hickory Ridge		Gail	Leithauser
Hunters Creek		Rebecca	Levine
Shepards Glen	Shepards Glen	Jennifer	Levy
River Hill		Bessie	Lewis
Wild Lake		Lauren	Lewkowicz
Cedar Creek		Jessica	Li
Cedar Creek		Yali	Li
Cedar Creek		Yuexing	Li
River Hill		Wenping	Li
River Hill		zhiyu	Li
Elliott City	Elliott City	Lynn	Liang
Guilford		Kimi	Liang
River Hill		Sophia	Lin
Hickory Ridge		Vanessa	Lin-Mims
River Hill		Angela	Ling
River's Edge		John	Linsenmeyer
Cedar Creek		Mo	Liu
Cheery Creek		Hanna	Liu
Clsrksville	Clarksville	Delong	Liu
Long Reach		Minzhi	Liu
Ellicott City	Ellicott City	Barabara	Livieratos
Glenwood	Glenwood	Catherine	Loomis
River Hill		Guang	Lou
Gwenley Estates		Susan	Love
Kings Contrivance		Richard	Love
Clarksville Ridge	Clarksville Ridge	Lucie	Low
Hickory Ridge		Kimberly	Lowe

Ellicott City	Ellicott City	Rongbo	Lu
Ellicott City		Mary	Lu
River Hill		Wei	Lu
Owen Brown		Mara	Lueking
Clark’s Glen	Clark’s Glen	Beth	Luntz
River Hill		Laurie	Lyons
Centennial Overlook		Lan	Ma
River Hill		Nicole	Ma
Kings Contrivance		Debbi	Mack
Highland	Highland	Joseph	MacKrell
Catonsville	Catonsville MD	Namika	Mahmoodi
Ashleigh Knolls		cara	mahoney
Castelberry		Jigna	Majmudar
Ellicott City	Burleigh Manor	Melissa	Major
Cedar Creek		Rene	Maldonado
Ellicott City	Brampton Hills	Cathy	Malin
Hickory Ridge		Sharath	Manduva
Byrd Manor	Byrd Manor	Neesha	manickam
Ridgewood	Ridgewood	Mannik	Manokian
Dorsey's Search		Yali	Mao
Hanover	6285 Hanover Road	Joseph	Marcus
River Hill		Leslie	Marcuse
River Hill		Scott	Markow
Cedar Creek		Ramya	Marravula
Ellicott City	Ellicott - close to River	Toby	Martin
Bonnie Branch		Allison	Masterson
River Hill		Denny	Mathew
Kings Contrivance		Ying	Matties
River Hill		Fran	May
Hickory Ridge		Ferdinand	Mayer
Centre Ridge	Virginia	Tammy	McCarron
River Hill		Lauren	McCarthy
Harper's Choice		Patrick	Mccarville
Harper's Choice		Kelly	Mcculley
Guilford		Phoebe	McDougal
Jonestown	Jonestown	Jack	McGowan
On Simpson Rd	Simpson Rd	Lindsay	McLeester
15 mins away	Brookeville MD	Jordanna	McMillan
Hickory Ridge		Debra	McPherson
Kings Contrivance		Sharon	McRae
Buckskin Lake		Lehigh	Mearns
Dorsey's Search		Janet	Medina
Ashleigh Knolls	Ashleigh Knolls	Puneet	Mehrotra
River Hill		Monica	Meier-Beck

woodbine	woodbine	ivy	meissner
Maple Lawn	Maple Lawn	Pamela	Mellott
Wild Lake		Alex	Memory
River Hill		Cecelia	Mendiola
River Hill		Julia	Merti
Thunder Hill	Thunder Hill	Dorothy	Mettee
Dayton	Dayton, MD	Janet	Miller
Fulton Manor	Fulton, Manor off of Ha	Andrew	Miller
Fulton Manor	Fulton Manor	Nicole	Miller
River Hill		Robyn	Miller
River's Edge		Glenn	Miller
Town Center		Jon	Miller
Dorsey's Search		Eric	Miller
Hickory Ridge		Marilyn	Mills
River Hill		Michell	Min
Allview Estates	River Rock Way	Bibi Sanam	Miralikhel
River Rick Way	River Rock Way	Mohamma	Miralikhel
River Hill		Sharada	Modur
River Hill		Teresa	Money
Dayton	Dayton	Kevin	Montgomery
Bridgewater		Julie	Moody
Highland	Highland	John	Moore
Fulton Manor		Jeanne	Morck
Cedar Creek		Sara	Morrell
River Hill		Joan	Morton
River Hill		Gary	Mousigian
River Hill		Gary	Mousigian
Triadelphia		Yvonne	Mrha
Dayton	Dayton	Don	Mu
Trotter road	On trotter road	Bharathi	Muniswamy
River Hill		Urmila	Murali
Guilford		KEERTHI	MUTHYALA
River's Edge		Candice	Nager
River Hill		Brian	Nagle
Cedar Creek		Sreevatsan	Narayanan
Harper's Choice		Gem	Nason
River Hill		Doha	Nassar
Harper's Choice		Peggy	Nebus
River Hill		Bahareh	Negahban
River Hill		Elise	Ng
Hunter creek	Hunter creek	Crystal	Ngo
Cedar Creek	Not applicable	Thanh-Ha	Nguyen
Guilford	Pointers Run Overlook	Molly	Nicholl
River Hill		Lisa	Nichols

Hickory Ridge		Alisa	Niefeld-Batiz
Allnutt Lane	Highland	Alyssa	Noonan
Cedar Creek		Debbie	Noonan
Scaggsville		John	Noonan
Highland Reserve		Meredith	Nowak
Walnut Springs	Walnut Springs	Debra	O’Byrne
Cedar Creek		Shannon	O'Dell
Dayton	Dayton	Raymond	Ohl
Clarksville		Zaki	Omar
Cedar Creek		Mustafa	Omarzad
River Hill		Stephanie	Ong
Western HoCo	Western HoCo	Jennifer	Ormond
Hickory Ridge		Dorothy	Ortiz
River Hill		Valerie	Osula
Woodbine	Woodbine	Heather	Outman
Near savage mill		Ben	Pafe
West Friendship	West Friendship	Liisa	Palmer
Ellicott City	Ellicott City	Sarah	Pan
Hickory Ridge		Karen	Pang
River Hill	Clarksville	Helen	Pappas
Pointers Run	Clarksville , Pointers Ri	Nancy	Parlette
North Laurel	North Laurel, in Howar	Carolyn	Parsa
Fulton Ridge	Fulton, MD	Kelli	Passalacqua
Cedar Creek		Kamini	Patel
Cedar Creek		Purvita	Patel
Cedar Creek		Sanket	Patel
Dayton md	Dayton MD	Paul	Patel
FULTON	FULTON	DHARMESH	PATEL
Near by	Hanover MD	Dimple	Patel
River Hill		Dhara	Patel
Cedar Creek		Kamini	Patel
Oakland Mills		Meryl	Patrick
River Hill		Julie	Pavlovsky
Dorsey's Search		Stanley	Pearson
River Hill		Shivakumar	Peddi
River Hill		Maria	Pelikan
Clary’s Forest	Clary’s Forest	Scott	Pelletier
River Hill		Xiaoqing	Peng
Woodbine		Junzhong	Peng
River Hill		Greg	Perlstein
Hunter's Creek	Hunter's Creek	Paul	Perret
Owen Brown		Terri	Petzold
Preserve at Waverly Gl	10928 Tompkins way. \	Michael	Pfau
Clearview Estates	Clearview Estates	Karen	Pham

Glenwood, MD	Glenwood, MD	Erin	Phelps
Ashleigh Knolls		Allison	Pihl
River Hill		Alan	Pine
Fulton, MD	Fulton, MD	Stuart	Pineo
River's Edge		Julia	Pogach
Hickory Ridge		Miriam	Pokharel-Wood
Ashleigh Knolls	Ashleigh Knolls	John	Porcelli
N/a	Cooksville	Mikayla	Porterfield
Hickory Ridge		David	Portnoy
Hickory Ridge		Harriet	Porton
Hickory Ridge		William	Powers
Hickory Ridge		Angela	Prescott
River Hill		Nora	Presti
Cedar Creek		Shamieka	Preston
Stonecrest	Ellicott City	Annie	Prodoehl
Oakland Mills		Tim	Pyne
Simpson Mill	Simpson Mill	Swetha	Pyreddy
Cedar Creek		Zain	Qazi
Hickory Ridge		Zelda	Rachbach
Highland	Highland	Judy	Radas
Highland	Highland	Judy	Radas
River Hill		Faraz	Rahman
Wellington Farms	Wellington Farms	Jessica	Raimondi
River Hill		Urjita	Rami
Fulton		VICKI	RAND
Hickory Ridge		Virginia	Raney
Simpson mill	Simpson mill	Aishwarya	Ravichandran
Hickory Ridge		Lilian	Regmi
Owen Brown		Elaine	Reid
Owen Brown		Ilyse	Reid
Glenelg		Jessica	Reikowsky
Hunt Ridge	Western Ellicott Citt	Claire	Reinken
Highland	Highland	Mike	Ren
River Hill		Brian	Resnick
River Hill		Stacie	Resnick
Clary’s Chase	Clary’s Chase	Luzmila	Robinson
Elkridge	Elkridge	Camila	Rodriguez
Glenelg	Glenelg	Leslie	Roecklein
Hickory Ridge		William	Rollow
River Hill		Julie	Rosenthal
River Hill		Walter	Rowe
Hickory Ridge		Debating rah	Rubin
Hickory Ridge		Deb	Rubin
River Hill	Pointer's Run	Samuel	Rumford

Hickory Ridge		Charlie	Ryan
Dorsey's Search		Sousan	Saadat
River Hill		Jawad	Saade
River Hill		Mary	Sabella
Cedar Creek		Sue	Sabenorio
River Hill		Susan	Sackel
Cedar Creek		Vedangana	Saini
Western Ellicott City		Amanda	Salamon
River Hill		Sabina	Salimova
Hunterbrooke		Rebecca	Salkeld
Dorsey's Search		Steven	Salsburg
Settler's Landing	Settler's Landing in Lau	Diane	Salvatore
Simpson Mill	Simpson Mill	Ronny	Samet
River Hill		Michael	Sanderoff
Wild Lake		Adrianna	Sanders
Maple lawn	Maple lawn	Hannah	Sanderson
Dayton	Private Road Dayton M	Anjali	Sandhu
Hickory Ridge		Preet	Sandhu
Centennial	Centennial	Yingying	Sang
north laurel	North Laurel	Beth	Satisky
Harper's Choice		Stephanie	Schindler
Glenwood	Glenwood	Sara	Schlanger
River Hill		Rachel	Scholnick
Beaverbriij	Beaverbrook	Janet	Schreibstein
Harper's Choice		Cathy	Schwarz
Kings Contrivance		Kurt	Schwarz
River Hill		Robert	Scollar
River Hill		Lori	Scott
River Hill		Zachary	Scott
River Hill		Betsy	See
Reservoir Overlook	Reservoir Overlook	Alan	Seigel
Fulton Manor	Fulton Manor	John	Sessler
Wild Lake		Sarah	Sexton
Hickory Ridge		Laura	Seylar
River Hill		Mike	Share
Cedar Creek		Garima	Sharma
Ellicott City		Nicole	Shastri
Highland	Highland	Donna	Shatzer
Mckendree Estates	Glenwood	Diane	Shaver
Cedar Creek		Michael	Shaw
Cedar Creek		Deborah	Shaw
Glenelg		Hui	Shen
Guilford		Ning	Shen
River Hill		Leanne	Sheriff

River Hill		Girish	Shetty
River Hill		Randy	Shore
River Hill		Raghid	Shourbaji
River Hill		Steven	Shuman
Clarks Glen		Japjit	Sidana
Catonsville	Catonsville	Luthfe	Siddique
Cedar Creek		Nusrat	Siddique
Long Reach		Fazle	Siddique
Cedar Creek		Kishor	Sigdel
River Hill		Valerie	Sikora
Ashleigh Knolls	Ashleigh Knolls (Clarks	Judith	Simons
Cedar Creek		Kingsley	Simons
Cedar Creek		Rakhi	Singh
River Hill		Bik	Singh
Kings Contrivance		Maria	Singletary
Twelve Hills		Aaron	Skolnick
Hunters Creek / N laure	Hunters Creek / N laure	Shari	Skye
Dorsey's Search		Gina	Smary
Countryside	Countryside	Kristen	Smith
River Hill		Meg	Snyder
Ashleigh Knolls		Scott	Sokolowski
River Hill		Deb	Solomon
River Hill		Nancy	Solowski
Kings Contrivance		Harold	Sommers
Near pindell school roa	12150 Fulton estates c	Daljit	Soni
Dunloggin		Tamim	Sookoor
Olde Mill	9801 Diversified Lane,	Mark	Sormanti
Olde Mill	9801 Diversified Lane,	Mark	Sormanti
Harper's Choice		Samantha	Sotolongo
Dayton	Dayton	Ellen	Sowry
River Hill		Adam	Spanier
Dayton	Dayton, Md	Jack	Spencer
Cedar Creek		Hari	Srinivasan
Sykesville	Sykesville	Melanie	Starling
Simpson Woods	Simpson Woods	Daniel	Steil
Hickory Ridge		Richard	Steinberg
Glenmont	Off 108 between Thunc	Marjorie	Steiner
River's Edge		Kim	Stepanuk
River Hill		Regina	Steuer
River Hill		Kathy	Stevens
Lisbon	Lisbon	Anne	Stockbridge
River Hill		Gail	Stovall
Ashleigh Knoll	Ashleigh Knoll	Alan	Strott
Oakwood overlook ct	Dayton md	Mary	Stubs

Sewells Orchard	Sewells Orchard	Mary	Sturm
Hickory Ridge		Howard	Sturman
Hickory Ridge		Robin	Sturman
River Hill		Nora	Sudarsan
River Hill		Terry	SULLIVAN
Laurel	PG county	Laura	Sullivan
Owen Brown		Katie	Surine
Cedar Creek		Sudhangi	Suthrave
Hickory Ridge		Susan Keach	Sweeney
Clarksville	Near Brighton Dam in (	Karin	Swenson
Cedar Creek		Rafi	Syed
Harper's Choice		Mohiuddin	Syed
River Hill		Kareem	Syed
River Hill		Nazia	Tabassum
Waverly Woods West	Waverly Wood West	Roseann	Taff
Turf Valley		Luhua	Tai
Private road	Beside Buckskin	Laura	Tan
Hickory Ridge		Elizabeth	Tanaka
River Hill		Janet	Tangney
River Hill		Edward	Tanner
Stonecrest	Stonecrest/autumn hill	Patti	Taylor
Sebring	Sebring	Danielle	Taymoorian
Maple lawn		Noor	Teebi
Waverly Woods-Woodstock		Carla	Tevelow
Clarksville	Clarksville	Vaishali	Thakkar
River Hill		Judith	Thomas
River Hill		Suzanne	Thomas
Hickory Ridge		Marta	Thompson
Ellicott City		Rebecca	Thornton
River Hill		Sharon	Thorpe
River Hill		Jing	Tian
River Hill		Karen	Titus
Fulton Manor	Fulton Manor	Tracy	Totaro
Fulton Manor	Fulton Manor	Deborah	Towner
Guilford		Jahnavi	TRIVEDI
River Hill		Marlene	Trossman
Maple Law	Maple Law	Rick	Trott
Maple Lawn	Maple Lawn	Natalie	Trott
Hickory Ridge		SONIA	TRUESDALE
Font Hill	Font Hill	Alice	Tsai
Cedar Creek		Christine	Tupino
Ashleigh Knolls	Clarksville	Stephanie	Tyler
Baltimore	Baltimore.	Claire	Usiak
River Hill		Ross	Usmani

Ashleigh Knolls	Ashleigh Knolls	Irene	Vane
River Hill		Beth Anna	Varson
Hunters Creek	Hunters Creek	Margaret	Vaughan
Wild Lake	Wilde Lake	Diane	Vaughan
Scaggsville/Fulton	Scaggsville	Kelly	Vee
Clarks Glen		Nitin	Verma
River's Edge		Heather	Verron
Ellicott City	Ellicott City	Sara	Via
Kings Contrivance		Jawad	Vohra
River Hill		Marina	Vornovitsky
Scaggsville	Scaggsville	Mallory	Waggoner
Braeburn	Braeburn (Lochridge R	Andy	Walker
River Hill		Robert	Wallace
Cedar Creek		Jinhua	Wang
Centennial	Centennial	Zhengfang	Wang
Font Hill	Font Hill	Ruby	Wang
Fulton, MD	Fulton, MD	Jim	Wang
Reserved at Rocky Go	Laurel	Debbie	Wang
River Hill		Talia	Wang
River Hill		Guohui	WANG
River Hill		Xuejiao	Wang
River's Edge		Hua	Wang
Highland Md 20777	Highland md	Kenneth	Ward
Hickory Ridge		Kim	Watters
Ellicott City near Clarks	Ellicott City near clarks	Morag	Weedlun
River Hill		Christopher	Weih
River Hill		Eliza	Weih
Wild Lake		MARCIE	WEIL
River Hill		Mona	Weinberg
Harper's Choice		Devi	Weinkle stephens
Fulton		Noah	Weintraub
River Hill		Lily	Weiss-Lora
Beaverbrook	Beaverbrook	Baktash	Wessal
Belvedere Estates	Belvedere Estates	Nicole	Weszka
River Hill		Sarah	Wharton
Harper's Choice		Cheryle	Wharton
Waterford	Clarksville	Shelby	Willets
River Hill		Kate	Williams
Hickory Ridge		Emily	Winkelstein
jessup	Cedar Villa Heights, Je	Rachel	Wolven
Cedar Creek		Annabelle	Wu
Ellicott city	Ellicott citu	Tao	Wu
Ellicott city		Nancy	Wu
River Hill		Fang	Wu

Woodland Village	Woodland Village	Mia	Wyatt
Glenelg		Zhengxiong	Xi
Maple Lawn	Maple Lawn	Lucy	Xu
River Hill		Melanie	Yaksich
River Hill		yanrong	Yan
Hickory Ridge		Debbie	Yare
Burleigh Manor		Xin	Yi
River Hill		Yanming	Yin
River Hill		Pyunghwa	Yoon
Waterford in Clarksville	Waterford in Clarksville	Julia	Young
River Hill		Victoria	Yozwiak
Dorsey's Search		Gongmei	Yu
River Hill		Yang	Yu
Cedar Creek		Christina	Yuan
Harper's Choice		Aaron	Zaccaria
Harper's Choice	Na	Ari	Zastrow
Hickory Ridge		Maya	Zegarra
River Hill		Subing	Zeng
Emerson	Emerson	Harris	Zeng
Oakland Mills		Spark	Zeng
ELLICOTT CITY		JIYU	ZHAN
Centennial		Wei	Zhang
Clarksville	Clarksville	Nancy	Zhang
Dorsey's Search		Yi	Zhang
Ellicott city		Maria	Zhang
Long Reach		Bing	Zhang
River Hill		Bing	Zhang
River Hill		Lixin	Zhang
River Hill		Yuanzhen	Zhang
River Hill		Joan	Zhang
Ellicott City		Chunsheng	Zhao
Glenelg		Nian	Zhao
Paul Mill Road		Nan	Zhao
Wheatfield	Ellicott City	Joanne	Zhao
Harper's Choice		Ling	Zheng
River Hill		Jing	Zheng
Guilford		miaochan	Zhi
Cedar Creek		Lirong	Zhou
Ellicott City	Ellicott City	Donna	Zhou
Glenelg	Glenelg	Christine	Zhou
River Hill		Katherine	Zidarich
River Hill		Roula	Zureick
Cedar Creek			
Cedar Creek			

Cedar Creek	
Cedar Creek	
Cedar Creek	
Cedar Creek	
Cedar Creek	
Hickory Ridge	
Kings Contrivance	
Long Reach	
Other	Clarksville
Other	1.5 miles from river hill
Other	Clarksville Hunt off of Sanner Rd
River Hill	
River Hill	
River Hill	
River Hill	
River Hill	
River Hill	
River Hill	
River Hill	
River's Edge	
River's Edge	
River's Edge	
River's Edge	

I support the petition at Column 11	If you are representing	Column 7
Arundati kharel sigdel		4
Jennifer Aballo		
Heidi Abdelhady		
Mary Acker		2
Nina Ad	Prefer not to say.	
Ariel Addy		3
Vic Agrawal		5
Saman Ahmed		5
Tiffany Ake		2
Alexandra Aleshin-Guendel		5
Hasnat Ali		5
Farnoush Allen		3
Birchard Allen		5
Richard Allen		3
Maria Alvarez		2
Muhammad Aashir hussian Alvi		5
Mariam Ameri		
Virginia M Amerman		2
Sima Amin		4
Erin Anderson		3
Yes, it’s a health hazard to the senior citizens, I		3
Agata Anthony		2
Kaela Arnest		3
Karen Arnold		2
Alicia Aronovich		4
David Asher		2
Mohammed Asif		4
Hibah Askari		3
David Askwith		3
Frances Askwith		3
Elaha Atayee		5
Nawid Atayee		5
Ugur Ates		4
Ruth Lynn Auerbach		
Rebecca Bai		4
No		5
Chloe Banks		5
Debra Barlly		3
Randolph Barlly		3
Sharon Barnes	6 or more	
Shalamar Barnes		2
Martha Bartlett		4
Najla Barton		5

Patricia Bascietto		2
Jacqueline M Bates		4
I support the petition above		2
Amy Becker		4
Caitlin Bender		4
Henry berghoff		2
Ilan Berman		4
Kathryn Bernas		4
Melissa Berry-Carolina		4
Suzanne Bierer	Prefer not to say.	
Sheila BISHOFF		2
Brooke Blankenship		3
Barbara block		4
Kr		2
Pouyan Bokaei		
Amina Bokhari		4
Anthony Bolanos		4
Andrew Bonic		4
Grace Boudreau		3
Michael Boule		5
Erin Bounds		
Colin Bowers		4
Tina Bowers		4
Leonard Boyd		4
Kiera Boyle-Toledo		3
Katie Bozarth		5
Teresa Erica Bradford		
Staci Bradley		3
Susan C. Brazzel		2
Daniel Bregman		5
Sara Brenner		5
Gary Brick		
Ron Briggs		2
Theresa Brillant		3
Kathy Broughton		5
Martha Brucato		4
Dena Brzezicki		4
Marlene Buczynski		3
Hajer Buker	6 or more	
Susan B. Buningh		3
SJ Buonato		4
Jake Burdett		
Katherine Burke		4
Dennis Anthony Burns		4

Karin Cantrell		4
Jianjing Cao		4
Nick Caputo		2
Sarah Casagrande		3
John Cash		
Suzanne Castner		
Laura Cavanaugh		4
Grace Chaisson		3
Sarah Chandler		4
Ankita Chandupatla		4
Yes		3
Amanda Chaves	6 or more	
Yes		3
Wengen Chen		4
Chun Chen		5
Meifeng chen		3
Shiowei Cheng		3
Vishal Chhikara		4
Emily Chikhaoui		4
Rhonda Chitwood		2
Rhonda Chitwood		2
Li-Lin Chiu		4
Aamir Chowdhury		4
Joya Chowdhury		5
Proma Chowdhury		2
Andrea Chronis-Tuscano		4
Shirley Chu	Prefer not to say.	
Wendi Cichowicz		3
Mikaela Rossman Clark	6 or more	
Kim Clarke		
Richard Clayton		3
Tracy cogdill		5
Danielle Cohen		
Rita R. Cohen		2
Elizabeth Collins		4
Brynn Conover		
Donna Considine		2
Sarah Cooke		3
Ellen Cooper		
Jennifer Cornell		4
Barbara Cosgrove		4
Debra Counts		2
Adrian Cox		2
Amy Crouch		5

Sandy K Cummings		2
Domonic Cusimano		3
Peter S. D'Arpa		2
Christopher T. Dailey		4
Justin Daniel	6 or more	
Angela Davis	6 or more	
I support		2
Bita Dayhoff		
Rakhi De		4
Rukman De Silva		4
Jennifer Decker		4
Eric DeMenthon		4
Aynur Demirel		5
Allison Dennis		2
Rebecca Detig	6 or more	
Justin Patrick Devlin		4
Jennifer Diamond		3
Bridgette dibble		2
Haiwen Ding		2
Maria Diwanji		3
Kim Doggette		4
Aling Dong		3
Li Ming Dong		2
Yes, I support this petition.		
Emily Downs		2
Rosemary J Duncan		4
Bernadette Dunn		3
Bernadette Dunn		3
Karen Dwyer		2
Karen & Michael Dwyer		2
Magdy ebeid		4
Gina Egel		5
Linda Eisenberg		2
Kira Elbeyli		4
Jacalyn Ely	Prefer not to say.	
Norman Engelberg		2
Monica Ennaciri		4
Lauren Erxleben		5
I support the above petition		
Tammy Eves		
Calcifer Fan	6 or more	
Stephanie Fang		4
Hasan Farook		2
Bassam Farroha		4

Yan Feng		4
Raymond Ferrer		4
María Ferrucci		4
Carla Figueroa		4
Elizabeth Fishman		5
Frances Flannery		2
Hilda Flike Jacobson		
Cecilia Flike Jacobson		5
Kimberly Ford		4
Bibi		2
Elizabeth Franks		3
Scott Freinberg	6 or more	
Amanda Fries		4
Junyan Fu		4
QIANG FU		4
Laurie Gamble		4
Art and Nancy Gamzon		3
Kathryn E. Gandy	6 or more	
Mg		4
Md Osman Gani		4
George Ganim		5
Keerthi Ganji		
Jorge Gao	6 or more	
Nicole Garrett		3
Kim garrison		5
Diana Gersuk	6 or more	
Seth Gersuk	6 or more	
Ragaey Ghaleb		2
Keivan Ghoseiri		4
Lili Gibson	6 or more	
Keith Gigliello	Prefer not to say.	
Paul Gionis		
Marc Gittleman		3
Sharon Glazer		4
Emily Godfrey		5
Wayne Gold		3
Jeffrey Gold		2
Robyn Gold		2
Brittany Goldberg		4
Ruth Goldberg		3
Dan Gordon		3
INDRANIL GOSWAMI		3
Lisa Gouker		3
Laura Grassi		3

Lauren Graybeal		4
Bryan S Grenn		3
Sandra Griego		3
Brian Grodsky		2
Tyler Grossi		4
Kate Gunther		5
Jennifer		4
Maria J. Gutierrez		5
Pamela Gutman		4
Jennifer Guy	6 or more	
Eric Gwin		4
Danielle Haddy		4
Hiruy Hadgu		4
Annie Hager		2
Jeffrey Hahn		
Irene Halkias		3
Stephen Hall		2
Hameeda Hameed		5
Melissa Hamet		4
Holli Hamilton		2
Jenna Hammer		5
Kristen Hammill		4
Yi Han		4
Jacqueline Handelman	Prefer not to say.	
Lei Hao		2
Carissa Harper		5
Eileen Harrity		3
Nina Harry		4
Kristin Hartman		5
Jill Hartman		5
Aisha Hasan		5
Anwer Hasan		2
ROOMINA HASAN		2
Amanda Hatten		
Nicholas Hawthorne		
Jie He		
Paula Henry		4
Mary Hepple		5
Maria Herold		2
Ina hersh		2
Ina hersh		2
Jane Hershey		3
Eric Herzig		4
Julie Hickey		4

Beth higgins		
Christine Hipple		2
Diane Hitch		2
Michelle Ho		5
Elizabeth Hodnett		5
Karen Holloway	6 or more	
Marlene Holmes		2
Sandra Holt		5
Yes		
Chenjie Huang		2
Aron Hubbard		4
Ruth Huffman		4
Carolyn Hughes	Prefer not to say.	
Brenda hughes		
Colleen Hughes		3
Heidi Hughes		5
Zarina Hunt		
Damon Hurbon		
Joel Hurewitz		
Carol Hutchison. I support the decision to stop	Prefer not to say.	
Ryejin Hwang		3
Alan Wayne Idoni		3
Cliff Itwaru		4
Mikaela Iwaskiw		
Lauren Jagtiani		4
Samina Jahangir		4
Vaishali Jarral		4
Tashia Jenkins		5
lei Ji		3
Michael Ji		
Jerry Jiang		4
Ambar Jimenez		
Yuezhou Jing		3
Scott Johnson		3
Fred and Teresa Johnston		4
Cherae Jones		3
Logan Jones		4
Mary Elizabeth Jones		2
Chris Josey		4
Jonathan Jou		5
Francis Jung		4
H. Karen Jung		4
Swati Kabaria		4
Karen Kaiser	6 or more	

Maithili Kale		3
Mona Kamal		5
Murali Kannan		
Luke Kao		
Kara Karabias		
Patricia Lynn Katebini		3
Melissa Kay		3
Phyllis A Kelley		3
Lisa A Kelly		3
I do support this petition !!!!		
Stephanie Kenez		4
Krithika Kesavan	6 or more	
Mustafa Khaliqi		4
Saima Khan		5
Maarij Khan		5
Arundati kharel sigdel		5
Aisha Khetib		5
mari Kim		
Helen Kim	6 or more	
Cathryn Kim		5
Anita Kiran		3
Krista Kirk		5
Judith Klee		
Alicia Kohler		3
Crystal Konny		3
Tracee Kramer		3
Victoria Kraushar-Plantholt	Prefer not to say.	
David A. Krausz		4
Lisa Krausz		2
Jeffrey S. Kulik		
Jennifer Kulik		3
Sharon Kulik		3
Kavitanjali Kumar		4
Liz Kundu		4
Manasa Kuppalli		4
Lisa Kurr		
Virginia Kwitkowski		3
Barbara Lagas		2
Nicole Ashley Lahman		4
Kasau Lai		5
Christina Lambert		4
Lorie E. Lana		3
Emily Lanciano		5
Alan L Lane		

Shelley Laub		2
Stephanie Lavner		4
Julia Lawrence	Prefer not to say.	
Beth Lawson		5
Yes	6 or more	
Cara LeConte		5
Haena-Young Lee		2
EUNMYOUNG LEE		3
John T Lee		3
Ja Hyung Lee		3
Pearl Lee		4
Somin Lee		3
Hillary Legrain		4
Tammy LeGrys		2
Martha Leibowitz		2
Jeff Leikin		
Sherry Leikin		3
Gail Leithauser		3
Rebecca Levine		3
Jennifer L Levy		3
Bessie Lewis		
Lauren Lewkowicz		3
Jessica Li		
Yali Li		4
YUEXING LI		4
Wenping Li		3
zhiyu li		
Lynn Liang		4
Yu Xuan Kimi Liang		4
Sophia Lin		4
Vanessa Lin-Mims		5
Angela Ling		3
John Linsenmeyer		5
Mo Liu	Prefer not to say.	
Hanna Liu		3
Delong liu		2
Minzhi Liu		4
Barabara Livieratos		
Catherine Loomis		4
Guang Lou		2
Susan Lynn Love		4
Richard Love		2
Lucie Low		3
Kimberly A Lowe		2

Rongbo Lu		4
Mary Lu		3
Wei Lu		3
Mara Lueking		3
Beth Luntz		4
Laurie Lyons		3
Lan Ma		
Nicole Ma		4
Debbi Mack		
Joseph Mackrell		3
Namika Zaman Mahmoodi		5
Cara Mahoney		4
Jigna Majmudar		4
Melissa Major		3
Rene Maldonado		2
Catherine Malin		4
Sharath manduva		4
Neesha Manickam		5
Mannik manokian	6 or more	
Yali Mao		4
Joseph Marcus		4
Leslie Marcuse		
Scott Markow		4
Ramya Marravula		4
Toby Msrtin	Prefer not to say.	
Allison Masterson		2
Denny Mathew		4
Ying Matties		2
Fran May		5
Ferdinand Mayer		2
Tammy McCarron		4
Lauren McCarthy		
Patrick Mccarville		3
Kelly mcculley		4
Phoebe McDougal		4
Jack McGowan		2
Lindsay McLeester		
Jordanna McMillan		5
Debra McPherson		3
Sharon McRae		4
Lehigh Mearns	6 or more	
Janet Medina		
Puneet Mehrotra		4
Monica Meier-Beck		3

ivy meissner		
Pamela Mellott		5
Alex Memory		
Cecelia Mendiola		3
Julia Merti		4
Dorothy Mettee		2
Janet Miller		3
A. Michael Miller		4
Nicole Miller		4
Robyn Miller		4
Glenn Miller		
Jon Miller		
Eric Miller		
Marilyn Mills		2
Michell Min		4
Bibi Sanam Miralikhel		4
Mohammad Miralikhel		5
Sharada Modur		4
Teresa Money		2
Kevin Montgomery		3
Julie moody		4
John Moore		2
Jeanne SMorck		
Sara Morrell		2
Joan Morton		3
Gary M. Mousigian		4
Gary Mousigian		4
Yvonne Mrha		4
Don Mu		4
No		2
Urmila Murali		
Keerthi Muthyala		4
Candice Kassin Nager		
Brian Nagle		5
Sreevats Narayanan		5
Gem Nason		4
Doha Nassar	6 or more	
Peggy Nebus		4
Bahareh Negahban		4
Elise Ng		5
Crystal Ngo		5
Thanh-Ha Nguyen	6 or more	
Molly Nicholl Inglis		2
Lisa Nichols		2

Alisa Niefeld -Batiz		3
Alyssa Noonan		4
Debbie Noonan		4
John Noonan		2
Meredith nowak		4
Debra O’Byrne		4
Shannon E. O'Dell		5
Raymond G. Ohl, IV		4
Zaki Omar		5
Mustafa Omarzad		5
Stephanie S. Ong		5
Jennifer Ormond		3
Dorothy Ortiz		3
Valerie Osula		2
Heather outman	Prefer not to say.	
Ben Pafe		4
Liisa Palmer		4
Sarah Pan		
Karen Pang		5
Helen Pappas		5
Nancy Turner Parlette		3
Carolyn Parsa		
Kelli Passalacqua		3
Kamini patel		4
Purvita Patel		3
Sanket Patel		
Paul patel		5
DHARMESH PATEL		3
Dimple Patel		3
Dhara Patel		5
Kamini Patel		4
Meryl Patrick		4
Julie Pavlovsky		5
Stanley D Pearson Jr		2
Shivakumar Peddi		4
Maria Pelikan		2
Scott R Pelletier		2
Xiaoqing peng		3
Junzhong Peng		3
Greg Perlstein		4
Paul Perret		4
Terri Petzold		
Michael L Pfau		2
Karen Pham		5

Erin Phelps		2
Allison Pihl		3
Alan Pine		4
Stuart Pineo		
Julia V Pogach		5
Miriam Pokharel-Wood		3
John Porcelli		4
Mikayla porterfield		3
David Portnoy		4
Harriet Porton		
William J Powers		2
Angela Prescott		5
Nora Presti		2
Shamieka Preston		4
Anne M. Prodoehl		5
Tim Pyne		4
Swetha Pyreddy		4
Zain Qazi		4
Zelda Rachbach		
Judy Radas		3
Yes, I support the petition above.		3
Faraz Rahman		4
Jessica Raimondi		3
Urjita Rami	6 or more	
VICKI RAND		5
Virginia Raney		4
Aishwarya Ravichandran		3
Lilian Regmi		4
Elaine Reid		2
Ilyse Reid		
Jess Reikowsky		4
Claire Reinken		4
Yes		4
Brian Resnick		4
Stacie Resnick		4
Luzmila Robinson		5
Camila Rodriguez		4
Leslie Roecklein		4
William Rollow		3
Julie A. Rosenthal		4
Walter Rowe		
Deborah Rubin		3
Deborah Rubin		2
Samuel Rumford		3

Charlie Ryan		4
Sousan Saadat		
Jawad Saade		5
Mary Sabella		2
Sue Sabenorio		3
Susan Sackel		5
Vedangana Saini		4
Amanda Salamon		3
Sabina Salimova		5
Rebecca Salkeld	6 or more	
Steven Salsburg		3
Diane D. Salvatore		
Ronny Michael Silver Samet		4
Michael Sanderoff		4
Adrianna Sanders		3
Hannah Sanderson		4
Anjali Sandhu	6 or more	
Preet sandhu	6 or more	
Yingying Sang		4
Beth Satisky		3
Stephanie Schindler		
Sara Schlanger		4
Rachel Scholnick		5
Janet Schreibstein	Prefer not to say.	
Cathy J Schwarz		
Kurt R. Schwarz		
Robert Scollar		3
Lori Scott		3
Zachary Scott		
Elizabeth (Betsy) Mahaffey See		4
Alan T Seigel		2
John E Sessler	6 or more	
Sarah Elise Sexton		
Laura Seylar		
David Michael Share		2
Garima Sharma		3
Nicole Shastri		4
Donna Shatzer	6 or more	
Diane Shaver		5
Michael Shaw		
Deborah Shaw		2
Stop Grace’s proposed the plan		4
Ning Shen		4
Leanne Sheriff		4

Girish Shetty		4
Randy Shore		2
Raghid Shourbaji		4
Steven Shuman		3
Japjit Sidana		4
Luthfe Elahy Siddique		3
Nusrat Siddique		4
Fazle Siddique		4
Kishor sigdel		4
Valerie V Sikora		3
Judith SImons		5
Kingsley Simons		4
Rakhi Singh		3
Bik Singh		4
Maria Singletary		3
Aaron M Skolnick		5
Shari Skye		
Gina Smart		3
Kristen Smith		3
Meg Snyder		3
Scott H Sokolowski		2
Deb Solomon		3
Nancy Solowski		4
Harold Sommers		2
Daljit Soni		5
Tamim Sookoor		3
Mark Sormanti		5
Mark Sormanti		5
Samantha Sotolongo		3
Ellen Sowry		5
Adam Spanier		4
Jack W. Spencer		
Hari Srinivasan		4
Melanie Starling		4
Daniel Steil	Prefer not to say.	
Richard Steinberg		2
Marjorie Steiner		2
Kim Stepanuk		4
Regina Steuer		4
Kathy Stevens		3
Anne Stockbridge		5
Gail Stovall		2
Alan Strott		3
Mary stubs		4

Mary Ellen Sturm		2
Howard Sturman		
Robin Sturman		3
Nora Sudarsan		4
Terry SULLIVAN		
Laura Sullivan		
Katie Surine		
Sudhangi Suthrave		5
Susan Keach Sweeney		4
Karin Swenson		3
Rafi Syed		3
Mohiuddin Syed		
Kareem Syed		4
Nazia Tabassum		4
Roseann Taff		2
Luhua Tai		5
Laura Tan		4
Elizabeth Tanaka	Prefer not to say.	
Janet Tangney		5
Edward Charles Tanner		4
Patricia taylor		4
Danielle Taymoorian		4
Noor teebi		4
Carla Tevelow		
Vaishali thakkar		4
Judith S. Thomas		5
Suzanne Thomas		5
Marta Thompson	6 or more	
Rebecca Thornton		4
Sharon Thorpe		3
Jing Tian	6 or more	
Karen Titus		4
dttotaro@aol.com		5
Deborah Wortman Towner		4
Jahnavi Trivedi	6 or more	
Marlene Trossman		3
Rick Trott		4
Natalie Trott		4
SONIA TRUESDALE		
Alice Tsai		4
Christine Tupino		3
Stephanie Tyler		5
Claire usiak		
Ross Usmani		3

Irene Vane		4
Beth Anna Varson		3
Margaret T Vaughan		2
Diane Vaughan		2
Kelly Vee		
I support this petition.		4
Heather Verron		5
Sara Via		
Jawad Vohra		5
Marina Vornovitsky		4
Mallory Waggoner		4
Andrew J Walker		3
Robert L. Wallace		4
Jinhua Wang		4
Zhengfang Wang		3
Ruby Wang		2
Jim Wang	6 or more	
Debbie Wang		5
Talia Wang		2
Guohui Wang		4
Xuejiao Wang		4
Hua Wang		4
Kenneth Ward		2
Kim Watters		2
Morag Weedlun		3
Christopher Weih		4
Eliza Weih		4
MARCIE WEIL		2
Mona Weinberg		4
Devi weinkle stephens		4
Noah Weintraub		3
Lily Weiss-Lora		3
Baktash Wessal		5
Nicole Weszka		5
Sarah Wharton		4
Cheryle Wharton		
Shelby Willets		3
Kate Williams		4
Emily Winkelstein		3
Rachel Wolven		2
Annabelle Wu		
Tao Wu		2
Nancy wu		4
Fang Wu		3

Mia Wyatt		2
Opposite		4
Lucy Xu		3
Melanie R. Yaksich		2
yanrong yan		
Debbie Yare		2
Xin Yi	6 or more	
Yanming Yin		4
Pyunghwa Yoon	6 or more	
Julia Young		4
Victoria Yozwiak		2
Gongmei yu		3
Yang Yu		3
Christina Yuan		2
Aaron Zaccaria		2
Ari Mudan Zastrow		4
Maya Zegarra		4
Subing Zeng		5
Harris Haifeng Zeng		3
2		2
JIYU ZHAN		2
Wei Zhang		4
Nancy Zhang		3
Yi Zhang		5
Maria zhang		2
Bing Zhang		4
Bing Zhang		4
Lixin Zhang		3
Yuanzhen Zhang		3
Joan Zhang		2
Chunsheng Zhao		4
Nian Zhao		3
Nan Zhao		4
Joanne Zhao		3
Ling zheng		4
JING ZHENG		4
Miaochan zhi		5
Lirong Zhou		2
Donna Zhou		3
Christine Zhou		
Katherine Zidarich		2
Roula Zureick		2

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Uploaded by: Liz Feighner
Position: FAV

Testimony on:	**HB1058 – Emission Standards, Ambient Air Quality**
Sponsor:	**Delegate Terrasa**
Committee:	**Environment and Transportation**

Testimony on:	**HB1092 –Recycling - Prohibition on the Chemical Conversion of Plastic**
Sponsor:	**Delegate Terrasa**
Committee:	**Environment and Transportation**
Organization:	**Less Plastic Please, Indivisible Howard County & HoCo Climate Action**
Submitting:	**Liz Feighner**
Position:	**Favorable**
Hearing Date:	**February 26, 2025**

Less Plastic Please is a Howard County based grassroots organization representing more than 200 subscribers. We are also a partner of the Zero Waste Team of Howard County Sierra Club and a Beyond Plastics Affiliate. Reducing the production of plastics and creating a zero-waste economy is one of our top concerns. **Indivisible Howard County** represents 800+ members and is an active member of the Maryland Legislative Coalition (with 30,000+ members). **HoCo Climate Action** is a 350.org local chapter and a grassroots organization representing approximately 1,400 subscribers. It is also a member of the Climate Justice Wing of the Maryland Legislative Coalition.

Our organizations support **HB1092** which will ban in Maryland, facilities that use equipment to chemically convert plastics into byproducts. “Chemical recycling” or “advanced recycling” generates hazardous air pollution and large amounts of hazardous waste and Maryalnd should ban this process to protect its residents from this harmful practice.This is not recycling but is actually an incineration process..

The benefit of recycling comes when you return materials into the production cycle, which reduces the demand for virgin resources. If you are taking plastic and burning it as fuel, it’s not feeding back into plastic production. And so, to keep making new plastic, you have to keep extracting fossil fuel. A recent U.S. Department of Energy study found that pyrolysis and gasification had very low yields, with only 0.1% to 14% of the inputs turned into outputs that are suitable for reuse as plastic. An analysis conducted by the Natural Resources Defense Council shows that most of the eight so-called “chemical recycling” facilities in the US are not actually recycling any plastic.

“Chemical recycling” generates hazardous air pollution and large amounts of hazardous waste. As noted in a July, 2022 letter signed by 35 members of Congress, “Chemical recycling facilities emit highly toxic chemicals, including benzene, toluene, ethyl benzene, xylenes, and dioxins, many of which are linked to cancer, nervous system damage, and negative effects on reproduction and development.”

The plastic industry is trying to convince the public that they can clean up the plastic pollution crisis with this technology. Chemical recycling further aggravates climate change by perpetuating continued extraction of fossil fuel for plastic production.

We urge a **favorable report for HB1092.**

Submitted by Liz Feighner

Less Plastic Please

Indivisible Howard County

HoCo Climate Action

HB1092_FAV_Chemical Recycling_ENT_LPP.org.pdf
Uploaded by: Liz Feighner
Position: FAV

Testimony on:	**HB1092 –Recycling - Prohibition on the Chemical Conversion of Plastic**
Sponsor:	**Delegate Terrasa**
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We urge a **favorable report for HB1092.**

Submitted by Liz Feighner

Less Plastic Please

Indivisible Howard County

HoCo Climate Action

HB 1092 - National Aquarium - Support.pdf
Uploaded by: Maggie Ostdahl
Position: FAV

NATIONAL AQUARIUM®

Date: February 26, 2025

Bill: HB 1092 - Recycling - Prohibition on the Chemical Conversion of Plastic

Position: Support

Chair Korman and Members of the Committee:

The National Aquarium respectfully requests a favorable report for HB 1092 - Recycling - Prohibition on the Chemical Conversion of Plastic. This legislation would appropriately ensure that Maryland's definition of recycling does not include chemical conversion of plastics and would prohibit construction of facilities that convert plastic to fuel or feedstock.

Stopping plastic pollution is one of the National Aquarium's three strategic conservation goals. The plastic pollution crisis has been well-documented as global plastic production has outpaced any other manufactured material.[1] Waste management practices are unable to keep up with the sheer volume of plastic we produce. Municipalities and taxpayers continue to bear the burdens of current waste management inadequacies in the form of waste disposal costs, environmental justice concerns, and harmful litter. Despite developed waste management systems in the U.S., experts estimate that between one and two million metric tons of plastic waste enters the environment[2] where it endangers wildlife, contaminates the global food web, and transports toxins harmful to human health.

Solutions to the plastic pollution crisis include policies that prioritize plastic reduction and reuse, extended producer responsibility programs, minimum recycled content standards, and other measures being considered by this committee that would help improve existing recycling infrastructure and support production of fewer products or packaging made from virgin polymers. "Advanced" chemical recycling is falsely marketed[3] as an effective way to address plastic pollution but mainly results in plastics being burned as the fossil fuels they were originally derived from. The U.S. Environmental Protection Agency (EPA) has a long-standing position[4] that solid waste, including plastic, that is converted to fuels or energy is not considered recycling. Plastic chemical conversion processes are unproven, cannot be scaled in a timely or cost-effective manner, and rely on fossil fuels that drive climate change and air pollution.

Instead of addressing the root causes of the plastic pollution crisis, chemical recycling threatens to keep us further entrenched in them. Addressing the harmful impacts of the plastic pollution crisis requires comprehensive, proven, and systemic change. Chemical recycling cannot and should not be part of those changes in Maryland. **We urge the Committee to issue a favorable report on HB 1092.**

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[1] Geyer, R. et al. 2017. Production, use, and fate of all plastics ever made. Science Advances (3):7. DOI: 10.1126/sciadv.1700782

[2] National Academies of Science, Engineering and Medicine 2022. Reckoning with the U.S. Role in Global Ocean Plastic Waste.

[3] ProPublica 2024. Selling a mirage.

[4] U.S. EPA (Environmental Protection Agency). (1997). Measuring recycling: A guide for state and local governments (EPA530-R-97-011).

HB1092_MDSierraClub_fav_26Feb2025 final.pdf
Uploaded by: Martha Ainsworth
Position: FAV

SIERRA CLUB
MARYLAND CHAPTER

P.O. Box 278
Riverdale, MD 20738

Committee: Environment and Transportation

Testimony on: HB 1092 - Recycling – Prohibition on the Chemical Conversion of Plastic

Position: Support

Hearing Date: February 26, 2025

The Maryland Chapter of the Sierra Club urges a favorable report on HB 1092. This bill would change the definition of recycling to exclude chemical conversion processes as well as prohibit the building of a facility in Maryland that converts plastic to fuel or feedstock through certain chemical conversion processes. If passed, this bill would go into effect October 1, 2025.

The plastics industry is gearing up to increase production four-fold by 2050 amidst a global plastic pollution crisis that threatens our land, oceans, wildlife, and human health. This crisis was caused largely by excessive production of cheap, single-use plastic with the knowledge decades ago that mechanical recycling of plastic would never be adequate to address plastic waste created.[1]

The industry is promoting "chemical recycling," also referred to as "advanced recycling," as a new solution to the plastic pollution crisis. These processes[2] break down plastics into their monomer components with heat, pressure, and solvents, in a low-oxygen chamber, after which the components could then be used, in principle, to make new plastic via repolymerization, creating a circular economy in plastic.

In practice, however, the chemical conversion of plastic is mostly **not** being used to create new plastic, but to transform plastic back into fossil fuel for combustion, which is not recycling. Despite fifty years of experimentation, the technology for chemical conversion of plastic is not mature and is not delivering on conversion of plastic to plastic.

According to report by Beyond Plastics and the International Pollutant Elimination Network (IPEN), as of September 2023, eleven chemical recycling plants had been built in the United States. These plants have encountered a variety of problems including high costs along with low quality end products, fires, and spills.[3] By September 2024, two of the eleven plants had closed. Most of the nine remaining plants were "still not operating at full capacity…with minimal production of actual recycled plastic."[4] Three of the remaining plants "have a stated purpose of only making feedstock for plastic production. Two only make fuels, and four make a

[1] See *Plastic Wars* (https://www.pbs.org/wgbh/frontline/film/plastic-wars/), produced by PBS, and *The Story of Plastic* (https://www.storyofplastic.org/), produced by The Story of Stuff Project.
[2] Primarily pyrolysis and gasification.
[3] Beyond Plastics and International Pollutant Elimination Network (IPEN). 2023. *Chemical Recycling: A Dangerous Deception*, October. https://www.beyondplastics.org/publications/chemical-recycling
[4] Beyond Plastics and IPEN. 2024. Fact Sheet: "Why Chemical Recycling Won't Solve the Plastic Pollution Problem," based on updated findings from *Chemical Recycling: A Dangerous Deception*, October 2023, *Ibid.* https://static1.squarespace.com/static/5eda91260bbb7e7a4bf528d8/t/66d724a67a85c90bb98e309c/1725375657031/CHEMICAL+RECYCLING+FACT+SHEET+-+Updated+September+2024.pdf

combination of fuels, chemicals, and plastic feedstocks. …Some plants have experienced fires and explosions."[5]

The processes for converting plastic back into fossil fuel are energy intensive, have a large carbon footprint, and create a new waste stream of toxic contaminants in addition to the environmental impacts of burning the contaminated fossil fuels.[6]

- Just as for mechanical recycling, the plastic still needs to be sorted by type. Additives and contaminants have to be stripped out.
- The process produces a new waste stream of gas products, oil products, and solvent products ("char") for disposal.
- Pyrolysis creates new contaminants, including high concentrations of dioxin, furans, heavy metals (mercury, cadmium, and lead), and particulates.
- Each stage of the process demands a lot of energy and has an enormous carbon footprint.

This bill does not preclude the eventual development of plastic-to-plastic technologies. Repolymerization is not banned. However, even if chemical conversion of plastic to plastic worked, it would be much more expensive than mechanical recycling. *The fact is, no form of plastic recycling – mechanical or chemical – will be able to compete economically in a market is flooded with cheap virgin plastic*.[7] The solution to the plastic pollution crisis going forward is clear: produce less plastic, especially single-use plastic.

To summarize, plastic is made from fossil fuels, most commonly from fracked gas. Maryland has banned fracking because of its environmental impact. Now the industry wants us to allow a process that turns plastic into a contaminated fossil fuel in an expensive, polluting, high-energy process. Furthermore, building these plants will add to existing environmental injustices by burdening communities with safety and health risks as well as the risks associated with increased extraction of fossil fuels. This is not recycling. Let's prevent these plants from coming to Maryland.

We respectfully request a favorable report on HB 1092 to ban these processes in Maryland and ensure that they are not classified as recycling.

Carolyn Parsa
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[5] *Ibid.*
[6] Global Alliance for Incinerator Alternatives (GAIA). 2020. *All Talk and No Recycling: An Investigation of the U.S. "Chemical Recycling" Industry.* Berkeley, California. www.no-burn.org/chemical-recycling-us.
[7] GAIA. 2021. "Questions and Answers: Chemical Recycling." https://www.no-burn.org/wp-content/uploads/2021/11/Questions-and-Answers_Chemical-Recycling.pdf

Testimony HB1092.pdf
Uploaded by: Nusrat Siddique
Position: FAV

I urge members of the Maryland State Legislature to vote in favor of Bill HB 1092. I currently reside in the Cedar Creek Community in Columbia, MD, and our community is in danger of the company WR Grace potentially starting a plastic recycling plant in my back yard. I moved to Howard County to give my children a safe place to grow up and live without the worries of hazardous environmental exposures. This pilot plant that is being proposed by WR Grace is harmful in so many ways—in the short term concern for explosions that would affect my community, and in the long term significant health effects such as cancers, respiratory disorders, and neurological disorders. By passing this bill, this will put a stop to WR Grace's poorly thought out proposal and allow us Cedar Creek residents to finally have a chance to breath knowing a company who has a history of causing harmful environmental ramifications has been stopped.

Kindest Regards,

Nusrat Siddique

Just Zero - Testimony in Support of HB 1092.pdf
Uploaded by: Peter Blair
Position: FAV

ADVANCING COMMUNITY-CENTERED ZERO WASTE SOLUTIONS

February 26, 2025

Chair Korman
Environment and Transportation Committee
Maryland House of Delegates
Room 251
House Office Building
Annapolis, Maryland 21401

RE: Testimony in Support of HB 1092: Recycling – Prohibition on Chemical Conversion of Plastic.

Dear Chair Korman, Vice Chair Boyce, and Members of the Maryland Environment and Transportation Committee:

Thank you for the opportunity to provide testimony on HB 1092. Just Zero strongly supports this bill and urges a favorable report from the committee. Just Zero is a national environmental non-profit advocacy organization that works alongside to implement just and equitable solutions to climate-damaging and toxic production, consumption, and waste disposal practices. We believe that all people deserve Zero Waste solutions with zero climate-damaging emissions and zero toxic exposures.

Maryland is taking important measures to address the plastic pollution crisis. HB 1092 is a commonsense measure that ensures the laws and regulations aimed at addressing plastic pollution only include recycling technologies that will actually recycle plastic waste. This bill does two important things. First, it clarifies that "chemical recycling"[1] technologies do not count as recycling. Second, it prohibits the development "chemical recycling" facilities. This bill will protect Maryland's residents and environment from the pollution associated with an array of unproven and polluting technologies.

The truth is chemical recycling is not the solution plastic lobbyists make it out to be. It is an expensive, unreliable, and toxic myth that does not recycle meaningful amounts of plastic. But the industry lobbyists don't care about that. What they care about is tricking lawmakers and the public into believing that this silver bullet will solve our plastic problems. This testimony (1) provides an overview of what chemical recycling is, (2) uses case studies to demonstrate that chemical recycling does not result in the recycling of plastic waste, (3) explains the environmental and public health concerns associated with chemical recycling, (4) exposes how the plastic industry uses chemical recycling to undermine policies designed to address the plastic pollution crisis, and (5) illustrates how the plastic industry is lobbying state legislatures to exempt these facilities from commonsense regulation.

[1] The following terms are generally used interchangeably – "chemical" recycling, "advanced" recycling, and "molecular" recycling. For the purpose of this testimony, we will be using the term chemical recycling.

I. Overview of Chemical Recycling

In theory, chemical recycling refers to an array of technologies that use heat and/or solvents to break down plastics into monomers (the building blocks of plastic), hydrocarbons, fuels, chemicals, and waste byproducts.[2] These technologies include gasification, pyrolysis, depolymerization, solvolysis, methanolysis, and hydrolysis.[3] Pyrolysis and gasification are by far the two most prominent forms of chemical recycling.

According to proponents like the American Chemistry Council, these materials can be used to manufacture new plastic products.[4] The reality of chemical recycling, however, dramatically contrasts with these statements. Chemical recycling isn't an answer to our plastic woes. It's an expensive, risky, toxic, and climate-damaging process that doesn't improve recycling. And its only purpose is to convince us to deepen our dependence on single-use plastics. In fact, all the chemical recycling facilities operating at a commercial scale in the U.S. are using pyrolysis to primarily create and burn plastic derived fuel.[5] Converting plastic into fuels is not considered recycling by national and international standards.[6]

II. Chemical Recycling Does Not Result in the Recycling of Plastic Waste

The simple truth in chemical recycling does not result in any meaningful recycling of plastic waste. Chemical recycling processes result in plastics being boiled down into gases, chemicals, tars, oils, and toxic waste byproducts, which are subsequently burned.[7] Little to no new plastics are manufactured.[8] Below are several case studies and examples illustrating how chemical recycling facilities actually operate in the U.S.

Case Study #1 – Brightmark (Ashley, Indiana)

Brightmark Energy operates a chemical recycling facility in Ashley, Indiana.[9] The facility utilizes pyrolysis to process plastic waste into diesel fuel, pyrolysis oil, and wax which are intended for use as transportation fuels and raw chemical materials.[10] Four years after breaking ground, the facility is still operating in a test-phase capacity, and has only processed 2,000 tons of plastic waste – a fifth of the plant's publicized yearly capacity of 10,000 tons per year.[11] The company has received over $4 million in public subsidies.[12] Documents show that 70% of the

[2] Andrew Rollinson & Jumoke Oladejo, Chemical Recycling: Status, Sustainability, and Environmental Impacts, Global Alliance for Incinerator Alternatives, p. 7–12. (2020).
[3] *Id.*
[4] American Chemistry Council, Advanced Recycling – Overview.
[5] *Id.*
[6] See EPA's 1997 Measuring Recycling: A Guide for State and Local Governments and European Union, Directive of the European Parliament on Waste and Repealing Certain Directives, Pub. L. No. Article 3(17).
[7] Dr. Veena Singla, Recycling Lies: Chemical Recycling of Plastic is Just Greenwashing Incineration, Natural Resources Defense Council, p. 2. (2022).
[8] *Id.* at 3.
[9] Lee Bell, et. al., Chemical Recycling: A Dangerous Deception – Why Chemical Recycling Won't Solve the Plastic Pollution Problem, Beyond Plastics, at. 91. (Oct. 2023).
[10] *Id.*
[11] *Id.*
[12] *Id.* at 92.

output from this facility is plastic-derived "syngas," which Brightmark burns onsite.[13] Another 20% of the output is liquid fuel, which Brightmark ships to be burned offsite.[14] The remaining 10% is a "powdery residue," which Brightmark landfills.[15],

In 2022, Brightmark Energy sought to build another chemical recycling facility in Macon County, Georgia.[16] To develop the facility, Brightmark reached a tentative deal to receive $500 million in exempt facility revenue bonds to help finance construction of the $680 million plant.[17] This deal was contingent upon Brightmark demonstrating that its existing Ashley, Indiana, plant was successfully producing and selling products that can be used to manufacture new plastic products.[18] The company could not make the demonstration and subsequently was forced to scrap the project.[19]

Case Study #2 – Agilyx (Tigard, Oregon).

The Agilyx chemical recycling facility in Tigard, Oregon, offers another example of how these technologies do not actually recycle plastic and instead produce hazardous waste that is subsequently burned. The now closed facility utilized pyrolysis to process polystyrene – a plastic often used for food and beverage containers – into its monomer styrene.[20] Agilyx claimed this styrene would be used as a feedstock to create new polystyrene. But that never occurred. Agilyx shipped much, if not all, of that styrene to be burned offsite.[21] Between 2019 and 2021, Agilyx reported to the U.S. Environmental Protection Agency that it shipped more than 340,000 pounds of styrene to be burned for "energy recovery."[22] The quantity of styrene generated resulted in the EPA designated the facility as a "large quantity generator" of hazardous waste. The facility closed in March of 2024.[23]

Case Study #3 – U.S. Department of Energy Study

While proponents argue that ***some*** of the plastic processed at chemical recycling facilities is used to manufacture new plastic products, this is extremely misleading. A report from the Department of Energy found that plastic processed through chemical recycling technologies – specifically pyrolysis and gasification – were rarely used manufacture new plastic products.[24] In fact, only 1 – 14% of the plastic processed at chemical recycling facilities were retained and used to manufacture new plastics.[25] In addition to resulting in virtually no recycling, the Department of Energy report also found that these technologies had significant economic and environmental

[13] See, Brightmark Response to Draft Survey for Pyrolysis and Gasification Units, p. 17. (Dec. 23, 2021).
[14] *Id.*
[15] *Id.*
[16] DeAnne Toto, Brightmark Scraps Plans for Georgia Plant, Recycling Today. (Apr. 12, 2022).
[17] Lee Bell, et. al., Chemical Recycling: A Dangerous Deception – Why Chemical Recycling Won't Solve the Plastic Pollution Problem, Beyond Plastics, at. 92. (Oct. 2023).
[18] DeAnne Toto, Brightmark Scraps Plans for Georgia Plant, Recycling Today. (Apr. 12, 2022).
[19] *Id.*
[20] See Agilyx, Regenyx: Changing the Way We Recycle Polystyrene.
[21] U.S. Environmental Protection Agency, Agilyx Production Related Waste Management for Styrene.
[22] *Id.*
[23] Beyond Plastics, One of the Eleven Constructed Chemical Recycling Facilities in the U.S. Shuts Down (Mar. 6, 2024).
[24] Taylor Uekert, et al, Technical, Economic, and Environmental Comparison of Closed-Loop Recycling Technologies for Common Plastics, Department of Energy, ACS Sustainable Chem. Eng. 2023, 11, 3, 965–978.
[25] *Id.*

impacts.[26] The study found that the environmental and economic impacts of pyrolysis and gasification are 10 to 100 times worse than using virgin plastics.[27]

Case Study #4: Pro-Publica Reporting

A recent in-dept analysis from ProPublica found that the maximum amount of feedstock produced through pyrolysis that can be used to manufacture new plastic products is 20%.[28] This means if a pyrolysis operator started with 100 pounds of plastic waste, it can expect to end up with 15-20 pounds of reusable plastic.[29] Importantly, this 20% is only achievable under ideal conditions. In general, the process yields significantly lower outputs due to contamination in post-consumer plastics.[30]

Case Study #5: Maine's De Facto Ban on Chemical Recycling

In 2024, Maine passed a legislation clarifying how chemical recycling facilities are classified under the state's solid waste management laws.[31] The law was a response to the American Chemistry Council's lobbying campaign which seeks to enact legislation exempting chemical recycling facilities from state and local solid waste management laws and regulations.[32]

Maine's new law clarifies that chemical recycling facilities are considered solid waste processing facilities.[33] Therefore, to develop a chemical recycling facility in Maine, an applicant must meet the permitting requirements for solid waste processing facilities. This includes demonstrating that at least 50% of the waste accepted is recycled.[34] Proponents of chemical recycling are calling Maine's new law a ban because chemical recycling technologies are incapable of recycling 50% of the plastic waste they accept.

III. Chemical Recycling is Toxic, Dangerous, and Threatens Maryland Communities

In addition to not actually recycling any meaningful amount of plastic waste, chemical recycling facilities pose a significant threat to the environment. These facilities also jeopardize the health of the surrounding communities and the communities near where the plastic-derived fuels and chemicals are burned.

Air emissions, chemicals, and waste products generated at chemical recycling facilities can include lead, mercury, chromium, benzene, toluene, arsenic, and dioxins – all of which pose significant risks to human health and the environment.[35] These chemicals are found in the gases,

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[26] Taylor Uekert, et al, Technical, Economic, and Environmental Comparison of Closed-Loop Recycling Technologies for Common Plastics, Department of Energy, ACS Sustainable Chem. Eng. 2023, 11, 3, 965–978.
[27] *Id.*
[28] Lisa Song, Selling a Mirage: The Delusion of "Advanced Plastic Recycling, ProPublica. (June 20, 2024).
[29] *Id.*
[30] *Id.*
[31] Maine Legislature, L.D. 1660: An Act to Ensure the Proper Regulation of Chemical Plastic Processing. (Mar. 5, 2024).
[32] Colin Staub, Chemical Recycling Not "Recycling" in Maine, Resource Recycling (Mar. 6, 2024).
[33] *Id.*
[34] 38 M.R.S.A. §1310-N
[35] Dr. Veena Singla, Recycling Lies: Chemical Recycling of Plastic is Just Greenwashing Incineration, Natural Resources Defense Council, p. 6. (2022).

fuels, oils, tars, and solid wastes that result from processing the plastic waste.[36] Burning these materials – which as explained above is the status quo – releases many of these toxics into the air.[37] The EPA found that the production of jet fuel through pyrolysis of plastic waste – the leading chemical recycling technology – can emit air pollution that is so toxic, 1 out of 4 people exposed to it over a lifetime may develop cancer.[38] That risk is 250,000 times greater than the level usually considered acceptable by the EPA.[39]

Unsurprisingly, the pollution and public health impacts created by chemical recycling facilities are primarily born by communities that are already subjected to a disproportionate amount of pollution from other sources.[40] 76% of chemical recycling facilities in the U.S. are in communities of color and/or low-income communities.[41]

IV. Maryland Must Reject Chemical Recycling to Ensure Policies That Address the Plastic Pollution Crisis Only Include Real Solutions.

Clarifying that chemical recycling does not count as recycling is necessary to ensure the efforts Maryland is taking to address plastic pollution are actually solving – rather than masking – the problem. Over the past several years, lobbyists for the plastic industry have worked to add language in state recycling laws that allow plastic waste sent to chemical recycling facilities to count as being recycled.

Given the country's extremely low plastic recycling rate, this language does two things. First, it incentivizes companies making and distributing plastic packaging to send their plastic waste to chemical recycling facilities. This gives them an easy out to say they're working to manage their plastic waste. It also provides financial support to help prop-up the chemical recycling industry. Second, it helps perpetuate the myth that these facilities actually recycle plastic.

Specifically, they seek to include language that allows chemical recycling to count as recycling in post-consumer recycled content laws and in extended producer responsibility for packaging laws. Maryland is currently considering both these legislative initiatives and lobbyists for the plastic industry are arguing for the inclusion of chemical recycling.[42] Including chemical recycling in these programs undermines their ability to meaningfully address the plastic waste crisis.

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[36] Andrew Rollinson & Jumoke Oladejo, Chemical Recycling: Status, Sustainability, and Environmental Impacts, Global Alliance for Incinerator Alternatives 23-27. (2020)
[37] Dr. Veena Singla, Recycling Lies: Chemical Recycling of Plastic is Just Greenwashing Incineration, Natural Resources Defense Council, p. 6. (2022). David Azoulay et al., Plastic & Health: The Hidden Costs of a Plastic Planet, Center for International Environmental Law, p. 47-48. (2019)
[38] Sharon Lerner, This "Climate-Friendly" Fuel Comes With an Astronomical Cancer Risk, ProPublica. (Feb. 23, 2023).
[39] *Id.*
[40] Lauren Fernandez, Environmental Justice Communities Are Not Responsible for Our Waste Crisis, Just Zero. (Nov. 8, 2022).
[41] Kevin Budris, Loopholes, Injustice, and the Advanced Recycling Myth, Just Zero, p. 31. (Dec. 2022).
[42] See, Maryland Legislature, Senate Bill 901 – Extended Producer Responsibility for Packaging (2025), and Maryland Legislature, Senate Bill 69 – Post-Consumer Recycled Content for Plastic Products (2025).

Take post-consumer recycled content law for example. These laws are designed to increase the use of recycled material in new plastic products. This in turn reduces demand for virgin plastic, while also increasing the market for recycled materials. Allowing chemical recycling to count as recycling undermines the entire intention of these laws.

As explained through the case studies above, most of the plastic processed through chemical recycling is burned. Only a small amount of feedstock that can be used to manufacture new plastics is created. However, this material is extremely contaminated and cannot be used to directly manufacture new plastics.[43] Rather, it must be mixed with crude oil to be clean enough to work. Therefore, even when chemical recycling "works," it relies heavily on extracting fossil fuels to make new plastics. Studies show that 90% of the feedstock remains crude oil.[44] So at the end of the day, nothing that comes out of pyrolysis can physically contain more than 10% recycled material (though experts and studies have shown that, in practice, it's more like 5% or 2%).[45]

To obscure how ineffective chemical recycling is, the plastic industry uses a controversial and inaccurate accounting method to inflate the recycled content it advertises in everyday products made from chemical recycling feedstock. This accounting method – called the mass balance method – allows plastic products to advertise products as 20% or 30% recycled content even if they physically contain less than 1% recycled content.[46]

Enacting HB 1092 will provide consistency to Maryland's existing waste programs regarding what is and is not considered recycling. Additionally, it will ensure that any future programs designed to address plastic waste – including post-consumer recycled content requirements – only allow legitimate recycling practices to count as recycling.

V. Chemical Recycling is Failing Despite Successful Efforts to Sheild Facilities from Solid Waste Laws and Regulations

Despite the repeated failures of chemical recycling facilities, the plastic and petrochemical industry – lead primarily by the American Chemistry Council – have spent the past several years working to lobby state legislatures to promote these unproven and polluting technologies.[47] The purpose of the legislative campaign is to enact laws that reclassify chemical recycling as manufacturing, and not solid waste management.[48] Currently, 24 states have passed these deregulatory laws.[49] Many of these laws also exempt plastic waste that is processed at a chemical recycling facility from being classified as solid waste.[50] Some also automatically classify plastic

[43] Lisa Song, Selling a Mirage: The Delusion of Advanced Plastic Recycling, ProPublica (June 20, 2024).
[44] *Id.*
[45] *Id.*
[46] *Id.*
[47] Joseph Winters, The Petrochemical Industry is Convincing States to Deregulate Plastic Incineration, Grist. (Aug. 18, 2022).
[48] Kevin Budris, Loopholes, Injustice, and the Advanced Recycling Myth, Just Zero, p. 15-21. (Dec. 2022).
[49] *Id.* at 17. This chart shows the laws passed prior to Dec. 2022. Since the chart was published Kansas, Indiana, Michigan, and Utah have also passed laws that exempt advanced recycling from commonsense solid waste regulation.
[50] *Id.* at 15.

waste sent to an chemical recycling facility as being recycled without any requirement that the plastic was used to manufacture a new product.[51]

States subject solid waste facilities to significantly more stringent regulations than manufacturing facilities. And for good reasons. Shipping, accepting, dumping, processing, and even recycling waste comes with inherent risks to the environment and surrounding communities. And plastic is a particularly toxic component of the waste stream.

The impact of this reclassification is that these facilities are now exempt from state solid waste laws and regulations that they would otherwise be required to comply with. This includes commonsense requirements for all facilities that handle solid waste such as public permitting processes, siting restrictions, public input and oversight, transparency requirements, closure plans, and operating conditions that apply to all solid waste facilities but not manufacturing facilities. Unsurprisingly, more than half of the chemical recycling facilities operating in the U.S. are located in states that have passed laws exempting these facilities from solid waste regulation.[52] By design, this unproven and polluting industry is expanding most rapidly where there is little oversight or accountability.

VI. Conclusion

Maryland is on the cusp of passing important policies that will improve recycling, reduce plastic pollution, and protect public health. Chemical recycling threatens this important work. HB 1092 is a necessary and important policy that makes it clear that in Maryland expensive, ineffective, and polluting facilities are not welcome. And that recycling means actually recycling waste into new consumer products, not burning it.

Thank you for your time and consideration of this testimony.

Respectfully submitted,

Peter Blair, Esq.
Policy Director
Just Zero

[51] *Id.* at 22-27.
[52] U.S. Environmental Protection Agency, Potential Future Regulations Addressing Pyrolysis and Gasification Units, 86 Fed. Reg. 50296, 50302 (Sept. 8, 2021).

Rene Maldonado Testimony 2-26-2025.pdf
Uploaded by: Rene Maldonado
Position: FAV

Testimony from Rene Maldonado

I am a retired chemist residing in the Cedar Creek community in Columbia. I have Multiple Sclerosis, which prevents me from delivering this testimony in person today. Bills HB-1058 and HB-1092 are important to my community and I ask for your support.

Currently, WR Grace is planning to operate a chemical recycling pilot plant on their campus, located just yards from our residences.
This operation will utilize a fluid catalytic cracking reactor to break down plastic polymers. Three-quarters of the starting polymer feedstock will end up burned in an incinerator after gasification occurs in the reactor.

This operation is scheduled to run for 16 hours a day, year-round, for years to come.

This plant will generate toxic emissions, produce solid toxic catalyst waste that could contaminate the soil, and store up to nine drums of fuel at their facilities each year. The potential for negative health effects and catastrophic accidents is significant.

As a pilot facility, the Grace plant will conduct experiments where the chemical ingredients and the process conditions will be changed daily. This type of experimentation is inherently very dangerous and does not belong in a residential neighborhood. WR Grace already has industrial locations in North Baltimore and Pennsylvania where they could conduct these experiments more safely.

We need laws and regulations in place to prevent this type of operation from taking place in residential areas.

Again, please help our community remain safe and healthy by approving these two bills.

Thank you.

Rene Maldonado

Testimony HB1092 E&T Kranz.pdf
Uploaded by: Rhonda Kranz
Position: FAV

Committee: **Environment and Transportation**
Testimony on: **HB1092 – Recycling – Prohibition on the Chemical Conversion of Plastic**
Submitting: **Rhonda Kranz**
Position: **Favorable**
Hearing Date: **February 26, 2025**

Dear Chair Korman and Committee Members:

Thank you for allowing my testimony today in strong support of HB1092. HB1092 excludes from the definition of recycling various forms of chemical conversation of plastic and prohibits building in Maryland facilities that convert plastic to fuel or plastic feedstock.

I have been a resident of MD for 30 years and have been concerned about incineration and other technologies touted to be environmentally positive when in fact they produce dangerous chemicals that cause serious health problems and produce greenhouse gases. Advanced plastic recycling, also known as chemical recycling, refers to several chemical or heat based processes that break down plastic into its raw materials which can then be used to make new plastic products. Advanced plastic recycling is marketed to the public as a miraculous technical advance to create a truly circular economy with respect to plastic.

As the General Assembly considers removing incineration from the renewable portfolio standard, legislators need to understand that these new technological processes, like incineration, emit harmful pollutants including dioxins, furans, benzene, polycyclic aromatic hydrocarbons (PAHs) and hazardous waste. Advanced chemical recycling needs extremely high temperatures to break the chemical bonds in plastic so that the end products can be used to create new plastics. The energy consumption and greenhouse gas emissions are typically higher than that needed to create plastic from virgin materials. The plastic created through advanced recycling typically is of much lower quality than virgin plastic so that the created plastic cannot be “recycled” in the same manner again and is simply burned to create electricity.

The more direct answer to plastic pollution is to reduce the consumption and thus the production of plastic in the first place. This General Assembly and local Maryland jurisdictions have considered many ways to reduce the demand for plastic, particularly certain types of extended producer responsibility laws directed to plastic packaging.

I urge this Committee to issue a favorable report on HB1092.

Sara Morrell in Support of HB1092.pdf
Uploaded by: Sara Morrell
Position: FAV

Thank you for your attention to the grave concern of residents regarding the W.R. Grace Pilot Project, permit docket 16-23. The Cedar Creek Community has summarized key findings and statistics on why advanced recycling has no place in our Maryland communities. We have also included flaws in Grace's permit application. **You will find many reasons below to vote YES to HB1092 to protect public health and the health of Marylanders.**

Flaws in Grace's Recycling Claims

1. **Recycling Misconception**: The industry promotes chemical recycling as a solution to plastic waste, but it is often just a way to **greenwash** incineration (NRDC, 2022, p. 1; Beyond Plastics, 2025)
2. **EPA regulations define pyrolysis units as incinerators:** The EPA stated in a letter to the Maryland Department of the Environment that the W.R. Grace Pilot Plant "would meet the definition of an Other Solid Waste Incinerator, as OSWI expressly includes pyrolysis units" (U.S. Environmental Protection Agency, Region 3. (2025, January 8). Applicability Determination Request - OSWI Rule and Proposed Pilot Plant in Maryland [Letter to Suna Yi Sariscak, Maryland Department of the Environment].).
3. **Energy Recovery**: Burning plastic for fuel (plastic-to-fuel) does not count as **recycling** by international standards, as it generates the same harmful pollutants as fossil fuels (NRDC, 2022, p. 3).HOWARD COUNTY ZONING REGULATIONS | Zoning | Howard County, MD | Municode Library

Health and Environment Concerns of Plastic Incineration

4. **Health Risks**: The chemicals released or disposed of by these facilities are highly toxic, with many being **carcinogenic**, **neurotoxic**, or **reproductive toxicants**. For instance, **VOC's** are among the substances that pose severe health risks, including cancer and developmental harm (NRDC, 2022, p. 5,6) (Dragon et al. 2023) (Smolker et al, 2024) (Brumberg et al. 2021) (EPA 2024) (American Lung Association 2024)
5. **Hazardous Waste**: Most "chemical recycling" facilities in the U.S. are **not recycling plastic**, and instead, generate **hazardous waste** that is often incinerated (NRDC, 2022, p. 3, 4; Beyond Plastics, 2025).
6. **Air Pollution**: "Chemical recycling" facilities are known to release **hazardous air pollutants** like styrene, toluene, and dioxins. These pollutants are linked to serious health issues such as **cancer**, **birth defects**, and **respiratory problems** (NRDC, 2022, p. 5,6; Beyond Plastics, 2025).
7. **Polymer Burning Evidence in Grace's Own MDE Application:** Grace will burn 2,588 kg/yr of polymer following a gasification step in the reactor as indicated in their permit application. In addition, burning will also take place in the catalyst regeneration unit. (Maryland Department of the Environment [MDE], 2023, Docket #16-23, p. 29 and p. 16, respectively).
8. **Harmful Chemicals:** About 16,000 chemical additives are used in making plastics. More than a quarter (4,200) of these chemicals are known to be harmful to human health and/or the environment while even more have not yet been studied (PlastChem, 2024).
9. **Increased Risk as a Pilot Plant:** A study looking at health impacts on a similar facility concluded that hazards of a pilot-plant can be greater than those of a production plant, since pilot-plants are operated to test different process conditions, far from the optimized ones. (Paladino et al, 2021).

Flaws in Grace's Claims that R&D Emissions will be Negligible

10. **An Independent Scientific Review Conducted for Maryland House of Delegates Concluded that Emissions Are Likely Greater than Stated by Grace:** Grace has strongly denied that there will be any emissions of PFAS, benzene, or other chemicals that residents have expressed concern about. However, **according to an independent chemical engineer, Dave Arndt who reviewed Grace's permit application for Maryland State Delegate Jennifer R. Terrasa**, *"W.R. Grace has stated that the materials that they are going to feed into their reactor are "hard to recycle" plastics, resin identification code 1-7. These plastics have been found to include the following items which have been documented to be released in incineration emissions:* ***PFAS****, Bisphenols, Phthalates, Chlorine, Florine, Lead, Cadmium, Selenium, Benzene, 1,2-dichloroethane, Chromium, Vinyl chloride, Barium, Styrene, Benzene, Toluene, Mercury, Arsenic, Dioxins, Ethyl benzene, Xylenes, Naphthalene, Acetaldehyde, Formaldehyde, Hydrochloric acid, Methanol, Hexane and PM2.5. Please note that this is not an all-inclusive list, there may be other compounds released depending on the plastic feedstock being used."* The above findings by Mr. Arndt are consistent with a near-unanimous consensus among the scientific community, all of which identify many of the above emissions as probable byproducts from similar incineration/pyrolysis operations.
11. **Grace's MDE Application Uses One Polymer as its Benchmark Feedstock for Emission Calculation Purposes, While Acknowledging that It May Use Several "Other" Polymers:** Grace says that its MDE application is focused on homogeneous polypropylene (*"The proposed Project is designed to process 1 kg/hr of commercially available plastic pellet feedstock (the benchmark feedstock can be 100% homogeneous polypropylene (PP)"*) but acknowledges the intention to use several other polymers as feedstock (*"However, a typical mixed plastic also can include low density polyethylene (LDPE), high density polyethylene (HDPE), polyethylene terephthalate (PET), polystyrene (PS), polyvinyl chloride (PVC), and others"*). The use of the term "others" in the list of polymers is a major concern, as it would open the door for Grace to include any type of polymer imaginable and potentially produce new kinds of emissions that are not contemplated in the initial report. (Maryland Department of the Environment [MDE], 2023, Docket #16-23, p. 15).
12. **Chemical Recycling Facilities Release Pollutants that Can be Dangerous Regardless of R&D Size and Scale:** Even small R&D facilities release pollutants, and many of these pollutants (like benzene, dioxins, and VOCs) are harmful even in small amounts and have no safe threshold for exposure. According to Dave Arndt, the chemical engineer who reviewed Grace's permit application for Maryland State Delegate Jennifer R. Terrasa, *"W.R. Grace only presents that 0.218 lb of VOCs will be emitted daily, however [they] don't give the chemical make-up of the VOCs being emitted. Some VOCs are highly carcinogenic and even at that volume should not be release[d] to the public."*

Grace's Regulatory Non-Compliance and Application Omissions

13. **Failure to Comply with the Clean Air Act:** As discussed earlier, Grace's pyrolysis unit is classified as an "Other Solid Waste Incinerator." Federal Clean Air Act Section 129 addresses emissions from solid waste combustion, and incinerators are regulated under the Clean Air Act's incinerator provision, Section 7429. There is no mention of compliance with Sections 129 or 7429 of the Federal Clean Air Act in Grace's application or MDE's tentative determination for the permit. Both the text and legislative history of the Clean Air Act indicate that Congress intended Section 7429 to cover all facilities that combust solid waste, except those expressly exempted by Congress. Since Congress did not expressly exempt small units combusting plastic and other wastes from the

Clean Air Act, they are still covered by the Act and need a Section 129 Clean Air Act permit. Indeed, subsequent court decisions have affirmed that Congress did intend to regulate these small facilities burning waste. [See Sierra Club v. EPA, 167 F.3d 658, 662 (D.C. Cir. 1999)].

14. **Zoning Non-Compliance:** Since the plant is established as an incineration facility, then the Zoning regulations of Howard County preclude the facility to be located in a PEC District. Bill No. 17-2021(ZRA-197), § 1, 5-6-2021; Bill No. 39-2023(ZRA-204), § 1, 11-6-2023) The Solid Waste District permits processing facilities for non-hazardous solid waste which are not covered elsewhere in the Zoning Regulations, while requiring detailed review of each proposal to evaluate its land use impacts and its potential contribution to the County's solid waste management system. **Because many solid waste processing facilities are of a heavy industrial nature, the SW District is an overlay district which may be applied only to land in the M-2 District.** HOWARD COUNTY ZONING REGULATIONS
15. **Grace's Emission Numbers Ignore Contributions from Several Factors, including:** Early plant trials; operation outside of steady-state (e.g. start-ups, shutdowns); catalyst regenerator venting; leaks; fugitive emissions; and accidents.
16. **Flaws in Grace's Environmental Justice Report:** Grace's Environmental Justice (EJ) report indicates that there are no high schools, grocery stores, or land restoration facilities within Census Tract 6055.05, Howard County, Maryland (Maryland Department of the Environment [MDE], 2023, Docket #16-23, p. 9). However, public maps confirm that River Hill High School, the River Hill Shopping Center, and the Forest Retention Area on the property line between Cedar Creek and Grace all fall within this tract.
17. **Regulatory Concerns**: Many facilities are not subject to stringent regulations because some states have sought to reclassify chemical recycling as a non-solid waste facility, reducing oversight (NRDC, 2022, p.7,8). MDE's grant funding from the federal government to oversee an operation like Grace's plant has been eliminated (WYPR, 2025).

Safety Concerns

18. **Incidents of Fires**: Two advanced recycling plants, **New Hope Energy** and **Brightmark**, experienced **fires** within the first year of operation, highlighting the potential safety hazards (NRDC, 2022, p.8).
19. **Grace's Application Indicates there will be Fuel Storage and Transfer, which Increases Fire and Accident Risk**: Grace will be regularly producing, warehousing, and transporting multiple 55-gal drums of fuel and shipped to a third party waste treatment facility (Maryland Department of the Environment [MDE], 2023, Docket #16-23, p. 16). This is not accurate reporting. Every drop needs to be accounted for, plus shipment dates and times, method of shipment and name of the treatment facility must be documented. Therefore, a hazardous liquid permit must also be obtained.
20. **Documented Accidents Involving the use of Pyrolysis Reactors and Thermal Oxidizers:** These include Husky Energy Refinery in 2018 in Superior, WI (36 workers injured, 39,000 lb. of flammable hydrocarbons released) and Exxon-Mobil in 2018 in Torrance, CA (four contractors were injured, neighborhood was dusted with a coat of ash).
21. **Exempt from Emergency Planning and Community Right-to-Know Act (EPCRA):** EPCRA enhances **public safety** by ensuring first responders and communities have critical information to prevent and manage hazardous incidents, reducing risks to human health and the environment. However, this facility's classification as a research and development facility (NAICS code 541715) exempts Grace from much of this reporting.

Effects on Minorities, Low-Income Households, and Children:

22. **Environmental Justice Issues**: Many advanced recycling facilities are located in communities with a high percentage of **low-income** residents and **people of color** (NRDC, 2022, p. 7, Beyond Plastics, 2025). **The Environmental Justice (EJ) score of 29% indicated in Grace's MDE application is understated and misleading, as it does not include groups of minorities and low-income households who moved into residential communities adjacent to Grace after the 2020 census.** The 2020 census indicates a 54.33% minority population per Grace's EJ report (Maryland Department of the Environment [MDE], 2023, Docket #16-23, p. 11). However, we believe as many as 80% of residents in Cedar Creek, all of whom moved in after the 2020 census, are people of color. Additionally, **Robinson Overlook Apartments, an affordable housing community adjacent to Grace's headquarters, only opened in August 2021** (Woda Cooper Companies, 2021). **Outreach from Cedar Creek residents confirmed that Robinson Overlook residents are unaware of Grace's plans.**
23. **Growing Children in the Community:** The Cedar Creek neighborhood consists of 100+ children. Children breathe more air relative to their body weight than adults, breathing in 2 to 3 times as much air per minute, making them more susceptible to harmful air pollution (Unicef, 2019).

Benefits Do Not Outweigh Risks:

24. **Current Evidence Suggests Benefits of Projects like Grace's are Overstated:** Of 11 constructed chemical recycling facilities in the U.S., two of these facilities closed in the first half of 2024: Regenyx in Oregon and Fulcrum in Nevada. Most of the remaining nine facilities are not operating at full capacity. Even if they were operating at full capacity, the remaining nine facilities could only process 1.2% of all U.S. plastic waste (Beyond Plastics, 2025). More concerning, a study published by the Federal Governments Renewable Energy Lab, found that chemical recycling was actually 10-100 times worse for the environment than simply producing new, virgin plastic.
25. **Hours of Facility Operation Increase Risks:** The plant will operate 16 hours a day (Maryland Department of the Environment [MDE], 2023, Docket #16-23, p. 16), five days a week, all year round, potentially for many years. The long-term cumulative effects of this persistent exposure on the health of children and adults residing just yards from the facility are unknown, but remain a major concern.
26. **Grace Has a Documented History of Contaminating this Location with Hazardous Waste, Suggesting this Project Carries Elevated Risks:** There is a public report on the EPA's website describing the efforts to clean-up environmental pollutants around Grace's headquarters. According to the EPA, "*The contaminants of concern include trichloroethene (TCE), 1,1,2,2-tetrachloroethane, tetrachlorethene, 1,1-dichloroethene, 1,1-dichloroethane, 1,2-dichloroethane, and trichlorofluoromethane*."

Unanimous Recommendation from Howard County Department of Planning & Zoning:

27. **Howard County Department of Planning & Zoning Recommendation:** DPZ reviewed all the facts and the 3 board members **unanimously** recommended for the Council to come up with legislation/amendments to move the project because of potential hazards.

    The Board in their discussions suggested that this project be moved to M1/M2 districts. James Cecil testified for a bill presented by Senator Clarence Lam regarding rendering a

tax credit to residents impacted by these plants, and he suggested that the state should instead use the money contemplated for the tax credit to move the project to M1, M2.

Maryland's mission includes striving to be a place with safe and healthy communities. Vetoing or tabling HB1092, and allowing WR Grace to build their pilot plant facility, will cause irreparable HARM to our community and surrounding communities. This includes health impacts to our children and elderly, safety impacts from possible leaks/fires/explosions, and environmental justice impacts to resources like Robinson Nature Preserve. The Howard County Planning Board unanimously approved the proposed ZRA-211 as they were concerned about the impacts to the community. As constituents and members of the Howard County community, we trust you to uphold the county's values and do the right thing and vote yes for HB1092.

Thank you!

Sincerely,

Cedar Creek Residents

25-01305-R03-PAO Preston.pdf
Uploaded by: Shamieka Preston
Position: FAV

REGION 3 ADMINISTRATOR
PHILADELPHIA, PA 19103

February 12, 2025

VIA ELECTRONIC MAIL

Shamieka Preston
Cedar Creek Resident
snixon2993@gmail.com

Dear Ms. Preston:

Thank you for your December 23, 2024, electronic correspondence to the U.S. Environmental Protection Agency (EPA) concerning W.R. Grace's proposed research and development pilot project in Columbia, Maryland. The authority to issue Clean Air Act permits in Maryland, including the W.R. Grace draft permit, has been delegated to Maryland Department of the Environment (MDE), and MDE will make a final determination regarding the issuance of a permit modification for the facility. The EPA and MDE are coordinating regarding questions related to Clean Air Act applicable requirements for the W.R. Grace pilot project. This coordination includes determining the applicability of Solid Waste Incineration Rules under Clean Air Act Section 129.

On December 13, 2024, MDE submitted an applicability determination request to the EPA regarding the applicability of the 40 CFR Part 60, Subpart EEEE Standards of Performance for Other Solid Waste Incineration Units (OSWI Rule) to the project. The EPA issued a determination on January 8, 2025 that the proposed project meets an exemption in the OSWI Rule for units operated for the sole purpose of research. These letters are attached to this correspondence.

The EPA reviewed the draft permit, and the EPA is working with MDE throughout the state permitting process to ensure comprehensive oversight and effective action. The EPA is aware of your concerns regarding the W.R. Grace pilot project permit. The EPA intends to review the final permit once MDE makes a final permit determination. MDE maintains an email list of interested parties, and MDE will notify anyone who signs up for the email list of the final permit decision.

If you have any questions, please do not hesitate to contact me, or have your staff contact Cristina

Fernández, Director, Air and Radiation Division, Four Penn Center, 1600 John F. Kennedy Boulevard, Philadelphia, Pennsylvania 19103 at 215-814-2178 or Fernandez.Cristina@epa.gov.

Sincerely,

Catherine A. Libertz
Acting Regional Administrator

ENCLOSURES
1. OSWI Applicability Determination Request Letter
2. WR Grace Reg. Interpretation Signed

cc: Renee Sharp rsharp@nrdc.org
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Enclosure- WR Grace Reg. Interpretation Signed.pdf
Uploaded by: Shamieka Preston
Position: FAV

REGION 3
PHILADELPHIA, PA 19103

January 8, 2025

VIA ELECTRONIC MAIL
RETURN RECEIPT REQUESTED

Ms. Suna Yi Sariscak
Manager
Maryland Department of the Environment
Air Quality Permits Program
Air and Radiation Administration
1800 Washington Blvd,
Baltimore, MD 21230

RE: Applicability Determination Request - OSWI Rule and Proposed Pilot Plant in Maryland

Dear Ms. Sariscak:

We have received your December 13th, 2024 letter requesting an Applicability Determination for W.R. Grace & Co.-Conn and applicability of 40 CFR Part 60, Subpart EEEE - Standards of Performance for Other Solid Waste Incineration (OSWI).

Background

The December 13th letter and supplemental application describe a proposed Research and Development lab to be constructed by W.R. Grace & Co.-Conn ("Grace"). The proposed R&D facility intends to construct a catalytic pyrolysis unit, for the purposes of:

> …researching the scaling up of an innovative process to convert 1kg/hr of plastics back to their original components. The reactor in this proposed process will use a catalyst and heat in the form of steam to carry out this reaction. The Product from the reactor is a vapor. The vapor is sent via pipe to a condenser. The vapor that is liquified in the condenser is the product, which is then stored in drums. The drums are sent off site for disposal once data is collected. Non condensables from the condenser are sent via pipe to an electric flameless thermal oxidizer to control any VOC that may be present in the gas stream.

Furthermore, two phases will occur in which phase 1 will utilized virgin plastic as feedstock and if the project is determined to be "technologically feasible" and "commercially viable" phase 2 will consist of

processing recycled plastics. It's stated that Grace "cannot directly process plastic waste" and will need to source cleaned, pelletized recycled plastics.

Determination

Subpart EEEE has three applicability requirements, which are:

(a) Your incineration unit is a new incineration unit as defined in § 60.2886.
(b) Your incineration unit is an [Other Solid Waste Incinerator] OSWI unit as defined in § 60.2977 or an air curtain incinerator subject to this subpart as described in § 60.2888(b). Other solid waste incineration units are very small municipal waste combustion units and institutional waste incineration units as defined in § 60.2977.
(c) Your incineration unit is not excluded under § 60.2887.

The proposed catalytic pyrolysis unit, when constructed would be "new" as defined in §60.2886, which is defined to mean having a construction date after December 9, 2004. Additionally, the unit would meet the definition of an Other Solid Waste Incinerator, as OSWI expressly includes pyrolysis units. Despite the first two applicability requirements being satiated, the proposed catalytic pyrolysis unit would meet an exemption under § 60.2887.

§ 60.2887 states that "Your unit is excluded if it burns samples of materials only for the purpose of chemical or physical analysis." If the catalytic pyrolysis unit is operated for the sole purpose of research, the unit would be exempted from other requirements promulgated in 40 CFR Part 60, Subpart EEEE - Standards of Performance for Other Solid Waste Incineration (OSWI). Please note that rules such as 40 CFR 60 – Standards of Performance for New Stationary Sources do change occasionally, and any future changes to Subpart EEEE should be evaluated.

The EPA's response hereinabove to the request for applicability determination was coordinated with EPA's Office of Enforcement and Compliance Assurance (OECA) and EPA's Office of Air Quality Planning and Standards (OAQPS). EPA's applicability determination is specific to the facts provided in the December 13th, 2024 letter and supplemental application from W.R. Grace & Co.-Conn and any differences in the constructed facility or its operations may invalidate this response. If you have any questions regarding this response, please contact Steve Ott, of the Enforcement and Compliance Assurance Division at (215) 814-2267 or ott.steven@epa.gov.

Sincerely,

Karen Melvin
Director
Enforcement and Compliance Assurance Division

CC:
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Environmental Health Risks and Housing Values Evid

Uploaded by: Shamieka Preston

Position: FAV

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Environmental Health Risks and Housing Values: Evidence from 1,600 Toxic Plant Openings and Closings†

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Abstract

Regulatory oversight of toxic emissions from industrial plants and understanding about these emissions' impacts are in their infancy. Applying a research design based on the openings and closings of 1,600 industrial plants to rich data on housing markets and infant health, we find that: toxic air emissions affect air quality only within 1 mile of the plant; plant openings lead to 11 percent declines in housing values within 0.5 mile or a loss of about $4.25 million for these households; and a plant's operation is associated with a roughly 3 percent increase in the probability of low birthweight within 1 mile.

Industrial plants that emit toxic pollutants are ubiquitous in the United States today, and many lie in close proximity to major population centers. These plants emit nearly 4 billion pounds of toxic pollutants in the United States annually, including 80,000 different chemical compounds.[1] Whereas criteria air pollutants like particulate matter have been regulated for decades, regulation of airborne toxic pollutants remains in its infancy. The nascent state of regulation of these emissions is controversial because, on the one hand, most of the chemicals emitted have never undergone any form of toxicity testing (US Department of Health and Human Services 2010)[2], and, on the other hand, they are widely believed to cause cancer, birth defects, and damage to the brain and reproductive systems (Centers for

†Go to http://dx.doi.org/10.1257/aer.20121656 to visit the article page for additional materials and author disclosure statement(s).

Correspondence to: Reed Walker.

[1]US Government Accountability Office, http://www.gao.gov/highrisk/risks/safety-security/epa_and_toxic_chemicals.php (accessed March 19, 2012).

[2]The Environmental Protection Agency characterizes their risk assessments as "not completely accurate" because "scientists don't have enough information on actual exposure and on how toxic air pollutants harm human cells. The exposure assessment often relies

Disease Control and Prevention 2009). The unveiling of the Mercury and Air Toxics Standards in December 2011 represents the first time the US government has enforced limits on mercury and other toxic chemicals.

Toxic emissions are one of the reasons why siting industrial plants is so controversial. Policymakers must balance the negative externalities associated with industrial plants with their potential to create jobs, increase local economic activity, and lead to positive economic spillovers (Greenstone, Hornbeck, and Moretti 2010). While negative externalities often generate intense local opposition (e.g., "not in my backyard" or NIMBY movements), there is also frequently intense competition among communities to entice industrial plants to locate within their jurisdictions. If siting decisions are to be made efficiently, it is crucial that policymakers have reliable measures of the different costs and benefits.

This paper represents a first step toward understanding the external costs of industrial plants that emit toxic pollutants in terms of both individuals' willingness to pay to avoid these facilities and population health. In order to address this question, we have assembled an extraordinarily rich dataset on the location and economic activity of industrial plants in five large US states. Our analysis focuses, in particular, on plants that report toxic emissions to the US Environmental Protection Agency's *Toxic Release Inventory*. We link information on these "toxic" plants with administrative data that provides detailed information on the near-universe of housing transactions and birth outcomes in these states. All three datasets provide geographic coordinates, so we are able to perform the analysis with an unusually high degree of spatial detail.

Since the previous literature offers little guidance about how far toxic air pollutants travel, our first contribution is to measure the relationship between toxic emissions and air quality. Using data from pollution monitoring stations and a difference-in-differences estimator, we document that there are significantly higher levels of ambient toxic pollution within one mile of operating plants but no significant effect at further distances. On average, each birth in our sample lies within 1 mile of 1.27 toxic plants, so our results imply that the total amount of exposure could be substantial.

The findings on the distance that toxic air emissions travel guide our research design, which is based on the sharp changes in local amenities that result from more than 1,600 toxic plant openings and closings.[3] Our estimates are based on comparing housing prices and birth outcomes within 0.5 miles or 1 mile of plants with these same outcomes measured 1–2 miles away from plants, after adjustment for all unobserved time-varying factors that are common within 2 miles of the plants.[4] Further, the estimates are based on millions of births and hundreds of thousands of housing transactions.

on computer models when the amount of pollutant getting from the source(s) to people can't be easily measured. Dose-response relationships often rely on assumptions about the effects of pollutants on cells for converting results of animal experiments at high doses to human exposures at low doses" (EPA 1991).

[3]Our approach is inspired by pioneering studies by C. Arden Pope and collaborators who examined the health effects of opening and closing the Geneva steel mill near Provo, Utah in the late 1980s (Pope 1989; Ransom and Pope 1992; Pope, Schwartz, and Ransom 1992). These studies have been influential largely because the resulting sharp changes in airborne particulates over a short period of time make the empirical analyses transparent and highly credible.

This research design reveals that housing prices within 0.5 miles of a toxic plant's site decrease by about 11 percent after a plant opens, relative to the period before the plant was constructed. This decline implies an aggregate loss in housing values of approximately $4.25 million for the average plant opening. Housing prices are largely unaffected by a plant closing, relative to the period when the plant was operating, implying that toxic plants continue to negatively affect housing prices after they cease operations. Potential explanations for a plant's lasting effect include persistent visual disamenities, concerns about local contamination, or an expectation that the plant will reopen.

Many toxic pollutants are colorless, odorless, and not well monitored, making them less salient than other negative externalities. Thus, it is valuable to contrast housing prices with health outcomes, which should immediately respond to changes in plant activity. We find that the incidence of low birthweight increases by roughly 3 percent within 1 mile of operating toxic plants, with comparable magnitudes between 0 and 0.5 miles and 0.5 and 1 miles. Like the housing price impacts, the impacts on infant birthweight appear to be highly localized, with no impact beyond one mile.

We believe our study is the first large-scale empirical analysis of the external costs of toxic plants.[5] The availability of 1,600 plant openings and closings allows us to begin to characterize the heterogeneity of effects across plants. In additional results, we stratify plants by size, the amount and toxicity of emissions, and local demographic characteristics and find that the housing price and health impacts are experienced broadly across different types of plants. There is some evidence that housing price responses are stronger in lower income communities, whereas the estimated health effects are relatively uniform across plant and community types.

The rest of the paper proceeds as follows: Section I presents an analytical framework which helps motivate the empirical analysis. Section II discusses the data, and Section III discusses the research design. Sections IV and V outline the econometric specifications and results for housing values and infant health respectively. Finally, Section VI interprets the results, and Section VII concludes.

I. Conceptual Framework for the Incidence of Toxic Plant Openings

To motivate our empirical strategy, we outline a partial equilibrium model of housing incidence in the context of toxic plant externalities.[6] A local economy consists of a continuum of agents of measure one (denoted L) who choose to live in one of two locations $g \in \{N, F\}$; some choose to live near a plant ($g = N$) and others choose to live further away from a plant ($g = F$), but in the same local labor market. Toxic plant activity is assumed to generate local economic benefits for both sets of residents in the form of wage income, w.

[4]There have been attempts to study the health and housing price responses of toxic emissions at the county level (Agarwal, Banternghansa, and Bui 2010; Bui and Mayer 2003; Currie and Schmieder 2009), but counties are too large due to the short transport distances of most airborne toxic pollutants (see Figure 1).

[5]Studies of individual plants include the studies by C. Arden Pope mentioned above, as well as Blomquist (1974), Nelson (1981), and Kiel and McClain (1995). For studies of multiple plants see, e.g., Bui and Mayer (2003) and Davis (2011).

[6]The results from this partial equilibrium exercise generalize into a model of general equilibrium of the sort found in Kline (2010) and Moretti (2011). These models are themselves generalizations of the canonical models of Rosen (1974) and Roback (1982).

Wages are assumed to be an exogenous function of local productivity and are the same across groups. Residents in each location enjoy location-specific amenities net of any housing costs, A_g, associated with their location. Lastly, each resident i has some idiosyncratic preference for both locations, ϵ_{ig}, representing heterogeneity in the valuation of local amenities. The ϵ_{ig}s are independently and identically distributed across individuals and assumed to possess a continuous multivariate distribution with mean zero.

An individual seeks to maximize utility by choosing over locations

$$U_{ig}=\max\{\nu_N+\varepsilon_{iN},\nu_F+\varepsilon_{iF}\},$$

where ν_g represents mean utility in location g. Individuals will locate in whichever community yields the highest utility. Without heterogeneity in locational preferences, all individuals will locate in the community that offers the highest amenities. With heterogeneity in tastes, individuals in location N will have $\nu_N-\nu_F>\epsilon_{iF}-\epsilon_{iN}$. Define the distribution function $\eta_i\equiv\epsilon_{iF}-\epsilon_{iN}$ by $G(\cdot)$. Then, $L_N\equiv\Pr(\eta_i<\nu_N-\nu_F)$ is the measure of individuals in location N.

Write the total welfare of workers in location N and F as

$$V=E[\max\{\nu_N+\varepsilon_{iN},\nu_F+\varepsilon_{iF}\}]$$

and consider a positive economic shock stemming from a toxic plant opening in the community. We model this shock as a marginal improvement in productivity in the local community, which is assumed to increase wages in both the near and far locations equally. The plant opening, however, creates a negative externality for residents living near the plant through, for example, air pollution and related health effects.

Taking the derivative of workers' welfare with respect to the economic shock associated with a plant opening yields the expression:

$$\frac{dV}{d\theta}=L_F\cdot\frac{\partial w}{\partial\theta}+L_N\cdot\left[\frac{\partial w}{\partial\theta}+\frac{\partial A_N}{\partial\theta}\right]=L\cdot\frac{\partial w}{\partial\theta}+L_N\cdot\frac{\partial A_N}{\partial\theta},\quad(1)$$

where $d\theta$ represents the marginal effect of a plant opening and $\frac{dV}{dv_g}=L_g$.[7] Equation (1) suggests the incidence of the plant opening may be summarized by two terms. The first term is the total wage effect associated with the plant opening. Since in our empirical application, all residents near or far live within two miles of a plant, we assume that the wage effects are similar for both nearby residents and those a little further from a plant. The second term consists of the non-wage changes in amenities associated with a plant opening for residents

[7]The relationship $\frac{dV}{dv_g}=L_g$ follows directly from assuming that preference heterogeneity is drawn from a Type I Extreme Value distribution (Train 2003). However, this relationship also holds independent of the distribution of the taste heterogeneity. See Busso, Gregory, and Kline (2013).

near the plant. Since negative plant externalities in the form of noise or air pollution are highly localized, these costs will only accrue to the residents living near the plant.

After the plant opening some "marginal" residents who initially lived near the plant are better off moving further away. However, since workers are assumed to be optimizing with respect to location decisions, a simple envelope result suggests that workers who switch locations in response to a change in local amenities experienced small gains in private utility by doing so.[8] Therefore, the incidence of the plant opening may be approximated simply by the change in prices experienced by the immobile population.[9]

This paper aims to estimate the local disamenities of toxic plant operation, $\frac{\partial A_N}{\partial \theta}$, *holding all other factors fixed*. We do this by comparing residents near a plant to those within the same local labor market who live slightly further away. Since, by assumption, both groups are affected similarly by the productivity shock, the difference- in-differences estimate will approximate $\frac{\partial A_N}{\partial \theta}$. By explicitly controlling for the first component of equation (1) in this way, our estimates will reflect the gross external costs/benefits of a toxic plant opening or closing rather than the net external costs/benefits after accounting for any local economic gains associated with toxic plant production.

II. Data Sources and Summary Statistics

A. The Toxic Release Inventory Data

We identify plants that emit airborne toxic pollutants using the Toxic Release Inventory (TRI), a publicly available database established and maintained by the US Environmental Protection Agency (EPA).[10] The TRI was established by the Emergency Planning, Community Right to Know Act (EPCRA) in 1986, in response to the Bhopal disaster and a series of smaller spills of dangerous chemicals at American Union Carbide plants. Bhopal added urgency to the claim that communities had a "right to know" about hazardous chemicals that were being used or produced in their midst. EPCRA requires manufacturing plants (those in Standard Industrial Classifications 2000 to 3999) with more than 10 full-time employees that either use or produce more than threshold amounts of listed toxic substances to report releases to the EPA.[11]

[8]Although the change in amenities induces changes in behavior, these behavioral responses cannot have a first-order effect on private welfare; if they did, agents would not be optimizing. Alternatively, in this model the marginal migrant is indifferent between location 1 and location 2. Thus, any marginal shift in amenities in location 1 cannot make the agent much better off given the pre-intervention indifference between the two locations. Of course, plant openings and closings might not be marginal changes.

[9]In the case of non-marginal changes in productivity or local amenities, the envelope theorem no longer holds, and taste-based sorting may also have first-order implications for welfare. However, in the case of localized disamenities such as a single plant, Bartik (1987) and Palmquist (1992) show that the slope of the hedonic price function is an approximate measure of the willingness to pay for a non-marginal change. See Greenstone and Gallagher (2008) for a more complete discussion of non-marginal changes in the context of environmental amenities. Equilibrium sorting models may also yield insight into the welfare effects of non-marginal changes in the context of environmental disamenities. See Kuminoff, Smith, and Timmins (2013) for a recent review.

[10]See EPA (2009a) and EPA (2012) for detailed descriptions of the TRI.

[11]Currently, facilities are required to report if they manufactured or processed more than 25,000 pounds of a listed chemical or "otherwise used" 10,000 pounds of a listed chemical. For persistent bio-accumulative toxins, the thresholds are lower. These thresholds have changed periodically over the life of the program. For example, in 1998, EPA added the receipt or disposal of chemical waste to the definition of "otherwise used."

The toxic emissions measures in the TRI have been widely criticized (de Marchi and Hamilton 2006; Koehler and Spengler 2007; Bennear 2008). The emissions data are self-reported, and believed to contain substantial measurement error.[12] Moreover, coverage has expanded over time to include additional industries and chemicals, making comparisons of total emissions levels over time extremely misleading. [13] Finally, because of the minimum thresholds for reporting, plants may go in and out of reporting even if they are continually emitting toxic chemicals. This feature of the TRI introduces additional measurement error, and also makes the TRI poorly suited for identifying plant openings and closings.

The TRI is extremely useful, however, for identifying which US industrial plants emit toxic pollutants. The approach we adopt in this paper is to ignore the self-reported magnitudes and instead exploit variation introduced by plant openings and closings. Using the publicly available TRI data, we create a list of all US "toxic" plants by keeping every plant that ever reported toxic emissions to the TRI in any year. This method sidesteps the problems introduced by changes in reporting requirements because plants end up being classified as "toxic" plants, even if, for example, they are in industries which were not included in the early years of the TRI. We then link this list of toxic plants to establishment-level data from the US Census Bureau to determine the years in which each plant opened (and closed, if applicable).

B. The Longitudinal Business Database

We determine the exact years in which plants open and close using the US Census Bureau's Longitudinal Business Database (LBD). Started in 1975, the LBD is a longitudinal, establishment-level database of the universe of establishments in the United States.[14] The LBD has been used widely by economists, for example, in studying plant-level employment dynamics (Davis et al. 2010), and is by far the most accurate existing record of US plant activity.

These data must be accessed at a Census Research Data Center under authorization from the Census Bureau. In addition to the year of opening and closing (if applicable) for each plant, these data report mean annual employment and mean annual total salaries.[15] We merge the LBD with a second restricted access Census database called the Standard Statistical Establishment List (SSEL), which contains plant names and addresses for all plants in the LBD. Finally, we merge the LBD/SSEL dataset with the EPA's TRI database via a name- and address-matching algorithm.[16]

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[12]The EPCRA explicitly states that plants need not engage in efforts to measure their emissions. The EPA provides guidance about possible estimation methodologies, but plants estimate their emissions themselves, and estimating methodologies vary between plants and over time. In addition, EPA enforcement of TRI reporting has typically taken the form of ensuring compliance rather than accuracy (de Marchi and Hamilton 2006).

[13]Federal facilities were added in 1994. Mining, electric utilities, hazardous waste treatment and disposal facilities, chemical wholesale distributors, and other additional industrial sectors were added in 1998. Treatment of persistent bio-accumulative toxins was changed in 2000. By the EPA's own admission, the TRI is not well suited for describing changes in total amounts of toxic releases over time (EPA 2012).

[14]For more information about the LBD, see Davis, Haltiwanger, and Schuh (1998) and Jarmin and Miranda (2002).

[15]The year of a plant opening is left-censored for those plants that were operating on or before 1975.

[16]See Walker (2013) for further details pertaining to the match algorithm.

C. Housing Values

The housing data for this project includes housing transactions in five large states (Texas, New Jersey, Pennsylvania, Michigan, and Florida). These data report the date, price, mortgage amount, and address of all property sales for these five states from approximately 1998 to 2005.[17] The data also include the exact street address of the property, which allows us to link the housing data with plant level data from the TRI based on the latitude and longitude of the geocoded address (described in more detail below). The main limitation of the housing data is that it contains very little information pertaining to housing unit characteristics.[18] These data include both residential and commercial real estate transactions; we focus only on single-family, residential properties. To limit the influence of outliers and focus on "arms length" transactions, we exclude properties that sold for less than $25,000 or more than $10 million. All housing prices have been adjusted to year 2000 dollars.

D. Vital Statistics Data

Data on infant health comes from vital statistics natality and mortality data for the same five large states: Texas, New Jersey, Pennsylvania, Michigan, and Florida, from 1990 to 2002. Together, these states accounted for 10.9 million births between 1990 and 2002, approximately 37 percent of all US births. The substantial advantage of these restricted-access data is their geographic detail, including the residential address of the mother. This precision is crucial in our context because the health consequences of toxic plants are highly localized.

These data include detailed information about the universe of births and infant deaths in each state. We focus, in particular, on whether the infant is low birthweight defined as birthweight less than 2,500 grams. Low birthweight is not uncommon, affecting about seven percent of the births in our sample. Low birthweight is also one of the most widely used overall indicators of infant health, in part because it has been shown to predict adult well-being.[19] Other birth outcomes that we examine include a continuous measure of birthweight, very low birthweight (defined as birthweight less than 1,500 grams), prematurity (defined as gestation less than 37 weeks), congenital abnormalities, and infant mortality (death in the first year).[20] Focusing on infant health is advantageous, relative to adult outcomes, because infants do not have a long unobserved health history, reducing concerns about time lags between exposure and outcomes.

In addition to these health outcomes, the vital statistics data include a number of important maternal characteristics including age, education, race, and smoking behavior. In the

[17]The transaction records are public due to state information disclosure acts, but the raw data are often housed in PDF images on county websites making them inaccessible for computational analysis on a large scale. We used an external data provider who compiled the information from the county registrar websites into a single dataset. Data availability and temporal coverage varies by county but is fairly consistent between 1998–2005, the years of our housing analysis.

[18]For example, we observe square footage of the housing unit for less than half of the transactions.

[19]Black, Devereux, and Salvanes (2007) use twin and sibling fixed effects models on data for all Norwegian births over a long time period to show that birthweight has a significant effect on height and IQ at age 18, earnings, and education. Using US data from California, Currie and Moretti (2007) find that mothers who were low birthweight have less education at the time they give birth and are more likely to live in a high poverty zip code. They are also more likely to have low birthweight children.

[20]These are all outcomes that have been previously examined in the environment-infant health literature (e.g., Chay and Greenstone 2003; Currie, Neidell, and Schmieder 2009; Currie, Greenstone, and Moretti 2011; and Currie and Walker 2011).

empirical analyses below we control explicitly for these factors, as well as for month of birth, birth order, and gender of child. In all analyses we exclude multiple births since they are likely to have poor birth outcomes for reasons that have little to do with environmental pollution. We also test whether plant openings and closings have affected these characteristics directly, either by changing the composition of neighborhoods near plants and/or by changing fertility.

The fact that the LBD data is annual, while births are reported monthly raises the question of how to appropriately structure the empirical models for infant health outcomes. We focus the analysis on a data file comprised of births in November, December, January, and February. Births in November and December are merged to LBD data from the same calendar year, while births from January and February are merged to LBD data from the preceding calendar year. The idea is that a baby born January 1, 2002 has not been exposed to any of the toxic plant activity for calendar year 2002, but was exposed to toxic emissions in 9 out of 12 months of 2001. Similarly, a baby born in November 2001 was exposed to toxic emissions for 9 out of 12 months of 2001. This restriction has the additional advantage of limiting the extent to which seasonality in plant activity or birth outcomes affects our findings. The robustness of the results to alternative timing assumptions is explored in the subsequent analysis.

E. Data Linkages and Aggregation

We link plants in the TRI and LBD to the housing and vital statistics, based on the latitude and longitude of the plants, houses, and mother's residence. Specifically, we first create a large dataset consisting of all pairwise combinations of plants and outcome variables (i.e., births and/or housing transactions). We keep outcome and explanatory variables within two miles of a plant. This means that any house or birth observation within two miles of more than one plant will contribute one observation for each plant-outcome pair. For the primary specifications, we collapse the outcome measures into various distance bins surrounding plants in a given year to minimize the computational burden of working with the universe of birth and housing transactions crossed with plants. That is, for each plant-year, we construct the mean of the outcome variable and key covariates for outcomes that occurred within 0 to 0.5, 0.5 to 1.0, 0 to 1.0, and 1.0 to 2.0 miles of a plant. In addition to easing the computational burden, the collapsing of the data accounts for issues pertaining to inference when the identifying variation occurs at a more aggregate level. In supplementary specifications, we analyze subsamples using the underlying microdata.

F. Summary Statistics

Panel A of Table 1 presents summary statistics for the 3,438 plants that form the basis for our analysis. The three columns reflect the sample characteristics for plants that were always open, newly opened, and newly closed within our sample frame respectively. A plant can appear in both columns 2 and 3, and we have about 1,600 total plants that either open or close. In practice, the plants in our sample tend to be long-lived, with a median age of around 17 years.[21] For continuously operating plants, the mean value of plant equipment and structures is $22 million, and mean annual salary and wages is $11.7 million.[22] Mean salary and wages is lower for plants that opened or closed. The table also reports mean

annual toxic emissions, which exceeds 17,000 pounds in all three columns. These are the self-reported measures of airborne toxic emissions from the TRI, and are averaged over all non-missing observations (i.e., if a plant does not report to the TRI during a particular year in which we know the plant is operating, we treat this as missing rather than zero).

Panel B of Table 1 describes community characteristics near plants that either opened or closed during our sample period. Statistics are reported separately by distance to the plant and observations are restricted to the two years after a plant opening or the two years before a plant closing. Note that a house or birth can be close to more than one plant, and so the same house or birth can appear in more than one column. Within columns, we have restricted houses and births so that they appear only once in this panel, implicitly giving equal weight to each birth and housing outcome.

Both housing values and maternal characteristics tend to improve with distance from the plant. The average housing value is $124,424 within a half mile of a plant compared to $132,227 for houses between one and two miles away. Similarly, average maternal education rises from 11.93 to 12.22 over the same distance. Rather than rely on equality of levels, our difference-in-differences-style identification strategy relies on the assumption that trends in the unobserved determinants of the outcomes are evolving equally in the 0–1 (or 0–0.5 and 0.5–1.0) and 1–2 mile distance from the plant categories. The subsequent analysis provides graphical evidence supporting the validity of this assumption.

III. The Transport of Airborne Toxic Pollutants as the Basis of a Research Design

Our difference-in-differences strategy compares houses and births in areas “near” a toxic plant to those in areas slightly farther away. While this is a simple idea conceptually, there is little guidance in the literature about how near a household must be to a plant for proximity to affect either housing prices or birth outcomes (or alternatively, about how far toxic emissions are transported). Hence the first step in our analysis is to characterize this relationship empirically. This evidence is of significant independent interest and an important contribution of our paper.

Our approach uses data from monitoring stations about ambient levels of hazardous air pollution. While the EPA has been monitoring criteria air pollutants for four decades, they have only recently begun monitoring hazardous air pollutants (HAPs).[23] The first year of data availability was 1998, and monitors have been gradually added over time. As of 2005, the last year of our sample, there were 84 pollutants being monitored across the 5 states we examine. We investigate the ways in which plant operating status maps into local ambient

[21]Plant age in the LBD is left-censored in 1975 (the first year the plants are observed in the sample). Therefore, the median age of the plants in our sample is likely to be a bit larger.

[22]The capital stock measures come from the Annual Survey of Manufacturers, and are computed using a modified perpetual inventory method (Mohr and Gilbert 1996). Since the ASM is a sample and oversamples large establishments, these statistics are not available for all plant years and reflect statistics for larger plants.

[23]Hazardous air pollutants, also known as toxic air pollutants, are defined by the EPA as “pollutants that are known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental effects” (EPA 2011). In contrast, criteria air pollutants, are the more commonly found air pollutants that are regulated according to the EPA’s National Ambient Air Quality Standards (NAAQS), such as particulate matter.

hazardous air pollution in two separate ways. First, we take the eight most monitored pollutants in our data and examine pollutant-by-pollutant heterogeneity in emissions transport as a function of plant operating status and distance between a plant and a monitor. Second, we combine all pollutants into a single summary measure by standardizing each pollutant to have mean zero and standard deviation of one.[24]

We matched the monitoring station data to our data on toxic plants using latitude and longitude, keeping monitor-plant pairs in which the plant had ever reported releasing the monitored pollutant and in which the monitor was less than four miles away from the plant. We then estimate the following linear regression model:

$$\text{Poll}_{\text{jmt}}=\beta_0+\beta_1 1[\text{Plant Operating}]_{jt}+(1[\text{Plant Operating}]_{jt}\cdot\text{Distance}_{jm})'\beta_d+\eta_{jm}+\tau_t+\varepsilon_{\text{jmt}}, \quad (2)$$

where the dependent variable is one of the pollution measures described in the previous paragraph for monitor m linked to plant j in year t. The regression includes an indicator variable for whether a plant is operating in a given year, and the interaction between the indicator and a quartic polynomial in the distance between the plant and the monitor.[25], [26] We also include monitor-plant pair fixed effects, η_{jm}, which are collinear with the main effect of the distance polynomial. The inclusion of these fixed effects ensures that identification comes from plant openings and closings. Lastly, we include year fixed effects, τ_t, to control for overall trends in ambient pollution concentrations. The standard errors are two-way clustered on monitor and plant.

Figure 1 plots the marginal effect of an operating plant on hazardous air pollution as a function of distance from the plant for eight of the most widely monitored pollutants. Each panel of Figure 1 presents the pollutant-specific distance gradient, showing how the marginal effect of plant operation fades with distance. Each pollutant has been standardized by subtracting the pollutant-specific mean and dividing by the standard deviation so that the distance gradient may be interpreted as standard deviations from the mean value. Below each graph is a histogram showing the number of monitors in 0.1 mile increments. There is some heterogeneity across pollutants, and in future work it might be possible to take advantage of these differences to disentangle the impacts of specific pollutants. For the most part, however, pollution levels tend to fall exponentially with distance from the plant. In most cases, pollution is only detectable within one mile of a plant.

Figure 2 plots the standardized pollution measure pooling over all 84 pollutants in our sample. Average levels of ambient hazardous air pollution are one standard deviation higher immediately adjacent to an operating plant, and decline exponentially with distance, reaching zero at roughly one mile from a plant. Most previous analyses of the economic

[24]Note that some pollutants are more toxic or hazardous than others. For the purposes of this particular econometric exercise, we are simply trying to understand if *any* detectible relationship exists between toxic plant activity and ambient levels of hazardous air pollutants, irrespective of the toxicity of a given pollutant.

[25]We have also examined different functional forms for distance and the results are similar. Models using more flexible distance specifications, such as replacing a continuous distance measure with dummy variables for different distance bins yield similar results, but the models are less precisely estimated.

[26]The LBD provides information on the first year and last year that a plant is observed in the data. We define $1[\textit{Plant Operating}]_{jt} = 1$ if year t is greater than or equal to the first year the plant is observed in the data and less than or equal to the last year the plant is observed in the data.

impacts of toxic emissions have used county-level data, making it impossible to measure these highly localized impacts. An important exception is Banzhaf and Walsh (2008), who use block-level aggregates from the 1990 and 2000 censuses for urban areas in California to examine localized changes in average household income.

Documenting this relationship between toxic plant activity and ambient levels of hazardous air pollution helps to motivate our empirical specification. There are several ways for an industrial plant to affect housing values and human health including aesthetics, congestion, and noise. Toxic emissions may be among the channels that have the most distant effects, and the evidence suggests that on average emissions do not reach further than one mile.[27] This finding underscores the importance of performing the analyses that follow using spatial data at a high level of resolution. In most analyses below, we define "near" as within 0.5 or 1 mile of a plant and "far" as one to two miles away. That is, houses and households between one and two miles are used as comparison groups. We also present results using alternative distances. As discussed above, the underlying assumption is that the comparison groups are close enough to experience the wage and productivity effects of the plant. A second assumption is that outcomes in the near and far areas are evolving with similar trends. Under these assumptions, differences in the impact of plant operations reflect the effects of the local disamenities of plant operation.

IV. Housing Values

A. Housing Values: Empirical Strategy

We begin our investigation of the effects of toxic plants on housing values by fitting the following econometric model:

$$\begin{aligned} Y_{\mathrm{jdt}} = {} & \beta_0 + \beta_1 1[\text{Plant Operating}]_{jt} + \beta_2 1[\text{Near}]_{jd} \\ & + \beta_3 (1[\text{Plant Operating}]_{jt} \times 1[\text{Near}]_{jd}) + \eta_{jd} + \tau_t \\ & + \beta_4 (X1990_{jd} \times T_t) + \varepsilon_{\mathrm{jdt}}, \end{aligned} \quad (3)$$

where Y_{jdt} denotes the natural log of average housing values near plant site *j*, within distance group *d*, in year *t*. For each plant *j*, there are two observations per year. In each plant-year, one observation consists of average housing prices "near" a plant (i.e., within 0.5, 0.5 to 1.0, or 1 mile of the plant). The second observation per plant-year consists of average house prices for houses within 1–2 miles of the plant; this second group provides a counterfactual for housing prices near the plant. The availability of these two groups allows for a difference-in-differences-style estimator.

The variable 1 [*Plant Operating*]$_{jt}$ is an indicator equal to one if a toxic plant *j* is operating in year *t* and zero otherwise. It is equal to one for both distance groups associated with a plant. The indicator 1 [*Near*]$_{jd}$ is equal to one for observations from the near category, regardless of whether the plant is currently operating. Equation (3) also includes plant-by-distance fixed effects η_{jd} to control for all time-invariant determinants of house prices in a plant-by-

[27] A recent literature also finds that other forms of housing externalities are very localized (see, for example, Linden and Rockoff 2008; Harding, Rosenblatt, and Yao 2009; Rossi-Hansberg, Sarte, and Owens 2010; and Campbell, Giglio, and Pathak 2011).

distance group, which in practice is collinear with the indicator 1 $[Near]_{jd}$. Additional controls include 1990 census tract characteristics, $X1990_{jd}$, interacted with quadratic time-trends T_t.[28]

Equation (3) also includes time fixed effects, τ_t, to flexibly account for trends in housing values over time. We report specifications that include either state-by-year fixed effects to account for state-level trends in housing prices or plant-by-year fixed effects to account for highly localized trends. The richer specification adds approximately 10,000 fixed effects, one for each plant-year.

The parameter of interest in equation (3) is β_3, the coefficient on the interaction term: $1[Plant\ Operating]_{jt} \times 1\ [Near]_{jd}$. It captures the differential impact of an open plant on locations "near" the plant, relative to those one to two miles away. Given that our models include plant-by-distance fixed effects, η_{jd}, β_3 is identified by changes in the operating status of a plant (i.e., plant openings and closings). The model with plant-by-year and plant-by-distance fixed effects provides an average of the estimates that would be derived from the roughly 1,600 case studies of plant openings and closing that underlie this analysis. Specifically, β_3 is identified by within-year differences in the change in house prices among houses "near" and 1–2 miles from toxic plant openings and closings.

We also estimate a "repeat-sales" model with individual-level, rather than grouped, data. The advantage of this model is that our housing value data contain few housing characteristics, so the estimates of β_3 from equation (3) may confound willingness to pay to avoid a toxic plant with changes in the composition or type of house sold. To distinguish between these two possibilities we focus on a sample of houses that sold more than once between 1998–2005, allowing us to difference out the unobserved time invariant qualities of a house.

We use several versions of the following first differenced specification:

$$\begin{aligned}\Delta Y_{\mathrm{ijt},t-\alpha} = {} & \beta_1 \Delta 1[\mathrm{Plant\ \ Operating}]_{jt,t-\alpha} + \beta_2 \Delta 1[\mathrm{Near}]_{ij} \\ & + \beta_3 \Delta (1[\mathrm{Plant\ \ Operating}]_{jt,t-\alpha} \times 1[\mathrm{Near}]_{ij}) + \Delta \tau_{t,t-\alpha} \\ & + \beta_4 \Delta (X1990_{jd} \times T_{t,t-\alpha}) + \Delta \varepsilon_{jdt,t-\alpha},\end{aligned} \quad (4)$$

where $\Delta\ Y_{ijt,t-a}$ denotes the difference in ln(house price) between sales of house *i*, near plant site *j*, in years *t* and $t - \alpha$. Notice that the time between sales varies across houses so α takes different values across houses. Since houses are in fixed locations, there is no variation in $\Delta 1[Near]_{ij}$ and it is infeasible to obtain estimates of β_2.

The coefficient of interest remains β_3, which captures the variation in housing prices when there is a change in plant operating status for houses "near" sites, relative to the change in housing prices among houses 1–2 miles from the site. It is important to recognize that β_3 does not compare the operating period to either the period before a plant opened or to the period after it closed. Rather, it compares the operating period to a weighted average of

[28]Census tract characteristics were mapped to plant radii using ArcGIS, where the radius characteristics consist of the area weighted averages of census tracts that intersect the distance circle/radius. Results are similar with and without these controls.

periods before the plant opened and periods after the plant closed that is specific to this sample, so that its external validity may be limited.

Because of these important issues of interpretation, we also estimate an alternative version of equation (4) that allows us to separately identify the effects of plant openings and plant closings. For these models, the variable $1[Plant\ Operating]_{jt}$ is replaced by two separate indicators $1[Plant\ Opened]_{jt}$ and $1\ [Plant\ Closed]_{jt}$. The variable $1\ [Plant\ Opened]_{jt}$ is an indicator equal to zero before the plant opens, and equal to one in all years after the plant opens, even if the plant subsequently closed. The variable $1\ [Plant\ Closed]_{jt}$ is an indicator variable equal to zero before the plant opens and while it is operating, and then equal to one for all years after the plant closes.[29] These indicators are then interacted with $1\ [Near]_{jd}$.

The result is that the $1[Plant\ Opened]_{jt}$ interaction measures the effect on housing prices in near locations, relative to the 1–2 mile locations, during the period that the plant is operating, relative to the period before it opened. Because of the way that the indicators are defined, the interaction with $1[Plant\ Closed]_{jt}$ tests for an additional effect on housing prices in near locations, relative to 1–2 mile locations, after the plant has closed, relative to the period when it was operating; so, the coefficient associated with this interaction provides a direct test of whether plant closings affect housing prices, relative to the period that the plant was operating. We also report on tests of the hypothesis that the parameters associated with the two interactions are equal and of opposite sign, which would be the case if a plant's closing completely reversed the effect of its opening.

Note that housing values reflect both current and expected future amenities. In our setting, these expectations are likely to include valuations of local air pollution, visual disamenities, traffic related to plant activity, and soil and water pollution, as well as expectations about how long the plant will operate and whether it will reopen if it closes. These expectations are, of course, unobservable (see, e.g., Bishop 2012), but it is nevertheless important to keep in mind that housing values reflect the present discounted value of the entire stream of amenities associated with a particular location when interpreting the estimates.

B. Housing Values: Results

We first present event study graphs that motivate the regression analyses that follow. These graphs are derived from the estimation of versions of equation (3) that include plant-by-year fixed effects and allow the coefficients on $1[Plant\ Opened]_{jt} \times [Near]_{jd}$ and $1[Plant\ Closed]_{jt} \times 1[Near]_{jd}$ to vary with event time; here, year zero is the year that the plant's operating status changes (i.e., the year of the plant opening or closing). The figures plot these coefficients and their 95 percent confidence intervals.[30] They provide an opportunity to judge the validity of the difference-in-differences-style approach that is based on the assumption of similar trends in advance of the opening or closing.

[29]Formally, we define $1[Plant\ Closed]_{jt} = 1$ if year t is greater than the last year the plant is observed in the LBD and $1\ [Plant\ Opened]_{jt} = 1$ if year t is greater than or equal to the first year the plant is observed in the LBD.

[30]The available housing price data only allow for the estimation of the coefficients for event years −3 through +5 for plant openings and −5 through +5 for plant closings since plant openings are concentrated in the earlier part of our sample.

Figure 3 plots event study coefficients from two separate regressions. Panel A of Figure 3 plots event study coefficients for years before/after a plant opening, and panel B plots event time coefficients before/after a plant closing. The plotted coefficients represent the time path of housing values within 0–1 miles from a plant, relative to 1–2 miles from a plant, conditional on plant-by-distance and plant-by-year fixed effects. Both panels support the validity of the design as there is little evidence of differential trends in housing prices between houses 0–1 and 1–2 miles from the plant in the years preceding the opening or the closing. There is clear evidence that plant openings lead to housing price declines in the year that the plant opens. The plant-closing figure provides less decisive evidence, although on average prices rise slightly after the year of a closing.

Table 2 reports baseline estimates for the effect of toxic plants on housing values. Panel A shows least squares estimates from various versions of equation (3), in each case reporting the coefficient and standard error associated with the interaction of $1[Plant\ Operating]_{jt} \times Near_{jd}$. We estimate these models on a balanced panel of plant-by-distance-by-year observations, excluding a subset of plants for which no housing values occurred in a specific distance-by-year cell.[31] Panels B and C report estimates of equation (4), where panel B reports the coefficient and standard error associated with the interaction of $1[Plant\ Operating]_{jt} \times Near_{jd}$, and panel C allows the effects of openings and closings to differ.

In all regressions the comparison group is homes located between one and two miles from the plant, whereas the definition of “near” changes across regressions, as indicated by the column headings. The odd-numbered columns report estimates from specifications that include state-by-year fixed effects and the even-numbered columns report estimates from specifications that use plant-by-year fixed effects (or county-by-year fixed effects in the repeat sales analysis).[32]

The estimates in columns 1 and 2 of panel A show that an operating toxic plant within a half-mile is associated with a 2 to 3 percent decrease in housing values. The point estimates in columns 3 and 4 are smaller in magnitude, suggesting that the effects of plant operations on housing values tend to fade with distance. For example, the point estimate in column 3 suggests that the effect of an operating plant falls to one percent in the half mile to one mile range. The standard errors are large enough, however, that their 95 percent confidence intervals overlap the 95 percent confidence intervals of the estimates in columns 1 and 2. Hence, in columns 5 and 6 we compare the entire zero to one mile area with the one to two mile zone.[33] Not surprisingly given the previous estimates, the overall impact on housing values within one mile is about −1.5 percent.

[31]Results using an unbalanced panel are similar. Models estimated using plant-by-year fixed effects are estimated in two steps. The first step demeans all regression model variables by plant-by-year. The second step then estimates the model on the remaining covariates using the demeaned data. Given all the fixed effects in these models, it is not surprising that they explain a lot of the variation in housing prices. The R^{2}s are around 0.7 and 0.9 for models with and without the repeat sales, respectively.

[32]We ran into computational challenges when estimating the full set of plant-by-year fixed effects in the first difference setting, and thus we rely on county-by-year fixed effects as a compromise. This being said, estimates using equation (3) with county-by-year or plant-by-year fixed effects are almost identical.

[33]The column 6 specification is the difference-in-differences analogue to the event-time regression plotted in Figure 2.

The last two columns of Table 2 report estimates from specifications that restrict observations to within two years of a change in plant operation. In the short-run, prices will do a better job of capturing the full welfare effects because supply is relatively inelastic over short periods of time; over the longer run, the full welfare effects are captured by adjustments in prices and quantities (which are unobservable in our data). This restriction attenuates the point estimates, but the 95 percent confidence intervals overlap those associated with the estimates in columns 5 and 6.

Panels B and C present the repeat sales estimates from fitting equation (4). For the most part, the estimates in panel B are similar to those found in panel A, albeit somewhat smaller in absolute magnitude. The differences between the two panels are consistent with the interpretation that some of the estimated impacts in panel A are driven by less expensive houses selling near to a plant whenever a plant is operating. The disparities between the results in panels A and B are also consistent with greater attenuation due to measurement error in a first difference setting. However, the 95 percent confidence intervals overlap across all estimates, and thus we are not able to make strong conclusions about the difference in magnitudes.

Panel C presents parameter estimates associated with $1[Plant\ Opened]_{jt} \times 1[Near]_{jd}$ and $1[Plant\ Closed]_{jt} \times 1[Near]_{jd}$. Within 0.5 miles, a plant's operation is associated with a 10 percent–11 percent decline in housing prices; these estimates are economically large and statistically significant. There is little evidence of an effect on housing prices between 0.5 and 1.0 miles from the plant. As Figure 3 foreshadowed, plant closings appear to modestly increase housing prices, but this effect is small economically (less than 2 percent, even less than 0.5 miles from a plant) and statistically indistinguishable from zero.

The final row reports the results from a test that the opening and closing coefficients are equal and opposite in sign. This null hypothesis can be rejected in the 0–0.5 mile range. One possible interpretation is that households expect closed plants to reopen. However, we measure closings using the last year that a plant is observed in the LBD. Consequently, our data generally pick up permanent (not temporary) plant closures, though home buyers and sellers may not realize this at the time of the closure.[34] Other potential explanations for a plant's lasting effect include persistent visual disamenities and concerns about local contamination.

Thus far we have concentrated on the average effect of plant openings and closings. We next explore heterogeneity in our baseline estimates by stratifying plants by observable characteristics. Since the housing price impacts are almost entirely concentrated within 0.5 miles of a plant, we focus on housing values within this range.

[34]We also tested whether plant openings and closings affect the volume of housing transactions. We used the baseline housing regression approach (aggregated at the plant-distance-year level), but replaced mean log(sales price) with the number of houses sold (in logs). While the housing price regressions weight cells by the number of houses sold, we excluded regression weights from this volume regression so as to not weight observations by the outcome variable. The results suggest that the number of transactions decreases when there is an operating toxic plant nearby, especially within 0.5 miles after plants open. It is difficult to draw definitive conclusions, however, because most of the estimates are not statistically significant.

We group plants into whether the median value of a particular variable (taken over all years of plant operation) is above or below the population median (taken over the plant-level medians). The plant characteristics we explore are plant employment, payroll, stack emissions, fugitive emissions, and total emissions, as well as the mean and maximum toxicity of the chemicals that are released. Plants in the TRI report both stack and fugitive emissions. Stack emissions occur during the normal course of plant operations, and are emitted via a smoke stack or some other form of venting equipment which is, in many cases, fitted with pollution abatement equipment. Because stacks are often extremely high, these emissions tend to be dispersed over a wide geographic area. Fugitive emissions are those that escape from a plant unexpectedly, generally without being treated. These emissions may be more likely to be manifest to households in the form of noxious odors or residues. The toxicity measures were calculated using the EPA's Risk-Screening Environmental Indicators.[35] We also stratify plants based on the characteristics of the nearby communities (i.e., within 2 miles), including the fraction of the population that is college educated, the fraction of the population that is Caucasian, the median housing value surrounding a plant, and median income.

Table 3 reports the results of this exploration. We focus on the baseline first-differences specification, augmenting equation (4) to include an additional interaction term for whether or not a plant is above the median for each of the above listed characteristics. We then estimate the full three-way interaction, allowing for all lower order interaction terms. The estimates indicate that the housing results are fairly homogeneous across various plant types (columns 1–6) but that the negative impacts appear to be concentrated in relatively disadvantaged communities (columns 7–10). If households were aware of the toxicity measures and they were valued (negatively) by households, then one might have expected to see relative toxicity reflected in housing price differentials. A possible explanation for the absence of such a pattern is that households have imperfect information. Given the lack of scientific evidence about the health effects of exposure, such ignorance would not be surprising.

The online Appendix presents estimates from several additional specifications. Appendix Table A2 examines the sensitivity of the baseline estimates to varying sets of controls. The qualitative findings are unchanged across several different approaches. Appendix Table A3 presents estimates of equation (3) that use a comparison group of two to four miles from a plant instead of one to two miles, and the results are similar to the baseline results in Table 2. This is reassuring because it suggests that the results are not driven by patterns in housing prices in the one to two mile zone. Appendix Table A4 presents regressions identical to the baseline estimates of equation (3) except that each regression is estimated using only observations from a single distance bandwidth (e.g., 0 to 0.5 miles, 0.5 to 1 miles, 1 to 1.5 miles, 1.5 to 2.0 miles, etc…) for each plant. Identification in these models comes from differential timing of openings and closings across plants. Estimates from this specification corroborate our baseline findings and choice of comparison group; the effects of plant

[35]Surprisingly little is known about the relative toxicity of different chemicals. Although animal testing is broadly used for evaluating the toxicity of chemical compounds, these studies are of limited relevance for evaluating which chemicals are likely to be most damaging for human health.

operating status are highly localized, and there seems to be little negative effect of plant openings in areas more than one mile away from a plant.

V. Infant Health

A. Infant Health: Empirical Strategy

The empirical strategy for examining infant health outcomes is very similar to the approach used for housing values. Again, our main focus is on comparing outcomes "near" a plant with outcomes one to two miles away. We estimate models of the form:

$$\begin{aligned} Z_{\mathrm{jdt}} = {} & \alpha_0 + \alpha_1 1[\text{Plant Operating}]_{jt} + \alpha_2 1[\text{Near}]_{jd} \\ & + \alpha_3 (1[\text{Plant Operating}]_{jt} \times 1[\text{Near}]_{jd}) + \eta_{jd} + \tau_t \\ & + \beta_4 (X1990_{jd} \times T_t) + \varepsilon_{\mathrm{jdt}}, \end{aligned} \quad (5)$$

where Z_{jdt} denotes the average incidence of low birthweight or another measure of infant health near plant site j, within distance group d, in year t. As before, the specification includes plant-by-distance fixed effects, η_{jd}, year fixed effects τ_t (which in practice are state-by-year or plant-by-year fixed effects), and census controls, $X1990_{jd}$, interacted with quadratic time-trends T_t

As in the housing equations, the coefficient of interest, now denoted α_3, is the differential impact of an operating plant within one mile. We again explore a version of this specification that replaces the $1[\textit{Plant Operating}]_{jt}$ variable with the $1[\textit{Plant Opened}]_{jt}$ and $1[\textit{Plant Closed}]_{jt}$ variables. For this richer specification, we again test whether the coefficients on the interactions of these variables with $1[\textit{Near}]_{jd}$ are equal and opposite in sign. If air toxic emissions are the channel for any infant health effects, then the plausibility of this null is stronger than in the housing price regressions where plant closings may be perceived as temporary and visual disamenities could remain after a closure.

The vital statistics data include a rich set of mother's characteristics that can be used to control for possible changes in the composition of mothers. However, the identifying variation in our models comes at a much higher level of aggregation; hence, in order to avoid overstating the precision of our estimates and to limit the computational burden of our most stringent specifications we control for mother's characteristics using a two-step, group-level estimator (Baker and Fortin 2001; Donald and Lang 2007). In the first step, we estimate the relationship between low birthweight (Z_{jdt}) and plant-by-distance by year indicators (g_{jdt}), after controlling for mother's characteristics (m_{it}):

$$Z_{\mathrm{jdt}} = m'_{\mathrm{it}}\theta + g_{\mathrm{jdt}} + \xi_{\mathrm{jdt}}. \quad (6)$$

The vector m_{it} controls for maternal characteristics including indicators for: age categories (19–24, 25–34, and 35+), education categories (< 12, high school, some college, and college or more), race (African American or Hispanic), smoking during pregnancy, month of birth, birth order, and gender of child.[36] The estimated $\widehat{g_{jdt}}$ provides group-level, residualized averages of each specific birth outcome after controlling for the observable characteristics of

the mother. These averages are used as the dependent variable in equation (5), instead of Z_{jdt}. In this second step, the equation is weighted by the group-level cell size.[37, 38]

B. Infant Health: Results

We start by presenting event study graphs for the incidence of low birthweight (i.e., an infant born weighing less than 5.5 pounds or 2,500 grams) based on a version of equation (5). The plotted estimates and 95th percentile confidence intervals correspond to the interaction of event-time indicators with $1[Plant\ Opened]_{jt} \times 1[Near]_{jd}$ and $1[Plant\ Closed]_{jt} \times 1[Near]_{jd}$. The specification includes plant-by-distance and plant-by-year fixed effects, as well as the census controls interacted with a quadratic time trend. The birth data cover a longer period than the housing prices data and we can estimate the parameters of interest for all event years from five years before an opening/closing through five years after an opening/closing.

Figure 4 suggests that operating plants raise the incidence of low birthweight. There is little evidence of differential trends in the adjusted incidence of low birthweight between mothers living 0–1 and 1–2 miles away during the years leading up to plant openings or closings, which supports the validity of the design. After plant openings, there is a relative increase in the incidence of low birthweight among mothers living within one mile of a plant. After plant closings, there is some evidence of an opposite effect. Specifically, the incidence of low birthweight within one mile decreases modestly relative to what is observed between one and two miles although the decline is less sharp than in the plant opening panel.

Table 4 presents regression estimates, and is structured similarly to panels B and C of Table 2 which reports the housing price results. We focus on the panel B results, which have a clearer counterfactual and greater external validity. Further, due to the finding that toxic air emissions travel roughly 1 mile on average, we concentrate on the 0–1 mile results.

The final four columns suggest that an operating toxic plant increases the incidence of low birthweight by 0.0024 – 0.0037 percentage points or 3.3 percent–5.1 percent. The effects among infants born to mothers in the 0–0.5 mile and 0.5–1 mile ranges are nearly identical. It is also interesting that the larger estimates come from the restricted sample that only includes births within 2 years of a change in operating status.

The results are less conclusive on the question of whether a plant closing reverses the negative effects of a plant's operation on the incidence of low birthweight. On the one hand, all of the point estimates suggest that low birthweight declines after a plant closing. This decline, however, is only statistically significant at the 95 percent level of confidence in

[36] For a small number of observations there is missing data for one or more of these control variables and we include indicator variables for missing data for each variable.

[37] To limit the computational burden of estimating the first stage of the full sample, the first stage is estimated separately by state. Alternative group-level weights include the inverse of the sampling error on the estimated fixed effects, but since we are estimating state by state, the estimated standard errors are likely to be inefficient (although the group level estimates are still consistent) making this weighting mechanism less attractive. Donald and Lang (2007) present an alternative feasible GLS specification where the weights come from the group level residual and the variance of the group effect. Since all of these weights are proportional and highly correlated, the choice of weights has little effect on the results. We follow Angrist and Lavy (2009), who weight by the group cell size. These models have R^2s of about 0.3.

[38] We obtain similar results from group-level models that convert micro-level covariates into indicator variables and take means within cells.

column (8), though this specification is perhaps the most reliable one. The null that the coefficients are equal and of opposite sign cannot be rejected in any of the specifications.

Table 5 examines plant heterogeneity, stratifying plants as was done in the housing regressions (i.e., Table 3) using the version of equation (5) that includes plant-by-year fixed effects. There is little evidence of heterogeneity across these cuts of the data, except that there are no effects on low birthweight in areas with above median housing values. It is possible that richer households are better able to take compensatory measures to protect themselves.

We probed the robustness of these results in several ways. The results are qualitatively similar when we vary the set of controls used in our baseline regressions (see online Appendix Table A5), and when we use a comparison group of births that occur two to four miles from a plant, rather than one to two miles (see online Appendix Table A3). The results are also similar when we estimate the regressions separately by distance group (see online Appendix Table A4). These alternate specifications corroborate the main results, again indicating that the effects of plant operating status are highly localized, and providing additional empirical support for the choice of comparison group.

We also tested for changes in the composition of mothers giving birth in online Appendix Table A6. Documenting this type of compositional change is of significant independent interest (see, for example, Cameron and McConnaha 2006; Banzhaf and Walsh 2008; and Currie 2011). Overall, impacts of plant openings and closings on mothers' characteristics are small and generally statistically insignificant, suggesting that the low birthweight estimates are not driven by changes in the composition of mothers who live near plants. If anything, toxic plants appear to be associated with a small *increase* in the socioeconomic status of mothers; if the regressions fail to adequately adjust for these changes, then the measured health effects may modestly understate the true effects.

When assigning plant events to birth outcomes, there is some ambiguity as to whether the plant event occurred before or after a birth because we observe plant operating status just once a year in the LBD. In online Appendix Table A7 we investigate the sensitivity of our results to alternative approaches to timing. Estimates from these alternative specifications are largely consistent with our baseline findings. See the online Appendix for details.

C. Alternative Measures of Infant Health: Results

This section presents estimates for alternative measures of infant health. We begin by examining the influence of toxic plant activity on the birthweight distribution. We first create indicators for births falling within 500-gram birthweight intervals, and we aggregate these outcomes to the plant-by-distance bin by year level. We then use these binned averages as the dependent variable when estimating nine different versions of equation (5), one per bin. The resulting estimates of the parameter associated with $1[Plant\ Operating]_{jt} \times 1[Near]_{jd}$ are plotted in Figure 5. All regressions compare birth outcomes for mothers less than one mile from a plant to those of mothers living one to two miles away, so that these models are comparable to those presented in columns 5 and 6 of Table 4. Figure 5 suggests that when a plant is operating the birthweight distribution is skewed to the left, increasing the likelihood

of births below 2,500 grams. Appendix Table A8 reports the regression results that underlie this figure, as well as results that replace the 1[*Plant Operating*]$_{jt}$ variable with the 1[*Plant Opened*]$_{jt}$ and 1 [*Plant Closed*]$_{jt}$ variables.

Table 6 reports estimates of equation (5) using additional measures of infant health as the dependent variables. These estimates support the hypothesis that toxic plants damage infant health; birthweight decreases and the incidence of prematurity increases. The other birth outcomes are not individually statistically different from zero although this is perhaps unsurprising given that many of these outcomes, such as the incidence of very low birthweight (i.e., an infant born weighing less than 3.3 pounds or 1500 grams) and infant deaths, are an order of magnitude more rare than low birthweight.

In light of this issue of precision, the last two columns show models using a summary index measure of infant health as the dependent variable. We first convert each birth outcome measure so that they all move in the same direction (i.e., an increase is undesirable) and then subtract the mean and divide by the standard deviation of each outcome. We construct our summary measure by taking the mean over the standardized outcomes, weighting by the inverse covariance matrix of the transformed outcomes in order to ensure that outcomes that are highly correlated with each other receive less weight than those that are uncorrelated, and thus represent new information, receive more weight (Hochberg 1988; Kling, Liebman, and Katz 2007; Anderson 2008).[39] An operating plant has a small but statistically significant positive effect on the index, increasing the probability of a bad health outcome by 0.016–0.017 standard deviations.

VI. Interpretation

The estimates in Table 2 indicate that the opening of a toxic plant reduces housing values by roughly 11 percent within 0.5 miles and this effect appears to persist even after the plant ceases operations.[40] As with all of our estimates, this effect is measured relative to homes 1 to 2 miles away. Since the mean housing value within 0.5 miles of a plant is $125,927, this decrement corresponds to about $14,000 for the average house. In our sample, the value of the housing stock within 0.5 miles of a toxic plant is $38.5 million. Multiplying this figure by 11 percent yields a decline in local housing values of about $4.25 million per plant. Although non-negligible, these housing price changes are small compared to the capital cost of new industrial plants; for example, a typical natural gas power plant (620MW) costs about $570 million to build.[41]

It is important to bear in mind that this is an incomplete measure of these plants' total welfare consequences. For example, it misses the effects of increased emissions of criteria pollutants, such as particulates, ozone, and sulfur dioxide, which may harm human health over a much broader geographic area. Further, it does not include any impacts on non-

[39]Alternatively, we have created summary index measures that weight each outcome variable equally, as in Kling, Liebman, and Katz (2007), with little appreciable effect on our results.

[40]Potential explanations for a plant's lasting effect on property values even after it closes include persistent visual disamenities, concerns about local contamination, and an expectation that the plant will reopen.

[41]US Department of Energy, Energy Information Administration. 2013. "Updated Capital Cost Estimates for Utility Scale Electricity Generation Plants." http://www.eia.gov/forecasts/capitalcost/ (accessed May 2012).

residential property (which could even be positive if there are spillovers in production efficiency).[42] Moreover under our imposed assumption that the economic benefits of plant production accrue equally to homes within two miles of the plant, this estimate reflects an upper bound on the net costs associated with toxic plants. As we have emphasized throughout, these plants have positive as well as negative externalities, bringing jobs to local communities and potentially raising wages and housing prices over a wide area.

An appealing feature of the analysis is that it provides estimates of the effect of toxic plant openings on *both* housing prices and on an important health outcome. It is interesting to compare the estimates from the housing value analysis with a valuation of the low birthweight impacts. The point estimate in Table 4, column 6 implies that an operating toxic plant within one mile reduces the incidence of low birthweight by 0.0024 percentage points or 3.1 percent. There is an average of 67 births within 1 mile of each toxic plant per year. Thus, the estimate implies that there are approximately 0.16 additional low birthweight births per toxic plant per year. Using estimates in the literature, this corresponds to about $5,600 in decreased lifetime earnings per toxic plant per year.[43] This measure is small compared to the estimated value of losses in the housing market but, of course, low birthweight is only one of many potential health consequences of exposure to toxic plants. Further, the finding that housing prices remain depressed after the plant has closed and air toxic emissions have ceased suggests that willingness to pay is comprised of more than health effects in this setting.

VII. Conclusion

Toxic emissions are widely believed to cause birth defects, cancer, and other severe health impacts, yet there is little evidence about their effects on humans. Governments have only recently begun to regulate these emissions. In many respects, this state of affairs resembles the situation that prevailed more than four decades ago when the Clean Air Act compelled the EPA to begin to regulate airborne particulate matter and other criteria air pollutants. This paper represents a first step toward understanding the local external effects of toxic plant production on the health and well-being of local residents.

The application of a research design based on more than 1,600 plant openings and closings matched to extraordinarily detailed, geocoded data yields three primary findings. First, on average, toxic air pollutants affect ambient air quality only within 1 mile of the plants, suggesting that health effects from these emissions should be concentrated in this range. The highly localized range differs substantially from particulate matter emissions, which can affect ambient air quality several hundred miles away from their source. Second, the opening of a plant that emits these pollutants leads to a roughly 11 percent decline in housing prices

[42]The $4.25 million measure does not capture changes to the value of industrial, commercial, or undeveloped property. While some industrial uses may not be substantially affected by toxic plant proximity, commercial property and, perhaps more importantly, the price of undeveloped land may be affected.

[43]Black, Devereux, and Salvanes (2007) estimate that each 1 percent decrease in birthweight decreases expected earnings by about 0.13 percent. Based on our analysis of the distribution of birthweight, the impact appears to be more births 1,000–2,000 grams, compared to about 3,200 grams for the average birth, for a back-of-the-envelope average reduction of about 50 percent. So a low birthweight birth would be associated with approximately 6.5 percent lower lifetime earnings. Isen, Rossin-Slater, and Walker (2014) calculate that the mean present value of lifetime earnings at age zero in the US population is $542,000 (2000$) using a real discount rate of 3 percent (i.e., a 5 percent discount rate with 2 percent wage growth), so this is equivalent to $35,320 per low birthweight birth.

within 0.5 miles, or a loss of about $4.25 million per operating plant. Housing prices are largely unaffected by a plant closing, implying that toxic plants continue to negatively affect housing prices after they cease operations. Third, the incidence of low birthweight increases by roughly 3 percent within one mile of an operating toxic plant, with comparable magnitudes between 0 and 0.5 miles and 0.5 and 1 miles.

These results underscore opportunities for further research in several areas. We interpret the estimated effects of low birthweight to be a rejection of the null hypothesis that there are no health effects from toxic air emissions. This finding opens the door to seeking creative approaches to testing for longer run health effects on children and adults. It is also possible that toxic air emissions cause households to engage in costly behaviors to protect themselves and documenting these costs would be a contribution (see e.g., Deschenes, Greenstone, and Shapiro 2012).

This paper also raises broader questions around the determinants of housing prices. As computing power increases and more detailed data are accessible, it will be possible to assess the degree to which housing markets fully capture the present discounted value of all present and expected future amenities associated with a particular location. A related and important question is the degree to which health effects are capitalized into housing prices. Finally, we believe that a better understanding of belief formation around local amenities and how these beliefs interact with willingness to pay in the context of local housing markets is a critical area for future research.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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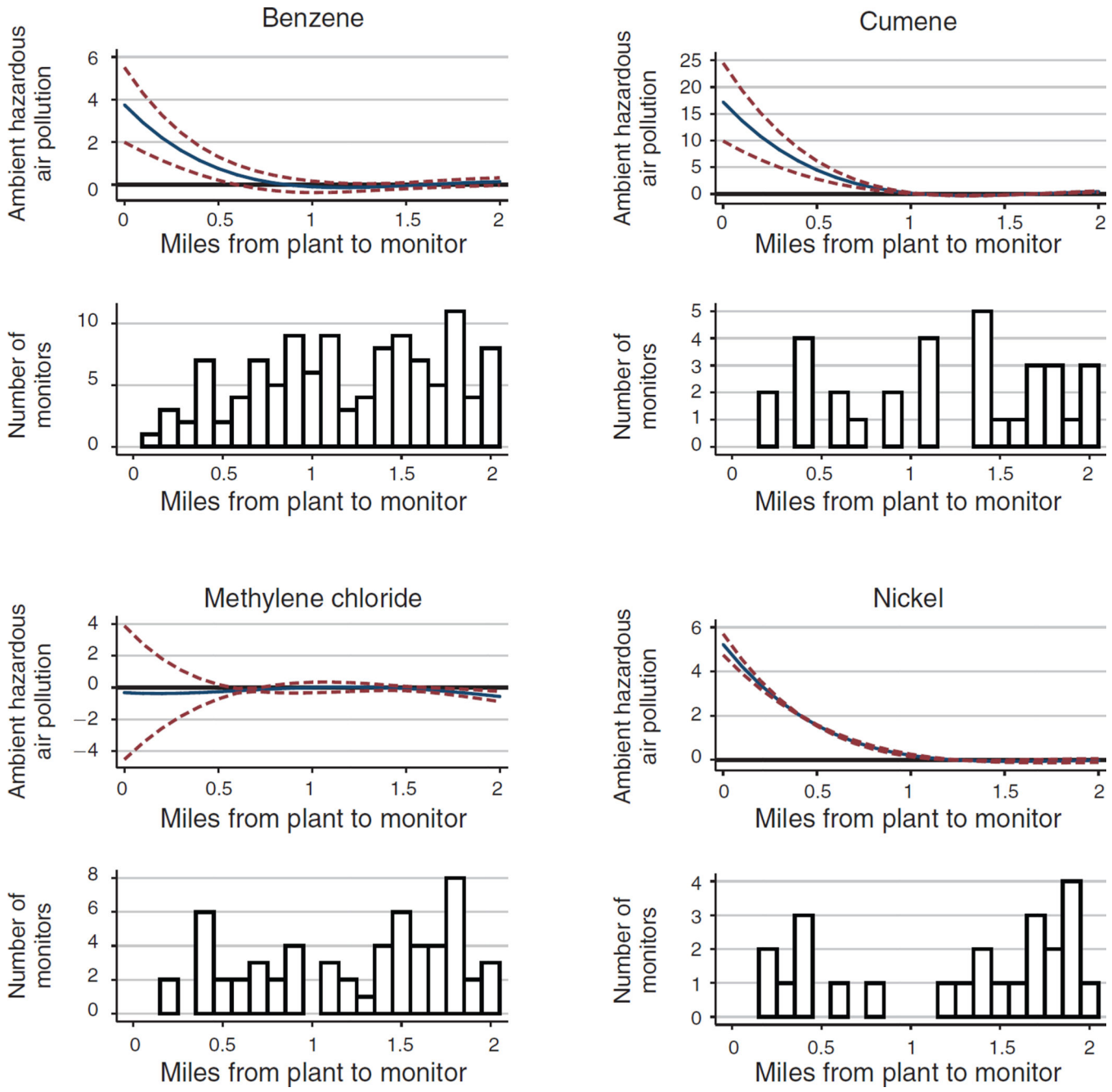


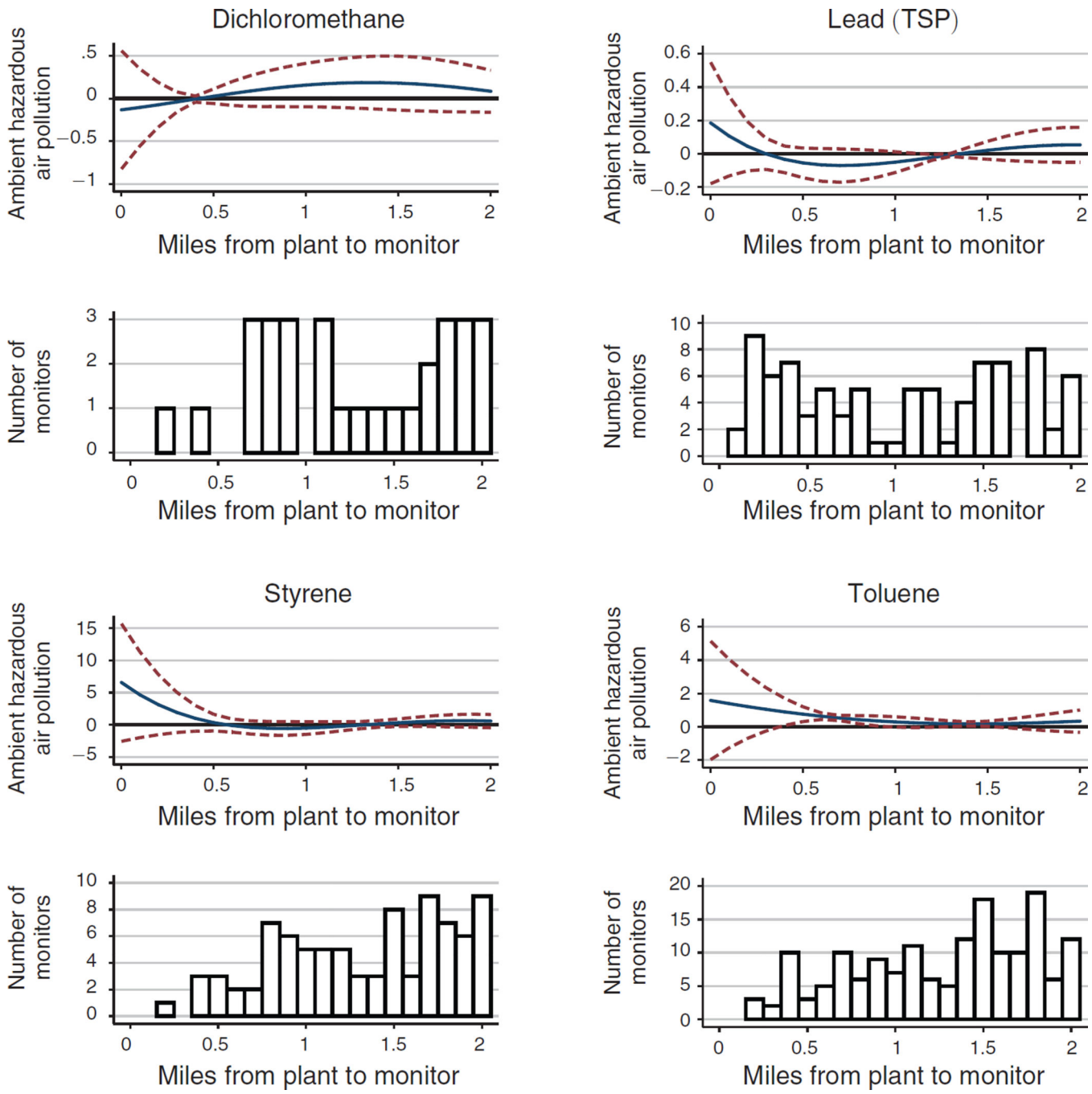


Figure 1. The Effect of Toxic Plants on Ambient Hazardous Air Pollution

Notes: This figure plots marginal effects and ninety-fifth percentile confidence intervals from 8 separate regressions of a single form of ambient hazardous pollution on a quartic in distance to the nearest operating toxic plant. The unit of observation is the monitor-plant pair and all regressions include monitor-plant fixed effects so the distance gradient is identified using plant openings and closings. In the regression sample, each pollutant has been standardized to be mean 0 and standard deviation 1. The distance gradient can therefore be interpreted as standard deviations from the mean value. Standard errors for the regression

are two-way clustered on plant and monitor, and the pointwise standard errors in the figure are calculated using the delta method. Below each pollutant specific graph is a histogram, representing the number of monitors at various distance bins from the plants in the sample.

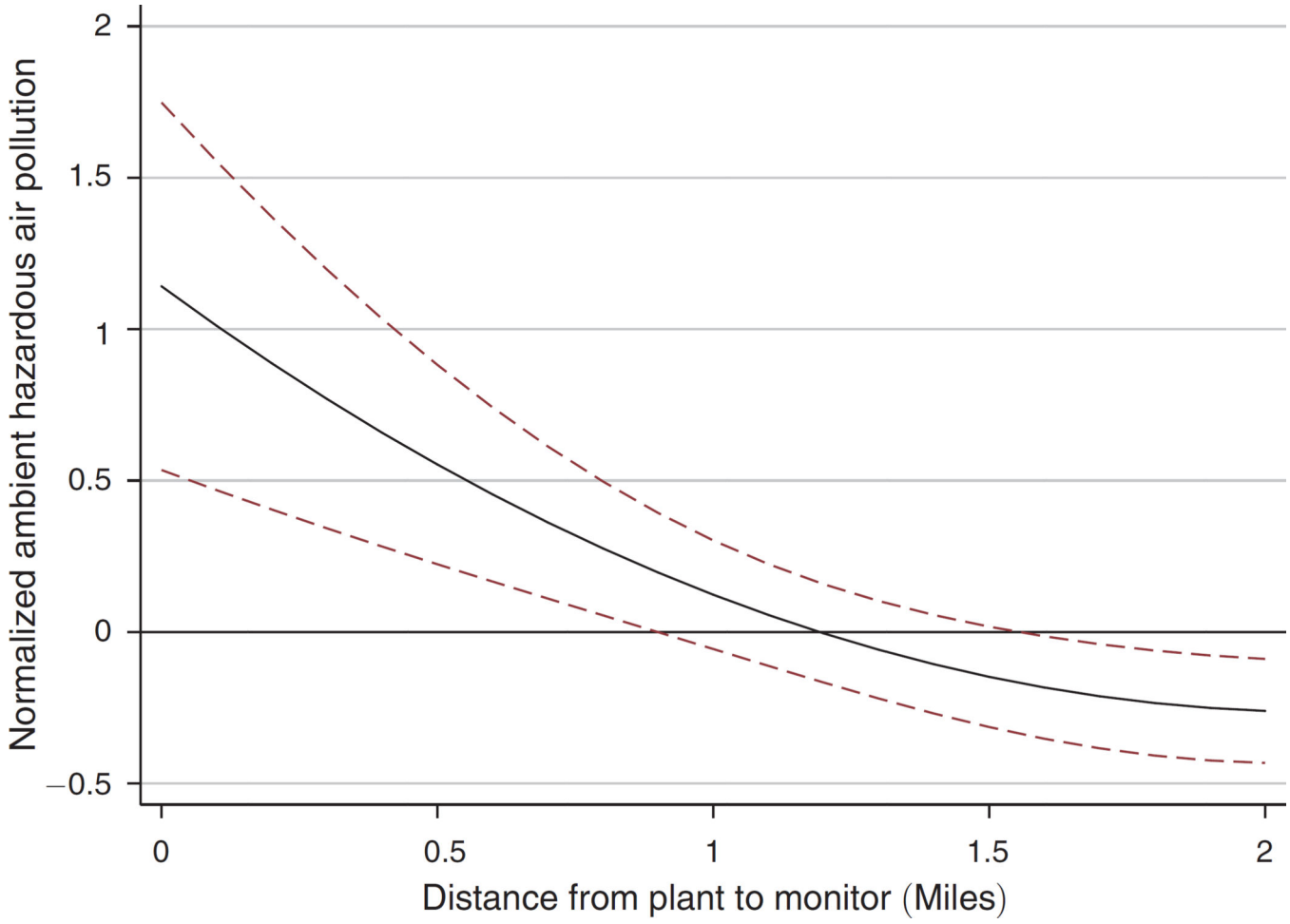


Figure 2. The Effect of Toxic Plants on Ambient Hazardous Air Pollution, All Pollutants

Notes: This figure plots marginal effects and ninety-fifth percentile confidence intervals from a regression of ambient hazardous pollution on a quartic in distance to the nearest operating toxic plant. The unit of observation is the monitor-plant pair and the regression includes monitor- plant fixed effects so the distance gradient is identified using plant openings and closings. In the regression sample, pollutants are pooled, standardizing each pollutant to be mean 0 and standard deviation 1. The distance gradient can therefore be interpreted as standard deviations from the mean value. Standard errors for the regression are two-way clustered on plant and monitor, and the pointwise standard errors in the figure are calculated using the delta method.

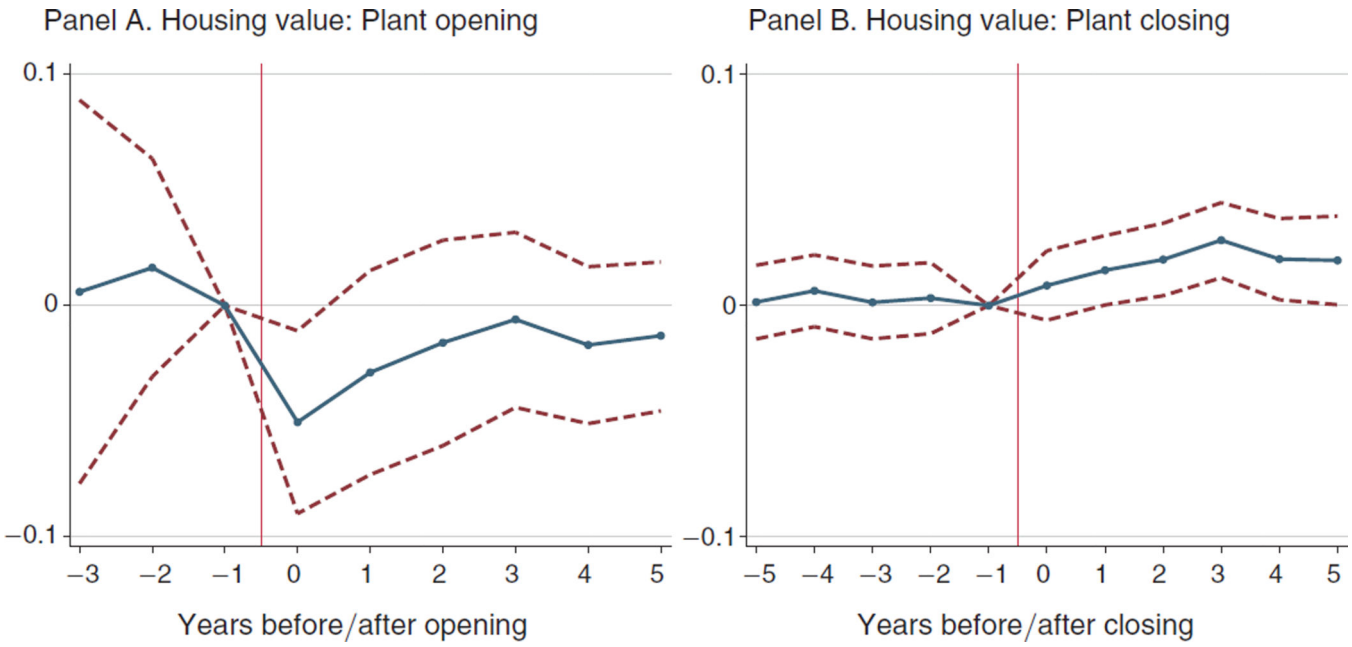


Figure 3. Event Study: The Effect of Toxic Plant Openings and Closings on Local Housing Values

Notes: These are event study plots created by regressing log housing sale price for a plant-by-distance-by-year cell on a full set of event time indicators interacted with an indicator for "near," plant-by-distance fixed effects, plantby- year fixed effects, and census controls (interacted with quadratic trends), weighting by the group-level cell size. Reported are the coefficients for event-time, which plot the time path of housing values "near" relative to "far" before and after a plant opening or closing. "Near" is defined as less than 1 mile between a plant and a house, and "far" is defined as 1–2 miles between a house and plant. The dashed lines represent 95 percent confidence intervals, where standard errors are computed using two-way cluster-robust standard errors, clustering on plant and year. Time is normalized relative to the year that the plant's operating status changes ($\tau = 0$), and the coefficients are normalized to zero in the year prior to a change in operating status ($\tau = -1$). The coefficients corresponding to four or more years before a plant opening are not identified due to the lack of openings in the second half of our sample period and the lack of housing data prior to 1998.

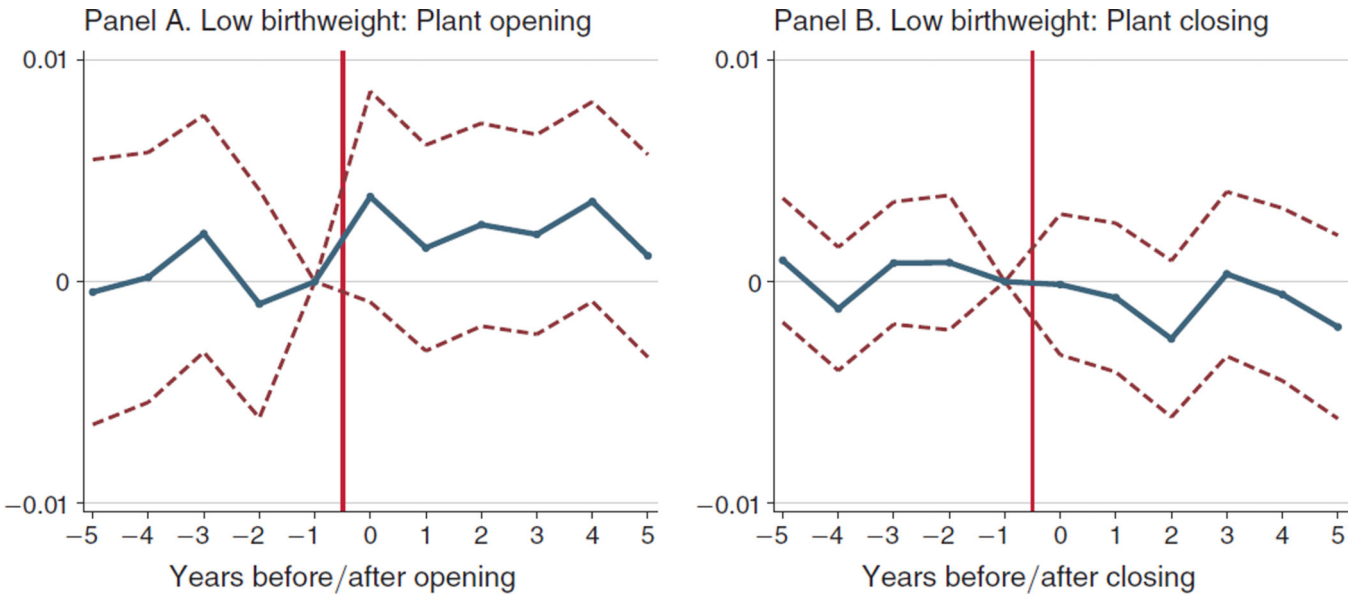


Figure 4. Event Study: The Effect of Toxic Plant Openings and Closings on the Incidence of Low Birthweight

Notes: These are event study plots created by regressing the incidence of low birthweight for a plant-by-distance by year cell on a full set of event time indicators interacted with an indicator for "near," plant-by-distance fixed effects, plant-by-year fixed effects, and census controls (interacted with quadratic trends), weighting by the group-level cell size. The dependent variable in the regression is the residualized mean incidence of low birthweight for a plant-by-distance-by-year, adjusted for micro-level covariates in a first stage. Reported are the coefficients for event-time, which plot the time path of low birthweight "near" relative to "far" before and after a plant opening or closing. "Near" is defined as less than 1 mile between a plant and a house, and "far" is defined as 1–2 miles between a house and plant. The dashed lines represent 95 percent confidence intervals, where standard errors are computed using two-way cluster-robust standard errors, clustering on plant and year. Time is normalized relative to the year that the plant's operating status changes ($\tau = 0$), and the coefficients are normalized to zero in the year prior to a change in operating status ($\tau = -1$).

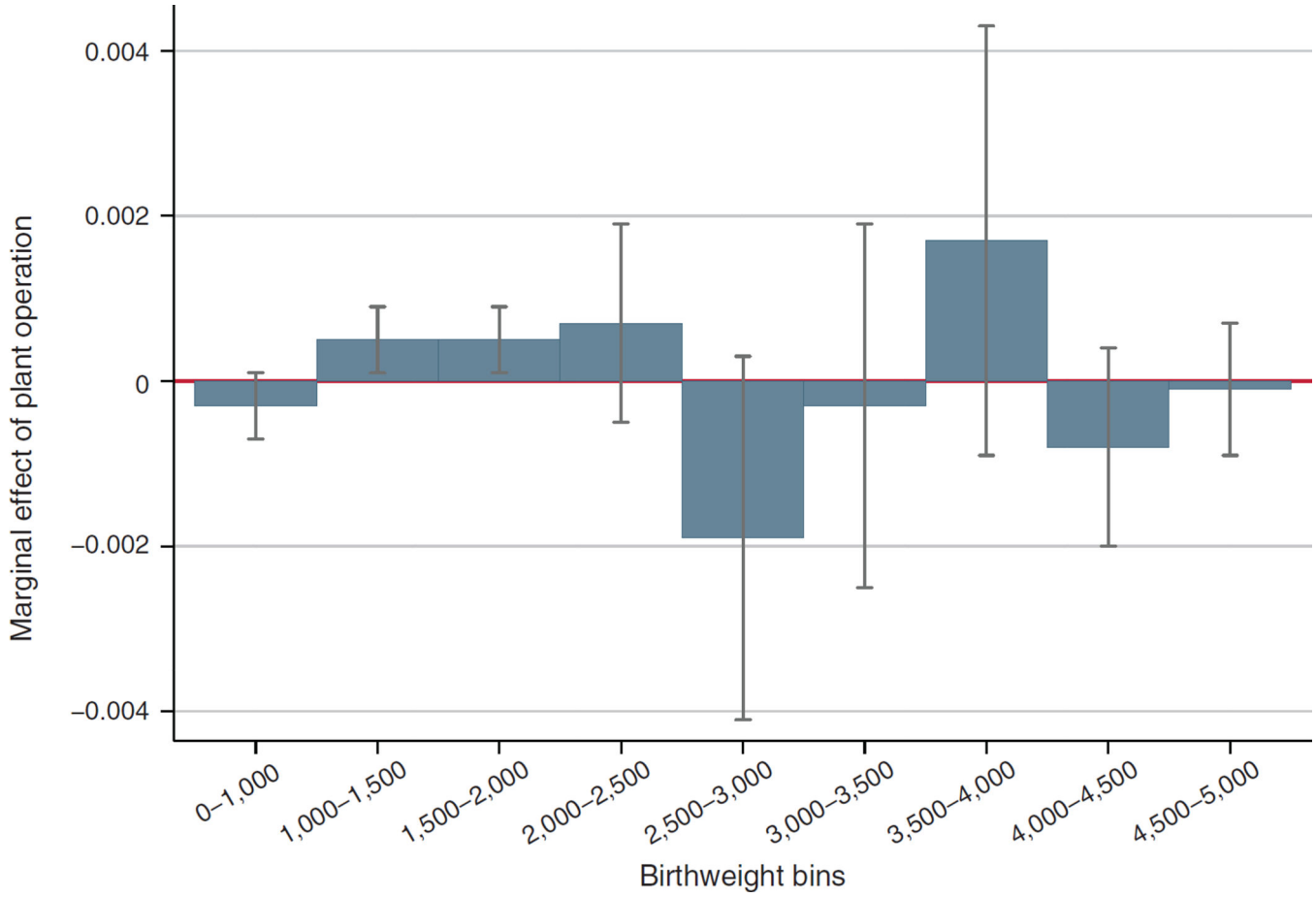


Figure 5. Effect of Plant Operation on the Distribution of Birthweight 0–1 Miles from a Plant

Notes: This figure reports regression coefficients from nine separate regressions. The dependent variable in each regression is an indicator variable for whether a birth falls in a particular birthweight range as indicated on the *x*-axis, and the data have been aggregated to plant-by-distance by year cells. The estimates reflect the effect of plant operation on "near" relative to "far" birth outcomes. All regression estimates control for census tract characteristics (interacted with quadratic trends) and regressions are weighted by the group-level cell size. Multiple births are dropped from regressions. Standard errors are two-way clustered by plant and year, and reported confidence intervals reflect 2 standard errors above and below the estimate.

Table 1

Characteristics of Toxic Plants and the Surrounding Community

	Open continuously 1990–2002 (1)	Opened between 1990–2002 (2)	Closed between 1990–2002 (3)	
Panel A. Plant characteristics by opening and closing status				
Number of plants	1,846	689	1,062	
Average plant employment (total workers)	224	90	114	
Average plant age (years)	18.6	2.0	16.2	
Mean value of plant equipment (in millions)	$15.8	$15.4	$14.9	
Mean value of plant structures (in millions)	$6.2	$5.8	$5.1	
Mean annual salary and wages (in millions)	$11.7	$5.5	$6.2	
Mean annual toxic emissions (in pounds)	22,016	23,303	17,919	
	$0 < d \leq 0.5$ (1)	$0.5 < d \leq 1$ (2)	$0 < d \leq 1$ (3)	$1 < d \leq 2$ (4)
Panel B. Community characteristics by distance, d, from plants that opened or closed 1990–2002				
Housing characteristics				
Mean housing value	$124,424	$126,492	$125,927	$132,227
Aggregate housing value (in millions)	$38.56	$60.00	$98.57	$174.80
Birth and maternal characteristics				
Mother’s education	11.93	12.08	12.05	12.22
Mother’s age	26.33	26.50	26.46	26.70
Proportion teenage mother	0.15	0.15	0.15	0.15
Proportion smoker	0.14	0.13	0.13	0.13
Proportion African American	0.23	0.25	0.25	0.26
Proportion Hispanic	0.32	0.30	0.31	0.29
Proportion white/Caucasian	0.72	0.71	0.71	0.70

Notes: Panel A describes the 3,438 plants in Florida, Michigan, New Jersey, Pennsylvania, and Texas that reported to the Toxic Release Inventory at least one year between 1990 and 2002. In calculating plant characteristics in columns 2 and 3, the sample is restricted to observations in the 2 years after a plant opening or 2 years before a plant closing, and a single plant can appear in both columns. Plant age is right censored, as the year a plant opened is not available for plants opened before 1975 in the Longitudinal Business Database. The value of plant equipment, structures, and salary and wages come from the NBER Productivity Database microdata and is only available for a subset of our data that matches the NBER Productivity Database in a given year. The value of plant equipment and structures is constructed using the perpetual inventory method from investment data (Mohr and Gilbert 1996). All dollar amounts are in 2000 dollars. Panel B statistics describe community characteristics surrounding toxic plants that either opened or closed between 1990 and 2002. Housing sales and births may appear in multiple columns if they are within 2 miles of more than one plant opening or closing, but within each column a house or birth appears only once.

Table 2

The Effect of Toxic Plants on Local Housing Values

	0–0.5 Miles		0.5–1 Miles		0–1 Miles		0–1 Miles (+/− 2 years)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A. Estimated effect of plant operation								
1(Plant Operating) × Near	−0.030*** (0.007)	−0.022*** (0.006)	−0.010** (0.005)	−0.012*** (0.004)	−0.015*** (0.005)	−0.014*** (0.004)	−0.009** (0.004)	−0.010*** (0.003)
Observations (plant-distance-year cells)	34,736	34,736	34,736	34,736	34,736	34,736	30,492	30,492
Plant × distance-bin FE	X	X	X	X	X	X	X	X
State × year FE	X		X		X		X	
Plant × year FE		X		X		X		X
Panel B. First difference: Estimated effect of plant operation								
1(Plant Operating) × Near	−0.020** (0.010)	−0.014** (0.007)	−0.008* (0.004)	−0.003 (0.004)	−0.010** (0.005)	−0.005 (0.004)	−0.005 (0.006)	−0.002 (0.005)
Observations	1,114,248	1,114,248	1,305,780	1,305,780	1,375,751	1,375,751	1,196,000	1,196,000
Panel C. First difference: Estimated effect of plant openings and closings								
1(Plant Opening) × Near	−0.096*** (0.036)	−0.107*** (0.034)	−0.007 (0.023)	−0.008 (0.020)	−0.020 (0.022)	−0.022 (0.019)	−0.030 (0.028)	−0.038 (0.025)
1(Plant Closing) × Near	0.017 (0.011)	0.010 (0.009)	0.008 (0.005)	0.003 (0.004)	0.010* (0.006)	0.005 (0.005)	0.005 (0.007)	0.001 (0.005)
H_0: Opening = −Closing (p-value)	0.051	0.013	0.968	0.827	0.688	0.438	0.402	0.164
Observations	1,114,248	1,114,248	1,305,780	1,305,780	1,375,751	1,375,751	1,196,000	1,196,000
State × year fixed FE	X		X		X		X	
County × year FE		X		X		X		X

Notes: This table reports regression coefficients from 24 separate regressions, 8 per panel, from a sample of 2,171 plants. The dependent variable in all regressions is housing values (in logs). Both the regression sample and the indicator variable "Near" change as one moves across the columns, indicated by the column headings. For example, the specification in columns 1 and 2 examines how group-level average housing values within 0.5 miles of a plant (i.e. "Near") respond to plant operating status, relative to the comparison group. The comparison group in all columns is homes between 1 and 2 miles from a plant. In columns 7 and 8, the sample removes observations more than two years before and after changes in plant activity. In panel A, the data have been aggregated to plant-by-distance-by-year cells and regressions are weighted by the group-level cell size. Panel B reports the same estimates as panel A using the set of houses we observe selling more than once in our sample and estimating in first

differences. Panel C estimates of the asymmetric effect of plant openings/closings using the first difference specification, including *p*-values from tests that the two coefficients are equal, but of opposite sign. All specifications control for census tract characteristics (interacted with quadratic trends). Standard errors two-way clustered by plant and year are in parentheses.

*** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level.

Table 3

The Effect of Toxic Plants on Local Housing Values: Above/Below Median (0–0.5 Miles), First-Difference

	Employment (1)	Payroll (2)	Fugitive emissions (3)	Stack emissions (4)	Mean toxicity (5)
1(Plant Operating) × 1(< 0.5 Miles)	−0.005	−0.002	−0.009	−0.008	−0.010
	(0.009)	(0.009)	(0.006)	(0.006)	(0.006)
1(Plant Operating) × 1(< 0.5 Miles) × 1(Above Median)	−0.012	−0.017	−0.010	−0.010	−0.006
	(0.012)	(0.012)	(0.015)	(0.014)	(0.014)
Observations	1,140,399	1,140,399	1,140,399	1,140,399	1,140,399
	Max toxicity (6)	Fraction college (7)	Fraction white (8)	Housing value (9)	Median income (10)
1(Plant Operating) × 1(< 0.5 Miles)	−0.003	−0.014**	−0.016**	−0.012	−0.024***
	(0.008)	(0.007)	(0.006)	(0.007)	(0.006)
1(Plant Operating) × 1(< 0.5 Miles) × 1(Above Median)	−0.016	0.007	0.014	0.002	0.032***
	(0.013)	(0.014)	(0.012)	(0.012)	(0.009)
Observations	1,140,399	1,140,399	1,140,399	1,140,399	1,140,399

Notes: This table reports regression coefficients from 10 separate regressions, where we interact our treatment variable 1(Plant Operating) × 1(< 0.5 Miles) with an indicator for whether the plant/community is above or below the median characteristic indicated in the column heading. The median indicator is equal to 1 if the plant-level median of the column variable (taken over plant operating years) is above or below the sample median value (taken over median plant values). The dependent variable in all regressions is housing values (in logs). All regressions control for county by year fixed effects and census tract characteristics (interacted with quadratic trends), and the model is estimated in first differences. Standard errors are two-way clustered by plant and year.

*** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level.

Table 4

The Effect of Toxic Plants on Low Birthweight

	0–0.5 Miles		0.5–1 Miles		0–1 Miles		0–1 Miles (+/− 2 years)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A. Estimated effect of plant operation								
1(Plant Operating) × Near	0.0010 (0.0010)	0.0012 (0.0012)	0.0014** (0.0006)	0.0015** (0.0006)	0.0013** (0.0006)	0.0014** (0.0007)	0.0021** (0.0009)	0.0026*** (0.0009)
Observations	88,958	88,958	88,958	88,958	88,958	88,958	63,324	63,324
Plant count	3,438	3,438	3,438	3,438	3,438	3,438	3,438	3,438
Panel B. Estimated effect of plant openings and closings								
1(Plant Opened) × Near	0.0025 (0.0019)	0.0022 (0.0018)	0.0024*** (0.0009)	0.0027*** (0.0010)	0.0024** (0.0009)	0.0024*** (0.0008)	0.0031* (0.0017)	0.0037** (0.0017)
1(Plant Closed) × Near	−0.0002 (0.0016)	−0.0007 (0.0016)	−0.0009 (0.0009)	−0.0009 (0.0010)	−0.0007 (0.0009)	−0.0009 (0.0009)	−0.0016 (0.0012)	−0.0021* (0.0013)
H_0: Opening = −Closing (p-value)	0.44	0.56	0.32	0.28	0.22	0.24	0.51	0.48
Observations	88,958	88,958	88,958	88,958	88,958	88,958	63,324	63,324
Plant count	3,438	3,438	3,438	3,438	3,438	3,438	3,438	3,438
Plant × Distance-bin FE	X	X	X	X	X	X	X	X
State × Year FE	X		X		X		X	
Plant × Year FE		X		X		X		X

Notes: This table reports regression coefficients from 16 separate regressions, 8 per panel. The dependent variable in all regressions is the mean incidence of low birthweight where the data have been aggregated to plant by distance by year cells. Cell level averages have been adjusted for maternal characteristics including age, education, race, and smoking behavior, as well as for month of birth, birth order, and gender of child. See text for details. The mean incidence of low birthweight in our sample is 0.07. Both the regression sample and the indicator variable "Near" change as one moves across the columns, indicated by the column headings. For example, the specification in columns 1 and 2 examines how group-level average birth outcomes within 0.5 miles of a plant (i.e. "Near") respond to plant operating status, relative to the comparison group. The comparison group in all columns is births between 1 and 2 miles from a plant. In columns 7 and 8, the sample removes observations more than two years before and after changes in plant activity. Panel A estimates the effect of plant operating status on local birth outcomes, where 1(Plant Operating) is an indicator variable equal to one for plants that have opened and/or have not yet closed. Panel B estimates the asymmetric effect of plant openings/closings. Panel B reports p-values from tests that the two coefficients are equal in magnitude but of opposite sign. All columns control for census tract characteristics (interacted with quadratic trends) and regressions are weighted by the group-level cell size. Multiple births are dropped from regressions. Standard errors are two-way clustered by plant and year.

*** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level.

Table 5

The Effect of Toxic Plants on Low Birthweight: Above/Below Median (*0–1 Miles*)

	Employment (1)	Payroll (2)	Fugitive emissions (3)	Stack emissions (4)	Mean toxicity (5)
1(Plant Operating) × 1(< 1 Mile)	0.0016** (0.0007)	0.0012 (0.0007)	0.0010 (0.0007)	0.0008 (0.0007)	0.0013* (0.0007)
1(Plant Operating) × 1(< 1 Mile) × 1(Above Median)	−0.0010 (0.0013)	0.0003 (0.0014)	0.0007 (0.0013)	0.0010 (0.0011)	−0.0001 (0.0017)
Observations	88,958	88,958	88,958	88,958	88,958
	Max toxicity (6)	Fraction college (7)	Fraction white (8)	Housing value (9)	Median income (10)
1(Plant Operating) × 1(< 1 Mile)	0.0006 (0.0007)	0.0007 (0.0007)	0.0010* (0.0005)	0.0028*** (0.0010)	0.0014* (0.0007)
1(Plant Operating) × 1(< 1 Mile) × 1(Above Median)	0.0020 (0.0013)	0.0017 (0.0017)	0.0009 (0.0010)	−0.0028* (0.0017)	−0.0003 (0.0013)
Observations	88,958	88,958	88,958	88,958	88,958

Notes: This table reports regression coefficients from 10 separate regressions, where we interact our treatment variable 1(Plant Operating) × 1(< 1 Mile) with an indicator for whether the plant/community is above or below the median characteristic indicated in the column heading. The median indicator is equal to 1 if the plant-level median of the column variable (taken over plant operating years) is above or below the sample median value (taken over median plant values). The dependent variable in all regressions is the mean incidence of low birthweight, where the data have been aggregated to plant by distance by year cells. Cell level averages have been adjusted for micro covariates, and all regressions control for plant by distance and plant by year fixed effects, as well as census tract characteristics (interacted with quadratic trends). Regressions are weighted by the group-level cell size. Standard errors are two-way clustered by plant and year.

*** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level.

Table 6

The Effect of Toxic Plants on Alternative Measures of Infant Health

	Birthweight (grams, in logs) (1)	Birthweight (grams, in logs) (2)	Very low birthweight (3)	Very low birthweight (4)	Premature (5)	Premature (6)
1(Plant Op) × 1(< 1 Mile)	−0.0011*** (0.0003)	−0.0012*** (0.0004)	0.0001 (0.0002)	0.0001 (0.0001)	0.0009** (0.0004)	0.0009** (0.0005)
Observations	88,958	88,958	88,958	88,958	88,404	88,404
Mean	8.09	8.09	0.0113	0.0113	0.0845	0.0845
Plant × dist-bin FE	X	X	X	X	X	X
State × year FE	X		X		X	
Plant × year FE		X		X		X
	Congenital anomaly (7)	Congenital anomaly (8)	Infant death (9)	Infant death (10)	Summary index (11)	Summary index (12)
1(Plant Op) × 1(< 1 Mile)	−0.0003 (0.0009)	−0.0005 (0.0010)	0.0001 (0.0001)	0.0000 (0.0001)	0.0165** (0.0066)	0.0158** (0.0071)
Observations	88,212	88,212	89,388	89,388	89,388	89,388
Mean	0.0679	0.0679	0.0068	0.0068	−0.0004	−0.0004
Plant × dist-bin FE	X	X	X	X	X	X
State × year FE	X		X		X	
Plant × year FE		X		X		X

Notes: This table reports regression coefficients from 12 separate regressions on a sample of 3,438 plants. The dependent variable is listed in the column heading, and data have been aggregated to plant by distance by year cells. Cell level averages have been adjusted for maternal characteristics. See text for details. The comparison group in all columns is births between 1 and 2 miles from a plant. Columns 11 and 12 present results from a summary index measure of outcomes to address concerns pertaining to inference with a large number of outcomes. Outcomes for the summary index measure include those listed above, in addition to low birthweight, and outcomes are standardized to be mean 0 and standard deviation 1. Before combining, birthweight is multiplied by −1 so that an increase in the summary index measure reflects an increase in adverse health outcomes. All regressions control for tract characteristics (interacted with quadratic trend). Multiple births are dropped from regressions. Regressions are weighted by the group-level cell size. Standard errors are two-way clustered by plant and year.

Grace_email_testimony Shamieka_house.pdf
Uploaded by: Shamieka Preston
Position: FAV

February 24, 2025

Dear Environment and Transportation committee members,

My name is Shamieka Preston, my husband, 12-year-old, and 9-year-old have lived in Cedar Creek since 2022.

We moved from California to Columbia due to Howard County's commitment to racial and economic inclusion and the environment.

We left California in part due to years of wildfires affecting our air quality and quality of life. Although we were located hundreds of miles from the wildfires, we were impacted daily during fire season. My husband and I were deeply concerned about the effects of these toxic chemicals on ourselves and our young children. Fast forward to today, we are genuinely concerned about a new, unexpected environmental threat. Our home is 200 feet from the WR Grace facility where they would like to build an "advanced recycling" pilot plant.

It is truly unfortunate that the WR Grace has even gotten this far in their permitting process. They have moved through various processes in the approval chain without any regulators, zoning officials, etc saying, "No Grace, your attempt to burn plastic is way too dangerous to happen near residential homes."

I support HB1058 and HB 1092 for the following reasons:

1. The EPA and MDE have designated WR Grace's pilot plant as a pyrolysis incinerator.[1]
In the attached communications between the Maryland Department of the Environment (MDE) the Environmental Protection Agency (EPA), they have officially defined WR Grace's proposed pilot plant as a *pyrolysis incinerator*. To those who live nearby, this is extremely important and pertinent because Grace has repeatedly stated, in local media, public hearings, and on their website, that their pilot plant is **not** an incinerator.

Although the pilot plant meets the applicability criteria for a pyrolysis incinerator, it does not appear that MDE is intending to regulate it as one.

WR Grace's proposal to build an incinerator on their campus, within 200 feet from homes and backyards with kids and other vulnerable groups, should be of grave concern to local residents, elected officials, and the broader Howard County community. Setting this type of precedent could enable other bad actors to build other hazardous facilities in the name of research. Howard County should not allow any company to build any type of incinerator near homes or outside of manufacturing or industrial zones.

[1] See Attachment "Pyrolysisunits-defined.png"- EPA's working definition of Pyrolysis Units from the Other Solid Waste Incinerators (OSWI): New Source Performance Standards (NSPS) and Emission Guidelines (EG) for Existing Sources

For more details, see attached document named, "Enclosure- WR Grace Reg. Interpretation Signed.pdf", " 25-01482-R03-PAO Walsh.pdf", "Enclosure-OSWI Applicability Detemination Request Letter.pdf"

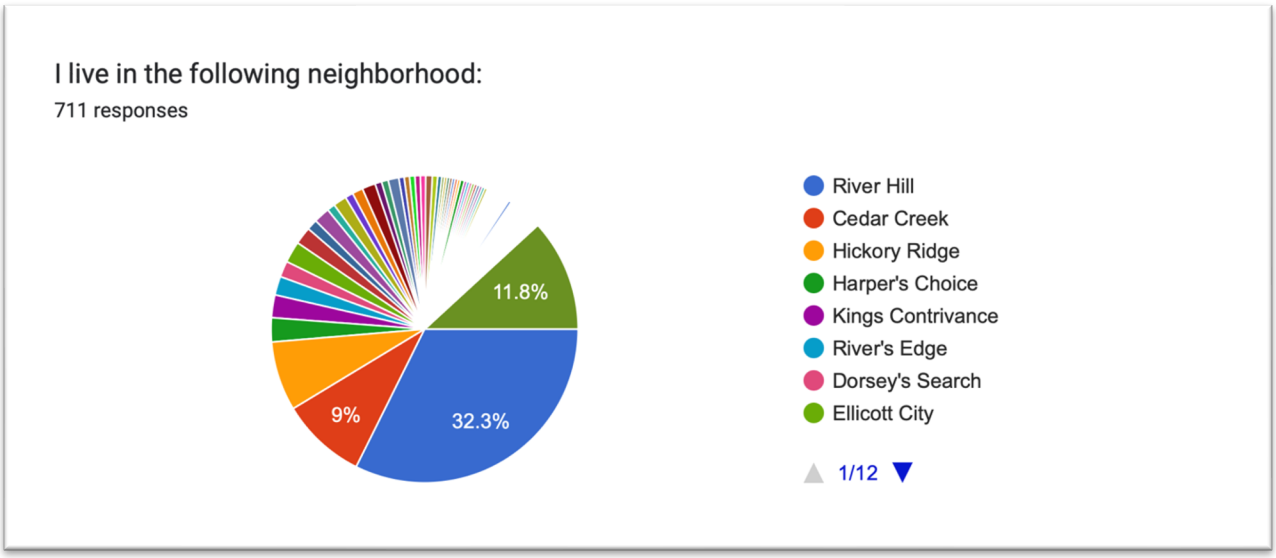
I have spoken to many of the residents who signed petitions, attended hearings, and lent their voices to this cause, we would not have opted to live near WR Grace had we known they intended to build an incinerator (no matter the size nor purpose). My family certainly would not have.

2. Community members are alarmed by the WR Grace pilot plant project.

The Stop Grace grassroots organization created a petition and collected over 700 names of those who oppose Grace's Pyrolysis Incineration Project. This petition has evolved over time based on growing concern and outreach. Despite the evolution, the message from those who signed is clear and emphatic:

> ***"...RESPECTFULLY PETITION OUR LOCAL AND STATE OFFICIALS AS WELL AS OUR COUNTY AND STATE AGENCIES TO BLOCK W.R. GRACE FROM CONSTRUCTING AND OPERATING THE PROPOSED PILOT PLANT.***

The data extract below demonstrates that the vast majority of respondents live in the communities within a mile of WR Grace (including Cedar Creek, River Hill and Hickory Ridge) with many others neighboring communities within Howard County sharing the same concerns.[2]



3. **An NIH study showed that health risks increase within 1 mile of toxic air emissions**

The majority of the concerned petitioners live closest to the WR Grace Project. According to a 2015 NIH Study[3]of 1,600 industrial plants with toxic air emissions, there are clear impacts to health and housing

[2] For more details, see attached document named, "Stop Grace Member Petition_combinedMaster.pdf"

[3]Detailed information can be found in the link and attached document named, "Environmental Health Risks and Housing Values Evidence from 1,600 Toxic Plant Openings and Closings.pdf"

prices in communities that are within 1 mile of a plant emitting toxic air pollutants. A summary of the study and the findings are as follows:

> The application of a research design based on more than 1,600 plant openings and closings matched to extraordinarily detailed, geocoded data yields three primary findings. First, on average, toxic air pollutants affect ambient air quality only within 1 mile of the plants, suggesting that health effects from these emissions should be concentrated in this range. The highly localized range differs substantially from particulate matter emissions, which can affect ambient air quality several hundred miles away from their source. Second, the opening of a plant that emits these pollutants leads to a roughly 11 percent decline in housing prices within 0.5 miles, or a loss of about $4.25 million per operating plant. Housing prices are largely unaffected by a plant closing, implying that toxic plants continue to negatively affect housing prices after they cease operations. Third, the incidence of low birthweight increases by roughly 3 percent within one mile of an operating toxic plant, with comparable magnitudes between 0 and 0.5 miles and 0.5 and 1 miles.

On a personal note, this is one of the most terrifying points for me as a parent and homeowner because my house is approximately 200 feet from Grace's fence line and within line of sight of Building 30, the intended site for the pyrolysis incinerator. My children and my neighbor's children play in our backyards which abut Grace's fence. I am deeply concerned over the potential negative health impacts to my children, visiting relatives, and neighborhood animals (including my 14-month-old dog), waterways, and the broader environment. In addition, wild animals such as deer, foxes and bunnies roam the land between Robinson Nature Center, Cedar Creek, and WR Grace's campus and the Middle Patuxent River runs nearby.

This photo, taken from my front porch on February 14, 2025, is of WR Grace's corporate headquarters located at 7500 Grace Drive, Building 30.

4. **WR Grace plans to emit toxic air emissions for most of the day, for more than half of the year, for an unknown number of years.**

According to [WR Grace's Air and Radiation Administration Application for Permit to Construct Docket #16-23], they will run their incinerator every hour for 16 hours a day, 5 days a week, and for 50 weeks each year. The below is a screen capture of the page in their permit where they outline the projected schedule.

Describe the emission point including all associated equipment and control devices:
31 of 169 tput gas stream controlled by thermal oxidizer

3. Emissions Schedule for the Emission Point			
Continuous or Intermittent (C/I)?	I	**Seasonal Variation** Check box if none: ☒ Otherwise estimate seasonal variation:	
Minutes per hour:	60	Winter Percent	
Hours per day:	16	Spring Percent	
Days per week:	5	Summer Percent	
Weeks per year:	50	Fall Percent	

In an April 11, 2024, [virtual public hearing (YouTube video)], hosted by the Maryland Department of the Environment, Grace's lead scientists on the project stated, "we envision this running primarily between waking hours" for an unknown number of years (see YouTube video linked above, timestamps 32:34 and 1:03:50). The Grace scientists were unable to express an exact number of years, "we expect a fairly long run in terms of the number of years that we will operate this pilot plant."

This is untenable for folks who have just moved into our homes and especially for those of us with young children who need to be outdoors. As new members to the Cedar Creek community and Howard County as a whole, Grace is severely limiting our enjoyment of our new home and community.

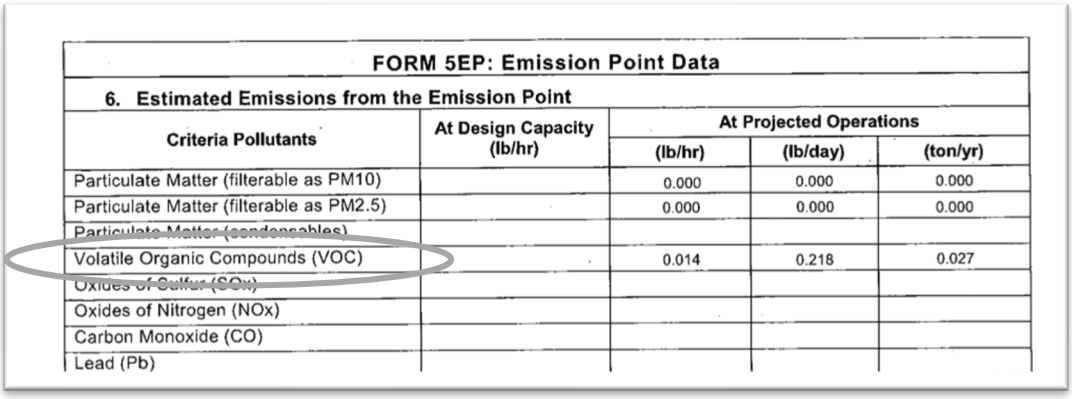
It is unfair that Grace stands to gain with their pilot plant while their closest neighbors are negatively impacted. Grace gets to conduct research every day of the week nearly every week of the year for "4000 hours a year" for an unknown number of years. As a result, neighbors like me, lose access to my outdoor space due to pollution exposure and noise every day of the week, nearly every week of the year, for an unknown number of years.

Additionally, we get to worry about when the toxic air emissions, including, and especially, VOCs will increase our risks of respiratory ailments and cancer.

The potential health and safety impacts have already affected our family's plans. We've stopped investing in home improvements projects (which impacts local businesses); we are stressed about whether our neighborhood can weather this storm. Leaving would devastate our family. Staying would destroy our health. These are difficult decisions we shouldn't have to make 2 years into a new home but the risks of a pyrolysis incinerator so close is too serious to ignore.

5. **WR Grace continues to contradict themselves in their documentation. We do not know what to believe and we do not trust them with our safety.**

In the case of the pyrolysis incinerator that Grace wants to operate, details matter. I will give you one simple example that highlights this point. In WR Grace's permit application, they state the number of pounds of anticipated daily VOCs emitted is projected to be ***"0.218 lb/day"*** (see below screenshot from their Form 5EP submission).

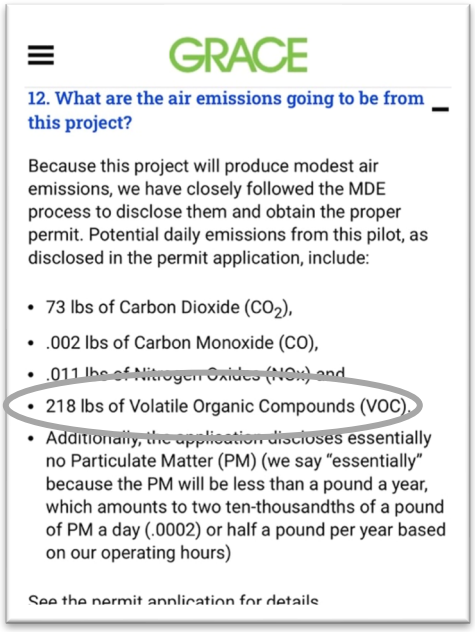


FORM 5EP: Emission Point Data

6. Estimated Emissions from the Emission Point

Criteria Pollutants	At Design Capacity (lb/hr)	At Projected Operations (lb/hr)	(lb/day)	(ton/yr)
Particulate Matter (filterable as PM10)		0.000	0.000	0.000
Particulate Matter (filterable as PM2.5)		0.000	0.000	0.000
Particulate Matter (condensables)				
Volatile Organic Compounds (VOC)		0.014	0.218	0.027
Oxides of Sulfur (SOx)				
Oxides of Nitrogen (NOx)				
Carbon Monoxide (CO)				
Lead (Pb)				

As recently as Sunday, February 16, 2025, their website, intended to explain the pilot project, stated that "***218 lb/day"*** of VOCs would be emitted -- **a 1,000x difference**. (see below screenshot from their website).



A missed "comma or period" can be catastrophic. This is just one example of the carelessness and contradictions around what Grace has communicated regarding this plant and its impacts. Recklessness like this could be the difference between life and death. It can lead to more toxic emissions than projected, a fire, or an explosion. A mistake this big makes us wonder how many of their "facts" can be trusted. If they cannot get the details right now, how can we trust them to safeguard our health and safety in the future? **MY GREATEST DESIRE IS THAT MY HOME DOES NOT BECOME A TOXIC WASTE ENVIRONMENT DUE TO GRACE'S MISSED DECIMAL POINTS.**

6. **WR Grace has a history of causing harm to communities**

WR Grace has not been a good neighbor now or ever. Since they became a chemical company in the early 1950s, they have left a string of disasters across many cities including Columbia. Their consent order to clean up groundwater here continues and local communities such as Curtis Bay continue to experience issues related to having WR Grace as a neighbor. See the following links for more information on WR Grace's decades long negative impact on local communities: Wayne, NJ, Woburn, MA, Acton, MA, Libby, MO, Tampa, FL. In total, they have had 32 superfund sites to remediate and many toxic spills since including one as recently as 2023.

7. **Recent changes to federal funding will impact MDE's ability to monitor air pollution including WR Grace's pilot plant**

Finally, I will leave you with this. Last week, it was announced that nearly $14 million in federal funds intended for Maryland Department of the Environment (MDE) were frozen, impacting their ability to monitor air pollution (see screenshot below from WYPR news article).

> About $13.7 million in direct grants to the Maryland Department of the Environment were “suspended” Tuesday, agency spokesman Jay Apperson said. They include funding for air pollution monitoring, mining-related projects, the expansion of electric vehicle chargers, coastal and forest restoration projects, and workforce training for energy-sector jobs.

We do not know if this funding will be reinstated. Without independent monitoring, there is no clear understanding of how Maryland or Howard County would be able to hold WR Grace to their projected emissions.

It is for all of these stated reasons, that I believe no company—present or future—should be allowed to operate a pyrolysis incinerator or similar technology involving “commercial plastic pellets or feedstock which produces flue gas and requires a permit from the state of Maryland” near residential homes. There should be no loopholes, no exceptions, and no grandfathering in for any company in Howard County.

I implore you, as the officials whom we elected to keep our communities safe, to do the right thing and approve CB11-2025. This measure will ensure that Howard County families stay safe from air pollution, fires, explosions hazards and pilot plants that lack community support and offer little to the adjacent communities.

Sincerely,

Shamieka Preston and family

part1_Enclosure- OSWI Applicability Detemination R
Uploaded by: Shamieka Preston
Position: FAV

Maryland
Department of the Environment

Wes Moore, Governor
Aruna Miller, Lt. Governor

Serena McIlwain, Secretary
Suzanne E. Dorsey, Deputy Secretary

SENT VIA E-MAIL CORRESPONDENCE

December 13, 2024

Ms. Karen Melvin, Director
EPA Region 3
Enforcement and Compliance Assurance Division
melvin.karen@epa.gov

Ms. Cristina Fernandez, Director
EPA Region 3
Air and Radiation Division
fernandez.cristina@epa.gov

Dear Director Melvin and Director Fernandez:

I am writing to you on behalf of the Maryland Department of the Environment's Air and Radiation Administration (ARA) to request an applicability determination regarding a proposed pilot plant to be located in Howard County, Maryland and the Standards of Performance for Other Solid Waste Incineration (OSWI) Units for Which Construction is Commenced After December 9, 2004, or for Which Modification or Reconstruction is Commenced on or After June 16, 2006 at 40 CFR 60, Subpart EEEE.

Background

On September 21, 2023 W.R. Grace & Co.-Conn ("Grace") submitted an air quality application for a permit to construct a new pilot plant in Howard County, MD. The pilot plant will be used to research the scaling up of an innovative process to convert 1 kg/hr of plastics back to their original components. The reactor in this proposed process will use a catalyst and heat in the form of steam to carry out this reaction. The product from the reactor is a vapor. The vapor is sent via pipe to a condenser. The vapor that is liquified in the condenser is the product, which is then stored in drums. The drums are sent off site for disposal once data is collected. Non-condensables from the condenser are sent via pipe to an electric flameless thermal oxidizer to control any VOC that may be present in the gas stream.

The project will have two phases of testing. In the first phase, the feed will consist of virgin plastic pellets from commercial suppliers. Grace plans to use a variety of types of pellets to assess the potential reaction products from different types of plastics. In addition, Grace may also add non-hazardous materials, such as calcium carbonate, to test the impact of these materials on the reaction output. If the results of the first phase indicate that the process is technologically feasible and commercially viable, Grace hopes to conduct a second phase of the project to test recycled plastics. The pilot plant can not directly process plastic waste. During the second phase of the project, Grace will need to clean and pelletize recycled plastic or purchase cleaned, pelletized recycled plastic.

The process in the pilot plant reactor is a catalytic chemical conversion, or catalytic pyrolysis. 40 CFR, Part 60, Subpart EEEE includes pyrolysis units as OSWI units by definition. The reactor in the proposed Grace pilot plant would be subject to the requirements of 40 CFR 60, Subpart EEEE as a pyrolysis unit unless otherwise exempt.

Laboratory Analysis Unit Exemption

40 CFR §60.2887 lists combustion units that are exempt from Subpart EEEE. Specifically, §60.2887(j) states the following:

"Laboratory Analysis Units. Your unit is excluded if it burns samples of materials only for the purpose of chemical or physical analysis."

Grace's proposed pilot plant only serves to gather and analyze data for research. There is no product being manufactured for sale from this operation. This is further detailed in the air quality permit to construct application, enclosed as Appendix A, and supplemental letter submitted by Grace, enclosed as Appendix B. ARA requests a determination from EPA regarding whether the proposed pilot plant's pyrolysis unit is exempt from 40 CFR 60, Subpart EEEE as a laboratory analysis unit.

Furthermore, Grace's proposed pilot plant will use both virgin plastic pellets and recycled plastic pellets as raw materials for their process. 40 CFR 60, Subpart EEEE applies to OSWI units if the units combust municipal solid waste. Virgin pellets are not solid waste, and as such the first phase of the project is exempt from the requirements of 40 CFR 60, Subpart EEEE. If the pilot plant's pyrolysis unit is not exempt from Subpart EEEE as a laboratory analysis unit, it is necessary to determine if the pellets used in the second phase of the project meet the definition of municipal solid waste.

Non-Solid Waste Exemption

In order to determine if the pellets originating from recycled material meet the definition of municipal solid waste, a review of the RCRA rules for Non-Hazardous Secondary Materials (NHSM) is required. Although many EPA guidelines refer to the use of NHSM as fuel, this does not directly apply to the Grace pilot plant. The recycled pellets will be used as an ingredient, not a fuel, in the proposed process.

Examining 40 CFR §241.3, *Standards and procedures for identification of non-hazardous secondary materials that are solid wastes when used as fuels or ingredients in combustion units,* §241.3(b)(3) states that NHSM used as an ingredient in a combustion unit that meet the legitimacy criteria of §241.3(d)(2), listed below, are not solid wastes when combusted.

"Legitimacy criteria for non-hazardous secondary materials used as an ingredient in combustion units include the following:

(i) The non-hazardous secondary material must be managed as a valuable commodity based on the following factors:

   (A) The storage of the non-hazardous secondary material prior to use must not exceed reasonable time frames;

   (B) Where there is an analogous ingredient, the non-hazardous secondary material must be managed in a manner consistent with the analogous ingredient or otherwise be adequately contained to prevent releases to the environment;

   (C) If there is no analogous ingredient, the non-hazardous secondary material must be adequately contained to prevent releases to the environment;

(ii) The non-hazardous secondary material must provide a useful contribution to the production or manufacturing process. The non-hazardous secondary material provides a useful contribution if it contributes a valuable ingredient to the product or intermediate or is an effective substitute for a commercial product.

(iii) The non-hazardous secondary material must be used to produce a valuable product or intermediate. The product or intermediate is valuable if:

(A) The non-hazardous secondary material is sold to a third party, or

(B) The non-hazardous secondary material is used as an effective substitute for a commercial product or as an ingredient or intermediate in an industrial process.

(iv) The non-hazardous secondary material must result in products that contain contaminants at levels that are comparable in concentration to or lower than those found in traditional products that are manufactured without the non-hazardous secondary material."

Although the pellets originated from recycled materials, they are cleaned and re-processed to be used as a feedstock. The pellets have not been discarded or abandoned in a landfill and are expected to be processed in the pilot plant in a reasonable amount of time. The pellets from recycled material will be handled in the same way as the analogous virgin plastic pellets. The pellets will be used as the primary ingredient of the proposed process, providing an essential and useful contribution as a research feedstock.

The process intends to reduce the pellets to the original components of plastic and would only contain contaminants comparable to those found in traditional plastic. If the pilot plant's pyrolysis unit is not exempt from Subpart EEEE as a laboratory analysis unit, ARA requests a determination from EPA regarding whether the recycled plastic pellets used in proposed pilot plant's pyrolysis unit qualify as a NHSM used as an ingredient and therefore, not subject to the requirements of 40 CFR 60, Subpart EEEE.

Thank you for your consideration of this request. Should you have any questions regarding this letter, please contact me at 410-537-4129 or by email at suna.sariscak@maryland.gov.

Sincerely,

Suna Yi Sariscak

Suna Yi Sariscak, Manager
Air Quality Permits Program
Air and Radiation Administration

cc: Kris Hall, Chief Air Section, Air and RCRA Branch, Enforcement & Compliance Assurance Division, EPA Region 3

Mary Cate Opila, Air Permits Branch Manager, EPA Region 3

Enclosures

APPENDIX A

W.R. Grace &Co.-CONN
Air Quality Permit to Construct Application
Received September 2023 and
Revised January 2024

August 3, 2023

Suna Yi Sariscak, Manager
Air Quality Permits Program
Maryland Department of the Environment
Air and Radiation Management Administration
1800 Washington Boulevard, Suite 720
Baltimore, Maryland 21230-1720
MDE.Submit-AirPermits@maryland.gov

Re: Permit to Construct (PTC) Application to Install Research Pilot Scale Test Catalytic Chemical Conversion of Plastics Process

Dear Ms. Sariscak:

W.R. Grace & Company – Conn. (Grace) is submitting this PTC application to construct a research pilot scale test catalytic chemical conversion of plastics process at the Columbia, Maryland facility. This test process will use Grace's innovative catalyst technology to convert commercially available plastic pellets into potentially usable energy-containing liquids and gas. This test process will evaluate the desired new technologies including catalyst and process conditions as well as resultant liquid/gas properties for research and development purposes only. As presented in the PTC application the reactor gases will be controlled by a very high efficiency electric, flameless thermal oxidizer prior to exhausting to the atmosphere. Atmospheric emissions from this test process will be low.

Enclosed are the completed MDE Forms 5, 5EP, 5T and 6, supporting flow diagram, plot plans and emissions calculations, and a TAP compliance demonstration.

Your prompt attention to our application would be appreciated. Grace would like to request a meeting/call with you in the next few weeks to discuss our planned process and to answer any initial questions you may have on our application. If you need anything additional or have any questions, do not hesitate to contact me at 410-531-4570 or at daniel.resca@grace.com.

Sincerely,

Recoverable Signature

X Daniel Resca

Daniel Resca
Project Manager
Signed by: Daniel Resca

Enclosures
Cc:

W. R. Grace & C0.-Conn. Columbia, MD Facility

Application to Install a Research Pilot Scale Test Catalytic Chemical Conversion of Plastics Process

Introduction

W. R. Grace & Co.-Conn.'s (Grace's) research facility located in Columbia, Maryland performs research and development (R&D) activities involving proprietary processes and materials. Grace proposes to install, in Building 30, a pilot-scale test catalytic chemical conversion process (the Project), using Grace's innovative catalyst technology, to convert commercially available plastics pellets into potentially usable energy-containing liquids and gas. This proposed pilot plant will be used to evaluate the desired new technologies including catalyst and process conditions as well as resultant liquid/gas properties for research and development only.

The following comprises the application for a permit-to-construct (PTC) the proposed Project, and includes a project description as well as several attachments, namely:

Attachment 1 Simplified Process Flow Diagram

Attachment 2 List of Key Project Equipment

Attachment 3 Site Plan

Attachment 4 MDE PTC Application Checklist and Forms 5, 5T, 5EP (two) and 6

Attachment 5 Emissions – Calculations, Engineering Estimates and Assumptions

Attachment 6 TAP Compliance Demonstration

Attachment 7 Safety Data Sheet of Example Plastic Feedstock

Attachment 8 Vendor Information for Electric Flameless Thermal Oxidizer

Project Description

The proposed Project will involve four key systems: 1) reaction; 2) product recovery; 3) catalyst circulation/regeneration; and 4) steam generation. Attachment 1 is a simplified process flow diagram of the proposed Project.

The proposed Project is designed to process 1 kg/hr of commercially available plastic pellet feedstock (the benchmark feedstock can be 100% homogeneous polypropylene (PP). However, a typical mixed plastic also can include low density polyethylene (LDPE), high density polyethylene (HDPE), polyethylene terephthalate (PET), polystyrene (PS), polyvinyl chloride (PVC), and others). The plastic feedstock will be manually transferred to a feed system that

meters the feedstock into the reaction system. The catalytic chemical conversion reaction occurs at high temperature, in an oxygen-free environment. A catalyst circulation/regeneration system will be used to supply fresh and regenerated catalyst to the reaction system as well as supply heat required for the reaction. The catalytic chemical conversion reaction produces a product vapor comprised of non-condensable gas and condensable liquid. Residual catalyst in the product vapor will be recovered by a process cyclone and returned to the reactors. Then, the product vapor will go through a product recovery system involving vapor condensation and gas/liquid separation. The separated non-condensable gas will go through an electric flameless thermal oxidizer prior to venting to the atmosphere. The separated condensed liquid will be collected in two, 3-gal tanks. The collected liquid will be transferred, daily, to 55-gal drums in the warehouse, and ultimately shipped to a 3rd party waste treatment facility.

Spent catalyst from the reaction system will go through a steam stripper, then transferred with N_2 gas to the top of the catalyst regenerator. Combustion air will be introduced to the regenerator to burn off the spent catalyst coke. The regenerator is designed to provide excess air sufficient for complete combustion. Hot, regenerated catalyst is withdrawn from the regenerator and transferred, through risers, back to the reaction system with steam and N_2 gas. As mentioned above, the hot regenerated catalyst provides the heat for the reaction. Electric heating at the regenerator, the transfer lines to the risers, and the risers will heat the catalyst transferred from the regenerator to the reaction system and will be the prime source of heat during process startup. Regenerator hot combustion flue gas will be treated prior to venting to the atmosphere. The flue gas will go through a knock-out filter pot (to remove residual catalyst) and a gas/liquid separator (to remove water and cool the gas).

Steam used in the proposed process will be produced by electric steam generating units.

Being a pilot scale test installation for research and development there will be handling of samples of gas and liquid products, feedstock and catalyst for testing/analysis all at bench scale.

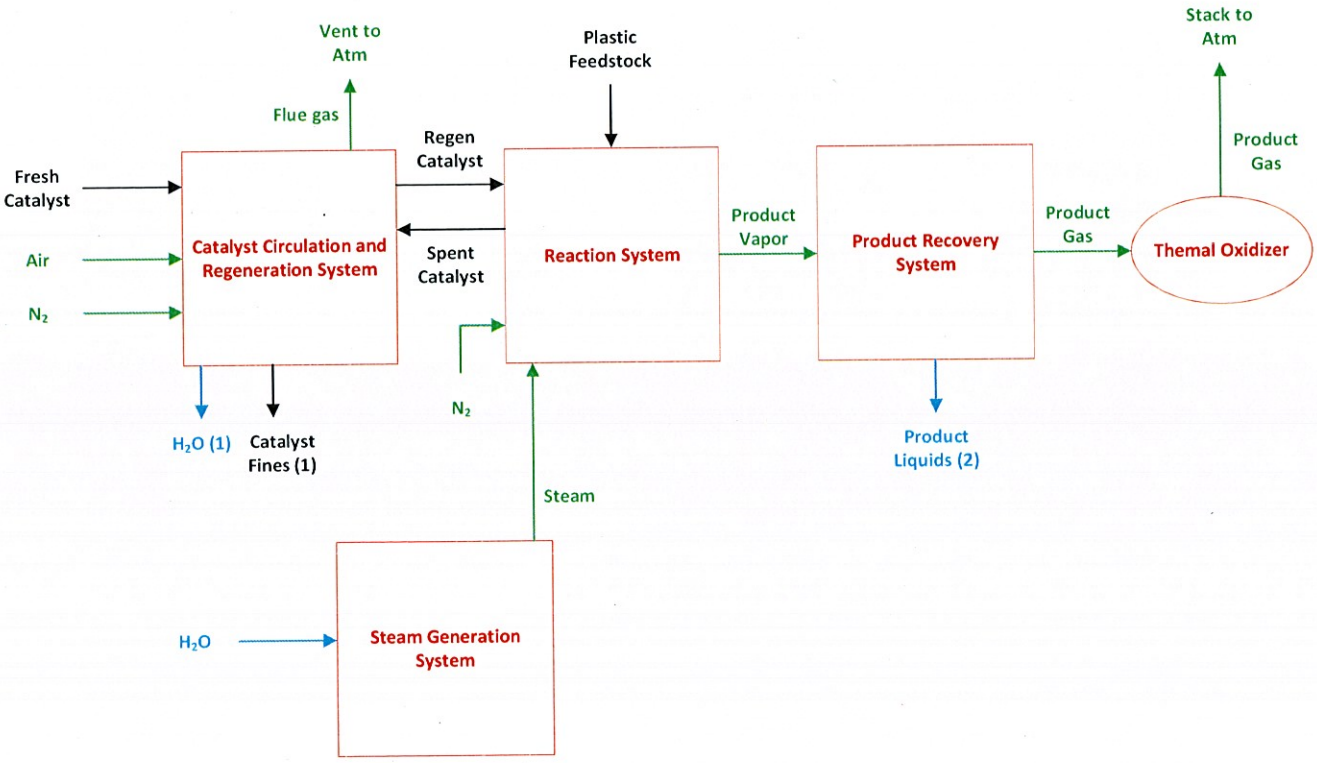
Attachment 2 lists the key process equipment proposed for the Project.

The proposed installation is scheduled to operate over two shifts on a given workday, with start-up activities, continuous reactor operation, shut-down activities and regular maintenance all occurring over 16 hours. Yearly operation is expected to be less than or equal to 4000 hr/yr.

ATTACHMENT 1

Simplified Process Flow Diagram

Simplified Process Flow Diagram for Proposed Research Pilot Scale Test Catalytic Chemical Conversion Process



Notes:
(1) Non-hazardous waste disposal
(2) Transfer to 3rd party treatment facility

ATTACHMENT 2

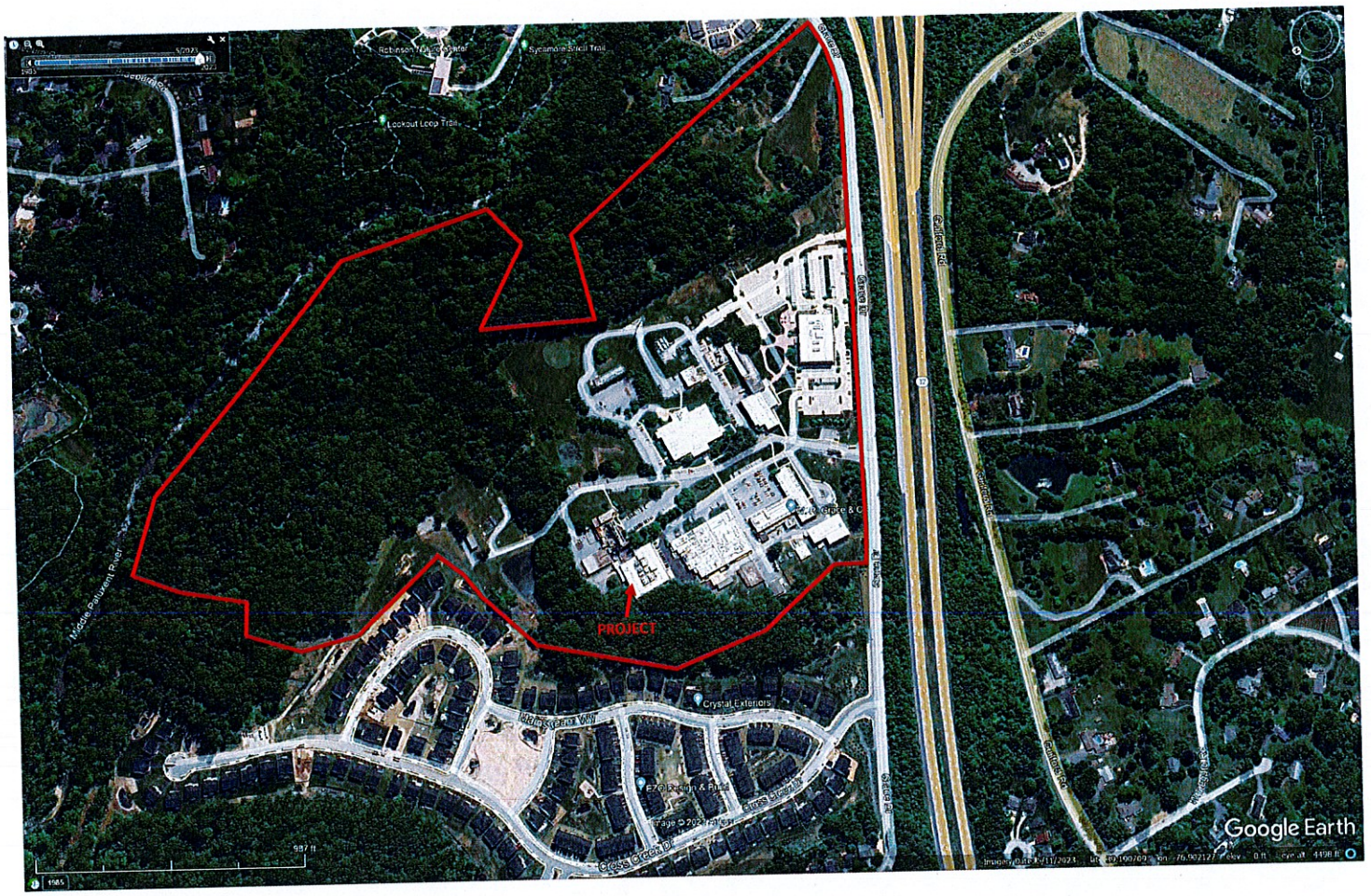
List of Key Project Equipment

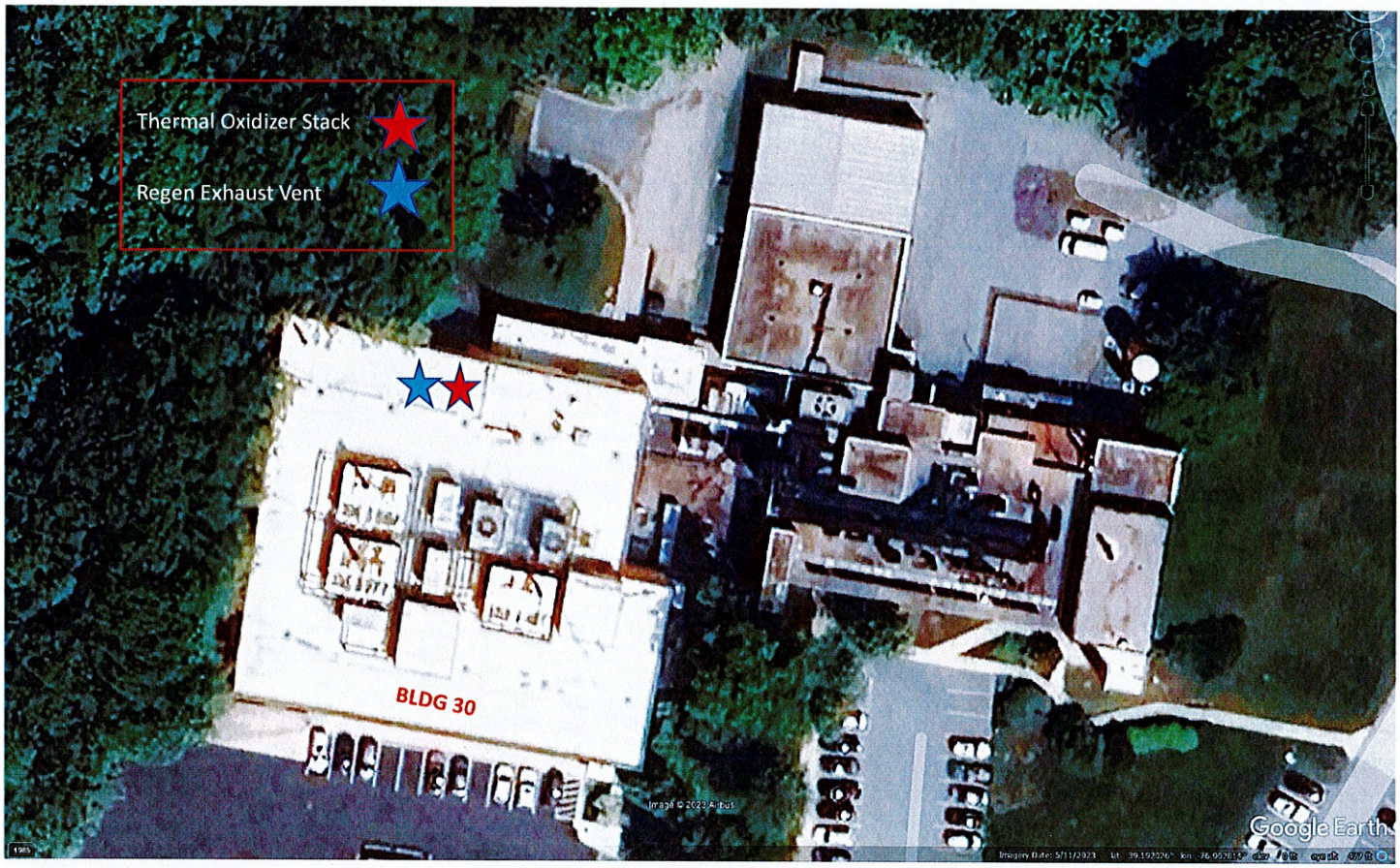
List of Key Equipment for Planned Project

- Reactors and risers
- Reactor gas cyclone
- Reactor gas stabilization column
- Electric flameless thermal oxidizer
- Spent catalyst stripper
- Spent catalyst regenerator
- Steam generators
- Associated hoppers, vessels/tanks, heat exchangers, coolers, electric heating units, conveyance systems, piping, analyzers and instrumentation

ATTACHMENT 3

Site Plan


PROJECT
Middle Patuxent River
Lookout Loop Trail
Sycamore Stroll Trail
Crystal Exteriors
Google Earth


Thermal Oxidizer Stack
Regen Exhaust Vent
BLDG 30
Image © 2023 Airbus
Google Earth

ATTACHMENT 4

MDE PTC Application Checklist and Forms 5, 5T, 5EP (two) and 6

AIR QUALITY PERMIT TO CONSTRUCT APPLICATION CHECKLIST

OWNER OF EQUIPMENT/PROCESS	
COMPANY NAME:	W.R. Grace & Co - Conn
COMPANY ADDRESS:	7500 Grace Drive, Columbia, MD 21044
LOCATION OF EQUIPMENT/PROCESS	
PREMISES NAME:	W.R. Grace Corporate Headquarters
PREMISES ADDRESS:	7500 Grace Drive, Columbia, MD 21044
CONTACT INFORMATION FOR THIS PERMIT APPLICATION	
CONTACT NAME:	Dan Resca
JOB TITLE:	Project Manager, Columbia
PHONE NUMBER:	410-531-4570
EMAIL ADDRESS:	daniel.resca@grace.com
DESCRIPTION OF EQUIPMENT OR PROCESS	
Catalytic Chemical Conversion of Plastics R&D Process	

Application is hereby made to the Department of the Environment for a Permit to Construct for the following equipment or process as required by the State of Maryland Air Quality Regulation, COMAR 26.11.02.09.

Check each item that you have submitted as part of your application package.

☒ Application package cover letter describing the proposed project

☒ Complete application forms (Note the number of forms included or NA if not applicable.)

No. 1 Form 5
No. 1 Form 5T
No. 2 Form 5EP
No. 1 Form 6
No. _____ Form 10
No. _____ Form 11
No. _____ Form 41
No. _____ Form 42
No. _____ Form 44

☒ Vendor/manufacturer specifications/guarantees

☒ Evidence of Workman's Compensation Insurance

☒ Process flow diagrams with emission points

☒ Site plan including the location of the proposed source and property boundary

☒ Material balance data and all emissions calculations

☒ Material Safety Data Sheets (MSDS) or equivalent information for materials processed and manufactured.

☐ Certificate of Public Convenience and Necessity (CPCN) waiver documentation from the Public Service Commission (1)

☐ Documentation that the proposed installation complies with local zoning and land use requirements (2)

(1) Required for emergency and non-emergency generators installed on or after October 1, 2001 and rated at 2001 kW or more.

(2) Required for applications subject to Expanded Public Participation Requirements.

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APPLICATION FOR FUEL BURNING EQUIPMENT

Information Regarding Public Outreach

For Air Quality Permit to Construct applications subject to public review, applicants should consider the following information in the initial stages of preparing a permit application.

If you are not sure at the time you are applying for a permit whether public review of your application is required or for information on steps you can take to engage the surrounding community where your planned project will be located, please contact the Air Quality Permits Program at 410-537-3225 and seek their advice.

Communicating and engaging the local community as early as possible in your planning and development process is an important aspect of your project and should be considered a priority. Environmental Justice or "EJ" is a movement to inform, involve, and engage communities impacted by potential and planned environmental projects by affording citizens opportunities to learn about projects and discuss any concerns regarding impacts.

Although some permit applications are subject to a formal public review process prescribed by statute, the Department strongly encourages you to engage neighboring communities separate from and well ahead of the formal permitting process. Sharing your plans by way of community meetings, informational outreach at local gatherings or through local faith-based organizations can initiate a rewarding and productive dialogue that will reduce anxiety and establish a permanent link with your neighbors in the community.

All parties benefit when there is good communication. The Department can assist applicants in developing an outreach plan that fits the needs of both the company and the public.

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APPLICATION FOR PROCESSING/MANUFACTURING EQUIPMENT

Permit to Construct ☑ Registration Update ☐ Initial Registration ☐

1A. Owner of Equipment/Company Name
W.R. Grace & Company - Conn.

Mailing Address
7500 Grace Drive
Street Address

Columbia | Maryland | 21044
City | State | Zip

Telephone Number
(410) 531-8300

Signature

Matt Meixell, Facilities Site Manager
Print Name and Title

8/4/2023
Date

DO NOT WRITE IN THIS BLOCK
2. REGISTRATION NUMBER

County No. (1-2) | Premises No. (3-6)
Registration Class (7) | Equipment No. (8-11)
Data Year (12-13) | Application Date

1B. Equipment Location and Telephone Number (if different from above)
Same as above
Street Number and Street Name

City/Town | State | Zip | ( ) Telephone Number

Premises Name (if different from above)

3. Status (A= New, B= Modification to Existing Equipment, C= Existing Equipment)

Status	New Construction Begun (MM/YY)	New Construction Completed (MM/YY)	Existing Initial Operation (MM/YY)
A	0124	0824	
15	16-19	20-23	20-23

4. Describe this Equipment: Make, Model, Features, Manufacturer (include Maximum Hourly Input Rate, etc.)
Research-scale catalytic chemical conversion of plastics process for Research & Development

5. Workmen's Compensation Coverage 792878903 (Binder/Policy Number) 11/15/2023 (Expiration Date)
Company Zurich American Insurance Company
NOTE: Before a Permit to Construct may be issued by the Department, the applicant must provide the Department with proof of worker's compensation coverage as required under Section 1-202 of the Worker's Compensation Act.

6A. Number of Pieces of Identical Equipment Units to be Registered/Permitted at this Time See Attach 2

6B. Number of Stack/Emission Points Associated with this Equipment 2

7. Person Installing this Equipment (if different from Number 1 on Page 1)

Name _____ Title _____

Company _____

Mailing Address/Street _____

City/Town _____ State _____ Telephone (_____) _____

8. Major Activity, Product or Service of Company at this Location

Research & Development

9. Control Devices Associated with this Equipment

None ☐ 24-0

Simple/Multiple Cyclone	Spray/Adsorb Tower	Venturi Scrubber	Carbon Adsorber	Electrostatic Precipitator	Baghouse	Thermal/Catalytic Afterburner	Dry Scrubber
☐ 24-1	☐ 24-2	☐ 24-3	☐ 24-4	☐ 24-5	☐ 24-6	☐ 24-7	☐ 24-8

Other

☑ Describe Electric flameless thermal oxidizer

24-9

10. Annual Fuel Consumption for this Equipment

OIL-1000 GALLONS	SULFUR %	GRADE	NATURAL GAS-1000 FT^3	LP GAS-100 GALLONS	GRADE
26-31	32-33	34	35-41	42-45	

COAL- TONS	SULFUR %	ASH%	WOOD-TONS	MOISTURE %
46-52	53-55	56-58	59-63	64-65

OTHER FUELS (Specify Type) ☐ 66-1 ANNUAL AMOUNT CONSUMED (Specify Units of Measure)

OTHER FUEL (Specify Type) ☐ 66-2 ANNUAL AMOUNT CONSUMED (Specify Units of Measure)

1= Coke 2= COG 3=BFG 4=Other

11. Operating Schedule (for this Equipment)

Continuous Operation	Batch Process	Hours per Batch	Batch per Week	Hours per Day	Days Per Week	Days per Year
☐ 67-1	☑ 67-2	16 68-69		16 70-71	☐ 72	250 73-75

Seasonal Variation in Operation:

No Variation	Winter Percent	Spring Percent	Summer Percent	Fall Percent	(Total Seasons= 100%)
☑ 76	77-78	79-80	81-82	83-84	

12. Equivalent Stack Innformation- is Exhaust through Doors, Windows, etc. Only? (Y/N) N (85)
See Form 5EP

If not, then	Height Avove Ground (FT)	Inside Diameter at Top	Exit Temperature (°F)	Exit Velocity (FT/SEC)
	86-88	89-91	92-95	96-98

NOTE: See Attach 1 and Attach 3
Attach a block diagram of process/process line, indicating new equipment as reported on this form and all existing equipment, including control devices and emission points.

13. Input Materials (for this equipment only)
Is any of this data to be considered confidential? N (Y or N)

	NAME	CAS NO. (IF APPLICABLE)	INPUT RATE PER HOUR	UNITS	PER YEAR	UNITS
1.	Commercial plastic pellet feedstock		1000	g	4000	kg
2.	Catalyst					
3.						
4.						
5.						
6.						
7.						
8.						
9.						
TOTAL						

14. Output Materials (for this equipment)
Process/Product Stream

	NAME	CAS NO. (IF APPLICABLE)	OUTPUT RATE PER HOUR	UNITS	PER YEAR	UNITS
1.	Gas stream (H2. CO2 C4 hydrocarbons)		647	g	2588	kg
2.	Liquid stream (C5+ organic, H2O, HCl)		320	g	1280	kg
3.	Char		33	g	132	kg
4.						
5.						
6.						
7.						
8.						
9.						
TOTAL						

15. Waste Streams- Solid and Liquid

	NAME	CAS NO. (IF APPLICABLE)	OUTPUT RATE PER HOUR	UNITS	PER YEAR	UNITS
1.	Liquid stream (C5+ organic, H2O HC)		320	g	1280	kg
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
TOTAL						

16. Total Stack Emissions (for this equipment only) in Pounds Per Operating Day

Particulate Matter	Oxides of Sulfur	Oxides of Nitrogen
0.000	0.000	0.011
99-104	105-110	111-116

Carbon Monoxide	Volatile Organic Compounds	PM-10
0.002	0.218	0.000
177-122	123-128	129-134

17. Total Fugitive Emissions (for this equipment only) in Pounds Per Operating Day

Particulate Matter	Oxides of Sulfur	Oxides of Nitrogen
135-139	140-144	145-149

Carbon Monoxide	Volatile Organic Compounds	PM-10
150-154	155-159	160-164

Method Used to Determine Emissions **(1= Estimate 2= Emission Factor 3= Stack Test 4= Other)**

TSP	SOX	NOX	CO	VOC	PM10
4	4	4	4	4	4
165	166	167	168	169	170

AIR AND RADIATION MANAGEMENT ADMINISTRATION USE ONLY

18. Date Rec'd. Local _____ **Date Rec'd. State** _____ **Return to Local Jurisdiction** Date_____ By_____

Reviewed by Local Jurisdiction Date_____ By_____ **Reviewed by State** Date_____ By_____

19. Inventory Date **Month/Year** (171-174) **Equipment Code** (175-177) **SCC Code** (178-185)

20. **Annual Operating Rate** (186-192) **Maximum Design Hourly Rate** (193-199) **Permit to Operate Month** (200-201) **Transaction Date (MM/DD/YR)** (202-207)

Staff Code (208-210) **VOC Code** (211 212) **SIP Code** (213 214) **Regulation Code** (215-218) **Confidentiality** (219)

Point Description (220-238) **Action** (239) A: Add C: Change

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FORM 5EP: Emission Point Data

Complete one (1) Form 5EP for EACH emission point (stack or fugitive emissions) related to the proposed installation.

Applicant Name: W.R. Grace & Company - Conn.

1. Emission Point Identification Name/Number

List the applicant assigned name/number for this emission point and use this value on the attached required plot plan:
TO Stack

2. Emission Point Description

Describe the emission point including all associated equipment and control devices:
Reactor output gas stream controlled by thermal oxidizer

3. Emissions Schedule for the Emission Point

Continuous or Intermittent (C/I)?	I	**Seasonal Variation** Check box if none: ☒ Otherwise estimate seasonal variation:	
Minutes per hour:	60	Winter Percent	
Hours per day:	16	Spring Percent	
Days per week:	5	Summer Percent	
Weeks per year:	50	Fall Percent	

4. Emission Point Information

Height above ground (ft):	59'-1"	Length and width dimensions at top of rectangular stack (ft):	Length:	Width:	
Height above structures (ft):	30'-5"				
Exit temperature (°F):	1600	Inside diameter at top of round stack (ft):		0.833	
Exit velocity (ft/min):	200.4	Distance from emission point to nearest property line (ft):		280	
Exhaust gas volumetric flow rate (acfm):	109.3	Building dimensions if emission point is located on building (ft)	Height 28'-8"	Length 163'	Width 144'

5. Control Devices Associated with the Emission Point

Identify each control device associated with the emission point and indicate the number of devices. ***A Form 6 is also required for each control device***. If none check none:

- ☐ None
- ☐ Baghouse No. _____
- ☐ Cyclone No. _____
- ☐ Elec. Precipitator (ESP) No. _____
- ☐ Dust Suppression System No. _____
- ☐ Venturi Scrubber No. _____
- ☐ Spray Tower/Packed Bed No. _____
- ☐ Carbon Adsorber No. _____
  - ☐ Cartridge/Canister
  - ☐ Regenerative
- ☐ Thermal Oxidizer No. _____
  - ☐ Regenerative
- ☐ Catalytic Oxidizer No. _____
- ☐ Nitrogen Oxides Reduction No. _____
  - ☐ Selective ☐ Non-Selective
  - ☐ Catalytic ☐ Non-Catalytic
- ☒ Other No. _____
  Specify: Electric Flameless Thermal Oxidizer

FORM 5EP: Emission Point Data

6. Estimated Emissions from the Emission Point

Criteria Pollutants	At Design Capacity (lb/hr)	At Projected Operations (lb/hr)	At Projected Operations (lb/day)	At Projected Operations (ton/yr)
Particulate Matter (filterable as PM10)		0.000	0.000	0.000
Particulate Matter (filterable as PM2.5)		0.000	0.000	0.000
Particulate Matter (condensables)				
Volatile Organic Compounds (VOC)		0.014	0.218	0.027
Oxides of Sulfur (SOx)				
Oxides of Nitrogen (NOx)				
Carbon Monoxide (CO)				
Lead (Pb)				

Greenhouse Gases (GHG)	At Design Capacity (lb/hr)	At Projected Operations (lb/hr)	At Projected Operations (lb/day)	At Projected Operations (ton/yr)
Carbon Dioxide (CO_2)		4.31	68.90	8.61
Methane (CH_4)		0.000	0.001	0.000
Nitrous Oxide (N_2O)				
Hydrofluorocarbons (HFCs)				
Perfluorocarbons (PFCs)				
Sulfur Hexafluoride (SF6)				
Total GHG (as CO_2e)		4.31	68.93	8.62

List individual federal Hazardous Air Pollutants (HAP) below:	At Design Capacity (lb/hr)	At Projected Operations (lb/hr)	At Projected Operations (lb/day)	At Projected Operations (ton/yr)
1,3-Butadiene		0.000	0.001	0.000

(Attach additional sheets as necessary.)

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FORM 5EP: Emission Point Data

Complete one (1) Form 5EP for EACH emission point (stack or fugitive emissions) related to the proposed installation.

Applicant Name: W.R. Grace & Company - Conn.

1. Emission Point Identification Name/Number

List the applicant assigned name/number for this emission point and use this value on the attached required plot plan:
TO Stack

2. Emission Point Description

Describe the emission point including all associated equipment and control devices:
Reactor output gas stream controlled by thermal oxidizer

3. Emissions Schedule for the Emission Point

Continuous or Intermittent (C/I)?	I	**Seasonal Variation** Check box if none: ☒ Otherwise estimate seasonal variation:	
Minutes per hour:	60	Winter Percent	
Hours per day:	16	Spring Percent	
Days per week:	5	Summer Percent	
Weeks per year:	50	Fall Percent	

4. Emission Point Information

Height above ground (ft):	59'-1"	Length and width dimensions at top of rectangular stack (ft):	Length:	Width:	
Height above structures (ft):	30'-5"				
Exit temperature (°F):	1600	Inside diameter at top of round stack (ft):		0.833	
Exit velocity (ft/min):	200.4	Distance from emission point to nearest property line (ft):		280	
Exhaust gas volumetric flow rate (acfm):	109.3	Building dimensions if emission point is located on building (ft)	Height 28'-8"	Length 163'	Width 144'

5. Control Devices Associated with the Emission Point

Identify each control device associated with the emission point and indicate the number of devices. ***A Form 6 is also required for each control device***. If none check none:

- ☐ None
- ☐ Baghouse No. _____
- ☐ Cyclone No. _____
- ☐ Elec. Precipitator (ESP) No. _____
- ☐ Dust Suppression System No. _____
- ☐ Venturi Scrubber No. _____
- ☐ Spray Tower/Packed Bed No. _____
- ☐ Carbon Adsorber No. _____
  - ☐ Cartridge/Canister
  - ☐ Regenerative
- ☐ Thermal Oxidizer No. _____
  - ☐ Regenerative
- ☐ Catalytic Oxidizer No. _____
- ☐ Nitrogen Oxides Reduction No. _____
  - ☐ Selective ☐ Non-Selective
  - ☐ Catalytic ☐ Non-Catalytic
- ☒ Other No. _____
  Specify: Electric Flameless Thermal Oxidizer

1/12/24 Replaced per Jan 11, 2024 Email from D. Rescia to S. Nash IZN

FORM 5EP: Emission Point Data

6. Estimated Emissions from the Emission Point

Criteria Pollutants	At Design Capacity (lb/hr)	At Projected Operations (lb/hr)	At Projected Operations (lb/day)	At Projected Operations (ton/yr)
Particulate Matter (filterable as PM10)		0.000	0.000	0.000
Particulate Matter (filterable as PM2.5)		0.000	0.000	0.000
Particulate Matter (condensables)				
Volatile Organic Compounds (VOC)		0.014	0.218	0.027
Oxides of Sulfur (SOx)				
Oxides of Nitrogen (NOx)				
Carbon Monoxide (CO)				
Lead (Pb)				

Greenhouse Gases (GHG)	At Design Capacity (lb/hr)	At Projected Operations (lb/hr)	At Projected Operations (lb/day)	At Projected Operations (ton/yr)
Carbon Dioxide (CO_2)		4.31	68.90	136.61
Methane (CH_4)		0.000	0.001	0.000
Nitrous Oxide (N_2O)				
Hydrofluorocarbons (HFCs)				
Perfluorocarbons (PFCs)				
Sulfur Hexafluoride (SF6)				
Total GHG (as CO_2e)		4.31	68.93	136.61

List individual federal Hazardous Air Pollutants (HAP) below:	At Design Capacity (lb/hr)	At Projected Operations (lb/hr)	At Projected Operations (lb/day)	At Projected Operations (ton/yr)
1,3-Butadiene		0.000	0.001	0.000

(Attach additional sheets as necessary.)

1/12/24
Replaced per Jan 11, 2024 email from D. Rescu to S. Nash /sc

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FORM 5EP: Emission Point Data

Complete one (1) Form 5EP for EACH emission point (stack or fugitive emissions) related to the proposed installation.

Applicant Name: W.R. Grace & Company - Conn.

1. Emission Point Identification Name/Number

List the applicant assigned name/number for this emission point and use this value on the attached required plot plan:
Regen Exhaust Vent

2. Emission Point Description

Describe the emission point including all associated equipment and control devices:
Regenerator flue gas stream

3. Emissions Schedule for the Emission Point

Continuous or Intermittent (C/I)?	I	**Seasonal Variation** Check box if none: ☒ Otherwise estimate seasonal variation:	
Minutes per hour:	60	Winter Percent	
Hours per day:	16	Spring Percent	
Days per week:	5	Summer Percent	
Weeks per year:	50	Fall Percent	

4. Emission Point Information

Height above ground (ft):	39.0	Length and width dimensions at top of rectangular stack (ft):	Length:	Width:	
Height above structures (ft):	10.3				
Exit temperature (°F):	80	Inside diameter at top of round stack (ft):		0.833	
Exit velocity (ft/min):	1835	Distance from emission point to nearest property line (ft):		280	
Exhaust gas volumetric flow rate (acfm):	1000	Building dimensions if emission point is located on building (ft)	Height 28'-8"	Length 163'	Width 144'

5. Control Devices Associated with the Emission Point

Identify each control device associated with the emission point and indicate the number of devices. ***A Form 6 is also required for each control device***. If none check none:

- ☒ None
- ☐ Baghouse No. _____
- ☐ Cyclone No. _____
- ☐ Elec. Precipitator (ESP) No. _____
- ☐ Dust Suppression System No. _____
- ☐ Venturi Scrubber No. _____
- ☐ Spray Tower/Packed Bed No. _____
- ☐ Carbon Adsorber No. _____
  - ☐ Cartridge/Canister
  - ☐ Regenerative
- ☐ Thermal Oxidizer No. _____
  - ☐ Regenerative
- ☐ Catalytic Oxidizer No. _____
- ☐ Nitrogen Oxides Reduction No. _____
  - ☐ Selective ☐ Non-Selective
  - ☐ Catalytic ☐ Non-Catalytic
- ☐ Other No. _____
  Specify:

FORM 5EP: Emission Point Data

6. Estimated Emissions from the Emission Point

Criteria Pollutants	At Design Capacity (lb/hr)	At Projected Operations (lb/hr)	At Projected Operations (lb/day)	At Projected Operations (ton/yr)
Particulate Matter (filterable as PM10)		0.000	0.000	0.000
Particulate Matter (filterable as PM2.5)		0.000	0.000	0.000
Particulate Matter (condensables)				
Volatile Organic Compounds (VOC)				
Oxides of Sulfur (SOx)				
Oxides of Nitrogen (NOx)		0.001	0.011	0.001
Carbon Monoxide (CO)		0.000	0.002	0.000
Lead (Pb)				

Greenhouse Gases (GHG)	At Design Capacity (lb/hr)	At Projected Operations (lb/hr)	At Projected Operations (lb/day)	At Projected Operations (ton/yr)
Carbon Dioxide (CO_2)		.....	4.019	0.502
Methane (CH_4)				
Nitrous Oxide (N_2O)				
Hydrofluorocarbons (HFCs)				
Perfluorocarbons (PFCs)				
Sulfur Hexafluoride (SF6)				
Total GHG (as CO_2e)		0.251	4.019	0.502

List individual federal Hazardous Air Pollutants (HAP) below:	At Design Capacity (lb/hr)	At Projected Operations (lb/hr)	At Projected Operations (lb/day)	At Projected Operations (ton/yr)

(Attach additional sheets as necessary.)

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FORM 5T: Toxic Air Pollutant (TAP) Emissions Summary and Compliance Demonstration

Applicant Name: W.R. Grace & Co. - Conn.

Step 1: Quantify premises-wide emissions of Toxic Air Pollutants (TAP) from new and existing installations in accordance with COMAR 26.11.15.04. Attach supporting documentation as necessary.

Toxic Air Pollutant (TAP)	CAS Number	Class I or Class II?	Screening Levels (µg/m^3)			Estimated Premises Wide Emissions of TAP			
						Actual Total Existing TAP Emissions	Projected TAP Emissions from Proposed Installation	Premises Wide Total TAP Emissions	
			1-hour	8-hour	Annual	(lb/hr)	(lb/hr)	(lb/hr)	(lb/yr)
ex. ethanol	*64175*	*II*	*18843*	*3769*	*N/A*	*0.60*	*0.15*	*0.75*	*1500*
ex. benzene	*71432*	*I*	*80*	*16*	*0.13*	*0.5*	*0.75*	*1.00*	*400*
See Attach 5 and Attach 6									

(attach additional sheets as necessary.)

Note: Screening levels can be obtained from the Department's website (http://www.mde.maryland.gov) or by calling the Department.

Step 2: Determine which TAPs are exempt from further review. A TAP that meets either of the following Class I or Class II small quantity emitter exemptions is exempt from further TAP compliance demonstration requirements under Step 3 and Step 4.

Class II TAP Small Quantity Emitter Exemption Requirements (COMAR 26.11.15.03B(3)(a))
A Class II TAP is exempt from Step 3 and Step 4 if the Class II TAP meets the following requirements: Premises wide emissions of the TAP shall not exceed 0.5 pounds per hour, and any applicable 1-hour or 8-hour screening level for the TAP must be greater than 200 µg/m^3.

Class I TAP Small Quantity Emitter Exemption Requirements (COMAR 26.11.15.03B(3)(b))
A Class I TAP is exempt from Step 3 and Step 4 if the Class I TAP meets the following requirements: Premises wide emissions of the TAP shall not exceed 0.5 pounds per hour and 350 pounds per year, any applicable 1-hour or 8-hour screening level for the TAP must be greater than 200 µg/m^3, and any applicable annual screening level for the TAP must be greater than 1 µg/m^3.

If a TAP meets either the Class I or Class II TAP Small Quantity Emitter Exemption Requirements, no further review under Step 3 and Step 4 are required for that specific TAP.

FORM 5T: Toxic Air Pollutant (TAP) Emissions Summary and Compliance Demonstration

Step 3: Best Available Control Technology for Toxics Requirement (T-BACT, COMAR 26.11.15.05)
In the following table, list all TAP emission reduction options considered when determining T-BACT for the proposed installation. The options should be listed in order beginning with the most effective control strategy to the least effective strategy. Attach supporting documentation as necessary.

Target Pollutants	Emission Control Option	% Emission Reduction	Costs		T-BACT Option Selected? (yes/no)
			Capital	Annual Operating	
ex. ethanol and benzene	*Thermal Oxidizer*	*99*	*$50,000*	*$100,000*	*no*
ex. ethanol and benzene	*Low VOC materials*	*80*	*0*	*$100,000*	*yes*
VOC	Electric Flameless TO	99.99			Yes

(attach additional sheets as necessary)

Step 4: Demonstrating Compliance with the Ambient Impact Requirement (COMAR 26.11.15.06)
Each TAP not exempt in Step 2 must be individually evaluated to determine that the emissions of the TAP will not adversely impact public health. The evaluation consists of a series of increasingly non-conservative (and increasingly rigorous) tests. Once a TAP passes a test in the evaluation, no further analysis is required for that TAP. "Demonstrating Compliance with the Ambient Impact Requirement under the Toxic Air Pollutant (TAP) Regulations (COMAR 26.11.15.06)" provides guidance on conducting the evaluation. Summarize your results in the following table. Attach supporting documentation as necessary.

Toxic Air Pollutant (TAP)	CAS Number	Screening Levels ($\mu g/m^3$)			Premises Wide Total TAP Emissions		Allowable Emissions Rate (AER) per COMAR 26.11.16.02A		Off-site Concentrations per Screening Analysis ($\mu g/m^3$)			Compliance Method Used?
		1-hour	8-hour	Annual	(lb/hr)	(lb/yr)	(lb/hr)	(lb/yr)	1-hour	8-hour	Annual	AER or Screen
ex. ethanol	*64175*	*18843*	*3769*	*N/A*	*0.75*	*1500*	*0.89*	*N/A*	*N/A*	*N/A*	*N/A*	*AER*
ex. benzene	*71432*	*80*	*16*	*0.13*	*1.00*	*400*	*0.04*	*36.52*	*1.5*	*1.05*	*0.12*	*Screen*
See Attach 6												

(attach additional sheets as necessary)

If compliance with the ambient impact requirement cannot be met using the allowable emissions rate method or the screening analysis method, refined dispersion modeling techniques may be required. Please consult with the Department's Air Quality Permit Program prior to conducting dispersion modeling methods to demonstrate compliance.

MARYLAND DEPARTMENT OF THE ENVIRONMENT

1800 Washington Blvd ▪ Baltimore, Maryland 21230
(410) 537-3230 ▪ 1-800-633-6101 ▪ www.mde.state.md.us

Air and Radiation Management Administration ▪ Air Quality Permits Program

APPLICATION FOR PERMIT TO CONSTRUCT
GAS CLEANING OR EMISSION CONTROL EQUIPMENT

1. Owner of Installation	Telephone No.	Date of Application
W.R. Grace & Co. - Conn.	(410) 531-4570	8/3/23

2. Mailing Address	City	Zip Code	County
7500 Grace Drive	Columbia	21044	Howard

3. Equipment Location	City/Town or P.O.	County
7500 Grace Drive	Columbia, MD	Howard

4. Signature of Owner or Operator	Title	Print or Type Name

5. Application Type: Alteration ☐ New Construction ☑

6. Date Construction is to Start: 1/24 **Completion Date (Estimate):** 8/24

7. Type of Gas Cleaning or Emission Control Equipment:

Simple Cyclone ☐ Multiple Cyclone ☐ Afterburner ☐ Electrostatic Precipitator ☐

Scrubber ☐ _____ (type) Other ☑ Electric Flameless TO (type)

8. Gas Cleaning Equipment Manufacturer	Model No.	Collection Efficiency (Design Criteria)
PCC	EFTO25	> 99.99%

9. Type of Equipment which Control Equipment is to Service:

Catalyst Chemical Conversion Reactor System

10. Stack Test to be Conducted:

Yes ☐ No ☑ _____ (Stack Test to be Conducted By) _____ (Date)

11. Cost of Equipment _____

Estimated Erection Cost _____

Form number: 6
Revision date: 0/2000
TTY Users 1-800-735-2258

Recycled Paper

12. The Following Shall Be Design Criteria:

	INLET	OUTLET
Gas Flow Rate	_____ ACFM*	109.3 ACFM*
Gas Temperature	_____ °F	1600 °F
Gas Pressure	_____ INCHES W.G.	_____ INCHES W.G.
	PRESSURE DROP _____	
Dust Loading	_____ GRAINS/ACFD**	_____ GRAINS/ACFD**
Moisture Content OR Wet Bulb Temperature	_____ % _____ °F	_____ % _____ °F
Liquid Flow Rate (Wet Scrubber)	_____ GALLONS/MINUTE	

(WHEN SCRUBBER LIQUID OTHER THAN WATER INDICATE COMPOSITION OF SCRUBBING MEDIUM IN WEIGHT %)

*= ACTUAL CUBIC FEET PER MINUTE **= ACTUAL CUBIC FEET DRY

WHEN APPLICATION INVOLVES THE REDUCTION OF GASEOUS POLLUTANTS, PROVIDE THE CONCENTRATION OF EACH POLLUTANT IN THE GAS STREAM IN VOLUME PERCENT. INCLUDE THE COMPOSITION OF THE GASES ENTERING THE CLEANING DEVICE AND THE COMPOSITION OF EXHAUSTED GASES BEING DISCHARGED INTO THE ATMOSPHERE. USE AVAILABLE SPACE IN ITEM 15 ON PAGE 3.

13. Particle Size Analysis

Size of Dust Particles Entering Cleaning Unit	% of Total Dust	% to be Collected
0 to 10 Microns	_____	_____
10 to 44 Microns	_____	_____
Larger than 44 Microns	_____	_____

14. For Afterburner Construction Only:

Volume of Contaminated Air _____ CFM (DO NOT INCLUDE COMBUSTION AIR)

Gas Inlet Temperature _____ °F

Capacity of Afterburner _____ BTU/HR

Diameter (or area) of Afterburner Throat _____

Combustion Chamber _____ (diameter) _____ (length) Operating Temperature at Afterburner _____ °F

Retention Time of Gases _____

15. Show Location of Dust Cleaning Equipment in the System. Draw or Sketch Flow Diagram Showing Emission Path from Source to Exhaust Point to Atmosphere.

See Attach 1

Date Received: Local _____ State _____

Acknowledgement Date: _____

By _____

Reviewed By:

Local _____

State _____

Returned to Local:

Date _____

By _____

Application Returned to Applicant:

Date _____

By _____

REGISTRATION NUMBER OF ASSOCIATED EQUIPMENT: ☐ ☐☐☐☐

PREMISES NUMBER: ☐☐ ☐☐☐☐

Emission Calculations Revised By _____ Date _____

ATTACHMENT 5

Emissions – Calculations, Engineering Estimates and Assumptions

Table 1. Reactor Product Gas Emissions

Operation 16 hr/dy 4000 hr/yr

Pollutant	CAS	C	VOC?	HAP?	From Reactor (1)		Control Efficiency	Emissions (3)			
					Other C4 Speciation (% Other C4) (4)	Mass (g/hr)	(%)	(lb/hr)	(lb/dy)	(lb/yr)	(tpy)
CO_2						18	0	0.040	0.635	158.733	0.079
PM (5)						0.375	99	0.000	0.000	0.033	0.000
Methane	74-82-8	C1	No	No		3	99	0.000	0.001	0.265	0.000
Ethane	74-84-0	C2	No	No		8	99	0.000	0.003	0.705	0.000
Ethylene	74-85-1	C2	Yes	No		79	99	0.002	0.028	6.967	0.003
Propane	74-98-6	C3	Yes	No		66	99	0.001	0.023	5.820	0.003
Propylene	115-07-1	C3	Yes	No		246	99	0.005	0.087	21.694	0.011
Butane	106-97-8	C4	Yes	No		60	99	0.001	0.021	5.291	0.003
Other C4		C4				167					
Isobutene	115-11-7	C4	Yes	No	36	60.12	99	0.001	0.021	5.302	0.003
1-Butene	106-98-9	C4	Yes	No	20	33.4	99	0.001	0.012	2.945	0.001
t-2-Butene	624-64-6	C4	Yes	No	23	38.41	99	0.001	0.014	3.387	0.002
c-2-Butene	590-18-1	C4	Yes	No	20	33.4	99	0.001	0.012	2.945	0.001
1,3-Butadiene	106-99-0	C4	Yes	Yes	1	1.67	99	0.000	0.001	0.147	0.000
Total VOC			Yes				99	0.014	0.218	54.498	0.027

(1) Based on engineering estimates

(2) For VOC, the proposed electric flameless thermal oxidizer is designed for a VOC control efficiency of greater than 99.99% (i.e., meets requirements of COMAR 26.11.19.30 of at least 90% control overall). For PM, assume 99% particulate control for process cyclone

(3) Assumed 16 hr/dy and 4000 hr/yr operation

(4) Based on typical distribution for catalyitic cracking

(5) Based on regenerator outlet particulate fines equal to 0.3% /dy of catalyst inventory. The catalyst inventory for the regenerator is about 2000 g, and daily operation is 16 hr/dy

Reactor Outlet PM g/hr = 0.3 g PM/dy/100 g catalyst inventory X 2000 g catalyst / 16 hr/dy

Table 2. Additional Thermal Oxidizer CO_2 Emissions From Controlling Hydrocarbons

Operation	16	hr/dy	4000 hr/yr
TO CE	99	%	
CO_2 MW	44.01	g/mol	

Pollutant	CAS	# of C	MW (g/mol)	TO Inlet Mass Rate (g/hr)	Mass Rate Controlled by TO (g/hr)	Mol Rate Controlled by TO (mol/hr)	Equiv Mol C Rate (mol/hr)	Mass Rate CO_2 (g/hr)	
Methane	74-82-8	1	16.04	3	2.97	0.1851621	0.185162	8.148984	
Ethane	74-84-0	2	30.07	8	7.92	0.2633854	0.526771	23.18319	
Ethylene	74-85-1	2	28.05	79	78.21	2.7882353	5.576471	245.4205	
Propane	74-98-6	3	44.097	66	65.34	1.4817335	4.4452	195.6333	
Propylene	115-07-1	3	42.08	246	243.54	5.7875475	17.36264	764.1299	
Butane	106-97-8	4	58.12	60	59.4	1.0220234	4.088094	179.917	
Isobutene	115-11-7	4	56.11	60.12	59.5188	1.0607521	4.243008	186.7348	
1-Butene	106-98-9	4	56.11	33.4	33.066	0.5893067	2.357227	103.7416	
t-2-Butene	624-64-6	4	56.11	38.41	38.0259	0.6777027	2.710811	119.3028	
c-2-Butene	590-18-1	4	56.11	33.4	33.066	0.5893067	2.357227	103.7416	
1,3-Butadiene	106-99-0	4	54.09	1.67	1.6533	0.0305657	0.122263	5.38079	
				629				1935.334	
								4.266685	lb/hr
								68.26696	lb/dy
								17066.74	lb/yr
								8.53337	tpy

Table 2. Additional Thermal Oxidizer CO_2 Emissions From Controlling Hydrocarbons

Operation	16 hr/dy	4000 hr/yr
TO CE	99 %	
CO_2 MW	44.01 g/mol	

Pollutant	CAS	# of C	MW (g/mol)	TO Inlet Mass Rate (g/hr)	Mass Rate Controlled by TO (g/hr)	Mol Rate Controlled by TO (mol/hr)	Equiv Mol C Rate (mol/hr)	Mass Rate CO_2 (g/hr)	
Methane	74-82-8	1	16.04	3	2.97	0.1851621	0.185162	8.148984	
Ethane	74-84-0	2	30.07	8	7.92	0.2633854	0.526771	23.18319	
Ethylene	74-85-1	2	28.05	79	78.21	2.7882353	5.576471	245.4205	
Propane	74-98-6	3	44.097	66	65.34	1.4817335	4.4452	195.6333	
Propylene	115-07-1	3	42.08	246	243.54	5.7875475	17.36264	764.1299	
Butane	106-97-8	4	58.12	60	59.4	1.0220234	4.088094	179.917	
Isobutene	115-11-7	4	56.11	60.12	59.5188	1.0607521	4.243008	186.7348	
1-Butene	106-98-9	4	56.11	33.4	33.066	0.5893067	2.357227	103.7416	
t-2-Butene	624-64-6	4	56.11	38.41	38.0259	0.6777027	2.710811	119.3028	
c-2-Butene	590-18-1	4	56.11	33.4	33.066	0.5893067	2.357227	103.7416	
1,3-Butadiene	106-99-0	4	54.09	1.67	1.6533	0.0305657	0.122263	5.38079	
				629				1935.334	
								4.266685	lb/hr
								68.26696	lb/dy
								273067.9	lb/yr
								136.5339	tpy

1/12/24
Replaced per Jan 11, 2024 email from D. Rescia to S. Nash / EM

Table 3. Regenerator Flue Gas Emissions

Operation 16 hr/dy 4000 hr/yr

Pollutant	Control Efficiency (1) (%)	Emissions (2) (lb/hr)	(lb/dy)	(tpy)
CO_2 (3)		0.251	4.019	0.502
CO (4)		0.0001	0.0017	0.0002
NO (5) (6)		0.0007	0.0107	0.0013
PM (7)	99	0.0000	0.0001	0.0000

(1) Assume 99% particulate control for process knockout pot
(2) Assume 16 hr/dy and 4000 hr/yr operation
(3) Assume engineering estimate of CO_2 flow rate equal to 33 NL/hr

CO_2 g/hr = 44 g CO_2/mol CO_2 X 58 NL CO_2/hr / 22.4 NL/mol

(4) Assume lean burn (excess oxygen) conditions resulting in 0.01 vol% CO in flue gas (detection limit of CO analyzer) and flue gas flow rate of 377 NL/hr

CO g/hr = 28 g CO/mol CO X 0.01 NL CO/100 NL flue gas X 377 NL flue gas/hr / 22.4 NL/mol

(5) Assume the mass of nitrogen in the composite plastic feedstock is equal to the mass of nitrogen in the fraction of the feedstock that is Nylon, the constituent with the highest nitrogen content. Nylon has a nitrogen content of 12.3 wt% and the fraction of Nylon in the composite feedstaock is less than 2 wt%

N content of feed wt% = (12.3 g N/ 100 g Nylon X 2 g Nylon/ 100 g feed) X 100 = 0.246

(6) Based on 600 ppmv (dry basis) NO in flue gas from Xinjin Zhao et. al., 1997, Nitrogen Chemistry and NOx Control in a Fluid Catalytic Cracking Regenerator (Ind. Eng. Chem. Res., 1997, 36, 11, 4535-4542) for a similar N content feed and lean combustion, and a flue gas flow rate of 377 NL/hr

NO g/hr = 30 g NO/mol NO X 600 NL NO/1000000 NL flue gas X 377 NL flue gas/hr / 22.4 NL/mol

(7) Based on engineering estimate of regenerator outlet particulate fines equal to 0.3% /dy of catalyst inventory. The catalyst inventory for the regenerator is about 1500 g, and daily operation is 16 hr/dy

Regenerator Outlet PM g/hr = 0.3 g PM/100 g catalyst inventory/dy X 1500 g catalyst / 16 hr/dy

ATTACHMENT 6

TAP Compliance Demonstration

TAP Compliance Demonstration

MARYLAND TAP REQUIREMENTS

The proposed Project has the potential to discharge to the atmosphere several non-criteria substances which include Toxic Air Pollutants (TAPs) and, pursuant to COMAR 26.11.15.03 A (1), is subject to the Maryland TAP requirements (under COMAR 26.11.15 and 26.11.16) because the proposed installation is required to obtain a permit to construct (PTC) under COMAR 26.11.02.09.

COMAR 26.11.15.06 requires a demonstration that TAP emissions will not unreasonably endanger human health. Grace is demonstrating compliance with this ambient impact requirement using a screening analysis as specified under COMAR 26.11.15.07. According to COMAR 26.11.16.02 A, such a demonstration is made by showing that TAP emissions from the premises will not cause increases in ambient levels that exceed the applicable risk-based screening level for a Class I TAP and the applicable TLV-/threshold-based screening level for a Class II TAP (MDE Screening Levels).

The proposed Project will be a new installation/source as defined under COMAR 26.11.15.01 B (10). For new installations, COMAR 26.11.15.06 A (1) requires that the total emissions from the premises of each TAP discharged by the new installation be used in demonstrating compliance with the TAP impact requirements. COMAR 26.11.15.06 A (2) does not require the accounting of other premise-wide emissions from existing installations/sources on the existing premises (as defined under COMAR 26.11.15.01 B (7)) for a TAP that is not listed in COMAR 26.11.16.07. Except for 1,3-Butadiene, all TAPs expected to be discharged from the proposed Project (see Table 1 (Attachment 5)) are not listed in COMAR 26.11.16.07. However, several of the registered installations/sources at the existing premises are considered new installations (not existing installations).

EMISSIONS

Proposed Project TAP Emissions

Several non-criteria pollutants are expected to be discharged into the ambient air from the proposed Project's new thermal oxidizer stack (see Table 1 (Attachment 5)). Methane (CAS 74-82-8), ethane (CAS 74-84-0), ethylene (CAS 74-85-1), propane (CAS 74-98-6), and propylene (CAS 115-07-1) are listed as simple asphyxiants under COMAR 26.11.16.08 and are excluded from the definition of Toxic Air Pollutants (TAPs), as defined under COMAR 26.11.15.01 B (20). 1,3-butadiene (CAS 106-99-0) is a Class I TAP while the remaining non-criteria pollutants in Table 1 (Attachment 5) are Class II TAPs.

Other Premise-Wide TAP Emissions

Other new installations on the existing premises discharge a TAP that is expected to be discharged from the proposed Project; namely, butene (CAS 106-98-9).

The Test Polymerization Process (controlled by the existing thermal oxidizer) constructed in 2014 (ARA Registration Number 027-0013-7-0084) and the Test Gas-Phase Polymerization Process constructed in 2017 (ARA Registration Number 027-0013-7-0086) are permitted to emit butene. The maximum combined hourly butene emissions from these two installations is 0.03 lb/hr. For the Test Polymerization Process the maximum hourly butene emissions is expected to be 0.01 lb/hr (based on the supplement to the permit to Construct application (dated November 21, 2014), if butene is used as an additive). For the Test Gas-Phase Polymerization Process the maximum hourly butene emissions is expected to be 0.02 lb/hr (assuming butene from one linear low density polyethylene (LLDPE) batch run is released in one hour].

EXEMPTION FROM TAP REGULATIONS

The anticipated emissions of butane, isobutene (CAS 115-11-7), 1-butene, t-2-butene (CAS 624-64-6), and c-2-butene (CAS 590-18-1) from the premises are exempt from the Maryland TAP regulations (specifically COMAR 26.11.15.05 and COMAR 26.11.15.06) because of the small quantity of discharge from this proposed Project and other permitted installations.

Under COMAR 26.11.15.03 B (3) (a):

> "The emissions of a Class II TAP from a premises are exempt from the requirements of Regulations .05 and .06 of this chapter, if:
>
> (i) The total allowable emissions of the TAP from the premises are 0.5 pound per hour (0.23 kilogram per hour) or less; and
>
> (ii) All applicable TLV-based, threshold-based, or special screening levels for the TAP are greater than 200 micrograms/cubic meter."

After construction of the proposed Project, the maximum hourly emissions of butane from the premises will be about 0.001 lb/hr. This premises value includes the anticipated emissions due to the proposed Project. These emissions are well below the 0.5 lb/hr level for Class II TAPs in section (i) above. In addition, the screening level for butane is 23770.96 $\mu g/m^3$ (8-hour). This screening level is well above the minimum set forth in (ii) above.

After construction of the proposed Project, the maximum hourly emissions of isobutene from the premises will be about 0.001 lb/hr. This value includes the anticipated emissions due to the proposed Project. These emissions are well below the 0.5 lb/hr level for Class II TAPs in section (i) above. In addition, the screening level for isobutene is 5737.22 $\mu g/m^3$ (8-hour). This screening level is well above the minimum set forth in (ii) above.

After construction of the proposed Project, the maximum hourly emissions of 1-butene (butene) from the premises will be about 0.03 lb/hr (0.001 lb/hr + 0.03 lb/hr). This premises value includes the anticipated emissions due to the proposed Project and the possible emissions due to the Test Polymerization Process and the Test Gas-Phase Polymerization Process (see Other Premise-Wide TAP Emissions above). These emissions are well below the 0.5 lb/hr level for Class II TAPs in section (i) above. In addition, the screening level for butane is 5737.22 $\mu g/m^3$ (8-hour). This screening level is well above the minimum set forth in (ii) above.

After construction of the proposed Project, the maximum hourly emissions of t-2-butene from the premises will be about 0.001 lb/hr. This value includes the anticipated emissions due to the proposed Project. These emissions are well below the 0.5 lb/hr level for Class II TAPs in section (i) above. In addition, the screening level for isobutene is 5737.22 $\mu g/m^3$ (8-hour). This screening level is well above the minimum set forth in (ii) above.

After construction of the proposed Project, the maximum hourly emissions of c-2-butene from the premises will be about 0.001 lb/hr. This value includes the anticipated emissions due to the proposed Project. These emissions are well below the 0.5 lb/hr level for Class II TAPs in section (i) above. In addition, the screening level for isobutene is 5737.22 $\mu g/m^3$ (8-hour). This screening level is well above the minimum set forth in (ii) above.

Because the total allowable butane, isobutene, butene, t-2-butene and c-2-butene (Class II TAPs) emissions from the premises are each below 0.5 lb/hr, and the applicable screening levels are well above 200 $\mu g/m^3$, these emissions qualify for the small-emitter exemption from TAP compliance demonstration requirements.

Under COMAR 26.11.15.03 B (3) (b):

> "The emissions of a Class I TAP from a premises are exempt from the requirements of Regulations .05 and .06 of this chapter, if:
>
> (i) The total allowable emissions of the TAP from the premises are 0.5 pound per hour (0.23 kilogram per hour) or less;
> (ii) The total allowable emissions of the TAP from the premises are 350 pounds per year (159 kilograms per year) or less;
> (iii) All applicable TLV-based, threshold-based, or special screening levels for the TAP are greater than 200 micrograms/cubic meter; and
> (iv) The applicable risk-based screening level is greater than 1 microgram/cubic meter."

Because the risk-based screening level for 1,3-butadiene (i.e., 0.03 $\mu g/m^3$) is not greater than 1 $\mu g/m^3$, the 1,3-butadiene emissions do not qualify for the small-emitter exemption from TAP compliance demonstration requirements.

SCREENING ANALYSIS

For the screening analysis, estimates of TAP emissions are compared to the conservative Allowable Emission Rates (AERs) consistent with the Table provided under COMAR 26.11.16.02 A (4) (MDE AER). Compliance with the TAP impact requirements is demonstrated if the TAP emissions are less than the respective AERs.

MDE-Based AER

The AERs given in the Table under COMAR 26.11.16.02 (4), for non-stack or downwash sources, can be generalized as follows:

Short-term (1-hr/8-hr) AER (lb/hr) = SL/279

Long-term (annual) AER (lb/yr) = SL/0.00274

where SL is the applicable MDE Screening Level ($\mu g/m^3$).

This is based on discussions in "An Example of Demonstrating Compliance with Ambient Impact Requirement. (COMAR 26.11.15.06) – Fact Sheet" on MDE's website.

Screening Compliance Demonstration

Since many of the expected non-criteria pollutants from the proposed Project are not TAPs and of the TAPs 1,3-butadiene (CAS 106-99-0, a Class I TAP) is the only TAP not exempt from the TAP requirements under COMAR 26.11.15.05 and 26.11.05.06, a TAP screening analysis was performed for 1,3-butadiene. The screening analysis presented in Table 4 demonstrates TAP compliance for 1,3-butadiene.

Table 4. TAP Demonstration Screening Analysis

Substance	Substance Alternate Name	CAS Number	MDE TAP (1)	MDE Screenling Level (2)			TAP Emissions						Small Quantity Exemption (5)	MDE AER (6)			Compliance		
				1-hr	8-hr	Annual	Project TAP Hourly (3)	Project TAP Annual (3)	Other TAP Hourly (4)	Other TAP Annual	Sitewide TAP Hourly	Sitewide TAP Annual		1-hr	8-hr	Annual	1-hr	8-hr	Annual
				($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	(lb/hr)	(lb/yr)	(lb/hr)	(lb/yr)	(lb/hr)	(lb/yr)		(lb/hr)	(lb/hr)	(lb/yr)			
Methane		74-82-8	No				0.000066	0.264555			0.000066	0.26455493							
Ethane		74-84-0	No				0.0001764	0.70548			0.00017637	0.705479814							
Ethylene		74-85-1	No				0.0017417	6.966613			0.001741653	6.966613168							
Propane		74-98-6	No				0.0014551	5.820208			0.001455052	5.820208469							
Propylene		115-07-1	No				0.0054234	21.6935			0.005423376	21.69350429							
Butane		106-97-8	Class II		23770.9611		0.0013228	5.291099			0.001322775	5.291098608	Yes	0	85.20057742	0		Yes	
Isobutene	Isobutylene	115-11-7	Class II		5737.2188		0.0013254	5.301681			0.00132542	5.301680806	Yes	0	20.56350824	0		Yes	
1-Butene	Butene, isomers	106-98-9	Class II		5737.2188		0.0007363	2.945378	0.03		0.030736345	2.945378225	Yes	0	20.56350824	0		Yes	
t-2-Butene	Butene, isomers	624-64-6	Class II		5737.2188		0.0008468	3.387185			0.000846796	3.387184959	Yes	0	20.56350824	0		Yes	
c-2-Butene	Butene, isomers	590-18-1	Class II		5737.2188		0.0007363	2.945378			0.000736345	2.945378225	Yes	0	20.56350824	0		Yes	
1,3-Butadiene		106-99-0	Class I		44.2454	3.00E-02	0.000037	0.147269			0.000037	0.147268911	No	0	0.158585663	10.94890511		Yes	Yes

(1) COMAR 26.11.15.01 and COMAR 26.11.16.08

(2) MDE's Toxic Air Pollutant Regulations Assistance web page; Screening Levels

(3) See Table 1 (Attachment 5)

(4) Other sitewide emissions: Butene emissions based on PTC application for Gas Phase Polymerization Process submitted on May 26, 2016 (accounting for GPP emissions and RSPP controlled emissions)

(5) COMAR 26.11.15.03 B (3) (a) and (b)

(6) Based on "An Example of Demonstrating Compliance with Ambient Impact Requirement. (COMAR 26.11.15.06 - Fact Sheet" on MDE's website

part2_Enclosure- OSWI Applicability Detemination R
Uploaded by: Shamieka Preston
Position: FAV

ATTACHMENT 7

Safety Data Sheet for Example Plastic Feedstock

1 Identification

· **Product identifier**

· **Trade name:** polypropylene

· **Application of the substance / the preparation:**
Product for industrial research and applicability tests.
· **Details of the supplier of the safety data sheet**
· **Manufacturer/Supplier:**
GRACE
W. R. Grace & Co.-Conn
7500 Grace Drive
Columbia MD 21044
U. S. A.

· **Information department:**
Health and Safety (9 AM to 5 PM-EST) 1-410-531-4000
MSDS.Davison@grace.com

· **Emergency telephone number:**
Chemtrec North America: +1-800-424-9300
Chemtrec International: +1-703-527-3887
Other Emergencies (24hr): +1-410-531-4000

2 Hazard(s) identification

· **Classification of the substance or mixture**
The substance is not classified, according to the Globally Harmonized System (GHS).
· **Label elements**
· **GHS label elements** None
· **Hazard pictograms** None
· **Signal word** None
· **Hazard statements** None
· **Classification system:**

· **NFPA ratings (scale 0 - 4)**

Health = 0
Fire = 1
Reactivity = 0

· **HMIS-ratings (scale 0 - 4)**

Health = 0
Fire = 1
Reactivity = 0

· **Hazard not otherwise classified**
WARNING: Product dust together with air may develop ignitable and explosive mixtures

3 Composition/information on ingredients

· **Chemical characterization: Substances**

· **Additonal information:**

· **CAS No. and description:**		
9003-07-0	polypropylene	100%

USA

(Contd. on page 2)

(Contd. of page 1)

4 First-aid measures

· **Description of first aid measures**

· **After inhalation:** Supply fresh air; consult doctor in case of complaints.
· **After skin contact:**
Generally the product does not irritate the skin.
Wash with water.
After contact with the molten product, cool rapidly with cold water.
Do not pull solidified product away from the skin.
Seek medical treatment.
· **After eye contact:**
Flush opened eye with large quantities of running water for at least 30 minutes. If symptoms occur, consult a doctor.

· **After swallowing:** Seek medical attention. Do not induce vomiting.

· **Information for doctor:**
· **Most important symptoms and effects, both acute and delayed**
No further relevant information available.
· **Indication of any immediate medical attention and special treatment needed**
No further relevant information available.

5 Fire-fighting measures

· **Extinguishing media**

· **Suitable extinguishing agents:**
CO2, extinguishing powder or water spray. Fight larger fires with water spray or alcohol resistant foam.
· **Hazardous combustion products**
In case of fire, the following can be released:
Carbon monoxide and carbon dioxide
· **Advice for firefighters**

· **Protective equipment:**
Do not inhale explosion gases or combustion gases.
Wear personal protective equipment.
Wear respiratory protective device.
· **Additional information**
Collect contaminated fire fighting water separately. It must not enter the sewage system.
Dispose of fire debris and contaminated fire fighting water in accordance with official regulations.
WARNING: Product dust together with air may develop ignitable and explosive mixtures
Prevent formation of dust.

6 Accidental release measures

· **Personal precautions, protective equipment and emergency procedures**
Remove persons from danger area.
Wear protective clothing.
WARNING: Product dust together with air may develop ignitable and explosive mixtures
Keep away from ignition sources
· **Environmental precautions:**
Do not allow to enter sewers, surface or ground water.
Prevent from spreading (e.g. by damming-in or oil barriers).
· **Methods and material for containment and cleaning up:**
Vacuuming or wet sweeping may be used to avoid dust dispersal.
Vacuuming or wet sweeping may be used to avoid dust dispersal.

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USA

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· **Reference to other sections**
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.
· **Protective Action Criteria for Chemicals**

· **PAC-1:**	
	5.2 mg/m³
· **PAC-2:**	
	58 mg/m³
· **PAC-3:**	
	350 mg/m³

7 Handling and storage

· **Handling:**
· **Precautions for safe handling**
Keep away from heat and direct sunlight.
Prevent formation of dust.
Provide suction extractors if dust is formed.
Use appropriate industrial vacuum cleaners or central vacuum systems for dust removal.
Take precautionary measures against static discharges.

· **Information about protection against explosions and fires:**
Dust can combine with air to form an explosive mixture.
When transferring this material into flammable solvents, use proper grounding to avoid static electric sparks.
WARNING: Product dust together with air may develop ignitable and explosive mixtures
When transferring this material, use proper grounding to avoid static electric sparks.
· **Conditions for safe storage, including any incompatibilities**
· **Storage:**
· **Requirements to be met by storerooms and receptacles:** No special requirements.

· **Information about storage in one common storage facility:** Store away from foodstuffs.

· **Further information about storage conditions:** None.

8 Exposure controls/personal protection

· **Additional information about design of technical systems:**
Dust control and material handling systems should contain explosion relief vents, an explosion suppression system or other explosion suppression or prevention controls. Ensure that dust-handling systems are designed in a manner to prevent the escape of dust into the work area. Use only appropriately classified electrical equipment and powered industrial trucks.
· **Control parameters**
· **Components with limit values that require monitoring at the workplace:** Not required.
· **Additional information:** Valid lists at time of creation were used as basis.
· **Exposure controls**
· **Personal protective equipment:**

· **General protective and hygienic measures:**
The usual precautionary measures for handling chemicals should be followed.

· **Breathing equipment:**
As appropriate for the employee exposure, use a NIOSH approved respirator and cartridge.

(Contd. on page 4)
USA

(Contd. of page 3)

· **Protection of hands:**

Protective gloves

Check protective gloves prior to each use for their proper condition.
The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation

· **Material of gloves**
The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer. As the product is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application.
Nitrile rubber, NBR
Butyl rubber, BR
Strong fabric gloves
Leather gloves
Recommended thickness of the material: ≥ 0.35 mm

· **For the permanent contact gloves made of the following materials are suitable:**
Butyl rubber, BR
Nitrile rubber, NBR

· **Eye protection:**

Safety glasses

· **Body protection:** Protective work clothing

* 9 Physical and chemical properties

· **Information on basic physical and chemical properties**	
· **General Information**	
· **Appearance:**	
Form:	Granulate
Color:	Transparent
· **Odor:**	Odorless
· **Odor threshold:**	Not applicable.
· **pH-value at 20 °C (68 °F):**	7
· **Change in condition**	
Melting point/Melting range:	120-170 °C (248-338 °F)
Boiling point/Boiling range:	Not determined.
· **Flash point:**	Not determined.
· **Flammability (solid, gaseous):**	Not determined.
· **Ignition temperature:**	410 °C (770 °F)
· **Decomposition temperature:**	~250 °C (~482 °F)
· **Auto igniting:**	Product is not self-igniting.

(Contd. on page 5)
USA

(Contd. of page 4)

· **Danger of explosion:**	Danger of dust explosion.
· **Explosion limits:**	
Lower:	Not applicable.
Upper:	Not applicable.
· **Vapor pressure:**	Not applicable.
· **Density at 20 °C (68 °F):**	0.90 - 0.92 g/cm³ (7.5105 - 7.6774 lbs/gal)
· **Bulk density at 20 °C (68 °F):**	0.5 kg/m³
· **Vapor density**	Not applicable.
· **Evaporation rate**	Not applicable.
· **Solubility in / Miscibility with**	
Water:	Insoluble.
· **Coefficient of water/oil distribution:**	Not available.
· **Viscosity:**	
Dynamic:	Not applicable.
Kinematic:	Not applicable.
· **Other information**	No further relevant information available.

10 Stability and reactivity

· **Reactivity** No further relevant information available.
· **Chemical stability** No decomposition if used and stored according to specifications.
· **Possibility of hazardous reactions**
WARNING: Product dust together with air may develop ignitable and explosive mixtures
As the product is supplied it is not capable of dust explosion; however enrichment with fine dust causes risk of dust explosion.
· **Conditions to avoid**
In case of thermal decomposition caused by smouldering and incomplete combustion toxic fumes may be developed.
· **Incompatible materials:** Protect from contamination.
· **Hazardous decomposition products:**
Carbon monoxide and carbon dioxide
Aldehyde
At temperatures above 250°C, depolymerization and the release of starting monomers can arise.

11 Toxicological information

· **Information on toxicological effects**

· **Acute toxicity:**

· **Primary irritant effect:**

· **on the skin:** No irritant effect.

· **on the eye:** Irritating effect.
· **Respiratory sensitization** No further relevant information available.
· **Skin sensitization** No further relevant information available.

· **Additional toxicological information:**

· **Carcinogenic categories**

· **IARC (International Agency for Research on Cancer)**
3

(Contd. on page 6)

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· **NTP (National Toxicology Program)**
Substance is not listed.

· **OSHA-Ca (Occupational Safety & Health Administration)**
Substance is not listed.

· **CMR effects (carcinogenity, mutagenicity and toxicity for reproduction)**
· **Carcinogenicity** No further relevant information available.
· **Mutagenicity** No further relevant information available.
· **Reproductive toxicity** No further relevant information available.
· **Specific target organ toxicity (single exposure)** No further relevant information available.
· **Specific target organ toxicity (repeated exposure)** No further relevant information available.

12 Ecological information

· **Toxicity**

· **Aquatic toxicity:** No further relevant information available.

· **Persistence and degradability** No further relevant information available.

· **Behavior in environmental systems:**

· **Bioaccumulative potential** No further relevant information available.
· **Mobility in soil** No further relevant information available.

· **Additional ecological information:**
· **General notes:** Do not allow product to reach ground water, water course or sewage system.
· **Results of PBT and vPvB assessment**
· **PBT:** Not applicable.
· **vPvB:** Not applicable.
· **Other adverse effects** No further relevant information available.

13 Disposal considerations

· **Precautions for disposal:**

· **Recommendation:**
Disposal must be made according to official regulations.
Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Processing, use or contamination of this product may change the waste management options. State/provincial and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state/ provincial and local requirements.

14 Transport information

· **UN-Number**	
· **DOT, ADR, ADN, IMDG, IATA**	None
· **UN proper shipping name**	
· **DOT, ADR, ADN, IMDG, IATA**	None
· **Transport hazard class(es)**	
· **DOT, ADR, ADN, IMDG, IATA**	
· **Class**	None

(Contd. on page 7)

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· **Packing group** · **DOT, ADR, IMDG, IATA**	None
· **Environmental hazards:**	Not applicable.
· **Special precautions for user**	Not applicable.
· **Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	Not applicable.
· **Transport/Additional information:**	Not dangerous according to the above specifications. GRACE recommendation for air transport: Cargo aircraft only.

15 Regulatory information

· **Safety, health and environmental regulations/legislation specific for the substance or mixture**
· **SARA**

· **SARA 302/304**
Substance is not listed.

· **SARA 313**
Substance is not listed.

· **SARA 311/312** Combustible Dust.

· **TSCA (Toxic Substances Control Act):**
ACTIVE

· **Hazardous Air Pollutants**
Substance is not listed.

· **Proposition 65**

· **Chemicals known to cause cancer:**
Substance is not listed.

· **Chemicals known to cause reproductive toxicity for females:**
Substance is not listed.

· **Chemicals known to cause reproductive toxicity for males:**
Substance is not listed.

· **Chemicals known to cause developmental toxicity:**
Substance is not listed.

· **Carcinogenic categories**

· **EPA (Environmental Protection Agency)**
Substance is not listed.

· **TLV (Threshold Limit Value established by ACGIH)**
Substance is not listed.

· **NIOSH-Ca (National Institute for Occupational Safety and Health)**
Substance is not listed.

· **Canadian DSL**

9003-07-0	polypropylene

· **Canadian NDSL**
Substance is not listed.

(Contd. on page 8)
USA

Trade name: polypropylene

(Contd. of page 7)

· **European EINECS**
The corresponding monomers are listed in EINECS.

Substance is not listed.

· **Philippines Inventory of Chemicals and Chemical Substances PICCS**

Substance is listed.

· **Inventory of the Existing Chemical Substances manufactured or imported in China IECSC**

9003-07-0	polypropylene

· **Australian Inventory of Chemical Substances AICS**

Substance is listed.

· **Existing and New Chemical Substance List ENCS**

6-402

· **Korean Existing Chemical Inventory KECI**

KE-29389

· **TCSCA (Taiwan)**

Substance is not listed.

· **New Zealand Inventory of Chemicals (NZIoC)**

Substance is listed.

· **Existing Chemical Directory of Thailand (DIW)**

Substance is listed.

· **TCSI - Taiwan Chemical Substance Inventory**

Substance is listed.

· **GHS label elements** None
· **Hazard pictograms** None
· **Signal word** None
· **Hazard statements** None

16 Other information

This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

· **Department issuing SDS:** GRACE Safety & Health Department
· **Other information:**
Refer to NFPA 654, Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids, for safe handling

· **Contact:**
SALES OFFICES

USA:
GRACE
W. R. Grace & Co.-Conn
7500 Grace DR
Columbia, MD 21044
Tel: +1 410-531 4000

Europe:
Grace GmbH
In der Hollerhecke 1
D-67545 Worms, Germany
Tel: +49 6241 40300

Asia Pacific:
Grace Products (Singapore) Pte Ltd
230 Orchard Road

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(Contd. of page 8)

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Kohken New River Bldg 3F
2-21-18, Shinkawa
Chuo-ku, Tokyo 104-0033
JAPAN
Tel: +81 3.3537.6006
Fax: +81 3.3537.6007

· **Other information:**
· **Date of preparation / last revision** 01/08/2021 / 3.1
· **The first date of preparation** 06/06/2006
· **Number of revision times and the latest revision date** 3.2 / 01/08/2021
· **Abbreviations and acronyms:**
ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road)
IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
ACGIH: American Conference of Governmental Industrial Hygienists
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
PBT: Persistent, Bioaccumulative and Toxic
vPvB: very Persistent and very Bioaccumulative
NIOSH: National Institute for Occupational Safety
OSHA: Occupational Safety & Health
TLV: Threshold Limit Value
PEL: Permissible Exposure Limit
REL: Recommended Exposure Limit
· **Others** No further relevant information available.
· *** Data compared to the previous version altered.**

1 Identification

· **Product identifier**

· **Trade name:** Polyethylene

· **Application of the substance / the preparation:** Raw material
· **Details of the supplier of the safety data sheet**
· **Manufacturer/Supplier:**
GRACE
W. R. Grace & Co.-Conn
7500 Grace Drive
Columbia MD 21044
U. S. A.

· **Information department:**
Health and Safety (9 AM to 5 PM-EST) 1-410-531-4000
MSDS.Davison@grace.com

· **Emergency telephone number:**
Chemtrec North America: +1-800-424-9300
Chemtrec International: +1-703-527-3887
Other Emergencies (24hr): +1-410-531-4000

2 Hazard(s) identification

· **Classification of the substance or mixture**
The substance is not classified, according to the Globally Harmonized System (GHS).
· **Label elements**
· **GHS label elements** None
· **Hazard pictograms** None
· **Signal word** None
· **Hazard statements** None
· **Hazard not otherwise classified** The product is combustible.

3 Composition/information on ingredients

· **Chemical characterization: Substances**

· **Additonal information:**

· **CAS No. and description:**		
9002-88-4	Polyethylene	100%

4 First-aid measures

· **Description of first aid measures**

· **General information:**
Immediately remove contaminated clothing if necessary to prevent direct skin contact.

· **After inhalation:** Supply fresh air; consult doctor in case of complaints.
· **After skin contact:**
Immediately wash with water at least for 30 minutes and rinse thoroughly.
Seek medical treatment.
· **After eye contact:**
Flush opened eye with large quantities of running water for at least 30 minutes. If symptoms occur, consult a doctor.

· **After swallowing:** Seek medical attention. Do not induce vomiting.

(Contd. on page 2)

(Contd. of page 1)

· **Information for doctor:**
· **Most important symptoms and effects, both acute and delayed**
No further relevant information available.
· **Indication of any immediate medical attention and special treatment needed**
No further relevant information available.

5 Fire-fighting measures

· **Extinguishing media**

· **Suitable extinguishing agents:**
CO2, extinguishing powder or water spray. Fight larger fires with water spray or alcohol resistant foam.

· **For safety reasons unsuitable extinguishing agents:** Water with full jet
· **Hazardous combustion products**
Carbon monoxide and carbon dioxide
Can form explosive gas-air mixtures.
· **Advice for firefighters**

· **Protective equipment:**
Wear personal protective equipment.
Wear respiratory protective device.
· **Additional information**
Cool receptacles with water spray.
Dispose of fire debris and contaminated fire fighting water in accordance with official regulations.
Heating of container(s) will cause the pressure to rise with risk of bursting.

6 Accidental release measures

· **Personal precautions, protective equipment and emergency procedures**
Ensure adequate ventilation
Keep away from ignition sources
Wear protective clothing.
Wear respiratory protective device.
· **Environmental precautions:**
Damp down dust with water spray.
Do not allow to enter sewers, surface or ground water.
· **Methods and material for containment and cleaning up:**
Dispose of the collected material according to regulations.
· **Reference to other sections**
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.
· **Protective Action Criteria for Chemicals**

· **PAC-1:**
16 mg/m³

· **PAC-2:**
170 mg/m³

· **PAC-3:**
1,000 mg/m³

USA

(Contd. on page 3)

(Contd. of page 2)

7 Handling and storage

· **Handling:**
· **Precautions for safe handling**
Keep away from heat and direct sunlight.
Any deposit of dust which cannot be avoided must be regularly removed.
Take precautionary measures against static discharges.
No special measures required.

· **Information about protection against explosions and fires:**
WARNING: Product dust together with air may develop ignitable and explosive mixtures
Keep ignition sources away. Do not smoke.
Protect against electrostatic charges.
The product is flammable.
· **Conditions for safe storage, including any incompatibilities**
· **Storage:**
· **Requirements to be met by storerooms and receptacles:**
Use only receptacles specifically permitted for this substance/product.

· **Information about storage in one common storage facility:** Store away from foodstuffs.

· **Further information about storage conditions:** Store in dry conditions.

8 Exposure controls/personal protection

· **Additional information about design of technical systems:** No further data; see item 7.
· **Control parameters**
· **Components with limit values that require monitoring at the workplace:** Not required.
· **Additional information:** Valid lists at time of creation were used as basis.
· **Exposure controls**
· **Personal protective equipment:**

· **General protective and hygienic measures:**
The usual precautionary measures for handling chemicals should be followed.
Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing.
Wash hands before breaks and at the end of work.
Do not inhale dust / smoke / mist.
Prevent contact with the eyes and skin.

· **Protection of hands:**
The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Due to lack of information no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.


Protective gloves

Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation

· **Material of gloves**
Recommended thickness of the material: ≥ 0.35 mm
Leather gloves

· **For the permanent contact in work areas without heightened risk of injury (e.g. Laboratory) gloves made of the following material are suitable:**
Leather gloves

(Contd. on page 4)

Trade name: Polyethylene

(Contd. of page 3)

· **For the permanent contact gloves made of the following materials are suitable:**
Leather gloves

· **For the permanent contact of a maximum of 15 minutes gloves made of the following materials are suitable:**
Leather gloves

· **Not suitable are gloves made of the following materials:** Strong fabric gloves

· **Eye protection:**

Safety glasses

· **Body protection:** Protective work clothing

9 Physical and chemical properties

· **Information on basic physical and chemical properties**	
· **General Information**	
· **Appearance:**	
Form:	Solid
Color:	White
· **Odor:**	Odorless
· **Odor threshold:**	Not applicable.
· **pH-value (50 g/l) at 20 °C (68 °F):**	7
· **Change in condition**	
Melting point/Melting range:	120-135 °C (248-275 °F)
Boiling point/Boiling range:	Not determined.
Drip point:	50-150 °C (122-302 °F) (DIN 51801 & ASTM D 3954-9)
· **Flash point:**	>220 °C (>428 °F) (DIN 51758)
· **Flammability (solid, gaseous):**	Flammable.
· **Ignition temperature:**	>350 °C (>662 °F)
· **Decomposition temperature:**	Not applicable.
· **Auto ignition temperature:**	Product is not self-igniting.
· **Danger of explosion:**	Product is not explosive. However, formation of explosive air/vapor mixtures are possible.
· **Explosion limits:**	
Lower:	Not applicable.
Upper:	Not applicable.
· **Vapor pressure:**	Not applicable.
· **Density at 20 °C (68 °F):**	~0.93 g/cm³ (~7.76085 lbs/gal)
· **Vapor density**	Not determined.
· **Evaporation rate**	Not determined.
· **Solubility in / Miscibility with**	
Water:	Insoluble.
· **Coefficient of water/oil distribution:**	>6 log POW (calculated)

(Contd. on page 5)

(Contd. of page 4)

· **Viscosity:**	
Dynamic at 120 °C (248 °F):	<400 mPas (DIN 53019)
Kinematic:	Not applicable.
· **Other information**	
Particle characteristics	Not determined.

10 Stability and reactivity

· **Reactivity** No further relevant information available.
· **Chemical stability** No decomposition if used and stored according to specifications.
· **Possibility of hazardous reactions**
As the product is supplied it is not capable of dust explosion; however enrichment with fine dust causes risk of dust explosion.
· **Conditions to avoid**
In case of thermal decomposition caused by smouldering and incomplete combustion toxic fumes may be developed.
· **Incompatible materials:** Protect from contamination.
· **Hazardous decomposition products:**
Carbon monoxide and carbon dioxide
Flammable gases/vapors
Hydrocarbons

11 Toxicological information

· **Information on toxicological effects**

· **Acute toxicity:**

· **LD/LC50 values that are relevant for classification:**		
9002-88-4 Polyethylene		
Oral	LD50	7,950 mg/kg (rat)

· **Primary irritant effect:**

· **on the skin:**		
9002-88-4 Polyethylene		
Irritation of skin	IS	0 (-)

· **on the eye:**		
9002-88-4 Polyethylene		
Irritation of eyes	IS	0 (-)

· **Sensitization:** No sensitizing effects known.
· **Skin sensitization** No further relevant information available.

· **Additional toxicological information:**

· **Carcinogenic categories**

· **IARC (International Agency for Research on Cancer)**
3

· **NTP (National Toxicology Program)**
Substance is not listed.

· **OSHA-Ca (Occupational Safety & Health Administration)**
Substance is not listed.

(Contd. on page 6)

(Contd. of page 5)

· **CMR effects (carcinogenity, mutagenicity and toxicity for reproduction)**
· **Carcinogenicity** No further relevant information available.
· **Mutagenicity** No further relevant information available.
· **Reproductive toxicity** No further relevant information available.
· **Specific target organ toxicity (single exposure)** No further relevant information available.
· **Specific target organ toxicity (repeated exposure)** No further relevant information available.

12 Ecological information

· **Toxicity**

· **Aquatic toxicity:** No further relevant information available.

· **Persistence and degradability** No further relevant information available.
· **Other information:**
Do not allow product to reach sewage system, groundwater and any water course.
By the insolubility in water there is a separation at every filtration and sedimentation process.

· **Behavior in environmental systems:**

· **Bioaccumulative potential**
Due to the distribution coefficient n-octanol/water an accumulation in organisms is possible.
· **Mobility in soil** No further relevant information available.

· **Additional ecological information:**
· **General notes:**
Do not allow product to reach ground water, water course or sewage system.
Not hazardous for water.
· **Results of PBT and vPvB assessment**
· **PBT:** Not applicable.
· **vPvB:** Not applicable.
· **Other adverse effects** No further relevant information available.

13 Disposal considerations

· **Precautions for disposal:**

· **Recommendation:**
Disposal must be made according to official regulations.
Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Processing, use or contamination of this product may change the waste management options. State/provincial and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state/ provincial and local requirements.

14 Transport information

· **UN-Number** · **DOT, ADR, ADN, IMDG, IATA**	Not applicable.
· **UN proper shipping name** · **DOT, ADR, ADN, IMDG, IATA**	Not applicable.
· **Transport hazard class(es)** · **DOT, ADR, ADN, IMDG, IATA** · **Class**	Not applicable.

(Contd. on page 7)

(Contd. of page 6)

· **Packing group** · **DOT, ADR, IMDG, IATA**	Not applicable.
· **Environmental hazards:**	Not applicable.
· **Special precautions for user**	Not applicable.
· **Segregation groups**	-
· **Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	Not applicable.
· **Transport/Additional information:**	Not dangerous according to the above specifications. GRACE recommendation for air transport: Cargo aircraft only.

15 Regulatory information

· **Safety, health and environmental regulations/legislation specific for the substance or mixture**
· **SARA**

· **SARA 302/304**
Substance is not listed.

· **SARA 313**
Substance is not listed.

· **SARA 311/312** Not applicable.

· **TSCA (Toxic Substances Control Act):**
ACTIVE

· **Hazardous Air Pollutants**
Substance is not listed.

· **Proposition 65**

· **Chemicals known to cause cancer:**
Substance is not listed.

· **Chemicals known to cause reproductive toxicity for females:**
Substance is not listed.

· **Chemicals known to cause reproductive toxicity for males:**
Substance is not listed.

· **Chemicals known to cause developmental toxicity:**
Substance is not listed.

· **Carcinogenic categories**

· **EPA (Environmental Protection Agency)**
Substance is not listed.

· **TLV (Threshold Limit Value)**
Substance is not listed.

· **NIOSH-Ca (National Institute for Occupational Safety and Health)**
Substance is not listed.

· **Canadian DSL**

9002-88-4	Polyethylene

(Contd. on page 8)

(Contd. of page 7)

· **Canadian NDSL**
Substance is not listed.

· **European EINECS**
Substance is not listed.

· **Philippines Inventory of Chemicals and Chemical Substances PICCS**
Substance is listed.

· **Inventory of the Existing Chemical Substances manufactured or imported in China IECSC**

9002-88-4	Polyethylene

· **Australian Inventory of Industrial Chemicals (AIIC)**
Substance is listed.

· **Existing and New Chemical Substance List ENCS**
6-1

· **Korean Existing Chemical Inventory KECI**
KE-28877

· **TCSCA (Taiwan)**
EPEP4A01714252

· **Russian Register of Potentially Hazardous Chemical and Biological Substances (RPOHV)**
№ ВТ-000548 от 14.07.1995 г.

· **New Zealand Inventory of Chemicals (NZIoC)**
Substance is listed.

· **Existing Chemical Directory of Thailand (DIW)**
Substance is listed.

· **TCSI - Taiwan Chemical Substance Inventory**
Substance is listed.

· **Mexican National Inventory of Chemical Substances (INSQ)**
Substance is listed.

· **GHS label elements** None
· **Hazard pictograms** None
· **Signal word** None
· **Hazard statements** None
· **Classification system:**

· **NFPA ratings (scale 0 - 4)**

Health = 1
Fire = 1
Reactivity = 0

· **HMIS-ratings (scale 0 - 4)**

Health = 1
Fire = 1
Reactivity = 0

*

16 Other information

This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

· **Department issuing SDS:** GRACE Safety & Health Department

(Contd. on page 9)

(Contd. of page 8)

· **Contact:**
SALES OFFICES

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7500 Grace DR
Columbia, MD 21044
Tel: +1 410-531 4000

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In der Hollerhecke 1
D-67545 Worms, Germany
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Asia Pacific:
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230 Orchard Road
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Singapore 238854
Tel: +65 6737 3033
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Grace Trading (Shanghai) Ltd
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Kohken New River Bldg 3F
2-21-18, Shinkawa
Chuo-ku, Tokyo 104-0033
JAPAN
Tel: +81 3.3537.6006
Fax: +81 3.3537.6007

· **Other information:**
· **Date of preparation / last revision** 03/11/2022 / 3.2
· **The first date of preparation** 05/07/2003
· **Number of revision times and the latest revision date** 3.3 / 03/10/2022
· **Abbreviations and acronyms:**
ADR: Accord relatif au transport international des marchandises dangereuses par route (European Agreement Concerning the International Carriage of Dangerous Goods by Road)
IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
LC50: Lethal concentration, 50 percent
LD50: Lethal dose, 50 percent
PBT: Persistent, Bioaccumulative and Toxic
vPvB: very Persistent and very Bioaccumulative
NIOSH: National Institute for Occupational Safety
OSHA: Occupational Safety & Health
TLV: Threshold Limit Value
PEL: Permissible Exposure Limit
REL: Recommended Exposure Limit
· **Others** No further relevant information available.
· *** Data compared to the previous version altered.**

ATTACHMENT 8

Electric Flameless Thermal Oxidizer Vendor Information

ELECTRIC FTO
FLAMELESS THERMAL OXIDIZER

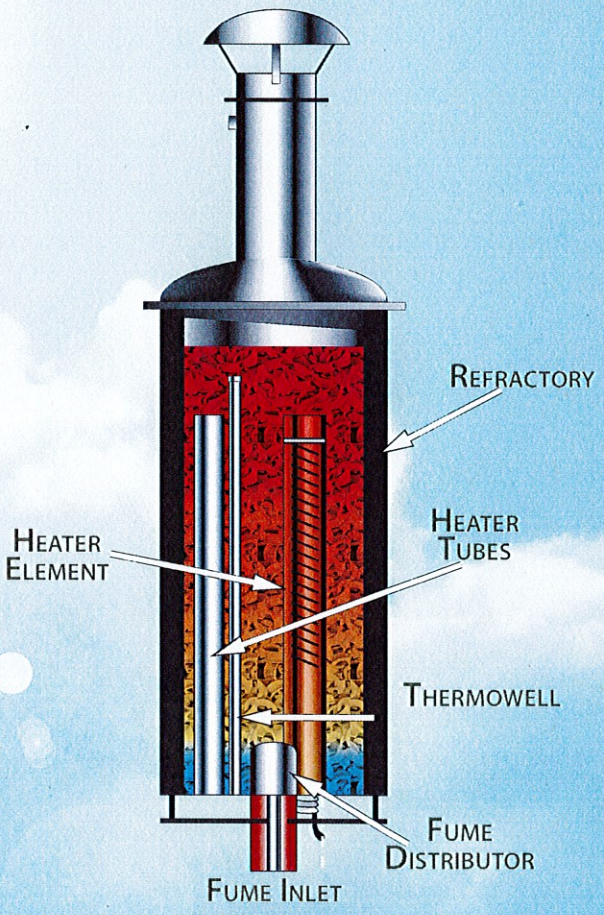
High Destruction Efficiency, Low NOx, Electrically Heated

The *PCC Electric FTO (EFTO)* consistently treats Volatile Organic Compounds (VOCs) in waste gas streams yielding removal efficiencies of 99.9999%. The thermal oxidation is accomplished at 1800°F to avoid production of thermal NOx and to minimize operating costs. Thermal NOx levels are <1 ppmv.

The *PCC Electric FTO* consists of a carbon steel, refractory-lined oxidation vessel. The vessel contains three spiral-wound electric resistance heater elements in 310SS protection tubes surrounded by a bed of randomly packed inert ceramic saddles. The *PCC Electric FTO* is fully automatic and there are no moving parts in the oxidizer. Alternate materials of construction are available as required based on the waste gas composition. A typical system requires 480V 3phase 100 amp, 120V 1 phase 20 amp, and 5 scfm of instrument air at 80 psig.

How the PCC Electric FTO Works

The *PCC EFTO* consists of a vertical, refractory-lined vessel filled with ceramic media. The ceramic media is pre-heated to a calculated temperature through the use of an electric resistance heater. Electrical energy is only required as a supplement to the heat content of the fume and to preheat the ceramic bed during start-up.



The waste gas and air are pre-mixed at the bottom of the vessel and introduced into the unit. The organic compounds found in the waste gas are oxidized and discharged into the atmosphere via a stack extension on the top of the unit.

The *PCC Electric FTO* operates well below the Lower Flammable Limit (LFL), eliminating the possibility of a flame within the system. The fume oxidizes as it passes through the oxidation zone releasing heat, which is transferred into the surrounding ceramic matrix thus maintaining the operating temperature of the bed without the need for supplemental heat via the electric heaters.

Simplicity of Design

The *PCC EFTO's* simplicity of design and portability make it a multi-purpose piece of equipment for multiple low volume gas treatment applications. The *PCC EFTO's* standardized design requires minimal customization. The modular configuration makes it simple to install.

PROCESS COMBUSTION CORPORATION
300 Weyman Road, Suite 400 · Pittsburgh, PA 15236 · (412) 655-0955 · pcc@pcc-group.com · www.pcc-group.com

Call now for a competitive proposal!

January 9, 2024

Susan Nash, Regulatory and Compliance Engineer Sr.
Air and Radiation Administration
Air Quality Permits Program
Maryland Department of the Environment
1800 Washington Boulevard
Baltimore, Maryland 21230
susan.nash@maryland.gov

W. R. Grace & Co.- Conn. Columbia, MD facility's application for a planned pilot-scale test catalytic chemical conversion process was submitted to MDE on August 7, 2023.

The following is a response to your question, received on January 5, 2024, regarding emissions estimates in our application; namely, "How were the emissions estimates done for both stacks and for all types of pollutants [criteria, GHG, TAPs, etc.}".

Estimated emissions (along with relevant information in footnotes and assumed control efficiencies) for the Thermal Oxidizer (TO) Stack and the Regenerator Exhaust Vent are presented in Tables 1 and 2, for the TO Stack and Table 3, for the Regenerator Exhaust Vent, in Attachment 5 of the application. A summary of the bases and assumptions for the emissions estimates are given below.

For the TO Stack:

- Criteria pollutants
  - VOC based on gaseous hydrocarbon yield (i.e., mass hydrocarbon per mass raw material) and typical distribution of hydrocarbons from catalytic cracking estimated from
    - Bench scale lab testing results
    - Published technical papers of similar reactions
    - Understanding of cracking chemistry of the raw material
    - Mass balance of the system
  - PM estimated from
    - Assumed percentage of outlet particulate fines based on system catalyst inventory
- GHG pollutants
  - CO_2 estimated from
    - Bench scale lab testing results
    - Published technical papers of similar reactions
    - Understanding of cracking chemistry of the raw material
    - Mass balance of the system
    - As a result of the destruction of hydrocarbons in the TO, assumed moles of hydrocarbon carbon input to TO are converted to mass of CO_2 (one mole of carbon to one mole of CO_2)

    - Methane based on gaseous hydrocarbon yield (i.e., mass hydrocarbon per mass raw material) and typical distribution of hydrocarbons from catalytic cracking estimated from
        - Bench scale lab testing results
        - Published technical papers of similar reactions
        - Understanding of cracking chemistry of the raw material
        - Mass balance of the system
- TAPs
    - Six of the speciated VOC pollutants are Class II TAPs. See Criteria Pollutants bullet above for VOC.

For the Regenerator Exhaust Vent:

- All pollutants
    - Based on 20 years of experience on operating regenerators from other similar pilot plants (eg., Davison Circulating Riser (DCR))
- Criteria pollutants
    - CO estimated from
        - Assumed lean burn (excess oxygen) resulting in trace CO at detection limit
    - NO estimated from
        - Published technical paper of similar process (and similar N content of raw feed and lean combustion)
    - PM estimated from
        - Assumed percentage of outlet particulate fines based on system catalyst inventory
- GHG pollutants
    - CO_2 estimated from
        - Carbon balance of coke deposited on spent catalyst

Please contact me with any questions.

Sincerely,

Daniel Resca
Project Manager
W.R. Grace & Co.-Conn
Daniel.resca@grace.com
410-531-4570

HOWARD COUNTY DEPARTMENT OF PLANNING AND ZONING
3430 Court House Drive ■ Ellicott City, Maryland 21043 ■ 410-313-2350
Lynda D. Eisenberg, AICP, Director FAX 410-313-3467

September 13, 2024

To Whom It May Concern:

In September of 2023, WR Grace requested a Zoning Compliance Certificate associated with an application for a research-scale pilot plant for development purposes only at the request of Maryland Department of the Environment (MDE). The zoning compliance certificate was limited to whether this use is permitted at 7500 Grace Drive (Building 30 Lab 120).

A letter was issued to WR Grace and MDE in September of 2023 confirming R&D as an allowable use according to the following:

The property was zoned Residential in the first zoning regulations adopted in 1948 and rezoned as follows:

- 1961: R-40 (Residential, One and Two-Family Detached)
- 1977: R (Rural)
- 1986: PEC (Planned Employment Center) Zoning Board Case No. 814

The research and development laboratory land use was permitted as a matter of right in the PEC zoning district in 1991. This use was legally established in Building 30, as approved through SDP-91-090 in 1991.

The research and development establishments land use was removed as a matter of right use from the PEC zoning district during the 2013 Comprehensive Zoning.

Section 129.0.A of the Howard County Zoning Regulations, states that a nonconforming use is "any lawful existing use, whether of a structure or a tract of land, which does not conform to the use regulations of the zoning district in which it is located, either on the effective date of these Regulations or as a result of any subsequent amendment thereto. Therefore, the research and development activity on the Property is a nonconforming use.

A nonconforming use may be continued subject to the requirements of Section 129.0.B. The proposed research and development lab complies with these requirements.

More recently on August 19, 2024, because of numerous zoning inquiries regarding this site, the Maryland Department of the Environment requested DPZ to again verify the allowance of this use. The Department of Planning and Zoning received a zoning complaint on August 8, 2024, alleging that Engineering and Scientific Research is occurring at the property and is not in conformance with the PEC district. On Monday September 9, 2024, the Chief of Public Service and Zoning Administration along with representatives from the Maryland Department of the Environment and WR Grace visited the site and toured the inside of the facility to investigate possible zoning violations. During this inspection there were no zoning violations observed and no unapproved exterior development evident. WR Grace further supported their nonconforming use status by providing a letter indicating that the building has been used for research and development without cessation since 2013.

Attached is the close out letter indicating no zoning violations found at 7500 Grace Drive (Building 30 Lab 120) along with the WR Grace letter mentioned above.

The Department of Planning and Zoning only has the authority to inspect and validate the zoning and site conditions of the property and is not the issuer of the Air Quality Permit. The Maryland Department of Environment issues the permit and has previously conducted public meetings to receive comments and questions. Further concerns and questions may be directed to MDE's Shannon Heafey. Her contact information is below.

Shannon Heafey, Public Participation Coordinator Air Quality Permits Program, Air and Radiation Administration Maryland Department of the Environment
1800 Washington Boulevard, Baltimore, Maryland 21230 shannon.heafey@maryland.gov
410-537-4433

Sincerely,

Geoff Goins, Division Chief
Public Service and Zoning Administration

Cc: Lynda Eisenberg, DPZ Director

HOWARD COUNTY DEPARTMENT OF PLANNING AND ZONING
3430 Courthouse Drive ■ Ellicott City, Maryland 21043 ■ 410-313-2350

Lynda D. Eisenberg, AICP, Director

www.howardcountymd.gov
FAX 410-313-3391
TDD 410-313-2323

September 13, 2024

Nana Adadey
7252 Mainstream Way
Columbia, MD 21044

RE: Alleged Zoning Violation
7500 Grace Drive
CE-24-107

Ms. Adadey,

In response to your request regarding the above-mentioned property a representative of the Zoning Division inspected the property on September 9, 2024. There were no violations of the Howard County Zoning Regulations or Subdivision and Land Development Regulations found for this property. Since there are no violations, the case is closed.

If you are interested in reviewing the case file for more details, please submit a written request to me at 3430 Court House Drive Ellicott City, MD 21043 or via email to ggoins@howardcountymd.gov.

Thank you for referring this matter to the Division of Public Service and Zoning Administration. If you have any questions concerning this case, please contact Geoff Goins at (410) 313-4350.

Sincerely,

DocuSigned by:
Lynda Eisenberg
DE9E3B54B3144...

Lynda D. Eisenberg, AICP, Director
Department of Planning and Zoning

Any person aggrieved by a decision of the Department of Planning and Zoning ***may file an appeal to the Board of Appeals.*** *An appeal to this notice must be filed within 30 days of the date of the notice and must state the alleged error or other grounds for the appeal. Instructions and forms for filing an appeal may be obtained from the Department of Planning and Zoning.*

GRACE
Talent | Technology | Trust

Scott K. Purnell
Vice President, R&D
Refining Technologies

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M +1 443 280 1265
Scott.Purnell@grace.com

W. R. Grace & Co.
7500 Grace Drive
Columbia, MD. USA 21044

September 9, 2024

W. R. Grace Building 30: Use

To Whom it May Concern:

I am writing to confirm that Building 30 on our property at 7500 Grace Drive, Columbia, MD has been in continuous use for research and development (R&D) activities since 2013 without cessation.

Examples of R&D work conducted in this building includes:

- Catalytic performance testing of Grace methanol-to-olefins (MTO) catalysts whereby methanol is reacted with our catalysts at high temperatures and converted to ethylene, propylene and other products. Catalysts are tested for activity, selectivity, and stability and compared against each other and over a range operating conditions.
- Catalytic performance testing of Grace RANEY® hydrogenation catalysts. RANEY catalysts are used in a range of hydrogenation reactions from nitro compounds to amines, carbonyls to alcohols, nitriles to amines, olefins, and acetylenes to saturates. Also, they are widely used in reductive alkylations, reductive aminations and ammonolysis of alcohols. Catalysts are tested for activity, selectivity, and stability and compared against each other and over a range operating conditions.
- Drying and high-temperature heat treatment of Grace Fluid Cracking Catalysts (FCC) and Additives as well as zeolites such as USY and ZSM-5.
- Studies whereby fluidizable catalysts with different particle size distributions and morphologies are studied over a range of air flow rates to compare their fluidization properties.
- Bench-scale sample handling including sample collection, separation, screening, preparation and submission to in-house and third-party analytical laboratories, etc.

If you have any further questions, please do not hesitate to contact me.

Sincerely,

Scott K. Purnell
Vice President, R&D

APPENDIX B
W.R. Grace &Co.-CONN
Letter Dated Oct 10, 2024

GRACE
Talent | Technology | Trust™

Ms. Apple Chapman
Assistant General Counsel
Regulatory & EHS

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apple.chapman@grace.com
W. R. Grace & Co.-Conn.
7500 Grace Drive
Columbia, MD 21044

Suna Yi Sariscak, Manager
Air Quality Permits Program
Maryland Department of the Environment
Air and Radiation Management Administration
1800 Washington Boulevard, Suite 720
Baltimore, Maryland 21230-1720
MDE.Submit-AirPermits@Maryland.gov

October 10, 2024

Sent Via Electronic Mail

Re: Supplemental Information for Permit to Construct Research-Scale Pilot Plant, W.R. Grace & Co., 7500 Grace Drive, Columbia MD
Docket No. 16-23

Dear Ms. Sariscak:

W.R. Grace & Co. – Conn. (Grace) submitted the above-referenced application for a permit to construct in August 2023. We understand that questions have been raised regarding whether the proposed unit is subject to the requirements of NSPS Subpart EEEE, 40 C.F.R. Part 60, Subpart EEEE, which regulates, among other things, small municipal solid waste (MSW) incinerators. We are writing to provide confirmation that the unit is not subject to these requirements for reasons including the following: first, the unit will not process MSW; and second, the unit is exempt as a laboratory analysis unit.

I. Background

Purpose

Grace seeks to permit a pilot-scale project to research a new catalytic chemical process to convert plastics back into their original components. The purpose of this pilot plant is to develop data to assess the technical and economic feasibility of this advanced conversion technology. If successful, the technology could be licensed or sold to refineries and chemical manufacturing facilities to enable more efficient and low-pollution recycling of plastic wastes into useful raw materials and feedstocks.

Currently, plastic waste is often disposed either in landfills or by incineration. The only widely available commercial recycling technology for plastics is mechanical recycling, which involves breaking down the plastic into smaller pieces to be melted and re-used as recycled plastic. Mechanical recycling, however, has a substantial downside: plastic begins to lose its integrity as it is mechanically recycled—especially after multiple cycles. Grace's unique technology, if proven, will provide a new recycling option that is both more environmentally friendly and more commercially desirable: it will use a chemical reaction to break down the plastic into its component parts, such as ethylene, propylene, and butylene. These chemicals are commercially valuable and can be used to manufacture virgin plastic or for other uses.

The specific project that Grace proposes for its Columbia, Maryland R&D facility involves a pilot-scale process, which is several orders of magnitude smaller than a commercial process. The unit is designed to process only small quantities of various types of plastics to test/assess the process solely for research and development purposes.

Process

The process itself is shown in the attached drawing. The process begins by feeding plastic pellets into the unit's reactors along with a heated catalyst, nitrogen, and steam. No oxygen or flame is present in the reaction chamber; instead, heat is required to activate the catalyst and trigger the chemical reaction. This process is known as catalytic chemical conversion, or catalytic pyrolysis. The heated catalyst interacts with the plastic to break it down into its component parts, which at this point are entirely in a gaseous phase. The gas exits the reactor through a cyclone, which captures any small bits of catalyst that may be entrained in the gases and returns them to the reactor. From the cyclone, the gases enter a condenser unit to separate the products into gas and liquid fractions.[1] All liquids appropriate disposal; waste gases are controlled through a thermal oxidizer.

During the process, the catalyst becomes coated with catalytic coke, a soot-type substance that prevents the catalyst from interacting with the plastic feedstock. As a result, the catalyst is sent to a catalyst regenerator in a continuous process. The regenerator is like those used at many industrial catalytic processes and is an integral part of the process. The regenerator

[1] As described in more detail below, this pilot unit will employ a condenser for this stage of the process, but Grace anticipates that a commercial-sized unit would employ one or more distillation processes to separate out the gas and liquid fractions into individual products.

oxidizes the coke, which removes it from the catalyst, and the regenerated catalyst is returned to the reactor.

Contemplated Research Unit

The contemplated unit is specifically designed only for testing purposes. The unit will be different in several ways from a commercial unit.

First, the unit is very small, processing only 1 kg/hr of plastic pellets. Yearly operation is expected to be less than or equal to 4000 hours/year, compared with commercial operations that generally strive for more than 85% annual uptime, or 7400+ hours/year.

Second, the feedstock characteristics will be significantly different from a commercial unit. A commercial unit will likely be fed rough-shredded post-consumer plastics direct from a recycling facility, whereas the pilot process is only capable of feeding clean and carefully pre-sized pelletized plastics. The pilot project will have two phases of feed testing. In the first phase, the feedstock for the unit will comprise virgin plastic pellets bought from commercial suppliers. Grace plans to use a variety of types of pellets to assess the potential reaction products from different types of plastics (numbers 1-7). In addition, Grace may also add non-hazardous materials that are typically used as additives in manufacturing plastics, such as calcium carbonate, so that it may test the impact of these materials on the reaction output.[2]

If the results of the first phase indicate that the process is technologically feasible and commercially viable, Grace hopes to conduct a second phase of the pilot project to test recycled plastics. The unit cannot, however, directly process plastic waste. Rather, it is designed to accept only cleaned, pelletized plastic. Therefore, if and when the site moves to the second phase of the operation, it will need to either clean and pelletize recycled plastic before the plastic is fed to the process, or purchase cleaned, pelletized recycled plastic. This type of pelletized recycled plastic is often commercially sold as feedstock for a variety of manufacturing processes, including highly regulated food contact applications.

Third, we anticipate that a commercially sized process would conduct significant additional processing, including, for example, multiple distillations to separate the individual gaseous and liquid compounds produced by the process, and then use or sell those products as raw materials or feedstocks. The small size of the project here, however, means that it is not economically feasible to further process and sell or re-use the products. Instead, the pilot project

[2] Note that Grace will *not* intentionally add PFAS as part of its testing program.

will use a condenser to separate the vent stream from the reactor into liquid and gaseous components.

Grace will assess both the material yields and the chemical composition of each stream by sending the materials through analytical equipment such as a gas chromatograph. The results of these tests will be used to assess the technical and commercial viability of the operation and assess any environmental and/or commercial implications (*e.g.*, production of either useful or undesirable byproducts when particular types or combinations of materials are processed). After this testing is complete, the liquids will be sent off-site for proper treatment and disposal, and the gases will be sent to a thermal oxidizer with 99.99% combustion efficiency.

II. Applicability of NSPS EEEE

EPA has promulgated a variety of regulations for incinerators. NSPS Subpart EEEE applies to new incineration units that meet the definition of "very small municipal waste combustion units" and that are not otherwise excluded. 40 C.F.R. § 60.2885. A "municipal waste combustion unit" is defined as:

> any setting or equipment that combusts municipal solid waste (as defined in this subpart) including, but not limited to, field-erected, modular, cyclonic burn barrel, and custom-built incineration units (with or without energy recovery) operating with starved or excess air, boilers, furnaces, pyrolysis/combustion units, and air curtain incinerators (except those air curtain incinerators listed in § 60.2888(b))."

40 C.F.R. § 60.2977. "Municipal solid waste" (MSW), in turn, is defined as:

> refuse (and refuse-derived fuel) collected from the general public and from residential, commercial, institutional, and industrial sources consisting of paper, wood, yard wastes, food wastes, plastics, leather, rubber, and other combustible materials and non-combustible materials such as metal, glass and rock, provided that: (1) the term does not include industrial process wastes or medical wastes that are segregated from such other wastes; and (2) an incineration unit shall not be considered to be combusting municipal solid waste for purposes of this subpart if it combusts a fuel feed stream, 30 percent or less of the weight of which is

> comprised, in aggregate, of municipal solid waste, as determined by § 60.2887(b).

Id.

Finally, Subpart EEEE excludes "laboratory analysis units," which are defined as units that [burn] samples of materials only for the purpose of chemical or physical analysis." *Id.* § 60.2887(j).

The proposed project does not fall within the scope of Subpart EEEE, for reasons including: (1) the unit does not combust MSW;[3] and (2) the unit is an exempt "laboratory analysis unit."

A. The feedstock is not "municipal solid waste."

As discussed above, phase 1 of the project will use virgin plastic pellets as feedstock. These pellets are commercially available and sold on the market for a number of uses. They are not and cannot be considered to be "refuse" or "refuse-derived fuel" within the meaning of the definition of MSW because they have never been "discarded."

The same holds true for the second phase, which will use cleaned, recycled plastic pellets. In this phase, the material used as feedstock may have begun as a waste material (*i.e.*, it was discarded from any number of residential, commercial, industrial, or institutional sources) in some past iteration, but the cleaned, processed plastic pellets used as feedstock are considered a new product and are no longer waste. Indeed, EPA has determined and courts have held that this feedstock is not a waste[4] and these types of clean, recycled plastic pellets are commercially available from a number of sources and can be used to make a variety of products, including

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[3] Please note that the catalytic chemical process does not "combust" any materials. While Subpart EEEE does refer to "pyrolysis" units, EPA's focus at the time was on "pyrolysis/combustion" units – *i.e.*, those that use direct application of heat alone to burn/destroy materials, not catalytic chemical units that rely on a catalyst to chemically break down a material into its component parts. *See* 70 Fed. Reg. 74870, 74876-66 (Dec. 16, 2005).

[4] *See* 76 Fed. Reg. 15456, 15537 ("Collected plastic is generally sent to a reclaimer, who will sort, grind, and clean the plastic. The cleaned and sorted plastic is sent to a manufacturer who will use it as feedstock. These are clear examples where discarded materials are processed into legitimate non-waste products."); *Cf. Alternate Fuels, Inc. v. Dir. of Illinois E.P.A.*, 215 Ill. 2d 219, 240 (2004), as modified on denial of reh'g (June 16, 2005) (holding that plastic pesticide containers that were cleaned, shredded into chips, and sold as fuel did not constitute "waste" because the material was a new product that had been returned to the economic stream of commerce).

plastic bottles, piping, decking, or textiles. *See*, *e.g.*, https://www.ptonline.com/products/mechanically-recycled-food-contact-hdpe-

We note that Subpart EEEE does apply to "refuse-derived fuel." *See* 40 C.F.R. §§ 60.2977. In this case, however, the pelletized plastic is not a "fuel" at all, because it is not being combusted (or otherwise used) for its heating or energy value.[5] Indeed, the heat required to activate the catalyst, generate steam for the process, and run the thermal oxidizer will be provided by electricity, using the existing electrical service at the Columbia site. In particular, the equipment identified in the permit application will be heated/cooled as follows:

1) Reactors and risers, heated by electric heater, with power provided and controlled by skid-mounted panel.
2) Reactor gas cyclone, heated by electric heater, with power provided and controlled by skid-mounted panel.
3) Reactor gas stabilization column, cooled by heat exchangers with circulating coolants, which are powered and controlled by skid-mounted electric chillers.
4) Electric flameless thermal oxidizer, heated by electric heater, with power provided and controlled by skid-mounted panel.
5) Spent catalyst stripper, heated by electric heater, with power provided and controlled by skid-mounted panel.
6) Spent catalyst regenerator, heated by electric heater, the power is provided and controlled by skid-mounted panel.
7) Steam generators, heated by electric heater, with power provided and controlled by skid-mounted panel.
8) Some associated hoppers, vessels/tanks, conveyance systems, and piping are heat traced by electric heaters, with power provided and controlled by on-skid panel.

Nor are other parts of the process where heat is used – *i.e.*, the thermal oxidizer and the catalyst regeneration unit – subject to Subpart EEEE.

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[5] Refuse-derived fuel consists of mixed MSW subject to some basic level of shredding and sorting of non-combustibles. *See* "Energy Recovery from the Combustion of Municipal Solid Waste (MSW)," available at: https://www.epa.gov/smm/energy-recovery-combustion-municipal-solid-waste-msw; *see also* 76 Fed. Reg. 15456, 15537 ("Another example is scrap tires retrieved from waste tire piles that have been shredded/chipped into [tire derived fuel (TDF)] with the wire removed. In this instance, the scrap tires have been sufficiently processed and thus, the TDF would not be considered a solid waste when burned as a fuel. On the other hand, scrap tires from waste tire piles that have been shredded/chipped without the metal wire removed, would not be considered to have been sufficiently processed, and any TDF that is generated in such a fashion would be considered a waste-derived fuel."). Due to the level of sorting, cleaning, and processing required to manufacture them, as well as the variety of their non-fuel uses, the plastic pellets that Grace intends to use are not refuse-derived fuel.

Thermal oxidizer. The pilot plant will use a thermal oxidizer to destroy the gas stream exiting the condenser. As discussed above, this gas stream would normally be considered a "product" (and not a "waste"). In this case, however, the unit is too small to produce the kind of volume necessary for commercial viability; accordingly, the pilot plant will use the thermal oxidizer to destroy the product after it has been analyzed by the gas chromatograph. These kinds of gases, however, are expressly excluded from the definition of MSW, because they are uncontained and segregated from any other waste streams.[6] As such, the thermal oxidizer is not subject to Subpart EEEE; instead, it is treated and permitted as an air pollution control device and will be subject to appropriate emissions limits and monitoring requirements under the permit.

Catalyst regeneration unit. The chemical reaction process leads to the development of coke, or a sooty layer, on the catalyst. Because an effective chemical reaction requires catalyst with a sufficient clean surface area, the catalyst must be treated in a regeneration unit, which uses heat and oxygen to oxidize the coke. The catalyst regeneration unit operates continuously while the process is running to ensure a sufficient supply of clean catalyst.

These types of regeneration processes are used across a variety of industries and are consistently regulated as part of the process, not as a waste management unit.[7] Indeed, if the catalyst could be used only once before being disposed of, this catalytic chemical process would be cost-prohibitive; the regeneration is necessary to make the process commercially viable.[8]

Moreover, the materials heated in the catalyst regeneration unit are not "municipal solid waste" for purposes of Subpart EEEE. Specifically, all such materials are by-products of the on-site industrial/R&D activities. They are not "collected from" multiple off-site sources, as is required if Subpart EEEE is to apply. *See* 40 C.F.R. § 60.2977 (MSW must be "collected from the general public *and* from residential, commercial, institutional, and industrial sources.") (emphasis added).

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[6] *See* 40 C.F.R. § 60.2977 (defining "municipal solid waste" to exclude "industrial process wastes . . . that are segregated from such other wastes," and limiting "solid waste" to "contained gaseous material resulting from industrial . . . activities"); *see also* 70 Fed. Reg. 74870, 74877 ("It is important to note, however, that [thermal oxidizers and flameless thermal oxidizers] often are used to combust uncontained gases (generally from industrial processes) and are not used to dispose of solid waste. Such units would not be subject to the final OSWI rules.").

[7] *See, e.g.*, 40 C.F.R. Part 60, Subpart J (regulating, among other things, fluid catalytic cracking unit catalyst regenerators at refineries); 40 C.F.R. Part 63, Subpart UUU (regulating process vents from catalyst regeneration and reforming processes at refineries).

[8] Once the catalyst is completely spent and can no longer be used effectively in the process, is it considered a "waste" and will be properly disposed of at a permitted waste management facility.

In sum, no part of the pilot plant will combust municipal solid waste as those terms are defined in Subpart EEEE, and therefore the unit is not subject to Subpart EEEE's requirements.

B. The pilot process is an exempt "laboratory analysis unit."

In addition to not processing any MSW, the unit also is exempt from Subpart EEEE as a "laboratory analysis unit." 40 C.F.R. § 60.2887(j). Subpart EEEE expressly excludes units that "[burn][9] samples of materials only for the purpose of chemical or physical analysis."

Grace's pilot project falls squarely within this provision. As discussed above, the sole purpose of the project is to allow Grace to gather and analyze data on the products generated by the proposed catalytic chemical process. In particular, the site intends to weigh the products and evaluate them in a gas chromatograph to assess the composition of the products and the yield and quantity of each potentially useful material.

The unit in question is *not* designed to produce any gases or liquids for sale; indeed, the quantity of material that the unit is capable of processing (1 kg/hr) is so small that attempting to use the unit to manufacture a product for sale would not be commercially viable. Grace will thus receive no immediate economic benefit from this operation; indeed, it will be incurring costs to purchase feedstocks, provide power, and operate the process, without the benefit of generating any revenue. In sum, this pilot project would never be commercially viable as proposed. Accordingly, the pilot project qualifies as a "laboratory analysis unit" that is exempt from regulation under Subpart EEEE.

III. Conclusion

We appreciate the opportunity to address MDE's questions regarding the appropriate regulations to apply to this proposed project, and we hope we have addressed the concerns you raised. We believe that this new process technology will provide a more environmentally beneficial method of managing and re-using plastic wastes, producing more valuable products with lower environmental impacts. But we need to complete this project and conduct the planned testing to determine whether the process can work as efficiently and cost-effectively as we believe it will – and, indeed, to assess whether this process will be at all commercially viable.

[9] As noted above, the process in question does not in fact "burn" anything; rather, it uses a catalytic chemical reaction to break plastic molecules into their individual components.

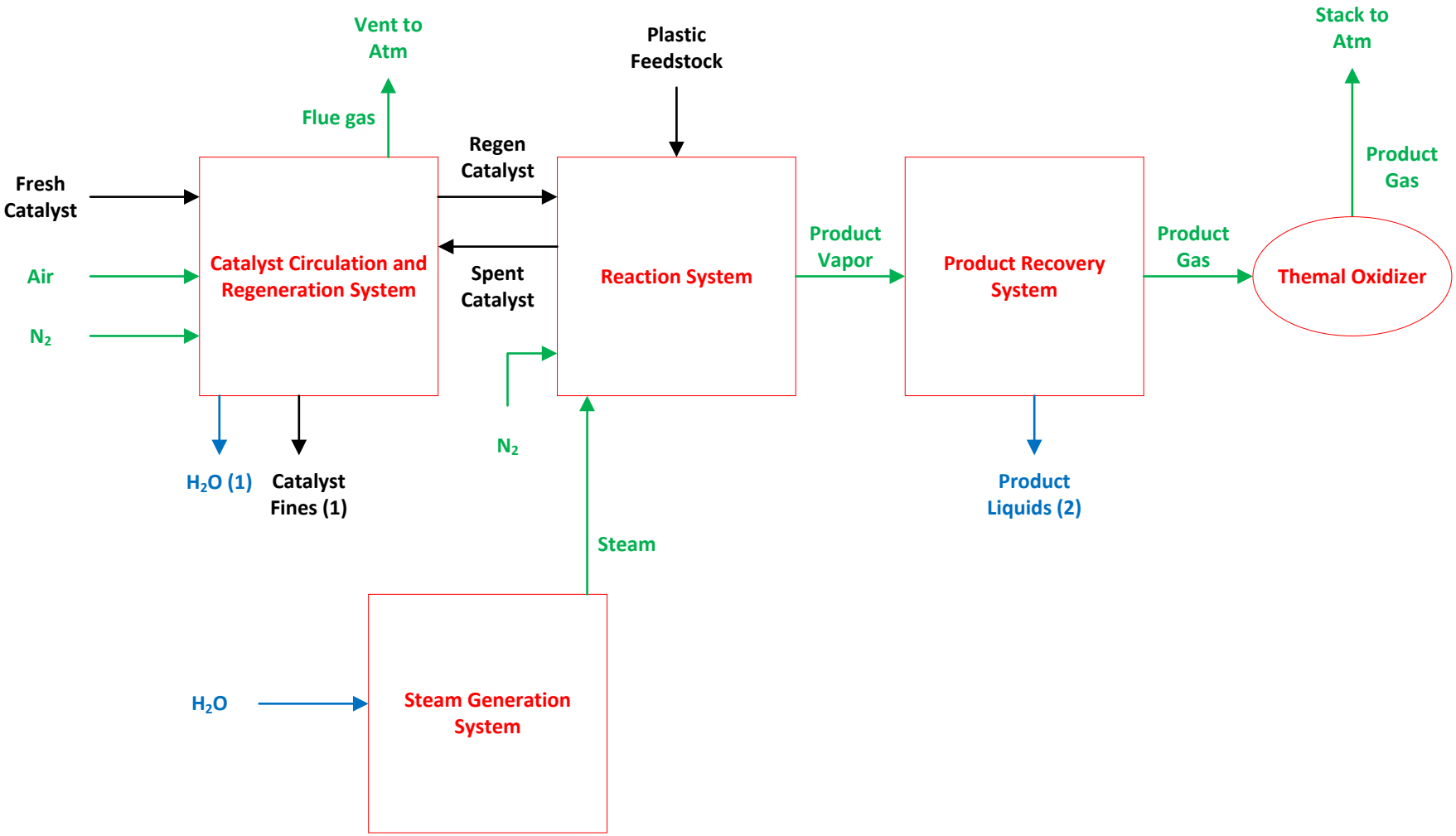
Thank you for your assistance in ensuring that this project is properly permitted, and please let us know if you have any additional questions or need additional information.

Sincerely,

Ms. Apple Chapman
Assistant General Counsel
Regulatory & EHS

Attachment

Simplified Process Flow Diagram for Proposed Research Pilot Scale Test Catalytic Chemical Conversion Process



Notes:
(1) Non-hazardous waste disposal
(2) Transfer to 3rd party treatment facility

Stop Grace Member Petition_combinedMasterv2.pdf
Uploaded by: Shamieka Preston
Position: FAV

Stop the W.R. Grace Plastics Burning Project in Howard County, Maryland Petition

Please sign our petition:

I oppose the construction and operation of a pilot plant by W.R. Grace Chemical Company for the purposes of recycling plastics at their Grace Drive facility in Columbia, Maryland. I call on our local and state officials as well as our county and state agencies to take the appropriate steps to block this project as it endangers the health, safety, and well-being of our community residents.

.

The proposed plant will consist of a pyrolysis reactor, an incinerator (aka, a flameless electrical oxidizer), plus supporting structures and equipment. All of this equipment will be located approximately 70 yards away from family homes in a residential neighborhood.

.

The risks to our communities are very significant in terms of toxic air emissions and the catastrophic effect of potential fires and explosions from the reactor and incinerator. According to Grace's permit application to the Maryland Department of the Environment (MDE, Docket number 16-23), the plant will operate for 16 hours a day, 5 days a week, all year round, potentially for several years.

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Several chemicals will be emitted as volatile organic compounds, the cumulative health effects of these emissions to developing children and to everyone in the community could be severe and are a real concern.

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In addition, incidents of fires and explosions resulting

in injury, death, contamination, and damage to neighboring communities with this type of installation are well-documented in the chemical industry literature. This aspect is particularly concerning to our communities located next to the Grace Chemical facilities.

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Our group has reviewed W.R. Grace's permit application to MDE and expressed our concerns at a public hearing on April 29th, 2024 and in follow-up letter to MDE officials.

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We also have contacted the Howard County Department of Planning and Zoning and questioned their decision to approve the proposed expansion without a review on the basis that the pilot plant will be part of an existing previously approved laboratory. We believe there are significant differences between a research laboratory and a pilot plant of this nature. We believe that a thorough review was required.

Based on these concerns, we respectfully petition our local and state officials as well as our county and state agencies to block W.R. Grace from constructing and operating the proposed pilot plant.

By signing this petition, we will keep you informed of important updates and action steps you can take to stop Grace's proposed plan. You can unsubscribe at any point by responding to an email with the word UNSCUBSCRIBE in that return email.

* Indicates required question

1. Email *

2. I support the petition above. My printed name here represents my support for this petition. Please fill in your full name here. Thank you. *

3. First Name *

4. Last Name *

5. I represent the opinions of: *

Mark only one oval.

- My Family Household (i.e., Multiple Family Member in Household)
- My Self (i.e., Single Person Household or Just Your Self in a Family)

6. If you are representing a Family Household, how many members are in your family?

Mark only one oval.

- 2
- 3
- 4
- 5
- 6 or more
- Prefer not to say.

7. Home Address *

8. Cell Phone Number

9. I live in the following neighborhood: *

Mark only one oval.

- Allview Estates
- Cedar Creek
- Dorsey's Search
- Guilford
- Harper's Choice
- Hickory Ridge
- Kings Contrivance
- Long Reach
- Oakland Mills
- Owen Brown
- River's Edge
- River Hill
- Town Center
- Wild Lake
- Other: _____

10. If other above, where do you live?

_____

Stop Grace Member Information

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Username	I support the petition above. My printed name here represents my support for this petition. Please fill in your full n	First Nam	Last Name	Home Address	Cell Phone Numb	I live in the following neighborl	If other above, where do you live?	
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Username	I support the petition above. My printed name here represents my support for this petition. Please fill in your full n	First Nam	Last Name	Home Address	Cell Phone Numb	I live in the following neighborl	If other above, where do you live?	
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Username	I support the petition above. My printed name here represents my support for this petition. Please fill in your full n	First Nam	Last Name	Home Address	Cell Phone Numb	I live in the following neighborl	If other above, where do you live?	
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Username	I support the petition above. My printed name here represents my support for this petition. Please fill in your full n	First Nam	Last Name	Home Address	Cell Phone Numb	I live in the following neighborl	If other above, where do you live?	
joelhurewitz@gmail.com	Joel Hurewitz	Joel	Hurewitz	5681 C Harpers Farm Rd Columbia MD 21044		Harper's Choice		
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Username	I support the petition above. My printed name here represents my support for this petition. Please fill in your full n	First Nam	Last Name	Home Address	Cell Phone Numb	I live in the following neighborl	If other above, where do you live?	
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Username	I support the petition above. My printed name here represents my support for this petition. Please fill in your full n	First Nam	Last Name	Home Address	Cell Phone Numb	I live in the following neighborl	If other above, where do you live?	
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mikaela.iwaskiw@gmail.com	Mikaela Iwaskiw	Mikaela	Iwaskiw	5436 dogwood Rd Gwynn Oak MD 21207		I don't live in Howard county, bu	Near Catonsville MD	
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Username	I support the petition above. My printed name here represents my support for this petition. Please fill in your full n	First Nam	Last Name	Home Address	Cell Phone Numb	I live in the following neighborl	If other above, where do you live?	
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Username	I support the petition above. My printed name here represents my support for this petition. Please fill in your full n	First Nam	Last Name	Home Address	Cell Phone Numb	I live in the following neighborl	If other above, where do you live?	
norapresti@verizon.net	Nora Presti	Nora	Presti	6546 South Wind Circle Columbia MD 21(	410-952-8922	River Hill		
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sanket369@gmail.com	Sanket Patel	Sanket	Patel	7933 Lawndale Cir		Cedar Creek		

Username	I support the petition above. My printed name here represents my support for this petition. Please fill in your full n	First Nam	Last Name	Home Address	Cell Phone Numb	I live in the following neighborl	If other above, where do you live?	
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ugur_ates13@hotmail.com	Ugur Ates	Ugur	Ates	7405 Plainview Ter, Columbia, MD 22044	2409070846	Cedar Creek		
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chaseshari1@gmail.com	Yes	Shari	Chase	6629 towering Oak Path , Columbia, Mary	3015372747	Pointlers run/Riverhill	Pointers run in the Riverhill area. I denounce Grace for doing this and they h	
farroha@hotmail.com	Bassam Farroha	Bassam	Farroha	6429 River Run	4436769420	River Hill		

Username	I support the petition above. My printed name here represents my support for this petition. Please fill in your full n	First Nam	Last Name	Home Address	Cell Phone Numb	I live in the following neighborl	If other above, where do you live?	
rcohen0126@aol.com	Rita R. Cohen	Rita	Cohen	6106 Forestvale Court	410-916-5917	Hickory Ridge		
a2c2hubbard@gmail.com	Aron Hubbard	Aron	Hubbard	6410 Liquid Laughter Lane		River Hill		
ongschoolstuff@gmail.com	Stephanie S. Ong	Stephanie	Ong	6500 Evensong Mews, Columbia, MD		River Hill		
sskyedesigns@gmail.com	Shari Skye	Shari	Skye	10309 Derby Dr laurel, MD 20723	3014833512	Hunters Creek / N laurel	Hunters Creek / N laurel	
sec.odell@gmail.com	Shannon E. O'Dell	Shannon	O'Dell	7409 Plainview Terrace	202-699-0194	Cedar Creek		
roulazureick@gmail.com	Roula Zureick	Roula	Zureick	6478 River Run		River Hill		
martha.brucato@gmail.com	Martha Brucato	Martha	Brucato	6513 Ocean Shore Lane		River Hill		
lisalkrausz@comcast.net	Lisa Krausz	Lisa	Krausz	6109 Trackless Sea Court	4157177065	River Hill		
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hikingboots6@aol.com	MARCIE WEIL	MARCIE	WEIL	10450 waterfowl ter	703-927-9551	Wild Lake		
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davidhsteiner@verizon.net	Marjorie Steiner	Marjorie	Steiner	5288 Golden Sky Court. Columbia, MD 2	410-707-3875	Glenmont	Off 108 between Thunderhill and PhelpsLuck	
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luciealow@gmail.com	Lucie Low	Lucie	Low	6629 Whitegate Rd, Clarksville		Clarksville Ridge	Clarksville Ridge	
jessraimondi@gmail.com	Jessica Raimondi	Jessica	Raimondi	7901 Olive Branch Lane, Laurel, MD 20723		Wellington Farms	Wellington Farms	
gary.mousigian@gmail.com	Gary Mousigian	Gary	Mousigian	6469 River Run Columbia, MD	313-671-1155	River Hill		
faerieblossom@gmail.com	Mara Lueking	Mara	Lueking	9317 Angelina Circle	3028246144	Owen Brown		

HB 1092_ The Recycling - Prohibition on the Chemic

Uploaded by: Sharon Boies

Position: FAV

February 24, 2025

HB1092 - The Recycling – Prohibition on the

Chemical Conversion of Plastic

COMMITTEE - Environment and Transportation

Testimony on HB1092

POSITION – FAVORABLE

Hearing Date – February 26, 2025

Dear members of the Environment and Transportation Committees,

Thank you for the opportunity to testify on HB 1092.

There is no doubt about the tremendous negative impacts associated with plastic products, from their production and harmful contents, to where even just a single piece of plastic winds up. It seems plastic never really goes away; it just goes elsewhere. Microplastics are even known to be in our bodies. Plastic or chemical recycling converts plastic to gas and liquid with a final by-product being vented to the atmosphere.

So, when we hear that there could be more “air pollutants” and greenhouse gases from plastic waste intentionally being added to the air and the environment, it’s very concerning. During this time of record-breaking heat and our state bearing witness to the impacts of climate change and global warming, it seems that any intentional increase in greenhouse gases and pollutants adding to this, would be very counterproductive, counterintuitive, and bad for the citizen’s health.

“Pellets” made from the various types of plastics used in plastic water bottles and other recyclables, meat trays, packaging, medical trash, PVC pipes, containers for fluids, coating for cables, Styrofoam peanuts, and egg cartons, just to name a few examples, would be used as the source for a chemical/plastic conversion process that would use combustion to convert these pellets into different forms of gas and liquid. Citizens are rightly concerned these projects could potentially have extremely negative consequences for the surrounding environment and people’s health. I want to remind everyone that we live in a state with high density in many places and we’re all downwind or upwind of each other, especially in central

Maryland. I was taught as a very small child that we should never burn plastic materials.

Pro Publica published an article that describes the toll that PFAS and other related chemicals have had on our bodies and in the environment.

https://www.propublica.org/article/3m-forever-chemicals-pfas-pfos-inside-story

These chemicals were produced for decades while research on their impact was performed, after they were created and sold. We must not allow anything like this to happen here.

Noted concerns regarding “Chemical recycling facilities” include “they emit highly toxic chemicals, including benzene, toluene, ethyl benzene, xylenes, and dioxins, many of which are linked to cancer, nervous system damage, and negative effects on reproduction and development”.

If passed, HB 1092 would protect Maryland from this process to begin with.

I have many additional concerns and questions about the process and these types of facilities that include-

If a multi-million-dollar corporation wants to perform chemical experiments and conversions, why do they have to do it here in heavily populated Maryland near tens of thousands of people and sources of drinking water?

Why not at a superfund site or a plastics manufacturer?

If we were to allow a facility to perform this process, who would monitor the activity to ensure this doesn’t become a large-scale industrial program over time and who will measure the cumulative impacts on the environment and citizen’s health over time?

Information provided on one proposed chemical conversion recycling “pilot” project that would convert plastic pellets to other materials says, “a final by-product will be vented to the atmosphere, and the separated condensed liquid will be collected and transferred daily, to 55-gal drums in the warehouse, and ultimately shipped to a 3rd party waste treatment facility”.

What size scale “pilot” project do they mean?

Is it just one 55-gallon drum, or 10 drums a day, or even more?

We've learned some of these products and processes are flammable and combustible. There have been explosions and fires, and one can only assume those included toxic releases into the atmosphere.

I'm concerned about where the plastic pellets would come from, and where the waste treatment facility for the 55-gallon drums of liquid would be located? How many loads of pellets, and 55-gallon drums a day, on small roads, with heavy trucks, in and out of a facility could there be in one day? Would the pellets come to Maryland by train, then be transferred to a truck for transport to the facility? Will this encourage the import of plastic pellets and trash to the region? How are the pellets packaged for transport?

What if the pellets being transported to the facility, or waste being hauled away is involved in an accident? Would a hazmat team be required for any clean up? How big are the pellets? Would the taxpayers pay for the clean-up? Are the by-products hazardous materials?

What environmental harms could be expected if this were to occur?

How would any of this be removed from a waterway?

Will there be any wastewater involved in any step of the process and if so, what is the process for its treatment and disposal?

I'm very concerned about emissions. Will the facility operators be responsible for providing the Emissions Point Data? Or will a state agency? What standard will be used for measuring and reporting the data?

I'm concerned that it could take MDE a very long time to shut a project down if it were determined to be a threat to human health and the environment. I'm concerned the impacts will be cumulative over time, therefore easier to dismiss in the present.

Due to the many questions, that we won't have the answers for in some cases until it may be much too late, like we've now learned about PFAS, and the known concerns about chemical conversion, I'm asking you to please vote in Favor of HB 1092.

Thank you for your consideration of our health and the environment.
Sharon Boies
Columbia, MD

2025MGAHB1092.pdf
Uploaded by: Sharon Davlin
Position: FAV

SB 1092 Recycling - Prohibition on the Chemical Conversion of Plastic
Environment and Transportation Committee
February 26, 2025

Position: SUPPORT

Chair Korman, Vice Chair Boyce and members of the Environment and Transportation Committee,

My family and I, friends and neighbors in District 43B and everyone I know in the state of Maryland support SB 1092. We do so because chemical or "advanced" recycling is another environmental scam. Chemical recycling plants generate little or no recycled plastic. They produce dangerous air pollution and generate large amounts of hazardous waste. Their construction and operation make environmental injustices much worse. Listed below are resources that explain how and why chemical recycling must be stopped.

I urge you to vote for HB1092 and speed its passage into law.

Beyond Plastic, "CHEMICAL RECYCLING: A DANGEROUS DECEPTION", Authors: Lee Bell, IPEN - International Pollutants Elimination Network, Mercury and POPs policy advisor;and Jenny Gitlitz, Beyond Plastics director of solutions to plastic pollution, October, 2023, ISBN: 978-1-955400-22-0, beyondplastics.org

Ohio River Valley Institute, Jacqueline Ebner, Ph.D., Kathy Hipple, MBA, Irina Spector, MBA, "Chemical Recycling: A False Promise for the Ohio River Valley", July 17, 2024 https://ohiorivervalleyinstitute.org/

CENTER FOR CLIMATE INTEGRITY, "The Fraud of "Advanced Recycling", April 2024. For questions or more information, reach out to plastics@climateintegrity.org. www.nrdc.org

National Resources Defense Council Fact Sheet, "CHEMICAL RECYCLING" IS NOT RECYCLING:
The Plastic Industry Is Greenwashing Incineration", September 2022. For more information, please contact: Veena Singla vsingla@nrdc.org,

Sreevatsan_Narayanan_Testimony_to_support_CB11-202
Uploaded by: SREEVATSAN NARAYANAN
Position: FAV

To whomever this may concern

I am writing this testimony today to urge you to support CB-11-2025. This measure will protect our community and the communities surrounding the W.R. Grace campus from the deleterious health and safety impacts of the company's planned plastic R&D facility. Howard County residents deserve to reap the benefits of clean air and the peace of mind in knowing that their families are not being exposed to ongoing chemical emissions from this planned facility, nor must they live in constant fear of leaks and fires, very real possibilities.

W.R. Grace is planning on installing an incinerator (as determined by the EPA) on its campus next to and in the midst of Howard County communities. This is unacceptable. A project like this does not belong in our residential communities.

Despite Grace's assurances, we are not reassured that the impacts of this facility are negligible. W.R. Grace has demonstrated a careless approach and significant disregard to residents' opposition to this project. Given Grace's terrible track record in polluting communities, residents, employees, towns and surrounding environments (the movie A Civil Action is based on Grace negligence and abuse), coupled with the way in which they have handled this proposed plan, we strongly oppose this project.

We need you to stand up to Grace's lack of regard for our health and safety. **I vote in support of CB-11-2025 without any amendments.**

Sincerely,
Sreevatsan Narayanan
Cedar Creek resident

HB1092 Support Testimony - Prohibition on the Chem

Uploaded by: Tom Taylor

Position: FAV

Testimony in Support of HB1092 - Prohibition on the Chemical Conversion of Plastic

February 24, 2025

To: Environment and Transportation Committee

Subject: Testimony in Support of HB1092 - Prohibition on the Chemical Conversion of Plastic

Position: **Favorable**

Dear Chair Korman, Vice Chair Boyce, and Members of the Environment and Transportation Committee,

I am submitting testimony in support of HB1092 - Prohibition on the Chemical Conversion of Plastic. I am in favor of this legislation because chemical recycling is a significant danger to public health and the environment, and facilities that engage in this practice should not be allowed.

These facilities emit hazardous chemicals into the air, and also produce large amounts of greenhouse gases, making the climate emergency worse.

The toxic waste generated by the chemical recycling process poisons the natural resources that we depend on to support human life. Plastics contain thousands of hazardous chemicals. Many of these are released during burning and create highly toxic emissions during that process. These emissions include chemicals which have been linked to serious health risks such as cancer, developmental disorders, and harm to organs.

Chemical recycling plants also raise issues of environmental justice, as they are often located near low-income communities and communities of color. These communities frequently are already overburdened by pollution from nearby industry, making them especially vulnerable to risks to their health.

Maryland should support clean energy generation, not polluting facilities.

Please give a favorable vote to HB1092.

Sincerely,

Tom Taylor
11-G Laurel Hill Road
Greenbelt, MD 20770
301-513-9524

HB1092_EnergyJusticeNetwork_Ewall_FWA.pdf
Uploaded by: Mike Ewall
Position: FWA

February 26, 2025

Comments before House Environment & Transportation Committee

FAVORABLE WITH AMENDMENTS

House Bill 1092

Recycling - Prohibition on the Chemical Conversion of Plastic

Mike Ewall, Esq.
Founder & Director
Energy Justice Network
215-436-9511
mike@energyjustice.net
www.EnergyJustice.net

Good afternoon. My name is Mike Ewall and I'm the founder and director of a national organization, Energy Justice Network. Energy Justice works at the local level with grassroots community groups in Maryland and the rest of the country to support efforts to promote zero waste, and to stop polluting and unnecessary energy and waste industry facilities.

Energy Justice Network strongly supports House Bill 1092 and recommends the following amendment

> "A PERSON MAY NOT BUILD **OR OPERATE** IN THE STATE A FACILITY THAT CONVERTS16 PLASTIC TO FUEL OR FEEDSTOCK THROUGH…"

This amendment would ensure that no facilities slip through the cracks by being quickly constructed before this bill goes into effect.

This bill protects Maryland communities against a toxic scam of an industry that many communities have had to organize themselves to fight. Plastics pyrolysis is a failed industry that dresses up an incineration process as if it's recycling.

One of the most alarming things we've seen is that plastics pyrolysis chemicals have been found to have a shocking 1 in 4 cancer risk. Standards are usually set at one in one million.[1]

Most of the materials in plastics, when put into a pyrolysis process, are ultimately burned, whether on-site or off-site. When burned on-site, this is essentially an incineration process, though it is broken into two stages.

To illustrate, if you light a piece of paper on fire, and look closely, you'll notice a small gap between the paper and the flame. It is the heat that gasifies the paper, and the gases that burn. This takes place in any sort of incinerator. Technically, all incineration is gasification. However, in a gasification or pyrolysis type of incinerator, they basically put a pipe in the middle, between the paper and the flame, making it a two-stage incineration process. In the first stage, temperature and sometimes pressure are used to make the material into a gas. They call this "syngas," short for "synthesis gas" and describe it as hydrogen (H_2) and carbon monoxide (CO). However, there are many more elements in waste than just hydrogen, carbon, and oxygen, so there will be many other chemicals in syngas than what is typically described.

The second stage is typically burning the gas, which is why EPA, when these processes are done in the same facility, still sees the full process as incineration, even though it's broken into a two-stage process. Claims that gasification and pyrolysis are not incineration or do not involve combustion depend on a limited analysis that focuses on the first stage and ignores the second.

[1] Sharon Lerner, "This 'climate-friendly' fuel comes with an astronomical cancer risk," ProPublica, Feb. 23, 2023. https://www.theguardian.com/environment/2023/feb/23/climate-friendly-us-program-plastics-fuel-cancer

There are a few important differences between convention incineration and pyrolysis.

First, pyrolysis provides the *opportunity* to filter the syngas before burning it, which theoretically allows for better pollution control than putting the filters after the flame. However, pyrolysis facilities are more experimental and often operated at small, pilot scales where such filtering is not required by regulation as permits for larger facilities would require.

Second, gasification and pyrolysis allow for the gas to be used in different ways than simply burning it on-site. In some more complex proposals (and most are proposals… few exist in commercial operation), the syngas is to be fed into a second stage that separates out gases for certain industrial uses, or converts gases to liquid fuels to be burned off-site in motor vehicles or other applications.

The most telling assessment of these technologies is from the waste industry consultants who evaluate and even recommend them to local governments they consult for. While all traditional, major solid waste consulting firms (Arcadis, CDM Smith, Geosyntec, HDR, MSW Consultants, SCS, etc.) tend to be enamored with incinerators, none are bigger cheerleaders for the industry than Gershman, Brickner & Bratton, Inc. (GBB). GBB is the only consulting outfit that joins the incinerator industry players in funding the New York City-based academic research outfit that routinely puts out pro-incinerator academic research (similar to how the tobacco industry became popular for "tobacco science"). They are the go-to outfit to present the state of the "waste-to-energy"[2] industry at solid waste and utility conferences.

In these presentations, GBB typically shows a slide on various "waste-to-energy" technologies and their risks. GBB does not consider there to be any health or environmental risk to any of these technologies, but is presenting to industry audiences about the financial investment risk. In that context, GBB characterizes both gasification and pyrolysis as high risk investments due to "previous failures at scale" and "no operating experience with large-scale operations in the U.S."[3] GBB has continuously presented variations of this high-risk assessment for the past decade, as these technologies are relegated to small-scale demonstration plants that typically fail technically and/or economically. Plants that continue to operate do so by abandoning mixed municipal solid waste and switching to very homogeneous feedstocks.

Examples from 2012 and 2017 presentations by GBB follow on the next page.

While GBB has a long history of urging communities to explore all "waste-to-energy" technologies, including those they describe as high risk when talking within the industry, various reports from other solid waste consultants continue to this day to dismiss the technology as unproven.

Arcadis, a consultant currently working for Montgomery County, recently describes pyrolysis as a type of gasification for a county client in Florida and summarizes it, saying "Unproven technology. Can be equipped for electrical generation, counts as recycling in Florida, fire hazards from syngas production."[4]

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[2] "Waste-to-energy" is in quotes because it is an unscientific public relations term for waste incineration technologies, and does not literally turn matter into energy, violating the laws of physics, but turns waste into air pollution and ash. See: https://www.energyjustice.net/incineration/waste-to-energy

[3] "Waste Conversion Technologies for Minnesota," GBB presentation to SWANA, October 17, 2017. See slide 30 in http://gbbinc.com/wp-content/uploads/2017/10/SimmonsRAM-SWANA2017.pdf See also, slide 43 in "The Latest Updates on Waste-to-Energy and Conversion Technologies; Plus Projects Under Development," GBB presentation to WasteCon 2012. http://www.gbbinc.com/speaker/GershmanWASTECON2012.pdf

[4] Arcadis, "Miami-Dade County Department of Solid Waste Management – Preliminary Solid Waste System Siting Alternatives Report," August 2023, Table 3.4, pp. 71-72. https://www.miamidade.gov/solidwaste/library/final-preliminary-future-wte-siting-report.pdf

Technologies and Risk

Source: Gershman, Brickner & Bratton, Inc. August 2012

Alternative	Risks/Liability	Risk Summary
Mass Burn/WaterWall	Proven commercial technology	Very Low
Mass Burn/Modular	Proven commercial technology	Low
RDF/ Dedicated Boiler	Proven commercial technology	Low
RDF/Fluid Bed	Proven technology; limited U.S. commercial experience	Moderate to Low
Anaerobic Digestion	Proven technology; limited U.S. commercial experience	Moderate to Low
Mixed-Waste Composting	Previous large failures; No large-scale commercially viable plants in operation; subject to scale-up issues	Moderate to high
Pyrolysis	Previous failures at scale, uncertain commercial potential; no operating experience with large - scale operations	High
Gasification	Limited operating experience at only small scale; subject to scale-up issues	High
Chemical Decomposition/ Depolymerization	Technology under development; not a commercial option at this time	High

Conversion Technologies have Different Risk Profiles

Alternative	Risks/Liability	Risk Summary
Processing for Recyclables and Fuel	Proven commercial technology	Low
Composting	Proven commercial technology	Low
Mass Burn Combustion	Proven commercial technology	Low
RDF Combustion	Proven technology; limited U.S. commercial experience	Moderate to Low
Anaerobic Digestion	Proven technology; limited U.S. commercial experience	Moderate to Low
Pyrolysis and Gasification	Previous failures at scale; no operating experience with large -scale operations in the U.S.; full-scale demonstrations nearing operation	High

Source: Gershman, Brickner & Bratton, Inc. 2017

In over 30 years of our own experience across the nation, we can affirm that gasification facilities are generally more hype than reality. They cannot operate continuously, do not work with feedstocks that are not very homogenous, they tend to be pilot scale efforts that cannot scale up to commercial facilities, and they typically fall apart technically, economically, or both, if they even get as far as permitting and construction.

As far as pollution levels go, there is little data because gasification facilities are typically not working or lasting long, and are often flying below regulatory thresholds for testing and reporting. However, data we've seen shows that emissions are comparable to traditional incinerators, though some pollutants can be emitted at lower levels, while others at higher levels. Robust data to make generalizations about how they compare is simply unavailable, though select data points can be found here and there.

In its greenhouse gas comparison study for Miami-Dade County, Arcadis writes:

> **"1.5.2 Gasification Facility**
> There is no emission factor for the gasification process provided by USEPA. Based on our understanding of the process and professional knowledge, GHG emissions for gasification facilities would be comparable and on par with GHG emissions from a [trash incinerator] with the same carbon content of fuel."[5]

In other words, gasification is just as much a carbon emitter as conventional incinerators. Greenhouse gas emissions from conventional incinerators are 65% worse than coal per unit of energy, according to EPA data.[6]

In the face of this history, we see communities typically spend money on consultants to evaluate gasification and other "waste-to-energy" technologies just to ultimately throw up their hands and return to landfilling. In 2011, Prince George's County, Maryland hired GBB to review alternatives to landfilling. After extensive analysis of options including municipal solid waste combustion, gasification, waste-to-fuels, and mixed waste processing, GBB narrowed the list of qualified vendors from 16 to seven before Prince George's County abandoned all of them in 2016 in favor of a plan to extend the life of its landfill and adopt zero waste measures. Vendors with pyrolysis and gasification technologies didn't make the short-list of seven.

In 2014, the world's largest waste corporation, Waste Management, Inc., sold off its investments in gasification, pyrolysis and other waste-to-fuels companies.[7]

In June 2020, consultant Geosyntec completed a $450,000 Solid Waste and Recycling Master Plan for the City of Baltimore, which looked at options for replacing its aging trash incinerator. Their final report states:

> *Gasification is also an emerging and untested technology for waste processing in the U.S., which may make it difficult to permit and build such a facility. . . Based on the very high capital costs for a MWP facility using gasification technology, and the fact that gasification is a largely untested technology for processing organics separated from a mixed waste stream, a MWP facility configuration with a gasifier is not recommended.*[8]

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[5] Arcadis, "Miami-Dade County Department of Solid Waste Management – Greenhouse Gas Emissions Study," October 14, 2024, p.2. https://www.miamiherald.com/latest-news/article296016704.ece/BINARY/Levine%20Cava%20memo%20on%20incinerator%20site.pdf#page=31

[6] https://www.energyjustice.net/incineration/worsethancoal

[7] Big Waste Hauler Rethinks Startups," Wall Street Journal, Jan 3, 2014.

[8] "Draft Master Plan, City of Baltimore, Recycling and Solid Waste Management Master Plan," Geosyntec, June 2020. See pages 57 and 60: https://publicworks.baltimorecity.gov/sites/default/files/LWBB_Draft%20Master%20Plan_6-5-20.pdf

MWP stands for mixed waste processing, which involves sorting trash to remove materials such as glass and metal before preparing what remains to be burned, composted or digested. Although proponents of gasification and pyrolysis claim these technologies can effectively process a wide variety of materials, they cannot process them as a heterogenous mixture. Extensive use of MWP is required to produce an acceptable feedstock and even when such sorting methods are in place, what comes off the back end is often still too diverse for the highly sensitive mechanical components that comprise these systems.

In their more detailed "Managing What's Left" report leading up to the Master Plan, Geosyntec elaborates on gasification, stating:

> *Geosyntec is not aware of any commercial scale MSW gasification project currently in operation in the U.S. It is not a mature technology and thus analyses presented in this section are based on extrapolation from pilot projects that may not be scalable or projects currently under construction (which are unproven). This adds an extra dimension of uncertainty to the findings discussed here.*[9]

Please find the article in the first footnote, and other relevant materials attached:

Attachments:

1) Sharon Lerner, "This 'climate-friendly' fuel comes with an astronomical cancer risk," ProPublica, Feb. 23, 2023. https://www.theguardian.com/environment/2023/feb/23/climate-friendly-us-program-plastics-fuel-cancer

2) Declaration of Dr. Ranajit (Ron) Sahu relating to pyrolysis (followed by his CV)

3) Zero Waste Europe, "El Dorado of Chemical Recycling: State of play and policy challenges"

Please also review:

4) The Delusion of Advanced Plastic Recycling Using Pyrolysis, ProPublica https://www.propublica.org/article/delusion-advanced-chemical-plastic-recycling-pyrolysis [best viewed online]

5) Natural Resources Defense Council, "Recycling Lies: 'Chemical Recycling' of Plastic is Just Greenwashing Incineration" https://www.nrdc.org/resources/recycling-lies-chemical-recycling-plastic-just-greenwashing-incineration [protected; cannot attach]

[9] "Managing What's Left, City of Baltimore, Recycling and Solid Waste Management Master Plan," Geosyntec, April 2020. See page 36: https://publicworks.baltimorecity.gov/sites/default/files/LWBBTask7ReportFINAL4-15-20.pdf

https://www.theguardian.com/environment/2023/feb/23/climate-friendly-us-program-plastics-fuel-cancer

This ‘climate-friendly’ fuel comes with an astronomical cancer risk

Almost half of products cleared so far under a new US federal ‘biofuels’ program are not, in fact, biofuels

This article is co-published with ProPublica, a nonprofit newsroom that investigates abuses of power

Sharon Lerner
Thu 23 Feb 2023 11.00 GMT

The Environmental Protection Agency (EPA) recently gave a Chevron refinery the green light to create fuel from discarded plastics as part of a climate-friendly initiative to boost alternatives to petroleum. But, according to agency records obtained by ProPublica and the Guardian, the production of one of the fuels could emit air pollution that is so toxic, one out of four people exposed to it over a lifetime could get cancer.

“That kind of risk is obscene,” said Linda Birnbaum, former head of the National Institute of Environmental Health Sciences. “You can’t let that get out.”

That risk is 250,000 times greater than the level usually considered acceptable by the EPA division that approves new chemicals. Chevron hasn’t started making this fuel yet, the EPA said. When the company does, the cancer burden will disproportionately fall on people who have low incomes and are Black because of the population that lives within three miles of the refinery that will produce the fuel in Pascagoula, Mississippi.

ProPublica and the Guardian asked Maria Doa, a scientist who worked at the EPA for 30 years, to review the document laying out the risk. Doa, who once ran the division that managed the risks posed by chemicals, was so alarmed by the cancer threat that she initially assumed it was a typographical error. “EPA should not allow these risks in Pascagoula or anywhere,” said Doa, who now is the senior director of chemical policy at Environmental Defense Fund.

In response to questions from ProPublica and the Guardian, an EPA spokesperson wrote that the agency’s lifetime cancer risk calculation is “a very conservative estimate with ‘high uncertainty’”, meaning the government erred on the side of caution in calculating such a high risk.

That kind of risk is obscene. EPA should not allow these risks in Pascagoula or anywhere
Linda Birnbaum, former head of the National Institute of Environmental Health Sciences

Under federal law, the EPA can’t approve new chemicals with serious health or environmental risks unless it comes up with ways to minimize the dangers. And if the EPA is unsure, the law allows the agency to order lab testing that would clarify the potential health and environmental harms. In the case of these new plastic-based fuels, the agency didn’t do either of those things. In approving the fuel, the EPA didn’t require any lab tests, air monitoring or controls that would reduce the release of the cancer-causing pollutants or people’s exposure to them.

In January 2022, the EPA announced the initiative to streamline the approval of petroleum alternatives in what a press release called “part of the Biden-Harris administration’s actions to confront the climate crisis”. While the program cleared new fuels made from plants, it also signed off on fuels made

from plastics even though they are petroleum-based and contribute to the release of planet-warming greenhouse gases.

Although there's no mention of discarded plastics in the press release or on the EPA website's description of the program, an agency spokesperson told ProPublica and the Guardian that it allows their production because the initiative also covers fuels made from waste. The spokesperson said that 16 of the 34 fuels the program approved so far are made from waste. She would not say how many of those are made from plastic and stated that such information was confidential.

All of the waste-based fuels are the subject of consent orders, documents the EPA issues when it finds that new chemicals or mixtures may pose an "unreasonable risk" to human health or the environment. The documents specify those risks and the agency's instructions for mitigating them.

But the agency won't turn over these records or reveal information about the waste-based fuels, not even their names or chemical structures. Without those basic details, it is nearly impossible to determine which of the thousands of consent orders on the EPA website apply to this program. In keeping this information secret, the EPA cited a legal provision that allows companies to claim as confidential any information that would give their competitors an advantage in the marketplace.

Nevertheless, ProPublica and the Guardian did obtain one consent order that covers a dozen Chevron fuels made from plastics that were reviewed under the program. Although the EPA had blacked out sections, including the chemicals' names, the document showed that the fuels that Chevron plans to make at its Pascagoula refinery present serious health risks, including developmental problems in children and cancer and harm to the nervous system, reproductive system, liver, kidneys, blood and spleen.

Aside from the chemical that carries a 25% lifetime risk of cancer from smokestack emissions, another of the Chevron fuels ushered in through the program is expected to cause cancer in 1.2 of 10,000 people – a rate also far higher than the agency allows for the general population. The EPA division that screens new chemicals typically limits cancer risk from a single air pollutant to one case of cancer per million people. The agency also calculated that air pollution from one of the fuels is expected to cause cancer in 7.1 of every 1,000 workers – more than 70 times the level the EPA's new chemicals division usually considers acceptable for workers.

In addition to the chemicals released through the creation of fuels from plastics, the people living near the Chevron refinery are exposed to an array of other cancer-causing pollutants, as ProPublica reported in 2021. In that series, which mapped excess cancer risk from lifetime exposure to air pollution across the US, the greatest risk was one cancer case per 53 people, in Port Arthur, Texas.

A refinery in Port Arthur, Texas, where the risk of cancer from lifetime exposure to air pollution is the greatest in the US. Photograph: Eric Gay/AP

The one-in-four lifetime cancer risk from breathing the emissions from the Chevron fuel is higher even than the lifetime risk of lung cancer for current smokers.

In an email Chevron spokesperson Ross Allen wrote: “It is incorrect to say there is a one-in-four cancer risk from smoke-stack emissions. I urge you [to] avoid suggesting otherwise.” Asked to clarify what exactly was wrong with the statement, Allen wrote that Chevron disagrees with ProPublica and the Guardian’s “characterization of language in the EPA consent order”. That document, signed by a Chevron manager at its refinery in Pascagoula, quantified the lifetime cancer risk from the inhalation of smokestack air as 2.5 cancers per 10 people, which can also be stated as one in four.

In a subsequent phone call, Allen said: “We do take care of our communities, our workers and the environment. Generally, this is job one for Chevron.” In a separate written statement, Chevron said it followed the EPA’s process under the Toxic Substances Control Act: “The TSCA process is an important first step to identify risks and if EPA identifies unreasonable risk, it can limit

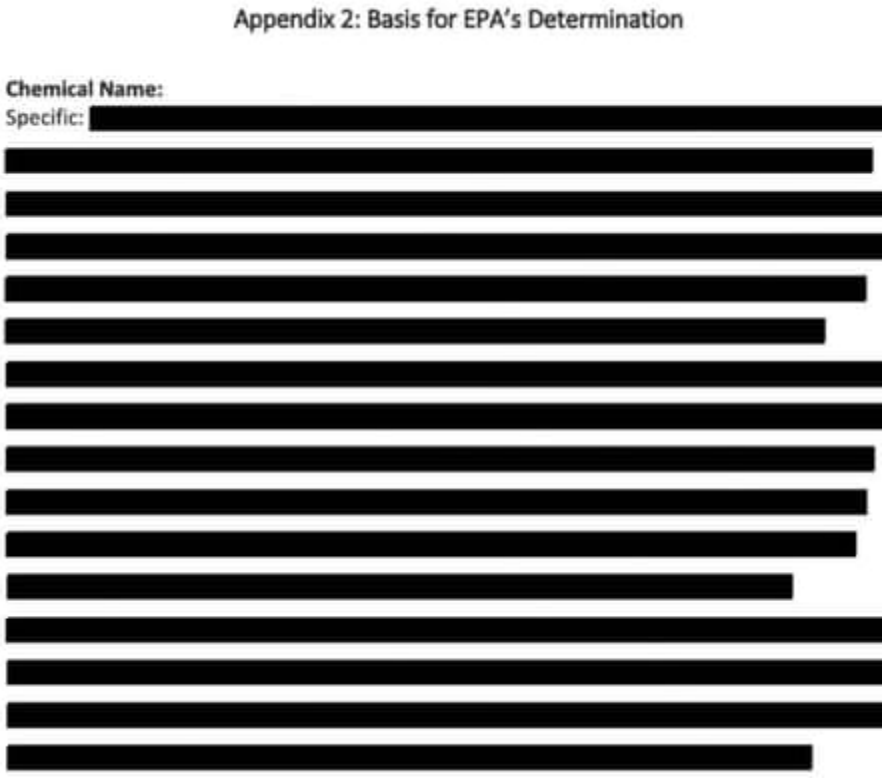
or prohibit manufacture, processing or distribution in commerce during applicable review period."

The Chevron statement also said: "Other environmental regulations and permitting processes govern air, water and handling hazardous materials. Regulations under the Clean Water, Clean Air and Resource Conservation and Recovery Acts also apply and protect the environment and the health and safety of our communities and workers."

Similarly, the EPA said that other federal laws and requirements might reduce the risk posed by the pollution, including Occupational Safety and Health Administration (Osha) regulations for worker protection, the Clean Water Act, the Clean Air Act and rules that apply to refineries.

But Osha has warned the public not to rely on its outdated chemical standards. The refinery rule calls for air monitoring only for one pollutant: benzene. The Clean Water Act does not address air pollution. And the new fuels are not regulated under the Clean Air Act, which applies to a specific list of pollutants. Nor can states monitor for the carcinogenic new fuels without knowing their names and chemical structures.

We asked Scott Throwe, an air pollution specialist who worked at the EPA for 30 years, how existing regulations could protect people in this instance. Now an independent environmental consultant, Throwe said the existing testing and monitoring requirements for refineries couldn't capture the pollution from these new plastic-based fuels because the rules were written before these chemicals existed. There is a chance that equipment designed to limit the release of other pollutants may incidentally capture some of the emissions from the new fuels, he said. But there's no way to know whether that is happening.



A redacted section of an EPA consent order covering plastic-derived fuels. Photograph: EPA

Under federal law, companies have to apply to the EPA for permission to introduce new chemicals or mixtures. But manufacturers don't have to supply any data showing their products to be safe. So the EPA usually relies on studies of similar chemicals to anticipate health effects. In this case, the EPA used a mixture of chemicals made from crude oil to gauge the risks posed by the new plastic-based fuels. Chevron told the EPA the chemical components of its new fuel but didn't give the precise proportions. So the EPA had to make some assumptions, for instance that people absorb 100% of the pollution emitted.

Asked why it didn't require tests to clarify the risks, a spokesperson wrote that the "EPA does not believe these additional test results would change the risks identified nor the unreasonable risks finding".

In her three decades at the EPA, Maria Doa of the Environmental Defense Fund had never seen a chemical with that high of a cancer risk that the agency allowed to be released into a community without restrictions.

“The only requirement seems to be just to use the chemicals as fuel and have the workers wear gloves,” she said.

While companies have made fuels from discarded plastics before, this EPA program gives them the same administrative break that renewable fuels receive: a dedicated EPA team that combines the usual six regulatory assessments into a single report.

The irony is that Congress created the Renewable Fuel Standard Program, which this initiative was meant to support, to reduce greenhouse gas emissions and boost the production of renewable fuels. Truly renewable energy sources, such as plants or algae, can be regenerated in a short period of time. While there is significant debate about whether ethanol, which is made from corn, and other plant-based renewable fuels are really better for the environment than fossil fuels, there is no question that plastics are not renewable and that their production and conversion into fuel releases climate-harming pollution.

Under the EPA’s Renewable Fuel Standard, bio-based fuels must meet specific criteria related to their biological origin as well as the amount by which they reduce greenhouse gas emissions compared with petroleum-based fuels. But under this new approach, fuels made from waste don’t have to meet those targets, the agency said.

In its written statement, Chevron said that “plastics are an essential part of modern life and plastic waste should not end up in unintended places in the environment. We are taking steps to address plastic waste and support a circular economy in which post-use plastic is recycled, reused or repurposed.” But environmentalists say such claims are just greenwashing.

Whatever it’s called, the creation of fuel from plastic is in some ways worse for the climate than simply making it directly from fossil fuels. Over 99% of all plastic is derived from fossil fuels, including coal, oil and gas. To produce fuel from plastics, additional fossil fuels are used to generate the heat that converts them into petrochemicals that can be used as fuel.

“It adds an extra step,” said Veena Singla, a senior scientist at the Natural Resources Defense Council. “They have to burn a lot of stuff to power the process that transforms the plastic.”

Less than 6% of plastic waste is recycled in the US. Scientists estimate that more than a million tons of that unrecycled plastic ends up in the environment each year, killing marine mammals and polluting the world.

Plastic does not fully decompose; instead it eventually breaks down into tiny bits, some of which wind up inside our bodies. As the public's awareness of the health and environmental harm of plastic grows, the industry has found itself under increasing pressure to find a use for the waste.

The idea of creating fuel from plastic offers the comforting feeling that plastics are sustainable. But the release of cancer-causing pollution is just one of several significant problems that have plagued attempts to convert discarded plastic into new products. One recent study by scientists from the Department of Energy found that the economic and environmental costs of turning old plastic into new resources using a process called pyrolysis were 10 to 100 times higher than those of making new plastics from fossil fuels. The lead author said similar issues plague the use of this process to create fuels from plastics.

Chevron buys oil that another company extracts from discarded plastics through pyrolysis. Though the parts of the consent order that aren't redacted don't mention that this oil came from waste plastics, a related EPA record makes this clear. The cancer risks come from the pollution emitted from Chevron's smokestacks when the company turns that oil into fuel.

The EPA attributed its decision to embark on the streamlined program in part to its budget, which it says has been "essentially flat for the last six years". The EPA spokesperson said that the agency "has been working to streamline its new chemicals work wherever possible".

The New Chemicals Division, which houses the program, has been under particular pressure because updates to the chemicals law gave it additional responsibilities and faster timetables. That division of the agency is also the subject of an ongoing EPA inspector general investigation into whistleblowers' allegations of corruption and industry influence over the chemical approval process.

This story was updated on 1 March 2023. A previous version misstated what happens to unrecycled plastic in the US. Scientists estimate that more than a million tons of it end up in the environment each year. It is not known precisely how much of this plastic from the US winds up in the oceans.

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Declaration of Dr. Ranajit (Ron) Sahu

1. My name is Dr. Ranajit (Ron) Sahu. A copy of my resume is provided in Attachment A to this Declaration. I have a Bachelor's of Technology degree in Mechanical Engineering from the Indian Institute of Technology (IIT) followed by M.S and Ph.D degrees in Mechanical Engineering from the California Institute of Technology (Caltech). My Ph.D work focused on pyrolysis and combustion, which are directly relevant to this Declaration.

2. In my opinion, all gasification and pyrolysis of waste necessarily involves the combustion of at least some of the material being gasified or pyrolyzed (i.e., the waste materials).

3. Broadly, combustion is a subset of a broader set of chemical reactions, called oxidation. While typically oxidation involves oxygen, from a chemistry standpoint oxidation is defined more broadly where the agent causing oxidation can be different than oxygen.

4. Combustion is the "burning" that occurs for various materials in the presence of oxygen. Most commonly the source of the oxygen is ambient air. Typically combustion releases heat – i.e., it is exothermic. The most common form of oxidation and combustion that takes place in pyrolysis and gasification units is the reaction of carbon with oxygen to create a combination of carbon dioxide (CO_2) and also some carbon monoxide (CO), accompanied with a release of heat.

5. Other examples of oxidation include formation of rust (or oxidation of iron, but not carbon) which is a very slow form of oxidation. At the other end in terms of speed, explosions are also often caused by rapid oxidation of fuels which can contain carbon. Combustion, in terms of speed, falls somewhere in between. Within the set of oxidation reactions that involve the combination of carbon with oxygen, all reactions that are not explosions are combustion..

6. Combustion typically requires the presence of a source of carbon (i.e., the materials to be combusted either intentionally or not), the oxidant (i.e., typically oxygen or air), and the presence of sufficient energy. A flame is not necessary for combustion because, if the temperature of a material is raised significantly it can "autoignite" and there is no need for a separate ignition source. Thus, in simple terms combustion can occur when there is a source of carbon, a source of oxygen and an energy source either from an ignitor or due to the material temperature being high enough to cause auto-ignition.

7. Theoretically, pyrolysis is the chemical decomposition of typically organic (i.e., carbon-based) materials via the application of heat but in the absence of oxygen. The absence of oxygen, however, is an aspirational goal, because it is not possible to eliminate the presence of all oxygen in real-world pyrolysis units.

8. In general terms all materials that can be pyrolyzed/gasified contain some oxygen or oxygen compounds. Also, if the pyrolysis chamber or container is not perfectly sealed and maintained at greater than atmospheric pressure, external oxygen can be introduced into the pyrolysis process. For both reasons, it is impossible to operate a pyrolysis unit in the absence of all oxygen.

9. As the temperature of organic material that is to be pyrolyzed/gasified is increased in order to effect the pyrolysis/gasification, the presence of some of the inherent oxygen in the material and/or

any externally introduced oxygen will initiate combustion reactions while pyrolysis/gasification is going on. Thus, some combustion is impossible to avoid in pyrolysis/gasification units.

10. Pyrolysis/gasification is often the first stage or first step in combustion. Heat causes the waste materials to release volatile organic materials which then react with available oxygen (always present to some degree), releasing more heat and causing the formation of carbon dioxide and carbon monoxide along with other products of complete and incomplete combustion.

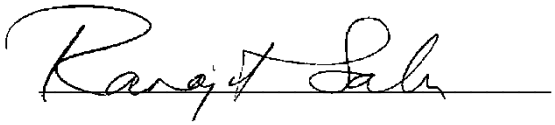
11. Because some oxygen is always unavoidably present in organic materials (which consist of carbon, hydrogen, oxygen, and other elements such as sulfur, nitrogen, etc.), some combustion is inevitable during pyrolysis/gasification and always occurs.

12. Further proof that some combustion always occurs in pyrolysis/gasification units is the invariable presence of products of complete combustion (such as carbon dioxide and water vapor as well as sulfur oxides, if sulfur compounds are present in the "fuel") as well as the products of incomplete combustion such as carbon monoxide in the product gases from pyrolysis. These products of complete combustion would not be present if at least some materials had not been combusted.

13. Based on the inevitable and unavoidable aspects of both gasification/pyrolysis and some combustion occurring simultaneously, it is futile to artificially "separate" these processes into idealized forms where only one of these processes can occur to the exclusion of the other(s). Thus, in a practical incinerator, including one designed to first pyrolyze/gasify substances, followed by the subsequent combustion of the gaseous products, some combustion is inevitable in the first or pyrolysis chamber. It is impossible to separate such multi-component devices and call them separate names. They are collectively as a whole an incinerator. They work together to combust the substances in the waste that is fed into them.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge.

Executed this 17th day of December, 2021.



Ranajit Sahu, Ph.D.

ATTACHMENT A

RANAJIT (RON) SAHU, Ph.D, QEP, CEM (Nevada)

CONSULTANT, ENVIRONMENTAL AND ENERGY ISSUES

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EXPERIENCE SUMMARY

Dr. Sahu has over thirty one years of experience in the fields of environmental, mechanical, and chemical engineering including: program and project management services; design and specification of pollution control equipment for a wide range of emissions sources including stationary and mobile sources; soils and groundwater remediation including landfills as remedy; combustion engineering evaluations; energy studies; multimedia environmental regulatory compliance (involving statutes and regulations such as the Federal CAA and its Amendments, Clean Water Act, TSCA, RCRA, CERCLA, SARA, OSHA, NEPA as well as various related state statutes); transportation air quality impact analysis; multimedia compliance audits; multimedia permitting (including air quality NSR/PSD permitting, Title V permitting, NPDES permitting for industrial and storm water discharges, RCRA permitting, etc.), multimedia/multi-pathway human health risk assessments for toxics; air dispersion modeling; and regulatory strategy development and support including negotiation of consent agreements and orders.

He has over twenty eight years of project management experience and has successfully managed and executed numerous projects in this time period. This includes basic and applied research projects, design projects, regulatory compliance projects, permitting projects, energy studies, risk assessment projects, and projects involving the communication of environmental data and information to the public.

He has provided consulting services to numerous private sector, public sector and public interest group clients. His major clients over the past twenty six years include various trade associations as well as individual companies such as steel mills, petroleum refineries, chemical plants, cement manufacturers, aerospace companies, power generation facilities, lawn and garden equipment manufacturers, spa manufacturers, chemical distribution facilities, land development companies, and various entities in the public sector including EPA, the US Dept. of Justice, several states (including Oregon, New Mexico, Pennsylvania, and others), various agencies such as the California DTSC, and various municipalities. Dr. Sahu has performed projects in all 50 states, numerous local jurisdictions and internationally.

In addition to consulting, for approximately twenty years, Dr. Sahu taught numerous courses in several Southern California universities including UCLA (air pollution), UC Riverside (air pollution, process hazard analysis), and Loyola Marymount University (air pollution, risk assessment, hazardous waste management). He also taught at Caltech, his alma mater (various engineering courses), at the University of Southern California (air pollution controls) and at California State University, Fullerton (transportation and air quality).

Dr. Sahu has and continues to provide expert witness services in a number of environmental areas discussed above in both state and Federal courts as well as before administrative bodies (please see Annex A).

EXPERIENCE RECORD

2000-present **Independent Consultant.** Providing a variety of private sector (industrial companies, land development companies, law firms, etc.), public sector (such as the US Department of Justice), and public interest group clients with project management, environmental

consulting, project management, as well as regulatory and engineering support consulting services.

1995-2000 Parsons ES, **Associate, Senior Project Manager and Department Manager for** Air Quality/Geosciences/Hazardous Waste Groups, Pasadena. Responsible for the management of a group of approximately 24 air quality and environmental professionals, 15 geoscience, and 10 hazardous waste professionals providing full-service consulting, project management, regulatory compliance and A/E design assistance in all areas.

Parsons ES, **Manager for Air Source Testing Services**. Responsible for the management of 8 individuals in the area of air source testing and air regulatory permitting projects located in Bakersfield, California.

1992-1995 Engineering-Science, Inc. **Principal Engineer and Senior Project Manager** in the air quality department. Responsibilities included multimedia regulatory compliance and permitting (including hazardous and nuclear materials), air pollution engineering (emissions from stationary and mobile sources, control of criteria and air toxics, dispersion modeling, risk assessment, visibility analysis, odor analysis), supervisory functions and project management.

1990-1992 Engineering-Science, Inc. **Principal Engineer and Project Manager** in the air quality department. Responsibilities included permitting, tracking regulatory issues, technical analysis, and supervisory functions on numerous air, water, and hazardous waste projects. Responsibilities also include client and agency interfacing, project cost and schedule control, and reporting to internal and external upper management regarding project status.

1989-1990 Kinetics Technology International, Corp. **Development Engineer.** Involved in thermal engineering R&D and project work related to low-NOx ceramic radiant burners, fired heater NOx reduction, SCR design, and fired heater retrofitting.

1988-1989 Heat Transfer Research, Inc. **Research Engineer**. Involved in the design of fired heaters, heat exchangers, air coolers, and other non-fired equipment. Also did research in the area of heat exchanger tube vibrations.

EDUCATION

1984-1988 Ph.D., Mechanical Engineering, California Institute of Technology (Caltech), Pasadena, CA.

1984 M. S., Mechanical Engineering, California Institute of Technology (Caltech), Pasadena, CA.

1978-1983 B. Tech (Honors), Mechanical Engineering, Indian Institute of Technology (IIT) Kharagpur, India

TEACHING EXPERIENCE

Caltech

"Thermodynamics," Teaching Assistant, California Institute of Technology, 1983, 1987.

"Air Pollution Control," Teaching Assistant, California Institute of Technology, 1985.

"Caltech Secondary and High School Saturday Program," - taught various mathematics (algebra through calculus) and science (physics and chemistry) courses to high school students, 1983-1989.

"Heat Transfer," - taught this course in the Fall and Winter terms of 1994-1995 in the Division of Engineering and Applied Science.

“Thermodynamics and Heat Transfer,” Fall and Winter Terms of 1996-1997.

U.C. Riverside, Extension

"Toxic and Hazardous Air Contaminants," University of California Extension Program, Riverside, California. Various years since 1992.

"Prevention and Management of Accidental Air Emissions," University of California Extension Program, Riverside, California. Various years since 1992.

"Air Pollution Control Systems and Strategies," University of California Extension Program, Riverside, California, Summer 1992-93, Summer 1993-1994.

"Air Pollution Calculations," University of California Extension Program, Riverside, California, Fall 1993-94, Winter 1993-94, Fall 1994-95.

"Process Safety Management," University of California Extension Program, Riverside, California. Various years since 1992-2010.

"Process Safety Management," University of California Extension Program, Riverside, California, at SCAQMD, Spring 1993-94.

"Advanced Hazard Analysis - A Special Course for LEPCs," University of California Extension Program, Riverside, California, taught at San Diego, California, Spring 1993-1994.

“Advanced Hazardous Waste Management” University of California Extension Program, Riverside, California. 2005.

Loyola Marymount University

"Fundamentals of Air Pollution - Regulations, Controls and Engineering," Loyola Marymount University, Dept. of Civil Engineering. Various years since 1993.

"Air Pollution Control," Loyola Marymount University, Dept. of Civil Engineering, Fall 1994.

“Environmental Risk Assessment,” Loyola Marymount University, Dept. of Civil Engineering. Various years since 1998.

“Hazardous Waste Remediation” Loyola Marymount University, Dept. of Civil Engineering. Various years since 2006.

University of Southern California

"Air Pollution Controls," University of Southern California, Dept. of Civil Engineering, Fall 1993, Fall 1994.

"Air Pollution Fundamentals," University of Southern California, Dept. of Civil Engineering, Winter 1994.

University of California, Los Angeles

"Air Pollution Fundamentals," University of California, Los Angeles, Dept. of Civil and Environmental Engineering, Spring 1994, Spring 1999, Spring 2000, Spring 2003, Spring 2006, Spring 2007, Spring 2008, Spring 2009.

International Programs

“Environmental Planning and Management,” 5 week program for visiting Chinese delegation, 1994.

“Environmental Planning and Management,” 1 day program for visiting Russian delegation, 1995.

“Air Pollution Planning and Management,” IEP, UCR, Spring 1996.

“Environmental Issues and Air Pollution,” IEP, UCR, October 1996.

PROFESSIONAL AFFILIATIONS AND HONORS

President of India Gold Medal, IIT Kharagpur, India, 1983.

Member of the Alternatives Assessment Committee of the Grand Canyon Visibility Transport Commission, established by the Clean Air Act Amendments of 1990, 1992.

American Society of Mechanical Engineers: Los Angeles Section Executive Committee, Heat Transfer Division, and Fuels and Combustion Technology Division, 1987-mid-1990s.

Air and Waste Management Association, West Coast Section, 1989-mid-2000s.

PROFESSIONAL CERTIFICATIONS

EIT, California (#XE088305), 1993.

REA I, California (#07438), 2000.

Certified Permitting Professional, South Coast AQMD (#C8320), since 1993.

QEP, Institute of Professional Environmental Practice, since 2000.

CEM, State of Nevada (#EM-1699). Expiration 10/07/2021.

PUBLICATIONS (PARTIAL LIST)

"Physical Properties and Oxidation Rates of Chars from Bituminous Coals," with Y.A. Levendis, R.C. Flagan and G.R. Gavalas, *Fuel*, **67**, 275-283 (1988).

"Char Combustion: Measurement and Analysis of Particle Temperature Histories," with R.C. Flagan, G.R. Gavalas and P.S. Northrop, *Comb. Sci. Tech.* **60**, 215-230 (1988).

"On the Combustion of Bituminous Coal Chars," PhD Thesis, California Institute of Technology (1988).

"Optical Pyrometry: A Powerful Tool for Coal Combustion Diagnostics," *J. Coal Quality*, **8**, 17-22 (1989).

"Post-Ignition Transients in the Combustion of Single Char Particles," with Y.A. Levendis, R.C. Flagan and G.R. Gavalas, *Fuel*, **68**, 849-855 (1989).

"A Model for Single Particle Combustion of Bituminous Coal Char." Proc. ASME National Heat Transfer Conference, Philadelphia, **HTD-Vol. 106**, 505-513 (1989).

"Discrete Simulation of Cenospheric Coal-Char Combustion," with R.C. Flagan and G.R. Gavalas, *Combust. Flame*, **77**, 337-346 (1989).

"Particle Measurements in Coal Combustion," with R.C. Flagan, in "**Combustion Measurements**" (ed. N. Chigier), Hemisphere Publishing Corp. (1991).

"Cross Linking in Pore Structures and Its Effect on Reactivity," with G.R. Gavalas in preparation.

"Natural Frequencies and Mode Shapes of Straight Tubes," Proprietary Report for Heat Transfer Research Institute, Alhambra, CA (1990).

"Optimal Tube Layouts for Kamui SL-Series Exchangers," with K. Ishihara, Proprietary Report for Kamui Company Limited, Tokyo, Japan (1990).

"HTRI Process Heater Conceptual Design," Proprietary Report for Heat Transfer Research Institute, Alhambra, CA (1990).

"Asymptotic Theory of Transonic Wind Tunnel Wall Interference," with N.D. Malmuth and others, Arnold Engineering Development Center, Air Force Systems Command, USAF (1990).

"Gas Radiation in a Fired Heater Convection Section," Proprietary Report for Heat Transfer Research Institute, College Station, TX (1990).

"Heat Transfer and Pressure Drop in NTIW Heat Exchangers," Proprietary Report for Heat Transfer Research Institute, College Station, TX (1991).

"NOx Control and Thermal Design," Thermal Engineering Tech Briefs, (1994).

“From Purchase of Landmark Environmental Insurance to Remediation: Case Study in Henderson, Nevada,” with Robin E. Bain and Jill Quillin, presented at the AQMA Annual Meeting, Florida, 2001.

“The Jones Act Contribution to Global Warming, Acid Rain and Toxic Air Contaminants,” with Charles W. Botsford, presented at the AQMA Annual Meeting, Florida, 2001.

PRESENTATIONS (PARTIAL LIST)

"Pore Structure and Combustion Kinetics - Interpretation of Single Particle Temperature-Time Histories," with P.S. Northrop, R.C. Flagan and G.R. Gavalas, presented at the AIChE Annual Meeting, New York (1987).

"Measurement of Temperature-Time Histories of Burning Single Coal Char Particles," with R.C. Flagan, presented at the American Flame Research Committee Fall International Symposium, Pittsburgh, (1988).

"Physical Characterization of a Cenospheric Coal Char Burned at High Temperatures," with R.C. Flagan and G.R. Gavalas, presented at the Fall Meeting of the Western States Section of the Combustion Institute, Laguna Beach, California (1988).

"Control of Nitrogen Oxide Emissions in Gas Fired Heaters - The Retrofit Experience," with G. P. Croce and R. Patel, presented at the International Conference on Environmental Control of Combustion Processes (Jointly sponsored by the American Flame Research Committee and the Japan Flame Research Committee), Honolulu, Hawaii (1991).

"Air Toxics - Past, Present and the Future," presented at the Joint AIChE/AAEE Breakfast Meeting at the AIChE 1991 Annual Meeting, Los Angeles, California, November 17-22 (1991).

"Air Toxics Emissions and Risk Impacts from Automobiles Using Reformulated Gasolines," presented at the Third Annual Current Issues in Air Toxics Conference, Sacramento, California, November 9-10 (1992).

"Air Toxics from Mobile Sources," presented at the Environmental Health Sciences (ESE) Seminar Series, UCLA, Los Angeles, California, November 12, (1992).

"Kilns, Ovens, and Dryers - Present and Future," presented at the Gas Company Air Quality Permit Assistance Seminar, Industry Hills Sheraton, California, November 20, (1992).

"The Design and Implementation of Vehicle Scrapping Programs," presented at the 86th Annual Meeting of the Air and Waste Management Association, Denver, Colorado, June 12, 1993.

"Air Quality Planning and Control in Beijing, China," presented at the 87th Annual Meeting of the Air and Waste Management Association, Cincinnati, Ohio, June 19-24, 1994.

Annex A

Expert Litigation Support

A. Occasions where Dr. Sahu has provided Written or Oral testimony before Congress:

1. In July 2012, provided expert written and oral testimony to the House Subcommittee on Energy and the Environment, Committee on Science, Space, and Technology at a Hearing entitled "Hitting the Ethanol Blend Wall – Examining the Science on E15."

B. Matters for which Dr. Sahu has provided affidavits and expert reports include:

2. Affidavit for Rocky Mountain Steel Mills, Inc. located in Pueblo Colorado – dealing with the technical uncertainties associated with night-time opacity measurements in general and at this steel mini-mill.

3. Expert reports and depositions (2/28/2002 and 3/1/2002; 12/2/2003 and 12/3/2003; 5/24/2004) on behalf of the United States in connection with the Ohio Edison NSR Cases. *United States, et al. v. Ohio Edison Co., et al.*, C2-99-1181 (Southern District of Ohio).

4. Expert reports and depositions (5/23/2002 and 5/24/2002) on behalf of the United States in connection with the Illinois Power NSR Case. *United States v. Illinois Power Co., et al.*, 99-833-MJR (Southern District of Illinois).

5. Expert reports and depositions (11/25/2002 and 11/26/2002) on behalf of the United States in connection with the Duke Power NSR Case. *United States, et al. v. Duke Energy Corp.*, 1:00-CV-1262 (Middle District of North Carolina).

6. Expert reports and depositions (10/6/2004 and 10/7/2004; 7/10/2006) on behalf of the United States in connection with the American Electric Power NSR Cases. *United States, et al. v. American Electric Power Service Corp., et al.*, C2-99-1182, C2-99-1250 (Southern District of Ohio).

7. Affidavit (March 2005) on behalf of the Minnesota Center for Environmental Advocacy and others in the matter of the Application of Heron Lake BioEnergy LLC to construct and operate an ethanol production facility – submitted to the Minnesota Pollution Control Agency.

8. Expert Report and Deposition (10/31/2005 and 11/1/2005) on behalf of the United States in connection with the East Kentucky Power Cooperative NSR Case. *United States v. East Kentucky Power Cooperative, Inc*., 5:04-cv-00034-KSF (Eastern District of Kentucky).

9. Affidavits and deposition on behalf of Basic Management Inc. (BMI) Companies in connection with the BMI vs. USA remediation cost recovery Case.

10. Expert Report on behalf of Penn Future and others in the Cambria Coke plant permit challenge in Pennsylvania.

11. Expert Report on behalf of the Appalachian Center for the Economy and the Environment and others in the Western Greenbrier permit challenge in West Virginia.

12. Expert Report, deposition (via telephone on January 26, 2007) on behalf of various Montana petitioners (Citizens Awareness Network (CAN), Women's Voices for the Earth (WVE) and the Clark Fork Coalition (CFC)) in the Thompson River Cogeneration LLC Permit No. 3175-04 challenge.

13. Expert Report and deposition (2/2/07) on behalf of the Texas Clean Air Cities Coalition at the Texas State Office of Administrative Hearings (SOAH) in the matter of the permit challenges to TXU Project Apollo's eight new proposed PRB-fired PC boilers located at seven TX sites.

14. Expert Testimony (July 2007) on behalf of the Izaak Walton League of America and others in connection with the acquisition of power by Xcel Energy from the proposed Gascoyne Power Plant – at the State of Minnesota, Office of Administrative Hearings for the Minnesota PUC (MPUC No. E002/CN-06-1518; OAH No. 12-2500-17857-2).

15. Affidavit (July 2007) Comments on the Big Cajun I Draft Permit on behalf of the Sierra Club – submitted to the Louisiana DEQ.

16. Expert Report and Deposition (12/13/2007) on behalf of Commonwealth of Pennsylvania – Dept. of Environmental Protection, State of Connecticut, State of New York, and State of New Jersey (Plaintiffs) in connection with the Allegheny Energy NSR Case. *Plaintiffs v. Allegheny Energy Inc., et al.,* 2:05cv0885 (Western District of Pennsylvania).

17. Expert Reports and Pre-filed Testimony before the Utah Air Quality Board on behalf of Sierra Club in the Sevier Power Plant permit challenge.

18. Expert Report and Deposition (October 2007) on behalf of MTD Products Inc., in connection with *General Power Products, LLC v MTD Products Inc*., 1:06 CVA 0143 (Southern District of Ohio, Western Division) .

19. Expert Report and Deposition (June 2008) on behalf of Sierra Club and others in the matter of permit challenges (Title V: 28.0801-29 and PSD: 28.0803-PSD) for the Big Stone II unit, proposed to be located near Milbank, South Dakota.

20. Expert Reports, Affidavit, and Deposition (August 15, 2008) on behalf of Earthjustice in the matter of air permit challenge (CT-4631) for the Basin Electric Dry Fork station, under construction near Gillette, Wyoming before the Environmental Quality Council of the State of Wyoming.

21. Affidavits (May 2010/June 2010 in the Office of Administrative Hearings))/Declaration and Expert Report (November 2009 in the Office of Administrative Hearings) on behalf of NRDC and the Southern Environmental Law Center in the matter of the air permit challenge for Duke Cliffside Unit 6. Office of Administrative Hearing Matters 08 EHR 0771, 0835 and 0836 and 09 HER 3102, 3174, and 3176 (consolidated).

22. Declaration (August 2008), Expert Report (January 2009), and Declaration (May 2009) on behalf of Southern Alliance for Clean Energy in the matter of the air permit challenge for Duke Cliffside Unit 6. *Southern Alliance for Clean Energy et al., v. Duke Energy Carolinas, LLC*, Case No. 1:08-cv-00318-LHT-DLH (Western District of North Carolina, Asheville Division).

23. Declaration (August 2008) on behalf of the Sierra Club in the matter of Dominion Wise County plant MACT.us

24. Expert Report (June 2008) on behalf of Sierra Club for the Green Energy Resource Recovery Project, MACT Analysis.

25. Expert Report (February 2009) on behalf of Sierra Club and the Environmental Integrity Project in the matter of the air permit challenge for NRG Limestone's proposed Unit 3 in Texas.

26. Expert Report (June 2009) on behalf of MTD Products, Inc., in the matter of *Alice Holmes and Vernon Holmes v. Home Depot USA, Inc., et al.*

27. Expert Report (August 2009) on behalf of Sierra Club and the Southern Environmental Law Center in the matter of the air permit challenge for Santee Cooper's proposed Pee Dee plant in South Carolina).

28. Statements (May 2008 and September 2009) on behalf of the Minnesota Center for Environmental Advocacy to the Minnesota Pollution Control Agency in the matter of the Minnesota Haze State Implementation Plans.

29. Expert Report (August 2009) on behalf of Environmental Defense, in the matter of permit challenges to the proposed Las Brisas coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).

30. Expert Report and Rebuttal Report (September 2009) on behalf of the Sierra Club, in the matter of challenges to the proposed Medicine Bow Fuel and Power IGL plant in Cheyenne, Wyoming.

31. Expert Report (December 2009) and Rebuttal reports (May 2010 and June 2010) on behalf of the United States in connection with the Alabama Power Company NSR Case. *United States v. Alabama Power Company*, CV-01-HS-152-S (Northern District of Alabama, Southern Division).

32. Pre-filed Testimony (October 2009) on behalf of Environmental Defense and others, in the matter of challenges to the proposed White Stallion Energy Center coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).

33. Pre-filed Testimony (July 2010) and Written Rebuttal Testimony (August 2010) on behalf of the State of New Mexico Environment Department in the matter of Proposed Regulation 20.2.350 NMAC – *Greenhouse Gas Cap and Trade Provisions,* No. EIB 10-04 (R), to the State of New Mexico, Environmental Improvement Board.

34. Expert Report (August 2010) and Rebuttal Expert Report (October 2010) on behalf of the United States in connection with the Louisiana Generating NSR Case. *United States v. Louisiana Generating, LLC*, 09-CV100-RET-CN (Middle District of Louisiana) – Liability Phase.

35. Declaration (August 2010), Reply Declaration (November 2010), Expert Report (April 2011), Supplemental and Rebuttal Expert Report (July 2011) on behalf of the United States in the matter of DTE Energy Company and Detroit Edison Company (Monroe Unit 2). *United States of America v. DTE Energy Company and Detroit Edison Company*, Civil Action No. 2:10-cv-13101-BAF-RSW (Eastern District of Michigan).

36. Expert Report and Deposition (August 2010) as well as Affidavit (September 2010) on behalf of Kentucky Waterways Alliance, Sierra Club, and Valley Watch in the matter of challenges to the NPDES permit issued for the Trimble County power plant by the Kentucky Energy and Environment Cabinet to Louisville Gas and Electric, File No. DOW-41106-047.

37. Expert Report (August 2010), Rebuttal Expert Report (September 2010), Supplemental Expert Report (September 2011), and Declaration (November 2011) on behalf of Wild Earth Guardians in the matter of opacity exceedances and monitor downtime at the Public Service Company of Colorado (Xcel)'s Cherokee power plant. No. 09-cv-1862 (District of Colorado).

38. Written Direct Expert Testimony (August 2010) and Affidavit (February 2012) on behalf of Fall-Line Alliance for a Clean Environment and others in the matter of the PSD Air Permit for Plant Washington issued by Georgia DNR at the Office of State Administrative Hearing, State of Georgia (OSAH-BNR-AQ-1031707-98-WALKER).

39. Deposition (August 2010) on behalf of Environmental Defense, in the matter of the remanded permit challenge to the proposed Las Brisas coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).

40. Expert Report, Supplemental/Rebuttal Expert Report, and Declarations (October 2010, November 2010, September 2012) on behalf of New Mexico Environment Department (Plaintiff-Intervenor), Grand Canyon Trust and Sierra Club (Plaintiffs) in the matter of *Plaintiffs v. Public Service Company of New Mexico* (PNM), Civil No. 1:02-CV-0552 BB/ATC (ACE) (District of New Mexico).

41. Expert Report (October 2010) and Rebuttal Expert Report (November 2010) (BART Determinations for PSCo Hayden and CSU Martin Drake units) to the Colorado Air Quality Commission on behalf of Coalition of Environmental Organizations.

42. Expert Report (November 2010) (BART Determinations for TriState Craig Units, CSU Nixon Unit, and PRPA Rawhide Unit) to the Colorado Air Quality Commission on behalf of Coalition of Environmental Organizations.

43. Declaration (November 2010) on behalf of the Sierra Club in connection with the Martin Lake Station Units 1, 2, and 3. *Sierra Club v. Energy Future Holdings Corporation and Luminant*

Generation Company LLC, Case No. 5:10-cv-00156-DF-CMC (Eastern District of Texas, Texarkana Division).

44. Pre-Filed Testimony (January 2011) and Declaration (February 2011) to the Georgia Office of State Administrative Hearings (OSAH) in the matter of Minor Source HAPs status for the proposed Longleaf Energy Associates power plant (OSAH-BNR-AQ-1115157-60-HOWELLS) on behalf of the Friends of the Chattahoochee and the Sierra Club).

45. Declaration (February 2011) in the matter of the Draft Title V Permit for RRI Energy MidAtlantic Power Holdings LLC Shawville Generating Station (Pennsylvania), ID No. 17-00001 on behalf of the Sierra Club.

46. Expert Report (March 2011), Rebuttal Expert Report (June 2011) on behalf of the United States in *United States of America v. Cemex, Inc.*, Civil Action No. 09-cv-00019-MSK-MEH (District of Colorado).

47. Declaration (April 2011) and Expert Report (July 16, 2012) in the matter of the Lower Colorado River Authority (LCRA)'s Fayette (Sam Seymour) Power Plant on behalf of the Texas Campaign for the Environment. *Texas Campaign for the Environment v. Lower Colorado River Authority,* Civil Action No. 4:11-cv-00791 (Southern District of Texas, Houston Division).

48. Declaration (June 2011) on behalf of the Plaintiffs MYTAPN in the matter of Microsoft-Yes, Toxic Air Pollution-No (MYTAPN) v. State of Washington, Department of Ecology and Microsoft Corporation Columbia Data Center to the Pollution Control Hearings Board, State of Washington, Matter No. PCHB No. 10-162.

49. Expert Report (June 2011) on behalf of the New Hampshire Sierra Club at the State of New Hampshire Public Utilities Commission, Docket No. 10-261 – the 2010 Least Cost Integrated Resource Plan (LCIRP) submitted by the Public Service Company of New Hampshire (re. Merrimack Station Units 1 and 2).

50. Declaration (August 2011) in the matter of the Sandy Creek Energy Associates L.P. Sandy Creek Power Plant on behalf of Sierra Club and Public Citizen. *Sierra Club, Inc. and Public Citizen, Inc. v. Sandy Creek Energy Associates, L.P.,* Civil Action No. A-08-CA-648-LY (Western District of Texas, Austin Division).

51. Expert Report (October 2011) on behalf of the Defendants in the matter of *John Quiles and Jeanette Quiles et al. v. Bradford-White Corporation, MTD Products, Inc., Kohler Co., et al.,* Case No. 3:10-cv-747 (TJM/DEP) (Northern District of New York).

52. Declaration (October 2011) on behalf of the Plaintiffs in the matter of *American Nurses Association et. al. (Plaintiffs), v. US EPA (Defendant)*, Case No. 1:08-cv-02198-RMC (US District Court for the District of Columbia).

53. Declaration (February 2012) and Second Declaration (February 2012) in the matter of *Washington Environmental Council and Sierra Club Washington State Chapter v. Washington State Department of Ecology and Western States Petroleum Association,* Case No. 11-417-MJP (Western District of Washington).

54. Expert Report (March 2012) and Supplemental Expert Report (November 2013) in the matter of *Environment Texas Citizen Lobby, Inc and Sierra Club v. ExxonMobil Corporation et al.,* Civil Action No. 4:10-cv-4969 (Southern District of Texas, Houston Division).

55. Declaration (March 2012) in the matter of *Center for Biological Diversity, et al. v. United States Environmental Protection Agency,* Case No. 11-1101 (consolidated with 11-1285, 11-1328 and 11-1336) (US Court of Appeals for the District of Columbia Circuit).

56. Declaration (March 2012) in the matter of *Sierra Club v. The Kansas Department of Health and Environment*, Case No. 11-105,493-AS (Holcomb power plant) (Supreme Court of the State of Kansas).

57. Declaration (March 2012) in the matter of the Las Brisas Energy Center *Environmental Defense Fund et al., v. Texas Commission on Environmental Quality,* Cause No. D-1-GN-11-001364 (District Court of Travis County, Texas, 261st Judicial District).

58. Expert Report (April 2012), Supplemental and Rebuttal Expert Report (July 2012), and Supplemental Rebuttal Expert Report (August 2012) on behalf of the states of New Jersey and Connecticut in the matter of the Portland Power plant *State of New Jersey and State of Connecticut (Intervenor-Plaintiff) v. RRI Energy Mid-Atlantic Power Holdings et al.,* Civil Action No. 07-CV-5298 (JKG) (Eastern District of Pennsylvania).

59. Declaration (April 2012) in the matter of the EPA's EGU MATS Rule, on behalf of the Environmental Integrity Project.

60. Expert Report (August 2012) on behalf of the United States in connection with the Louisiana Generating NSR Case. *United States v. Louisiana Generating, LLC*, 09-CV100-RET-CN (Middle District of Louisiana) – Harm Phase.

61. Declaration (September 2012) in the Matter of the Application of *Energy Answers Incinerator, Inc.* for a Certificate of Public Convenience and Necessity to Construct a 120 MW Generating Facility in Baltimore City, Maryland, before the Public Service Commission of Maryland, Case No. 9199.

62. Expert Report (October 2012) on behalf of the Appellants (Robert Concilus and Leah Humes) in the matter of Robert Concilus and Leah Humes v. Commonwealth of Pennsylvania Department of Environmental Protection and Crawford Renewable Energy, before the Commonwealth of Pennsylvania Environmental Hearing Board, Docket No. 2011-167-R.

63. Expert Report (October 2012), Supplemental Expert Report (January 2013), and Affidavit (June 2013) in the matter of various Environmental Petitioners v. North Carolina DENR/DAQ and Carolinas Cement Company, before the Office of Administrative Hearings, State of North Carolina.

64. Pre-filed Testimony (October 2012) on behalf of No-Sag in the matter of the North Springfield Sustainable Energy Project before the State of Vermont, Public Service Board.

65. Pre-filed Testimony (November 2012) on behalf of Clean Wisconsin in the matter of Application of Wisconsin Public Service Corporation for Authority to Construct and Place in Operation a New Multi-Pollutant Control Technology System (ReACT) for Unit 3 of the Weston Generating Station, before the Public Service Commission of Wisconsin, Docket No. 6690-CE-197.

66. Expert Report (February 2013) on behalf of Petitioners in the matter of Credence Crematory, Cause No. 12-A-J-4538 before the Indiana Office of Environmental Adjudication.

67. Expert Report (April 2013), Rebuttal report (July 2013), and Declarations (October 2013, November 2013) on behalf of the Sierra Club in connection with the Luminant Big Brown Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 6:12-cv-00108-WSS (Western District of Texas, Waco Division).

68. Declaration (April 2013) on behalf of Petitioners in the matter of *Sierra Club, et al., (Petitioners) v Environmental Protection Agency et al. (Resppondents),* Case No., 13-1112, (Court of Appeals, District of Columbia Circuit).

69. Expert Report (May 2013) and Rebuttal Expert Report (July 2013) on behalf of the Sierra Club in connection with the Luminant Martin Lake Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 5:10-cv-0156-MHS-CMC (Eastern District of Texas, Texarkana Division).

70. Declaration (August 2013) on behalf of A. J. Acosta Company, Inc., in the matter of *A. J. Acosta Company, Inc., v. County of San Bernardino*, Case No. CIVSS803651.

71. Comments (October 2013) on behalf of the Washington Environmental Council and the Sierra Club in the matter of the Washington State Oil Refinery RACT (for Greenhouse Gases), submitted to the Washington State Department of Ecology, the Northwest Clean Air Agency, and the Puget Sound Clean Air Agency.

72. Statement (November 2013) on behalf of various Environmental Organizations in the matter of the Boswell Energy Center (BEC) Unit 4 Environmental Retrofit Project, to the Minnesota Public Utilities Commission, Docket No. E-015/M-12-920.

73. Expert Report (December 2013) on behalf of the United States in *United States of America v. Ameren Missouri*, Civil Action No. 4:11-cv-00077-RWS (Eastern District of Missouri, Eastern Division).

74. Expert Testimony (December 2013) on behalf of the Sierra Club in the matter of Public Service Company of New Hampshire Merrimack Station Scrubber Project and Cost Recovery, Docket No. DE 11-250, to the State of New Hampshire Public Utilities Commission.

75. Expert Report (January 2014) on behalf of Baja, Inc., in *Baja, Inc., v. Automotive Testing and Development Services, Inc. et. al*, Civil Action No. 8:13-CV-02057-GRA (District of South Carolina, Anderson/Greenwood Division).

76. Declaration (March 2014) on behalf of the Center for International Environmental Law, Chesapeake Climate Action Network, Friends of the Earth, Pacific Environment, and the Sierra Club (Plaintiffs) in the matter of *Plaintiffs v. the Export-Import Bank (Ex-Im Bank) of the United States*, Civil Action No. 13-1820 RC (District Court for the District of Columbia).

77. Declaration (April 2014) on behalf of Respondent-Intervenors in the matter of *Mexichem Specialty Resins Inc., et al., (Petitioners) v Environmental Protection Agency et al.,* Case No., 12-1260 (and Consolidated Case Nos. 12-1263, 12-1265, 12-1266, and 12-1267), (Court of Appeals, District of Columbia Circuit).

78. Direct Prefiled Testimony (June 2014) on behalf of the Michigan Environmental Council and the Sierra Club in the matter of the Application of DTE Electric Company for Authority to Implement a Power Supply Cost Recovery (PSCR) Plan in its Rate Schedules for 2014 Metered Jurisdictional Sales of Electricity, Case No. U-17319 (Michigan Public Service Commission).

79. Expert Report (June 2014) on behalf of ECM Biofilms in the matter of the US Federal Trade Commission (FTC) v. ECM Biofilms (FTC Docket #9358).

80. Direct Prefiled Testimony (August 2014) on behalf of the Michigan Environmental Council and the Sierra Club in the matter of the Application of Consumers Energy Company for Authority to Implement a Power Supply Cost Recovery (PSCR) Plan in its Rate Schedules for 2014 Metered Jurisdictional Sales of Electricity, Case No. U-17317 (Michigan Public Service Commission).

81. Declaration (July 2014) on behalf of Public Health Intervenors in the matter of *EME Homer City Generation v. US EPA* (Case No. 11-1302 and consolidated cases) relating to the lifting of the stay entered by the Court on December 30, 2011 (US Court of Appeals for the District of Columbia).

82. Expert Report (September 2014), Rebuttal Expert Report (December 2014) and Supplemental Expert Report (March 2015) on behalf of Plaintiffs in the matter of *Sierra Club and Montana Environmental Information Center (Plaintiffs) v. PPL Montana LLC, Avista Corporation, Puget Sound Energy, Portland General Electric Company, Northwestern Corporation, and Pacificorp (Defendants)*, Civil Action No. CV 13-32-BLG-DLC-JCL (US District Court for the District of Montana, Billings Division).

83. Expert Report (November 2014) on behalf of Niagara County, the Town of Lewiston, and the Villages of Lewiston and Youngstown in the matter of CWM Chemical Services, LLC New York State Department of Environmental Conservation (NYSDEC) Permit Application Nos.: 9-2934-00022/00225, 9-2934-00022/00231, 9-2934-00022/00232, and 9-2934-00022/00249 (pending).

84. *Declaration (January 2015) relating to Startup/Shutdown in the MATS Rule (EPA Docket ID No. EPA-HQ-OAR-2009-0234) on behalf of the Environmental Integrity Project.*

85. Pre-filed Direct Testimony (March 2015), Supplemental Testimony (May 2015), and Surrebuttal Testimony (December 2015) on behalf of Friends of the Columbia Gorge in the matter of the Application for a Site Certificate for the Troutdale Energy Center before the Oregon Energy Facility Siting Council.

86. Brief of Amici Curiae Experts in Air Pollution Control and Air Quality Regulation in Support of the Respondents, On Writs of Certiorari to the US Court of Appeals for the District of Columbia, No. 14-46, 47, 48. *Michigan et. al., (Petitioners) v. EPA et. al., Utility Air Regulatory Group (Petitioners) v. EPA et. al., National Mining Association et. al., (Petitioner) v. EPA et. al.,* (Supreme Court of the United States).

87. Expert Report (March 2015) and Rebuttal Expert Report (January 2016) on behalf of Plaintiffs in the matter of *Conservation Law Foundation v. Broadrock Gas Services LLC, Rhode Island LFG GENCO LLC, and Rhode Island Resource Recovery Corporation (Defendants)*, Civil Action No. 1:13-cv-00777-M-PAS (US District Court for the District of Rhode Island).

88. Declaration (April 2015) relating to various Technical Corrections for the MATS Rule (EPA Docket ID No. EPA-HQ-OAR-2009-0234) on behalf of the Environmental Integrity Project.

89. Direct Prefiled Testimony (May 2015) on behalf of the Michigan Environmental Council, the Natural Resources Defense Council, and the Sierra Club in the matter of the Application of DTE Electric Company for Authority to Increase its Rates, Amend its Rate Schedules and Rules Governing the Distribution and Supply of Electric Energy and for Miscellaneous Accounting Authority, Case No. U-17767 (Michigan Public Service Commission).

90. Expert Report (July 2015) and Rebuttal Expert Report (July 2015) on behalf of Plaintiffs in the matter of *Northwest Environmental Defense Center et. al., v. Cascade Kelly Holdings LLC, d/b/a Columbia Pacific Bio-Refinery, and Global Partners LP (Defendants)*, Civil Action No. 3:14-cv-01059-SI (US District Court for the District of Oregon, Portland Division).

91. Declaration (August 2015, Docket No. 1570376) in support of "Opposition of Respondent-Intervenors American Lung Association, et. al., to Tri-State Generation's Emergency Motion;" Declaration (September 2015, Docket No. 1574820) in support of "Joint Motion of the State, Local Government, and Public Health Respondent-Intervenors for Remand Without Vacatur;" Declaration (October 2015) in support of "Joint Motion of the State, Local Government, and Public Health Respondent-Intervenors to State and Certain Industry Petitioners' Motion to Govern, *White Stallion Energy Center, LLC v. US EPA*, Case No. 12-1100 (US Court of Appeals for the District of Columbia).

92. Declaration (September 2015) in support of the Draft Title V Permit for Dickerson Generating Station (Proposed Permit No 24-031-0019) on behalf of the Environmental Integrity Project.

93. Expert Report (Liability Phase) (December 2015) and Rebuttal Expert Report (February 2016) on behalf of Plaintiffs in the matter of *Natural Resources Defense Council, Inc., Sierra Club, Inc., Environmental Law and Policy Center, and Respiratory Health Association v. Illinois Power Resources LLC, and Illinois Power Resources Generating LLC (Defendants)*, Civil Action No. 1:13-cv-01181 (US District Court for the Central District of Illinois, Peoria Division).

94. Declaration (December 2015) in support of the Petition to Object to the Title V Permit for Morgantown Generating Station (Proposed Permit No 24-017-0014) on behalf of the Environmental Integrity Project.

95. Expert Report (November 2015) on behalf of Appellants in the matter of *Sierra Club, et al. v. Craig W. Butler, Director of Ohio Environmental Protection Agency et al.,* ERAC Case No. 14-256814.

96. Affidavit (January 2016) on behalf of Bridgewatch Detroit in the matter of *Bridgewatch Detroit v. Waterfront Petroleum Terminal Co., and Waterfront Terminal Holdings, LLC.*, in the Circuit Court for the County of Wayne, State of Michigan.

97. Expert Report (February 2016) and Rebuttal Expert Report (July 2016) on behalf of the challengers in the matter of the Delaware Riverkeeper Network, Clean Air Council, et. al., vs. Commonwealth of Pennsylvania Department of Environmental Protection and R. E. Gas Development LLC regarding the Geyer well site before the Pennsylvania Environmental Hearing Board.

98. Direct Testimony (May 2016) in the matter of Tesoro Savage LLC Vancouver Energy Distribution Terminal, Case No. 15-001 before the State of Washington Energy Facility Site Evaluation Council.

99. Declaration (June 2016) relating to deficiencies in air quality analysis for the proposed Millenium Bulk Terminal, Port of Longview, Washington.

100. Declaration (December 2016) relating to EPA's refusal to set limits on PM emissions from coal-fired power plants that reflect pollution reductions achievable with fabric filters on behalf of Environmental Integrity Project, Clean Air Council, Chesapeake Climate Action Network, Downwinders at Risk represented by Earthjustice in the matter of *ARIPPA v EPA, Case No. 15-1180*. (D.C. Circuit Court of Appeals).

101. Expert Report (January 2017) on the Environmental Impacts Analysis associated with the Huntley and Huntley Poseidon Well Pad on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

102. Expert Report (January 2017) on the Environmental Impacts Analysis associated with the Apex Energy Backus Well Pad on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

103. Expert Report (January 2017) on the Environmental Impacts Analysis associated with the Apex Energy Drakulic Well Pad on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

104. Expert Report (January 2017) on the Environmental Impacts Analysis associated with the Apex Energy Deutsch Well Pad on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

105. Affidavit (February 2017) pertaining to deficiencies water discharge compliance issues at the Wood River Refinery in the matter of *People of the State of Illinois (Plaintiff) v. Phillips 66 Company, ConocoPhillips Company, WRB Refining LP (Defendants)*, Case No. 16-CH-656, (Circuit Court for the Third Judicial Circuit, Madison County, Illinois).

106. Expert Report (March 2017) on behalf of the Plaintiff pertaining to non-degradation analysis for waste water discharges from a power plant in the matter of *Sierra Club (Plaintiff) v. Pennsylvania Department of Environmental Protection (PADEP) and Lackawanna Energy Center*, Docket No. 2016-047-L (consolidated), (Pennsylvania Environmental Hearing Board).

107. Expert Report (March 2017) on behalf of the Plaintiff pertaining to air emissions from the Heritage incinerator in East Liverpool, Ohio in the matter of *Save our County (Plaintiff) v. Heritage Thermal Services, Inc. (Defendant), Case No. 4:16-CV-1544-BYP*, (US District Court for the Northern District of Ohio, Eastern Division).

108. Rebuttal Expert Report (June 2017) on behalf of Plaintiffs in the matter of *Casey Voight and Julie Voight (Plaintiffs) v Coyote Creek Mining Company LLC (Defendant),* Civil Action No. 1:15-CV-00109 (US District Court for the District of North Dakota, Western Division).

109. Expert Affidavit (August 2017) and Penalty/Remedy Expert Affidavit (October 2017) on behalf of Plaintiff in the matter of *Wildearth Guardians (Plaintiff) v Colorado Springs Utility Board (Defendant,)* Civil Action No. 1:15-cv-00357-CMA-CBS (US District Court for the District of Colorado).

110. Expert Report (August 2017) on behalf of Appellant in the matter of *Patricia Ann Troiano (Appellant) v. Upper Burrell Township Zoning Hearing Board (Appellee)*, Court of Common Pleas of Westmoreland County, Pennsylvania, Civil Division.

111. Expert Report (October 2017), Supplemental Expert Report (October 2017), and Rebuttal Expert Report (November 2017) on behalf of Defendant in the matter of *Oakland Bulk and Oversized Terminal (Plaintiff) v City of Oakland (Defendant,)* Civil Action No. 3:16-cv-07014-VC (US District Court for the Northern District of California, San Francisco Division).

112. Declaration (December 2017) on behalf of the Environmental Integrity Project in the matter of permit issuance for ATI Flat Rolled Products Holdings, Breckenridge, PA to the Allegheny County Health Department.

113. Expert Report (Harm Phase) (January 2018), Rebuttal Expert Report (Harm Phase) (May 2018) and Supplemental Expert Report (Harm Phase) (April 2019) on behalf of Plaintiffs in the matter of *Natural Resources Defense Council, Inc., Sierra Club, Inc., and Respiratory Health Association v. Illinois Power Resources LLC, and Illinois Power Resources Generating LLC (Defendants)*, Civil Action No. 1:13-cv-01181 (US District Court for the Central District of Illinois, Peoria Division).

114. Declaration (February 2018) on behalf of the Chesapeake Bay Foundation, et. al., in the matter of the Section 126 Petition filed by the state of Maryland in *State of Maryland v. Pruitt (Defendant)*, Civil Action No. JKB-17-2939 (Consolidated with No. JKB-17-2873) (US District Court for the District of Maryland).

115. Direct Pre-filed Testimony (March 2018) on behalf of the National Parks Conservation Association (NPCA) in the matter of *NPCA v State of Washington, Department of Ecology and BP West Coast Products, LLC*, PCHB No. 17-055 (Pollution Control Hearings Board for the State of Washington.

116. Expert Affidavit (April 2018) and Second Expert Affidavit (May 2018) on behalf of Petitioners in the matter of *Coosa River Basin Initiative and Sierra Club (Petitioners) v State of Georgia Environmental Protection Division, Georgia Department of Natural Resources (Respondent) and Georgia Power Company (Intervenor/Respondent)*, Docket Nos: 1825406-BNR-WW-57-Howells and 1826761-BNR-WW-57-Howells, Office of State Administrative Hearings, State of Georgia.

117. Direct Pre-filed Testimony and Affidavit (December 2018) on behalf of Sierra Club and Texas Campaign for the Environment (Appellants) in the contested case hearing before the Texas State Office of Administrative Hearings in Docket Nos. 582-18-4846, 582-18-4847 (Application of GCGV Asset Holding, LLC for Air Quality Permit Nos. 146425/PSDTX1518 and 146459/PSDTX1520 in San Patricio County, Texas).

118. Expert Report (February 2019) on behalf of Sierra Club in the State of Florida, Division of Administrative Hearings, Case No. 18-2124EPP, Tampa Electric Company Big Bend Unit 1 Modernization Project Power Plant Siting Application No. PA79-12-A2.

119. Declaration (March 2019) on behalf of Earthjustice in the matter of comments on the renewal of the Title V Federal Operating Permit for Valero Houston refinery.

120. Expert Report (March 2019) on behalf of Plaintiffs for Class Certification in the matter of *Resendez et al v Precision Castparts Corporation* in the Circuit Court for the State of Oregon, County of Multnomah, Case No. 16cv16164.

121. Expert Report (June 2019), Affidavit (July 2019) and Rebuttal Expert Report (September 2019) on behalf of Appellants relating to the NPDES permit for the Cheswick power plant in the matter of *Three Rivers Waterkeeper and Sierra Club (Appellants) v. State of Pennsylvania Department of Environmental Protection (Appellee) and NRG Power Midwest (Permittee)*, before the Commonwealth of Pennsylvania Environmental Hearing Board, EHB Docket No. 2018-088-R.

122. Affidavit/Expert Report (August 2019) relating to the appeal of air permits issued to PTTGCA on behalf of Appellants in the matter of *Sierra Club (Appellants) v. Craig Butler, Director, et. al., Ohio EPA (Appellees)* before the State of Ohio Environmental Review Appeals Commission (ERAC), Case Nos. ERAC-19-6988 through -6991.

123. Expert Report (October 2019) relating to the appeal of air permit (Plan Approval) on behalf of Appellants in the matter of *Clean Air Council and Environmental Integrity Project (Appellants) v. Commonwealth of Pennsylvania Department of Environmental Protection and Sunoco Partners Marketing and Terminals L.P.*, before the Commonwealth of Pennsylvania Environmental Hearing Board, EHB Docket No. 2018-057-L.

124. Expert Report (December 2019), Affidavit (March 2020), Supplemental Expert Report (July 2020), and Declaration (February 2021) on behalf of Earthjustice in the matter of *Objection to the*

Issuance of PSD/NSR and Title V permits for Riverview Energy Corporation, Dale, Indiana, before the Indiana Office of Environmental Adjudication, Cause No. 19-A-J-5073.

125. Affidavit (December 2019) on behalf of Plaintiff-Intervenor (Surfrider Foundation) in the matter of *United States and the State of Indiana (Plaintiffs), Surfrider Foundation (Plaintiff-Intervenor), and City of Chicago (Plaintiff-Intervenor) v. United States Steel Corporation (Defendant),* Civil Action No. 2:18-cv-00127 (US District Court for the Northern District of Indiana, Hammond Division).

126. Declarations (January 2020, February 2020, May 2020, July 2020, and August 2020) and Pre-filed Testimony (April 2021) in support of Petitioner's Motion for Stay of PSCAA NOC Order of Approval No. 11386 in the matter of the *Puyallup Tribe of Indians v. Puget Sound Clean Air Agency (PSCAA) and Puget Sound Energy (PSE),* before the State of Washington Pollution Control Hearings Board, PCHB No. P19-088.

127. Expert Report (April 2020) on behalf of the plaintiff in the matter of Orion Engineered Carbons, GmbH (Plaintiff) vs. Evonik Operations, GmbH (formerly Evonik Degussa GmbH) (Respondent), before the German Arbitration Institute, Case No. DIS-SV-2019-00216.

128. Expert Independent Evaluation Report (June 2020) for *PacifiCorp's Decommissioning Costs Study Reports dated January 15, 2020 and March 13, 2020 relating to the closures of the Hunter, Huntington, Dave Johnston, Jim Bridger, Naughton, Wyodak, Hayden, and Colstrip (Units 3&4) plants*, prepared for the Oregon Public Utility Commission (Oregon PUC).

129. Direct Pre-filed Testimony (July 2020) on behalf of the Sierra Club in the matter of *the Application of the Ohio State University for a certificate of Environmental Compatibility and Public Need to Construct a Combined Heat and Power Facility in Franklin County, Ohio*, before the Ohio Power Siting Board, Case No. 19-1641-EL-BGN.

130. Expert Report (August 2020) and Rebuttal Expert Report (September 2020) on behalf of WildEarth Guardians (petitioners) in the matter of *the Appeals of the Air Quality Permit No. 7482-M1 Issued to 3 Bear Delaware Operating – NM LLC (EIB No. 20-21(A) and Registrations Nos. 8729, 8730, and 8733 under General Construction Permit for Oil and Gas Facilities (EIB No. 20-33 (A)*, before the State of New Mexico, Environmental Improvement Board.

131. Expert Report (July 2020) on the *Initial Economic Impact Analysis (EIA) for A Proposal To* Regulate *NOx Emissions from Natural Gas Fired Rich-Burn Natural Gas Reciprocating Internal Combustion Engines (RICE) Greater Than 100 Horsepower* prepared on behalf of Earthjustice and the National Parks Conservation Association in the matter of Regulation Number 7, Alternate Rules before the Colorado Air Quality Control Commission.

132. Expert Report (August 2020) and Supplemental Expert Report (February 2021) on the Potential Remedies to Avoid Adverse Thermal Impacts from the Merrimack Station on behalf of Plaintiffs in the matter of *Sierra Club Inc. and the* Conservation *Law Foundation (Plaintiffs) v. Granite Shore Power, LLC et. al., (Defendants)*, Civil Action No. 19-cv-216-JL (US District Court for the District of New Hampshire.)

133. Expert Report (August 2020) and Supplemental Expert Report (December 2020) on behalf of Plaintiffs in the matter of *PennEnvironment Inc., and Clean Air Council (Plaintiffs) and Allegheny County Health Department (Plaintiff-Intervenor) v. United States Steel Corporation (Defendant)*, Civil Action No. 2-19-cv-00484-MJH (US District Court for the Western District of Pennsylvania.)

134. Pre-filed Direct Testimony (October 2020) and Sur-rebuttal Testimony (November 2020) on behalf of petitioners (Ten Persons Group, including citizens, the Town of Braintree, the Town of Hingham, and the City of Quincy) in the matter of Algonquin Gas Transmission LLC, Weymouth MA, No. X266786 Air Quality Plan Approval, before the Commonwealth of Massachusetts, Department of Environmental Protection, the Office of Appeals and Dispute Resolution, OADR Docket Nos. 2019-008, 2019-009, 2019010, 2019-011, 2019-012 and 2019-013.

135. Expert Report (November 2020) on behalf of Protect PT in the matter of *Protect PT v. Commonwealth of Pennsylvania Department of Environmental Protection and Apex Energy (PA) LLC*, before the Commonwealth of Pennsylvania Environmental Hearing Board, Docket No. 2018-080-R (consolidated with 2019-101-R)(the "Drakulic Appeal").

136. Expert Report (December 2020) on behalf of Plaintiffs in the matter of *Sierra Club Inc. (Plaintiff) v. GenOn Power Midwest LP (Defendants)*, Civil Action No. 2-19-cv-01284-WSS (US District Court for the Western District of Pennsylvania.)

137. Pre-filed Testimony (January 2021) on behalf of the Plaintiffs (Shrimpers and Fishermen of the Rio Grande Valley represented by Texas RioGrande Legal Aid, Inc.) in the matter of the Appeal of Texas Commission on Environmental Quality (TCEQ) Permit Nos. 147681, PSDTX1522, GHGPSDTX172 for the Jupiter Brownsville Heavy Condensate Upgrader Facility, Cameron County, before the Texas State Office of Administrative Hearings, SOAH Docket No. 582-21-0111, TCEQ Docket No. 2020-1080-AIR.

138. Expert Report (June 2021) and Declarations (May 2021 and June 2021) on behalf of Plaintiffs in the matter of *Sierra Club (Plaintiff) v. Woodville Pellets, LLC (Defendant)*, Civil Action No. 9:20-cv-00178-MJT (US District Court for the Eastern District of Texas, Lufkin Division.)

139. Declaration (July 2021) on behalf of Plaintiffs in the matter of *Stephanie Mackey and Nick Migliore, on behalf of themselves and all others similarly situated (Plaintiffs) v. Chemtool Inc. and Lubrizol Corporation (Defendants)*, Case No. 2021-L-0000165, State of Illinois, Circuit Court of the 17th Judicial Circuit, Winnebago County.

140. Expert Report (April 2021) and Sur-Rebuttal Report (June 2021) on behalf of the Plaintiffs in the matter of *Modern Holdings, LLC, et al. (Plaintiffs) v. Corning Inc., et al. (Defendants)*, Civil Action No. 5:13-cv-00405-GFVT, (US District Court for the Eastern District of Kentucky, Central Division at Lexington).

141. Expert Witness Disclosure (June 2021) on behalf of the Plaintiffs in the matter of *Jay Burdick, et. al., (Plaintiffs) v. Tanoga Inc. (d/b/a Taconic) (Defendant)*, Index No. 253835, (State of New York Supreme Court, County of Rensselaer).

142. Expert Report (June 2021) on behalf of Appellants in the matter of *PennEnvironment and Earthworks (Appellants) v. Commonwealth of Pennsylvania Department of Environmental Protection (Appellee) and MarkWest Liberty Midstream and resource, LLC (Permittee)*, before the Commonwealth of Pennsylvania Environmental Hearing Board, EHB Docket No. 2020-002-R.

143. Expert Reports (March 2021 and May 2021) regarding the Aries Newark LLC Sludge Processing Facility, Application No. CPB 20-74, Central Planning Board, City of Newark, New Jersey.

144. Expert Report (April 2021) for *Charles Johnson Jr. (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant),* Civil Action No. 2:20-CV-01329. (US District Court for the Eastern District of Louisiana, New Orleans Division).

145. Expert Report (April 2021) for *Floyd Ruffin (Plaintiff), v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 2:20-cv-00334-CJB-JCW (US District Court for the Eastern District of Louisiana, New Orleans Division).

146. Expert Report (May 2021) for *Clifford Osmer (Plaintiff) v. BP Exploration and Production Inc., et. al., (Defendants)* related to No. 2:19-CV-10331 (US District Court for the Eastern District of Louisiana, New Orleans Division).

147. Expert Report (June 2021) for *Antonia Saavedra-Vargas (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 2:18-CV-11461 (US District Court for the Eastern District of Louisiana, New Orleans Division).

148. Affidavit (June 2021) for Lourdes Rubi in the matter of *Lourdes Rubi (Plaintiff) v. BP Exploration and Production Inc., et. al., (Defendants)*, related to 12-968 BELO in MDL No. 2179 (US District Court for the Eastern District of Louisiana, New Orleans Division).

149. Expert Report (May 2021) for *James Noel (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant),* Civil Action No. 1:19-CV-00694 (US District Court for the Southern District of Alabama, Mobile Division).

150. Expert Report (June 2021) for *Wallace Smitht (Plaintiff) v. BP Exploration and Production Inc., et. al. (Defendant)*, Civil Action No. 2:19-CV-12880 (US District Court for the Eastern District of Louisiana, New Orleans Division).

C. Occasions where Dr. Sahu has provided oral testimony <u>in depositions, at trial or in similar proceedings</u> include the following:

151. Deposition on behalf of Rocky Mountain Steel Mills, Inc. located in Pueblo, Colorado – dealing with the manufacture of steel in mini-mills including methods of air pollution control and BACT in steel mini-mills and opacity issues at this steel mini-mill.

152. Trial Testimony (February 2002) on behalf of Rocky Mountain Steel Mills, Inc. in Denver District Court.

153. Trial Testimony (February 2003) on behalf of the United States in the Ohio Edison NSR Cases, *United States, et al. v. Ohio Edison Co., et al.*, C2-99-1181 (Southern District of Ohio).

154. Trial Testimony (June 2003) on behalf of the United States in the Illinois Power NSR Case, *United States v. Illinois Power Co., et al.*, 99-833-MJR (Southern District of Illinois).

155. Deposition (10/20/2005) on behalf of the United States in connection with the Cinergy NSR Case. *United States, et* al. *v. Cinergy Corp., et al.*, IP 99-1693-C-M/S (Southern District of Indiana).

156. Oral Testimony (August 2006) on behalf of the Appalachian Center for the Economy and the Environment re. the Western Greenbrier plant, WV before the West Virginia DEP.

157. Oral Testimony (May 2007) on behalf of various Montana petitioners (Citizens Awareness Network (CAN), Women's Voices for the Earth (WVE) and the Clark Fork Coalition (CFC)) re. the Thompson River Cogeneration plant before the Montana Board of Environmental Review.

158. Oral Testimony (October 2007) on behalf of the Sierra Club re. the Sevier Power Plant before the Utah Air Quality Board.

159. Oral Testimony (August 2008) on behalf of the Sierra Club and Clean Water re. Big Stone Unit II before the South Dakota Board of Minerals and the Environment.

160. Oral Testimony (February 2009) on behalf of the Sierra Club and the Southern Environmental Law Center re. Santee Cooper Pee Dee units before the South Carolina Board of Health and Environmental Control.

161. Oral Testimony (February 2009) on behalf of the Sierra Club and the Environmental Integrity Project re. NRG Limestone Unit 3 before the Texas State Office of Administrative Hearings (SOAH) Administrative Law Judges.

162. Deposition (July 2009) on behalf of MTD Products, Inc., in the matter of *Alice Holmes and Vernon Holmes v. Home Depot USA, Inc., et al*.

163. Deposition (October 2009) on behalf of Environmental Defense and others, in the matter of challenges to the proposed Coleto Creek coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).

164. Deposition (October 2009) on behalf of Environmental Defense, in the matter of permit challenges to the proposed Las Brisas coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).

165. Deposition (October 2009) on behalf of the Sierra Club, in the matter of challenges to the proposed Medicine Bow Fuel and Power IGL plant in Cheyenne, Wyoming.

166. Deposition (October 2009) on behalf of Environmental Defense and others, in the matter of challenges to the proposed Tenaska coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH). (April 2010).

167. Oral Testimony (November 2009) on behalf of the Environmental Defense Fund re. the Las Brisas Energy Center before the Texas State Office of Administrative Hearings (SOAH) Administrative Law Judges.

168. Deposition (December 2009) on behalf of Environmental Defense and others, in the matter of challenges to the proposed White Stallion Energy Center coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).

169. Oral Testimony (February 2010) on behalf of the Environmental Defense Fund re. the White Stallion Energy Center before the Texas State Office of Administrative Hearings (SOAH) Administrative Law Judges.

170. Deposition (June 2010) on behalf of the United States in connection with the Alabama Power Company NSR Case. *United States v. Alabama Power Company*, CV-01-HS-152-S (Northern District of Alabama, Southern Division).

171. Trial Testimony (September 2010) on behalf of Commonwealth of Pennsylvania – Dept. of Environmental Protection, State of Connecticut, State of New York, State of Maryland, and State of New Jersey (Plaintiffs) in connection with the Allegheny Energy NSR Case in US District Court in the Western District of Pennsylvania. *Plaintiffs v. Allegheny Energy Inc., et al.,* 2:05cv0885 (Western District of Pennsylvania).

172. Oral Direct and Rebuttal Testimony (September 2010) on behalf of Fall-Line Alliance for a Clean Environment and others in the matter of the PSD Air Permit for Plant Washington issued by Georgia DNR at the Office of State Administrative Hearing, State of Georgia (OSAH-BNR-AQ-1031707-98-WALKER).

173. Oral Testimony (September 2010) on behalf of the State of New Mexico Environment Department in the matter of Proposed Regulation 20.2.350 NMAC – *Greenhouse Gas Cap and Trade Provisions,* No. EIB 10-04 (R), to the State of New Mexico, Environmental Improvement Board.

174. Oral Testimony (October 2010) on behalf of the Environmental Defense Fund re. the Las Brisas Energy Center before the Texas State Office of Administrative Hearings (SOAH) Administrative Law Judges.

175. Oral Testimony (November 2010) regarding BART for PSCo Hayden, CSU Martin Drake units before the Colorado Air Quality Commission on behalf of the Coalition of Environmental Organizations.

176. Oral Testimony (December 2010) regarding BART for TriState Craig Units, CSU Nixon Unit, and PRPA Rawhide Unit) before the Colorado Air Quality Commission on behalf of the Coalition of Environmental Organizations.

177. Deposition (December 2010) on behalf of the United States in connection with the Louisiana Generating NSR Case. *United States v. Louisiana Generating, LLC*, 09-CV100-RET-CN (Middle District of Louisiana).

178. Deposition (February 2011 and January 2012) on behalf of Wild Earth Guardians in the matter of opacity exceedances and monitor downtime at the Public Service Company of Colorado (Xcel)'s Cherokee power plant. No. 09-cv-1862 (D. Colo.).

179. Oral Testimony (February 2011) to the Georgia Office of State Administrative Hearings (OSAH) in the matter of Minor Source HAPs status for the proposed Longleaf Energy Associates power plant (OSAH-BNR-AQ-1115157-60-HOWELLS) on behalf of the Friends of the Chattahoochee and the Sierra Club).

180. Deposition (August 2011) on behalf of the United States in *United States of America v. Cemex, Inc.*, Civil Action No. 09-cv-00019-MSK-MEH (District of Colorado).

181. Deposition (July 2011) and Oral Testimony at Hearing (February 2012) on behalf of the Plaintiffs MYTAPN in the matter of Microsoft-Yes, Toxic Air Pollution-No (MYTAPN) v. State of Washington, Department of Ecology and Microsoft Corporation Columbia Data Center to the Pollution Control Hearings Board, State of Washington, Matter No. PCHB No. 10-162.

182. Oral Testimony at Hearing (March 2012) on behalf of the United States in connection with the Louisiana Generating NSR Case. *United States v. Louisiana Generating, LLC*, 09-CV100-RET-CN (Middle District of Louisiana).

183. Oral Testimony at Hearing (April 2012) on behalf of the New Hampshire Sierra Club at the State of New Hampshire Public Utilities Commission, Docket No. 10-261 – the 2010 Least Cost Integrated Resource Plan (LCIRP) submitted by the Public Service Company of New Hampshire (re. Merrimack Station Units 1 and 2).

184. Oral Testimony at Hearing (November 2012) on behalf of Clean Wisconsin in the matter of Application of Wisconsin Public Service Corporation for Authority to Construct and Place in Operation a New Multi-Pollutant Control Technology System (ReACT) for Unit 3 of the Weston Generating Station, before the Public Service Commission of Wisconsin, Docket No. 6690-CE-197.

185. Deposition (March 2013) in the matter of various Environmental Petitioners v. North Carolina DENR/DAQ and Carolinas Cement Company, before the Office of Administrative Hearings, State of North Carolina.

186. Deposition (August 2013) on behalf of the Sierra Club in connection with the Luminant Big Brown Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 6:12-cv-00108-WSS (Western District of Texas, Waco Division).

187. Deposition (August 2013) on behalf of the Sierra Club in connection with the Luminant Martin Lake Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 5:10-cv-0156-MHS-CMC (Eastern District of Texas, Texarkana Division).

188. Deposition (February 2014) on behalf of the United States in *United States of America v. Ameren Missouri*, Civil Action No. 4:11-cv-00077-RWS (Eastern District of Missouri, Eastern Division).

189. Trial Testimony (February 2014) in the matter of *Environment Texas Citizen Lobby, Inc and Sierra Club v. ExxonMobil Corporation et al.,* Civil Action No. 4:10-cv-4969 (Southern District of Texas, Houston Division).

190. Trial Testimony (February 2014) on behalf of the Sierra Club in connection with the Luminant Big Brown Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 6:12-cv-00108-WSS (Western District of Texas, Waco Division).

191. Deposition (June 2014) and Trial (August 2014) on behalf of ECM Biofilms in the matter of the *US Federal Trade Commission (FTC) v. ECM Biofilms* (FTC Docket #9358).

192. Deposition (February 2015) on behalf of Plaintiffs in the matter of *Sierra Club and Montana Environmental Information Center (Plaintiffs) v. PPL Montana LLC, Avista Corporation, Puget Sound Energy, Portland General Electric Company, Northwestern Corporation, and Pacificorp (Defendants)*, Civil Action No. CV 13-32-BLG-DLC-JCL (US District Court for the District of Montana, Billings Division).

193. Oral Testimony at Hearing (April 2015) on behalf of Niagara County, the Town of Lewiston, and the Villages of Lewiston and Youngstown in the matter of CWM Chemical Services, LLC New York State Department of Environmental Conservation (NYSDEC) Permit Application Nos.: 9-2934-00022/00225, 9-2934-00022/00231, 9-2934-00022/00232, and 9-2934-00022/00249 (pending).

194. Deposition (August 2015) on behalf of Plaintiff in the matter of *Conservation Law Foundation (Plaintiff) v. Broadrock Gas Services LLC, Rhode Island LFG GENCO LLC, and Rhode Island*

Resource Recovery Corporation (Defendants), Civil Action No. 1:13-cv-00777-M-PAS (US District Court for the District of Rhode Island).

195. Testimony at Hearing (August 2015) on behalf of the Sierra Club in the matter of *Amendments to 35 Illinois Administrative Code Parts 214, 217, and 225* before the Illinois Pollution Control Board, R15-21.

196. Deposition (May 2015) on behalf of Plaintiffs in the matter of *Northwest Environmental Defense Center et. al., (Plaintiffs) v. Cascade Kelly Holdings LLC, d/b/a Columbia Pacific Bio-Refinery, and Global Partners LP (Defendants)*, Civil Action No. 3:14-cv-01059-SI (US District Court for the District of Oregon, Portland Division).

197. Trial Testimony (October 2015) on behalf of Plaintiffs in the matter of *Northwest Environmental Defense Center et. al., (Plaintiffs) v. Cascade Kelly Holdings LLC, d/b/a Columbia Pacific Bio-Refinery, and Global Partners LP (Defendants)*, Civil Action No. 3:14-cv-01059-SI (US District Court for the District of Oregon, Portland Division).

198. Deposition (April 2016) on behalf of the Plaintiffs in *UNatural Resources Defense Council, Respiratory Health Association, and Sierra Club (Plaintiffs) v. Illinois Power Resources LLC and Illinois Power Resources Generation LLC (Defendants)*, Civil Action No. 1:13-cv-01181 (Central District of Illinois, Peoria Division).

199. Trial Testimony at Hearing (July 2016) in the matter of Tesoro Savage LLC Vancouver Energy Distribution Terminal, Case No. 15-001 before the State of Washington Energy Facility Site Evaluation Council.

200. Trial Testimony (December 2016) on behalf of the challengers in the matter of the Delaware Riverkeeper Network, Clean Air Council, et. al., vs. Commonwealth of Pennsylvania Department of Environmental Protection and R. E. Gas Development LLC regarding the Geyer well site before the Pennsylvania Environmental Hearing Board.

201. Trial Testimony (July-August 2016) on behalf of the United States in *United States of America v. Ameren Missouri*, Civil Action No. 4:11-cv-00077-RWS (Eastern District of Missouri, Eastern Division).

202. Trial Testimony (January 2017) on the Environmental Impacts Analysis associated with the Huntley and Huntley Poseidon Well Pad Hearing on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

203. Trial Testimony (January 2017) on the Environmental Impacts Analysis associated with the Apex energy Backus Well Pad Hearing on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

204. Trial Testimony (January 2017) on the Environmental Impacts Analysis associated with the Apex energy Drakulic Well Pad Hearing on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

205. Trial Testimony (January 2017) on the Environmental Impacts Analysis associated with the Apex energy Deutsch Well Pad Hearing on behalf citizens in the matter of the special exception use Zoning Hearing Board of Penn Township, Westmoreland County, Pennsylvania.

206. Deposition Testimony (July 2017) on behalf of Plaintiffs in the matter of *Casey Voight and Julie Voight v Coyote Creek Mining Company LLC (Defendant)* Civil Action No. 1:15-CV-00109 (US District Court for the District of North Dakota, Western Division).

207. Deposition Testimony (November 2017) on behalf of Defendant in the matter of *Oakland Bulk and Oversized Terminal (Plaintiff) v City of Oakland (Defendant,)* Civil Action No. 3:16-cv-07014-VC (US District Court for the Northern District of California, San Francisco Division).

208. Deposition Testimony (December 2017) on behalf of Plaintiff in the matter of *Wildearth Guardians (Plaintiff) v Colorado Springs Utility Board (Defendant)* Civil Action No. 1:15-cv-00357-CMA-CBS (US District Court for the District of Colorado).

209. Deposition Testimony (January 2018) in the matter of National Parks Conservation Association (NPCA) v. State of Washington Department of Ecology and British Petroleum (BP) before the Washington Pollution Control Hearing Board, Case No. 17-055.

210. Trial Testimony (January 2018) on behalf of Defendant in the matter of *Oakland Bulk and Oversized Terminal (Plaintiff) v City of Oakland (Defendant,)* Civil Action No. 3:16-cv-07014-VC (US District Court for the Northern District of California, San Francisco Division).

211. Trial Testimony (April 2018) on behalf of the National Parks Conservation Association (NPCA) in the matter of NPCA v State of Washington, Department of Ecology and BP West Coast Products, LLC, PCHB No. 17-055 (Pollution Control Hearings Board for the State of Washington.

212. Deposition (June 2018) (harm Phase) on behalf of Plaintiffs in the matter of *Natural Resources Defense Council, Inc., Sierra Club, Inc., and Respiratory Health Association v. Illinois Power Resources LLC, and Illinois Power Resources Generating LLC (Defendants)*, Civil Action No. 1:13-cv-01181 (US District Court for the Central District of Illinois, Peoria Division).

213. Trial Testimony (July 2018) on behalf of Petitioners in the matter of *Coosa River Basin Initiative and Sierra Club (Petitioners) v State of Georgia Environmental Protection Division, Georgia Department of Natural Resources (Respondent) and Georgia Power Company (Intervenor/Respondent)*, Docket Nos: 1825406-BNR-WW-57-Howells and 1826761-BNR-WW-57-Howells, Office of State Administrative Hearings, State of Georgia.

214. Deposition (January 2019) and Trial Testimony (January 2019) on behalf of Sierra Club and Texas Campaign for the Environment (Appellants) in the contested case hearing before the Texas State Office of Administrative Hearings in Docket Nos. 582-18-4846, 582-18-4847 (Application of GCGV Asset Holding, LLC for Air Quality Permit Nos. 146425/PSDTX1518 and 146459/PSDTX1520 in San Patricio County, Texas).

215. Deposition (February 2019) and Trial Testimony (March 2019) on behalf of Sierra Club in the State of Florida, Division of Administrative Hearings, Case No. 18-2124EPP, Tampa Electric Company Big Bend Unit 1 Modernization Project Power Plant Siting Application No. PA79-12-A2.

216. Deposition (June 2019) relating to the appeal of air permits issued to PTTGCA on behalf of Appellants in the matter of *Sierra Club (Appellants) v. Craig Butler, Director, et. al., Ohio EPA (Appellees)* before the State of Ohio Environmental Review Appeals Commission (ERAC), Case Nos. ERAC-19-6988 through -6991.

217. Deposition (September 2019) on behalf of Appellants relating to the NPDES permit for the Cheswick power plant in the matter of *Three Rivers Waterkeeper and Sierra Club (Appellants) v. State of Pennsylvania Department of Environmental Protection (Appellee) and NRG Power Midwest (Permittee)*, before the Commonwealth of Pennsylvania Environmental Hearing Board, EHB Docket No. 2018-088-R.

218. Deposition (December 2019) on behalf of the Plaintiffs in the matter of David Kovac, individually and on behalf of wrongful death class of Irene Kovac v. BP Corporation North America Inc., Circuit Court of Jackson County, Missouri (Independence), Case No. 1816-CV12417.

219. Deposition (February 2020, virtual) and testimony at Hearing (August 2020, virtual) on behalf of Earthjustice in the matter of *Objection to the Issuance of PSD/NSR and Title V permits for Riverview Energy Corporation*, Dale, Indiana, before the Indiana Office of Environmental Adjudication, Cause No. 19-A-J-5073.

220. Hearing (July 14-15, 2020, virtual) on behalf of the Sierra Club in the matter of *the Application of the Ohio State University for a certificate of Environmental Compatibility and Public Need to Construct a Combined Heat and Power Facility in Franklin County, Ohio*, before the Ohio Power Siting Board, Case No. 19-1641-EL-BGN.

221. Hearing (September 2020, virtual) on behalf of WildEarth Guardians (petitioners) in the matter of *the Appeals of the Air Quality Permit No. 7482-M1 Issued to 3 Bear Delaware* Operating *– NM LLC (EIB No. 20-21(A) and Registrations Nos. 8729, 8730, and 8733 under General Construction*

Permit for Oil and Gas Facilities (EIB No. 20-33 (A), before the State of New Mexico, Environmental Improvement Board.

222. Deposition (December 2020, March 4-5, 2021, all virtual) and Hearing (April 2021, virtual) in support of Petitioner's Motion for Stay of PSCAA NOC Order of Approval No. 11386 in the matter of the *Puyallup Tribe of Indians v. Puget Sound Clean Air Agency (PSCAA) and Puget Sound Energy (PSE),* before the State of Washington Pollution Control Hearings Board, PCHB No. P19-088.

223. Hearing (September 2020, virtual) on the *Initial Economic Impact Analysis (EIA) for A Proposal To* Regulate *NOx Emissions from Natural Gas Fired Rich-Burn Natural Gas Reciprocating Internal Combustion Engines (RICE) Greater Than 100 Horsepower* prepared on behalf of Earthjustice and the National Parks Conservation Association in the matter of Regulation Number 7, Alternate Rules before the Colorado Air Quality Control Commission.

224. Deposition (December 2020, virtual and Hearing February 2021, virtual) on behalf of the Plaintiffs (Shrimpers and Fishermen of the Rio Grande Valley represented by Texas RioGrande Legal Aid, Inc.) in the matter of the Appeal of Texas Commission on Environmental Quality (TCEQ) Permit Nos. 147681, PSDTX1522, GHGPSDTX172 for the Jupiter Brownsville Heavy Condensate Upgrader Facility, Cameron County, before the Texas State Office of Administrative Hearings, SOAH Docket No. 582-21-0111, TCEQ Docket No. 2020-1080-AIR.

225. Deposition (January 2021, virtual) on behalf of Plaintiffs in the matter of *PennEnvironment Inc., and Clean Air Council (Plaintiffs) and Allegheny County Health Department (Plaintiff-Intervenor) v. United States Steel Corporation (Defendant)*, Civil Action No. 2-19-cv-00484-MJH (US District Court for the Western District of Pennsylvania.)

226. Deposition (February 2021, virtual) on behalf of Plaintiffs in the matter of *Sierra Club Inc. (Plaintiff) v. GenOn Power Midwest LP (*Defendants*)*, Civil Action No. 2-19-cv-01284-WSS (US District Court for the Western District of Pennsylvania.)

227. Deposition (April 2021, virtual) on the Potential Remedies to Avoid Adverse Thermal Impacts from the Merrimack Station on behalf of Plaintiffs in the matter of *Sierra Club Inc. and the* Conservation *Law Foundation (Plaintiffs) v. Granite Shore Power, LLC et. al., (Defendants)*, Civil Action No. 19-cv-216-JL (US District Court for the District of New Hampshire.)

228. Deposition (June 2021, virtual) on behalf of Plaintiffs in the matter of *Sierra Club (Plaintiff) v. Woodville Pellets, LLC (Defendant)*, Civil Action No. 9:20-cv-00178-MJT (US District Court for the Eastern District of Texas, Lufkin Division).

229. Deposition (June 2021, virtual) on behalf of the Plaintiffs in the matter of *Modern Holdings, LLC, et al. (Plaintiffs) v. Corning Inc., et al. (Defendants)*, Civil Action No. 5:13-cv-00405-GFVT, (US District Court for the Eastern District of Kentucky, Central Division at Lexington).

230. Testimony (June 2021, virtual) regarding the Aries Newark LLC Sludge Processing Facility, Application No. CPB 20-74, Central Planning Board, City of Newark, New Jersey.

ZERO WASTE EUROPE

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El Dorado of Chemical Recycling

State of play and policy challenges

Study

August 2019 – Zero Waste Europe

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Executive Summary

Over the last few years the concept of chemical recycling has been promoted by the industry as a potential solution to help curb plastic pollution and waste management as a whole. This report looks into the information available as well as the state of implementation of such technologies in the European context.

Mechanical recycling is a mature industrial process which is well established and expanding in Europe. Yet, plastics cannot be endlessly recycled mechanically without reducing their properties and quality. Besides, not all plastic types can be mechanically recycled. These limits set challenges for plastics recycling and show the need for significant improvements in the end-of-life management of plastics.

Chemical recycling today often refers to technologies that can be classed depending on the level at which they break down the plastic waste. Concretely, the technologies can be divided into 3 types:

- Solvent-based purification. Comprises technologies that go down to the polymer stage. They are capable of decontaminating the plastic but cannot address its degradation. They work only with monostreams (PVC, PS, PE, PP).

- Chemical depolymerisation. Chemical process which turns the plastics back into their monomers. Allows for decontamination but not addressing degradation. Only works with monostreams (PET, PU, PA, PLA, PC, PHA, PEF).

- Thermal depolymerisation and cracking (pyrolysis and gasification) are energy-intensive processes which turn the polymers back into simpler molecules. They are capable of decontaminating polymers and, by bringing plastic back to its original building blocks, addressing the degradation of the material. These technologies can deal with more than one monomer at a time and are also capable of producing fuels. This raises the need for strict regulatory controls to prevent plastic being turned into fuel in lieu of recycling.

Gasification and pyrolysis have been tested since decades as alternatives to waste to energy incineration with very limited results due to the energy balance and the environmental impact. In general, the information available about the environmental performance of chemical recycling technologies as a whole is still extremely limited and requires further research.

In contrast with mechanical recycling, chemical recycling is an industry in its infancy and most plants in the market are in a pilot stage. The potential roll-out of such technologies at industrial scale can only be expected from 2025-2030 and this is an important factor when planning the transition to a Circular Economy and notably the decarbonisation agenda.

For the sake of policy consistency, it is key that the right policy framework is set up in order to, on the one hand, accommodate chemical recycling as complementary to mechanical recycling and, on the other hand, ensure that the carbon stays in the plastic and is not released into the environment. Therefore, allowing plastic to fuels to be considered chemical recycling risks creating a loophole in EU Climate and Circular Economy legislation.

With all its potential, chemical recycling can have a role to play in closing the material loop and moving away from disposal and recovery operations, up the waste hierarchy. Nevertheless, the best options to curb plastic pollution from environmental and economic perspective is to invest in reduction and reuse solutions; giving excessive attention to end of pipe solutions could undermine this exercise. For the plastic waste that cannot be avoided via redesign, thermal depolymerisation of mixed plastic could undermine efforts to source separate for mechanical recycling which is more environmentally favourable. Moreover, there is a risk of putting too much expectation on a solution whose potential is yet to be proven and this could delay the necessary efforts in the field of rethinking business models and material redesign.

Chemical recycling could be a complementary solution to mechanical recycling where the latter proves to be unsuited to materially recover plastic because it is too degraded, contaminated or too complex. At the same time, increased collection of high-quality waste and design for reuse and recycling should remain the two priorities in order to increase the recycling rates for plastics and ensuring no plastic escapes the material loop via plastic to fuels. For this to happen ZWE recommends to amend current waste legislation as follows:

- Come up with a clear definition of chemical recycling that excludes any operation that does not result in the production of new plastic.
- Only processes with a lower carbon footprint than the production of plastic from virgin feedstock can be classified as chemical recycling.
- Chemical recycling should be used to deal with degraded and contaminated plastics and never with plastics coming from separate collection.
- Establish verification systems to ensure chemical recycling process outputs plastic and plastic feedstocks; facilities licensed for chemical recycling may not produce fuel for on- or off-site combustion.
- In order to avoid competition with mechanical recycling, but also to differentiate from recovery and disposal operations, a new level in the waste hierarchy should be added for those operations that recover materials from mixed waste that today would end up burned.
- For coherence with EU Climate and Circular Economy agendas EU funding should only be allowed to finance plastic to plastic chemical operations.

1. Introduction

Plastic pollution is a topic that has been gaining traction in recent years and it is already seen as a global challenge. Indeed, our civilization struggles to make an efficient and sustainable use of this material, with 335 million tonnes of plastic produced in 2016 alone which is expected to substantially increase over the next decade[1].

The current plastics system has an estimated annual material value loss of EUR 70-105 billion globally. From an environmental perspective, it is estimated that 75,000 to 300,000 tonnes of microplastics are released into EU habitats annually.

Of the 8,300 million tonnes of plastics produced by humankind since the 1950s, it is estimated that 5,800 million tonnes of plastics, representing 70% of the total amount, have become waste, of which 84% or 4,900 million tonnes, has been disposed of in landfills or in the environment[2].

In the EU, separate collection rate of plastic waste in 2014 was 37%, whilst the recycling rate after the export of 30% of the plastic waste outside EU borders was estimated to be 13% (2.15 million tonnes). The rejects of the various sorting stages amount to about 1.5 million tonnes[3].

From a systemic perspective, given the inefficient way we are managing this resource, it is clear that a big effort will be needed to rethink the way we use plastics today and many single-use applications will need to be reconsidered. Moreover, in a scenario in which two thirds of EU's plastic waste are being landfilled or burned, there is a big opportunity to increase plastic recycling.

Bearing in mind the need to reduce the use of plastic for single-use applications and the necessary diversion from landfill and incineration to mechanical recycling, there is a legitimate question about what to do with those plastics that are too degraded or too contaminated to be reintroduced in the production cycle. Currently this fraction of plastic waste is exported, downcycled or disposed of, but in recent years some technologies have been presented claiming to be able to recycle this waste stream under the name of chemical recycling. This study looks into the state of play of these technologies in the current context and explores their potential for development in the future.

[1] PlasticsEurope, 2018
[2] Geyer, Jambeck & Law, 2017
[3] Deloitte Sustainability, 2017

2. What is plastic chemical recycling?

Plastics are chains of molecules linked together. Each of these molecules is a monomer and the resulting chains are called polymers. This is why many plastics begin with "poly," such as polyethylene, polystyrene, and polypropylene. Polymers often are made of carbon and hydrogen and sometimes oxygen, nitrogen, sulfur, chlorine, fluorine, phosphorous, or silicon. The term "plastics" encompasses all these various polymers.

In order for these polymers to be of use they need to be given properties such as flexibility, fire resistance, strength, etc. and this is possible thanks to the addition of additives in the production process.

Even though plastic is used as a generic term, every polymer follows a different production process and all have different melting temperatures, which makes it impractical for different polymers to be recycled together. Therefore, quality recycling requires sorting by polymer and also differentiating between the different additives within every family of polymers. For instance, opaque PET should not be recycled with transparent PET.

Almost exclusively, today plastic recycling means sorting, washing and compounding the different polymers into secondary plastics. The process of plastic use and the mechanical recycling cause degradation in the polymer structures which limits the number of times the same polymer can be effectively recycled as the bonds become more and more degraded. Also, mechanical recycling is unable to separate the additives and the non-intentionally added substances that are present in plastic waste; this explains why contaminated plastic cannot be turned into high grade plastic which could be used for food contact applications. As long as recycled plastic use is limited to lower-quality products ("downcycling"), it cannot replace the production of virgin plastic, which is almost entirely sourced from fossil fuels, with all the attendant environmental impacts. The limitations of plastic mechanical recycling open the door to chemical recycling, for the latter can sometimes address the challenges of both polymer degradation and contamination.

The number of technologies comprised in what is commonly referred to as chemical recycling can be divided into three different categories depending on the level of decomposition that the plastic waste will be subject to (see figure 1):

- Solvent-based purification, which decomposes plastics back to the polymer stage.
- Chemical depolymerisation, which turns the plastics back into their monomers via a chemical reaction.
- Thermal depolymerisation (pyrolysis and gasification) which in some cases can be considered as chemical recycling by cracking the polymers back into monomers and further down into hydrocarbons. Thermal depolymerisation technology can also produce fuels although in that case it can no longer be considered a form of recycling.

All these outputs (except fuels) are then reprocessed to form new plastics.

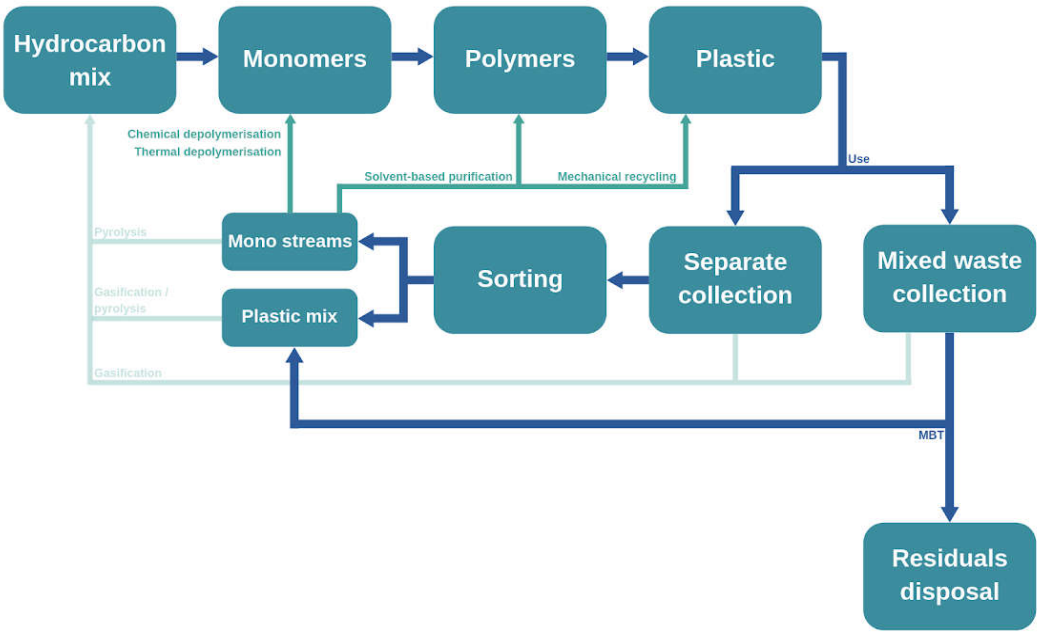

Figure 1: Diagram of different chemical recycling processes
Source: Zero Waste Europe: www.zerowasteeurope.eu

	Feedstock	Output	Decontamination	Ability to treat mixed plastic	Maturity
Mechanical recycling	PE, PET, PP, PS	Plastic (made of one or more polymers)	No	Yes*	Industrial scale
Solvent-based purification	PVC, PS, polyolefins (PE, PP)	Polymer	Yes	No	Pilot stage
Chemical depolymerisation	PET, PU, PA, PLA, PC, PHA, PEF	Monomers	Yes	No	Existing pilot plants for PET, PU, PA
Thermal depolymerisation (pyrolysis)	PMMA, PS	Monomers	Yes	No	Pilot stage
Cracking (pyrolysis and gasification)	Plastic mix	Hydrocarbon mix	Yes	Yes	Pilot stage

*Mechanically-recycled mixed plastics can be downcycled into lower-grade uses such as plastic lumber. Mechanical recycling of single resins, such as PET, can produce higher-value products.

Table 1: Technologies of different chemical recycling processes
Source: Zero Waste Europe: www.zerowasteeurope.eu

3. Solvent-based purification[4]

3.1 The technology

Solvent-based purification is a process based on the solubility of the polymer in a certain type of solvent: when immersed in this solvent, the plastic dissolves and goes back to the polymer stage. In general, the solvent is chosen so that other impurities such as additives or pigments can be removed through filtration or phase extraction. At the end of these purification steps, the polymer is recovered thanks to an anti-solvent in which the polymer is not soluble. **The solvent-based purification can only deal with homogeneous flows of plastic**. It can treat separately PVC, PS, and polyolefins such as PE and PP. The resulting output is a precipitated polymer, of sufficient purity to be reformulated into plastics in a near virgin quality since the additives, colourants and contaminants are removed at the molecular level. Their use is very diverse, from food packaging to insulating material. The composition due to mixing of different polymer grades (chain lengths or branching for example), remains more or less the same.

Nevertheless, this process raises several issues. First, the purity of the output polymer can vary according to the input and the process parameters: there is always a risk of finding residual contaminants and traces of the solvent. The treatment of the left-over solvent, which can contain plastic additives and contaminants, is not clear.

Then, even though the solvent process does not degrade the quality of the polymer, the latter needs to be processed again to form a new plastic object. As with mechanical recycling, the physical and thermal stress generated by this process decreases the average chain length of the polymer, affecting its quality. Solvent-based purification thus cannot be a perpetual recycling method for plastics.

Besides, the trend to multi-layer packaging continues: 20% of all packaging films are multi-layer[5]. This kind of packaging has some properties, such as a barrier against oxygen or water vapor, that a regular mono-layer packaging cannot have[6]. While solvent-based purification is technically able to separate complex layers of plastic, its practical feasibility remains unproven. This would indeed require additional solvation and separation steps, making the time and energy input needed for solvent removal even more important.

The economic viability of the process also needs to be evaluated. So far, this technology can only take care of homogeneous inputs of plastic. A strict upstream sorting system and the availability of sufficient amounts of plastic monostreams are therefore necessary. In general, mechanical recycling is preferable for monostreams; however, solvent-based purification is better able to process contaminated PS or PVC than mechanical recycling can. While technically feasible, this is not necessarily an economically viable process. The infrastructure and transport costs are also challenging: plastics are lightweight but production volumes need to be high. While the annual plant capacity should be above 10 or 20 kilotons to make the investment pay off, finding sufficient

[4] Crippa, M., De Wilde, B., Koopmans, R., Leyssens, J., Muncke, J., Ritschkoff A-C., Van Doorsselaer, K., Velis, C. & Wagner, M. A circular economy for plastics – Insights from research and innovation to inform policy and funding decisions, 2019 (M. De Smet & M. Linder, Eds.). European Commission, Brussels, Belgium

[5] APK, Company presentation

[6] APK, DSM and APK cooperate on recycling multilayer food packaging films, 2018, www.apk-ag.de/en/dsm-and-apk-cooperate-on-recycling-multilayer-food-packaging-films/

feedstock for a capacity above 40 or 50 kilotonnes[7] a year will probably be complicated. Striking the balance between capacity and available feedstock is therefore key.

Finally, the environmental impact of this type of processes needs to be further assessed as the energy and mass balance, emissions, solvents manufacturing, etc. are not fully analysed.

Because solvent-based purification goes down to the polymer level, some stakeholders claim that solvent-based purification is equivalent to mechanical recycling and should not be classified as chemical recycling. This lack of clarity is an argument for a clear definition for chemical recycling.

3.2 Industrial stage

As highlighted by the different points raised above, this technology still needs significant development to mature. But even though solvent-based recycling for packaging does not exist at scale, a few pilot plants are already working.

Soft Polyvinyl Chloride (PVC)

PVC is the third most produced plastic worldwide. It is used in pipes and electric cables, but also in clothing.

The VinyLoop plant was built in 2002 in Italy to treat 10,000 tonnes a year of PVC. This pilot project was founded by Solvay in order to recycle soft PVC from cables or films. It was closed in June 2018 following the new EU's REACH legislation making it clear that phthalates were hazardous. These phthalates were used in the production of PVC in the past, and it was not economically feasible to separate them through the VinyLoop process[8].

Polystyrene (PS)

The need for an alternative to mechanical recycling for PS is due to the presence of brominated flame retardant hexabromocyclododecane (HBCD) from old insulation material[9].

In 2017, PolyStyreneLoop was created with the aim of recycling PS across Europe through the CreaSolv Process. They focus on EPS (Expanded Polystyrene also known as styrofoam) containing HBCD that was used for many years in insulation and packaging. A pilot installation, with an annual capacity of 3,000 tonnes of PS foam waste, was built in Terneuzen (Netherlands). The process, developed by the German company Fraunhofer, works as follows: first the foam is dissolved with a solvent, the addition of a second solvent precipitates the polymer, while contaminants stay in the solution. The solvent is then vaporised and can be reused, as well as the polymer. HBCD remains as a sludge, which is sent to a hazardous waste incinerator with a bromine recovery unit to recover some of the bromine (which can then be used in new flame retardants).

According to Life Cycle Analyses (LCA), this process performs better than incineration regarding CO_2

[7] IFP Energies Nouvelles, www.ifpenergiesnouvelles.fr/innovation-et-industrie/nos-expertises/climat-et-environnement/recyclage-des-plastiques/nos-solutions
[8] Plastics Information Europe, *VINYLOOP Closure of operation in Italy / Phthalates issue under REACH brings down European PVC recycling project*, 2018, www.plasteurope.com/news/VINYLOOP_t240095/
[9] Crippa, M., De Wilde, B., Koopmans, R., Leyssens, J., Muncke, J., Ritschkoff A-C., Van Doorsselaer, K., Velis, C. & Wagner, M. *A circular economy for plastics – Insights from research and innovation to inform policy and funding decisions*, 2019 (M. De Smet & M. Linder, Eds.). European Commission, Brussels, Belgium

equivalent emissions and thus having less of an impact on climate change, but not as good as mechanical recycling. The Polystyrene Loop process would have an impact of about -1.5 tonnes of CO_2 eq/tonne input, while incineration of discarded plastic in a waste-to-energy plant emits 1.6 tonnes of CO_2 eq./tonne input, and mechanical recycling -2.3 tonne CO_2 eq/tonne input[10]. An ISO compliant LCA, performed by FH Münster and TÜV Rheinland, shows that the PolyStyreneLoop process performs better (roughly 50% of the impact) than incineration with energy recovery in all the impact categories for the treatment of EPS containing HBCD[11].

The current partners of this project are INEOS Styrolution, Synthos, Total, Trinseo and Versalis. It is supported by the EU through the LIFE programme and its viability without public intervention is unclear.

The use of this process can be extended to the recycling of EPS packaging, even though most of them do not contain HBCD (being mostly packaging for electrical and electronic equipment). However, from an economic and environmental point of view, it is better to mechanically recycle these EPS flows. But it offers a good alternative when the EPS is contaminated (organic waste, smell).

The Canadian company Polystyvert has also been working on PS recycling since 2011, using a patent-pending technology able to separate contaminants from PS. Agilyx opened a polystyrene recycling plant in Oregon (USA) too.

Polyolefins: Polyethylene (PE) and Polypropylene (PP)

These polymers, together representing more than 50% of the global polymer production volume, can be solvent-purified[12].

Unilever has piloted since 2017 the CreaSolv process in Indonesia to recover PE from multi-layer flexible sachets. According to the company, the plant is processing 3 tonnes of flexible plastic daily to recover the PE and use it to make new sachets[13].

In the meantime, Procter & Gamble is developing the PureCycle Technologies to purify PP - used in automobile interiors, food and beverage packaging, consumer goods packaging, electronics, construction materials, home furnishing, etc. - for use in home cleaning and hygiene product packaging in the US. This technology consists of a solvent-based purification under high temperature and pressure[14].

Finally, in Europe, APK (Germany) has worked since 2013 on the 'Newcycling technology' to recycle several polymers from multilayer packaging. With this process, they are able to produce LDPE (Low Density PE) and PA (Polyamides) in a near-virgin quality, which can be used in flexible packaging, technical injection molding, labels/stickers and films/laminates, from PE/PA multilayer film waste.

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[10] M. Broeren, E. Roos Lindgreen, G. Bergsma, *Verkenning chemische recycling - update 2019 Hoe groot zijn - en worden - de kansen voor klimaatbeleid?*, CE Delft, 2019

[11] PolystyreneLoop, www.polystyreneloop.org/

[12] Crippa, M., De Wilde, B., Koopmans, R., Leyssens, J., Muncke, J., Ritschkoff A-C., Van Doorsselaer, K., Velis, C. & Wagner, M. *A circular economy for plastics – Insights from research and innovation to inform policy and funding decisions*, 2019 (M. De Smet & M. Linder, Eds.). European Commission, Brussels, Belgium

[13] Unilever, 2017, www.unilever.com/news/news-and-features/Feature-article/2017/CreaSolv-a-breakthrough-waste-recycling-technology-that-we-want-to-share.html

[14] Newswire, 2017, *PureCycle Technologies and P&G introduce technology that enables recycled plastic to be nearly-new quality* www.prnewswire.com/news-releases/purecycle-technologies-and-pg-introduce-technology-that-enables-recycled-plastic-to-be-nearly-new-quality-300491368.html

These multilayer films are first dissolved to obtain two distinct fractions: a solid one, containing PA, and a liquid one, containing the dissolved PE. The solid fraction is washed with different solvents to remove impurities, then separated from the new liquid phase and is finally treated before being extruded or pelletised into PA. In the liquid fraction, the solvent is evaporated and can be reused after condensation, while the PE is extruded. Their plant in Merseburg (Germany) is divided into two parts: mechanical recycling and solvent-based recycling are complementing each other. The total capacity of the plant is 20,000 tonnes input per year[15].

[15] APK, www.apk-ag.de/en/about-us/history/

4. Chemical depolymerisation

4.1 The technology

Depolymerisation can be described as the exact reverse of polymerisation. It is mostly used for polymers formed through a polymerisation process called polycondensation. During this condensation, two molecules called monomers join together and lose small molecules such as water or methanol.

The activated bonds formed after polycondensation can be broken exactly where they were formed and "add back" the molecule that was lost. In some cases, it is preferable not to go back to the monomer stage again (total depolymerisation), but to divide the polymer in smaller chains (partial depolymerisation). This reaction usually happens with the help of heat and catalysers[16].

After the purification steps needed to remove colourants and contaminants, the pure monomer is obtained. In most cases, the reactant - which enables to break the bonds - for chemical depolymerisation is the solvent. Depending on the solvent used, the name of the reaction differs:

- Hydrolysis, if the solvent is water.
- Alcoholysis, if the solvent is alcohol (glycolysis for ethylene glycol and methanolysis for methanol).
- Aminolysis, if the solvent is an amine (ammoniac, ethylene diamine, etc.).

Some other techniques are being investigated - supercritical fluids, enzymes, reduction reactions or metathesis - but they are at an early research stage. In the figure below, some typical general reactions are displayed.

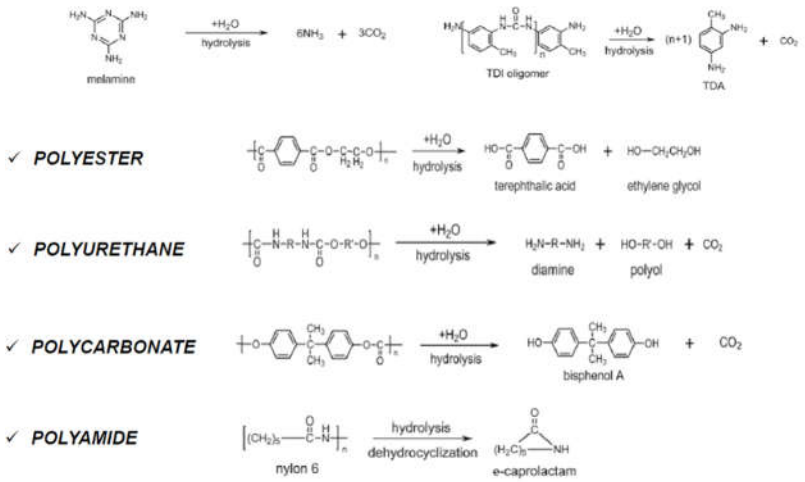

Figure 2: General reactions
Source: Enscm: www.enscm.fr/en/

The major possible feedstock for these reactions are: polyesters, polyethylene terephthalate (PET), polyamides (PA), polyurethanes (PU), polylactic acid (PLA), polyhydroxyalkanoates (PHA), polyethylene furanoate (PEF) and polycarbonates (PC). The resulting outputs are single monomer

[16] A. Parenty, C. Dadou-Willmann, 2ACR, *Recyclage chimique des déchets plastique : état des lieux et perspectives*, 2019

molecules or small polymer chains called dimers or oligomers. These must be polymerised again before the material can be converted into a new plastic product.

Since the resulting output must be polymerised again, the length of the polymer chain is not a problem as it is in mechanical recycling and the plastic can be recycled as many times as wished. The quality of the plastic is then equivalent to the quality of plastic made with virgin polymers. It also implies that the polymer is purified from all the additives that could have contaminated the plastic - from odours to flame retardants or colourants.

However, this technology needs to be performed with heat and sometimes in the presence of a catalyser. The amount of energy required by the process depends on the input material itself as well as the reaction and the separation phase. Multi-layer materials, for example, are more challenging to treat and thus require more energy.

Besides, chemical depolymerisation can be highly selective, provided that it has only one specific input. In order to be efficient, it needs a strict upstream sorting system beforehand.

Moreover, the price difference between the virgin polymer and the recycled one, can be key in the system. If virgin polymers are cheaper than recycled polymers the technology can only be viable if there is market intervention. Hence, as for solvent-based purification, finding sufficient amounts of sorted homogeneous plastic waste, infrastructure and transport are key in the economic viability of the process.

Finally, less information is available on other environmental and systemic impacts of depolymerisation such as yield, leftover by-products or chemical safety of the catalysers.

4.2 Industrial stage

Polyethylene Terephthalate PET

PET is the fourth most produced polymer worldwide. Its applications are mainly for textile (polyester) and plastic packaging, namely PET bottles. Transparent PET can be mechanically recycled, but opaque PET, which is getting more and more common in packaging, is not so easily recyclable[17].

That is why PET is the most widely researched polymer for recycling. Most of the depolymerisation projects are targeting PET flows that are not recycled today, such as packaging PET, textiles or opaque PET bottles.

PET can be depolymerised:

- Through glycolysis to produce Bis-HydroxyEthyl-Terephthalate (BHET). This method is the oldest and simplest. It involves the transesterification of PET with an excess of glycol at temperatures between 180°C and 250°C. A catalyser is usually used to accelerate the process.

[17] Crippa, M., De Wilde, B., Koopmans, R., Leyssens, J., Muncke, J., Ritschkoff A-C., Van Doorsselaer, K., Velis, C. & Wagner, M. A circular economy for plastics – Insights from research and innovation to inform policy and funding decisions, 2019 (M. De Smet & M. Linder, Eds.). European Commission, Brussels, Belgium

- Through hydrolysis, at high temperature and pressure, to produce Ethylene Glycol (EG) and Terephthalic Acid (TPA). The main drawbacks are the low purity of TPA and the relative slowness of the process.
- Through methanolysis, at relatively high temperatures (180°C-280°C) and pressure (20-40 atm) to produce Ethylene Glycol (EG) and DiMethyl Terephthalate (DMT) [18]

In the figure 3, some of the ways to depolymerise PET are described.

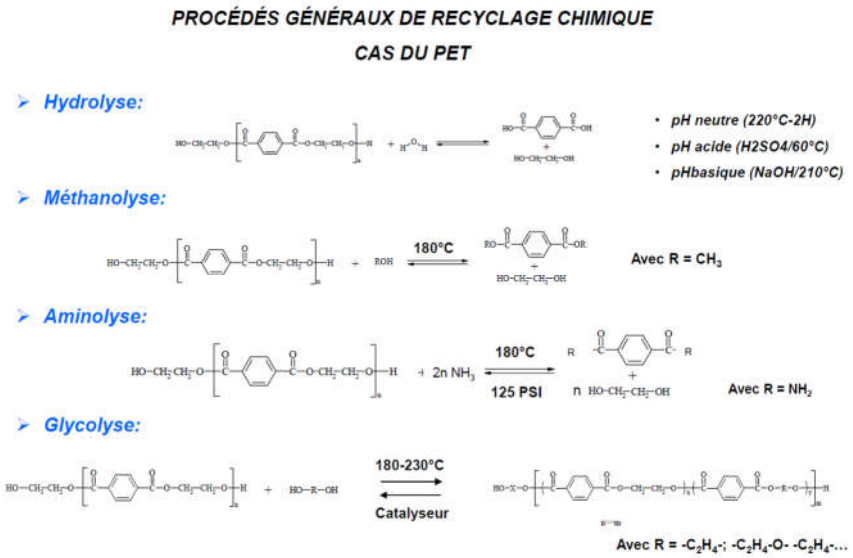

Figure 3: Depolymerisation of PET
Source: Enscm: www.enscm.fr/en/

All these molecules can be repolymerised to form PET again.

Several early stage industrial pilots to depolymerise PET both from packaging and textiles already exist. Garbo (Italy), Ioniqa (Netherlands) and Loop industries (Canada) are some of the most developed ones worldwide.

IONIQA is developing a glycolysis technology involving magnetic fluids to catalyse PET recycling into BHET, enabling it to obtain PET in a virgin quality. Even though the technique is still under development, Ioniqa has completed the funding for the next step: the construction of a production facility with a capacity of 10,000 tonnes a year, which it plans to scale up to 50,000 tonnes. The results of the first screening LCA indicate that the environmental performance of this process is not as good as the performance of mechanical recycling. However, most of the PET waste cannot be mechanically recycled and is currently stored, and could eventually be incinerated. The process developed by IONIQA performs better than incineration or storage on CO_2 equivalent emissions [19]. This process takes place at relatively low temperatures, and the catalyser can be reused many times after applying a magnetic field, keeping the operating costs low[20].

[18] Ragaert, K., et al. Mechanical and chemical recycling of solid plastic waste. Waste Management, 2017
[19] M. Broeren, E. Roos Lindgreen, G. Bergsma, Verkenning chemische recycling - update 2019 and Hoe groot zijn - en worden - de kansen voor klimaatbeleid?,CE Delft, 2019
[20] Ioniqa, www.ioniqa.com/pet-recycling/, 2013

GARBO's process, started in 2017 with EU's support, is based on a glycolysis technology with a specific purification system. They are working in collaboration with the University of Modena and Bologna to develop the so called 'ChemPET' project, which claims to be able to deal with almost all the currently non-recoverable PET waste (multi-layer thermoforming scrap and trays, multi-layer film, opaque rigid container, PET fines and dust, black PET trays, PET/PP strapping waste, non-woven fabric and polycotton). Through the reaction with ethylene glycol, PET goes back to BHET. The first plant, based in Cerano, is expected to reach 100 tonnes product per day at the end of 2019 [21].

Loop industries is using a methanolysis process and a specific catalyser to recycle waste PET of all types, including clothes, and break it down without heat or pressure into two monomers: Dimethyl Terephthalate and Mono Ethylene Glycol. Impurities and additives are removed, then repolymerised into new PET plastic, including for food packaging. Started in 2014, this company is working closely with L'Oréal, Danone, Nestlé, Coca-Cola and others. A joint facility with the plastic producing company Indorama Ventures Limited is expected to start its production in the second half of 2020. The production capacity of the plant, located in South Carolina (USA), will be 20,700 metric tonnes. They are also working on securing the feedstock needed for their commercial success[22].

The French group Soprema is currently creating a new recycling process within the Sopraloop R&D project launched in 2016. The aim is to combine mechanical recycling and depolymerisation to turn PET packaging waste into polyols used for insulating foam in the construction sector. This project is supported by Citeo (French Producer Responsibility Organisation for packaging) and the ADEME (French Environment and Energy Management Agency). A pilot unit should be created in 2019 to recycle around 5,000 tonnes of PET a year, and could double in the following years.

GR3N in Switzerland is using microwaves to catalyse the hydrolysis reaction. This patented technology called DEMETO (DEpolymerisation by MicrowavE TechnolOgy) is able to depolymerise continuously a wide range of different PET types (from colored packaging to textiles) by reducing the reaction time from 180 to 10 minutes. The pilot plant has been running since 2014 and GR3N is currently looking for more funding (€ 3.0 million) to build the first full scale pilot plant, which should produce PET equivalents suitable to all types of applications and cheaper than virgin ones[23].

IFPEN Axens (France) is developing a modular system that can be directly connected to a PET production unit. So far, their glycolysis project, that enables to produce PET monomers from opaque PET waste, is at the beginning of the pilot stage[24].
The project lead by Carbios and TechnipFMC (France) to recycle PET waste through hydrolysis with enzymatic catalysis (PETase[25]), should be taken to the industrial scale in 2021 in Lyon[26]. The first demonstrator is planned for this year.

In Japan, the company JEPLAN already owns two plants to chemically recycle PET from clothes and non-opaque PET bottles. With this technology, the BHET monomer is produced by depolymerising polyester in an ethylene glycol solvent, with a metal catalyst and heat. The product of this reaction

[21] Garbo: www.garbosrl.net/chempet-project/?lang=en and European Commission, www.cordis.europa.eu/project/rcn/210388/reporting/en, 2018
[22] Loop Industries, Securities & exchange commission Edgar Filing, www.filings.irdirect.net/data/1504678/000165495419005416/loop_10k.pdf, 2019 and Loop Industries, Supplying Demand and Transforming a Market, and Loop Industries, www.loopindustries.com/en/tech and www.loopindustries.com/assets/docs/Loop.IR%20Deck.Public.20190507.pdf, 2019
[23] GR3N, www.gr3n-recycling.com/
[24] IFP Energies Nouvelles, www.ifpenergiesnouvelles.fr/innovation-et-industrie/nos-expertises/climat-et-environnement/recyclage-des-plastiques/nos-solutions
[25] H Saporta, L'enzyme du PET nourrit le débat, Plastiques & Caoutchouc Magazine, 2018, www.plastiques-caoutchoucs.com/L-enzyme-du-PET-nourrit-le-debat.html
[26] Carbios, Carbios and TechniPFMC sign a contract on PET enzymatic biorecycling, www.carbios.fr/en/carbios-and-technipfmc-sign-a-contract-on-pet-enzymatic-biorecycling/, 2017

is then filtered with activated carbon to remove the colorants coming from the caps and the labels. Through an ion-exchange resin, impurities and the metal catalyser are removed. BHET is then crystallised at 20°C. The ethylene glycol can thus be removed, and the resulting BHET is re-polymerised into PET that can be reused in bottles or clothes[27].

PerPETual Global Technologies is based in the UK but the manufacturing and processing facilities are located in India, Turkey and South Korea. In their plant in Nashik (India), they daily convert over 2 million PET bottles into yarns through glycolysis, and are willing to increase the capacity in 2019. Their partners include big brands such as H&M, Adidas, Decathlon and Zara[28].

Finally, Eastman (USA) is currently running an engineering feasibility study for a commercial-scale methanolysis facility to recycle PET waste. The type of PET feedstock they are dealing with remains unknown. Their goal is to be operating a full-scale recycling facility by the end of 2021[29].

Polyurethanes and polyurethane resins (PU/PURs)

PU/PURs are collectively the fifth most produced plastics in the world. Chemical recycling through depolymerisation is at its early stages for these plastics. However, a few companies, including RAMPF Eco and H&S Anlagentechnik, have developed processes for recycling PU foams.

The multinational company RAMPF Eco, within their collaboration in the European project URBANREC, is producing polyols for all types of foam (shoes, cushions, insulations, mattresses, etc.) via the glycolysis of polyurethane resins from mattresses and furniture[30].

H&S Anlagentechnik has also developed a glycolysis process able to produce high-quality recovered polyols on a production scale from PU rigid foams[31].

Polyamides (PA)

The Italian company Aquafil[32] uses depolymerisation to turn used nylon in a new nylon yarn. The high energy intensity and decontamination costs are economically balanced by the high price of virgin PA, making the process cost-efficient.

[27] JEPLAN, www.jeplan.co.jp/en/
[28] PerPETual Technologies, www.perpetual-global.com/manufacturing/
[29] Eastman, www.eastman.com/
[30] RAMPF, www.rampf-group.com/en/news/newsroom/2018/chemical-recycling-expertise-for-european-project-urbanrec/
[31] H&S Anlagentechnik, www.hs-anlagentechnik.de/en/recycling-reactors-for-pu-residues.html
[32] ECONYL: "Some see trash. Others see treasure", www.econyl.com/the-process/ 2018

5. Thermal depolymerisation

Thermal depolymerisation and cracking are mainly based on pyrolysis or gasification techniques. They consist in heating up the plastics, but differ from direct combustion: the latter needs oxygen to be performed, while thermal depolymerisation and cracking work under reducing conditions (with no oxygen for pyrolysis or little oxygen for gasification).

They aim at transforming plastics and most of its additives or contaminants back into basic chemicals. Some polymers are more adapted to these techniques, namely those whose chain contains only carbon atoms: polymers synthesised via polyaddition such as polyolefins (PE or PP), PS and PMMA.

Nonetheless, it is important to distinguish between thermal depolymerisation and cracking:

- Controlled thermal depolymerisation is a selective operation which should correspond to the reverse operation of polymerisation, and produce monomers again. That is why it is also called 'plastic to monomer'.

- Cracking thermal depolymerisation consists in cutting the polymer chain in a non-selective way and produces a wide range of different molecules, leading to a product similar to petroleum fractions. Hence, it is also referred to as 'plastic-to-fuel'[33] even though it can potentially produce new plastics if the right conditions are in place.

5.1 Controlled thermal depolymerisation

Controlled thermal depolymerisation (plastic to monomer) exists for two types of plastics, PMMA and PS, because they present some activated bonds that are easier to break.

Poly (methyl methacrylate) (PMMA) is also known as plexiglass. It is a transparent plastic, often used as an alternative to glass, but also in inks or coatings. It can be pyrolysed specifically at 450°C, producing 99% liquid in which 96% is MMA, the monomer for PMMA[34]. The company Arkema, within the MMAtwo European project, is currently working on this selective depolymerisation.

For PS, the companies Agilyx (USA) and Pyrowave (Canada) are developing new processes. Pyrowave is planning to recycle PS through a catalytic microwave depolymerisation technology.

Very little information is available on these processes.

5.2 Cracking thermal depolymerisation

In general terms these technologies can in principle produce either monomers for plastic production or fuel, and whether the output will be the former or the latter depends on the inputs to the process but above all on the outputs that it aims to produce. Thermal depolymerisation aiming at producing plastic out of plastic needs to have security of supply and demand and once it is set up it is difficult

[33] A. Parenty, C. Dadou-Willmann, 2ACR, Recyclage chimique des déchets plastique : état des lieux et perspectives, 2019
[34] Dimitris S. Achilias, Chemical Recycling of Polymers. The Case of Poly(methyl methacrylate), Aristotle University of Thessaloniki, 2006

to change the output. This is why these plants tend to be built next to the facility that will be using the building blocks for new plastic, for instance Plastic Energy is building a depolymerisation plant next to SABIC which commits to buy the production. In practice this means that plastic to fuel depolymerisation is more flexible and mature than plastic to plastic depolymerisation and if left to the market alone without the right regulation it is likely that plastic to fuel depolymerisation will prevail over plastic to plastic. Because of this opportunity, some companies are deliberately conflating the two and pushing to group together plastic to plastic and plastic to fuel depolymerisation technologies.

Cracking processes are already on the market not only in the USA (Agilyx, Eastman, Plastic2oil, etc.), but also in Europe (Plastic Energy and Recycling Technologies in Great Britain, Recenso in Germany, etc.) and some other initiatives are emerging.

Pyrolysis

In the pyrolysis technique, plastics are broken down into a range of simpler hydrocarbon compounds by heating them in the absence of oxygen. Polymers tend to fragment into smaller hydrocarbon molecules which can be collected as effluents by condensing the hot gases.

Several types of pyrolysis exist:

- Conventional pyrolysis, during which the input is heated at a temperature between 400°C and 600°C.

- Integrated hydropyrolysis, during which the cracking process takes place in the presence of water at 300° C to 600°C[35].

The feedstock is supposed to be quite flexible: the technology can be applied to mixed and contaminated plastics streams. But the reality is different: some oxygenated resins such as PET are coke precursors which need to be avoided to obtain a good yield in liquid fraction, or PVC and brominated plastics, which lead to the production of acids. The formed acids, and especially HCl formed by PVC, will have to be removed (implying additional steps, even though HCl cannot be reused because it will be contaminated) and impose severe metallurgic constraints on the equipment material. Recyclers will mostly target polyolefins (PE or PP). Integrated hydropyrolysis is less sensitive to the variation in inputs, but it is still challenging to recycle PET, nylon and PVC through this technique.

The composition of the output mix can be controlled to some extent by changing the process parameters such as temperature, but the degradation is not controllable. It presents three different fractions: gas, liquid and solid residue (carbon char). Bond cleavage happens in random positions, leading to a hydrocarbon mix whose composition is similar to oil and can be used directly as fuel.

Pyrolysis enables to clean out additives and contaminants as part of the process. The output can be processed in the same way as oil, using conventional refining technologies to produce value-added chemicals, including new monomers, indistinguishable from virgin-grade ones. Hence, the additional processing infrastructure needed already exists in a mature and efficient value chain.

[35] M. Broeren, E. Roos Lindgreen, G. Bergsma, Verkenning chemische recycling - update 2019 and Hoe groot zijn - en worden - de kansen voor klimaatbeleid?, CE Delft, 2019

Plastic Energy owns two pyrolysis plants in Spain, running since 2014 and 2017, to transform LDPE, HDPE, PS and PP into hydrocarbon vapour. The resulting condensable gases are converted into raw diesel, light oil and synthetic gas components. These are then sold to the petrochemical industry to either turn them into virgin plastic, oil or transportation fuels. The other non-condensable gases produced during the process are combusted to produce the energy necessary to run the plant[36].

Nevertheless, in spite of the simplicity of this technology, pyrolysis has high energy requirements and can lead to the formation of hazardous chemicals such as Polycyclic Aromatic Hydrocarbons (PAH) or dioxins, implying the need for further purification steps. Furthermore, it is only economically viable if the volumes are large enough, and the input stable in terms of quantity, composition and quality. Pyrolysis is indeed expensive: according to the US Energy Information Administration (Department of Energy), the cost to produce 1 kilowatt of energy through pyrolysis is twice the cost of a kilowatt produced with photovoltaic solar energy[37].

Finally, considering the fact that turning the output fuel into new plastics requires other energy-consuming steps, there is a risk that the 'plastic-to-fuel' pathway will be preferred by the market. Today, the main viable market for pyrolysis output is crude diesel for power plants or ships. Besides, to optimise the conversion into plastics, increasing the naphtha fraction is necessary, which is challenging. **Encouraging pyrolysis would consequently create a 'linear lock-in' for plastics**.

Policy intervention is therefore mandatory to ensure this technology is indeed used to close the plastic-to-plastic loop and help decarbonize the economy instead of contributing to it by turning plastic into fuel.

Gasification

The gasification technique consists in heating mixed after-use materials (plastics and possibly biomass), in the presence of limited oxygen. It is able to treat almost every feed composed of organic material. There are several types of gasification, in which the temperature and other parameters can vary. Medium temperature gasification is less sensitive to fluctuations in composition and moisture than low temperature gasification.

The Texaco gasification process (figure 4) is the most common and well-known technology. The plastic waste is first cracked into synthetic heavy oil and some condensable and non-condensable gas fractions. The non-condensable gases are reused in the liquefaction as fuel (together with natural gas). The oil and condensed gas produced are injected into the entrained gasifier. The gasification is carried out with oxygen and steam at a temperature of 1,200°C – 1,500°C. Finally, a number of cleaning processes are performed (amongst others HCl and HF removal)[38].

The gasification output is a mix of predominantly hydrogen and carbon monoxide, smaller quantities of methane and carbon dioxide called syngas. It can be used to produce a variety of chemicals and plastics. It also contains impurities: NH_3, H_2S, NOx, alkali metals and tars. The purification step is the major contributor to the costs of producing the syngas.

[36] Plastic energy www.plasticenergy.com
[37] M Wilson, C. Arkin, In our opinion: Fueling a fantasy, 2018, www.resource-recycling.com/recycling/2018/04/02/in-our-opinion-fueling-a-fantasy/
[38] Ragaert, K., et al. Mechanical and chemical recycling of solid plastic waste. Waste Management, 2017

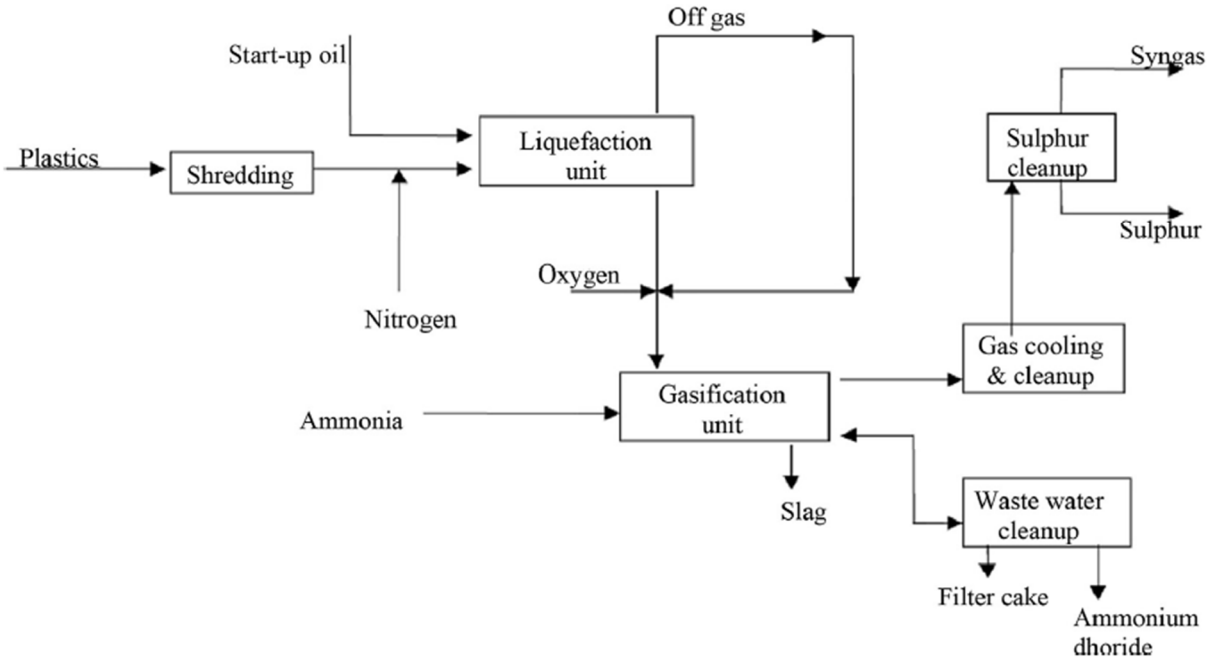

Figure 4: The Texaco gasification process schematic diagram
Source: Brems et al., 2015 Gasification Of Plastic Waste AsWaste- To- Energy Or Waste- To- Syngas Recovery Route, Solid Waste as a Renewable Resource. Apple Academic Press, pp. 241–263.

However, for low temperature gasification (700°C - 900°C), the syngas is only suitable for energy applications. For medium temperature gasification (900°C - 1,650°C), the syngas is suitable for plastic-to-plastic applications, but only after an additional step to increase the quality of syngas, which is measured by the ratio H_2/CO. There is thus a strong focus on energy production.

Enerkem in Canada is using a medium temperature gasification with a fluidised bed technology to produce fuel (ethanol) and methanol from sorted municipal solid waste (after recycling and composting). A similar project is being developed in Rotterdam (Netherlands): a consortium gathering Air Liquide, Enerkem, Nouryon, the Port of Rotterdam and Shell was created to build the first 'waste-to-chemicals' plant in Europe. It should be able to process 360,000 tonnes of waste into 220,000 tonnes of methanol. The conversion from syngas to methanol is usually performed at high temperature and pressure. This methanol can then be converted into chemicals such as acetic acid (for fibres and adhesives), thickening agents and dimethyl ether, which are currently produced almost entirely from fossil fuels[39].

Gasification presents more or less the same risks and challenges as pyrolysis. The technology is also energy-intensive and requires large volumes of stable waste in terms of composition and moisture. A pre-treatment is necessary to remove moisture and increase the calorific value of the input, resulting in higher costs. The output chemicals can produce fuels and fertiliser, but they will most likely be used as fuel, as it is the case today.

As with pyrolysis, policy intervention is needed to ensure plastic gasification stays in the plastic-to-plastic loop instead of being diverted to fuel.

[39] Ragaert, K., et al. Mechanical and chemical recycling of solid plastic waste. Waste Management, 2017

5.3 Environmental impact assessment of chemical recycling

The chemical recycling processes studied in this report are still very new and so far, most of the existing analysis were performed or led by the industries themselves. Therefore, further analysis on the environmental impact –notably analysing plants at scale and not at pilot stages- needs to be performed before a conclusive statement can be made or operating permits given.

The same is true for the energy and mass balance of the technologies analysed. Information available is, at best, insufficient, and at worst discouraging for technologies such as pyrolysis[40]. The health impacts from the emissions of such plants are also unknown.

An ISO compliant LCA, considering the whole plastic product life cycle, in which a realistic energy mix provenance is considered, is a good method to evaluate the consistency of such techniques from an environmental perspective. These calculations should take into account all the necessary purification steps. The results of these analyses should be compared with other existing and mature end of life treatments - mechanical recycling, mechanical and biological treatment (MBT), landfilling and energy recovery incineration.

It is important that the environmental impact assessments look not only at the climate impacts of today but also at the impacts that these technologies will have in the future, in the context of a decarbonising economy.

[40] Rollinson, A., & Oladejo, J. (2018). 'Patented blunderings', efficiency awareness, and self-sustainability claims in the pyrolysis energy from waste sector

6. Plastic to fuel in the XXI century

This study presents how some of the technologies used to produce plastic from plastic waste via chemical recycling, namely pyrolysis and gasification, can be used to produce fuel. Although these operations use the same core technology as other chemical recycling operations, their outputs, and therefore their impacts on the environment and the plastic economy, are quite different. Therefore from a political and economic perspective it is paramount to differentiate them. There are several reasons for doing so:

1. They risk undermining the Circular Economy agenda[41]. Turning plastic into fuel does not reduce the demand for virgin plastic, meaning that new plastic needs to be produced out of fossil sources. These techniques are undermining plastic reduction, the development of sustainable alternatives or innovations, and the incentives to phase out non-recyclable plastics. It prevents the EU from achieving its ambitious goals under the Circular Economy Strategy, including having all plastic packaging placed in the market be reusable or easily recyclable by 2030. As China's ban on recyclable imports is giving an opportunity for real change, plastic-to-fuel is encouraging to stay in this system by convincing consumers and cities that this waste can be "recycled" when the plan is to burn it.

2. It undermines the EU decarbonisation agenda[42] and the Paris agreement. Since plastic is made overwhelmingly from fossil fuels, plastic-derived fuels are a form of fossil fuel. The EU is currently set in the path to move away from fossil-fuel based sources of energy and plastic-to-fuel opens new doors to continue emitting CO_2 when we should be closing them. Turning plastic waste into fuel doesn't help to close the loop as it is still an energy intensive process that requires new virgin plastic to be produced. As such, plastic-to-fuel could be used to justify an increased virgin plastic production, creating this linear lock-in for plastics. Building new plastic-to-fuel facilities risks lock-ins at both the upstream and downstream ends of the plastic lifecycle: new PTF facilities will require a steady stream of fossil-based plastics produced.

Consequently, in order to avoid creating a legislative loophole in both the Circular Economy and the Climate agendas, it is key that the EU sets the right policies to direct plastic waste to plastic recycling operations, be it plastic to plastic mechanical or chemical recycling.

6.1 The right legal framework for chemical recycling

A clear definition

According to the current EU waste legislation:
Art 3.17 (WFD, 2008/98/EC): "*"recycling" means any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations".*

Therefore, the Waste Framework Directive's definition of recycling already comprises plastic-to-plastic recovery operations whether the process is mechanical or chemical. However, this poses the

[41] www.ec.europa.eu/environment/circular-economy/index_en.htm
[42] www.ec.europa.eu/clima/policies/strategies/2050_en

problem of blurring the preference that mechanical recycling should have over chemical recycling and it is important to make explicit that **chemical recycling is only suitable for those cases in which plastic waste is too degraded, too complex or too contaminated to be mechanically recycled**.

A definition is also important to differentiate plastic-to-plastic chemical recycling from plastic-to-fuels, given the growing confusion of both terms promoted outside EU borders. For instance, the Chemical Recycling Alliance created by the American Chemistry Council, considers chemical recycling as *those technologies that convert post-use plastics into chemicals, fuels and other products*[43]. Such consideration is at odds with the European waste legislation and it is yet another reason to provide legal certainty to these operations.

A potential definition for chemical recycling that excludes both mechanical recycling and plastic to fuels could be:

"Chemical recycling means any recovery operation by which waste materials that are unfit to be mechanically recycled are reprocessed into building blocks of a material of higher quality than the waste input."

A new level in the waste hierarchy

Besides a clear definition for chemical recycling, it is recommended to amend the EU waste hierarchy (Art 4) in order to create a new level to accommodate material recovery operations that are not mechanical recycling but whose output allows closure of the material loop. The rationale for this is based on the current available evidence on the environmental impacts of the different operations but also on the understanding of the economic and logistical aspects of current waste management processes. In this respect the waste hierarchy sets the following operations from lowest to highest environmental impact: prevention operations, mechanical recycling, chemical recycling and energy recovery.

Indeed, the process of mechanical recycling has the limitation that it is not possible to mechanically recycle every type of plastics (e.g. opaque PET), plastics which contain toxics (e.g. brominated flame retardants) or plastics that are too degraded. Mechanical recycling also usually entails downgrading the plastic quality, a process known as "downcycling". Mechanical recycling is consequently not a perpetual recycling method for plastics. This is why chemical recycling could play a role in the Zero Waste Hierarchy, as described in figure 5.

The nature of the plastic waste that is to be chemically recycled is equivalent to what today would be considered to be residual waste, since properly sorted plastic waste would be mechanically recycled. This is another argument for creating a dedicated level in the waste hierarchy to deal with residual waste in a way that allows for avoiding new virgin materials to be used.

This is what in the Zero Waste Hierarchy (see figure 5[44]) belongs to the 5th level: "Material and chemical recovery" namely dealing with the discards of sorting processes or with mixed waste with Mechanical Recovery and Biological Treatment operations that recover materials and stabilise organic waste, or with chemical recycling whose output are new building blocks for new plastic applications.

[43] www.plastics.americanchemistry.com/Chemical-Recycling-Alliance.html
[44] Zero Waste Europe, A Zero Waste hierarchy for Europe, 2019, www.zerowasteeurope.eu/2019/05/a-zero-waste-hierarchy-for-europe/

In contrast, the technologies that turn plastic to fuel don't allow for plastic waste to achieve its highest and best use and hence in the Zero Waste Hierarchy belong to the 7th level classed as "unacceptable".

Figure 5: A Zero Waste Hierarchy for Europe
Source: www.zerowasteeurope.eu/2019/05/a-zero-waste-hierarchy-for-europe/

7. Recommendations & conclusion

Today Chemical Recycling offers a range of potential solutions to the limitations of plastic as a circular material. Indeed, the capacity to upcycle degraded or contaminated plastics is an opportunity to close the loop and detoxify the Circular Economy which should be explored.

However, these technologies are still mostly in a pilot stage and they will not be able to operate at scale until the second half of next decade at the earliest. Considering the speed of change in the way we are using plastic today, it is uncertain how the plastic waste market will look 10 years down the line. Chemical recycling is currently uncompetitive with virgin plastic production and will require large-scale shifts in market conditions to establish itself. On the other hand, the lack of a clear legal definition for chemical recycling - in particular, one that excludes plastic-to-fuel - invites confusion and risks undermining both the Circular Economy and climate goals.
If plastic is to become a circular material and the toxics are to be phased out, maybe there will be no need for chemical recycling to deal with contaminated plastics in a world in which plastics should be designed to be less and less toxic. On the other hand, we know that plastics cannot be infinitely recycled and hence a solution for degraded plastics that does not involve downcycling or incineration is worth considering.

Moreover, it is important not to lose sight of the scale of the challenge and the solutions at hand. Whilst chemical recycling can be a tool in the waste management toolbox, one should not forget that **the solution to the plastic challenge is not to be found in how we manage the waste we create, but rather in how to prevent this waste from arising and preserve the value of materials in the economy**.

Indeed, the chemical recycling hype should not divert the attention from the real solution to plastic pollution which is replacing single-use plastics, detoxifying and simplifying new plastics, and designing business models to make efficient use of plastics.

This is especially relevant when it comes to potential EU funding to be made available in the coming years for the transition to a Circular Economy. The EU should avoid repeating past mistakes in waste policy such as the financing of waste-to-energy technologies instead of the higher levels of the waste hierarchy. EU funding should be directed to prevention, reuse operations, and any business model that prevents waste from being created. Too much focus on the residual waste treatment operations will not deliver a real Circular Economy.

With this in mind, a number of question marks are to be addressed in the roll out of the chemical recycling technologies. What are the scale of the plants that will make chemical recycling economically viable considering the costs of collection of such a low-weight material? Can chemical recycling be cost-competitive with virgin plastic in a world in which plastic from fracked gas makes recycling less and less competitive? What is the demand for the chemical recycling outputs of the different recycling processes? What are the real environmental and health impacts of the different chemical recycling processes when operating at scale?

The success of chemical recycling lies in the ability to be complementary to the other waste management processes whilst contributing to move towards a low carbon Circular Economy. At present the level of legal and economic uncertainty is high as is the lack of independent information available. It is key that the EU takes the initiative to regulate and provide the legal certainty that the market needs.

Glossary

atm	atmosphere (pressure unit)
BHET	Bis(2-Hydroxyethyl) terephthalate
DMT	Dimethyl Terephthalate
EG	Ethylene Glycol
EPS	Expanded PolyStyrene
HBCD	HexaBromoCycloDodecane (brominated flame retardant)
HCl	Chlorhydric Acid
HF	Fluorhydric acid
H_2S	Hydrogen Sulfide
LCA	Life Cycle Analysis
LDPE	Low Density Polyethylene
NH_3	Ammonia
NOx	Nitrogen oxides
PA	Polyamides
PAH	Polycyclic Aromatic Hydrocarbons
PC	Polycarbonate
PE	Polyethylene
PEF	Polyethylene Furanoate
PET	Polyethylene Terephthalate
PHA	Polyhydroxyalkanoates
PLA	Polylactic Acid
PMMA	Poly(methyl methacrylate)
PP	Polypropylene
PS	Polystyrene
PU	Polyurethane
PVC	Polyvinyl Chloride
TPA	Terephthalic Acid

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Zero Waste Europe is the European network of communities, local leaders, businesses, experts, and change agents working towards the same vision: phasing out waste from our society. We empower communities to redesign their relationship with resources, to adopt smarter lifestyles and sustainable consumption patterns, and to think circular.
www.zerowasteeurope.eu

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MD AR Ban (HB 1092) Opposition Coalition LetterDra

Uploaded by: Adam Peer

Position: UNF

February 26, 2025

To: Members of the Maryland State House Environment & Transportation Committee

RE: Maryland House Bill 1092

We are writing to ask you to oppose Maryland House Bill 1092, which would ban use of advanced recycling in the state. Advanced recycling is a critical set of technologies that help eliminate plastic waste from the environment and supports achievement of state and local sustainability and zero waste goals. Banning this recycling innovation would increase the amount of landfilling and materials in the environment, squander potential recycling of valuable material, and forgo economic growth and opportunity.

These innovative technologies convert post-use plastics into their original building blocks to produce new plastics, waxes, and other valuable products. It's important to note that plastics are not burned during advanced recycling. Advanced recycling technologies often use thermal energy (heat), but take place in the absence of oxygen, so there is no combustion. As a manufacturing process, there is a business incentive in advanced recycling to preserve every molecule to reuse.

Advanced recycling complements traditional (mechanical) recycling and enables us to recycle greater amounts and a wider variety of plastics, helping eliminate plastic waste. Successful recycling infrastructure is already in place for specific plastics such as soda bottles and milk jugs however advanced recycling technologies are needed for harder-to-recycle plastics, such as plastic bags, wrappers, tubs, lids, pouches, and many forms of packaging.

Banning advanced recycling would mean more landfilling and wasting valuable post-use plastics. More than 400 global companies have set goals to include more recycled content in their packaging. To get there, organizations are innovating and growing to meet this demand. Since 2017, there has been more

700 Second Street NE, Washington DC 20002 | 202.249.7000 | americanchemistry.com

than $4 billion announced for advanced recycling projects in the U.S. The economic basis for such investment is clear. A report by the Closed Loop Partners, an organization that invests in the development of the circular economy, found there is tremendous demand for the products of advanced recycling. The report concluded, “Our analysis indicates that these technologies could meet an addressable market with potential revenue opportunities of $120 billion in the United States and Canada alone.”

For Maryland to ban these technologies would be like banning electric car or solar power technologies in their early stages. In fact, half the states across the country have passed legislation encouraging new advanced recycling technologies. This bill is misguided, reflects a misunderstanding of the technology, and would set the precedent that Maryland opposes technological innovations. We encourage you to oppose HB 1092.

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PLASTICS - Testimony MD HB1092 - OPPOSE.pdf
Uploaded by: Danielle Fortunato
Position: UNF

PLASTICS
INDUSTRY ASSOCIATION

February 20, 2025

House Environment and Transportation Committee
Room 250
House Office Building
Annapolis, MD 21401

SUBJECT: HB 1092 – Recycling – Prohibition on Chemical Conversion of Plastic- OPPOSE

Dear Chair Korman and Esteemed Members of the Committee,

The Plastics Industry Association (PLASTICS) is the only national trade association that supports and represents the entirety of the plastics supply chain, representing nearly one million workers across the United States. Since 1937, PLASTICS has been advocating on behalf of the 8th largest manufacturing industry in the country to ensure our members and the industry as a whole continue to grow while advocating for an increase in recycling and sustainability across the supply chain. PLASTICS has a specific interest in advanced recycling technologies, as they play a vital role in the proper recycling of various plastic products and successful output of post-consumer recycled plastic. For these reasons, we unfortunately oppose HB 1092 as written, which would prohibit advanced recycling facilities and their technologies from being built and utilized in Maryland. Please consider the following:

PLASTICS strongly supports efforts to ensure that greater amounts of our post-use packaging materials, especially plastics, are recycled and converted into feedstock for new plastics and other useful products. Plastic materials are highly valuable materials that play an important role in the modern economy. They provide sustainability benefits versus alternative materials and will continue to play an important role in helping society mitigate greenhouse gas emissions.[1] Advanced recycling is a necessary and essential complement to mechanical and organic recycling technologies in order to improve the recycling rate, reduce plastic waste, and increase the amount of recycled plastic in commerce.

Advanced recycling technologies are critical to meeting plastic recycling and recycled content demands. As the economy becomes more circular, there is growing demand to increase plastic recycling as well as recycled content in products, and advanced recycling is critical to meeting this demand. Advanced recycling technologies can reduce environmental impacts associated with use of virgin natural resources—that is, raw material extraction, refining, and consumption—by producing fully circular outputs (polymers, monomers, intermediates, and other materials).[2]

[1] A recent study published by PLASTICS determined that "scientific life cycle assessments of plastics and alternative materials find that plastics tend to have lower carbon footprints, making them the more sustainable option among current materials in a number of applications." See Green, Kenneth, Plastics and Sustainability (Oct. 2021), p.2, available at https://2z2uy32ofddf3z9ep91ninb4-wpengine.netdna-ssl.com/wp-content/uploads/Plastics-and-Sustainability.pdf.

[2] See Am. Plastic Makers, What is Advanced Recycling, available at https://www.plasticmakers.org/advanced-recycling/ (noting that through advanced recycling, "[u]sed plastic products become new products again, keeping plastics out of our environment and reducing our need for virgin resources").

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P 202.974.5200 | plasticsindustry.org

Advanced recycling is NOT incineration. These processes convert post-use plastics into their original building blocks, specialty polymers, feedstocks for new plastics, waxes and other valuable products. These processes take place in the absence of oxygen and are therefore not incineration processes or "burning of plastic", as they are often inaccurately labeled. Currently, 25 states have enacted legislation classifying advanced recycling as manufacturing, thus opening their doors to these incredibly vital facilities being built, including New Hampshire, Illinois, Virginia, and Michigan.

PLASTICS encourages Maryland to recognize the benefits of advanced recycling. These technologies play an important role in ensuring resources are kept at their highest and best use and remain complementary to mechanical and organic recycling. They would allow for greater amounts and types of plastics to be recycled. Collaboration across the supply chain is critical to support the development of new material-to-material and plastic-to-plastic pathways. Advanced recycling will help decrease plastic waste and will support continued growth towards reaching and maintaining sustainability goals. Allowing advanced recycling to flourish across the state would create jobs, help foster economic development, and increase the amount of plastic that is recycled, and therefore kept out of landfills.

Thank you again for the opportunity to comment on this very important proposal. PLASTICS advocates for the responsible recycling, reuse, and recovery of all plastics products, and while we respectfully oppose this measure as it is currently written, we welcome any opportunity to work with policymakers to successfully grow and improve Maryland's recycling sector.

If I can provide any further information or answer any clarifying questions, please do not hesitate to reach out to me at dfortunato@plasticsindusty.org.

Sincerely,

Danielle Fortunato
Regional Director, State Government Affairs
Plastics Industry Association

HB 1092_MDCC_Recycling_Prohibition on the Chemical
Uploaded by: Hannah Allen
Position: UNF

MARYLAND
Chamber of Commerce

House Bill 1092

Position: Unfavorable
Committee: House Environment & Transportation
Date: February 26, 2025

Founded in 1968, the Maryland Chamber of Commerce is the leading voice for business in Maryland. We are a statewide coalition of more than 7,000 members and federated partners working to develop and promote strong public policy that ensures sustained economic health and growth for Maryland businesses, employees, and families.

House Bill 1092 (HB 1092) would alter the definition of recycling to exclude certain chemical conversion processes, pyrolysis, hydropyrolysis, methanolysis, gasification, enzymatic breakdown, or similar processes to be determined by the Maryland Department of Environment. HB 1092 would also prohibit a person from building a facility that converts plastic to fuel or feedstock through a chemical conversion process in the state. Effectively, this bill amounts to a ban on the utilization of advanced recycling technologies in Maryland.

Advanced plastics recycling, or chemical recycling, refers to a group of technologies that convert post-use plastics into their original building blocks, specialty polymers, and feedstocks for new plastics, waxes, lubricants, and other valuable products. It is these technologies that allow us to keep post-use plastics out of landfills and the environment, and to meet our waste and sustainability goals.

Importantly, the recent recommendations from the Extended Producer Responsibility Advisory Council emphasized the need for new technology to improve recycling rates and compliance. By banning advanced recycling, HB 1092 contradicts this recommendation and limits Maryland's ability to achieve its waste reduction and circular economy goals.

Further, it is a common misconception that plastics are burned during advanced recycling processes. Advanced recycling technologies often use heat, but take place in the absence of oxygen, the key ingredient for combustion. Instead of being combusted, plastics' physical form is altered to form new feedstocks for plastics, chemicals, and other products.

No state has blocked these technologies. Further, 21 states have passed legislation to encourage and promote these types of technologies, rather than ban them, because they acknowledge their benefits to technology and innovation. What is more, these states recognize the tremendous economic opportunity presented by advanced recycling technologies. Closed Loop Partners, a New York based investment firm, found that advanced recycling presents a $120 billion economic opportunity nationwide.

For these reasons, the Maryland Chamber of Commerce respectfully requests an **unfavorable report** on **House Bill 1092.**

2025MDHB1092Oppose.pdf
Uploaded by: John Richard
Position: UNF

Flexible Packaging Association
Connecting. Advancing. Leading.

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Testimony in Opposition
to
House Bill 1092
in the
Maryland House Environment and Transportation Committee

February 26, 2025

Dear Chair Korman, Vice-Chair Boyce, and Members of the House Environment and Transportation Committee,

The Flexible Packaging Association (FPA) appreciates the opportunity to submit testimony on House Bill 1092 (Del Terrasa), which would narrowly redefine what constitutes recycling in Maryland and ban the construction of advanced recycling facilities in our State.

I. Background on FPA and Flexible Packaging

FPA represents flexible packaging manufacturers and suppliers to the industry in the United States. Flexible packaging represents $42.9 billion in annual sales; is the second largest, and fastest-growing segment of the packaging industry; and employs approximately 85,000 workers in the United States. Flexible packaging is produced from paper, plastic, film, aluminum foil, or any combination of these materials, and includes bags, pouches, labels, liners, wraps, rollstock, and other flexible products.

These are products that you and I use every day—including hermetically sealed food and beverage products such as cereal, bread, frozen meals, infant formula, and juice, as well as sterile health and beauty items and pharmaceuticals, such as aspirin, shampoo, feminine hygiene products, and disinfecting wipes. Even packaging for pet food uses flexible packaging to deliver fresh and healthy meals to a variety of animals. Flexible packaging is also used for medical device packaging to ensure that the products packaged, like diagnostic tests, IV solutions and sets, syringes, catheters, intubation tubes, isolation gowns, and other personal protective equipment maintain their sterility and efficacy at the time of use. Trash and medical waste receptacles use can liners to

manage business, institutional, medical, and household waste. Carry-out and take-out food containers and e-commerce delivery, which became increasingly important during the pandemic, are also heavily supported by the flexible packaging industry.

Thus, FPA and its members are particularly interested in and deeply committed to solving the plastic waste issue and increasing the recycling of all packaging. FPA is deeply troubled by the efforts to redefine recycling in the state of Maryland, which would styme the circularity efforts for modern packaging manufacturers that have had to content with our nation's out-of-date recycling system.

Flexible packaging is in a unique situation as it is one of the most environmentally sustainable packaging types from water and energy consumption, product-to-package ratio, transportation efficiency, food waste, and greenhouse gas emissions reduction standpoints. But circularity options for flexible packaging are currently limited. There is no single solution that can be applied to all communities when it comes to the best way to collect, sort, and process flexible packaging. Viability is influenced by existing equipment and infrastructure; material collection methods and rates; volume and mix; and demand for the recovered material. Single-material flexible packaging, which is approximately half of the flexible packaging waste generated, can be mechanically recycled primarily through store drop-off programs; however, end markets are scarce. The other half can be used to generate new feedstock, through pyrolysis and gasification.

Developing end-of-life solutions for flexible packaging is a work in progress, and FPA is partnering with manufacturers, recyclers, retailers, waste management companies, brand owners, and other organizations to continue making strides toward total packaging recovery. Some examples include The Recycling Partnership (TRP); the Materials Recovery for the Future (MRFF) project; the Hefty® ReNew® Program; the Consortium for Waste Circularity; and the Flexible Film Recycling Alliance (FFRA). All these programs are seeking to increase the collection and recycling of flexible packaging. Also, increasing the recycled content of new products, including packaging, will not only create markets for the products, but will also serve as a policy driver for the creation of a new collection, sortation, and processing infrastructure for the valuable materials that make up flexible packaging.

It is FPA's position that a suite of options is needed to address the lack of infrastructure for non-readily recyclable packaging materials, and promotion and support of market development for recycled packaging is an important lever to build that infrastructure. FPA also supports well-crafted EPR that can be used to promote this needed shift in recycling in the U.S. In fact, FPA strongly supported the recycling needs assessment bill here in Maryland. It is with this background that FPA provides this testimony against HB 1092.

II. What is Advanced Recycling?

Common advanced recycling technologies like pyrolysis, gasification, and depolymerization convert used plastics that would be considered waste into high-value materials using methods that are regularly deployed in other industries. Despite being a nascent industry compared to other materials that have had centuries to figure out how to design for a circular economy, our industry has voluntarily invested over $7 billion which has led to a massive 21 billion pounds of plastic waste being diverted from landfills across the nation each year.[1] In time, we are confident that engineers and chemists will be able to definitively make the case for a circular plastics economy.

A common myth that our Association constantly must dispel is that advanced recycling is just burning plastic waste through incineration, when in reality, this type of recycling relies on cutting-edge technologies that purposefully operate with little to no oxygen (allowing for the recovery of material). Furthermore, advanced recycling produces emissions equal to or lower than similar facilities in other industries with the added benefit of no measurable lead or dioxin emissions.[2] All advanced recycling facilities are subject to the same Clean Air Act standards as mechanical recycling and often outcompete those facilities on environmental indicators.

III. Constituents Believe in the Science of Advanced Recycling

In compiling evidence for the FTC's Green Guides, which are developed to ensure truth in advertising, the American Chemistry Council's plastics division partnered with Heart + Mind Strategies to field an independent nationally representative survey that showed a staggering 88%

[1] Ross Eisenberg & Craig Cookson, *Advanced Recycling: Remaking Plastics to Meet Sustainability Goals* (Washington D.C.: American Chemistry Council, 2023), 2-3.

[2] Eisenberg & Cookson, 3.

of Americans consider advanced recycling to be recycling.[3] Our members know that consumers view advanced recycling as an important part of fixing our nation's woefully inadequate recycling system and have been proactively developing the technologies to address the resulting waste.

Any ban on advanced recycling will result in more plastic in the environment, destroy valuable feedstock for our industry, create inflationary pressure on consumers, and go against prevailing consumer sentiment. The Flexible Packaging Association believes this confounds the legislative intent of this bill.

IV. Conclusion & Next Steps

For these reasons, FPA and its members request that you reject HB 1092. Thank you for your consideration. We are happy to discuss any of these issues with you and your staff before your vote. If we can provide further information or answer any questions in advance of your decision, please do not hesitate to contact me at (410) 694-0824 or jrichard@flexpack.org.

Respectfully,

John J. Richard
Director, Government Affairs
Flexible Packaging Association

[3] Matthew Kastner, *Advanced Recycling Is Recycling, 88% of Americans Say in Survey* (Washington D.C.: American Chemistry Council, 2023).

MD HB 1092 Eastman Testimony_February 2025.pdf
Uploaded by: Kierstin Turnock
Position: UNF

Bill Title: House Bill 1092 Recycling– Prohibition on the Chemical Conversion of Plastic

Committee: Environment and Transportation

Date: February 24, 2025

Position: Oppose

Dear Chairman Korman and Honorable Members of the Committee:

On behalf of Eastman, thank you for the opportunity to provide comments on House Bill 1092 Environment – Recycling – Prohibition on the Chemical Conversion of Plastic (HB 1092). As attention increases on the waste plastic crisis, it is vital that representative government, advocates, and private industry collaboratively develop solutions to recycle a broad range of these materials. As a private industry stakeholder, Eastman has great concern that legislation like HB1092 will stifle the current progress and ultimately result in less plastic being recycled. Eastman supports Extended Producer Responsibility (EPR) programs that seek to fund necessary developments in recycling infrastructure, help create markets for hard to recycle materials and include innovative and material to material circular recycling technologies.

HB 1092 Will Stifle Recycling Innovation

HB 1092 incorrectly excludes truly circular solutions like those practiced by Eastman from the definition of 'recycling'. The definition of "recycling" should prohibit the use of certain technologies for energy and fuel conversion while still allowing for use in a material-to-material capacity. Allowing for innovative recycling technologies in the definition will result in the greatest amount of plastic materials being recycled and reduce reliance on virgin feedstock.

Approximately 300 million tons of plastic, including those used for single use and durable applications, are produced globally each year. At end of use, 40% goes to the landfill, 25% is incinerated, and 19% is disposed of in unmanaged dumps or otherwise makes its way into our environment. Only 16% is collected for recycling. Of that 16%, only 9% is successfully recycled in US recycling systems.[1]

A narrow definition of recycling that only includes mechanical recycling methodologies would limit the types of plastic suitable for recycling and therefore, not adequately address the growing

[1] www.mckinsey.com/industries/chemicals/our-insights/how-plastics-waste-recycling-could-transform-the-chemical-industry

need to address the waste crisis. As established previously, the traditional recycling system is not equipped to provide the quantity or quality of materials needed to meet recycling goals. It certainly cannot support even more progressive future targets. New, material-to-material molecular recycling technologies exist to work alongside traditional recycling to support these goals, and a technology-neutral definition for recycling is critical.

In certain cases, material-to-material molecular recycling can be complementary or advantaged to mechanical recycling within the circular economy. These molecular recycling processes should be recognized as the optimum solution from a greenhouse gas and carbon efficiency perspective for managing waste materials when:

i. The process prevents landfill or incineration of plastics that mechanical recycling cannot process.
ii. The process utilizes waste materials to directly replace fossil feedstock, enabling value from waste.
iii. The process has a carbon footprint equivalent to or better than the original manufacturing process for making the same product.
iv. The process produces products with equivalent or better performance relative to the original manufacturing process.

Eastman supports a technology-neutral approach to the acceptance of molecular recycling when it meets the above criteria and is truly material-to-material and not waste-to-fuel or waste-to-energy.

Eastman Supports Well-Designed EPR Programs

Eastman supports investments in recycling infrastructure and incentives for market development. We believe smart EPR policies, like those being considered by this body, that dedicate funding to consumer education and expanding recycling infrastructure are critical in ensuring the highest volume of plastics, including those used in durable products, are recycled.

The global waste crisis is too big and too important for any one organization to solve alone. To create a truly circular economy, where resources retain their value infinitely, our country needs to bring the 65% of waste plastic lost to landfills, incinerators, and the environment back into the production cycle. Technologies exist today that give new life to waste plastic, but without the right policies in place, these solutions will not reach their potential for good. Together, we can create and foster a truly circular economy that addresses the plastic waste crisis at its source. Together, we can shape a sustainable future for the economy that includes plastics that are used, recycled, and reused again and again, supporting, and enhancing our overall quality of life while preserving our environment.

Kierstin Turnock
State Government Affairs Manager
Northeast & Mid-Atlantic
Eastman

MD HB 1092 - Manu Rego Testimony.pdf
Uploaded by: Manu Rego
Position: UNF

W. R. Grace & Co.
7500 Grace Drive
Columbia, MD 21044

Public Hearing Testimony

Maryland HB 1092 - Opposed

February 24, 2025

My name is Manu Rego. I have worked at W. R. Grace in Columbia, Maryland for 11 years and am one of the scientists now working closely on developing a new process for plastic recycling. We began working on this project several years ago when we realized that only a small fraction of plastic is successfully recycled – that figure was just 9% in 2022.

We believe we have invented a process that will safely generate higher yields and purer products, use fewer resources and produce less emissions than other attempts at advanced recycling to-date.

It would be fitting to call this the Gen 2 of advanced recycling.

As the next step in this innovation, we hope to build a pilot lab at our global headquarters in Columbia, Maryland to study the process further.

If passed, HB 1092 could prevent us from pursuing this important research.

HB 1092 could have an immediate and direct impact on the 1,000 Marylanders who work across our global headquarters in Columbia and our largest U.S. manufacturing site in Baltimore.

Grace has conducted research like this in Maryland for over 60 years. In fact, right here in Maryland, Grace scientists have safely developed and tested products that you use every day.

- For example:
- We invented a catalyst in Maryland to help preserve water.
- We invented another one that helps keep your frozen food fresh and safe and makes toys tougher for children.
- We also invented a catalyst that helps make containers to safely hold gasoline in your car.
- Right here in Maryland, we came up with a way to help make cars lighter so you can get better efficiencies.

And now we are working to help our customers recycle plastic safely and in a way that addresses the shortfalls and criticisms of other types of plastic recycling.

Efforts to indiscriminately prevent research like this are shortsighted and anti-progress.

The first refrigerators used Chlorofluorocarbons or CFCs, which contributed to ozone depletion. If lawmakers attacked “refrigeration” wholesale the way this bill attacks advanced recycling, researchers would never have developed alternative refrigerants that have significantly lower environmental impact. And you’d be storing your milk in an icebox.

Early LEDs contained toxins like lead. If lawmakers attacked “light bulbs” wholesale the way this bill attacks advanced recycling, researchers would never have developed lead-free LEDs, which consume less energy than traditional lighting sources. And you’d be using incandescent lights (given their environmental impact, you might be using candlelight).

Early solar panels were inefficient and required large amounts of materials, including toxic substances like cadmium. If lawmakers attacked renewable energy wholesale the way this bill attacks advanced recycling, researchers would never have developed improvements in solar panel efficiency, reducing material requirements and environmental impact.

I am proud to share with you that Grace is already working with several customers to build a demonstration plant – a real plant at one of their sites (not in Maryland) – as the next step in our exciting plastic recycling process. Our customers want to see data from our pilot lab unit so they can begin to scale-up our process and ultimately use it to help meet the new regulations on recycled content around the world, help reduce plastic waste and promote more efficient and cleaner plastic recycling.

Wouldn’t it be wonderful if we could say this innovation was proudly born in Maryland?

All these years as a Marylander, I was always inspired to see the commitment to innovation. This inspiration has turned into a very strong concern and dismay that an opportunity like plastic recycling, with so much potential, can generate so much misunderstanding. I hope my comments today will help assure you that this is a great opportunity for celebrating innovation in Maryland, rather than attempting to shut it down.

HB1092_HCPA_UNF
Uploaded by: Michelle Kopa
Position: UNF

February 25, 2025

To: Members of the Maryland State House Environment & Transportation Committee

RE: Maryland House Bill 1092 - Oppose

On behalf of the Household and Commercial Products Association (HCPA), we submit these comments on HB 1092, a bill that would prohibit chemical conversion in Maryland.

HCPA members manufacture a diverse array of products—including household cleaning supplies, air care items, aerosols, floor care solutions, automotive maintenance products, and specialty pesticides such as antimicrobial disinfectants and sanitizers—that are vital for maintaining clean and healthy homes and workplaces. Many products represented by HCPA would be impacted by the prohibitions included in HB 1092; therefore, we have a direct pecuniary interest in discussion on matters about advanced recycling in the State. [1]

Advanced recycling approaches break down used plastics into their basic building blocks, enabling them to be reprocessed into new plastics, waxes, and other high-value products. These technologies produce high-purity plastic resins and chemicals from what would otherwise be waste, serving as a crucial complement to mechanical recycling. By expanding the range of materials that can be recycled and replacing virgin plastics in product packaging, advanced recycling facilities not only divert valuable materials from landfills but also convert waste into useful feedstock.

Our principal concern with HB 1092 is that it dismisses effective and valuable recycling technology indiscriminately. The proposal would eliminate numerous different technologies that work in concert with mechanical recycling and runs counter to Maryland's goals of increasing recycling under its extended producer responsibility initiatives.

We believe HB 1092 is fundamentally flawed. It jeopardizes progress toward a circular economy and is inconsistent with similar advanced recycling initiatives in other states. While HCPA supports policies that promote recycling and environmental sustainability, we must oppose HB 1092, as it would lead to unnecessary economic and environmental disruptions.

Respectfully submitted,

Michelle L. Kopa

Michelle L. Kopa
Senior Director, State Government Relations & Public Policy –
Eastern Region

[1] The Household & Commercial Products Association (HCPA) is the premier trade association representing companies that manufacture and sell $180 billion annually of trusted and familiar products used for cleaning, protecting, maintaining, and disinfecting homes and commercial environments. HCPA member companies employ 200,000 people in the U.S. whose work helps consumers and workers to create cleaner, healthier and more productive lives.