



October 7, 2025

Zoe Heller, Director  
Department of Resources Recycling and Recovery (CalRecycle)  
1001 I Street  
Sacramento, CA 95814

Cc: Mindy McIntyre, Chief Deputy Director,  
Karen Kayfetz, Product Stewardship Branch Chief

**Re: Comments on 19 August 2025 Draft SB 54 Regulations, focus on pyrolysis incineration and related technologies**

Director Heller,

We appreciate the opportunity to submit written comments on the 19 August 2025 iteration of the SB54 draft regulation, following our comments on earlier versions, as we appreciate your team's readiness to exchange views with us during informal workshops, advisory board meetings, and virtual meetings.

Recognizing the work that your agency has put into these draft regulations, we emphasize the need for compliance with the SB 54 statute, California's Public Resources Code (PRC) and the Clean Air Act, to ensure the safeguarding of California's climate commitments and protect our communities and ecosystems from toxic harm.

We note with regret that the 19 August formal draft regulations **left unaddressed virtually all of the issues regarding pyrolysis incineration and other technologies marketed as "chemical recycling"<sup>1</sup> that we had flagged** in our 3 June 2025 comments and in subsequent engagements with your agency, despite scientific evidence provided in support of our recommendations and briefings organized with leading scientists whose research demonstrates the climate and toxic harm arising from those technologies.

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<sup>1</sup> Quotation marks are in order as the term "chemical recycling"- like the term "advanced recycling" - is a marketing term rather than an accurate description of these industrial processes: many of them do not amount to recycling, but instead have as main outputs hazardous waste or at best polluting fuels, while several are in fact thermal processes (e.g. pyrolysis, gasification) that amount to incineration.

We take this opportunity to make the following recommendations :

1. The regulations must clarify that pyrolysis is incineration and disposal, not recycling, in line with California law and as explicitly categorized in the federal Clean Air Act (p. 2);
2. A prohibition or moratorium on plastic waste pyrolysis, gasification, solvolysis, depolymerization, and solvent-based purification would best uphold the statute (p. 3);
3. The unacceptable climate and toxics impacts from those technologies are inconsistent with the statutory definition of “responsible end markets” (p. 4);
4. The regulation’s responsible end market criteria ignore the statutory emphasis on environmental benefits, prevention of hazardous waste generation, broad consideration of health risk, and ignore California’s hazardous waste definition and fail environmental justice (p. 7).

While this letter focuses on the issue of disposal and hazardous technologies marketed as “chemical recycling”, we echo the concerns raised in the coalition sign-on comments letter led by Californians Against Waste.

### **1. Regulations must clarify that pyrolysis is incineration and disposal, not recycling, in line with federal and California law**

Federal legislation (Clean Air Act Section 129) classifies pyrolysis as incineration, not recycling. Pyrolysis also fits California’s definition of incineration under Title 14 of the California Code of Regulations § 17225.33.

At the same time, misleading claims are being made that pyrolysis and related technologies are “recycling” (with marketing terms such as “advanced recycling” or “chemical recycling”). As you are aware, the California Attorney General has filed a lawsuit alleging, with ample evidence, that these technologies are not recycling and that describing them as such amounts to fraudulent and deceptive business practices.<sup>2</sup> Eighty percent of both proposed and operating “chemical recycling” facilities in the U.S. use pyrolysis,<sup>3</sup> and therefore cannot be considered as recycling under the statute. Pyrolysis is expected to remain the dominant “chemical recycling” technology over the coming decade.<sup>4</sup>

Furthermore, pyrolysis and associated processes burn off most of the plastic waste, and produce a low yield of highly-contaminated pyrolysis oil that needs dilution with large amounts of virgin petroleum naphtha to become usable in a steam cracker to make recycled plastic polymer. This

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<sup>2</sup> State of California Department of Justice, Attorney General Rob Bonta (2024) [“Attorney General Bonta Sues ExxonMobil for Deceiving the Public on Recyclability of Plastic Products”](#)

<sup>3</sup> Dr Renée Sharp, Shannon Goff, Vivian Xu, Caroline Kim (2025) [“Chemical Recycling” Is a Toxic Trap](#) NRDC

<sup>4</sup> Marvin Kusenber, Andreas Eschenbacher, Marko R. Djokic, Azd Zayoud, Kim Ragaert, Steven De Meester, Kevin M. Van Geem (2022) [Opportunities and challenges for the application of post-consumer plastic waste pyrolysis oils as steam cracker feedstocks: To decontaminate or not to decontaminate?](#),

*Waste Management*

means that even in the best case scenario only 2% of the plastic waste fed into pyrolysis will actually make the round trip into the steam cracker and effectively be recycled.<sup>5</sup>

Currently the draft regulations text is hard to read, due to multiple references to different sections of California statute and regulations, and would benefit from some clarifications recalling existing definitions of pyrolysis. Reverting to the following language in the previous version would clearly delineate technologies that constitute disposal :

***Proposed textual changes (additions and deletions):***

Section 18980.3.5. Disposal of Covered Material

***(e) Pyrolysis and other forms of disposal, as defined in subdivision (b) of section 40192 of the Public Resources Code.***

**2. A prohibition or moratorium on plastic waste pyrolysis, gasification, solvolysis, depolymerization, and solvent-based purification would best uphold the statute**

A categorical **prohibition or moratorium** on plastic waste pyrolysis, gasification, solvolysis, depolymerization, and solvent-based purification - technologies marketed as “chemical recycling” - is needed to protect genuine recycling. It would also provide regulatory clarity and best uphold the statutory language in Section 42041.aa(5):

*The department’s regulations shall encourage recycling that **minimizes** generation of hazardous waste, generation of **greenhouse gases**, environmental impacts, **environmental justice impacts**, and **public health impacts**. [emphasis added]*

*The regulations shall include criteria to exclude plastic recycling technologies that produce significant amounts of hazardous waste.*

A prohibition or moratorium is justified because:

- It provides regulatory clarity since so-called “**chemical recycling**” of plastic waste is **not recycling**: most facilities (pyrolysis, gasification) burn off most of the plastic waste and otherwise have hazardous waste as their main outputs, rather than recycle that can safely be used in plastic packaging applications to replace primary (virgin) plastic (see Section 2. below);
- As a result, whatever minute amounts of plastic recycle produced come at an **unacceptable climate and toxics cost** (see Section 3.) that are **incompatible with the statutory definition of “responsible end markets”**;
- Unlike mechanical recycling, “chemical recycling” technologies produce **significant amounts of hazardous waste**, which should render them ineligible according to the statute, except that the draft regulation empties the definition of “significant amount of hazardous waste” of its substance;

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<sup>5</sup> Dr Andrew Rollinson (2023) [Leaky loop “recycling”: A technical correction on the quality of pyrolysis oil made from plastic waste](#), Zero Waste Europe

- “Chemical recycling” of plastic waste creates **environmental justice burdens for which the regulations have no safeguards**, in contradiction of the statute;

We therefore urge CalRecycle to revise the draft regulations in order to **exclude plastic waste pyrolysis, gasification, and solvolysis (ie. “chemical recycling”)** technologies in California, until these can be shown to be safe for health, the climate and the broader environment, from a whole-lifecycle standpoint, and until they meaningfully displace virgin plastics, instead of cementing our dependence on them. This can be achieved with the textual change below.

**Proposed textual changes (additions and deletions):**

*ARTICLE 4: Responsible End Markets - Section 18980.4.1. End Market Identification*

*[...]*

*(d) A PRO or Independent Producer shall not include in its plan as a responsible end market a technology, other than a mechanical recycling technology in use within the State as of the effective date of the Act, if the facilities employing it produce significant amounts of hazardous waste as defined in paragraph (1).*

**Delete all sub-paragraphs to paragraph (d) in their entirety: (1), (1)(A), (1)(B), (2), (3), (4), (4)(A), (4)(B), (4)(C), (4)(D), (4)(E), (5), and (6).**

**3. Climate and toxics harm from “chemical recycling” are incompatible with the statutory definition of responsible end markets**

SB 54 states that “To be considered recycled, covered material shall be sent to a responsible end market” (PRC Section 42041 (aa)(3)) and states:

*“Responsible end market” means a materials market in which the recycling and recovery of materials or the disposal of contaminants is conducted in a way that **benefits the environment and minimizes risks to public health and worker health and safety**. The department may adopt regulations to identify responsible end markets and to establish criteria regarding benefits to the environment and minimizing risks to public health and worker health and safety.”* (PRC Section 42041 (ad), emphasis added).

The following evidence on the environmental and health harms arising from pyrolysis, solvolysis, and other “chemical recycling” technologies are clearly not compatible with the abovementioned requirements of environmental benefit and minimized risk to public and worker health.

**Hazardous waste and emissions**

- **Flawed LCAs:** Lifecycle assessments (LCAs) are key tools used by policymakers and industry actors to evaluate the environmental performance of products and processes. A recent UCSF study shows that even government and peer-reviewed LCAs of “chemical recycling” systematically underestimate harm to human health and the environment from toxic and hazardous substances due to three structural flaws:

- they omit the generation and disposal of hazardous waste and the need to purify the complex and contaminated chemical mixtures resulting from pyrolysis, gasification, and solvolysis;
- they rely on inadequate inventory databases lacking information on plastic-related chemicals and their harm to human health and the environment;
- they wrongly assume that pyrolysis outputs can replace virgin petrochemical inputs at a 1:1 ratio;<sup>6</sup>

Unfortunately, ISO standard 59014:2024 quoted in the draft regulations promotes the use of misleading, narrow-scope LCAs that largely ignore the toxics footprint of recycling technologies and resulting harm to human health and the environment.

For this reason, GAIA recommends that the **regulations omit this ISO reference**. The regulations would not be weakened by omitting this reference since ISO 59014 is not specific to recycling, but is a general document on material recovery. It is not an international standard for what constitutes recycling and does not include a single environmental or efficiency benchmark to distinguish legitimate recycling operations from ineffective, toxic, and climate-harming operations.

- **Significant hazardous waste transported across states:** NRDC’s review of 47 operating, proposed, canceled and closed “chemical recycling” facilities in the U.S. shows that:
  - all forms of “chemical recycling” produce hazardous waste, hazardous emissions, and/or rely on toxic solvents, with EPA data showing that between 2021 and 2024, just three pyrolysis facilities processing plastic waste generated over 2 million pounds of hazardous waste;
  - hazardous waste from “chemical recycling” facilities puts multiple communities at risk: just three pyrolysis facilities had their hazardous waste transported through 13 states on the way to disposal;
  - if all pyrolysis facilities currently proposed or under construction begin operating, between 624,000 and 10.8 million additional pounds of hazardous waste would be generated, transported through, and disposed of in communities across the country.<sup>7</sup>

As drafted, the current draft regulation could open the floodgates for a dramatic rise in so-called “chemical recycling” facilities and associated hazardous waste generation, which evidence shows will pollute and harm adjacent communities and ecosystems, and along the routes where hazardous waste is transported.

- **Up to 100% cancer risk, organ damage, harm to unborn children:**
  - *ProPublica* reported that the EPA estimated a 100% cancer risk from lifetime exposure to a boat fuel component made from the pyrolysis of plastic waste at a US facility;<sup>8</sup>

<sup>6</sup> Dr Veena Singla (2025) [Major gaps in chemical recycling life cycle assessments \(LCAs\)](#) UCSF

<sup>7</sup> Dr Renée Sharp, Shannon Goff, Vivian Xu, Caroline Kim (2025) [“Chemical Recycling” Is a Toxic Trap](#) NRDC

<sup>8</sup> Sharon Lerner (2023) [EPA Approved a Fuel Ingredient Even Though It Could Cause Cancer in Virtually Every Person Exposed Over a Lifetime](#), *ProPublica*

- *ProPublica* also reported that EPA estimated, conservatively, that air pollution from making fuels out of plastic waste at a separate facility could lead to cancer in 1 out of 4 people exposed to it over a lifetime;<sup>9</sup>
- The “Braven Environmental” pyrolysis facility in North Carolina is registered with the EPA as a large quantity generator that generates at least 1,000 kilograms per month of hazardous waste. Its permit application lists risks from pyrolysis oil including: genetic defects and cancer, organ and fertility damage, dangers to unborn children, in addition to being “very toxic to aquatic life,” “extremely flammable,” and having “long lasting effects.”<sup>10</sup>

While SB 54 does not allow plastic to fuel, the plastic waste pyrolysis process to make chemicals that can be used in plastics is the same process as is used for fuels, except that it has additional purification/decontamination steps; if anything, the process toxic emissions are likely to be even higher than for fuels.

### **Greenhouse gas emissions**

- **Greenhouse gas emissions doubled:** Cutting-edge research shows that the widespread adoption of current “chemical recycling” technologies could double the greenhouse gas emissions from plastic production - largely due to the climate impact of making solvents and managing solvent waste.<sup>11</sup>
- **Major emitters:** The National Renewable Energy Laboratory found that “chemical recycling” produces an order of magnitude more greenhouse gas emissions than mechanical recycling, and more emissions per ton than primary (virgin) plastic.<sup>12</sup>
- **3 lb of CO<sub>2</sub> per lb of recycled styrene:** GAIA’s analysis of the much-hyped Agilyx facility in Tigard, Oregon found it emitted more than 3 pounds of CO<sub>2</sub> for every pound of recycled styrene that it produced.<sup>13</sup>

Increased so-called “chemical recycling” of waste plastic would therefore increase California’s overall greenhouse gas emissions and conflict with the environmental benefits and minimized harm to health requirements in the statutory definition of “responsible end markets.” GAIA further notes with concern that the current version of the regulations do not contain a single reference to greenhouse gases, nor does ISO standard 59014:2024 included as an end market criterion in section 18980.4.1.(d).2.

<sup>9</sup> Sharon Lerner (2023) [This “Climate-Friendly” Fuel Comes With an Astronomical Cancer Risk](#), *ProPublica*

<sup>10</sup> Schuyler Mitchell (2023) [Garbage In, Toxics Out: They Promised “Advanced Recycling” for Plastics and Delivered Toxic Waste](#), *The Intercept*

<sup>11</sup> Nihan Karali, Nina Khanna & Akshay Sharma (2025) [Global Assessment of the Emission Impacts of Chemical Recycling Technologies for Plastics](#), *pre-print*.

<sup>12</sup> Uekert, Taylor, Avantika Singh, Jason S. DesVeaux, Tapajyoti Ghosh, Arpit Bhatt, Geetanjali Yadav, Shaik Afzal et al. “Technical, economic, and environmental comparison of closed-loop recycling technologies for common plastics.” *ACS Sustainable Chemistry & Engineering* 11, no. 3 (2023): 965–978.

<sup>13</sup> Patel, D., Moon, D., Tangri, N., Wilson, M. (2020). [All Talk and No Recycling: An Investigation of the U.S. “Chemical Recycling” Industry](#). Global Alliance for Incinerator Alternatives. [www.doi.org/10.46556/WMSM7198](http://www.doi.org/10.46556/WMSM7198)

International standards are clear: the Basel Convention has [explicitly rejected the inclusion of pyrolysis and other so-called “chemical recycling” in its plastic waste management guidelines](#) because these technologies could not be shown to be environmentally sound.

California should likewise exclude these technologies from its definition of “responsible end markets” given their environmental and human health record. The abovementioned prohibition or moratorium would resolve this issue.

#### **4. Responsible end market criteria: regulations ignore statutory emphasis on environmental benefits and prevention of hazardous waste generation, broad consideration of health risk, ignore California hazardous waste definition, fail environmental justice**

As mentioned above, SB 54 defines responsible end markets as “a materials market in which the recycling and recovery of materials or the disposal of contaminants is conducted in a way that **benefits the environment** and **minimizes risks** to public health and worker health and safety. (emphasis added, PRC Section 42041(ad)).

In addition, the statute’s approach to hazardous waste focuses on prevention (“The department’s regulations shall encourage recycling that **minimizes generation of hazardous waste**”(emphasis added, PRC Section 42041(aa)(5)).

However, the regulations ignore the statutory emphasis on environmental benefits and on the prevention of hazardous waste generation.

Instead it shifts the emphasis downstream to the management of hazardous waste and defines away the statutory threshold of “significant amounts” of hazardous waste by equating it with permit compliance (Section 18980.4.1(B)).

This approach allows technologies to qualify as recycling regardless of the type and quantity of hazardous waste they produce, in direct violation of the statutory requirement for the Department to “include criteria to **exclude plastic recycling technologies that produce significant amounts of hazardous waste**”(emphasis added, PRC 42041(aa)(5)).

By relying on permitting to define hazardous waste, these draft regulations make the same technology subject to compliance with numerous different jurisdictional requirements, including those outside of California when dealing with end markets. Given that permitting tends to be less stringent outside of California, this provision could exacerbate existing, and create new, **waste colonialism abuses**.

Furthermore, the draft regulations undermine statutory intent by using the narrow [federal definition](#) of hazardous waste as a benchmark instead of the broader and more protective California definition that is already referenced in several CalRecycle regulations. Likewise, the regulation considers only “*significant effects on the environment and risks to public health and safety*”. This phrasing invites arguments to dismiss documented harms under the pretext that they are not “significant”, when it is known that toxics can harm human health and organisms at low

levels of exposure, particularly when such exposure is prolonged such as when polluting infrastructure is located near communities.

Furthermore, the regulations fail to provide any safeguard against cumulative pollution and cumulative health impacts from end markets, which the consideration of [CalEnviroScreen](#) would surface.

In conclusion, the draft regulations fall dangerously short of the statute when it comes to protecting public health, the climate, and the broader environment. Furthermore, they threaten to turn California into a toxic playground for polluters showcasing false solutions to plastic pollution, as detailed in California Attorney General Rob Bonta's ongoing lawsuit.<sup>14</sup>

It is essential that all of us—the State of California, community, non profits, PROs, and industry—are focused on the true intent of SB 54: to address the overwhelming amount of plastic packaging and its connected health, environmental, and climate impacts. It is more important than ever that California prevent industry polluting our communities, air, water, land, and climate. We're looking to you for that crucial leadership with SB 54.

Sincerely,



Sirine Rached, Senior policy advisor, GAIA  
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*The Global Alliance for Incinerator Alternatives (GAIA) is a global network of grassroots groups working to catalyze a global shift towards environmental justice by strengthening grassroots social movements that advance solutions to waste and pollution. We envision a just, zero waste world built on respect for ecological limits and community rights, where people are free from the burden of toxic pollution, and resources are sustainably conserved, not burned or dumped.*

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<sup>14</sup> State of California Department of Justice, Attorney General Rob Bonta (2024) ["Attorney General Bonta Sues ExxonMobil for Deceiving the Public on Recyclability of Plastic Products"](#)