



Peter Reinhardt  
Charm Industrial, Inc.  
182 Howard Street, #150  
San Francisco, CA 94105  
peter@charmindustrial.com

November 3, 2021

RE: Rulemaking - Informal Comment Period for Chapter 173-424 WAC, Clean Fuels  
Program Rule

TO: State of Washington Department of Ecology

These comments are submitted on behalf of Charm Industrial, Inc. (“Charm Industrial” or “Charm”). Charm Industrial is an innovative carbon sequestration company working to return the atmosphere to pre-Industrial Revolution CO<sub>2</sub> levels of 280 ppm. The company is composed of mechanical, electrical, and fabrication engineers who are focused on identifying the most innovative and impactful carbon reduction technologies. Charm Industrial is the world’s leading developer of bio-oil sequestration, having recently announced delivery of over 5,000 tons CO<sub>2</sub>e removal since January 2021.<sup>1</sup> Charm believes this represents the world’s largest permanent carbon dioxide removal delivery of all time from *any* permanent carbon removal company.

Charm greatly appreciates the opportunity to provide feedback to the Washington State Department of Ecology on its development of the Clean Fuel Standard (“CFS”). In order to meet Washington’s ambitious goals of achieving 45% of 1990 levels by 2030 and net zero by 2050, we believe that it is critical for the CFS to incorporate carbon capture and sequestration technology as enabled by Section 6 of HB 1091. **We request that the Department of Ecology permit all forms of measurable and verifiable carbon sequestration technology, including bio-oil sequestration, to participate in its Clean Fuels Standard.**

## Bio-oil Sequestration

Bio-oil sequestration strategies, such as Charm Industrial’s, convert waste biomass into carbon intensive bio-oil. The waste biomass, such as highly combustible forest residue and agricultural waste, would have otherwise been left to burn or rot, releasing greenhouse gases into the

---

<sup>1</sup> See October 20, 2021 “Largest Permanent Carbon Removal Delivery of All Time”, available at <https://charmindustrial.com/blog/largest-permanent-carbon-removal-delivery-of-all-time>.

atmosphere. The methodology follows four general steps: 1) produce bio-oil through fast pyrolysis<sup>2</sup> of waste biomass, 2) transport the bio-oil to an injection well, 3) prepare the bio-oil for injection, and 4) inject the bio-oil into geological formations. This process performs well from a permanence standpoint because bio-oil is denser than brine and sinks within the containing formation, quickly hardening into a semi-solid material.

Bio-oil sequestration can provide several benefits to Washington State beyond the reduction of atmospheric CO<sub>2</sub>e, including economic benefits, wildfire resilience, and improved air quality. Economic benefits come as a perfect compliment to the desire of Washington State to produce 15% of biofuel feedstock. The production of biofuel typically generates biowaste, which can be sold as an input to bio-oil sequestration instead of being left to decompose. Bio-oil sequestration can also produce local jobs, including collecting biowaste (such as forestry residue), operating the machinery that engages in the fast pyrolysis, and injecting the bio-oil.

Bio-oil sequestration also assists with wildfire resilience. Forestry residue is a potential biowaste input that can be converted to bio-oil. Collecting this forestry residue brings a dual benefit of removing biowaste that otherwise would have rotted and released greenhouse gas emissions while also removing flammable material that can accelerate the spread of wildfires.

Finally, bio-oil sequestration improves local air quality by offering an alternative and cleaner biowaste disposal option. Pyrolysis, including Charm's innovative approach, converts waste biomass into carbon intensive bio-oil that is safely and permanently stored underground. The agricultural waste and highly combustible forest residue used in the pyrolysis process would otherwise be burned - intentionally or due to forest fires - creating significant local air pollution.

## Justification for Inclusion

In HB 1091, which formalized the creation of the Clean Fuel Standard (CFS), Section 6 states that:

*“The rules adopted under sections 3 and 4 of this act may allow the generation of credits from activities that support the reduction of greenhouse gas emissions associated with transportation in Washington, including but not limited to:*

- *(a) Carbon capture and sequestration projects, including but not limited to:*
  - *(i) Innovative crude oil production projects that include carbon capture and sequestration;*

---

<sup>2</sup> Pyrolysis is a process where organic material is heated in the absence of oxygen. The heating process deconstructs the bio-polymers to decompose the organic material in a controlled environment. This allows the entity performing the pyrolysis to capture all associated greenhouse gases, rather than releasing them to the atmosphere through decomposition and/or combustion.

- *(ii) Project-based refinery greenhouse gas mitigation including, but not limited to, process improvements, renewable hydrogen use, and carbon capture and sequestration; or*
- *(iii) Direct air capture projects;”*

As explained above, bio-oil sequestration is a form of carbon capture and sequestration. The core processes of removing atmospheric CO<sub>2</sub> and sequestering it underground on a permanent basis is the same, even though bio-oil sequestration technology is distinct in many aspects. In that way, bio-oil sequestration is consistent with the intent of HB 1091.

Furthermore, bio-oil sequestration supports the transportation sector directly by economically supporting the production of bio-fuels. Bio-fuels generate biowaste, which typically would be left untreated and contribute to the release of greenhouse gases. Bio-oil sequestration provides an alternate (and cleaner) approach.

## Harmonization with California

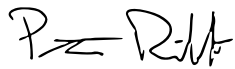
Section 7 of HB 1091 states, in part, that “the department shall seek to adopt rules that are harmonized with the regulatory standards, exemptions, reporting obligations, and other clean fuels program compliance requirements and methods for credit generation of other states.” One such state, called out specifically in the legislation, is California, whose Low Carbon Fuel Standard (“LCFS”) is administered by the California Air Resources Board (“CARB”). CARB takes the approach of incorporating carbon sequestration technology in its LCFS, which broadly is the right approach. We are encouraged that the legislature intends for the Washington CFS to do the same.

However, progress in generating credits for the California LCFS has been slowed because when the LCFS market rules were written they reflected *only* the current technology available. The LCFS did not future proof regulations to account for future technologies. Since the LCFS rules went into effect there have been many new carbon sequestration technologies that have emerged, and given the nascency of the field it is certain that more are on the horizon. This space is rapidly evolving, and we encourage Washington to adopt rules that can include emerging or future technology in its CFS. By taking a proactive approach, Washington could leapfrog California and become a leader in supporting innovative carbon removal technologies. Ultimately, a technology-neutral approach to carbon removal credit creation is needed in order to meet the aggressive but necessary timelines that have been set forth for Washington State.

## Conclusion

Charm applauds Washington for establishing a Clean Fuels program that will meaningfully accelerate our transition to a carbon-free economy. We believe that carbon sequestration technology such as Charm's can play an important role in the success of Washington's CFS. And, as the CFS harmonizes with Oregon and California, it is important that there is consistency between the states by enabling carbon sequestration technology to participate in all CFS markets. We appreciate the thoughtful consideration of these comments, and we look forward to working with the Department of Ecology staff as the rules for credits are developed in the rulemaking.

Sincerely,

A handwritten signature in black ink, appearing to read "P. Reinhardt". The signature is stylized with a large "P" and a long horizontal stroke.

Peter Reinhardt

CEO

November 3, 2021