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For a thriving New England

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House Committee on Natural Resources, Fish, and Wildlife
Vermont General Assembly
115 State Street
Montpelier, VT 05602

RE: H.501, An Act Relating to Physical Contaminant Standards for Residual Waste, Digestate, and Soil Amendments.

Dear Chair Sheldon and Members of the House Committee on Natural Resources, Fish & Wildlife:

Thank you for the opportunity to testify in support of H.501, An Act Relating to Physical Contaminant Standards for Residual Waste, Digestate, and Soil Amendments. My name is Peter Blair. I am a Staff Attorney with Conservation Law Foundation ("CLF").

CLF is a nonprofit, member-supported, environmental organization working to conserve natural resources, protect public health, and build healthy communities in Vermont and throughout New England. Through its Zero Waste Project, CLF aims to improve waste diversion and recycling programs and protect communities and our environment from the dangers of unsustainable waste management practices and pollution from landfills and waste incinerators.

This testimony is also being submitted on behalf of Vermont Natural Resources Council ("VNRC"). VNRC is an environmental non-profit working to protect and enhance Vermont's natural environments, vibrant communities, and productive working landscapes.

Land applying material that contain microplastics and other physical contaminants (e.g., metal, glass, rubber, leather, etc.) poses a threat to both the environment and human health. H.501 would establish a physical contamination standard for residual waste[1], digestate[2], and soil amendments.[3] If the material is found to exceed the contamination standard, then it would not be allowed to be land applied. Under the proposed law, the Department of Environmental Conservation ("DEC" or the "Department") would be responsible for promulgating regulations that implement the standard, including enforcement and testing requirements.

[1] Residual waste is domestic septage, sewage sludge, biosolids, and sludge from drinking water.
[2] Digestate is the material remaining after the anerobic digestion of biodegradable feedstock.
[3] Is a substance of mixture of substances that is intended to improve the physical, chemical, biological, or other characteristics of soil – such as compost, digestate, and residual waste.

If enacted, H.501 would help ensure that Vermont is developing a food recycling system that provides a clean stream of materials that will help increase the quality of soils, as opposed to one which contributes to the growing presence of microplastics in the environment and in our food supply. For these reasons, CLF urges your committee to vote in favor of H.501.

I. The Universal Recycling Law and Food Waste Recycling in Vermont

Before diving into the current bill, it is important to remember and understand where we are and how we got here. In 2012, the Vermont legislature passed one of the most progressive waste reform laws in the nation, Act 148. Commonly known as the Universal Recycling Law, this legislation banned the disposal of recyclables, leaf and yard debris, and food waste from Vermont's landfills. The food waste ban was phased in over time, first applying to only large generators of food waste before including all Vermonters. Since July 2020, the ban has been in full effect. Overall, this legislation has been extremely successful. A significant amount of attention has rightfully focused on the impact this law has had on increasing food donations, saving landfill capacity, and reducing greenhouse gas emissions. However, the goal of the law was not simply to keep food waste out of landfills.

The law was also enacted to helped facilitate the growth of Vermont's food recycling system, by increasing the amount of food waste that is collected and processed through composting or anerobic digestion. If done correctly, composting and anerobic digestion results in food waste being processed and managed in a manner that creates a material that can be used as a soil amendment that can add soil volume and replenish Vermont's farmland by providing nutrients without the need for industrial fertilizers that often contain harmful chemicals. In fact, the use of compost and digestate from anerobic digestors has been shown to increase the overall productivity and resiliency of soils by increasing water retention capacity and the levels of nitrogen, phosphorus, and potassium.

Transitioning from a system where food waste is simply thrown in a landfill to one where it is put to productive use requires time and energy. This is especially true because a significant amount of food waste is packaged – primarily in plastic. If not properly separated, materials such as food packaging, containers, bags, produce sticker, and service ware can result in plastic contamination in compost and digestate.[4] These plastic materials never fully decompose. Instead, they splinter and fragment into smaller and smaller particles called microplastics. If plastics are not removed from the food waste stream, they create operational problems for compost and anerobic digestion facilities, reduce the value of the finished soil amendment, and most importantly pose a risk to human health and the environment.

[4] U.S. Environmental Protection Agency, "Emerging Issues in Food Waste Management: Plastic Contamination." (Aug. 2021).

Most plastic is easily identifiable and removed from food waste by either the generator or the composter or digestor. However, this is not always the case. Especially if the food waste and the plastic packaging it is wrapped in are separated using a mechanical "depackager." Depackaging is a technique that involves collecting and commingling unpackaged and packaged food in order to mechanically separate packaging materials from the non-organic packaging. The machines essentially grind up the organic material and the predominantly plastic packaging and attempt to separate the two materials into two separate waste streams using a series of screens. While convenient, depackaging systems result in an organic waste stream that is contaminated with shredded plastic waste. Manufacturers of depackaging equipment list a contamination rate of at least 0.5%, and in some cases contamination rates as high as 2-3%. According to Biocycle, the contamination rate ranges between 3-10%.[5] Meaning that as much as 10% of the plastic packaging may not be effectively separated from the organic waste which currently may be used as a soil amendment.

II. Impacts of Microplastics in Soil Amendments

When soil amendments made from compost or digestate contain significant amounts of microplastics, these plastic fragments enter soil and water posing potential risks to the environment and human health.

The presence of microplastics in the environment is a global dilemma. These small plastic particles are known to pose a serious risk to humans and other living organisms.[6] A recent review of the potential health risks associated with microplastics shows that human ingestion of these particles may lead to:

- Inflammation – which is linked to cancer, heart disease, inflammatory bowel disease, and rheumatoid arthritis;
- Genotoxicity, damage to the genetic information within a cell causing mutations, which may lead to cancer;
- Oxidative stress leading to many chronic diseases such as atherosclerosis, cancer, diabetes, rheumatoid arthritis, post-ischemic perfusion injury, myocardial infarction, cardiovascular diseases, chronic inflammation, and stroke;
- Apoptosis, cell death associated with a wide variety of diseases including cancer; and
- Necrosis, cell death associated with cancer, autoimmune conditions, and neurodegeneration.[7]

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[5] Craig Coker, "Food Waste Depackaging Systems." Biocycle. (July 10, 2019).
[6] David Azoulay et al., Plastic & Health: The Hidden Costs of a Plastic Planet (Feb. 2019).
[7] *Id.*

Microplastics are already pervasive throughout the environment. These tiny plastic particles have been found everywhere from the deepest parts of the ocean to remote areas of the arctic.[8] These particles are also present in the human body. New studies have found microplastics in human organs as well as in placentas.[9] Therefore, it is unsurprising that microplastics have also been found in soil as well as in soil amendments like compost and digestate.

The presence of microplastic in soil and soil amendments is concerning given that there is mounting evidence illustrating the detrimental impacts microplastics have on the quality of our soil and the food grown from it. As humans are primarily exposed to microplastics through ingestion – actions that increase the levels of microplastics in food represent a significant public health concern.

Researchers at the University of Catania, Italy found that microplastics are present in vegetables and fruit like carrots, lettuce, apples, and pears.[10] Another study found that microplastics in soil penetrated the roots of lettuce and wheat plants, causing absorption as the plants grow.[11] Fruits and vegetables were also found to accumulate microplastics through uptakes from contaminated water and soil.[12] Moreover, a recent report attempted to quantify the current scientific understanding regarding the impacts microplastic-contaminated soil may have on food systems.[13] The report evaluated 41 peer reviewed studies that investigated the ability of plants to absorb and uptake microplastics from the environment.[14] Ultimately, a majority of these studies found that the plants can absorb microplastics when the material is present in the soil.[15]

In addition to allowing for microplastics to enter the food system through absorption and uptake, land applying microplastic-contaminated material may also contribute to the presence of other toxic materials in soil and food.[16] When plastics fragment and breakdown they begin to leach

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[8] Damian Carrington, "Microplastic Particles Now Discoverable in Human Organs." *The Guardian*. (Aug. 17, 2020).
[9] Antonio Ragusa et al., "Plasticenta: First Evidence of Microplastics in Human Placenta." *National Library of Medicine*. (Dec. 2, 2020).
[10] Conti, G.O, et al., Micro-and-Nano Plastics in Edible Fruits and Vegetables, *Environmental Research*. (August 2020). ISSN 0013-9351.
Gea Oliveri Conti, Margherita Ferrante, Mohamed Banni, Claudia Favara, Ilenia Nicolosi, Antonio Cristaldi, Maria Fiore, Pietro Zuccarello, Micro- and nano-plastics in edible fruit and vegetables. The first diet risks assessment for the general population, Environmental Research, Volume 187, 2020, 109677, ISSN 0013-9351.
[11] Kristin Toussaint, "Our Fruits and Veggies are Sucking Up Microplastics Through Their Roots." *Fast Company*. (June 25, 2020).
[12] *Id.*
[13] Mateos-Cardenas, A., O'Halloran, J., A.K. Jansen, M., (2021). Absorption, Uptake and Toxicity of Micro-and-Nanoplastics: Effects on Terrestrial Plants and Aquatic Macrophytes. Environmental Pollution. 284, 117183.
[14] *Id.*
[15] *Id.*
[16] Kim, S. W., Waldman, W. R., Kim, T.-Y., and Rillig, M. C. (2020). Effects of Different Microplastics on Nematodes in the Soil Environment: Tracking the Extractable Additives Using an Ecotoxicological Approach. Environ. Sci. Technol. 54 (21), 13868–13878.

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the additives they contain.[17] Many of these additives are highly toxic, including Bisphenol A, phthalates, and Per- and polyfluoroalkyl substances ("PFAS"). Phthalates are linked to asthma, attention-deficit disorder, breast cancer, obesity, decreased fertility, as well as type II diabetes.[18] PFAS are toxic to humans in very small concentrations—in the *parts per trillion* (ppt).[19] PFAS are suspected carcinogens and have been linked to growth, learning and behavioral problems in infants and children; fertility and pregnancy problems, including pre-eclampsia; interference with natural human hormones; increased cholesterol; immune system problems; and interference with liver, thyroid, and pancreatic function.[20] If these additives leach into the soil they may then be taken up by plants and begin entering the food web.

Additionally, microplastics have also been shown to impact the overall productivity and quality of soil. For instance, microplastics have been found to increase the pH levels, decrease water retention, and decrease enzymatic and microbial activities in soil.[21] pH increases limit the productivity of soil, while reduced water retention increases erosion and diminishes the soil's resiliency to droughts.[22] Studies have shown that these impacts can disrupt food growth, with crops exposed to microplastics having reduced weight, height, and chlorophyll content.[23]

III. H.501 Will Set a Physical Contamination Standard That Will Limit the Use of Plastic-Contaminated Soil Amendments

Given the range of damaging impacts microplastics have on soil quality, food production, and human health, plastic-contaminated soil amendments should not be allowed to be land applied. The adoption of a physical contamination standard for soil amendments will ensure that only clean material is being used to supplement Vermont's soil.

Physical contamination standards are a common regulatory tool. Currently, thirteen states have enacted laws and regulations that set a weight-based contamination standard for soil amendments such as compost and digestate.[24] Additionally, four states, California, Washington, Maryland,

[17] United Nations Environment Programme, "Plastic Planet: How Tiny Plastic Particles Are Polluting Our Soil." (Dec. 21, 2021).
[18] Amy Westervelt, "Phthalates Are Everywhere, and the Health Risks are Worrying." *The Guardian.* (Feb. 10, 2015).
[19] Agency for Toxic Substances and Disease Registry, *Per- and Polyfluoroalkyl Substances (PFAS) and Your Health*; Agency for Toxic Substances and Disease Registry, *Toxicological Profile for Perfluoroalkyls*, at 5–6.
[20] Agency for Toxic Substances and Disease Registry, *Toxicological Profile for Perfluoroalkyls*, at 5–6.
[21] Zhao T, Lozano YM and Rillig MC (2021) Microplastics Increase Soil pH and Decrease Microbial Activities as a Function of Microplastic Shape, Polymer Type, and Exposure Time. Front. Environ. Sci. 9:675803.
[22] *Id.*
[23] Kate S. Petersen, "Microplastics in Farm Soils: A Growing Concern." *Environment Health News.* (Aug. 31, 2020).
[24] U.S. Environmental Protection Agency, "Emerging Issues in Food Waste Management: Plastic Contamination." Page 25. (Aug. 2021). (These states are: North Carolina, New Hampshire, New York, South Carolina, Iowa, Montana, Rhode Island, Wisconsin, Minnesota, Maryland, Washington, Ohio, and California // California, Iowa,

and Ohio have enacted an additional plastic specific contamination.[25] Physical contamination standards are also common in Europe and Canada. In Europe, Germany, Austria, and the United Kingdom have physical contamination standards.[26] Recently, the European Union finalized regulations that establish a physical contamination standard for compost and digestate used as organic fertilizers and soil amendments. The regulations will take effect in July of this year and will apply to all European Union nations.[27] In Canada, both Ontario and British Columbia have contamination standards.[28]

Under H.501, the Department will be responsible for developing the regulations necessary to carry out the physical contamination standard. This includes determining both how testing will be performed and the frequency it will be performed. While there is not a standardized methodology for evaluating the level of physical contamination in soil amendments and digestate, there are well-established methods that are continuing to advance. The most common method is to screen the material using a sieve, which manually isolates the physical contaminant fragments from the rest of the material.[29] Once separated, the contaminants are weighed. If the weight exceeds the threshold for permissible contamination, the material cannot be land applied.[30] Additionally, laboratory analysis of samples is also an accepted methodology which offers increased precision, though it is more expensive and time consuming.[31] In terms of frequency, most states require testing for every 5,000 cubic yards of material. However, some states only require testing for every 10,000 cubic yards.

Through the rulemaking process, the Department can look to the dozens of other jurisdictions that currently have physical contamination standards and engage in a robust public process to determine the testing frequency and methodology that makes the most sense for Vermont.

IV. Conclusion

The Universal Recycling Law kickstarted the development of Vermont's food recycling system. Now that the food waste ban is in full effect, it is critical that the state take the necessary steps to preserve and protect this new system to ensure that it is developed in a way that helps replenish Vermont's farmlands with clean soil amendments. Adopting a physical contamination standard will make sure that only uncontaminated material is being used to grow our food. Thank you for

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Maryland, Minnesota, Montana, New York, North Carolina, New Hampshire, New York, Ohio, Rhode Island, Washington, and Wisconsin).
[25] *Id.* at 26.
[26] *Id.* at 25.
[27] *Id.* at 28.
[28] *Id.* at 25 and 28.
[29] *Id.* at 26-29.
[30] *Id.*
[31] *Id.*

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your time and consideration of this testimony. I am happy to answer any questions you may have.

Best,

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