

The State of Food Waste Depackaging Regulations in the U.S.

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BIOCYCLE

NRDC



About BioCycle

Founded in 1960, BioCycle is the nation's leading authority on organics recycling. For more than six decades, BioCycle has advanced the industry through independent journalism, technical publications, original research, and strategic advisory services. The organization partners with municipalities, corporations, investors, nonprofits, and technology providers to develop and scale organics recycling systems, including composting, anaerobic digestion, food waste collection, and other resource recovery solutions. Combining deep technical expertise with an unparalleled network across the organics value chain, BioCycle delivers practical, data-driven insights that help clients navigate complex challenges, identify opportunities, and build resilient circular economy infrastructure.

About NRDC

NRDC (the Natural Resources Defense Council) works to safeguard the earth—its people, its plants and animals, and the natural systems on which all life depends. Established in 1970, the international nonprofit environmental organization combines the power of more than 3 million members and online activists with the expertise of some 700 scientists, lawyers, and other specialists to confront the climate crisis, protect the planet's wildlife and wild places, and to ensure the rights of all people to clean air, clean water, and healthy communities.



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Executive Summary

Depackaging is the industrial process of separating organic contents from their surrounding packaging materials like plastic, metal, or glass. Depackaging is scaling faster than the regulations meant to govern it. In October 2025, the Natural Resources Defense Council (NRDC) commissioned BioCycle to research the regulatory landscape in 24 states for mechanical food waste depackaging. Across the 24 states surveyed for this research, regulation of depackaging facilities and the compost and digestate produced from the depacked food waste is a patchwork — with some states writing dedicated rules, most fitting depackaging into existing permit categories never designed for it, and several treating the practice as exempt from solid waste oversight altogether.

The highlighted findings to the right define this moment.

Vermont is the only state with regulations (in the final round of revisions as of Summer 2026) explicitly designed around the source-separated-versus-packaged distinction. Washington State, the next furthest along, released its most recent draft rule on June 22, 2026 — and notably raised its incoming contamination limit from a proposed 2% by volume back up to 5% by volume, positioning pre-processing (including depackaging) as the central tool for managing contamination rather than source separation by the generator. Most other states are using existing permit categories — solid waste

depackaging into a framework that was not built with it in mind.

- **The biggest regulatory bottleneck is the absence of a standardized measurement protocol for microplastics in food waste slurries, digestate, and compost.**
- **Mechanical food waste depackaging is here to stay. The question is not whether it should exist but under what conditions — and with what guardrails.**
- **Large-scale, stand-alone food waste depackagers and digesters with depackaging services are operating in regulatory vacuums in most states.**
- **Merchant depackaging services are reshaping the food waste market in ways that can limit availability of source separated streams for composting.**

This report lays out what BioCycle found, where the regulatory gaps are, and what others in the broader organics recycling community can do to close them.



SECTION 1

What is Depackaging?



What is Depackaging?

A food waste depackager uses mechanical force to separate food contents from packaging. Machines on the market today apply force in a tangential shearing action, a vertically-oriented hammering action, horizontal or vertical pressure through a metal sieve or screen, or some combination thereof. Early depackagers drew from the hammermills used in grinding wood; the splintering of the packaging allowed small particles to pass through the sieve. Newer models are designed to separate packaging with the least amount of applied force necessary, and to convey separated packaging out of the machine with the least additional handling.

Separation efficiency is evaluated using two metrics: recovery (the percent of food waste recovered from the entire incoming waste stream) and purity (the percent of food in the recovered slurry versus unwanted materials like plastic packaging). Operator preference — water usage, mobility, ease of changing screen sizes, and physical space — drives equipment selection more than machine design itself.

DEPACKAGING AND MICROPLASTICS

The mechanical process of depackaging can result in microplastics (≤ 5 mm). Currently, **no standardized measurement protocol exists for microplastics in depackaged food waste slurries, compost or digestate, causing a barrier for setting regulatory limits.** There also are no data available on which depackaging methods produce microplastics or in what quantities, but it is reasonable to assume that machines exerting more force on packaged foods risk higher production of microplastics due to shattering of brittle plastics like some high-density polyethylene (HDPE) and polypropylene.

For example, yogurt containers (#5 polypropylene) are routinely cited by operators as a plastic that shatters during processing. **The speed at which the depackager runs is the biggest variable operators control to manage that risk.** Some composting operations also use slow-speed shredders or mechanical mixers to size-reduce incoming food waste, and these can shatter packaging too — but those facilities do not intentionally accept packaged food, so the quantity is significantly less than at a facility taking pallet loads of packaged products.

The practical implication: **if regulators and researchers do not look for microplastics in depackaged streams, the**

quantities generated will not be known. The lack of a standardized measurement method (see Section 4) makes this a regulatory blind spot.





SECTION 2

Research Methodology

Research Methodology

NRDC selected 24 states for BioCycle to survey, including states with and without food waste diversion policies: California, Colorado, Connecticut, Florida, Illinois, Indiana, Iowa, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, Vermont, Virginia, Washington, and Wisconsin. Information was also collected on activity on tribal lands.

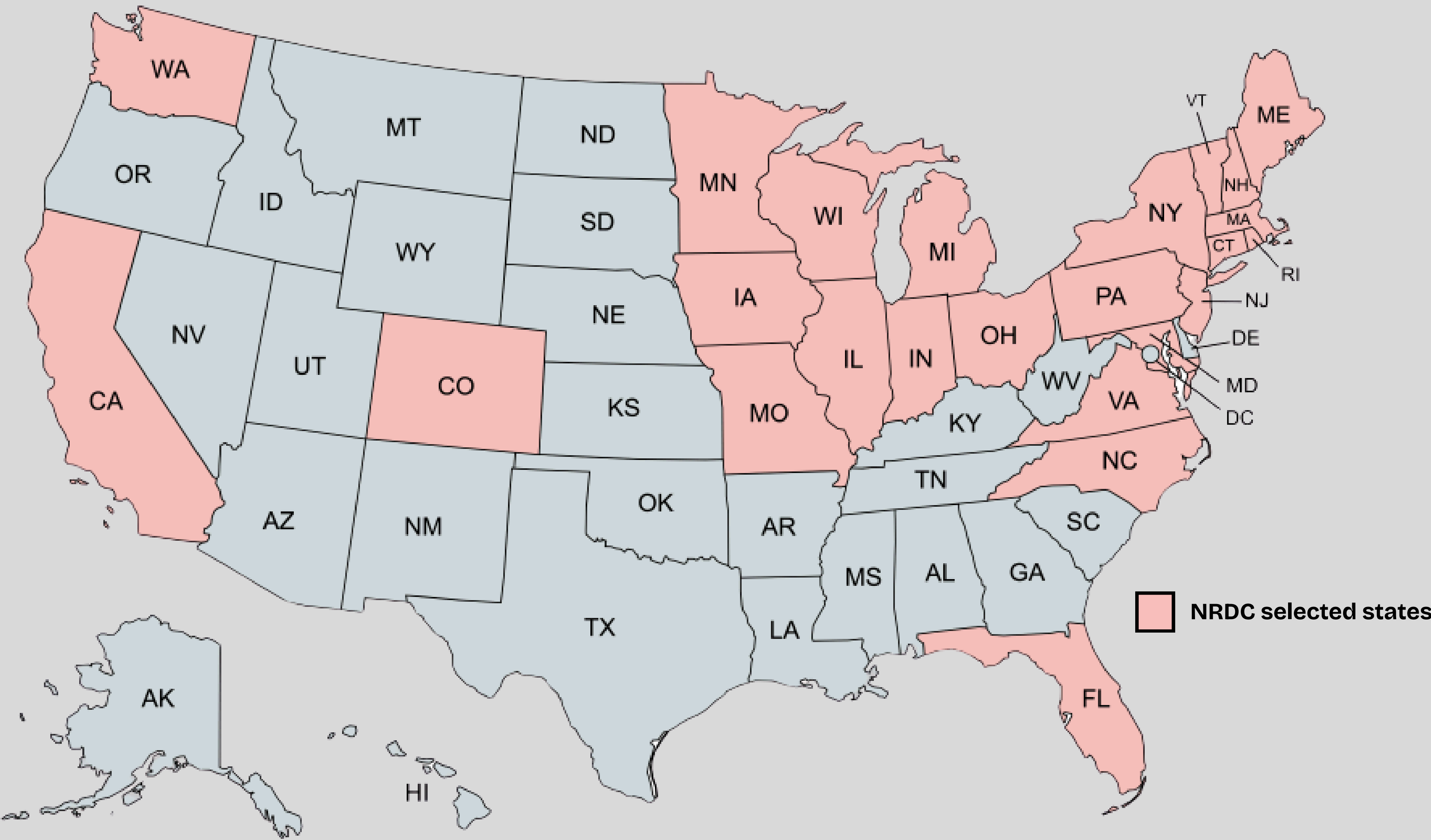
BioCycle contacted state regulatory officials responsible for oversight of food waste depackagers and physical contaminant limits for depackaged streams, and for use of digestate and compost that includes depackaged food waste. Outreach was conducted via email with offers for Zoom or phone interviews; states could also respond in writing. Interviews were conducted with regulators in Colorado, Connecticut, Iowa, Maine, Maryland, Michigan, New York, North Carolina, Pennsylvania, Vermont, and Washington.

Twenty-three of the 24 priority states responded; only the Florida Department of Environmental Protection did not.

Separately, BioCycle interviewed researchers at the University of Vermont with experience in measuring microplastics in depackaged food waste, digestate, and compost made with source-separated food waste streams. Additional outreach to operators of depackaging equipment and merchant depackaging service providers was conducted.



FIGURE 1. STATES CHOSEN FOR DEPACKAGING REGULATION ANALYSIS





SECTION 3

Depackaging Regulations Across the U.S.

Depackaging Regulations Across the U.S.

Most **states surveyed are actively grappling with how to regulate food waste depackaging** in a rapidly changing organics recycling landscape. The majority use existing permit types to regulate stand-alone depackagers, including solid waste, materials recycling, transfer, or preprocessing facilities — intermediary steps rather than final processing. Where depackaging is co-located with composting or anaerobic digestion (AD), it is most often added to the existing facility's permit.

RESTRICTIONS ON ELIGIBLE FOOD WASTE STREAMS

Only Vermont is addressing restrictions on the types of food waste streams eligible for depackaging as part of a solid waste rulemaking update. Revisions to Act 170 by the Agency of Natural Resources create two categories — source separated and packaged. Once the rule is adopted (anticipated in Fall 2026), guidance is expected to be issued for audits of incoming loads to keep source-separated food waste from being loaded into the depackager hopper and to maximize the capture of recyclables, especially cardboard boxes, prior to depackaging. Vermont's draft also requires depackaging facilities to provide sufficient staffing to manually remove outer film wraps, boxboard, cardboard, and

other non-food containing outer materials before depackaging.

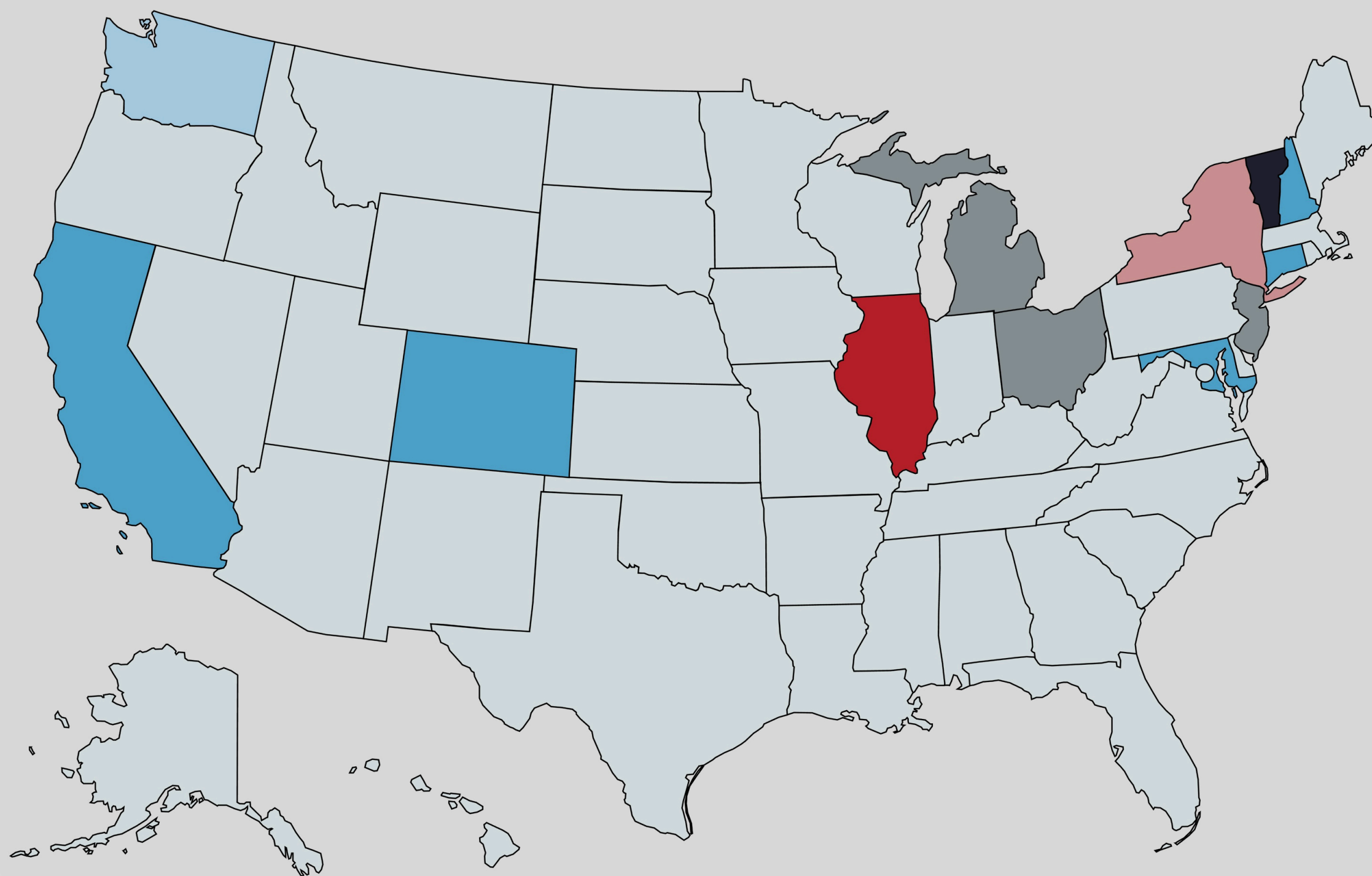
California's regulations distinguish between "Mixed Organics" and "Source Separated Organics." Per CalRecycle, packaged food waste is not always considered mixed organics — it depends on the material and how the jurisdiction collects it. To meet SB 1383 organics recycling requirements, jurisdictions that offer only a gray container for organics (rather than organics-specific green or brown bins) must send gray bin contents to a "high diversion organic waste processing facility" to recover organics (e.g. through depackaging).

New Jersey's Class C Recycling General Approvals may restrict incoming food waste types depending on the facility's equipment. One approved Class C recycling center with a depackager is authorized to accept food waste in factory-sealed glass, bi-metal, aluminum, and durable plastic containers (PET, polypropylene, or polycarbonate). Maine recently updated its solid waste types for a statewide waste audit to include "food waste without packaging" and "food waste with packaging"; these categories are likely to appear in the next revision of the state's solid waste management rules.

DEFINING A DEPACKAGING FACILITY

How a state classifies a depackaging facility shapes everything downstream — what permit applies, what contamination limits apply, what reporting is required. Figure 2 visualizes how these classifications vary widely as of Summer 2026.

FIGURE 2. HOW STATES DEFINE DEPACKAGING FACILITIES



- Vermont** considers stand-alone depackaging operations as designated organics recycling facilities.
- California, Colorado, Connecticut, Maryland, and New Hampshire** consider depackaging facilities as processing and/or transfer facilities (not designated organics recycling facilities) because they do not perform final processing or end use.
- In Illinois**, a facility that receives food waste and performs “depackaging or separating activities that constitute storage, transfer or treatment of solid waste” is regulated as a Pollution Control Facility and requires a solid waste permit.
- New Jersey, Ohio, and Michigan (in development)** classify depackaging facilities as materials recycling facilities. Note: Michigan anticipates adding language to its recycling permit to account for containment of liquids.
- Washington State** is drafting solid waste handling rules that categorize food waste depackaging facilities as organics pre-processing facilities.
- New York’s food waste diversion policy** considers proximity to a designated organics recycling or intermediary facility (currently 25 miles, increasing to 50 miles on Jan. 1, 2027) when determining which generators must comply. Depackaging facilities are considered intermediary facilities. NYS DEC is not aware of any stand-alone depackaging facilities in the state; all are co-located with or adjacent to a processing facility.

LOCATION-BASED REGULATION

Whether a depackager is stand-alone or co-located with another facility — and what kind of facility — often determines how it is regulated. Most states surveyed include co-located depackagers in the host facility's solid waste permit rather than permitting them separately. Stand-alone depackaging facilities are permitted as transfer facilities, transfer/processing facilities, processing/treatment facilities, solid waste facilities, or materials recycling facilities, depending on the state. Table 1 summarizes the permit categories states are using for stand-alone depackagers and co-located depackagers.

TABLE 1. STATE REGULATORY APPROACHES TO FOOD WASTE DEPACKAGING

Permit Type	Stand-Alone Depackager	Co-located with Organics Recycling
Solid Waste Facility	CT, IL, RI, NY, VA ²	CT, IL
Materials Recycling/Recovery Facility	MD ³ , MA ⁴ , MI ³ , NJ ⁴ , OH	OH ² , MA ⁴ , MI ³
Transfer/Processing/Treatment Facility	CA ¹ , CO, IN, ME, NH, WI	CA ¹ , IN, WI
Organics Recycling Facility	CA ¹ , MA ⁴ , NJ ⁴	CA ¹ , MA ⁴
Specific Depackaging / Pre-processing Regulation	VT ³ , WA ³	VT ³ , WA ³
Permit-by-Rule		VA
Exempt/No Permit Required	IA, MN, MO, NC ³ , PA ³ , VA ²	MD, MO
Included in Other Facility Permit		CO, ME, MN, NH, NJ, NY, NC, OH ² , PA ² , RI

1. Permit type varies 2. Depends on location (e.g. on-farm) 3. Draft/Regulations in development 4. One permit covers recycling and composting

Other state approaches include:

Ohio: Approach illustrates the layered complexity. If depackaging is located within the footprint of a permitted composting facility, it is treated as part of the feedstock receiving area and included in the facility's permitting requirements. If located outside that footprint — or associated with animal feed manufacturing, rendering, or most anaerobic digestion — it is most likely considered "legitimate recycling" and exempt from solid waste transfer facility regulations. (A "legitimate recycling facility" must recycle no less than 60% by weight of received solid waste.) Depackaging associated with a Water Resource Recovery Facility is subject to NPDES permitting; depackaging associated with a Concentrated Animal Feeding Operation is regulated by the Ohio Department of Agriculture.

New Hampshire: Takes a simpler approach. A stand-alone depackager would be classified as a Processing/Treatment facility and require a solid waste facility permit, while depackaging co-located with composting or AD would be included in the host facility's permit.

Maryland: Plans are to categorize food waste depackaging operations as "intermediate" recycling facilities.

Pennsylvania: Has an existing permit (WMGM042) for depackaging operations at farm digesters and is creating a permit for non-farm operations (anticipated in 2026).

North Carolina: Plans are to create a "notification" form for depackaging operations to collect operational information. The Department of Environmental Quality will begin a Solid Waste Section Rule Review and Readoption process (targeted for 2027) that will likely include permitting requirements for depackaging facilities. Currently, depackagers co-located at AD or composting facilities fall under those facilities' solid waste permits.

Colorado, Iowa, and Minnesota: All have depackaging facilities operating without a depackager permitting structure and no plans to develop one in the near future.



PHYSICAL CONTAMINATION LIMITS

Table 2 summarizes states' current physical contamination limits in regulation (or in draft). Existing limits apply most often to compost, sometimes to digestate, but rarely to depackaged food waste specifically. The most stringent limits are 0.5% by dry weight, with a particle size limit of 4 mm, and a stipulation that no more than 20% by dry weight of contaminants larger than 4 mm may be film plastic. California was an early adopter; New York recently lowered its particle size limit to 4 mm. Microplastics are particle sizes that are technically defined as ≤ 5 mm.

TABLE 2. STATE PHYSICAL CONTAMINATION LIMITS

Contamination Limit	Compost	Digestate	Food Waste
≤ 4 mm	CA, IL, MI, MN*, NH, NJ*, NY, OH, PA	CA, NY	
> 4 mm	IA		
$\leq 1\%$ (by dry weight)	CA, IL, MI, NY, OH, PA, RI*, WA*, WI	CA, NY, RI, WA*	
$> 1\%$ (by dry weight)	IA, MD, MN*, RI*		NJ, WA* (by vol)
Specific limits for film plastic	CA, NJ*, NY, WA*	CA, NY, WA*	
Other rules or guidance	CO, ME, MA	CO, CT, IA, MA, PA	IN
No limits or rules	CT, IN, MO, NC, VT, VA	IL, IN, ME, MD, MI, MO, NH, NC, OH, VT, VA, WI	CA, CO, CT, IL, IA, ME, MD, MI, MO, NH, NC, PA, VT, VA, WI

**NJ only has limits for film plastic. RI and MN allowable percentages depend on compost Class. WA regulations in draft form.*

Vermont & Washington

STATE TRAJECTORIES HEADING IN OPPOSITE DIRECTIONS



Vermont and Washington are the two states writing depackaging-specific regulations. They are heading in opposite directions.

As noted above, Vermont's final draft rule leans into preserving source separation. It prohibits commingling of manually source-separated food residuals with packaged food, prohibits treating manually source-separated residuals with mechanical depackaging, and requires depackaging facilities to

provide sufficient staffing to manually remove outer film wraps, boxboard, cardboard, and other non-food containing outer materials before depackaging.

The Washington Department of Ecology (Ecology) released its latest draft rule on June 22, 2026 — and moved in the opposite direction. The November 2025 draft proposed a 2% or less contamination limit by volume on incoming feedstocks.

Comments from local governments worried about rejected loads. The AD industry favored pre-processing as a contamination management tool. In response, Ecology's June 2026 draft raised the limit to 5% or less by volume. The new draft positions organic materials pre-processing — explicitly including mechanical depackaging — as the central strategy for handling loads above that 5% threshold. The draft also defines source separation in a way that includes packaged food, meaning grocery stores can place packaged and unpackaged food in a single container and have it treated as source-separated.

Washington state has had long-established source-separated organics programs with commercial generators historically participating in those programs. A number of composters have been vocal in opposition to the definition of source separation in the draft rule. One company argued that Ecology's revised approach "would allow food retailers to commingle packaged and unpackaged food in one storage bin" and provides an advantage to

processors with mechanical depackaging equipment. In contrast, a biogas industry association has framed depackaging as a realistic pre-processing pathway, given the composition of modern commercial food waste.

Washington's finished product contamination limits in the latest draft are 0.5% or less physical contaminants by dry weight, not to exceed 0.1% film plastics by dry weight. Required sampling frequency is every three months or every 5,000 cubic yards (solids) or 1,000,000 gallons (liquids), whichever is more frequent, using an accredited laboratory. Public comments were accepted through August 13, 2026; rule adoption is anticipated November 19, 2026.

OPERATORS SUBJECT TO SLURRY CONTAMINANT LIMITS

Pennsylvania stands out as the only state requiring (since 2022) a farm-based digester with a depackager to sample digestate quarterly to ensure it meets physical particle size limits. The WMGM042 permit does not specify a numerical limit; instead it requires "reporting only" for percent plastics and physical contaminants in the slurry and digestate. Reinford Farms, the first facility under this permit, sends solid digestate samples to a laboratory quarterly to test for microplastics. The permit also requires that no visible plastic fragments be in the digester effluent or dewatered solids destined for land application — though as the operator notes, microplastics can be very small and not visible.

Reinford Farms has refined its operations to reduce contamination at multiple points. The speed at which the depackager operates is the biggest variable that can impact creation of microplastics. For example, Reinford Farms runs its depackager at different speeds depending on the type of plastic going into the feed hopper. The farm also adjusted the depackager screen from 1 inch to three-eighths inch. Its two manure solids separators (post-digestion) are equipped with 1 mm screens, which remove most microplastics from the liquid digestate prior to land application.

The Massachusetts Department of Environmental Protection shared Vanguard Renewable's 2024 renewal of its

Recycling, Composting or Conversion (RCC) Operation permit for the company's stand-alone food waste depackager in Agawam, MA. The permit notes that previous studies showed non-organics passing through the depackager into the slurried organics range from 0.5% to 0.8% by weight on average. Vanguard documents the percentage of inorganic material by filtering and weighing the slurried organic material.

In Indiana, food waste depackaging facility permittees are required to sample the slurry coming out of the unit for microplastics to confirm the depackager manufacturer's specifications are met. Title 329 IAC 11 references waste determination sampling, analyses, methods, frequencies, and reporting. One permit holder uses preparation method US EPA 160.3 with a No. 7 sieve (2.83 mm) and must verify unacceptable waste with a particle size of 3 mm or greater is no more than 0.5% on a dry weight basis.



REGULATORY PRIMACY

In almost all states surveyed, the solid waste division — typically housed within an environmental or natural resources agency — is the primary regulatory authority for food waste preprocessing and the composting or AD facilities that receive food waste as a feedstock. In some states, water quality, wastewater, or air quality divisions have permitting authority for some or all of these facilities. In Connecticut, Maine, Maryland, and Wisconsin, the state's agricultural department has primacy over marketing and distribution of compost and digestate (most states require registration for compost or digestate sold as fertilizer). Food waste codigested with manure typically requires a nutrient management plan from the agricultural department; codigestion with biosolids puts the wastewater division in primacy for land application.

Having one set of product quality standards for downstream outputs containing food waste would address what is in some cases an unlevel regulatory playing field. Farm digesters that process food waste may only have to meet nutrient management plans; food waste composting facilities are typically required to meet compost quality standards including plastic contamination limits.



TRIBAL LANDS

After communications with EPA Regional contacts, BioCycle concluded that no Tribes are currently regulating food waste depackaging, compost, or digestate at a large scale. Dakota Prairie Composting in Minnesota, owned and operated by the Shakopee Mdewakanton Sioux Tribe, has a depackager — but the facility is located on fee land, not trust land, and is therefore subject to state regulations, according to contacts at the Minnesota Pollution Control Agency.



SECTION 4

Concerns & Open Questions

THE STATE OF MICROPLASTICS MEASUREMENT

The biggest regulatory barrier identified by this research is the absence of a standardized measurement protocol for microplastics in incoming food waste streams, slurried food waste, and the resulting compost and digestate. Until one is developed and adopted into state regulations, the risk of increasing microplastics generation from depackaging remains unchecked. State regulators interviewed during this research consistently acknowledged that **the lack of a standardized protocol is what has led — or is leading — most states to have no measurement requirement for microplastics at all.**

Where the Science Stands

In the United States, the University of Vermont's Nutrient Cycling and Ecological Design Lab has conducted the most in-depth research on identifying microplastics in source-separated organics, depackaged food waste, and digestate and compost made with food waste streams. The team is led by Dr. Eric Roy and Dr. Kate Porterfield. A summary of their methodology is available in the [fact sheet](#) Microplastics in Food Waste Recycling.

BioCycle interviewed Drs. Roy and Porterfield, along with Dr. Matthew Scarborough, about the current state of measurement protocols. The challenges, in their words:

*The time demanded in this process is largely under the microscope. After sieving, the sample needs to be systematically picked through by hand multiple times. Nobody loves doing it and no one has figured out a way to do it fast. **It's a slow process. In addition, there are a lot of particles in food waste-derived organic residuals that look remarkably like plastic but are not.** Furthermore, many microplastics in food waste are characterized by layers of multiple materials, which complicates confirmation of plastic status using Fourier transform infrared spectroscopy (FTIR).*



Tests for microplastics in water and soil are more widely used and can be done in a timely manner. With organic materials, said Roy and Porterfield, “**the density is in a range that overlaps with plastic...** Some approaches use density separation; UVM does not. For example, much of what is left in compost after digestion with hydrogen peroxide is recalcitrant organic materials that can look similar to plastic under the microscope and have similar densities to plastic.”

Another complication is that **plastics are more aged in a compost sample, compared to looking at a food waste slurry**, add Roy and Porterfield. “It’s more difficult to determine the type of plastic when it’s more aged, and aged particles can more closely resemble organic matter. This results in more ‘edge cases’ where human subjectivity comes into play because it can be difficult to confirm polymer type using both visual clues and FTIR. UVM has settled on a method, and uses it consistently to obtain replicable findings. We will continue to use our current method for the foreseeable future.”

ASTM and TMECC: Standards Development Initiatives

ASTM opened a work item — ASTM Work Item WK94491 — in April 2025, to develop an introductory guide on identification, assessment, and cleanup of microparticles, including microplastics, in air, soil, surface water, and groundwater. The scope will include identification of microplastics in different

media, initial characterization, best management practices, and documentation. This may be an early step toward an ASTM standard for quantifying microplastics in soil, compost, and other organic matrices.

ASTM standards are developed by Technical Committees composed of volunteer members from industry, government, academia, and other interest groups. Anyone with an interest can become an ASTM member and sit on committees; all subcommittee members have veto powers, and standards undergo two rounds of peer review before publication.

Many state measurement protocols for compost use the test methods in the U.S. Composting Council's TMECC (Test Methods for the Examination of Composting and Compost). An effort is underway to update TMECC test methods to address measurement of microplastics.

The bottom line: there is currently no standard laboratory protocol for measuring physical contaminants such as microplastics in depackaged food waste or in digestate and compost. **The lack of ability to regulate microplastics in end products — driven in large part by the lack of a standard lab protocol and the unresolved question of how to set limits (volume, weight, particle size) — is a critical bottleneck in regulatory oversight.**

“Opening Pandora’s Box”

In conversations with state regulators, a comment surfaced repeatedly: microplastics can be found in any recycled organic material if one looks for them, including compost. In other words, "Do you really want to open Pandora's Box?" It is similar to comments made about the ubiquitous presence of PFAS. The takeaway: **if regulators and researchers do not look, the quantity of microplastics in depackaged food waste — versus food waste source separated at the point of generation and/or at the processing facility — will not be known.** This is a slippery slope from a regulatory perspective given the increasing adoption of mechanical depackaging.

REGULATORY LOOPHOLES AND THE COMPETITIVE SQUEEZE

Beyond the measurement gap, the research surfaced a second category of concern: **the pathway from stand-alone depackaging to anaerobic digestion is a regulatory vacuum, and the rapid expansion of merchant depackaging services is reshaping the food waste management market in ways that disadvantage clean-feedstock composters.**

For example, stand-alone food waste depackaging facilities, especially when regulated as solid waste processing or materials recovery facilities, do not have to meet contaminant limits for the slurry. The pathway from a stand-alone depackager directly to an AD facility can also escape

having to meet physical contaminant limits when the AD facility and digestate are not subject to contamination limits. Conversely, composting facilities that receive food waste slurry typically do have to meet compost quality standards with contaminant limits.

In North Carolina, a regulatory vacuum has enabled one food waste digester developer to build a new stand-alone AD facility with depackaging without solid waste permits in place. North Carolina DEQ is actively working on a regulatory structure for depackaging facilities (a Notification tier) and has a solid waste rule readoption process targeted for two years out.

Contamination Removal Claims

It is common practice for manufacturers of depackaging equipment and developers of large-scale AD facilities to claim that their equipment yields a 99.9%+ clean food waste stream. **The question is whether these contaminant removal claims have been validated by outside third parties not associated with the company making them** — and what sampling process is used to verify that the "no microplastics" result is consistently replicable. BioCycle is not aware of publicly available third-party lab testing to verify these claims. When BioCycle asked the Washington Department of Ecology if it verifies claims made by depackaging companies, it replied that it does not. In Indiana, regulators rely on information provided by depackaging equipment manufacturers to determine slurry sampling requirements in permits.



Residual Rates and the Whole Picture

The quantity of residuals disposed after depackaging is typically expressed as a percentage — a 10% residual rate, for example — rather than as tonnage or volume. These percentages do not provide the whole picture (10% of what total?), and they do not capture the amount of food waste retained in the packaging residual stream. A spokesperson for Generate Upcycle, which operates the Cayuga Digester in New York State, explained that residual rates with no upfront materials recovery are generally 10–15%; with materials recovery before depackaging, the facility strives for 0–5%.

Several facilities are demonstrating that recovering recyclable materials before depackaging — cardboard especially, but also PET, HDPE, aluminum, and steel — both increases the value of recovered commodities and reduces wear on the depackager. BTS Bioenergy's Maryland Organics Recovery Center (built in 2025) receives palletized food and beverage

loads, removes shrink wrap and cardboard, and runs bottles and cans through a liquid extraction unit before sending the liquid stream to the digester. Vanguard Renewables has built similar pre-depackaging recovery lines at its newest AD facilities.

The Competitive Squeeze on Clean Feedstock

Merchant depackaging services are establishing food waste depackaging infrastructure to facilitate preprocessing of packaged food waste that they collect. One company advertises that mechanical depackaging is available at more than 45 locations across the U.S., and that customers report labor gains of 4 to 12 hours per day per location and increase food waste diversion by 30–70% as a result. Further research is needed to determine whether this rapid deployment of depackaging infrastructure is happening in a regulatory vacuum. What is clear is that **nationwide, depackaging infrastructure has the potential to:**

- **Disincentivize source separation of food waste from the commercial, retail, and food service sectors, and warehouse/distribution centers — leading to downstream contamination of end products.**
- **Eliminate source separation at the point of generation (other than putting packaged food waste in a separate cart from trash), significantly reducing food waste generators' labor costs to divert.**
- **Offer collection services for lower fees than local composters, cutting off the flow of clean food waste materials.**
- **Lock up food waste sourcing contracts with large-scale, stand-alone digesters. To pencil out, these facilities need assured feedstock, leading to multi-year contracts with food waste haulers — contracts that significantly reduce food waste availability for composting operations.**

The 1,475 tons/day Linden Renewable Energy AD facility under construction in Linden, NJ — which includes development of multiple off-site food waste preprocessing and depackaging operations — illustrates the dynamic. A facility of this scale creates a "feed the beast" reality, raising red flags for both the availability of clean food waste streams for composting and the potential of increased microplastics in downstream end products.





SECTION 5

What's Next and Needed?

What's Next and Needed?

Three gaps define the current state of food waste depackaging regulation in the U.S.: a measurement gap, a regulatory gap, and a market gap. Closing them will require coordinated work across researchers, regulators, industry, and advocates.

CLOSE THE MEASUREMENT GAP

Until a standardized protocol for measuring microplastics in food waste streams, slurries, digestate, and compost exists and is adopted into state regulation, regulators have no enforceable baseline. This work can be accelerated by:

- Participating in or helping initiate the development of standardized measurement protocols for microplastics in recycled organics streams.
- Engaging the University of Vermont research team to identify existing barriers and how to address them.
- Assessing the status of the ASTM standards-setting working group for microplastics (ASTM Work Item WK94491) and considering engagement in that process.

- Connecting with the Compost Research and Education Foundation (CREF) on TMECC updates.
- Updating the literature review on microplastics measurement in composts, digestates, and food wastes published by Dr. Porterfield et al. in the Journal of Environmental Quality (January 2023), and contacting authors of relevant papers to surface additional research.





CLOSE THE REGULATORY GAP

The patchwork nature of state regulations would benefit from a shared model that gives state regulators a starting framework. Steps to advance that include:

- Facilitating meetings between state regulators to utilize the findings from this research to lay the groundwork for further discussions about model or best-practice regulations and guidance. A working group could evolve out of those conversations to draft a model rule.
- At a minimum, standardizing how states track depackaging infrastructure and the food waste tonnages processed. Many states surveyed were unsure how many depackaging facilities were operating within their borders. A potential model is to establish some type of permitting or notification requirement for depack facilities that enables tracking of operations, annual reporting of tonnages received and recovered, end-product utilization, and sampling for research. (The North Carolina DEQ is in the process of creating a notification requirement.)
- Assessing whether food waste depackaging is being evaluated in state Extended Producer Responsibility (EPR) packaging schemes. Recovery of food packaging is hindered when it goes through a depackager — the process renders much of it nonrecyclable. This may create a loophole in EPR compliance that is worth examining.

CLOSE THE MARKET GAP

The growth of depackaging infrastructure is reshaping the competitive landscape for clean-feedstock composters in ways the industry has not yet quantified. To better understand the implications, steps such as the following can help:

- Assessing the impact that new depackaging infrastructure is having on the availability of source separated food waste streams for composting facilities — starting with composters within a 50- to 75-mile radius of large-capacity depackaging infrastructure.
- Comparing tipping fees at food waste composting facilities versus depackaging facilities (or, where possible, hauling contracts and pricing that generators have with service providers) to determine where lies the competitive advantage in pricing. This comparison would clarify whether depackaging's market share is being driven by service economics, regulatory vacuum, or both.

Mechanical food waste depackaging is here to stay. The question this research raises is not whether it should exist, but under what conditions — and with what guardrails — it should be allowed to scale. Closing the gaps identified in this report is necessary for depackaging to be a credible part of the organics recycling system rather than a potential liability.



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