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# Evaluating Per- and Polyfluoroalkyl Substances and Microplastics Pollution Prevention Practices in Vermont Food and Beverage Packaging

Emily Smith

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# Project Background

- Vermont law 18 V.S.A. § 1672 (effective July 1, 2023)
  - Prohibits a manufacturer from manufacturing, distributing, or selling a food package in Vermont "to which PFAS is intentionally added and are present in any amount"
- Vermont Department of Environmental Conservation (VTDEC)
  - Desire to help VT food processors reduce contamination in food and food residuals
  - Reduce microplastics and PFAS from entering the environment (e.g., organics stream)
- EPA's FY22-23 Pollution Prevention Grant

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# Project Background - Pollution Prevention Study

- Goals of the study:
  - Determine how PFAS and microplastics were entering the food waste system
  - Help prevent further exposure to consumers and the environment
- Benefits of the study:
  - Identification of PFAS and potential microplastic contamination
  - Environmentally safe and non-toxic packaging alternatives
  - Guidance on complying with the new VT law
  - Technical assistance
  - Share lessons learned

# Company Outreach and Pre-Assessment

- Voluntary, non-regulatory project
- Project scope limited to 3 facility visits
- Interesting survey responses:
  - Most commonly used packaging materials:
    - Paper (including cardboard and uncoated paperboard)
    - Multi-material packaging
  - Used for product stability and materials' recyclability

# Conducting an Assessment

- Determine goals of the inventory
  - **Reduce PFAS and microplastics exposure**
  - Environmental priorities – compostability, waste reduction, recyclable materials, improving sustainability
  - Human health / exposure reduction
  - Regulatory compliance
- Perform targeted inventories
  - Identify materials likely to enter the environment
    - Compostables
    - Disposal in trash receptacles
  - Target materials most likely to contain the contaminant of interest (e.g., PFAS)

# Conducting an Assessment

- List all raw, interim, and consumer facing packaging material
  - Identify reason(s) for current use of packaging type
    - Cost
    - Product shelf life
    - Product stability
    - Barriers/resistance
      - Water vapor barrier
      - Oxygen barrier
      - Aroma barrier
      - Grease/oil resistance
    - Environmental sustainability
      - Recycled content
      - Recyclability
      - Compostability
    - Appearance/marketing

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# Conducting an Assessment

- Evaluate and assign risk values to suspected packaging types
  - Prioritize high risk packaging types for further evaluation

# Environmental Impact

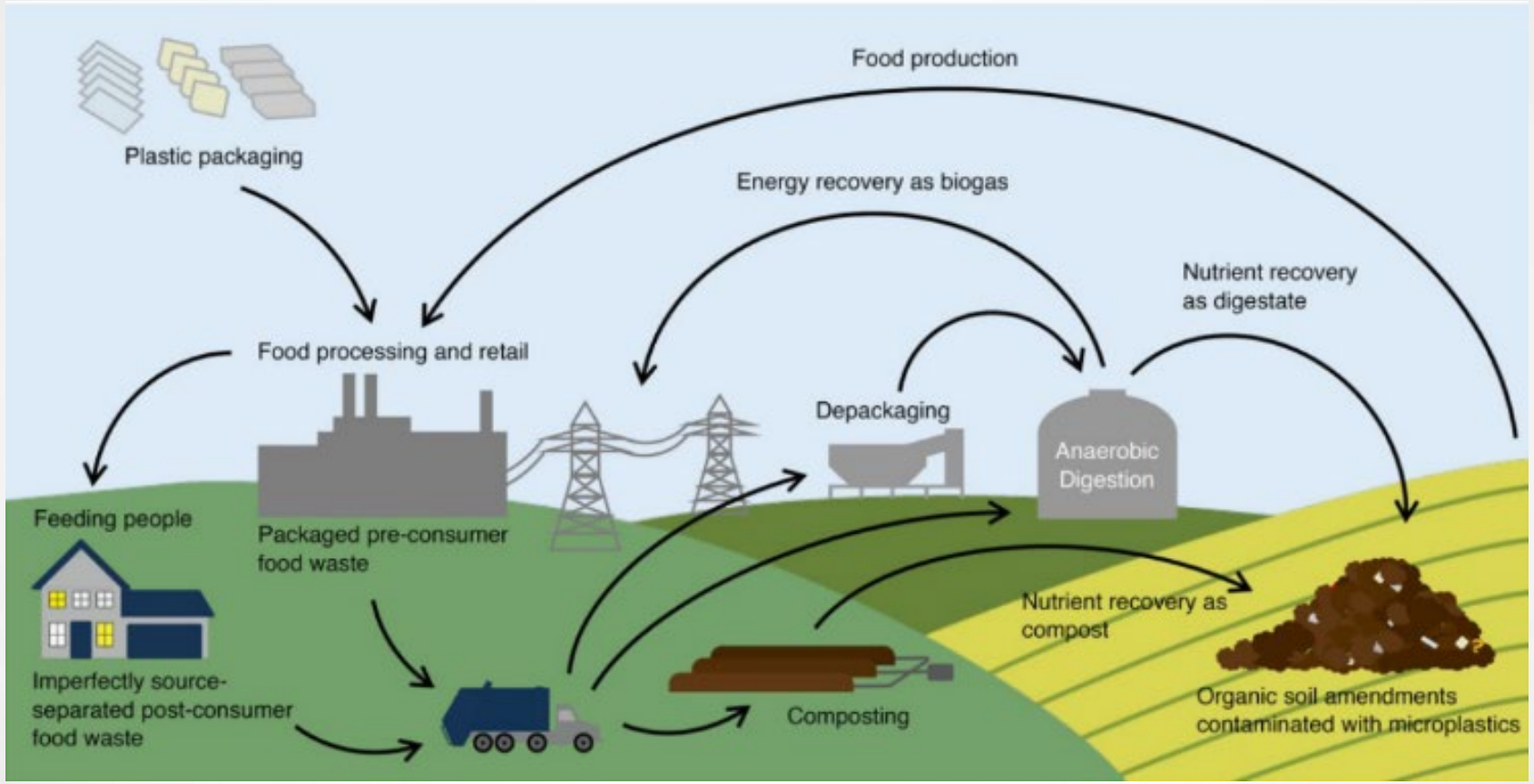


Image from Porterfield et al. 2023

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# Sources of PFAS and Microplastics in Packaging

| PFAS | Both | Microplastics |
| --- | --- | --- |
| ▪ Added **barrier** when plastic containers are formed<br>▪ **Release agents** when containers are manufactured | ▪ **Coatings** to improve oil/grease/moisture resistance of paperboard and labels<br>▪ **Reusable** containers | ▪ Released from **abrasion** when ingredients or food is filled into containers<br>▪ Released from compostable packaging |

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# Sources of PFAS and Microplastics from Manufacturing

## PFAS

- Release agent to remove food from molds
- Cartoners, labelers, conveyors, thermoformers, unnesters, unscramblers inhibit sticking and make production line move smoother/faster
- Ensure ingredient transfer

## Microplastics

- Released from equipment that encounters abrasion from textured foods
- Scuffed conveyors
- Filling operations, extruders, ingredient conveyance systems, hoppers, mixers

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# Key Factors in Assessing Risk

| PFAS | Both | Microplastics |
| --- | --- | --- |
| ▪ Use of recycled content<br>▪ Application of releasing agents<br>▪ Presence of PFAS in condensation polymers<br>▪ Potential for cross-contamination | ▪ Package protection<br>▪ Grease and oil resistance<br>▪ Oil and grease or water testing<br>▪ Visibility of coating<br>▪ Direct food contact | ▪ Water resistance<br>▪ Presence and type of plastic used<br>▪ Scuffing or abrasion of products |

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# Case Study Examples

- Chocolate manufacturer
  - Kraft recyclable content stock boxes
  - Plastic trays
  - Individually wrapped in foil
- Chocolate manufacturer
  - Loose or individually wrapped
  - Mini paper cups
  - Plastic trays
- Coffee manufacturer
  - Multilayer plastic bags
  - Aluminum cans


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# Key Considerations

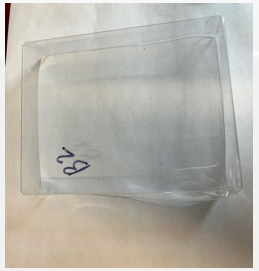
- Risk factors and conclusions should be viewed as subjective
  - Based on our current knowledge and team's expertise
- Used key factors to determine low to high classification
- Limited to physical and visual testing
  - Does not include analytical testing
- Gives manufacturers a starting point for further evaluations

# Lower Potential Risks

| Packaging Material | Direct Food Contact | PFAS Presence | Microplastics Presence | Litter Potential | Potential to Enter Organics Stream | Rationale | Alternative Lower Risk Packaging |
|---|---|---|---|---|---|---|---|
| Plastic Storage Container (PET, PE or PP) | Yes | Low | Low | Low | Low | Low temperature storage<br>**Releasing agents not required**<br>**Minimal abrasion** and limited contact time | None recommended |
| IBC (PET Blow Molded) | Yes | Low | Low | Low | Low | **Single use**<br>**Minimal fat resistance required**<br>**Minimal abrasion** | |
| Plastic Molding/Transportation Tray (PC) | Yes | Low | Low | Low | Low | PC is a rigid plastic<br>High chemical resistance<br>**No releasing agents required** | |
| Plastic Tray (PET) | Yes | Low | Low | Low | Low | PET is not brittle<br>High chemical resistance | |
| Jute Sack (Fiber) | Yes | Low | None | Low | Low | **No oil or grease resistance**<br>**Material does not contain plastic** | |

PET – polyethylene terephthalate; PE – polyethylene; PP – polypropylene; IBC – Intermediate Bulk Container; PC – polycarbonate

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# Increased Potential Risks

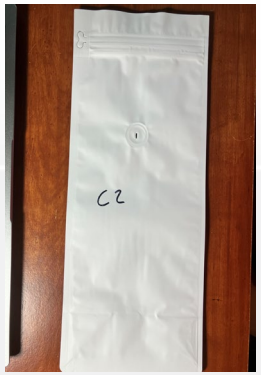
| Packaging Material | Direct Food Contact | PFAS Presence | Microplastics Presence | Litter Potential | Potential to Enter Organics Stream | Rationale | Alternative Lower Risk Packaging |
|---|---|---|---|---|---|---|---|
| Kraft Box / Layer Paperboard (Recycled Paperboard) | Yes | Medium-High | Low | Low | **High** | **Grease resistance;** **Recycled content;** Minimal use of plastic coating | Virgin paperboard; plastic free coated materials; reusable plastic/metal containers |
| Mini Coated Paper Cups | Yes | Low | **High** | **High** | **High** | No recycled paper content; **High oil and water resistance;** **Potential plastic coating;** Paper coating easily removable | More resistant plastic or metalized liner; plastic-free coating |
| Recycled Content Kraft Paper Bag (PLA Composite) | Yes | Low | Medium | **High** | **High** | Uncoated packaging materials; Certain **conditions could potentially release microplastics** | Single-layer resistant polymer |

PET – polyethylene terephthalate; PE – polyethylene; PP – polypropylene; IBC – Intermediate Bulk Container; PC – polycarbonate

# Increased Potential Risks

| Packaging Material | Direct Food Contact | PFAS Presence | Microplastics Presence | Litter Potential | Potential to Enter Organics Stream | Rationale | Alternative Lower Risk Packaging |
|---|---|---|---|---|---|---|---|
| Plastic Lined Bag/Pouch (PET/LLDPE) | Yes | Low | Medium | **High** | Low | No releasing agents required;<br>LLDPE is a soft polymer;<br>**Abrasion** can generate microplastics | More rigid food contact layer |
| Bubble Wrap (PE/PP) | No | Low | Low-Medium | **High** | Low | No releasing agents required;<br>**Punctured bubbles can generate microplastics** | Integrate added cushioning into box design |
| Multilayer Plastic Bag | Yes | Low | Low-Medium | Medium | Medium | No oil or grease resistance;<br>Small filling operation;<br>Limited contact time;<br>**Abrasion** can occur during transport of product | More rigid polymer; metalized film |
| Food Scrap Liner (PLA and additives) | Yes | Low | **High** | Low | **High** | No recycled paper content;<br>**Certain conditions could potentially release microplastics** | No use of compost bags |

PET – polyethylene terephthalate; PE – polyethylene; PP – polypropylene; PLA – polylactic acid; LLDPE – linear low-density polyethylene





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# Recommendations and Findings

- Implement recommended alternative lower risk-based options
- Obtain letters directly from manufacturers of packaging ingredients
- Request FDA approval for products
- Confirm releasing agents are not used
- Confirm bags and corrugated cases are not made from recycled content or are free of PFAS
- Inspect plastic molds, PE liners, PE containers for abrasions
- Use single-use packaging when possible

# Contact Information

## Emily Smith

- Civil & Environmental Consultants, Inc
- Office: 866.312.2024 x 2620
- Mobile: 508.272.3833
- Email: easmith@cecinc.com

## Jonathan Kitchen

- Civil & Environmental Consultants, Inc
- Office: 866.312.2024 x 2621
- Mobile: 508.326.8727
- Email: jkitchen@cecinc.com

## Dr. Claire Sand

- Packaging Technology & Research
- Direct: 612.807.5341
- Email: claire@packagingtechnologyandresearch.com

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# QUESTIONS?