Retail Regulation in 20:20 Hindsight

“Your Toothpaste Might Be Killing The Great Lakes And Congress Is Not Happy”

Kate Sellers, ARCADIS
Outline

• Prologue
• Bringing products to market
• Retail regulation and legislative action
• Looking at risk
• Postscript: *But what about…?*
PROLOGUE
This talk…

**IS:**
- A chance for us to examine the factors that shape risk perception and risk management in a neutral setting

**IS NOT**
- An advocacy piece
- Work performed for a client or by ARCADIS
Risk = Hazard + Outrage

- Peter Sandman
Outrage

• How we perceive risks influences our reaction

• Factors that influence outrage include:
  – Voluntariness
  – Controllability
  – Delayed effect
  – Natural vs manmade
  – Familiarity vs habituation
  – Risk-benefit distribution among people
  – Elimination vs. reduction

(Slovic, 1987; Sandman, 1993)
Survey: Our Views on Risk

<table>
<thead>
<tr>
<th>Product</th>
<th>Purchased/ Used?</th>
<th>Environmental Concerns?</th>
<th>Should be Banned?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microbeads</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fleece clothing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bottled water</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Answer yes or no to the questions for each product.*
Microbead
• Personal care products
• Typ. < 300 um diam.

Microplastic
• Attrition
• Typ. < 1 mm size
BRINGING PRODUCTS TO MARKET
This invention relates to a novel skin cleaner and more particularly to skin cleaners having plastic synthetic resin material in a fine state of comminution included therein so as to impart a scrubbing or mechanical detersive action thereto.

U.S. Patent 3,645,904
Filed 1967, granted 1972

Microbeads in cleansers patented 1972
## Patented Characteristics

<table>
<thead>
<tr>
<th>Composition</th>
<th>Specific Gravity</th>
<th>Particle Size (microns)</th>
<th>Wt% in Cleansers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyethylene</td>
<td>0.910-0.965</td>
<td>74-77 (up to 250)</td>
<td>8 - 10</td>
</tr>
<tr>
<td>Polypropylene</td>
<td>0.900-0.915</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Polystyrene</td>
<td>1.04-1.07</td>
<td>--</td>
<td>4-8%</td>
</tr>
<tr>
<td>Expanded polymers/copolymers</td>
<td>0.015-0.200</td>
<td>80-300</td>
<td>Optimum 0.3-1.5; range 0.1-10</td>
</tr>
</tbody>
</table>

**Measurements on off-the-shelf products:**

- Microbeads 11 – 700 microns in size
- Products 0.19 – 41wt% microbeads

(Zitco and Hanlon, 1991; Gregory, 1996; Fendall and Seell, 2009; Chua et al., 2014)
How much?

• Production data not readily available

• Products “outed” by NGO
RETAIL REGULATION AND LEGISLATIVE ACTION
Calls for action

Given their persistence in the environment, accumulation could occur should these plastic scrubber-containing cleaners become more widely used in the marketplace.

Zitco & Hanlon, 1991
Interest in Microbeads

Stewardship2015

ProductStewardsConference.org  + Salt Lake City, Utah  + June 1 - 3  + #Stewardship15
Outrage in Social Media

These microbeads are made from plastic and don't get filtered out by sewage plants after they go down a drain. SAY NO TO polyethylene beads!

MICRO BEADS AND POLLUTION INTOXICATING WATER

The Environmental Protection Act Passes!
slashedbeauty.com

bye bye, microbeads!

BANNED

Stewardship2015
ProductStewardsConference.org + Salt Lake City, Utah + June 1 - 3 + #Stewardship15
Action

**Voluntary phase out:**
- Colgate Palmolive 2014
- Unilever 2015
- Johnson & Johnson: Phase 1 – 2015, Phase 2 – 2017
- Procter & Gamble 2016
- L’Oreal 2017

**Legislative bans (U.S.)*:**
- Federal (P)
- California (P)
- Connecticut (P)
- Illinois: 2017-2019
- Maine: 2019
- Maryland (P)
- New Jersey: 2018
- New York (P)
- Maryland: 2018
- Michigan (P)
- Minnesota (P)
- Oregon (P)
- Vermont (P)
- Wisconsin: 2019

*As of May 2015.
## Timeline for action

<table>
<thead>
<tr>
<th>Event</th>
<th>Year</th>
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<tr>
<td>Microbeads in cleansers patented</td>
<td>1972</td>
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<tr>
<td>1st published concerns about microbeads</td>
<td>1991</td>
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<tr>
<td>Ban the Bead campaign (2012)</td>
<td></td>
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<tr>
<td>Dutch activists</td>
<td>2011</td>
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<tr>
<td>Illinois bans microbeads</td>
<td>2014</td>
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<tr>
<td>Legal bans take effect</td>
<td>2017-2019</td>
</tr>
<tr>
<td>Major mfg. began phaseout</td>
<td>2013</td>
</tr>
<tr>
<td>Major mfg. complete phaseout</td>
<td>2018</td>
</tr>
<tr>
<td>1st finding microbeads in environment</td>
<td>1991</td>
</tr>
<tr>
<td>Microbeads in plankton samples</td>
<td></td>
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<tr>
<td>Plastic beads in ocean, fish, birds</td>
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**Stewardship 2015**

ProductStewardsConference.org + Salt Lake City, Utah + June 1 - 3 + #Stewardship15
LOOKING AT RISK
Risk = Hazard + Outrage

- Peter Sandman

Your Toothpaste Might Be Killing The Great Lakes And Congress Is Not Happy

A bipartisan bill would ban “microbeads” in personal cosmetics, but the personal care industry has some concerns.

Concerns

"Because they are so small, [microbeads] escape water filtration systems and end up in our bodies of water, including the Great Lakes. They are known to absorb pollutants and are often mistaken as food by fish and wildlife. Simply put, microbeads are causing mega-problems."

Rep. Fred Upton (R-Mich.)
Chairman of the House Energy and Commerce Committee
Co-author bill HR 1321
May 1, 2015
Fate and Transport

Wastewater treatment largely ineffective?

- Separation by density
- Biodegradation
- Floc enmeshment

Microplastics, including microbeads, in discharge from 3 WWTP in New York:

- Avg. 4-32 particles/1000 gal
- Total on the order of $10^5$ to $10^6$ /day

[Chasky et al., 2014]
Fate and Transport

Hypotheses based on properties:

- Float indefinitely and accumulate in ocean gyres
- Slowly degrade
- “Marine snow” and sediment deposition
- Wash up on beaches

Data (to date):

- 3,000 surface water samples worldwide; microbeads common in near-shore samples, not open ocean
- St Lawrence River sediments
- Great Lakes microplastics

[Cozar et al., 2014; Castañeda, 2014]
Microplastics in the Great Lakes

- 2012: Lakes Superior, Huron and **Erie**
  - Towed net (0.333 mm openings) collected 21 samples of floating debris
  - Samples sieved, examined using scanning electron microscopy (SEM)
  - 20 of the samples contained plastic at up to 466,305 pieces/km²
  - 81% particles between 0.355 - 0.999 mm; 47% pellets in that size range

- 2013: Lakes Michigan, Erie and Ontario
  - 91 samples of floating debris
  - Reportedly contained “significant amounts” of microbeads.

[Eriksen et al, 2013; Nalbone, 2014]
Persistent Organic Pollutants

**Hypotheses based on properties:**
- Microbeads will sorb contaminants from the environment
- Enhanced transport of POPs would result

**Data (to date) – plastics in general, not microbeads:**
- Plastic debris in ocean contains hydrophobic compounds, e.g., up to 5 ppm PCBs
- Estimated mass transport to Arctic (per year)

<table>
<thead>
<tr>
<th>Compound</th>
<th>Via all floating plastics</th>
<th>Via water</th>
<th>Via atmospheric transport</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCBs</td>
<td>1 g – 1.6 kg</td>
<td>5.7 tons</td>
<td>8 – 10 tons</td>
</tr>
<tr>
<td>PBDE</td>
<td>25 g – 5.9 kg</td>
<td>--</td>
<td>720 tons</td>
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[Gouin et al., 2010; Zarfl and Matthies, 2010]
Ecological Effects

Hypotheses based on properties:
• Ingested (similar in size to plankton)
• Accumulation; potential mechanical effects
• Potential to release sorbed POPs within organism

Data (to date) for microplastics:
• Laboratory studies:
  – Consumed by planktonic organisms, copepods, invertebrate larvae
  – Accumulation in gut of mussels, translocate, persist (> 48 d)
• 2013 study 1,000 Lake Erie fish: no microbeads in stomachs
• Models and some lab data suggest plastics may sorb rather than release POPs in some organisms

[Cole et al., 2011; Chua et al., 2014; Gouin et al., 2011; Teuten et al., 2009; Bakir et al., 2014; Koelmans, et al., 2013; Koelmans et al., 2014; Browne et al., 2013; Besseling et al., 2012; Ryan et al., 1988; Yamashita et al., 2011; Tanaka et al., 2013]
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<tr>
<th>Event</th>
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<tr>
<td>Microplastics in plankton samples</td>
<td>Early 1960s</td>
</tr>
<tr>
<td>Plastic beads in ocean, fish, birds</td>
<td>1974</td>
</tr>
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*Stewardship2015*

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Re-Examining Outrage

Voluntariness
Controlability
Delayed effect
Natural vs manmade
Familiarity
Risk-benefit
Elimination vs reduction

Stewardship 2015
ProductStewardsConference.org + Salt Lake City, Utah + June 1 - 3 + #Stewardship15
Survey says?
POSTSCRIPT: BUT WHAT ABOUT...?
The “other microplastic”

“*Synthetic fibers are abundant in sludge, sludge products, and sewage treatment plant effluents.* The fibers evidently are introduced from clothes-washing machines and survive the sewage treatment process.”

- Habib et al., 1998

“*Experiments sampling wastewater from domestic washing machines demonstrated that a single garment can produce >1900 fibres per wash.* This suggests that a large proportion of microplastic fibres found in the marine environment may be derived from sewage as a consequence of washing of clothes.”

- Browne et al., 2011
A second look at findings from microbead studies

• NY wastewater treatment plants discharged up to $10^6$ microplastic particles per day, comprising microbeads and fibers from clothing

• Microplastics in sewage sludge disposed at sea comprised 67% polyester and 17% acrylic fibers

• Data from > 3000 surface water samples from around the world showed that “textile fibers are common in near-shore environments”
Why the difference?
References

References (cont’d)

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"Retail Regulation" in 20:20 Hindsight

Why do certain issues ignite public outcry that leads to ‘retail regulation’ and others do not? With the benefit of 20:20 hindsight, this case study will examine the scientific and regulatory context for the ‘Ban the Bead’ campaign against microbeads in personal cleansing products. In an interactive format, attendees will have an opportunity to explore and discuss why such products evoked a passionate public outcry while analogous materials have not.

At the end of the session, attendees will have:
• Gained perspective in an objective setting about the factors that shape retail regulation;
• Explored why one issue may ignite and a similar issue remain dormant;
• Practiced dissecting life cycle issues in a neutral setting.