EBC / SWANA / NRRA

TALKING TRASH

5th Annual Solid Waste Management Conference
Welcome

David Murphy

Chair, EBC Solid Waste Management Committee

Vice President, Tighe & Bond
Welcome

Mike Durfor

Program Co-Chair

Executive Director

Northeast Resource Recovery Association

Environmental Business Council of New England
Energy Environment Economy
Welcome

Kevin Roche

Program Co-Chair
President, SWANA Northern New England

General Manager, ecomaine
PFAS in the Landfill Industry: What to Expect and How to Manage

Elizabeth Denly

Quality Assurance & Chemistry Systems Director

TRC
Environmental

PFAS in the Landfill Industry:
What to Expect. How to Manage.

Fifth Annual Conference on Solid Waste Management in Northern New England

Talking Trash
April 6, 2018
Objectives

• Avoid Surprises
  – Don’t have a regulator or 3rd party identify a previously unknown contaminant of concern.
  – For example: New Hampshire has required every landfill to analyze for PFAS in their monitoring programs.

• Manage Sites Proactively
  – Develop responses prior to a site becoming an emergency.
  – But what constituents might become an issue?

• Maintain a Balanced Approach
Developing a Balanced Approach

- What are emerging contaminants & which ones have regulatory concerns?
  - What’s the probability they’re in my landfills?
  - What regulatory limits are being considered or implemented?
  - What’s their fate and transport. In the landfill? In the environment, especially in groundwater?
  - How do I manage the risk of emerging contaminants?
What are PFAS?

- PFAS = Per- and Poly-Fluoroalkyl Substances
- A large family of chemicals – not naturally occurring
- Used for decades (1940s to early 2000s)
- Wide range of industrial applications:
  - Fire-fighting foams (AFFF - Aqueous Film Forming Foam)
  - Fluoropolymer production/application (Teflon®, Gore-Tex®, Stainmaster®, Scotchgard®)
  - Metal plating, electronic and semiconductor applications, aviation hydraulic fluid, oil/mining production, wire coating, etc.
- Found globally, even in remote places – transported by air
PFAS = \textbf{per} and \textbf{poly} fluoroalkyl substances

\textbf{Per}fluoroalkyl substances – fully fluorinated alkyl tail

\textbf{PFOA}

- Head
  - Hydrophilic
  - Stable daughter in that all but 1 carbon are surrounded with Fluorine molecules

- Tail
  - hydrophobic
  - (makes it a great surfactant)
  - Carbon-Fluorine bond is short and strong (persistence in environment)

\textbf{Poly}fluoroalkyl substances – partially fluorinated alkyl tail

\textbf{Fluorotelomer Alcohol}

- Can biotransform to produce perfluoroalkyl substances
- Precursors

Non-fluorine atom on one or more carbons.
A Brief History of PFAS

1938-1949
• Teflon (PTFE) developed by DuPont
• PTFE used in products

1956
• Stain-resistant products (PFOS)

1968
• Navy developed AFFF (aqueous film forming foam)

1978
• Detected in blood of manufacturing workers

2002
• PFOS manufacturing phased out

2006-2015
• 2006 PFOA phased out
• EPA PFOA Stewardship Program
• 2009 Stockholm Convention

2012-2014
• UCMR-3 Sampling identifies PFAS in 97 public water supplies.

2016
• EPA Health Advisory announced for PFOA/PFOS (70 ppt)

2011-2015
• Several States establish SW & GW standards for PFAS for remediation

2017-2018
• POTWs considering sampling influents
• States taking active roles (e.g., NH requires GW permits to analyze for PFAS)

Conclusion: they’ve been around long enough to be present in most closed landfills.
Sources of PFAS Contamination

- Fire training facilities
- Fire stations
- Landfills (leaching from consumer products)
- Refineries
- DoD sites/Military bases
- Commercial and private airports
- Biosolids land application
- Rail yards
- Chemical facilities
- Plating facilities
- Textile/carpet manufacturers
- Residential areas with septic systems

Fire fighting foams: highest concentrations & most notable known groundwater plumes
Developing a Balanced Approach

- What are emerging contaminants, which ones are a regulatory concern?
- What’s the probability they’re in my landfills?
- What regulatory limits are being considered or implemented?
- What’s their fate and transport. In the landfill? In the groundwater?
- How do I manage the risk of emerging contaminants?
## Regulatory Status – State Standards and Guidance (ppb)

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**International:** Australia, Canada, Denmark, Germany, Italy, Netherlands, Sweden, UK

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Used with permission, ITRC 2017.

NHDES Direct
Contact S-1: PFOA & PFOS: 0.5 mg/kg
Other PFAS Regulatory Strategies

- **Wastewater Treatment Plants**
  - NEBRA has identified landfills as a potential source of PFAS that may affect biosolids
  - WWTPs in areas with PFAS in the public eye have started to analyze industrial influents for PFAS

- **New Hampshire** has required all landfill groundwater monitoring programs to analyze for PFAS constituents.

  October 19, 2017

  Subject: Inclusion of Per- and Polyfluoroalkyl Substances (PFAS) as Contaminants of Concern at New Hampshire Waste Sites
  Clarification to May 18, 2017 Letter

- **NYSDEC** environmental sites are completing PFAS analyses.

  October 2017

  **Issue:** Sampling of drinking water, groundwater water and other environmental media, as performed during remedial programs at State Superfund (SSF) sites, from this point forward, must include analysis for PFOS, PFOA and other associated Per-and polyfluoroalkyl substances (PFAS), as detailed below. Earlier documents
PFAS: The Rapidly Changing Knowledge Landscape

In the last few months:

- **NGWA**: Published groundwater and PFAS: State of Knowledge and Practice
- **ITRC**: Published six PFAS Fact Sheets (one more coming)
- **Michigan**: Established a state standard for PFAS in drinking water of 70 ppt
- **EPA**: Launched a cross-agency effort to address PFAS
- **California**: added PFOS and PFOA to its list of Prop 65 chemicals
  
  Published: Product – Chemical Profile for PFASs in Carpets and Rugs

- **Colorado**: Scheduled a hearing for an Aquifer Specific PFOA/PFOS groundwater standard (70 ppt) for April 18, 2018

- **Wisconsin**: WDNR Published Feb. 1, 2018 RR Report (a newsletter) stating it has authority to regulate PFAS compounds, relying on soil standards and EPA’s HA.
Developing a Balanced Approach

- What are emerging contaminants, which ones are a regulatory concern?
- What’s the probability they’re in my landfills?
- What regulatory limits are being considered or implemented?
- What’s their fate and transport. In the landfill? In the groundwater?
- How do I manage the risk of emerging contaminants?
Fate and Transport of PFAS
Landfill / WWTP / Biosolids

Figure 3. Conceptual site model for landfills and WWTPs.
(Source: Adapted from figure by L. Trozzolo, TRC, used with permission)

Source: ITRC PFAS Team 2018 Environmental Fate and Transport for PFAS Fact Sheet
PFAS detected in:
- Landfill Gas
- Landfill gas condensate
- Ambient air around landfill (and waste water treatment plants)

Volatile Precursors
- Some PFAS (e.g. fluorotelomer alcohols like 8:2-FTOH) have moderate volatility
- These compounds can break down to form shorter chain PFAS in the environment
- Significant PFAS (mostly FTOH) emissions (>1000 g/year) have been calculated from WWTPs and landfills (Ahrens et al, 2011)
PFAS in Leachate

PFAS Studies of Landfill Leachate

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<th>Mean PFAS</th>
<th>Max PFAS</th>
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<td>2.9 ug/L</td>
<td>21.3 ug/L</td>
<td>28 Canadian LFs (Dunan, 2012)</td>
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<td>12.5 ug/L</td>
<td>29 ug/L</td>
<td>18 US LFs (Lang, et.al. 2017)</td>
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<td>0.09 ug/L PFOS</td>
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<td>2.5 ug/L</td>
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<td>2 ug/L PFOSA</td>
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Mean 0.3-17x GW Std (0.04 to 0.4 ug/L).
Max 0.5-25x GW Std (0.04 to 0.4 ug/L).
*Near typical 10x dilution for leachate to groundwater.
*Can be of concern. Site-specifics dictate.

Trends:
- Short-chain PFAS > PFOA/PFOS
- PFAS conc in old & new waste similar
- PFAS conc increases with increasing pH & TOC

BOTTOM LINE: PFAS are likely in your landfill.
PFAS in Landfill Leachate

J. R. Lang, B. McKay Allred, J.A. Field, J.W. Levis, & Morton A. Barlaz

PFAS signature from typical landfills – 5:3FTCA from carpets
PFAS from leachate to POTWs estimated at around 600 kg (1,300 pounds) for 2013
PFAS Mobility

Theses PFAS sites are owned by DoD and are mostly Airforce bases.
Developing a Balanced Approach

- What are emerging contaminants, which ones are a regulatory concern?

- What’s the probability they’re in my landfills?

- What regulatory limits are being considered or implemented?

- What’s their fate and transport. In the landfill? In the groundwater?
  - PFCs
  - 1,4-Dioxane

- How do I manage the risk of emerging contaminants?
  - Sampling & Analysis
  - Separate landfill impacts from other impacts
  - Remediation Alternatives
When to sample?

- Sampling required by State, POTW, etc.
- In high risk settings, when considering:
  - Historical waste types, nearby water supplies, with UCMR detects,....

Analytical techniques

- PFAS – Analyze for PFOA & PFOS only? Others for forensics?
- Field QC and data validation can be critical with ultra low detection limits.

Sampling protocols

- PFAS – special precautions (ultra low detection limits and presence in so many consumer products)
PFAS Methods

- Finished drinking water: EPA Method 537
  - 14 analytes
- Non-potable water: SW-846 Method 8327 draft, fall 2018
  - Direct Injection
  - 24 analytes
- Non-potable water: draft method expected 2019
  - SPE-ID
  - 24 analytes
- Solids: draft method expected 2019
- TOP Assay
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<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N-Methyl perfluoroctane sulfonamidoethanol (N-MeFOSE)</td>
<td>24448-09-7</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N-Ethyl perfluoroctane sulfonamidoethanol (N-EtFOSSE)</td>
<td>1691-99-2</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N-Methyl perfluoroctane sulfonamide (MeFOSA)</td>
<td>31506-32-8</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N-Ethyl perfluoroctane sulfonamide (EtFOSA)</td>
<td>4151-50-2</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2,3,3,3-tetrafluoro-2-(heptafluoropropoxy) propanoate (CF_3CF_2CF_2OCF(CF_3)COO NH_4+) (Gen-X)</td>
<td>62037-80-3</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Separating Impacts
Example: Fingerprinting Multiple Sources of Fire Fighting Foam

PFAS ratios used to demonstrate that the airport (Area 1 and Area 4) is not the source of PFAS in reservoir.

Blue – PFOS
Green - PFHxS
Orange PFOA
Grey PFHxA
PFAS Treatment Technologies – Water

**Ex-Situ**

- **Activated Carbon**
  - Regeneration feasible
  - Less effective for shorter chain PFAS
  - Competitive adsorption from contaminants and organic carbon

- **Reverse Osmosis**
  - Pretreatment
  - Reject water disposal/processing

- **Ion Exchange Resins**
  - Pretreatment
  - Regeneration brine disposal issues

**In-Situ**

- **Liquid Activated Carbon**
  - Competitive adsorption
  - More sites/case studies needed
PFAS Management Strategies

- Recognize that they are in our landfills.

- Recognize potential for risk:
  - Closed, unlined Sites – groundwater
  - Lined Sites – leachate management
  - Waste accepted/Industries (active & historically) in service area
  - Fire fighting foam used at a site?

- Know which sites have high or low risk.

- Actively manage sites with high risk:
  - Sites in areas with sensitized population or regulatory groups
  - Near sensitive receptors – water supplies
  - Potential for high concentrations

- Watch sites with lower risk.
Contaminants of emerging concern have the potential to create unwanted surprises

Each contaminant has challenges in identification, characterization, analyses, and remediation

Rely on proactive approach and experts to consider:
  – Hydrogeology
  – Chemistry
  – Remedial Alternatives

The science (and policy) around contaminants of emerging concern is constantly evolving

Know what’s going on, take control, and manage the outcome
Questions?

Thank you

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www.trcsolutions.com

Acknowledgements:
Michael Eberle, Technical Director, TRC
Ken Quinn, Technical Director, TRC
Disposal Capacity Challenges In New England

Steve Poggi

Area Director of Disposal Operations
New England
Waste Management

Environmental Business Council of New England
Energy Environment Economy
Solid Waste Management in Northern New England
“Talking Trash”

Steven Poggi, Director of Disposal Operations
Waste Management NE & NY Market Area
April 6, 2018
Waste Management NE-UNY Market Area
Waste Management - New England (own/operate)

National:
- Fortune 500 NYSE List, 42k Employees
- 360 Collection Ops & 20M Customers
- 244 Landfills
- Large network of TSs - over 300
- Operate 127 LFGTE plants - 500 MW
- Operate 90+ MRFs - 8.5M TPY

New England:
- 35k+ Commercial Customers
- 12 Collection Districts
- 6 Disposal Sites
- 11 Transfer Stations
- 6 Recycling Facilities: SS + Transload
- 1 C+D Processing Operations
- 1 Organics Processing

Legend
- WM Locations
- WM - New England (Inset)

THINK GREEN.

Page 35
Waste Flow Analysis (All Waste Types) New England

- 2008-16 MSW volumes decreased 7% or 800+k tons following recession.
- Volumes have picked up in NE over last 2 yrs. as economy improves.
- MSW disposal capacity is getting tighter, with outlets for soils increased.
- Disposal generally split between landfills and WTE with approximately ~ 6 M TPY in permitted capacity.
- Future: Transfer operations to sites outside of NE will grow.

Waste Flow

<table>
<thead>
<tr>
<th>Waste Flow</th>
<th>Nationally</th>
<th>NE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landfill</td>
<td>54%</td>
<td>34%</td>
</tr>
<tr>
<td>Transfer Station</td>
<td>12%</td>
<td>25%</td>
</tr>
<tr>
<td>MRF</td>
<td>34%</td>
<td>34%</td>
</tr>
<tr>
<td>WTE</td>
<td>12%</td>
<td>41%</td>
</tr>
</tbody>
</table>

Sources: EPA, GAA, MADEP, RIDEM, NHDES, MEDEP, CTDEP, BioCycle Magazine, EEC of Columbia University
# Commercial Landfills in ME, VT, NH & MA

<table>
<thead>
<tr>
<th>Provider</th>
<th>Landfill Assets</th>
<th>Operation Status</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Traditional</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| National Companies | 6 MSW Landfills                          | • Smaller sites are closing  
• 3 closed in the last few years  
• 2 more closing w/in 4 years, leaving 4 comm. LFs in NE  
• Long haul disposal will fill needed disposal capacity for municipal and private customers |
| Regional Companies | 4 MSW Landfills                          | • 2 closing within 4 years, leaving 2 regional comm. LFs  
• Landfill disposal sites in northern NE states  
• Rail Haul options are being pursued                                                                             |
| **Non-Traditional**|                                          |                                                                                                                                                  |
| Ash landfills      | 7 - Ash Landfills supporting WTE         | • Primarily serves the ash disposal needs for the WTE plants in Mass. Collectively accepted 900,000 TPY.                                           |
| Impacted Soils     | 8 + various operations                   | • New landfills & closures approved by MADEP serving the needs of developers with impacted soils: Tewksbury, Chelmsford, Clinton, Blue Hills, Rutland, Dartmouth, Upton, Westfield |
### Projected Massachusetts Disposal Capacity

(Per Massachusetts DEP Solid Waste Data update)

<table>
<thead>
<tr>
<th>Municipality</th>
<th>2014 Actual Disposal</th>
<th>Permitted Capacity</th>
<th>End of current permitted capacity</th>
<th>Lifetime of LF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active Landfills</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bourne</td>
<td>166,694</td>
<td>219,000</td>
<td>2016 2025</td>
<td>219,000</td>
</tr>
<tr>
<td>Carver</td>
<td>120,449</td>
<td>620,500</td>
<td>2018 2021</td>
<td>620,500</td>
</tr>
<tr>
<td>Chicopee</td>
<td>218,328</td>
<td>365,000</td>
<td>2017 2017</td>
<td>365,000</td>
</tr>
<tr>
<td>Dartmouth</td>
<td>93,338</td>
<td>115,000</td>
<td>2018 2026</td>
<td>115,000</td>
</tr>
<tr>
<td>Middleborough</td>
<td>36,283</td>
<td>60,000</td>
<td>2020 2029</td>
<td>60,000</td>
</tr>
<tr>
<td>Nantucket</td>
<td>2,314</td>
<td>26,000</td>
<td>2020 2030</td>
<td>26,000</td>
</tr>
<tr>
<td>Southbridge</td>
<td>403,730</td>
<td>405,600</td>
<td>2017 2017</td>
<td>405,600</td>
</tr>
<tr>
<td>Taunton</td>
<td>97,565</td>
<td>120,120</td>
<td>2019 2019</td>
<td>120,120</td>
</tr>
<tr>
<td>Westminster</td>
<td>223,894</td>
<td>390,000</td>
<td>2017 2024</td>
<td>390,000</td>
</tr>
<tr>
<td>Municipal Waste Combustors</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agawam</td>
<td>121,334</td>
<td>131,400</td>
<td>131,400</td>
<td>131,400</td>
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<tr>
<td>Haverhill</td>
<td>588,265</td>
<td>602,250</td>
<td>602,250</td>
<td>602,250</td>
</tr>
<tr>
<td>Millbury</td>
<td>477,064</td>
<td>529,575</td>
<td>529,575</td>
<td>529,575</td>
</tr>
<tr>
<td>North Andover</td>
<td>453,613</td>
<td>460,500</td>
<td>460,500</td>
<td>460,500</td>
</tr>
<tr>
<td>Pittsfield</td>
<td>77,443</td>
<td>84,000</td>
<td>84,000</td>
<td>84,000</td>
</tr>
<tr>
<td>Rochester</td>
<td>1,117,131</td>
<td>1,591,200</td>
<td>1,591,200</td>
<td>1,591,200</td>
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<tr>
<td>Saugus</td>
<td>433,777</td>
<td>460,500</td>
<td>460,500</td>
<td>460,500</td>
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<tr>
<td>TOTAL PERMITTED CAPACITY</td>
<td>6,180,645</td>
<td>6,180,645</td>
<td>5,961,645</td>
<td>4,801,045</td>
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<tr>
<td>TOTAL POTENTIAL CAPACITY</td>
<td>6,180,645</td>
<td>6,180,645</td>
<td>6,180,645</td>
<td>5,410,045</td>
</tr>
<tr>
<td>KEY:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Permitted Capacity</td>
<td>Number without shading</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potential Additional Capacity</td>
<td>Number with shading</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ESTIMATED TOTAL POTENTIAL AVAILABLE CAPACITY</td>
<td>5,205,733</td>
<td>5,205,733</td>
<td>5,205,733</td>
<td>4,758,785</td>
</tr>
<tr>
<td>58% of potential for LFs and 100% of combustion capacity actual combustion amount will vary slightly year to year</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Potential LF Capacity</td>
<td>1,346,308</td>
<td>1,346,308</td>
<td>1,346,308</td>
<td>899,360</td>
</tr>
</tbody>
</table>

Actual 2014 disposal for MWCs is actual tonnage burned minus post combustion metal recovery.

MWC disposal capacity is not a fixed tonnage amount, but rather a function of the facility’s air permit and may vary slightly.
## WM of New England landfills
### Anticipated annual tons and site life (w/o expansions)

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rochester</td>
<td>1,082,000</td>
<td>1,135,000</td>
<td>1,135,000</td>
<td>1,135,000</td>
<td>1,135,000</td>
<td>1,135,000</td>
<td>1,135,000</td>
<td>2024</td>
</tr>
<tr>
<td>Norridgewock</td>
<td>275,000</td>
<td>329,000</td>
<td>350,000</td>
<td>350,000</td>
<td>350,000</td>
<td>350,000</td>
<td>350,000</td>
<td>2024</td>
</tr>
<tr>
<td>Fitchburg</td>
<td>417,000</td>
<td>445,000</td>
<td>450,000</td>
<td>500,000</td>
<td>500,000</td>
<td>500,000</td>
<td>450,000</td>
<td>2024</td>
</tr>
<tr>
<td>Taunton</td>
<td>115,000</td>
<td>115,000</td>
<td>120,000</td>
<td>120,000</td>
<td>20,000</td>
<td></td>
<td></td>
<td>2020</td>
</tr>
<tr>
<td>Middleboro</td>
<td>57,000</td>
<td>55,000</td>
<td>60,000</td>
<td>60,000</td>
<td>60,000</td>
<td>60,000</td>
<td>60,000</td>
<td>2031</td>
</tr>
<tr>
<td>Chicopee</td>
<td>210,000</td>
<td>235,000</td>
<td>250,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2018</td>
</tr>
<tr>
<td>Barre</td>
<td>36,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2016</td>
</tr>
<tr>
<td>Total:</td>
<td>2,192,000</td>
<td>2,314,000</td>
<td>2,365,000</td>
<td>2,115,000</td>
<td>2,165,000</td>
<td>2,165,000</td>
<td>2,095,000</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:** 1. Tonnages are MSW, C+D, and SPW; ADC volumes not included unless a small site or in closure.
Regional Disposal Capacity is Declining
 Massachusetts is greatest generator & seeing the greatest drop

• New England disposal capacity is down over 1MM tons over past few years
• MERC WTE traditionally took 170k tons from out of state. PERC potential closure by 2019.
• Another 449k of capacity will come off line in 2018
• Total New England disposal coming off line estimated to be ~ 2 MM TPY in the 2010’s

### Recent Off-Line Disposal Capacity

<table>
<thead>
<tr>
<th>Disposal Site</th>
<th>Annual Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall River, MA</td>
<td>468,000</td>
</tr>
<tr>
<td>Granby, MA</td>
<td>235,000</td>
</tr>
<tr>
<td>MERC, ME</td>
<td>293,000</td>
</tr>
<tr>
<td>Barre, MA</td>
<td>93,600</td>
</tr>
<tr>
<td>Claremont, NH</td>
<td>73,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,162,600</strong></td>
</tr>
</tbody>
</table>

### Pending Off-Line Disposal Capacity

<table>
<thead>
<tr>
<th>Disposal Site</th>
<th>Annual Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chicopee, MA</td>
<td>365,000</td>
</tr>
<tr>
<td>Pittsfield, MA</td>
<td>84,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>449,000</strong></td>
</tr>
</tbody>
</table>

### Possible Off-Line Disposal Capacity

<table>
<thead>
<tr>
<th>Disposal Site</th>
<th>Annual Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Southbridge, MA</td>
<td>405,600</td>
</tr>
</tbody>
</table>
Waste Industry Challenged - shrinking disposal capacity

In New England and New York:
- Landfill disposal capacity shrinking in NE/NY as operators see increased opposition to expansions. Between 2014-2024 it is est. NE (2.1M TPY) and NY (3.8M TPY) could lose a total of 5.9M TPY of capacity.
- WTE disposal capacity is generally stable.

- Recent Closures - Barre LF (100k TPY), Granby LF (100k TPY), South Hadley LF (100k TPY), and Claremont WTE (80k TPY)
- Pending Closures - Chicopee LF (WM) (365 k TPY) and Pittsfield WTE (80k TPY)
- Southbridge LF (Casella) - exp. DEP ‘unsuitable’ ruling ~ 350k TPY closing 2018?
- Bethlehem LF (Casella) exp. neg. Town vote in March ~ 350k TPY closing 2021?
- Seneca Meadows LF (Progressive) – Local Law #3 requires closure in 2025; ~ 2.2 M TPY closing 2023 at current disposal rates?
- Albany Rapp Rd. LF - 275k TPY capacity, now limited to City’s 35k TPY (240k lost)
- Colonie LF (Waste Connections) – proposed 20-year exp. challenged (250 TPY)
Waste Industry Responding to Current Challenges

At the Regional level:

- Abundant Capacity located nationally - outside of New England
- Transfer capabilities are being permitted to take advantage of this capacity outside of NE
- Rail transfer projects under permitting & development
  Seven (7) rail projects in Mass; one (1) in RI; and three (3) in CT (South Hadley, MA; Devens, MA; Champion City Brockton, MA; Tri-County Ware, MA; Vinagro in RI; Holbrook, MA; MHF Logistical Solutions in Worcester, MA; Western Processing in Wilbraham, MA; RED Log. In Portland, CT; Circle of Life in New Haven, CT; City Carting, Milford, CT) are now or planning to move volumes out of NE, take advantage of overcapacity in states such as PA and Ohio
- Capacity is being extended at larger regional sites. Expansion plans to keep sites operating, but not necessarily increased disposal capacity.
Waste Industry Reflections

• Volumes generated in NE declined ~1M tons over last 10 yrs. following the economic slowdown & waste diversion, now leveling off

• Landfill disposal capacity is becoming more difficult to permit

• PPA for WTE plants are expiring, challenging their future viability/expan.

• Disposal capacity is shrinking quicker than alternatives can replace it

• Recycling is not filling the gap and is presenting its own challenges

• Future technologies advancing slowly & not yet proven commercially viable

• Volumes will continue to move across state lines with long haul options growing as NE capacity becomes limited
Capacity Challenges and Regulatory Updates – Vermont & New Hampshire

Emily Boedecker

Commissioner

Vermont Department of Environmental Conservation
VERMONT: DISPOSAL CAPACITY CHALLENGES AND UPDATES ON MANAGING WASTE

“TALKING TRASH”
APRIL 6, 2018

Emily Boedecker, Commissioner
Vermont Department of Environmental Conservation
2016:
345,674 tons of MSW was disposed of in Vermont
100% was Vermont generated MSW
Disposal in Vermont – Other Materials

- VT C&D, 294
- OOS C&D, 9,168
- VT Sludge, 7,465
- OOS Sludge, 22,292
- OOS Asbestos, 17,118
- Asbestos, 603
- OOS Ash, 994
- Contaminated Soils, 2,149
- OOS Contaminated Soils, 8,608
- OOS other, 12,445
- OOS other, 12,445
- other, 2,937
- Medical waste, 98
- paper sludge, 759
- sewer grit, 840
Diversion - Growing

Targeted 50% Diversion Rate
• NEWSVT Inc. - Currently the only permitted landfill in Vermont

• Permitted for 600,000 tons per year

• Averages ~1,600 tons per day

• Application currently technically complete

• Proposed expansion would provide 22 years of additional capacity at current landfill
Solid Waste Management Regulations

- Last updated in 2012
  - Primarily to add composting

- Goals of Draft
  - Restructure
  - Incorporate procedures
    - over the years 25 procedures were developed to regulate landfills, 15 have been moved into rule. The remaining 10 are guidance type procedures.
  - Update technical provisions
Impact on Disposal

- Disposal of development soils at categorical disposal facilities
- More proscriptive landfill cap and cover transitions
- Updated landfill gas management requirements
- Updated leachate collection and removal requirements
- Clarification of application submittals
- Permit-by-Rule: post-closure and custodial care
Disposal vs. Materials Management

Considerations:

- How much?
- Type of Waste?
- Can it be reduced? Put to better use?
- Incentives?
- Who should be involved?
- What about other places?
How Much of This Can Be…
… Managed More Sustainably
~50% of MSW could be recycled or composted

Vermont Residential MSW: 2012

~60,000 tons of food disposed each
Materials Management Programs

Target Components of Wastestream

- Extended Producer Responsibility (EPR) Programs for challenging to manage materials

- Universal Recycling: recyclables and organics
  - 8.5% decrease in MSW disposal in 2 year period
  - 3% increase in amount recycled
  - Food rescue doubled 2014 to 2016

- Architectural Waste for certain C&D (diverted 16,000 tons 2017)

- Beyond Waste, next targeted materials
MSW waste composition by weight: 2013; projected 2022 under Act 148; potential future

Excludes C&D reported as MSW
Diverted amount includes estimated error associated with undocumented organics diversion
Crisis or Opportunity?
Stay Tuned!

Website -- www.vtrecycles.com

Follow us on Facebook, Twitter, & Instagram @VTrecycles
Capacity Challenges and Regulatory Updates – Vermont & New Hampshire

Pamela Hoyt-Denison

Administrator, Waste Programs

New Hampshire Department of Environmental Services
New Hampshire
Solid Waste Disposal Capacity & Regulatory Updates

Presented by
Pamela Hoyt-Denison, Administrator, Waste Programs
Waste Management Division
NH Department of Environmental Services
at
EBC / SWANA / NRRA
5th Annual “Talking Trash” in Northern New England
Manchester, New Hampshire
April 6, 2018
New Hampshire
SW Disposal Capacity & Regulatory Updates

1. Overview of NHDES’ Solid Waste Program

2. Disposal Capacity

3. Regulatory Updates

4. Conclusion
New Hampshire
Solid Waste Management Program

- RSA 149-M Solid Waste Management Act
  - Establishes authority & requirements
- NHDES regulates over 900 solid waste facilities, including:
  - Transfer stations
  - Processing/treatment facilities
  - Landfills (active and closed)
  - Motor vehicle salvage yards
  - Asbestos disposal sites (ADS)
- Various responsibilities include:
  - Facility permitting
  - Compliance assurance
  - Operator training and certification
  - Grants management
NH’s Waste Management Hierarchy

- Landfilling predominates
- Waste-to-Energy facilities facing pressures
- Continuing & new pressures on recycling
- Organics diversion slow to occur
- Agency’s ability to influence is limited
Before Disposal: Diversion---Current Projects

- Composting
  - Promote diversion of organics through composting
  - Meeting with stakeholder workgroups
  - Building internal capacity through technical training & networking
  - Partnering on technical trainings
  - Anticipate revising rules and publishing related guidance

- Impacted Soils
  - Identify non-landfilling reuse options (“Limited reuse soils or “LRS”)

- Data Compilation and Analysis
  - Review of how waste management data is measured and reported
**Disposal Capacity**

- NH disposes of about 1.1M tpy of in-state generated waste
- Most waste is disposed in our 6 MSW landfills and 1 WTE plant
- NH disposal facilities also accept about 1M tpy of imported waste
- Current disposal capacity anticipated through 2022
- NHDES has received applications for expansion of existing landfills or transfer stations
- NHDES welcomes applications for both proven diversion technologies and innovative technologies
Regulatory Updates: Emerging Contaminants & Changing AGQS

181 Landfills monitored under GW Permits

- PFAS AGQS set at 70 ng/L
  - PFAS = PFOA, PFOS and PFOA+PFOS
  - Detected at most monitored landfills
- 1,4-dioxane AGQS change
- AGQS for some other compounds changing
- Continued monitoring & assessment of LFs
- Site-specific responses, as appropriate

- AGQS proposed changes (Env-Or 600):
Regulatory Updates: Construction & Demolition Debris

- 2007: C&D burning banned by NH Legislature
- 2016: Legislature approved limited C&D combustion
  - 10,000 tons between November 15 and April 15 each year at approved facilities
  - Cannot be implemented until new rules adopted and facility permits are updated
  - New rules are being drafted by both Air Resources Division and Solid Waste Management Bureau
- 2018: Pending legislation to allow production of fuel (e.g., bio-oil, bio-synthetic gas) derived from pyrolysis/gasification of C&D debris
Regulatory Updates: Inactive Asbestos Disposal Sites

- 300 +/- Inactive Asbestos Disposal Sites in NH
- Applicable rules (Env-Sw 2100) are expiring
- Initial proposal to readopt with amendments filed in February
  - https://www.des.nh.gov/organization/commissioner/legal/rulemaking/index.htm#proposed
- Public hearing was held March 28, 2018
- Comments accepted through April 13, 2018 until 4 pm
- Final proposal to be filed by July 2018
In response to stakeholder concerns, NHDES updated/revised.

Changes were primarily related to permit modifications, including requirements relative to:

- 10\% debt and equity holders,
- Compliance certifications, and
- Background investigations.

Clarified and made easier for regulated entities to comply.

These changes took effect October 21, 2017.

Thank you

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Recycling Markets – China’s National Sword

Mike Durfor

Executive Director

Northeast Resource Recovery Association
TALKIN TRASH 5.0
CHINA SWORD
APRIL 6, 2018

Bob Cappadona – Casella
Mike Durfor - NRRA
National Sword — What is It and How will it Impact My Program?

Dylan de Thomas, The Recycling Partnership
October 19, 2017
Green Fence
Earth Goddess
Where Did It Come From?

- Like Green Fence in 2013, stemmed from a media scandal
- At core, a political issue for China
China is tightening the screw and we have to respond

U.S. companies concerned at China’s proposed ban

Largest waste firms say their recycling loads are certified and clean.

What comes next after China’s scrap ban surprise?

China's War on Foreign Garbage

Imported recycling has been a boon for China. So why ban it?
Where Did It Come From?

- Anti-pollution and anti-corruption measures are connected and popular
- High-profile enforcement

Xi’s Speech Had 89 Mentions of the ‘Environment,’ Just 70 of the ‘Economy’

China’s Xi Looks to Strengthen His Hand at Upcoming Communist Party Congress

China televises raids to enforce National Sword
What is Happening in China?

**China is facing a Severe Environmental Crisis**

- 60% of groundwater unfit for human consumption ...
- 19% of arable land contaminated with heavy metals ...
- Only 84 out of 338 prefecture-level or higher cities attained the national standard for air quality ...
- Rising social pressure: pollution related social incidents leading cause of social instability

**Result of many factors, including:**
- Decades of putting economic growth above the environment
- Lack of enforcement of existing environmental laws
- Lack of centralized control
- Staggering increase in urbanization
- 100 million new cars on the road in the last decade
What is National Sword?

- Inspections of plastics recycling facilities
- 900 facilities inspected, 590 with rule violations
- 53 were already closed, 383 suspended operations
What is National Sword?

- Import licenses not being renewed
- Customs enforcement in ports known for scrap
- Loads have been rejected
China’s Scrap Ban

- July 18 WTO Notice
- “4 classes, 24 kinds of scrap”
- All plastics, unsorted mixed paper, textiles, some glass and metals

Chinese authorities seize 85,000 tons in ‘Sword’ raid
While Within China …

July 2017: Country-wide inspection/enforcement actions
  • Environmental inspections found 65% of 1,700+ enterprises non-compliant.
  • Permits revoked, not issued or with smaller quotas; Smaller or lost orders
  • Enterprises closing (e.g., lost customers)

Restrictions on quotas within import licenses

March-Dec 2018: “Blue Sky” 2018
  • General Administration of Customs focused on “combating smuggling “foreign garbage” in the forms such as false declaration and concealing as well as transporting by sea or land where there are no customs”
Why Does It Matter?

- Approximately 30% of all recyclables collected are exported outside the U.S.
- Hong Kong and China account for 69% of all U.S. exports for plastics other than No. 1 PET
Why China is so Important to the Global Recycling Industry?

Mainland China's Share of Global Imports for Selected Recycled Commodities, 2016(p)
Source: UN Comtrade Database

- Iron and Steel Scrap: 3% China, 97% RoW
- Copper Scrap: 55% China, 45% RoW
- Aluminum Scrap: 24% China, 76% RoW
- Recovered Paper and Fiber: 55% China, 45% RoW
- Plastic Scrap: 51% China, 49% RoW
Today’s U.S. Recycling Industry: A Snapshot

155,000 Direct Employment plus 378,000 jobs throughout the economy indirectly supported by recycling 130,000,000+ Tons processed annually

Iron/Steel 67.0 Copper 1.8 Plastics 3.5 Paper 47.2 Lead 1.2 Electronics 5.0 Aluminum 5.0 Zinc 0.12 Tire (#) 122

In millions of tons (or other unit shown)
31% of all US scrap commodity exports – worth $5.6 billion – shipped to China in 2017.

- Recovered fiber: China is by far our most important market

- Plastics: China 67% of exports (although declining y-o-y)

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>14,292,148</td>
<td>14,979,154</td>
<td>14,527,207</td>
<td>-3.00%</td>
</tr>
<tr>
<td>India</td>
<td>1,747,162</td>
<td>1,654,455</td>
<td>1,728,272</td>
<td>4.50%</td>
</tr>
<tr>
<td>Mexico</td>
<td>1,321,855</td>
<td>1,290,741</td>
<td>1,646,529</td>
<td>26.80%</td>
</tr>
<tr>
<td>Korea</td>
<td>1,112,365</td>
<td>1,120,781</td>
<td>1,140,405</td>
<td>1.80%</td>
</tr>
<tr>
<td>Canada</td>
<td>710,905</td>
<td>650,515</td>
<td>717,540</td>
<td>10.30%</td>
</tr>
<tr>
<td>Indonesia</td>
<td>368,863</td>
<td>318,884</td>
<td>419,583</td>
<td>31.60%</td>
</tr>
<tr>
<td>Thailand</td>
<td>202,426</td>
<td>308,477</td>
<td>324,618</td>
<td>5.20%</td>
</tr>
<tr>
<td>Taiwan</td>
<td>257,226</td>
<td>151,052</td>
<td>201,739</td>
<td>47.40%</td>
</tr>
<tr>
<td>Vietnam</td>
<td>74,237</td>
<td>111,118</td>
<td>133,907</td>
<td>20.40%</td>
</tr>
<tr>
<td>Italy</td>
<td>89,894</td>
<td>112,536</td>
<td>102,700</td>
<td>-8.70%</td>
</tr>
<tr>
<td>Japan</td>
<td>51,910</td>
<td>84,342</td>
<td>101,223</td>
<td>20.00%</td>
</tr>
<tr>
<td>Netherlands</td>
<td>80,373</td>
<td>90,550</td>
<td>88,467</td>
<td>-2.40%</td>
</tr>
<tr>
<td>Colombia</td>
<td>73,428</td>
<td>81,768</td>
<td>88,309</td>
<td>8.00%</td>
</tr>
<tr>
<td>Germany</td>
<td>36,122</td>
<td>53,761</td>
<td>52,949</td>
<td>-1.50%</td>
</tr>
<tr>
<td>Chile</td>
<td>65,279</td>
<td>43,363</td>
<td>45,048</td>
<td>2.50%</td>
</tr>
</tbody>
</table>
2017 Paper Scrap Exports from the EU

Europe’s paper scrap exports to China halved between January and November 2017

SOURCE: Eurostat, Resource Recycling and CEPI
Recycling Commodity Markets Overview
American recycling is stalling, and the big blue bin is one reason why

Recycling Industry Facing ‘Nationwide Crisis,’ Waste Management CEO Says

The Reign of Recycling

By JOHN TIERNEY  OCT. 3, 2015

If you live in the United States, you probably do some form of recycling. It’s likely that you separate paper from plastic and glass and metal. You rinse the bottles and cans, and you might put food scraps in a container destined

‘Heavy Hitters’ in waste management call recycling ‘broken model’
And It’s All Single-Stream’s Fault
• According to WM figures, contamination of loads is an average of 16% of inbound tons.
• Contamination can be up to 50% of incoming loads.
• Processing costs continue to increase as markets demand reduced contamination. This drives up cost to customers.

And It’s All Glass’ Fault

Glass 'recycled' in curbside bins actually goes to landfill
Orange Grove Center not yet ready to sort it; raising $1.6 million for new recycling equipment

Houston City Council Approves New Recycling Contract, Excludes Glass
Residents now have four months until a ban on glass in green bins goes into effect.

Business
High Costs Put Cracks in Glass-Recycling Programs
Some cities pull back as processors begin to charge for accepting trash-heavy shipments

Value of a Commingled Ton

Source: Scott Mouw, NC DNER, 2016
## World’s Largest Plastic Scrap Exporter: U.S.

<table>
<thead>
<tr>
<th>Top 20 Plastic Scrap Exporters</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>2,127,877</td>
<td>2,011,095</td>
<td>1,909,535</td>
<td>2,172,382</td>
<td>2,043,124</td>
</tr>
<tr>
<td>Japan</td>
<td>1,631,455</td>
<td>1,673,620</td>
<td>1,681,733</td>
<td>1,670,228</td>
<td>1,606,271</td>
</tr>
<tr>
<td>Germany</td>
<td>1,462,561</td>
<td>1,511,349</td>
<td>1,324,863</td>
<td>1,453,609</td>
<td>1,376,833</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>880,577</td>
<td>811,509</td>
<td>648,614</td>
<td>764,404</td>
<td>791,554</td>
</tr>
<tr>
<td>Netherlands</td>
<td>381,131</td>
<td>428,666</td>
<td>464,294</td>
<td>431,322</td>
<td>505,903</td>
</tr>
<tr>
<td>France</td>
<td>502,826</td>
<td>508,034</td>
<td>454,119</td>
<td>483,026</td>
<td>468,754</td>
</tr>
<tr>
<td>Mexico</td>
<td>442,197</td>
<td>522,143</td>
<td>517,067</td>
<td>862,744</td>
<td>449,974</td>
</tr>
<tr>
<td>Belgium</td>
<td>414,619</td>
<td>456,860</td>
<td>471,666</td>
<td>437,310</td>
<td>430,720</td>
</tr>
<tr>
<td>Spain</td>
<td>192,363</td>
<td>236,880</td>
<td>225,844</td>
<td>333,466</td>
<td>329,937</td>
</tr>
<tr>
<td>Thailand</td>
<td>232,170</td>
<td>263,128</td>
<td>317,540</td>
<td>346,912</td>
<td>265,390</td>
</tr>
<tr>
<td>Italy</td>
<td>269,601</td>
<td>228,019</td>
<td>191,621</td>
<td>175,859</td>
<td>223,076</td>
</tr>
<tr>
<td>Canada</td>
<td>197,638</td>
<td>203,046</td>
<td>170,783</td>
<td>193,037</td>
<td>208,939</td>
</tr>
<tr>
<td>Australia</td>
<td>151,209</td>
<td>193,087</td>
<td>155,085</td>
<td>185,705</td>
<td>206,060</td>
</tr>
<tr>
<td>Rep. of Korea</td>
<td>161,358</td>
<td>182,975</td>
<td>183,291</td>
<td>192,851</td>
<td>187,609</td>
</tr>
<tr>
<td>Malaysia</td>
<td>153,865</td>
<td>197,598</td>
<td>250,809</td>
<td>247,007</td>
<td>182,271</td>
</tr>
<tr>
<td>Poland</td>
<td>102,736</td>
<td>101,301</td>
<td>99,431</td>
<td>138,834</td>
<td>166,378</td>
</tr>
<tr>
<td>Austria</td>
<td>133,556</td>
<td>170,389</td>
<td>172,440</td>
<td>182,299</td>
<td>149,306</td>
</tr>
<tr>
<td>Indonesia</td>
<td>166,430</td>
<td>204,750</td>
<td>231,747</td>
<td>193,842</td>
<td>148,735</td>
</tr>
<tr>
<td>Other Asia, nes</td>
<td>164,825</td>
<td>157,914</td>
<td>120,210</td>
<td>146,153</td>
<td>145,125</td>
</tr>
<tr>
<td>Czechia</td>
<td>102,361</td>
<td>115,307</td>
<td>128,813</td>
<td>120,879</td>
<td>123,793</td>
</tr>
<tr>
<td>Hong Kong*</td>
<td>863,754</td>
<td>308,016</td>
<td>190,491</td>
<td>82,698</td>
<td>90,808</td>
</tr>
<tr>
<td>Rest of World</td>
<td>1,755,980</td>
<td>1,660,216</td>
<td>1,934,263</td>
<td>1,946,799</td>
<td>1,740,598</td>
</tr>
<tr>
<td>Grand Total</td>
<td>12,491,089</td>
<td>12,145,903</td>
<td>11,844,060</td>
<td>12,760,676</td>
<td>11,841,157</td>
</tr>
</tbody>
</table>

*Domestic exports, does not include re-exports
Monthly U.S. Plastic Scrap Exports to Mainland China During 2017 (metric tons)

JAN: 74,758
FEB: 75,873
MAR: 73,536
APR: 56,684
MAY: 49,338
JUN: 49,250
JUL: 46,286
AUG: 53,734
SEP: 33,035
OCT: 25,717
NOV: 13,864
DEC: 5,807
What Happens Next?
Looking Forward

- Market growth opportunities in Southeast Asia (Vietnam, Malaysia, Thailand, Indonesia), India, Mexico, Canada and the Netherlands

<table>
<thead>
<tr>
<th>Country</th>
<th>2016 mt</th>
<th>2016 YTD mt</th>
<th>2017 YTD mt</th>
<th>YTD Vol Growth mt</th>
<th>YTD Growth (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>India</td>
<td>61,255</td>
<td>47,884</td>
<td>74,079</td>
<td>26,195</td>
<td>50.00%</td>
</tr>
<tr>
<td>Vietnam</td>
<td>16,290</td>
<td>13,516</td>
<td>29,518</td>
<td>16,002</td>
<td>118.40%</td>
</tr>
<tr>
<td>Malaysia</td>
<td>17,221</td>
<td>12,809</td>
<td>28,015</td>
<td>15,206</td>
<td>118.70%</td>
</tr>
<tr>
<td>Thailand</td>
<td>1,223</td>
<td>810</td>
<td>6,214</td>
<td>5,404</td>
<td>667.00%</td>
</tr>
<tr>
<td>Ecuador</td>
<td>192</td>
<td>12</td>
<td>2,287</td>
<td>2,285</td>
<td>19051.10%</td>
</tr>
<tr>
<td>Korea</td>
<td>224</td>
<td>101</td>
<td>1,972</td>
<td>1,871</td>
<td>1851.20%</td>
</tr>
<tr>
<td>Singapore</td>
<td>1,861</td>
<td>849</td>
<td>1,843</td>
<td>994</td>
<td>117.00%</td>
</tr>
</tbody>
</table>

- Demand growth in the United States
What’s Happening?

- Large regional differences
- Some buying Nos. 3-7 bales
- Some having trouble moving material
- Some paying to move material
- Some producing No. 5 PP bales (Tubs and Lids)
- Some talk of landfilling
Looking Ahead – What’s next

More environmental compliance inspections on Chinese enterprises

Low numbers of approved imports

Potential ban on additional paper, plastics and nonferrous metals
### Disposal Projections in Massachusetts (MSW) 0% per Year Disposal Reduction Scenario

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Total Disposal Tons (baseline)</td>
<td>5,610,000</td>
<td>5,610,000</td>
<td>5,610,000</td>
<td>5,610,000</td>
<td>5,610,000</td>
<td>5,610,000</td>
<td>5,610,000</td>
<td>5,610,000</td>
<td>5,610,000</td>
<td>5,610,000</td>
</tr>
<tr>
<td>Total Disposal Tons (No reduction)</td>
<td>5,610,000</td>
<td>5,610,000</td>
<td>5,610,000</td>
<td>5,610,000</td>
<td>5,610,000</td>
<td>5,610,000</td>
<td>5,610,000</td>
<td>5,610,000</td>
<td>5,610,000</td>
<td>5,610,000</td>
</tr>
<tr>
<td>Average WTE Availability (Tons)*</td>
<td>3,190,000</td>
<td>3,227,000</td>
<td>3,227,000</td>
<td>3,227,000</td>
<td>3,227,000</td>
<td>3,227,000</td>
<td>3,227,000</td>
<td>3,227,000</td>
<td>3,227,000</td>
<td>3,227,000</td>
</tr>
<tr>
<td>Landfill Capacity (Tons)</td>
<td>1,330,000</td>
<td>1,487,845</td>
<td>1,602,970</td>
<td>842,245</td>
<td>842,245</td>
<td>621,000</td>
<td>621,000</td>
<td>621,000</td>
<td>621,000</td>
<td>201,000</td>
</tr>
<tr>
<td>Total Capacity (Tons)</td>
<td>4,520,000</td>
<td>4,714,845</td>
<td>4,829,970</td>
<td>4,069,245</td>
<td>4,069,245</td>
<td>3,848,000</td>
<td>3,848,000</td>
<td>3,848,000</td>
<td>3,848,000</td>
<td>3,428,000</td>
</tr>
<tr>
<td>Delta (Tons)</td>
<td>(1,090,000)</td>
<td>(895,155)</td>
<td>(780,030)</td>
<td>(1,540,755)</td>
<td>(1,540,755)</td>
<td>(1,762,000)</td>
<td>(1,762,000)</td>
<td>(1,762,000)</td>
<td>(1,762,000)</td>
<td>(2,182,000)</td>
</tr>
<tr>
<td>Estimated Total Ash Disposal (Tons)</td>
<td>638,000</td>
<td>645,400</td>
<td>645,400</td>
<td>645,400</td>
<td>645,400</td>
<td>645,400</td>
<td>645,400</td>
<td>645,400</td>
<td>645,400</td>
<td>645,400</td>
</tr>
</tbody>
</table>

**Assumed 0% reduction in disposal**

HDR assumes MADEP Expansions and that Bourne’s current contract with SEAMASS to be extended and allows approximately 30,000 tons of MSW disposal

* HDR Calculation of Average Combustion Rate 2010 - 2016

Source - MassDEP, SWAC, 2016 Solid Waste & Waste Reduction Data
“WHEN WRITTEN IN CHINESE, THE WORD ‘CRISIS’ IS COMPOSED OF TWO CHARACTERS. ONE REPRESENTS DANGER AND THE OTHER REPRESENTS OPPORTUNITY”

John F. Kennedy
National Sword Partnership Messaging

1. Webinar

2. Clean up your recycling stream

3. Talk to Your MRF

4. Don’t change your programs

5. Don’t freak out your residents

6. Don’t feed the trolls
What should MRF operators be doing?
It’s All About Quality!

Clean up your bales:
- Communicate with customers
- Slow down the line
- Hire more workers
  - Some MRFs having trouble finding workers
- Add new technology
  - Optical sorters/robotics

SWANA.org
Time to Change

- We need to change our **thinking**
  - China isn’t going back to pre-Green Fence
  - Other Asian markets may be a temporary band-aid

- We need to change our **messaging**
  - Recycling isn’t free
  - Contamination costs cities/processors lots of $
  - Recycling creates U.S. jobs
  - Re-focus on waste diversion/Zero Waste - Boston

- We need to consider changing the **metrics**
  - Weight-based v GHG reduction v participation rates
What Can/Should we do?

Quality, Quality, Quality ....
Successful recycling is dependent upon Quality

Everyone along the recycling chain has a role:

- Manufacturers need to Design for Recycling™
- Municipalities need to educate the public about what can & cannot be recycled, and design collection systems so as to not mix wastes with recyclables
- Recyclers – including MRFs - need to continue to innovate, looking for ways to change processes and/or technology to increase yields of high quality recyclables

Most importantly, all of us - industry trade associations, governments, brand owners, industrial consumers and others – need to work together, to identify solutions to the ever changing stream of consumer products entering recycling, while also ensuring we meet the needs of the industrial consumer, at the end of the chain, to ensure a quality commodity product.
MOM - Members/Operations/Marketing meetings are held monthly.

In addition, NRRA conducts workshops and facility tours several times a year that can be used for continuing education credits toward transfer facility operator certifications and renewals.

Working Together to Make Recycling Strong!
The NRRA School CLUB

builds Community action by directing youth, teachers, schools, and communities to a clear understanding of pertinent solid and hazardous waste issues and supporting sustainable waste reduction programs.
Ben Harvey is the president of E. L. Harvey & Sons Inc. Ben will share his vast accumulation of knowledge of all facets of the recycling and waste stream business, its history, and, most importantly, its future.
MARKET PREDICTIONS

The future markets are more likely than not to be volatile for some time.

*Beyond that, major unforeseen events could occur totally undermining the stability of the recycling industry.*
NRRA
Your Best Defense Against China’s National Sword

A Recycling Non-Profit Working Together to Make Recycling Strong!
Thank You FOR RECYCLING
NEW HAMPSHIRE The Beautiful Inc.
Recycling Markets – China’s National Sword

Bob Cappadona

Vice President
Casella Recycling LLC
National Sword (Blue Sky)

Bob Cappadona
Vice President
Casella
April 6th, 2018
Casella Company Overview:

- Founded in 1975 with one truck
- 2,000 employees serving over 200,000 customers
- Nearly $600M in annual revenue
- Operating in MA, ME, NH, NY, PA, and VT
- Vertically integrated collection, transfer, disposal and recycling operations
- Provide professional resource management services to over 10,000 business locations in over 40 states
- Recover over 800,000 tons of recycling and over 450,000 tons of organics for beneficial use each year
- Since 2005, cut companywide carbon emissions by 50%
The Casella Recycling Arm

- 17 Recycling Operations
- 6 Single Stream Recycling Operations
- Merchant plants, Operating Contracts, Industrial Processing
- Process and market over 800,000 tons/yr
- Boston, MA MRF – 6th largest in the U.S. (230,000 tons processed in 2017)
National Sword – what is it?

1. Chinese Government initiative to continued reduction in Pollution.
2. A Ban on 24 types of Scrap
New standards set forth

• 13.2 millions tons per year of Recyclables diverted from China to Secondary markets.
• Reduction of import licenses within China.
• Chinese quality spec of no more than 0.5% of “carried waste” within the imported finished product
The Impact to the Value of a Single Stream Ton

- 13.2 millions tons per year of Recyclables diverted from China to Secondary markets.
- Supply and Demand – Mix Paper loses 70% of value.
- “Bottle to Bottle” glass market lost
- Average MRF inbound contamination = 15%
Recycling Commodity Prices At Historical Lows

- National Sword announced
- 13.2 million tons diverted to secondary markets
- Jan, 2018 – Mix Paper price continues to fall with announced closure of Glass plant
- 63% loss in value of SS ton.
Additional Transportation Costs

- Movement of material from Point A to Point B
- E-logs – long hauling 20% less productivity
- Shipments to India – up 400% from January, 2017
- Container lines to secondary markets - pricing up approx 100% (over $30/ton)
Impact to the MRF Operations

- Meet Quality – manage to the designed system throughput
- Additional Labor for quality
- Address Inbound Contamination
- Maintenance
- Possible system modifications
Contamination within the Stream

- Creates downtime and safety concerns.
- “Unacceptables” will get through the system.
- 15% contamination to produce 0.5% finished good
Manage to the Designed Throughput

- Processing design per ton/hour.
- Road to capacity
- Manage the tip floor.
- Maintenance is essential
- “Turtle wins the race”
What can you expect?

• Possible changes to the Acceptable List
• “Renewed Focus” on Contamination
  – Lower tolerance, chargebacks, etc.
• Reduced value to the overall curbside stream.
• Slow movement of material
What you can do in the future?

- Understand your contract
- Stay close to your MRF/Vendor
- Educate the constituents; recycling has never been a free service
- Address contamination
- Simplify the Acceptable list
- Educate, Educate, Educate
Overall Impact to the Recycling sector

- 13.2 millions tons diverted from China – supply and demand results in historical low values.
- 75% of total residential stream now selling at a negative value.
- Average of 15% contamination delivered to the tip floor = finished product of 0.5%.
- Higher processing costs – labor, slower throughput and Capital upgrades.
We believe the 0.5% prohibitive threshold will remain.

Secondary markets will follow strict specifications.

Current systems are designed to produce the ISRI spec (>3%).

A cleaner inbound stream

Equipment upgrades will be considered.

Capacity for Recycling and MSW in the Northeast will be challenging.
Questions?
Thank you for attending!