



Glass Recycling Stakeholder Meeting

January 17, 2019

Agenda



1:00pm - 1:10pm - Welcome & Introductions

- NYS Pollution Prevention Institute
- NYS Department of Environmental Conservation (NYSDEC)

1:10pm – 2:10pm - Guest Speakers

- NYSDEC & NYS Department of Transportation
- Rockland County Solid Waste Management Authority
- Sims Municipal Recycling

2:10pm - 2:50pm - Guided Discussion: Part I - Challenges

2:50pm - 3:30pm - Guided Discussion: Part II – Opportunities

3:30pm - 3:50pm - Wrap Up- Explorations of Solutions

3:50pm - 4:00pm - Summary:

- NYS Pollution Prevention Institute





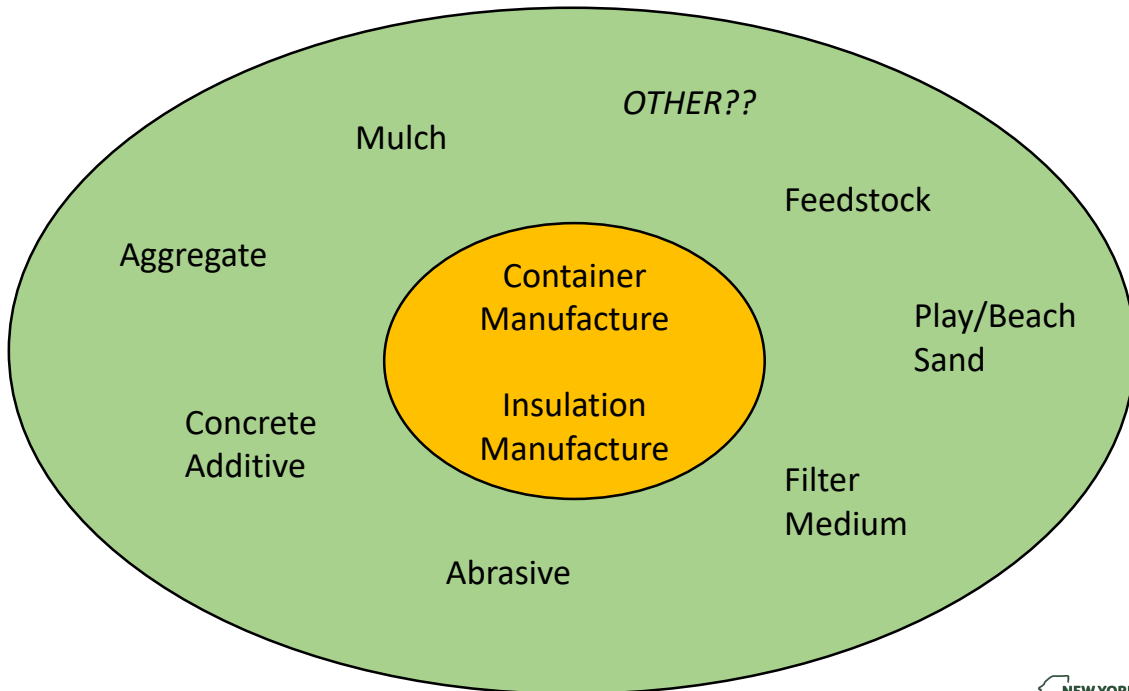
Department of
Environmental
Conservation

Beneficial Use of Post Consumer Glass: DEC's Regulatory Role

Glass Recycling Stakeholder Meeting
Suffolk County Water Authority
January 17, 2019

Kathleen Prather
Environmental Engineer,
Division of Materials Management,
NYSDEC

Beneficial Use: Expanding Options for Glass



DEC's Role in Expanding Glass Reuse

- Regulations: 6 NYCRR Parts 360 and 361
 - Section 360.12 Beneficial Use
 - Subpart 361-1 Recyclables Handling and Recovery Facilities (RHRFs)
- See <http://www.dec.ny.gov/regulations/81768.html>

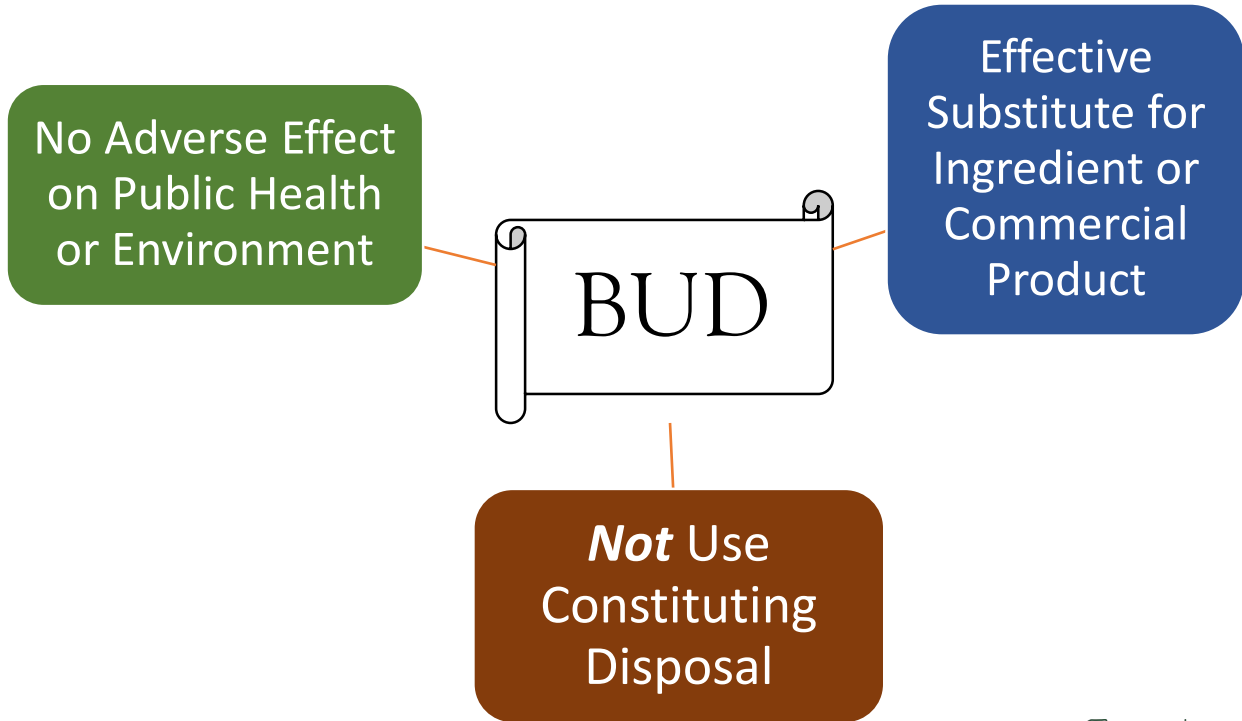


Beneficial Use Determination

- DEC determines a material to no longer be regulated as a waste when used in a specific manner
- “Pre-determined” or “Case-Specific”
- A BUD is for a ***material***, not a ***process*** (you still may need a facility registration or permit to process waste into BUD material)



BUD Decision Criteria



Container Glass – Pre-Determine BUD

- 360.12(c)(4)(i): Uncontaminated glass from a RHRF for use as aggregate must contain:
 - No more than 5 percent by volume non-glass contaminants
 - No more than 0.05% by weight paper and 1% by weight other non-glass material
 - Must meet industry or government criteria for the particular aggregate use
- The non-glass specifications above correspond with DOT specifications for glass reuse

Some NYSDOT Glass Use Specifications

§ 733-05 Glass Backfill:

Glass Backfill is crushed container glass meeting 6 NYCRR 360.12(c)(4)(i). It can be used up to 30% by weight in:

- Subbase Course (§733-04)
- Embankment in Place (§733-08)
- Select Granular Fill (§733-11)
- Select Structure Fill (§733-14)

Glass Backfill meeting Substitution Gradation can be used as:

- Underdrain Filter Material (§733-20)

For more information see [EI 18-007](#) and the §733-19 [Approved List](#)

Manufacturing Feedstocks

Pre-Determined Beneficial Use:

360.12(c)(2)(vii): “The following cease to be waste when received at the location of use as described in this paragraph:....**source-separated recyclables** that are typically managed at a recyclables handling and recovery facility but instead are **received directly by a manufacturing plant** for use as an ingredient in the manufacturing of a product;...”

360.12(c)(2)(vii)

- What constitutes “manufacturing”?
 - Physical or chemical transformation
 - Adding value
 - Product meets a recognized specification
 - A demonstrable market
- Only for container glass or other glass “typically managed at a recyclables handling and recovery facility (RHRF)”

Thank You

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NYSDOT

Office of Technical Services

Materials Bureau
Geotechnical Engineering Bureau

NYSDOT Materials

- **Glass beads for Pavement Marking**
- **Crushed glass in Hot Mix Asphalt (HMA)**

Glass Beads for Pavement Marking

NYSDOT Standard Specification 727-05 GLASS BEADS FOR PAVEMENT MARKINGS

- **Colorless, clean, and transparent**
- **Must meet AASHTO M247**

INDUSTRY STANDARD:

- **Standard Glass beads produced with about 90% recycled glass**
- **Other glass bead types use lower percentages of recycled glass**

Contractors have applied more than 2800 tons of glass beads in a year for NYSDOT Contracts as part of the various types of pavement markings used by the Department.

NYSDOT Maintenance Use

- **NYSDOT Maintenance purchases glass beads using the Office of General Services (OGS) Contract every year**
- **Approximately 1900 tons of standard glass beads are purchased in one year**
- **OGS Contract follows NYSDOT specifications in general, but other types of beads are included in the contract**

OGS Contract

The OGS Contract includes the following:

- Glass spheres must be highly resistant to traffic wear, decomposition, etching under atmospheric conditions, the effects of weathering, etc.
- To the maximum extent practicable be composed of recycled glass
- Glass spheres shall not exhibit toxicity characteristics (40 CFR 261.24)
- Recycled cullet (EPA methods 6010B & 3052):
 - ≤ 75 ppm of Arsenic
 - ≤ 100 ppm of Lead
 - ≤ 100 ppm of Antimony

Crushed Glass in HMA

- Every contract with HMA has a note allowing crushed glass
- Crushed glass may comprise up to 5% of total aggregate weight
- Glass allowed in Base, Binder, and Truing and Leveling Courses
- Not allowed in Top Course
- Gradation:

Sieve Size	Percent Passing
3/8 inch	100
¼ inch	90 - 100
No. 30	0 - 20

- Last used in 2004 on Rt. 49 in Region 2 - 3% Glass Content

Crushed Glass in HMA

Concerns and Barriers

- Potential variability in the mixture volumetric requirements
- Limited bond strength of liquid asphalt to smooth glass particles
- Lack of sufficient, consistent, quality supply of crushed glass
- Additional stockpile and space needed
- Additional processing to blend, or need additional separate bin
- Additional material requiring quality control
- Economics

NYSDOT Geotechnical

- **Allowable crushed glass applications**
- **Answers to common questions**
- **Foamed Glass Aggregate**

Allowable Crushed Glass Applications

- **§733-04 Subbase Course** - thoroughly mixed throughout, not more than 30% by weight of glass
- **§733-08 Embankment In Place** - thoroughly mixed throughout, not more than 30% by weight anywhere in the embankment
- **§733-11 Select Granular Fill** - thoroughly mixed throughout, not more than 30% by weight of glass
- **§733-14 Select Structure Fill** - thoroughly mixed throughout, not more than 30% by weight of glass

Allowable Crushed Glass Applications

- **§733-20 Underdrain Filter Material** - May be used as underdrain filter material provided it meets the following gradation requirements:

Sieve Size Designation	Percent Passing by Weight
1/2 inch	100
3/8 inch	90 - 100
No. 200	0 - 5

- Assuming the density of crushed glass to be 100 lbs/ft³, 1 cubic yard will weigh about 1.35 tons (2700 lbs)

Allowable Crushed Glass Applications

Regardless of what the specs allow, there is not much use.

- Steady supply
- Achieving the 3/8 inch top size requires the Producer to crush the glass more than once, slowing and complication the process; limiting deleterious material is another complication
- Expense - cost vs natural material, which all quarries have
- Expense - trucking
- RCA / RAP are more readily available

Answers to Common Questions

- To meet the NSYDOT specs as granular material, 100% of the material must pass the 3/8" sieve
- Bottle glass, when processed to minus 1/2 inch size, forms into little cubic shapes that do not have sharp edges and thus are safe to handle; window glass and other types of glass break into shards and slivers which are unsafe to handle
- When processed to minus 1/2 inch size, it will not cut geotextiles
- The specifications are written around recycled beverage containers, and excludes other glass types, particularly those with a high metals content (e.g., leaded crystal, plate glass, and CRT tube glass)

Foamed Glass Aggregates

- Processes any color of glass bottles (no sorting needed)
- Almost 100% recycled glass (glass plus a foaming agent)
- NYSDOT does not have a standard spec; special spec being used on DB project in Long Island (identifies Aero Aggregates product) requires:
 - *minimum 98% recycled glass*
 - *closed cell structure and non-leaching*
 - *density of 15-20 pcf*
 - *Above the water table*
 - *Fully encapsulated in geotextile*











**“Evolution of Crushed Glass Aggregate
Produced at the Rockland County Solid Waste Management
Materials Recovery Facility”**

**420 Torne Valley Road, Hillburn, NY 10931
(845) 753-2200**

www.rocklandrecycles.com

**ANNA ROPPOLO
Executive Director**

History

- In 2004/05, the Authority included glass recycling equipment as part of a capital improvement to the MRF.
- Based on (the then current section) Part 360-1.15(b)- Generic Beneficial Use Determination which deemed “The following items are no longer considered solid waste for the purposes of this Part when used as described”
- Uncontaminated glass when used as a substitute for conventional aggregate in asphalt or subsurface applications

RCSWMA's Materials Recovery Facility



Starting with Commingled Containers



Lubo Star Screen = First step in Glass Processing



A Hammermill Further Reduces Glass Size



Brush-and-Screen Removes Deleterious Material and Size Sorts



Two Sizes of Materials are Generated -1/8" and -3/8"



Typical over-the-top loading – note no/low dusting



2006 Geotechnical Parameters Analyzed

- Coefficient of Uniformity
- Coefficient of Gradation
- USCS Soil Classification
- AASHTO Soil Classification
- Standard Proctor Max. Dry Density
- Internal Friction Angle
- Coefficient of Permeability

Material Sampling Points

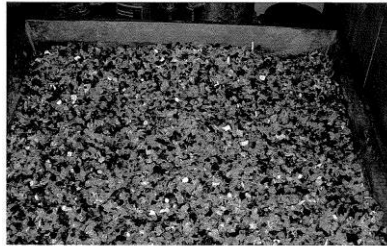


Picture 1 – Sampling.



Picture 2 – Sampling.

Samples Prior to Separation



Picture 3 – 3/8-Inch Crushed Glass Sample Prior to Separation.



Picture 4 – 1/8-Inch Crushed Glass Sample Prior to Separation.

Analysis for Deleterious Material



Picture 4 – Clean Crushed Glass Sample After Removal of Deleterious Material. Deleterious Material (Left).



Picture 5 – Deleterious Material.

Geotechnical Analysis Results

- Not suitable alone for structural fill
- Mixes of 10% to 30% with clean, inert soil
- “Small percentage of deleterious materials noticed in samples...would not have an adverse impact on engineering properties of the crushed glass product”
- Suitable Uses include the following

Possible Uses Comparing Geotechnical Characteristics with Agency Technical Specifications

- Pipe Bedding Material
- Drainage/Filtration Material
- Compacted Fills
- Component of Sub-base material
- Component of Embankment Material
- Component of Hot Mix Asphalt

Next Steps

- After the technical analysis was complete, the Authority required collaboration with a champion(s) to utilize the product in applications.



Collaborative Effort of Elected Officials, Depts. of Public Works, Authority, Private Contractors



Contractor's Employees Reported Less Dusting, Visual Discontinuity, Fluidity Easing Pipe Handling



Pipe Bedding Material



Preconstruction - Ramapo Middle School Ball field Material for Underdrain System



Middle School Sewer Main



Sandbags



On Site Demonstration project Complete - September 2005



Eight Weeks Later...



What happened next?

- Denis O'Donnell used his marketing skills within the County to educate various groups on the product.
 - Visited B&Z departments throughout the County and discussed and informed each town Director about uses.
 - Spoke to contractors and builders about the use of the product and pricing (free!)
 - Spoke to engineers within the County on the product.

Major projects utilizing Glass Aggregate over the years

- 128 unit over 55 housing project (bedding for utilities)
- Strip Mall project for pipe bedding (Lowe's, Stop&Shop)
- Athletic Fields (drainage system and pipe bedding for irrigation system).
- NYFC (drainage system)
- DPW Projects (drainage, rain gardens)
- RCSD#1

Glass Aggregate use in Orangetown



2013 Utility Company Pilot Project

- The Authority partnered with Jim Dean, Orangetown Highway Superintendent and Hetal Mistry, Suez New York Water Senior Project engineer, to determine how the crushed glass aggregate would perform when utilized in a 12” main replacement project.
- The pilot included evaluation of the compaction of backfill materials within the water main trench under four different set of conditions.

What happened – Authority Perspective?

- Article in the local paper
- Opposition by vocal residents



- Determination by the water company to continue with pilot project.

What happened ? – Suez perspective

- After one year, there was no difference in the level of compaction whether the trench was backfilled with crushed recycled glass or virgin stone.
- Hetal Mistry (Suez) Awarded 2014 National Association of Water Companies Management Innovation Award for a pilot program.
- Included in the Fall/Winter 2015 Aquarius magazine (peer article for American Water Works Association).

RCSWMA Glass Statistics & Information

- **Approximately 100,000 tons of glass have been processed since installation.**
- **Original Andella system cost in 2005 – app \$250,000**
- **Andella O&M costs included in overall RCSWMA MRF O&M costs**
- **Over the years Denis O'Donnell's marketing efforts has conservatively saved the Authority over \$3,500,000 (100,000 tons x \$35 per ton T&D as ADC).**

Thoughts & Takeaways -Local

- Find a champion and work on projects collaboratively
 - DPW and Highway Superintendents are material managers
 - Provide local engineers with samples and information on the glass aggregate
 - Discuss potential uses with utility companies to determine if they can provide a consistent outlet and work with them towards their sustainability goals

Thoughts & Takeaways – Broader View

- Can Rockland County Authority's success be duplicated?
- Potential regional glass recycling
- Potential collaboration with NYS organizations (such as DOT) on utilizing glass aggregate as a requirement on projects.
- Potential Regional Council funding

Economics to Consider

- How does the economics work with only glass processing (i.e. not supported by other recyclables).
- Look at cost of glass vs. cost of other material.
- Businesses focus on cost and sustainability goals.
- Do we have enough aggregate available for very large projects?

Thank you!

Rockland County Solid Waste Management Authority

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Glass Recycling Forum

New York State

Dept of Environmental Conservation

**Thomas Outerbridge
General Manager
Sims Municipal Recycling**

**Albany, NY
January 17, 2019**

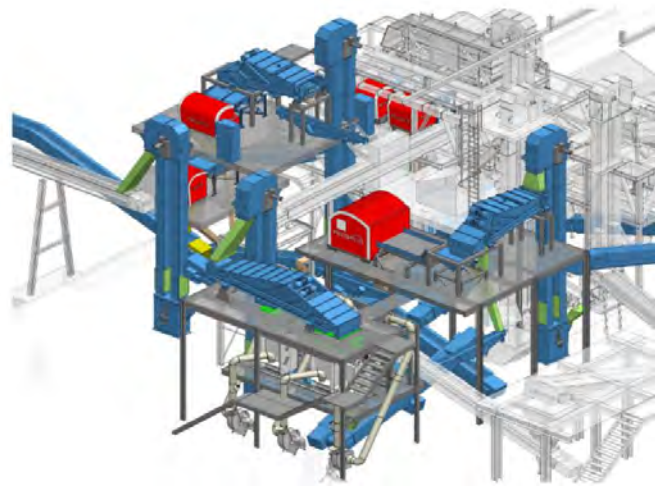
Sims Municipal Recycling (SMR) Overview

- Processing and marketing NYC curbside recyclables since 2003
- NYC contract includes:
 - 100% of Metal/Glass/Plastic (MGP) = approx. 24,500 TPM
 - 50% of Paper = approx. 14,500 TPM
- 2,500-3,000 TPM of other curbside MGP & baled mixed plastics under short term municipal and private contracts
- Division of Sims Metal Management
 - Global scrap metal recycler
 - Global e-waste recycler
 - Renewable energy in Australia



SMR Glass Plant

- Located in Jersey City, NJ
- Process 10,000-12,000 tons per month of residential MRF glass
- Color separation with optical sorters
- Mixed color glass cleaned and crushed to produce Recycled Glass Aggregate



Optical Sorters, X-Ray Sorter, Screens, Air Separation, Magnets, Eddy Current, Impact Crusher

Color Sorted Glass

- Clear glass (Flint) separation with optical sorters and X-ray detection for leaded and heat resistant glass
- Green/Amber glass separation with optics
- Flint & “Gramber” sold to glass container market
- Strict limits on ceramics, porcelain



Green/Amber “Gramber” for New Bottle Production



Clear Glass for New Bottle Manufacturing

SMR Recycled Glass Aggregate (RGA)

- Non-color-separated glass converted to RGA
- Ability to stockpile large volumes for civil construction projects
- Used as structural/non-structural fill, drainage and filtration medium, and pipe bedding
- Beneficial Use Determination (BUD) from NYS DEC
- Approved under NJ DEP Licensed Site Remediation Professional (LSRP) program
- Approved by NYS DOT for sub-base (blends), embankment (blends), underdrain filter, stormwater filtration
- -3/8"; Typical LOI (Loss on Ignition) of 1-3%
- Bulk Density 2,500-3,000 lbs/cu yd



SMR RGA Sample Projects



NYS DOT Yorktown lane widening project
Underdrain Medium



NYC DOT Harlem River Drive
Type 1 Underdrain Filter Medium



Distribution Ctr, Perth Amboy, NJ
Clean Fill & Site Elevation



NYC Department of Sanitation
Water Main Pipe Bedding

SMR RGA Sample Projects



NJ Turnpike Interchange
Sub-base & Embankments



MTA Bus Depot
Engineered Wetland



NYC Parks Department
Stormwater Capture/Storage



ePort Development, NJ
Clean Fill

Other Outlets/Applications

- Fiberglass
 - Tighter spec than bottle mfgs, but no color separation requirements
 - Large market but distant from NY (rail transport)
- Light Weight Aggregate
 - Produced in Europe since 1980s
 - 1st US plant in PA - Aero Aggregates
- Blast Medium
 - Substitute and safer than slag
 - Specific particle size distribution
- Cement (pozzolan)
 - Substitute for Portland Cement, fly ash and slag
 - Urban Mining NE demo plant upstate NY



Glass Challenge/Opportunity

- Comprises significant portion of weight of curbside recyclables
- Staple “recyclable” expected to be recycled by public
- Low value commodity (vs. plastics and metals)
- Costly to refine to market specs (e.g., cullet, fiberglass, blast medium)
- Can contaminate other recyclables, especially paper in older single-stream MRFs, at a time when market specs are tightening
- Producing RGA is relatively simple, but outlets are low value and not consistent
- High disposal costs provide primary financial incentive to recycle; Embedded energy provides environmental incentive
- Centralized plant for LI tons? Producing product for local consumption?
 - RGA with local use commitment
 - Lightweight aggregate; cement
 - Cullet or fiberglass with rail access



Guided Discussion- Challenges



- What are the major issues related to glass recycling that you are facing with regard to infrastructure, markets, or both?
- What specific barriers need to be overcome?
- What issues are there with NYS container glass compared to other states? Barriers to secondary use?
- Are there other barriers we should be aware of, quantity, quality, etc.?



Guided Discussion- Opportunities



- What could and should be done to assist glass recycling markets and infrastructure in the short term?
- What could and should be done to assist glass markets and infrastructure in the long term?
- What could and should be done to overcome other identified barriers?



Wrap-Up Explorations of Solutions



- What do you see as next steps for NYSDEC?
- What are the next steps for other organizations, agencies, or industry groups?
- Are there other organizations we should engage?



Summary



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