

PURE RECOVERY GROUP L.P.

- MAXIMIZING VALUE FROM WASTE TO ENERGY ASH AND MINIMIZING THE AMOUNT OF ASH GOING TO LANDFILL

WHO IS PURE RECOVERY GROUP L.P.?

- PRG is a multifaceted recycling company
- Innovative patented wet density separation system for combustor ash
- Reclaims over 55% of Waste to Energy ash for recycling and reuse



NYS SOLID WASTE MANAGEMENT PLAN

- Move NYS to an 85% total waste stream recycling rate by 2050
- Lots of the work is done; 43% recycling rate today
- The infrastructure for recycling exists; cardboard, plastic, metal, organics, e-waste
- The infrastructure that doesn't exist.....That's the HARD part

NYS DEC

- Foster a structure that allows for ingenuity and creativity to facilitate reuse / recycling

PURE RECOVERY GROUP L.P. (PRG) HISTORY

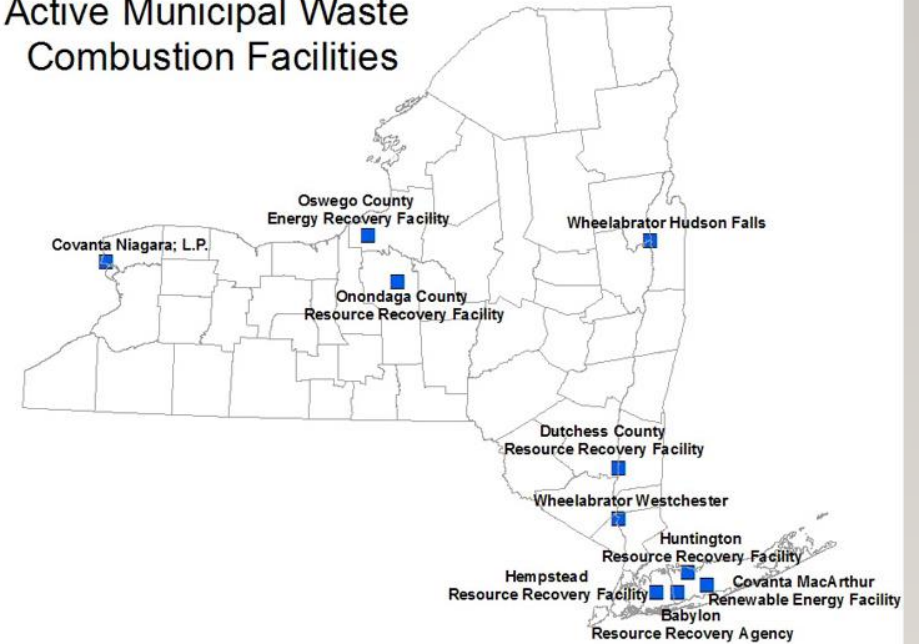
- PRG began working on a WET density separation system for combustor ash in 2010
- After 3 trial facilities, PRG applied for, and received a US patent for the wet separation of ash

NEW YORK STATE WASTE COMBUSTION FACILITIES

- **New York**

CITY	OWNER	OPERATOR	TONS/YR
Babylon	Covanta	Covanta	78,000
Hempstead	Covanta	Covanta	261,000
Poughkeepsie/Dutchess	Authority	Wheelabrator	47,000
Huntington	Counta	Covanta	78,000
Mac Arthur (RonKonKoma)	Authority	Covanta	51,000
Niagra Falls	Covanta	Covanta	234,000
Onondaga	Covanta	Covanta	103,000
Oswego	Authority	Authority	21,000
Hudson Falls	Wheelabrator	Wheelabrator	52,000
Westchester (Peekskill)	Wheelabrator	Wheelabrator	234,000

Active Municipal Waste Combustion Facilities



POTENTIAL ASH DIVERSION IN NEW YORK STATE

- Total ash produced in New York State: 1,200,000 tons / year
- Available recycling through wet density separation: 720,000 tons / year
 - Ferrous metal: 144,000 tons
 - Non Ferrous: 24,000 tons
 - Aggregate: 552,000 tons

YORK REDUCTION SYSTEMS L.P.

- July 2018 -York Reduction Systems L.P., licensed PRG's technology, and built an Ash Recycling and Processing Facility in York Pennsylvania, in partnership with York County Solid Waste Authority.
- May 2019 – Began to process 160,000 tons / year
- April 2020 – All sand and aggregate produced going to Beneficial Use







INCOMING RAW ASH

FROM ASH DESTINED FOR LANDFILL TO USABLE ASSET









CLOSED LOOP WATER PURIFICATION

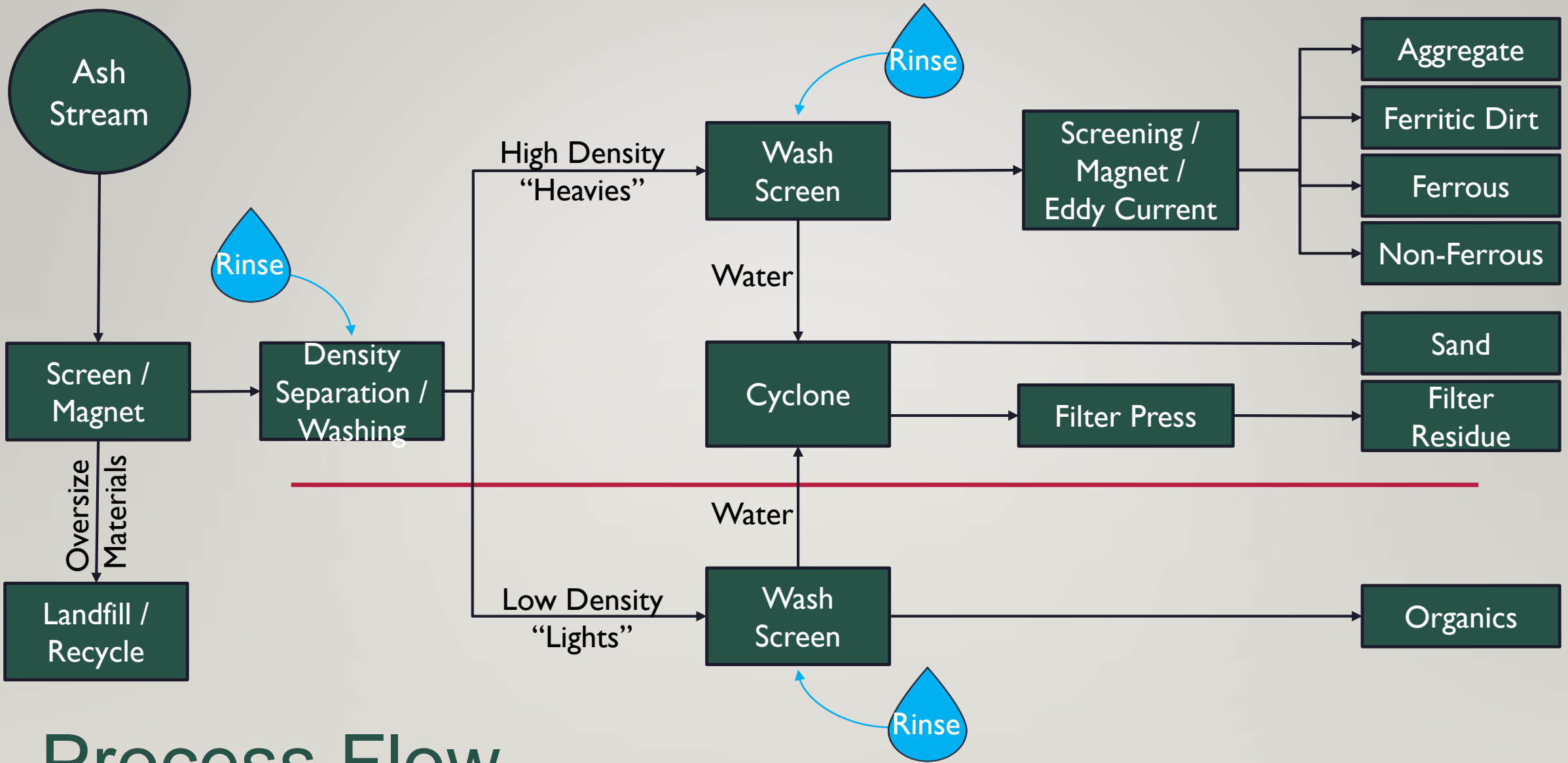
- The most complex complicated part of the process.
- The reason it took 10 years to perfect the wet system





PROCESS WALKTHROUGH





Process Flow



RECYCLED MATERIALS (PRODUCTS)

- Ferrous Metal
- Non-Ferrous Metal
- Aggregates (Fine and Coarse)



SEPARATED PRODUCTS

PRODUCT BREAKDOWN

- Ferrous Metal 12%
- Non Ferrous Metal 2%
- Light weight Sand 18%
- Aggregate 20%
- Organics 6%
- Ferritic dirt 8%
- Filter Cake 26%
- Moisture Loss 8%

TOTAL DIVERSION FROM LANDFILL

58%



**WE HAVE A
COMMERCIALY VIABLE
PROCESS**

**NOW WE NEED AN END USE
FOR THE AGGREGATE THAT
CAN BE USED ANYWHERE**

ENCAPSULATED PRODUCTS

PAVING STONES MADE
ENTIRELY FROM OUR SAND
AND AGGREGATE



ENCAPSULATED PRODUCTS

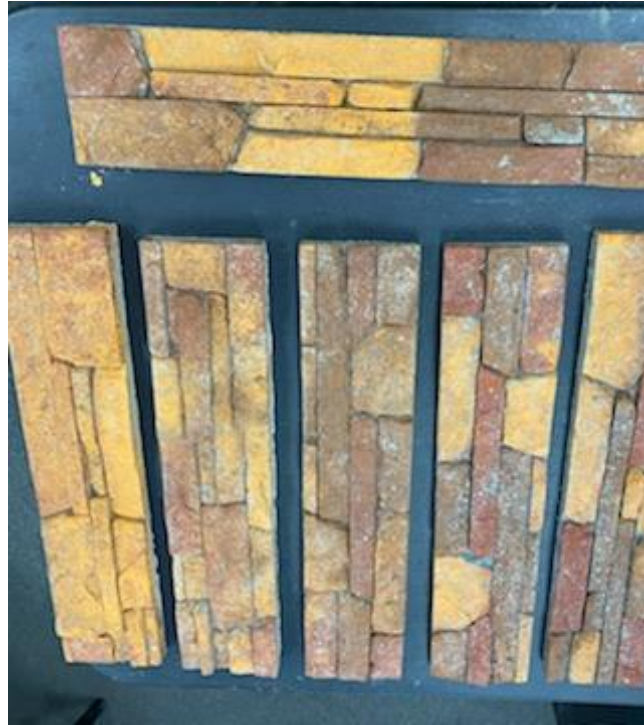


- HOLLOW STRUCTURAL
BLOCKS MADE ENTIRELY FROM
OUR SAND AND AGGREGATE

HARDSCAPE PRODUCTS
MADE ENTIRELY FROM OUR
SAND AND AGGREGATE
WITH COLOR ADDED



EXTERNAL STONE VENEER
WITH COLOR ADDED MADE
ENTIRELY FROM OUR SAND
AND AGGREGATE



ASTM C331 CERTIFICATION

LIGHTWEIGHT AGGREGATE STANDARD

ASTM C331 Testing



Designation: C331/C331M - 14

Standard Specification for Lightweight Aggregates for Concrete Masonry Units¹

This standard is issued under the fixed designation C331/C331M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last approval. A superscript symbol (e) indicates an editorial change since the last revision or approval.

1. Scope*

1.1 This specification covers lightweight aggregates intended for use in concrete masonry units when a prime consideration is to reduce the density of the units.

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard. Some values have only SI units because the inch-pound equivalents are not used in practice.

Note 1—Sieve size is identified by its standard designation in Specification E11. The alternative designation given in parentheses is for information only and does not represent a different standard sieve size.

1.3 The text of this specification references notes and footnotes which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the standard.

2. Referenced Documents

- 2.1 *ASTM Standards*,²
- C29/C29M Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate
 - C40 Test Method for Organic Impurities in Fine Aggregates for Concrete
 - C114 Test Methods for Chemical Analysis of Hydraulic Cement
 - C136 Test Method for Sieve Analysis of Fine and Coarse Aggregates
 - C142 Test Method for Clay Lumps and Friable Particles in Aggregates
 - C151 Test Method for Autoclave Expansion of Hydraulic Cement

¹ This specification is under the jurisdiction of ASTM Committee C09 on Concrete and Concrete Aggregates and is the direct responsibility of Subcommittee C09.21 on Lightweight Aggregates and Concrete.

² Current edition approved April 15, 2014. Published May 2014. Originally approved in 1955. Last previous edition approved in 2009 as C331-10. DOI: 10.1520/C331-14. ©2014 ASTM.

³ For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For a final list of ASTM standards, volume information, refer to the standard's Document Summary page on the ASTM website.

- C157/C157M Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete
- C641 Test Method for Iron Staining Materials in Lightweight Concrete Aggregates
- C702 Practice for Reducing Samples of Aggregate to Testing Size
- C1262 Test Method for Evaluating the Freeze-Thaw Durability of Dry-Cast Segmental Retaining Wall Units and Related Concrete Units
- D75 Practice for Sampling Aggregates
- E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves

3. Aggregate Types

3.1 Three general types of lightweight aggregates are covered by this specification, as follows:

3.1.1 Aggregates prepared by expanding, pelletizing, or sintering products such as blast-furnace slag, clay, diatomite, fly ash, shale, or slate, and

3.1.2 Aggregates prepared by processing natural materials, such as pumice, scoria, or tuff, and

3.1.3 Aggregates consisting of end products of coal or coke combustion.

3.2 The aggregates shall be composed predominantly of lightweight-cellular and granular inorganic material.

4. Chemical Composition

4.1 Lightweight aggregates shall not contain excessive amounts of deleterious substances, as determined by the following limits:

4.1.1 *Organic Impurities* (Test Method C40)—Lightweight aggregates subjected to the test for organic impurities that produce a color darker than the standard shall be rejected, unless it is demonstrated that the discoloration is due to small quantities of materials not harmful to the concrete.

4.1.2 *Staining* (Test Method C641)—An aggregate producing a stain index of 60 or higher shall be rejected when the deposited stain is found upon chemical analysis to contain an iron content, expressed as Fe₂O₃, equal to or greater than 1.5 mg/200 g of sample.

4.1.3 *Loss on Ignition* (Test Methods C114)—Loss on ignition of aggregates, consisting of end products of coal or coke combustion, shall not exceed 12%. Loss on ignition of other aggregates shall not exceed 5%.

C29 – Bulk Density	55-75
C40 – Organic Impurities	#3
C114 – Loss On Ignition	5%
C136 – Sieve Analysis	100Mesh<10% 200Mesh<5%
C142 – Clay Lumps & Friable Particles	2%
C151 – Autoclave Expansion	
C157 – Alkali Silica Reaction	
C641 – Iron Staining	60
C1262 – Freeze Thaw	

C331 Material Testing Results

Test	Limit	Fine Aggregate Results	Coarse Aggregate Results
Bulk Density	55-75	58 ✓	73 ✓
Organic Impurities	#3	#1 ✓	#1 ✓
Sieve Analysis	2.2 - 3.2 3.5-6.5	3.12 ✓	5.55 ✓
Iron Staining	60	0 ✓	20 ✓
Clay Lumps & Friable Particles	2%	1.8% ✓	.3% ✓
Loss on Ignition	5% - 12%	3.56% ✓	2.48% ✓

C331 Product Testing Results

Test	Limit	Blocks using 100% ash aggregates	Blocks with blended natural and ash aggregates
Freeze Thaw	7%	21%	6.3% ✓
Compressive Strength	1900 - Loadbearing	1856	3370 ✓
Alkali Silica Reaction		.086" ✓	N/A
Autoclave Expansion		N/A	N/A

NEXT STEPS



GROWTH



WE HAVE PROVEN IT WORKS



SEEK OUT NEW FORWARD-THINKING PARTNERS / OPERATORS



SEEK OUT CONCRETE PRODUCERS TO BUY THE PRODUCT