History of Dirty MRFs in Delaware

Experience with the Raytheon Plant

The Delaware Reclamation Project

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What is Old is New

People were creative 40 years ago
The Delaware Reclamation Project was the result of timely political leadership planning and at the time was a vital part of DSWA’s long range program for solid waste and sewage sludge disposal.

**DRP Timeline**

- **August 1978**: Raytheon Services selected to design, construct and operate DRP
- **May 1977**: RFP Issued
- **March 1984**: DRP Commercial Operations Begin
- **April 1985**: EGF begins Commercial Operations
- **April 1991**: EGF Shutdown
- **May 1993**: Shutdown of SSPM Ordered
- **January 1995**: Entire DRP Shutdown
- **April 1999**: Dismantlement Completed

**Energy Generating Facility (EGF) Timeline**

- **August 1975**: DSWA Created
- **April 1978**: EGF begins Commercial Operations
- **April 1991**: EGF Shutdown
- **January 1995**: Entire EGF Shutdown
- **April 1999**: Dismantlement Completed
DRP Flow Diagram

Solid Waste Processing Module

Solid Waste (1000 TPD)

Sewage Sludge (350 TDP, 20% Solids)

Sewage Sludge Processing Module

RDF (500 TPD)

FERROUS (80 TPD)

HEAVY FRACTION (420 TPD)

MIXED COLOR GLASS (120 TPD)

SAND (55 TPD)

NON-FERROUS (5 TPD)

HUMUS (300 TPD)

Energy Generating Facility

Recoverable Products

Solid Waste Disposal Facility

RESIDUE (60 TPD)

LOSS (230 TPD)
Solid Waste Processing Module Outputs

- Heavy Fraction: 420 TPD
- RDF: 500 TPD
- Ferrous: 80 TPD

Sewage Sludge Processing Module Outputs

- Loss: 230 TPD
- Humus: 300 TPD
- Residue: 60 TPD
- Mixed Color Glass: 120 TPD
- Sand: 55 TPD
- Non-Ferrous: 5 TPD
The Process

SOLID WASTE FEED → SHREDDER → PRIMARY AIR CLASSIFIER → MAGNETIC SEPARATOR → ROTARY TROMMEL SCREEN → COARSE MATERIAL JIG → ROD MILL → SCREEN → FLOTATION CELLS → SAND FILTER → ROTARY DRYER → REFUSE DERIVED FUEL

SEWAGE SLUDGE FEED → SECONDARY AIR CLASSIFIER → PULPER → DIGESTERS → PRIMARY DRYER → SCREEN → STONER → HUMUS → RESIDUE

ROTARY MAGNET → NON-FERROUS METAL SEPARATOR → FERROUS METALS → MIXED COLOR GLASS → NON-FERROUS METALS
Tipping and Storage Building

• Front end loaders push refuse onto metal pan conveyors
• Refuse is sent to one of two shredders
• Storage building was designed to hold 1,800 tons of solid waste
• Two Shredders (Hammermills), powered by a 1,000 h.p. electric motor
  • Capable of shredding in excess of 70 tons of solid waste per hour
    • One shredder is active while the other is on standby
  • Trash is pounded and shred into particle sizes between 4-12 inches
  • Designed with explosion venting and explosion suppression systems
Shredded material moves to primary air classifiers through enclosed conveyors.

Suction applied at the upper end of the drum separates the light fraction and becomes refuse derived fuel.
Owned and Operated by Crouse Group
1985-1991

- 600 tpd Capacity
- 5-120 tpd modular mass burn combustors
- 2-9 MW turbine generators
- Exhaust steam to ICI America’s Plant one mile south
  - Tip Fee: $42.00/ton
  - $65 million Capital Cost
Energy Generating Facility

**Issues**

- Combustors were designed for unprocessed waste
- Glass particles in RDF melted onto the combustor/boiler walls
- Never able to operate more than 3 combustors at the same time
  - Poor maintenance
  - Revenue did not cover costs

**Resulting Action**

- EGF closure in April 1991
The Ferrous Separation System

- Ferrous metal is removed from the heavy metal fraction using a magnet.
- Further separation is done by transporting ferrous metals to a drum magnet which removes the light ferrous fraction from the heavy ferrous fraction.
- Ferrous metal is collected in roll-off containers and sold as scrap.
• Remaining heavy fraction is conveyed to the wet processing building

• 9 foot screen with ¾” holes which separates glass-rich particles

• Larger particles are discharged into a second 11 foot diameter trommel

• Undersized material is sent to the humus processing section
• Fibers are separated from glass, ceramics and metals

• Fibrous organics rise to the surface and are floated away

• Heavy metal-rich fraction settles to the bottom and is manually removed
• Glass-rich heavy fraction is sent to the rod mill where it is crushed
Vibrating Sand Screens

- 20 mesh vibrating screens
- The screen undersize is sent to the Flotation Cells, the oversized is sent back to the Rod Mill
• Finely ground glass-rich fraction is mixed with amine acetate solution which makes glass particles hydrophobic

• Flotation cells produce fine air bubbles

• Glass particles float to the top

• Pure glass particles are dewatered, dried and magnetically cleaned before being shipped to fiberglass insulation market
• Non-glass particles from flotation cells are dewatered and sand product is produced
Aluminum Recovery

- Aluminum is recovered through eddy current magnetic boards
  - System was invented by Raytheon Services
- 80% of aluminum extracted during two stages of separation
• Sewage sludge is supplied by the City of Wilmington Waste Water Treatment Plant

• Each hopper has a holding capacity of 20 tons
• Sludge from hoppers is prepared for the digesters

• Two waste streams are blended
• Large, rapid and continuous composters

• Half of rotating bridge acts as feed mechanism for incoming waste/sludge, the other half mix and move material

• Aluminum dome maintains right environment for composting

• Feedstock has a residence time of 5-7 days
Compost is discharged from digesters is called humus

- Humus must be dried to 15% moisture content
- Humus is screened to remove plastic, glass and metallic particles
  - Screen material is cured or pelletized
- Oversize is used to fire an incinerator, which provides heat to the dryer
<table>
<thead>
<tr>
<th></th>
<th>SWPM</th>
<th>SSPM</th>
<th>TOTAL</th>
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<tbody>
<tr>
<td>Engineering</td>
<td>$ 2.5</td>
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<tr>
<td>Construction</td>
<td>$ 25.1</td>
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<td>Total Capital</td>
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## DRP
**Source of Funds ($1,000,000)**

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<th>Source</th>
<th>SWPM</th>
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<tbody>
<tr>
<td><strong>EPA-Solid Waste</strong></td>
<td>$8.7</td>
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<td><strong>EPA- Water Programs</strong></td>
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<td><strong>State of Delaware</strong></td>
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<td><strong>TOTAL GRANTS</strong></td>
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<td><strong>Revenue Bonds</strong></td>
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<td><strong>GRAND TOTAL</strong></td>
<td>$27.6</td>
<td>$43.9</td>
<td>$71.5</td>
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## Delaware Reclamation Project
### Annual Operation Cost ($1,000,000)

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<tr>
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<tr>
<td>Debt Service</td>
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<td>O+M</td>
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<td>Utilities</td>
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<td>Management Fee</td>
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<td><strong>SUB TOTAL</strong></td>
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<td><strong>$6.7</strong></td>
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<tr>
<td>Less Guaranteed Revenues</td>
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<td><strong>TOTAL</strong></td>
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### Tonnage
- **Solid Waste**: 260,000
- **Sewage Sludge**: 91,000

### Fee
- **SWPM**: $46.00/ton
- **SSPM**: $60.00/ton
Issue #1

Energy Generating Facility shutdown in 1991

Resulting Action

- DRP operation continued to produce RDF, but it was placed in the Cherry Island Landfill since there was no other cost effective option.
Waste-to-Energy

Mass Burn Technology
- Combustion of unprocessed waste
- Generation of steam and electricity
- Removal of metals from the ask

VS.

Refuse Derived Fuel Technology
- Processing waste by Dirty MRF
  - Removal of metals and glass
  - Preparation of RDF
- Combustion of RDF in specialized boilers
- Generation of steam and electricity
Delaware Reclamation Project

Issue #2

Odors from Digesters and Humus finishing area

Resulting Action

• DNREC order to shutdown Compost Operation in May 1993

• Sewage Sludge mixed with fly ash for landfill cover and berm construction
Delaware Reclamation Project

**Issue #3**

High amount and cost for water usage in the glass processing system and low value glass product

**Resulting Action**

- Shutdown of glass processing system
High cost of running the DRP only to produce:

- RDF that is landfilled
  - Ferrous Metals

**Resulting Action**

- Shutdown of the entire DRP in 1995
- Dismantlement and sale of equipment in 1999
Issue #5

DRP Shutdown in 1995

Resulting Action

• Expansion of Recycle Delaware Drop-off System

• Residential Solid Waste (250,000 TPY) was then sent to Delaware County, PA mass burn WTE Facility
Lessons Learned

to have a Sustainable Materials Management System...

• Obtain and establish end markets as soon as feasible

• Use proven technology for the materials to be processed

• Do not underestimate the problems odors can cause to the continued operations of organics processing

• Make sure the project’s revenue stream will be strong for the long term
Questions and Comments