Energy Justice Network

www.EnergyJustice.net

...helping communities protect themselves from polluting energy and waste technologies
Landfilling vs. Incineration
Landfilling vs. Incineration

...and Ash Landfilling
Number of Commercial Trash Incinerators Operating in the U.S.
World’s largest waste corporation driving away from incineration

[pulls out of gasification, pyrolysis, plasma and trash-to-ethanol investments, selling off Agilyx, Enerkem, Fulcrum, Genomatica & InEnTec]

Jul 29, 2014: “Waste Management to Sell Wheelabrator for $1.94 Billion”
[pulls out of long-standing ownership of Wheelabrator, the second-largest operator of conventional incinerators in U.S.]
Montgomery County’s 2nd Largest Polluter: NMWDA / Covanta Trash Incinerator
(Montgomery County Resource Recovery Facility)

The Montgomery County facility uses a rail system to bring in waste and avoid truck traffic, thereby avoiding over 9 billion road miles to date.
Montgomery County’s 2nd Largest Polluter: NMWDA / Covanta Trash Incinerator (Montgomery County Resource Recovery Facility)

• Can burn 1,800 tons of trash per day
  – 22 years old
  – One of two trash incinerators in MD and just 76 remaining nation-wide

• Responsible for 17% of all stationary sources of air pollution in Montgomery County (2011 & 2014 EPA data)

• Coal power plant in Dickerson responsible for 67% of the county’s air pollution.

• When the coal plant closes, the incinerator will make up 50% of the county’s air pollution (27 other sources)
Montgomery County’s 2nd Largest Polluter: NMWDA / Covanta Trash Incinerator (Montgomery County Resource Recovery Facility)

• In 2013, took in 558,184 tons of trash and turned them into air pollution and 170,590 tons of toxic ash
  – Ash shipped 100-150 miles away to landfills in black communities in Virginia
  – 30 tons of ash for every 100 tons burned

• Waste contract & service agreements expire in 2021
Among trash incinerators in the U.S., it’s 20th largest, but worse than average for some pollutants:

- #1 in Beryllium – 87% of industry total!
- #3 in Hydrochloric acid (HCl)
- #5 in Chromium VI
- #7 in Cobalt
- #8 in Particulate matter (PM/PM2.5)
- #10 in Formaldehyde
- #17 in Lead
- #18 in Sulfur dioxide (SO2)

Source: EPA 2014 National Emissions Inventory
Montgomery County’s 2nd Largest Polluter: NMWDA / Covanta Trash Incinerator (Montgomery County Resource Recovery Facility)

In Montgomery County, the incinerator is...

- #1 in Hydrochloric acid (83% of the emissions in the county)
- #1 in Beryllium
- #2 in Arsenic
- #2 in Chromium VI
- #2 in Cobalt
- #2 in Mercury
- #2 in Nitrogen Oxides (NOx) (18% of county total)
- #2 in Particulate Matter (PM & PM 2.5)
- #2 in Sulfur dioxide (SO2)
- #3 in Cadmium
- #3 in Lead (58 lbs)
- #5 in Nickel
- #4 in Carbon Monoxide (CO)

Source: EPA 2014 National Emissions Inventory
One of Maryland’s Largest Polluters: 13th out of 520 industrial polluters

In all of Maryland, the incinerator is…

- #1 in Beryllium
- #2 in Hydrochloric acid
- #9 in Chromium (VI)
- #10 in Cadmium
- #11 in Arsenic
- #11 in Mercury
- #13 in Ammonia
- #13 in Nitrogen oxides (NOx)
- #15 in Particulate Matter (PM & PM2.5)
- #14 in Sulfur dioxide (SO2)
- #15 in Cobalt

Source: EPA 2014 National Emissions Inventory
## MCRRF 2014 NOx Emissions

### 2014 Top 15 NOx Emission Sources in MD

<table>
<thead>
<tr>
<th>No.</th>
<th>FACILITY</th>
<th>NOx Emissions (tpy)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NRG Chalk Point Generating Station</td>
<td>3,877</td>
</tr>
<tr>
<td>2</td>
<td>Fort Smallwood Road Complex</td>
<td>3,638</td>
</tr>
<tr>
<td>3</td>
<td>Lehigh Cement Company LLC</td>
<td>2,902</td>
</tr>
<tr>
<td>4</td>
<td>Luke Paper Company</td>
<td>2,696</td>
</tr>
<tr>
<td>5</td>
<td>NRG Dickerson Generating Station</td>
<td>1,688</td>
</tr>
<tr>
<td>6</td>
<td>NRG Morgantown Generating Station</td>
<td>1,323</td>
</tr>
<tr>
<td>7</td>
<td>C. P. Crane LLC</td>
<td>1,247</td>
</tr>
<tr>
<td>8</td>
<td>Holcim (US), Inc</td>
<td>1,173</td>
</tr>
<tr>
<td>9</td>
<td>Wheelabrator Baltimore, LP</td>
<td>1,076</td>
</tr>
<tr>
<td>10</td>
<td>AES Warrior Run Inc</td>
<td>552</td>
</tr>
<tr>
<td>11</td>
<td><strong>MCRRF</strong></td>
<td><strong>427</strong></td>
</tr>
<tr>
<td>12</td>
<td>Harford County Resource Recovery Facility</td>
<td>284</td>
</tr>
<tr>
<td>13</td>
<td>Constellation Power - Perryman Generating Station</td>
<td>215</td>
</tr>
<tr>
<td>14</td>
<td>Mettiki Coal, LLC</td>
<td>125</td>
</tr>
<tr>
<td>15</td>
<td>Brandywine Power Facility</td>
<td>118</td>
</tr>
</tbody>
</table>

* Facility-wide NOx emissions
Incinerator Life Spans

• Few trash incinerators operate beyond a 30-year life time.
• Montgomery County Resource Recovery Facility will be 26 years old when contract expires in April 2021.
• Average life of the 76 currently operating trash incinerators in the U.S.: 28 years.
• Average lifespan of the 26 trash incinerators that have closed since 2000 was just 21 years.
Incinerator Life Spans

In 2016-2017, the incinerator experienced more downtime than usual, due to “much-needed plant maintenance.” The incinerator’s capacity and availability “is below industry standard” and has resulted in “high waste inventories” (larger piles of trash stored inside the plant).

“This reduced availability and capacity is a result of a lack of maintenance and repair on the boiler and air pollution control systems.”

Source: Covanta & Montgomery County Department of Environmental Protection. See pp. 4 & 49 in www.montgomerycountymd.gov/SWS/Resources/Files/rrf/RCA%20Documents.pdf
Incineration Worse than Coal

Toxic Air Emissions are…

• **Dioxins / furans** (28 times as much)
• **Mercury** (6-14 times as much)
• **Lead** (6 times as much)
• **Nitrogen Oxides** (NOx) (3.2 times as much)
• **Carbon Monoxide** (CO) (1.9 times as much)
• **Sulfur Dioxide** (SO$_2$) (20% worse)
• **Carbon Dioxide** (CO$_2$) (2.5 times as much)

[www.energyjustice.net/incineration/worsethancoal](http://www.energyjustice.net/incineration/worsethancoal)
Incineration Worse than Coal

Ratios of pollution levels emitted per unit of energy produced by U.S. coal power plants and trash incinerators.
Incinerator, Not a Power Plant

“a waste-to-energy plant is designed to manage solid waste... the electricity output is a secondary function”

Ted Michaels, President, Energy Recovery Council, March 18, 2013 testimony before Washington, DC City Council
Trash Incinerator Health Impacts

• Increased dioxins in blood of incinerator workers
• Increased cancers, especially:
  – laryngeal and lung cancers
  – childhood cancers
  – colorectal
  – liver
  – stomach
  – leukemia
  – soft-tissue sarcoma
  – non-Hodgkin’s lymphoma
• Increases in babies born with spina bifida or heart defects
• Increases in pre-term births
Landfills and Landfill Gas Burning

www.energyjustice.net/lfg/
All Landfills Leak

• U.S. EPA acknowledges that all landfill liners leak within 20 years, if not sooner
• Landfill liners are only guaranteed for about 20 years
• Landfills are permitted to leak a certain amount of gallons/acre
• It's easy not to find leakage (underground or in air); testing is often inadequate
Landfill Gas: What it is…

• Not simply “methane”
• About half methane, half CO$_2$
• Organics breaking down create the methane; methane helps the toxic chemicals escape
• Hundreds of toxic contaminants
  – Halogenated compounds (trichloroethane, vinyl chloride, carbon tetrachloride and many more)
  – Mercury (methylmercury – the really bad kind)
  – Sulfur compounds (the stinky stuff)
  – Tritium (radioactive)
  – Other toxic organic compounds (benzene, toluene…)
<table>
<thead>
<tr>
<th><strong>1 -butanol</strong></th>
<th>2,6-dimethylheptane</th>
<th>4-methyl-2-pentanol + branched C-8 paraffin</th>
<th>butanol isomer?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1 -chloro-1 -fluoroethane</strong></td>
<td>2-butanol</td>
<td>acetaldehyde</td>
<td>butyl hexanoate</td>
</tr>
<tr>
<td><strong>1 -chloro-1 -propene</strong></td>
<td>2-butanol</td>
<td>acetone</td>
<td>butylcyclohexane</td>
</tr>
<tr>
<td><strong>1 -chloropropane</strong></td>
<td>2-chloropropane</td>
<td>acetone + ethanol</td>
<td>butylene</td>
</tr>
<tr>
<td><strong>1 -heptene</strong></td>
<td>2-ethylfuran</td>
<td>alpha thujene</td>
<td>butylpropanoate</td>
</tr>
<tr>
<td><strong>1 -octene</strong></td>
<td>2-ethylhexyl alcohol</td>
<td>alpha-pinene</td>
<td>C-10 olefin</td>
</tr>
<tr>
<td><strong>1 -pentene</strong></td>
<td>2-ethyl-l-hexanol</td>
<td>alpha-thujene</td>
<td>C-11 diene</td>
</tr>
<tr>
<td><strong>1 -propanol</strong></td>
<td>2-methylandecalin</td>
<td>alpha-thujene + branched C-10 paraffin</td>
<td>C-11 paraffin</td>
</tr>
<tr>
<td><strong>1, 1 -dichloroethane</strong></td>
<td>2-methyl heptane</td>
<td>branched C-11 olefin + C-3 benzene</td>
<td></td>
</tr>
<tr>
<td><strong>1, 1, 1 -trichloroethylene</strong></td>
<td>2-methyl propanoate</td>
<td>benzene</td>
<td>C-11 paraffin  + C-3 benzene</td>
</tr>
<tr>
<td><strong>1, 1,2,3-tetramethyl-cyclohexane</strong></td>
<td>2-methyl-2-propanethiol</td>
<td>benzothiazole</td>
<td>C-11 cycloparaffin</td>
</tr>
<tr>
<td><strong>1,1,3-trimethylcyclohexane</strong></td>
<td>2-methyl-3-pentanone + 4-methylpentanol isomer</td>
<td>beta-pinene</td>
<td>C-10 diene</td>
</tr>
<tr>
<td><strong>1,1-dichloroethane</strong></td>
<td>2-methylbutane</td>
<td>branched C-11 olefin + C-12 diene</td>
<td>C-12 diene</td>
</tr>
<tr>
<td><strong>1,1-dimethyl-cyclopropane</strong></td>
<td>2-methyl-butane</td>
<td>branched C-11 olefin + C-12 diene</td>
<td></td>
</tr>
<tr>
<td><strong>1,2,3-trimethylcyclohexane</strong></td>
<td>2-methyl-ethyl butanoate</td>
<td>branched C-12 olefin</td>
<td>C-3 alkylcyclohexane isomer</td>
</tr>
<tr>
<td><strong>1,2,3-trimethylcyclohexane isomer</strong></td>
<td>2-methylfuran</td>
<td>branched C-11 paraffin</td>
<td>C-3 alkyl-substituted cyclopentadiene isomer</td>
</tr>
<tr>
<td><strong>1,2-dichloroethylene</strong></td>
<td>2-methylhexane</td>
<td>branched C-10 olefin</td>
<td>C-3 benzene</td>
</tr>
<tr>
<td><strong>1,2-dichloroethylene</strong></td>
<td>2-methylhexane</td>
<td>branched C-10 olefin + 2-methylhexylbutanoate</td>
<td></td>
</tr>
<tr>
<td><strong>1,2-dichloropropane</strong></td>
<td>2-methylhexylbutyrate</td>
<td>branched C-10 olefin + C-10 olefin</td>
<td>C-3 benzene + branched C-10 olefin + paraffin</td>
</tr>
<tr>
<td><strong>1,3,5-trimethylcyclohexane</strong></td>
<td>2-methyl-l-propanol</td>
<td>branched C-10 olefin + C3- benzene, …</td>
<td>C-3 benzene + branched C-10 paraffin</td>
</tr>
<tr>
<td><strong>1,3,5-trimethylcyclohexane isomer</strong></td>
<td>2-methylloctahydropentane</td>
<td>branched C-10 paraffin</td>
<td>C-3 benzene + C-11 paraffin</td>
</tr>
<tr>
<td><strong>1,3-dichloro-2-butene</strong></td>
<td>2-methylpentane</td>
<td>branched C-10 paraffin + 2-methylhexylbutanoate</td>
<td>C-3 benzene + C-10 paraffin</td>
</tr>
<tr>
<td><strong>1,5-cyclooctadiene</strong></td>
<td>2-methylothiobutane</td>
<td>branched C-10 paraffin + beta-pinene</td>
<td>C-3 benzene + C-9 diene</td>
</tr>
<tr>
<td><strong>1-butanol</strong></td>
<td>2-methylthiopropane</td>
<td>branched C-10 paraffin + octahydro-2-methylpentane</td>
<td></td>
</tr>
<tr>
<td><strong>1-butanol + 1,2-dichloropropane</strong></td>
<td>2-pentanone + 1,2-dichloropropane</td>
<td>branched C-10 paraffin + phellandrene</td>
<td>C-3 benzene isomer</td>
</tr>
<tr>
<td><strong>1-chloropropane</strong></td>
<td>2-pentene</td>
<td>branched C-12 diene</td>
<td>C-3 cyclohexane</td>
</tr>
</tbody>
</table>
Landfill Health Impacts

A New York study of 38 landfills found that women living near solid waste landfills where gas is escaping have a four-fold increased chance of bladder cancer or leukemia.

### Where DC’s waste went (to VA) in 2016:

<table>
<thead>
<tr>
<th>Landfill Name</th>
<th>Amount</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Covanta Fairfax</td>
<td>222,937</td>
<td>27%</td>
</tr>
<tr>
<td>Shoosmith Sanitary Landfill</td>
<td>221,415</td>
<td>27%</td>
</tr>
<tr>
<td>Middle Peninsula Landfill and Recycling Facility</td>
<td>190,323</td>
<td>23%</td>
</tr>
<tr>
<td>BFI Old Dominion Landfill</td>
<td>118,785</td>
<td>14%</td>
</tr>
<tr>
<td>Tri City Regional Disposal and Recycling Services</td>
<td>36,898</td>
<td>4%</td>
</tr>
<tr>
<td>King George Landfill &amp; Recycling Center</td>
<td>20,002</td>
<td>2%</td>
</tr>
<tr>
<td>Covanta Alexandria Arlington</td>
<td>16,690</td>
<td>2%</td>
</tr>
<tr>
<td>King and Queen Sanitary Landfill</td>
<td>267</td>
<td>0%</td>
</tr>
<tr>
<td>Charles City County Landfill</td>
<td>18</td>
<td>0%</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td><strong>827,335</strong></td>
<td></td>
</tr>
</tbody>
</table>
Where DC’s waste went (to VA) in 2016:
## Facilities in Focus for 2017 & This Presentation

<table>
<thead>
<tr>
<th>Facility Name</th>
<th>Type</th>
<th>Average Distance from DC Transfer Stations (mi)</th>
<th>Annual Precipitation (inches)</th>
<th>Years of Life Remaining</th>
</tr>
</thead>
<tbody>
<tr>
<td>Covanta Fairfax</td>
<td>Incinerator</td>
<td>26</td>
<td></td>
<td>13 (if it lives to 40)</td>
</tr>
<tr>
<td>King George</td>
<td>Landfill</td>
<td>68</td>
<td>42.8</td>
<td>11</td>
</tr>
<tr>
<td>King &amp; Queen</td>
<td>Landfill</td>
<td>122</td>
<td>45.4</td>
<td>26</td>
</tr>
<tr>
<td>Middle Peninsula</td>
<td>Landfill</td>
<td>130</td>
<td>45.4</td>
<td>73</td>
</tr>
<tr>
<td>Charles City</td>
<td>Landfill</td>
<td>130</td>
<td>46.3</td>
<td>74</td>
</tr>
</tbody>
</table>

[“Other 3 Landfills” in future slides refers to the last three above, which are all about the same distance from DC.]
How to Compare?

- Population impacted & environmental justice
- Human health impacts
  - Nitrogen Oxide emissions (asthma)
  - Particulate emissions
  - Toxic and Cancer-causing emissions
- Eutrophication
- Acidification (acid rain…)
- Ecosystem toxicity
- Ozone depletion
- Smog formation
- Global warming
- Cost
Data Sources

• U.S. EPA
  – National Emissions Inventory
  – Emissions & Generation Resource Integrated Database (eGRID)
  – FLIGHT (Greenhouse gas inventory)
  – Landfill Methane Outreach Program database

• U.S. Energy Information Administration
  – Form 860 database (Annual Electric Generator data)
  – Form 923 database (Annual Electric Utility Data)

• Virginia Department of Environmental Quality

• DC Department of Public Works

• Energy Recovery Council

• Sound Resource Management Group
Covanta Fairfax Reported Emissions (2014)

<table>
<thead>
<tr>
<th>Global Warming Pollutants</th>
<th>Pounds released (2014)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Dioxide (CO2)</td>
<td>2,169,540,876</td>
</tr>
<tr>
<td>Methane (CH4)</td>
<td>762,927</td>
</tr>
<tr>
<td>Nitrous Oxide (N2O)</td>
<td>100,130</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Health Damaging Pollutants</th>
<th>Pounds released (2014)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Monoxide</td>
<td>11,319</td>
</tr>
<tr>
<td>Hydrochloric Acid</td>
<td>57,408</td>
</tr>
<tr>
<td>Hydrofluoric Acid</td>
<td>1,385</td>
</tr>
<tr>
<td>Lead</td>
<td>68</td>
</tr>
<tr>
<td>Nitrogen Oxides (NOx)</td>
<td>3,398,301</td>
</tr>
<tr>
<td>Particulate Matter (PM10)</td>
<td>14,709</td>
</tr>
<tr>
<td>Fine Particulate Matter (PM2.5)</td>
<td>8,862</td>
</tr>
<tr>
<td>Sulfur Dioxide</td>
<td>257,899</td>
</tr>
<tr>
<td>Volatile Organic Compounds</td>
<td>11,813</td>
</tr>
</tbody>
</table>
## EPA 2014 National Emissions Inventory Data

<table>
<thead>
<tr>
<th>Row Labels</th>
<th>Grand Total</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Covanta Fairfax Inc</td>
<td>3,761,825.4</td>
<td>75%</td>
</tr>
<tr>
<td>Noman M Cole Jr Pollution Control Plant</td>
<td>623,138.0</td>
<td>12%</td>
</tr>
<tr>
<td>US Army - Fort Belvoir</td>
<td>264,181.0</td>
<td></td>
</tr>
<tr>
<td>Kinder Morgan Southeast Terminals LLC-Newington</td>
<td>144,809.7</td>
<td></td>
</tr>
<tr>
<td>Motiva Enterprises LLC - Springfield</td>
<td>105,306.2</td>
<td></td>
</tr>
<tr>
<td>BARNARD</td>
<td>51,994.9</td>
<td></td>
</tr>
<tr>
<td>Michigan Cogeneration Systems Inc</td>
<td>26,040.9</td>
<td></td>
</tr>
<tr>
<td>I-66 Landfil</td>
<td>3,926.5</td>
<td></td>
</tr>
<tr>
<td>RESTON HOSPITAL CENTER</td>
<td>603.0</td>
<td></td>
</tr>
<tr>
<td>MOUNT VERNON HOSPITAL</td>
<td>603.0</td>
<td></td>
</tr>
<tr>
<td>FORT BELVOIR COMMUNITY HOSPITAL</td>
<td>603.0</td>
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<tr>
<td>INOVA FAIRFAX HOSPITAL</td>
<td>603.0</td>
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</tr>
<tr>
<td>ROUBIN &amp; JANEIRO INC</td>
<td>603.0</td>
<td></td>
</tr>
<tr>
<td>CRIPPENS</td>
<td>603.0</td>
<td></td>
</tr>
<tr>
<td>CIA HEADQUARTERS</td>
<td>603.0</td>
<td></td>
</tr>
<tr>
<td>FAIRFAX COUNTY POLICE</td>
<td>603.0</td>
<td></td>
</tr>
<tr>
<td>7TH DIV STATE POLICE HQTRS</td>
<td>603.0</td>
<td></td>
</tr>
<tr>
<td>INOVA FAIR OAKS HOSPITAL</td>
<td>603.0</td>
<td></td>
</tr>
<tr>
<td>DAVISON AAF</td>
<td>12.7</td>
<td></td>
</tr>
<tr>
<td>CENTREVILLE</td>
<td>12.7</td>
<td></td>
</tr>
</tbody>
</table>
Covanta Fairfax Emissions

Within 20 miles of DC’s borders, Covanta Fairfax is…

• #1 in Nitrogen Oxides
  – So high that Covanta’s home state of New Jersey singled out this incinerator as ineligible to sell renewable energy credits to NJ
  – #2 in the entire industry, worse than the Detroit incinerator (which has no NOx controls)

• #1 in Carbon Dioxide

• #1 in Hydrochloric Acid

• #1 in Hydrofluoric Acid (was worst in their industry in 2008)

• #1 in Mercury

• #4 in Sulfur Dioxide

• Top 10 in Lead

• #3 in overall air pollution (after Dulles and DCA Airports)
Life Cycle Analysis on DC Waste Options

Analysis done by:
Jeffrey Morris, Ph.D. (Economics)
Sound Resource Management Group
360-867-1033
jeff.morris@zerowaste.com
www.zerowaste.com

Dr. Morris authored several peer reviewed published studies on waste systems.
Life Cycle Analysis on DC Waste Options

- All comparison data includes pollution from trucking.
  - Note the tiny difference that doubling hauling distance makes.
- A 75% landfill gas capture rate is assumed, based on what was reported to us in calls to the four landfills. All three we reached independently reported the same percentage.
- For the landfills, the best data available for DC waste composition is used. Where categories were vague, we filled in the proportions with more detailed data from Montgomery County’s waste characterization study. Actual emissions data for Covanta Fairfax is used, as reported to EPA.
- We used local precipitation data from the areas where the landfills are located, which is wetter than average.
- “Other 3 Landfills” = King & Queen LF, Middle Peninsula LF, and Charles City LF
Conservative Assumptions on Global Warming

- This study looks at the 20-year impact (most relevant for methane’s impacts on global warming) as well as the 100-year impact. The 20-year impact, based on methane being worse in the short-term, makes landfills out to be worse than they are when evaluated over 100 years.

- This study uses the latest science for methane's global warming potential (86 times worse than CO2 over 20 years based on the latest International Panel on Climate Change report).

See [www.energyjustice.net/naturalgas/#GWP](http://www.energyjustice.net/naturalgas/#GWP) for a link to the various data sources in the evolving science on global warming potentials.
Conservative Assumptions on Toxicity

• This study did not factor in two main things that would also trend toward incinerators being worse than landfills:
  – It did not include data on leaching of toxic chemicals from incinerator ash, but DID include leaching from trash. In fact, leaching of toxic chemicals from incinerator ash is expected to be worse, especially where the ash is used as landfill cover or is mixed with municipal solid waste, as it is in Old Dominion Landfill.
  – Dioxin/furan emissions were not included. This was due to a lack of good data on dioxin emissions from landfills. Dioxins and furans are the most toxic man-made chemicals known to science, and are largely associated with incineration sources, so ignoring them biases the study in a conservative way, making incinerators out to be less toxic than they truly are.
Nitrogen Oxide (NOx) Pollution

[Pounds of NOx per ton of waste disposed.]
Particulate Matter Pollution

[Pounds of PM2.5 equivalent per ton of waste disposed.]
Toxic Pollution

[Pounds of toluene equivalent per ton of waste disposed.]

Does not include dioxin/furan emissions or ash leaching.
Carcinogenic Pollution

[Pounds of benzene equivalent per ton of waste disposed.]

Does not include dioxin/furan emissions or ash leaching.
Eutrophication

[Pounds of nitrogen equivalent per ton of waste disposed.]

NOx and ammonia air emissions plus BOD, COD, phosphate, and ammonia water releases from landfills.
Acidification

[Pounds of SO₂ equivalent per ton of waste disposed.]

Incinerator emissions are largely from nitrogen oxides, but also include other acid gases (SO₂, HCl, HF). For the landfills, it’s hydrogen sulfide (H₂S) from the landfill, plus ammonia, NOx and SOx from the landfill gas burners.
Ecosystems Toxicity

[Pounds of 2,4-D herbicide equivalent per ton of waste disposed.]

For the incinerator, this is mainly based on mercury emissions. For the landfill, mainly formaldehyde.
Ozone Depletion

[Pounds of CFC-11 equivalent per ton of waste disposed.]
Smog Formation

[Pounds of ozone \((O_3)\) equivalent per ton of waste disposed.]
Global Warming Pollution

[Pounds of CO₂ equivalent per ton of waste disposed.]
Recap!
Global Warming Pollution
Smokestack CO2 Emissions from U.S. Power Plants

**CO2 (lbs/MWh)**

Data is in pounds of CO2 per unit of energy produced (lbs/MWh)

Source: U.S. EPA Emissions & Generation Resource Integrated Database (eGRID) v.9, released 2/24/2014 (2010 data)
Global Warming Pollution

[EPA Public Relations on MSW Incineration]

**CO2 (pounds per megawatt hour)**

- **MSW**: 1000 pounds per megawatt hour
- **Coal**: 2000 pounds per megawatt hour
- **Oil**: 1600 pounds per megawatt hour
- **Natural Gas**: 1200 pounds per megawatt hour
Global Warming Pollution

[EPA FLIGHT Data in 2015 metric tons CO2 equivalent.]

NOTE: This ignores biogenic emissions from incineration, but not from landfills, making Covanta seem half as bad as they are.
Global Warming Pollution

[Energy Recovery Council Public Relations on MSW Incineration]
How they Mislead on Global Warming

• Ignoring the “biogenic” half of carbon emissions from incinerators while counting all of the GHGs (all “biogenic”) from landfills.
  – Biomass carbon neutrality has been scientifically debunked. See a compilation of the science here: www.energyjustice.net/biomass/carbon

• Pretending “biogenic” carbon’s share in MSW is larger than the 52.7% that EPA factors into their eGRID data.

• Subtracting avoided methane emissions from landfills, as if conventional landfills are the only alternative.
  – Invalid when comparing incinerators to landfills, as the same assumption could be made for landfills, letting them subtract incinerator emissions.

• Subtracting emissions from offsetting fossil fuel electricity
  – …as if they’re not actually competing with wind power, especially with Covanta Fairfax cashing in on in Maryland Tier I Renewable Energy Credits ($3.9 million in 2015), as Maryland’s two trash incinerators also do.

Details at: www.energyjustice.net/incineration/climate
Evaluating Energy Displacement

Life-cycle analyses often include assumptions about electricity being displaced. The question is what is being displaced?

- Wind?
- Coal?
- Gas?
- The generation source most likely to be used to meet RPS Tier 1 requirements?
- The fuel most likely used in development of new generation? (wind and gas)
- The fuel used to meet peak demand when baseload generation on the grid isn’t sufficient? (gas)
- The system mix in the state? →
- The system mix in the regional PJM grid?

Just 47.5% of the MD 2017 electricity generation was from combustion sources that release GHGs. The average carbon intensity of the MD mix is lower than that of natural gas.

### 2017 Maryland Electricity Generation

<table>
<thead>
<tr>
<th>Source</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nuclear</td>
<td>44.3%</td>
</tr>
<tr>
<td>Coal</td>
<td>24.9%</td>
</tr>
<tr>
<td>Natural gas</td>
<td>19.7%</td>
</tr>
<tr>
<td>Hydro</td>
<td>5.8%</td>
</tr>
<tr>
<td>Trash incineration</td>
<td>1.9%</td>
</tr>
<tr>
<td>Wind</td>
<td>1.5%</td>
</tr>
<tr>
<td>Solar</td>
<td>1.0%</td>
</tr>
<tr>
<td>Biomass &amp; Landfill gas</td>
<td>0.6%</td>
</tr>
<tr>
<td>Oil</td>
<td>0.3%</td>
</tr>
</tbody>
</table>
Evaluating Energy Displacement

Wind displacement is a fair assumption.

- Nearly all trash incinerators and most landfills produce electricity, though landfills don’t produce as much.
- All of the waste facilities in question are producing electricity AND selling renewable energy credits into the Maryland Renewable Portfolio Standard (RPS). This includes the trash incinerator in Dickerson, all four VA landfills in the DC study, the Old Dominion landfill being used for MCRRF incinerator ash, and the Maplewood Landfill we recommend be used instead.
- Wind, trash incineration and landfill gas renewable energy credits are all being sold for about the same price in 2015 (latest available data).
- Landfills are not being built for electricity generation, and are not in a position to ramp up gas/energy production to meet demand.
- Closing an incinerator means MD utilities will likely turn to wind to meet their Tier 1 RPS obligation. Other resources are more costly.
Global Warming Pollution

[Pounds of CO₂ equivalent per ton of waste disposed.]

(Displacing wind / no energy displacement factored in)
Global Warming Pollution

[Pounds of CO₂ equivalent per ton of waste disposed.]

(Displacing Natural Gas)
Global Warming Pollution

[Pounds of CO\textsubscript{2} equivalent per ton of waste disposed.]

(Displacing Coal)
Evaluating Energy Displacement

- Even if we assume that coal power is being displaced, incineration comes out 10% worse for the climate than coal in the short term (20-years), and 113% worse than (2.1 times as bad as) landfilling in the long-term (100 years).

- Coal displacement is an extreme assumption, and completely unlikely:
  - No one is building new coal power plants anymore.
  - Coal assets are being retired rapidly across the country. Coal mining companies are going bankrupt.
  - U.S. coal production has peaked in 2002 in terms of energy value extracted, leaving the more expensive and harder to reach coal deposits, most of which will never be extracted because gas, and increasingly wind and solar, are undercutting and replacing coal.
  - Even the coal / gas power plant in Dickerson is planned for retirement in May 2021. It’s only been operating at 11% capacity in 2016 and 3% in 2017.
Dioxin Facts

• Dioxins and furans are the most toxic chemicals known to science. They are highly toxic even in miniscule amounts.

• Dioxins cause infertility, learning disabilities, endometriosis, birth defects, sexual reproductive disorders, damage to the immune system, cancer and more.

• 93% of dioxin exposure is from eating meat and dairy products.

www.ejnet.org/dioxin/
Exposure to Dioxins

<table>
<thead>
<tr>
<th>Source</th>
<th>North American Daily Intake (pg/day) of TEQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef Ingestion</td>
<td>38.0</td>
</tr>
<tr>
<td>Dairy Ingestion</td>
<td>24.1</td>
</tr>
<tr>
<td>Milk Ingestion</td>
<td>17.6</td>
</tr>
<tr>
<td>Chicken Ingestion</td>
<td>12.9</td>
</tr>
<tr>
<td>Pork Ingestion</td>
<td>12.2</td>
</tr>
<tr>
<td>Fish Ingestion</td>
<td>7.8</td>
</tr>
<tr>
<td>Egg Ingestion</td>
<td>4.1</td>
</tr>
<tr>
<td>Inhalation</td>
<td>2.2</td>
</tr>
<tr>
<td>Soil Ingestion</td>
<td>0.8</td>
</tr>
<tr>
<td>Water Ingestion</td>
<td>Negligible</td>
</tr>
</tbody>
</table>

Total Exposure = 119 pg/day
How to make dioxin

• Dioxins are created by burning hydrocarbons with chlorine in the presence of oxygen.

• Dioxin emissions increase when:
  – More chlorine is in the fuel/waste stream
  – Certain metal catalysts are present (Copper, Iron, Zinc…)
  – The gases stay in a low temperature range (200-450° C)
“In our industry, and in the waste industry as a whole, fires are becoming more prevalent.”

-Mark Harlacker – Covanta’s Commercial Business Director for Mid-Atlantic Region, 4/26/2017 testimony before DC City Council
“Waste-to-energy is an additional capital cost. That is not in dispute, compared to a landfill... compared to a landfill, which is a less capital-intense structure – it is more expensive. If you had a landfill next to a waste-to-energy facility, then almost in every case, you would think the landfill is going to be cheaper.”

Ted Michaels, President, Energy Recovery Council, March 18, 2013 testimony before Washington, DC City Council
Most Expensive Way to Manage Waste

Figure 3. Landfill and Incinerator Tip Fees

Most Expensive Way to Make Energy

Landfills Cheaper for DC

Former DPW Director William Howland, answering questions from Transportation and Environment Committee Chair, Mary Cheh, in hearing on 9/28/2012:

Howland: “We made the decision I think 2 years ago, 3 years ago, that – we were taking our trash to the landfill, then – that’s a policy decision, the department, we signed a long-term contract with Fairfax County to convert it from waste to energy. One of the interesting things about that is that the last two trash hauling contracts that we entered into, we asked each vendor to give us a proposal on whether to send the – what would the cost be to send it to landfill? What would be the cost to send it to Fairfax? We negotiated the price with Fairfax and you just needed to give us the hauling costs from DC to Fairfax. There were 9 vendors in 2004 that bid, and 5 vendors that bid in 2009. All 14 bids, it was cheaper to take it to a landfill, which typically was as far away as Richmond, than it was to take it to Fairfax County. But we thought, environmentally, it was better to take it to Fairfax County and convert it to energy, than it was to landfill it.”
Landfills Cheaper for DC

-----Original Message-----
From: Howland, William (DPW)
Sent: Tuesday, February 03, 2009 8:00 PM
To: Thomas, Chimeka (EOM)
Subject: RE: Waste To Energy proposal

Chimeka

Not exactly. I am sure the distance is a factor in determining the cost.

Five years ago, DPW issued a solicitation for waste disposal. In the solicitation DPW asked for the vendors for pricing on two different scenarios. We asked them to give us a price for disposal if the vendors disposed of the trash at any facility of their choosing.

We also asked for a price to transport it to Fairfax County to their waste to energy facility. The price for disposal was fixed at the same cost for all of the vendors so the only thing we needed to know is what the transport cost would be to Fairfax.

We had three bidders and all three companies bid a lower cost to haul the trash to a landfill much further away than it would be to haul it to Fairfax with a set disposal fee.

I doubt seriously that any waste to energy facility can get the cost significantly below $40 per ton. I realize the Fairfax County facility is nearly 20 years old and the technology has probably radically evolved.

I am still very much interested in discussing this option. I think it is environmentally a better option for the District. I am just not sure that it is a cheaper option. I think we will have achieved something if we can find an option that is price competitive.

Thanks

Bill

William O. Howland, Jr.
**Landfills Cheaper for DC**

- Tip fee at Covanta Fairfax is $34.64/ton plus Lucky Dog hauling contract ($10.95/ton), totaling $45.59/ton.
- As in the past, if landfills were permitted to bid on such a multi-year contract, they could provide cost-competitive bids to the current Covanta and Lucky Dog arrangement, even with the greater hauling distance.
- Since there is no “put or pay” clause requiring use of the Covanta contract, DPW ought to issue an RFP for landfill bids over a comparable contract term, and continue the current use of landfills, even once Covanta Fairfax is operational again.
Incinerator Ash

• Incinerators still require landfills for their toxic ash
• Choice is NOT landfill vs. incinerator, but:

  landfill

  vs.

  incinerator **AND** a smaller, more toxic landfill
Incinerator Ash

- Incinerators still require landfills for their toxic ash
- Choice is NOT landfill vs. incinerator, but:

  landfill

  vs.

  incinerator AND a smaller, more toxic landfill

  OR...

  Zero Waste and minimal landfiling
Incinerator Ash

- Incinerators still require landfills for their toxic ash
- 30 tons of ash produced for every 100 tons burned
Incinerator Ash = Hazardous Waste

Incinerator ash is toxic, but the U.S. EPA allows a special test that enables it to test as non-hazardous, saving the industry a lot of money.

Despite Canada relying on the same test, Vancouver’s incinerator ash is leaching toxic cadmium at levels about twice the province’s acceptable limits. They’ve had to ship the hazardous ash to a hazardous waste landfill in Alberta.
The back end is still a landfill...

1. **Direct landfilling**
   (bad, but better than incineration)

2. **Incineration → toxic ash to landfill**
   (most polluting and expensive option)

3. **Anaerobic digestion → landfill**
   (best option, economically and environmentally; avoids having gassy, stinky landfills)
Impacts of Each Major Option

1. **Direct landfilling**
   - leachate (toxins)
   - air emissions (toxins, methane, odors)

2. **Incineration** → **toxic ash to landfill**
   - leachate (even more toxins)
   - air emissions from ash blowing off site (toxins)

3. **Anaerobic digestion** → **landfill**
   - odor, leachate and air emissions highly minimized
Landfill Options in VA

• The question for Montgomery County is not whether to landfill in Virginia, but whether to send ash, trash, or processed residuals, how much to send, and which landfill to use.

• It’s not the volume of waste that harms people. It’s the toxicity. Based on this, and the many other measures in which incineration (and ash dumping) is more environmentally harmful than conventional landfilling, we recommend sending trash over ash, and ideally, sending an ever shrinking and biologically stabilized trash residual, incorporating the best Zero Waste practices.

• It’s also important to impact fewer people. The same rail carrier (CSX) that hauls ash to Old Dominion Landfill has access to other landfills that impact far fewer people.
Maplewood Landfill took in only 43 tons of ash, all in 2015, and thus isn’t visible on this chart.
## Landfill Options in VA

<table>
<thead>
<tr>
<th>Facility</th>
<th>City</th>
<th>County</th>
<th>Owner</th>
<th>Pop (1 mi)</th>
<th>Pop (5 mi)</th>
<th>Black Pop. (5 mi)</th>
<th>White Pop. (5 mi)</th>
<th>Median HH Income (5 mi)</th>
<th>Expected Remaining Permitted Life (Years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brunswick Waste Management Facility</td>
<td>Lawrenceville</td>
<td>Brunswick</td>
<td>Republic</td>
<td>19</td>
<td>5,782</td>
<td>67%</td>
<td>29%</td>
<td>$23,000</td>
<td>168</td>
</tr>
<tr>
<td>Old Dominion Sanitary Landfill</td>
<td>Richmond</td>
<td>Henrico</td>
<td>Republic</td>
<td>1,113</td>
<td>81,000</td>
<td>72%</td>
<td>23%</td>
<td>$39,000</td>
<td>2 (24)</td>
</tr>
<tr>
<td>King George Landfill</td>
<td>Sealston</td>
<td>King George</td>
<td>County</td>
<td>92</td>
<td>5,497</td>
<td>13%</td>
<td>80%</td>
<td>$81,000</td>
<td>30</td>
</tr>
<tr>
<td>Maplewood Landfill</td>
<td>Jetersville</td>
<td>Amelia</td>
<td>WMI</td>
<td>66</td>
<td>1,640</td>
<td>25%</td>
<td>70%</td>
<td>$58,000</td>
<td>148</td>
</tr>
<tr>
<td>Atlantic Waste Disposal Solid Waste Landfill</td>
<td>Waverly</td>
<td>Sussex</td>
<td>WMI</td>
<td>0</td>
<td>3,266</td>
<td>68%</td>
<td>29%</td>
<td>$56,000</td>
<td>76</td>
</tr>
</tbody>
</table>

The County has primarily been using the Old Dominion Landfill since 2011, which is the most populated and most African-American community among those available with CSX rail service. It’s due to fill up within 2 years, but a pending expansion would have it last another 24.

Using Maplewood Landfill would impact far fewer people without violating the Civil Rights Act. That landfill also has more remaining space than any in the state.
THE ZERO WASTE HIERARCHY

1. **RETHINK/REDESIGN**
2. **REDUCE**
3. **REUSE**
4. **RECYCLE/COMPOST**
5. **MATERIAL RECOVERY**
6. **RESIDUALS MANAGEMENT**
   (Biological treatment and stabilized landfilling)
7. **UNACCEPTABLE**
   (Waste deregulation, incineration, and “waste-to-energy”)

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This diagram outlines the zero waste hierarchy, which prioritizes prevention over disposal, aiming to minimize waste generation at its source.
Zero Waste Hierarchy

• Rethink / Redesign
• Reduce
• Source Separate:
  – Reusables
  – Recycle (multi-stream)
  – Compost
  – Waste
    • Research to see what is left, and encourage redesign
    • Recovery: mechanically remove additional recyclables
    • Anaerobically digest, then aerobically compost residuals
    • Stabilized (digested) residuals to landfill

www.energyjustice.net/zerowaste
What is the best disposal option for the “Leftovers” on the way to Zero Waste?

By
Dr. Jeffrey Morris
Dr. Enzo Favoino
Eric Lombardi
Kate Bailey

www.ecocycle.org/specialreports/leftovers
The MRBT scenarios had the lowest environmental and health impacts among all the disposal options.
Figure 3: Standardized Environmental Impact Scores for the Five Management Options for Leftover Waste Remaining after 70% Recycling
For more Info…

• Incineration:
  – www.EnergyJustice.net/incineration
  – www.EnergyJustice.net/biomass
  – www.EnergyJustice.net/tires
  – www.no-burn.org

• Landfills and Landfill Gas Burning:
  – www.EnergyJustice.net/lfg
  – www.ejnet.org/landfills
  – www.beyondlandfilling.org

• Zero Waste:
  – www.EnergyJustice.net/zerowaste
  – www.ilsr.org/initiatives/waste-to-wealth
  – www.grrn.org/zerowaste
  – www.zwia.org