Energy Justice Network

www.EnergyJustice.net

...helping communities protect themselves from polluting energy and waste technologies

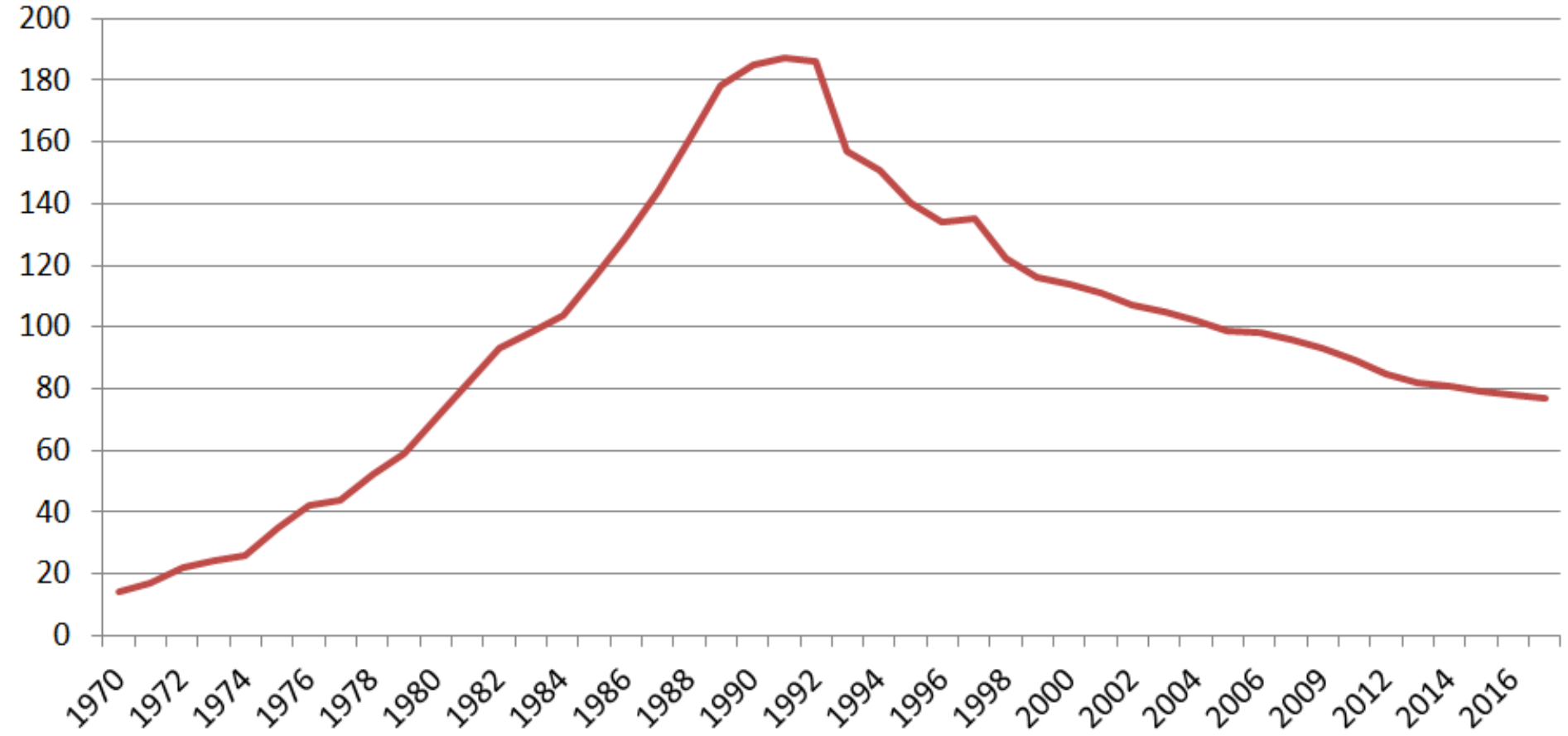
Landfilling vs. Incineration

Landfilling vs. Incineration

…and Ash Landfilling

www.EnergyJustice.net/map

Number of Commercial Trash Incinerators Operating in the U.S.



World's largest waste corporation driving away from incineration

WASTE MANAGEMENT

THE WALL STREET JOURNAL.

Jan 3, 2014: "Big Waste Hauler Rethinks Startups"

[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)

PHOTO COURTESY OF JAMES F. REGAN, COVANTA ENERGY CORPORATION

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

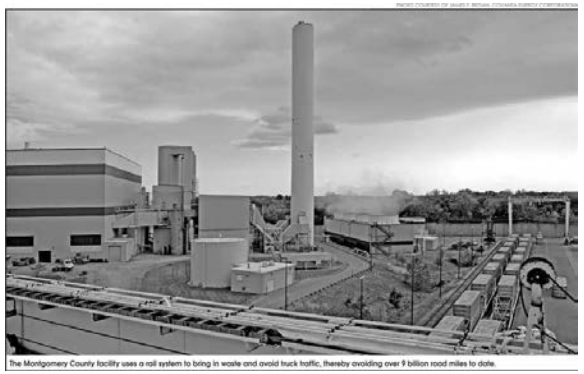
(Montgomery County Resource Recovery Facility)

- 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


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.

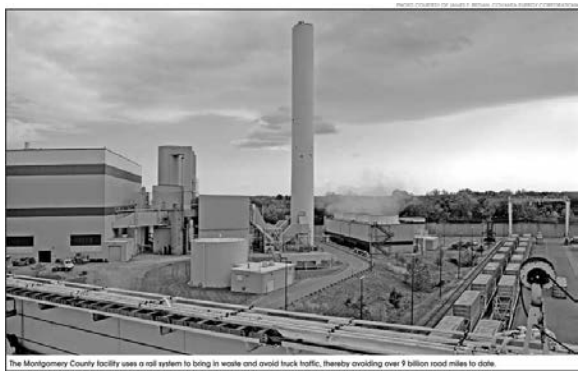
Montgomery County's 2nd Largest Polluter: NMWDA / Covanta Trash Incinerator

(Montgomery County Resource Recovery Facility)

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



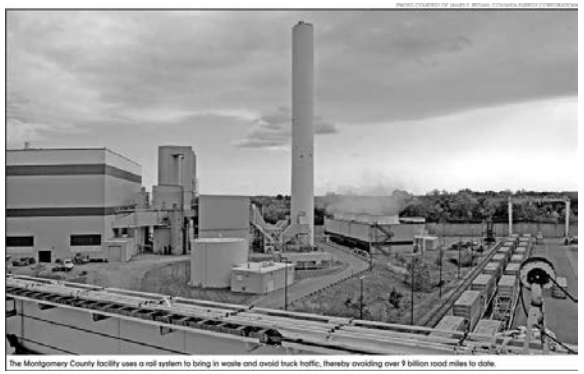
Montgomery County's 2nd Largest Polluter: NMWDA / Covanta Trash Incinerator

(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

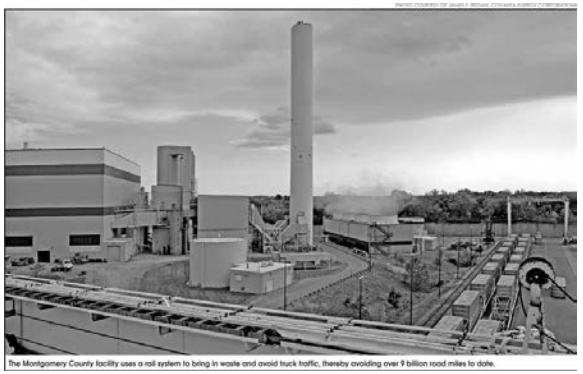


One of Maryland's Largest Polluters: 13th out of 520 industrial polluters

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

* Facility-wide NOx emissions

Maryland
Department of the Environment

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

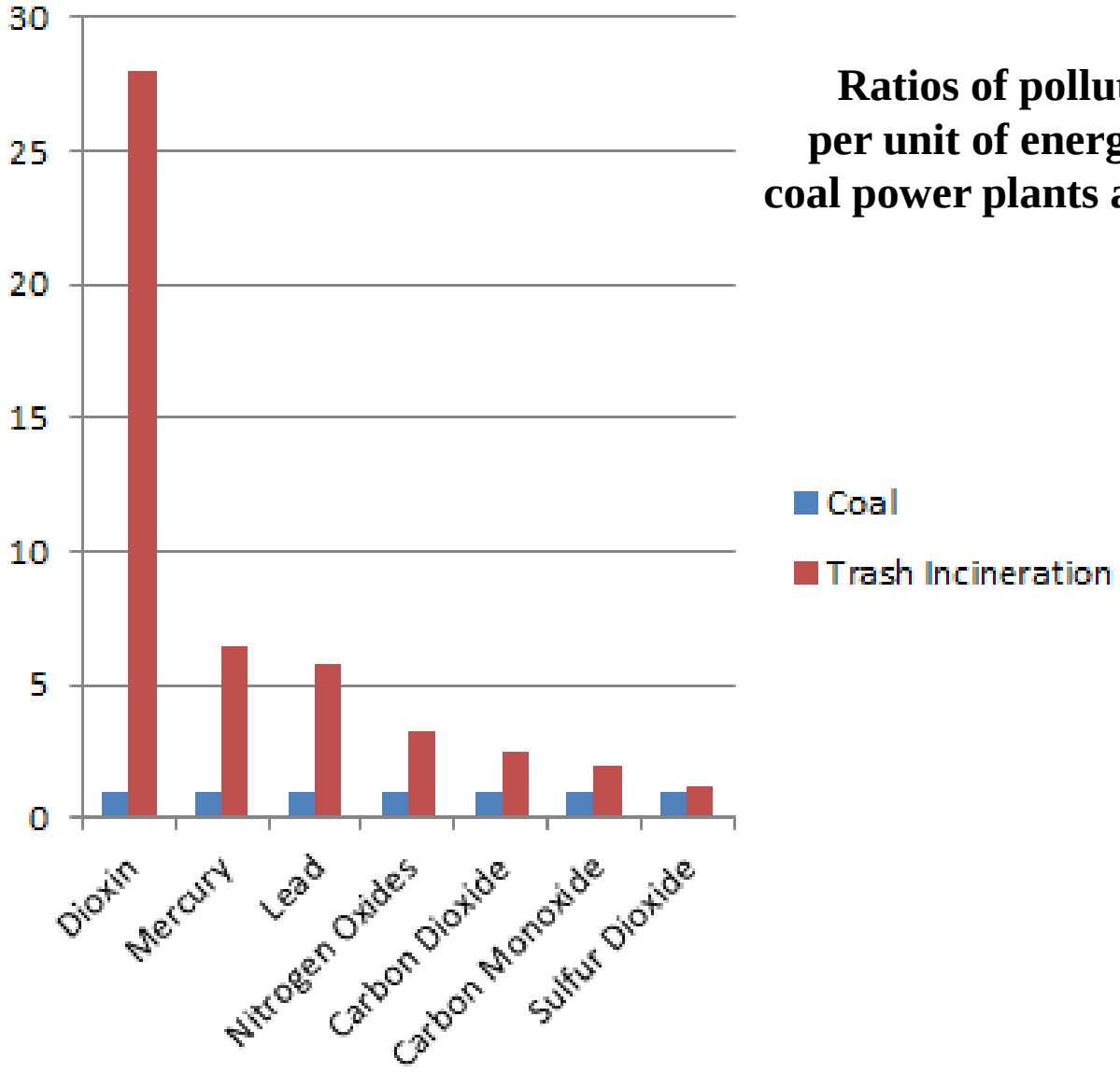
Incineration Worse than Coal

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

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

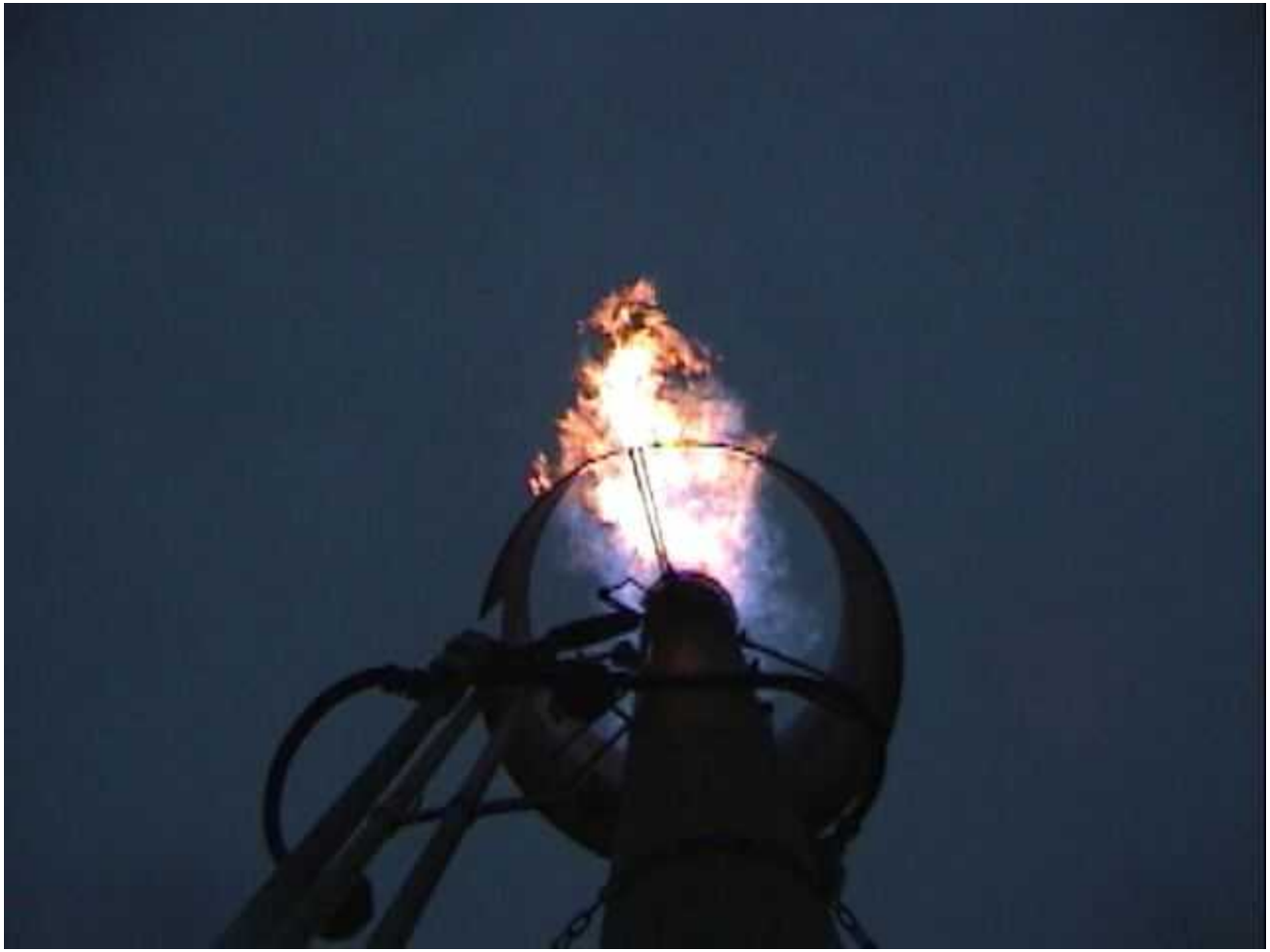
“a waste-to-energy plant is designed to manage solid waste... the electricity output is a secondary function”

Ted Michaels, President, Energy Recovery Council, March 18, 2013 testimony before Washington, DC City Council

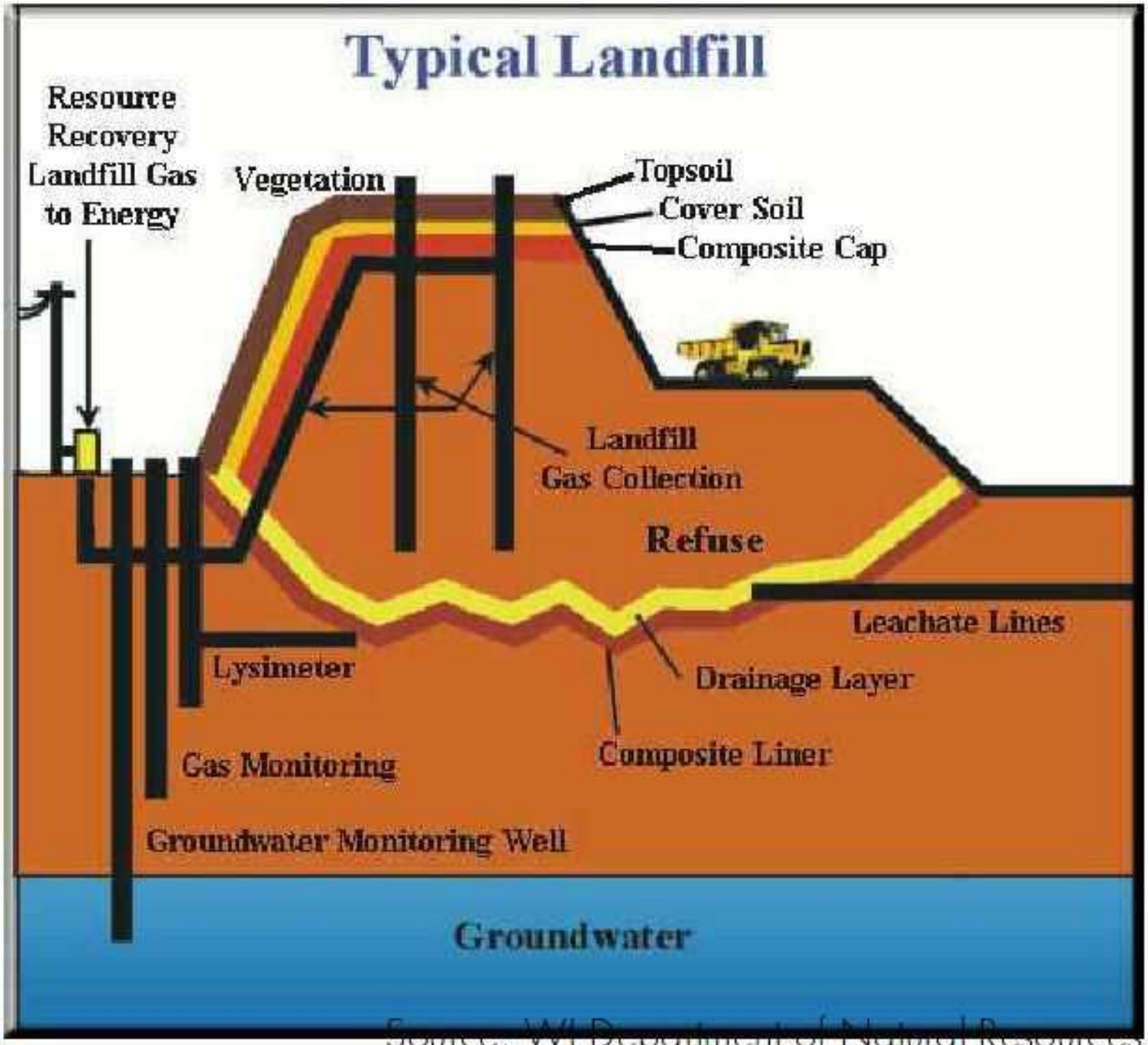
Trash Incinerator Health Impacts

- 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/



Source: WI Department of Natural Resources

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…)

1 -butanol	2,6-dimethylheptane	4-methyl-2-pentanol + branched C-8 paraffin	butanol isomer?
1 -chloro-1 -fluoroethane	2-butanethiol	acetaldehyde	butyl hexanoate
1 -chloro-1 -propene	2-butanol	acetone	butylcyclohexane
1 -chloropropane	2-chloropropane	acetone + ethanol	butylene
1 -heptene	2-ethylfuran	alpha thujene	butylpropanoate
1 -octene	2-ethylhexyl alcohol	alpha-pinene	C-1 0 olefin
1 -pentene	2-ethyl-l-hexanol	alpha-thugene	C-1 1 diene
1 -propanol	2-methyidecalin	alpha-thujene	C-1 1 olefin
1, 1 -dichloroethane	2-methyl heptane	alpha-thujene + branched C-10 paraffin	C-1 1 paraffin
1, 1, 1 -trichloroethylene	2-methyl propanoate	benzene	C-1 1 paraffin + C-3 benzene
1, 1,2,3-tetramethyl-cyclohexane	2-methyl-2-propanethiol	benzothiazole	C-1 I cylcoparaffin
1,1,3-trimethylcyclohexane	2-methyl-3-pentanone + pentanol isomer	beta-pinene	C-10 diene
1,1-dichloroethane	2-methylbutane	branched C-1 1 olefin	C-10 olefin
1,1-dimethyl-cyclopropane	2-methyl-butane	branched C-1 1 olefin & paraffin + C-1 2 diene	C-12 diene
1,2,3-trimethylcyclohexane	2-methyl-ethyl butanoate	branched C-1 1 olefin + branched C-1 2 olefin	C-3 alkylcyclohexane isomer
1,2,3-trimethylcyclohexane isomer	2-methylfuran	branched C-1 1 paraffin	C-3 alkyl-substituted cyclopentadiene isomer
1,2-dichloroethene	2-methylheptane	branched C-1 I paraffin	C-3 benzene
1,2-dichloroethylene	2-methylhexane	branched C-10 olefin	C-3 benzene + branched C-1 1 paraffin
1,2-dichloropropane	2-methylhexylbutyrate	branched C-10 olefin + branched C-1 1 paraffin	C-3 benzene + branched C-10 olefin + paraffin
1,3,5-trimethylcyclohexane	2-methyl-l-propanol	branched C-10 olefin + C3-benzene, …	C-3 benzene + branched C-10 paraffin
1,3,5-trimethylcyclohexane isomer	2-methyloctahydropentalene	branched C-10 paraffin	C-3 benzene + C-1 1 paraffin
1,3-dichloro-2-butene	2-methylpentane	branched C-10 paraffin + 2-methylhexylbutanoate	C-3 benzene + C-10 paraffin
1,5-cyclooctadiene	2-methylthiobutane	branched C-10 paraffin + beta-pinene	C-3 benzene + C-9 diene
1-butanol	2-methylthiopropane	branched C-10 paraffin + branched C-10 olefin	C-3 benzene + octahydro-2-methylpentalene
1-butanol + 1,2-dichloropropane	2-pentanone + 1,2-dichloropropane	branched C-10 paraffin + phellandrene	C-3 benzene isomer
1-chloropropane	2-pentene	branched C-12 diene	C-3 cyclohexane

Landfill Health Impacts

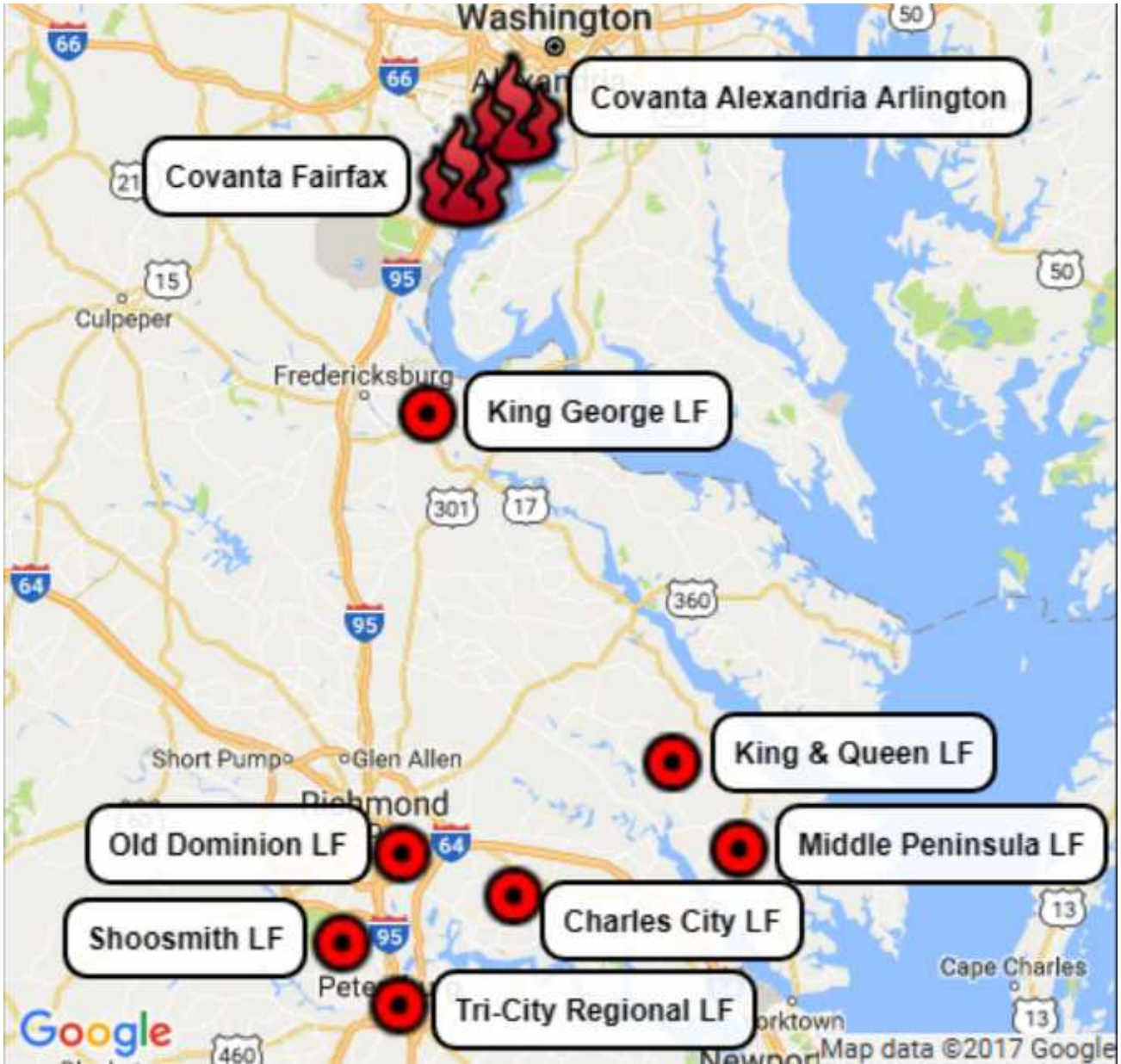
A New York study of 38 landfills found that women living near solid waste landfills where gas is escaping have a four-fold increased chance of bladder cancer or leukemia.

"Investigation of Cancer Incidence and Residence Near 38 Landfills With Soil Gas Migration Conditions, New York State, 1980-1989," State of New York Department of Health, (Atlanta, Ga: Agency for Toxic Substances and Disease Registry, June, 1998).

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

Covanta Fairfax	222,937	27%
Shoosmith Sanitary Landfill	221,415	27%
Middle Peninsula Landfill and Recycling Facility	190,323	23%
BFI Old Dominion Landfill	118,785	14%
Tri City Regional Disposal and Recycling Services	36,898	4%
King George Landfill & Recycling Center	20,002	2%
Covanta Alexandria Arlington	16,690	2%
King and Queen Sanitary Landfill	267	0%
Charles City County Landfill	18	0%
Total:	827,335	

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



Facilities in Focus for 2017 & This Presentation

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

[“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)

Global Warming Pollutants	**Pounds released (2014)**
Carbon Dioxide (CO2)	2,169,540,876
Methane (CH4)	762,927
Nitrous Oxide (N2O)	100,130
Health Damaging Pollutants	**Pounds released (2014)**
Carbon Monoxide	11,319
Hydrochloric Acid	57,408
Hydrofluoric Acid	1,385
Lead	68
Nitrogen Oxides (NOx)	3,398,301
Particulate Matter (PM10)	14,709
Fine Particulate Matter (PM2.5)	8,862
Sulfur Dioxide	257,899
Volatile Organic Compounds	11,813

EPA 2014 National Emissions Inventory Data

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

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).

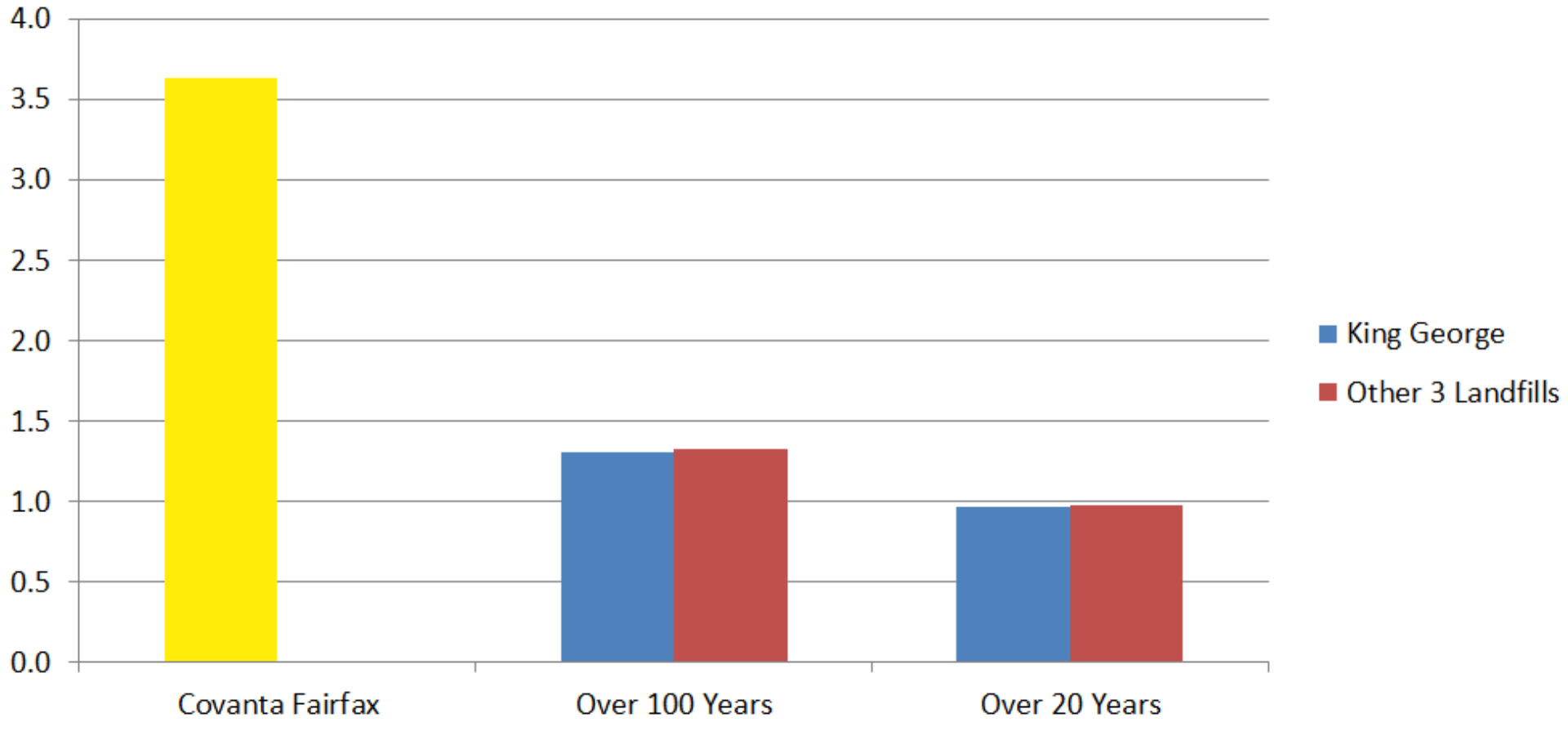
See www.energyjustice.net/naturalgas/#GWP for a link to the various data sources in the evolving science on global warming potentials.

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.

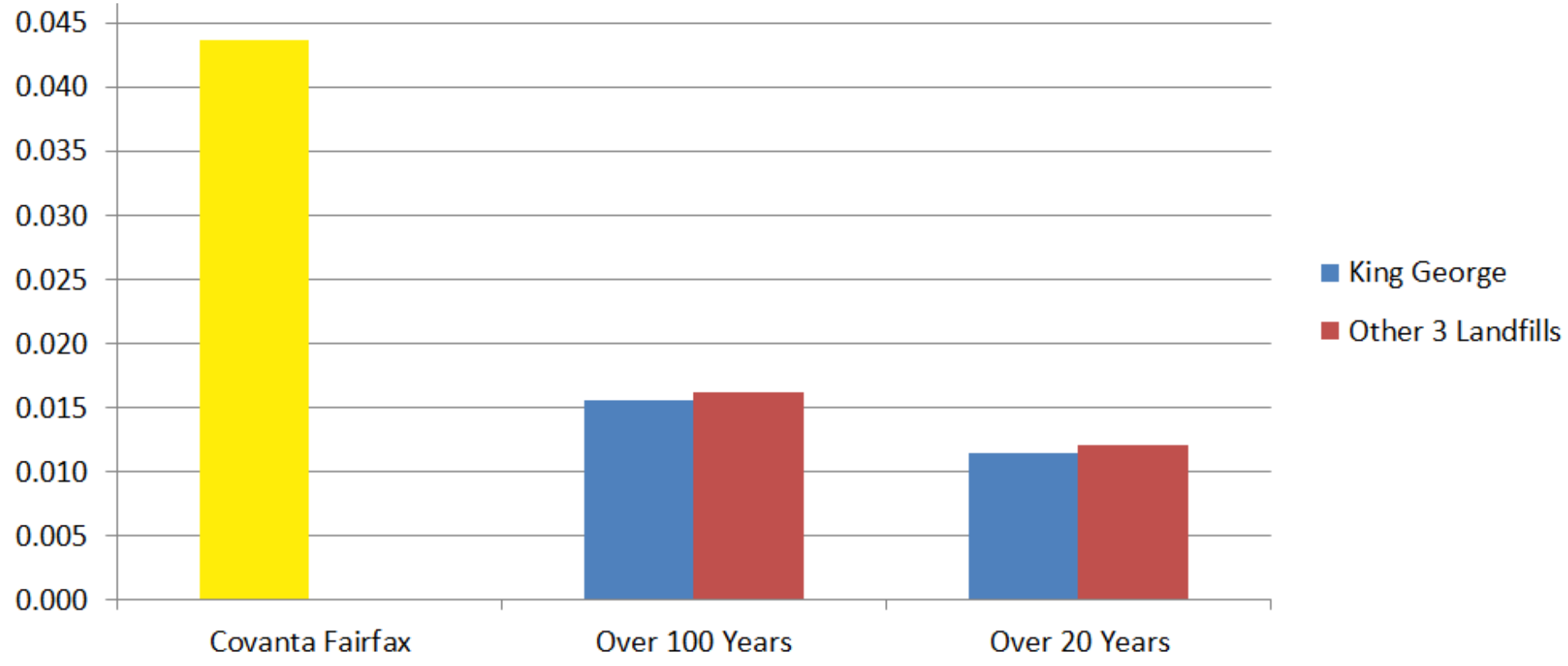
Nitrogen Oxide (NOx) Pollution

[Pounds of NOx per ton of waste disposed.]



Particulate Matter Pollution

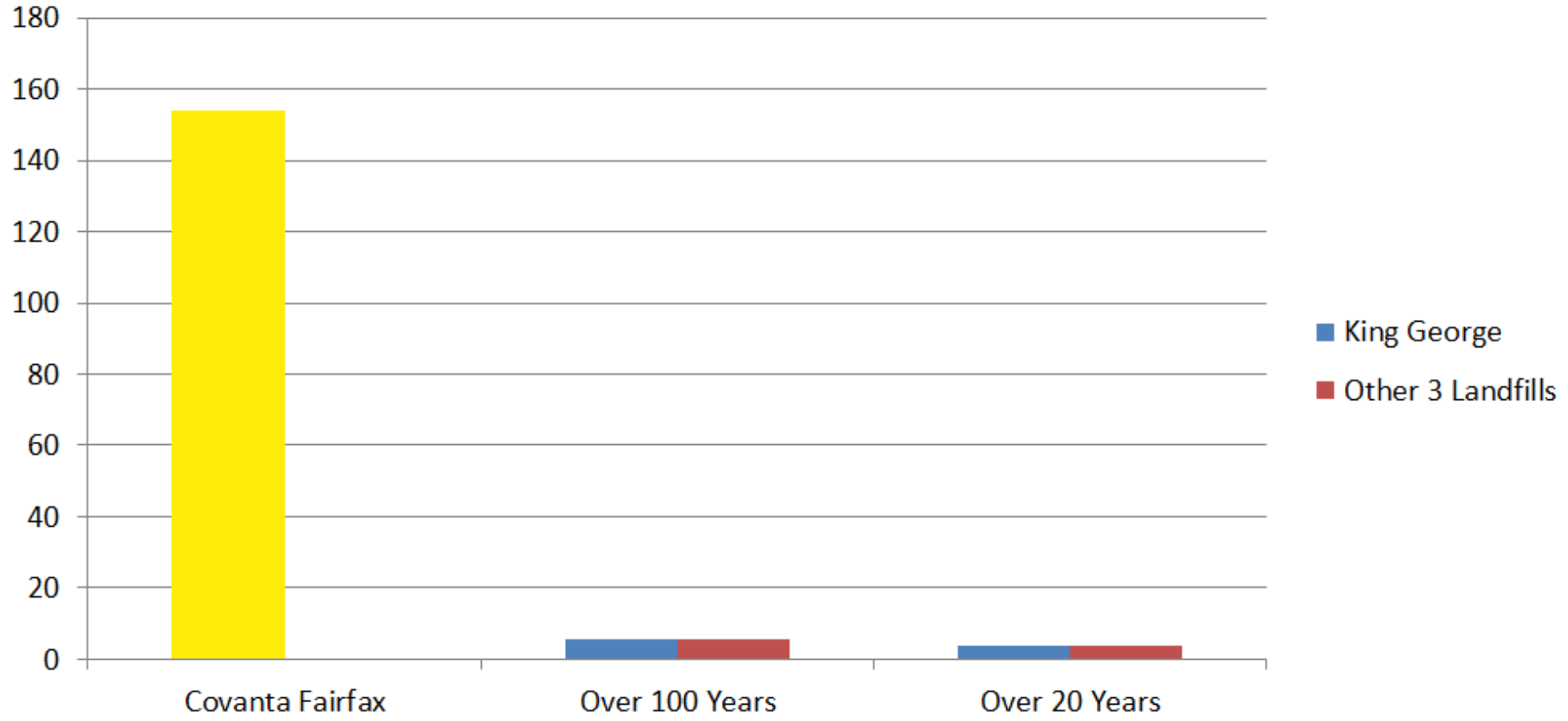
[Pounds of PM2.5 equivalent per ton of waste disposed.]



Toxic Pollution

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

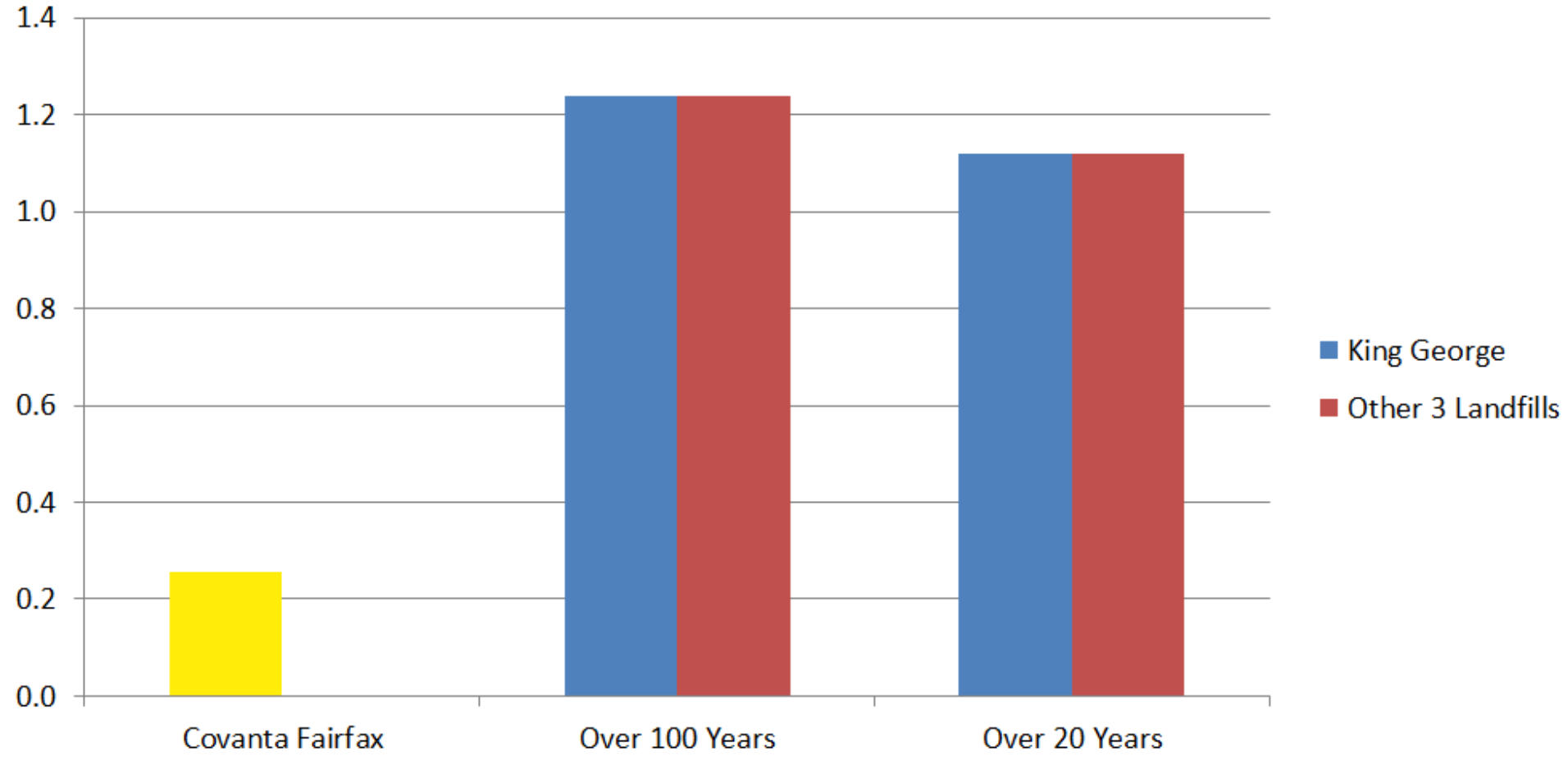
Does not include dioxin/furan emissions or ash leaching.



Carcinogenic Pollution

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

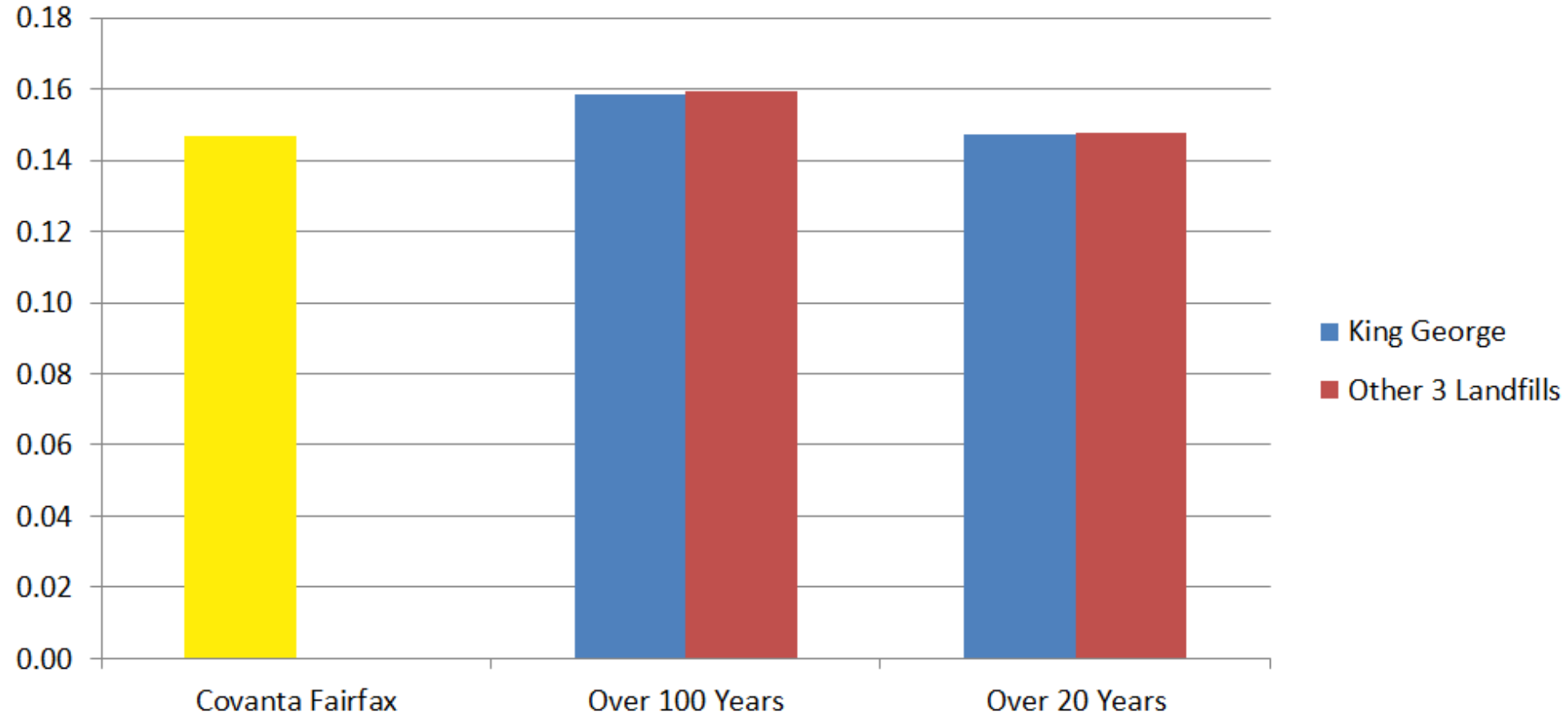
Does not include dioxin/furan emissions or ash leaching.



Eutrophication

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

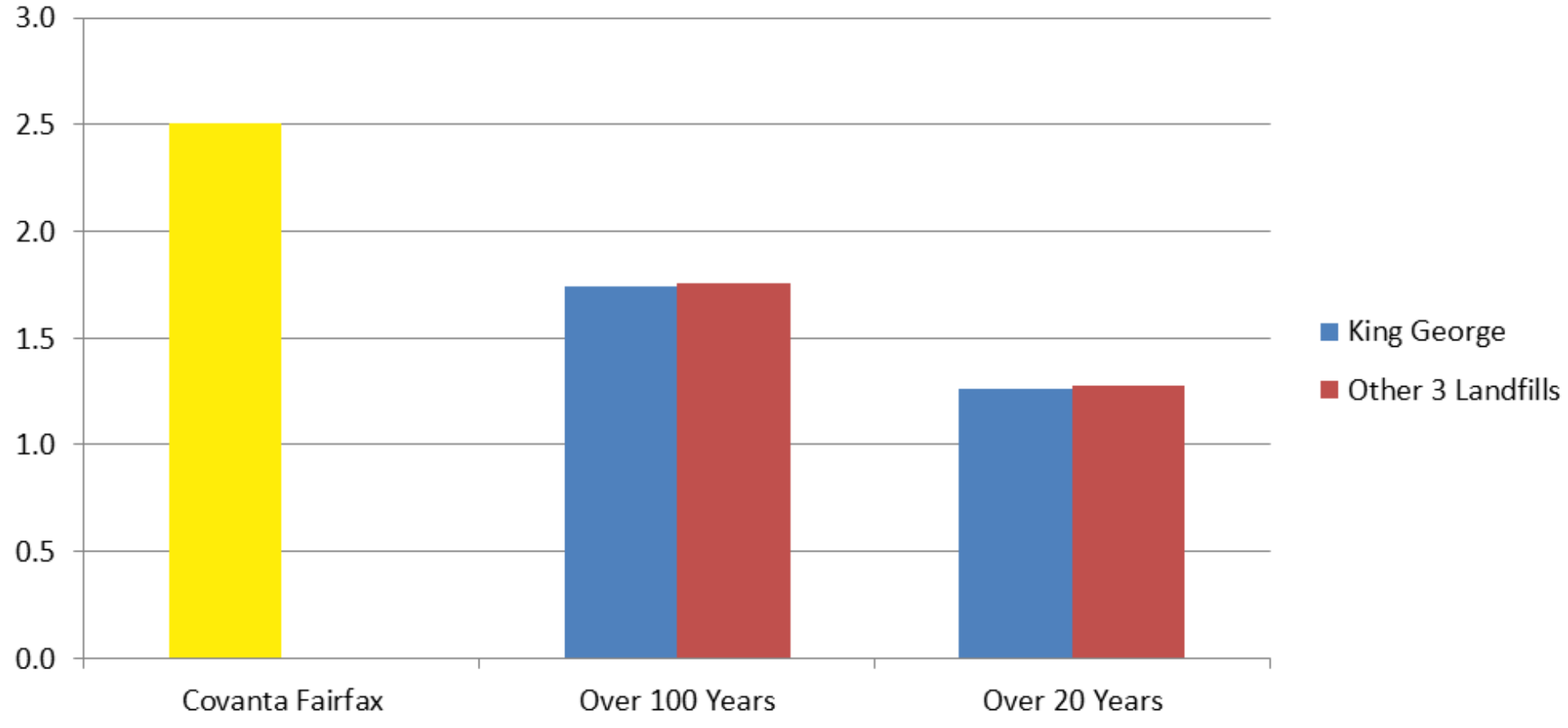
NOx and ammonia air emissions plus BOD, COD, phosphate, and ammonia water releases from landfills.



Acidification

[Pounds of SO_2 equivalent per ton of waste disposed.]

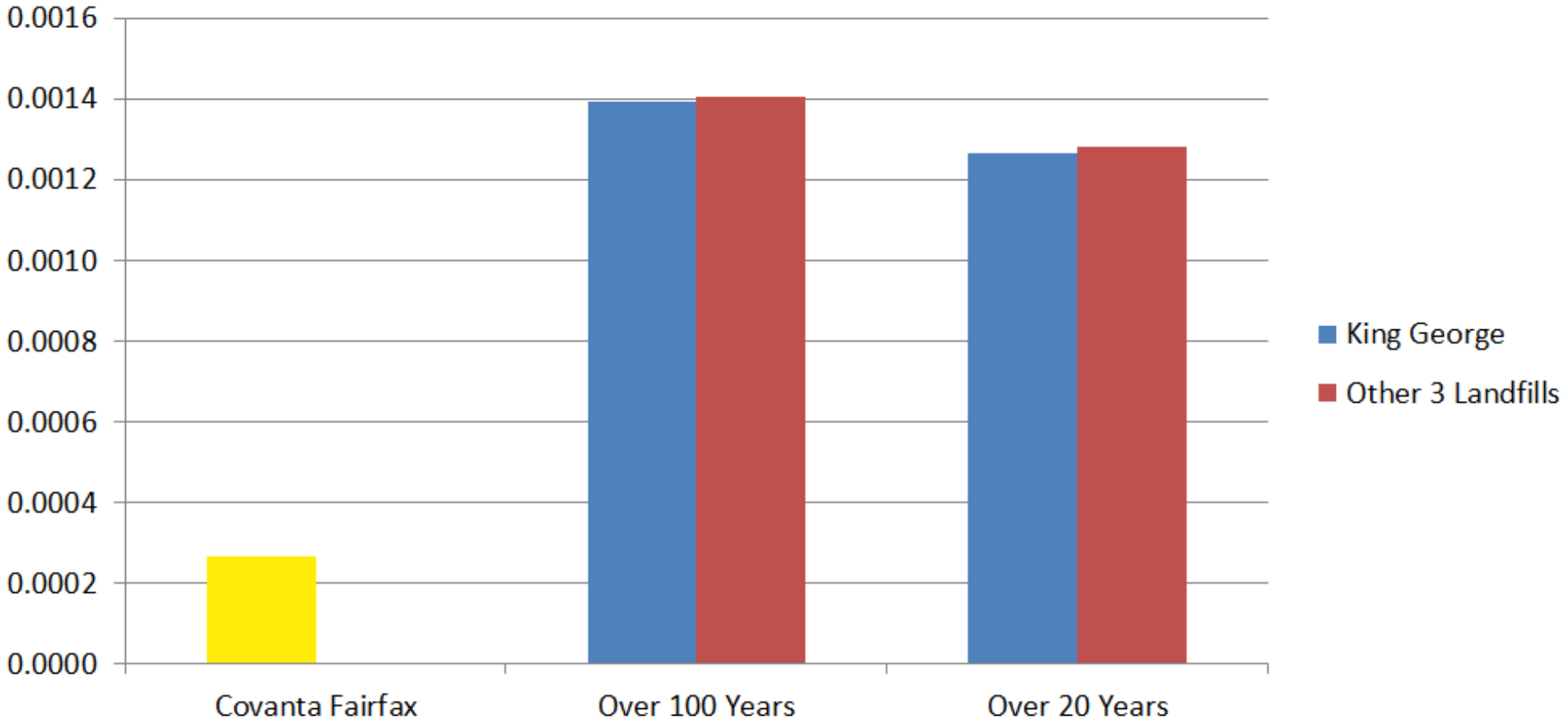
Incinerator emissions are largely from nitrogen oxides, but also include other acid gases (SO_2, HCl, HF). For the landfills, it's hydrogen sulfide (H_2S) from the landfill, plus ammonia, NOx and SOx from the landfill gas burners.



Ecosystems Toxicity

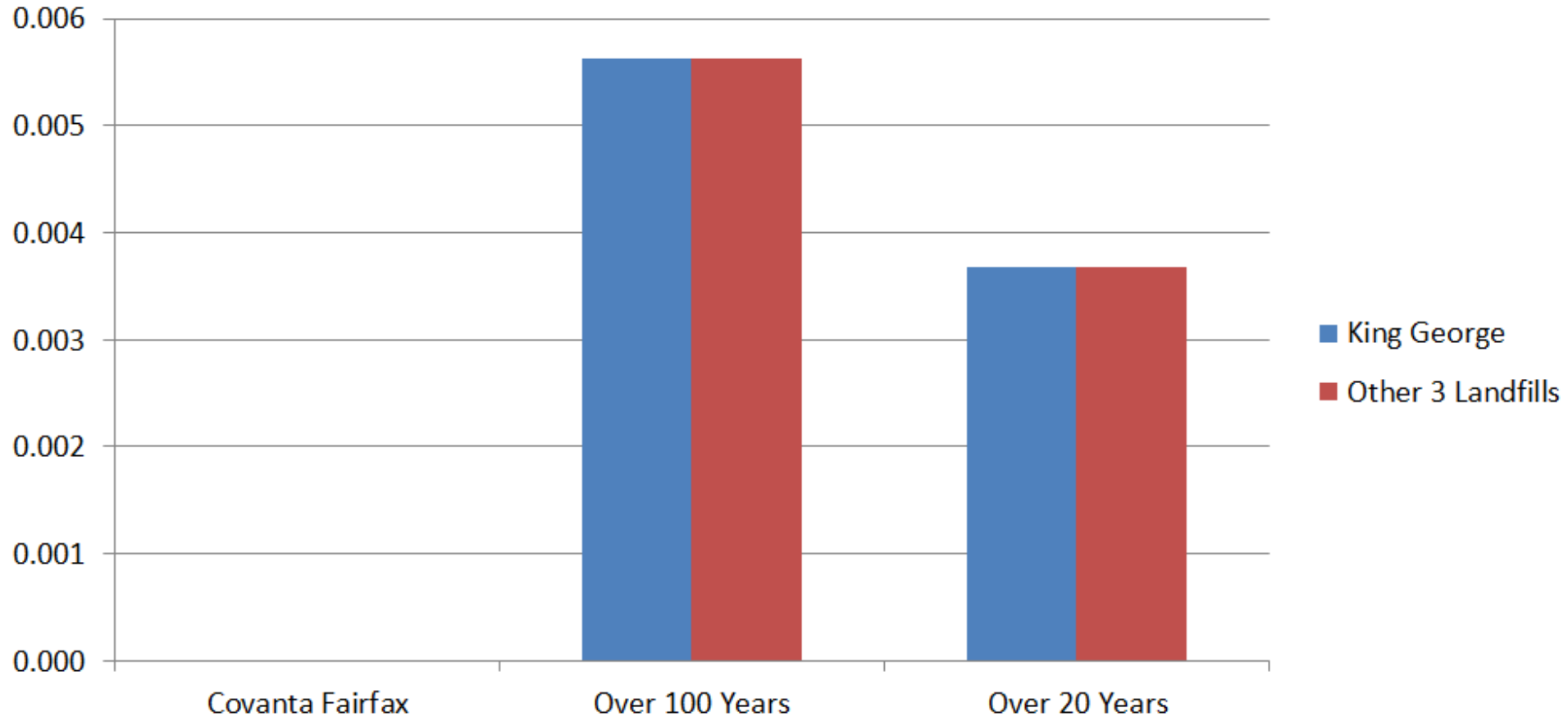
[Pounds of 2,4-D herbicide equivalent per ton of waste disposed.]

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



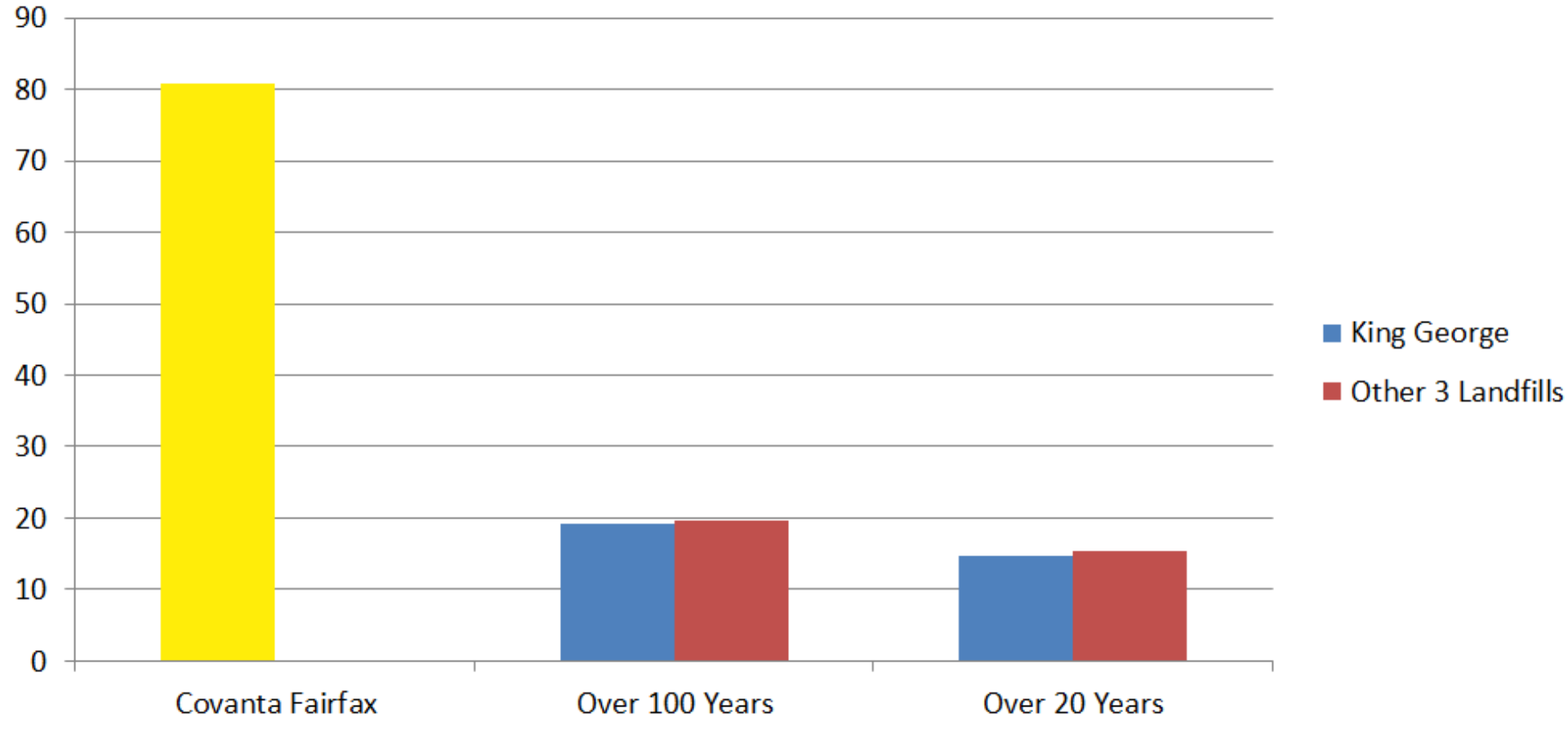
Ozone Depletion

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



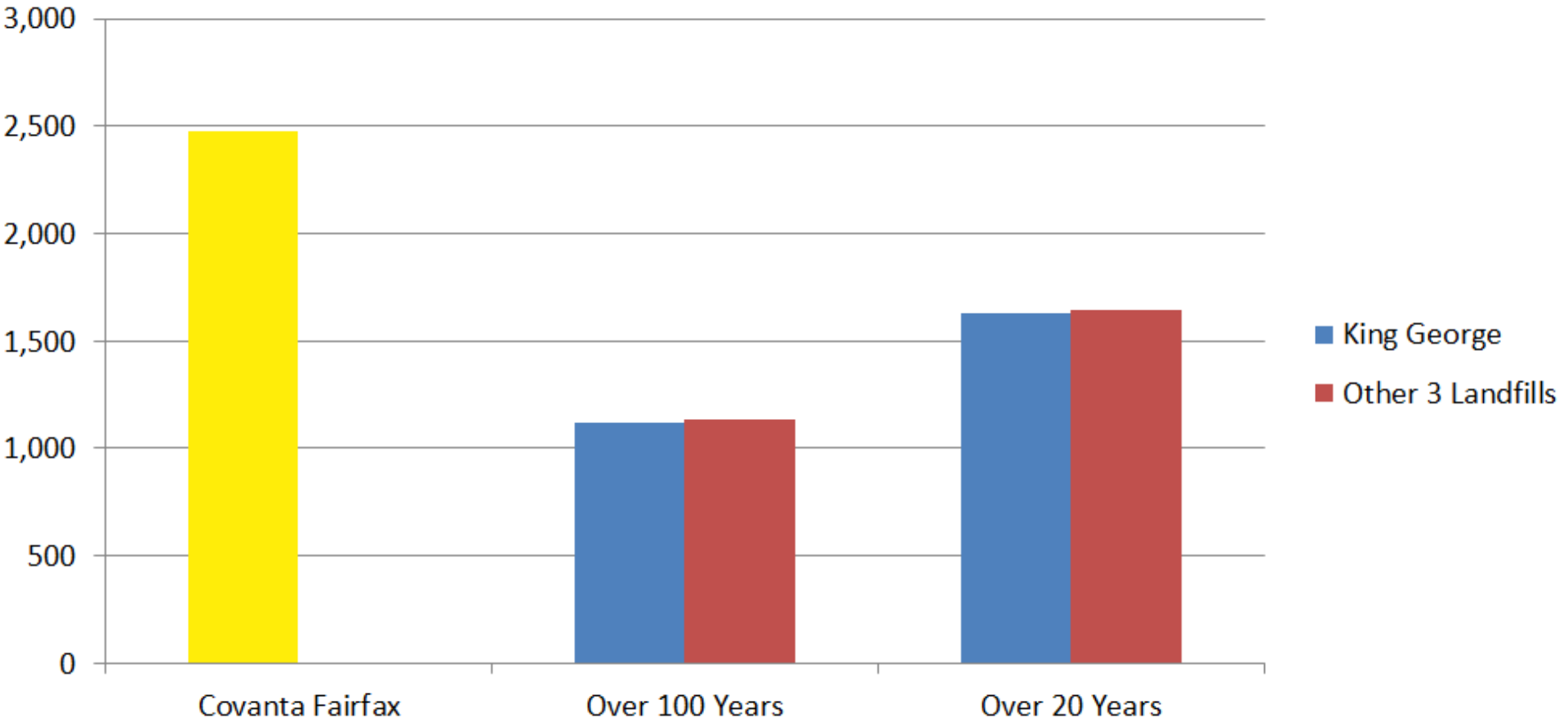
Smog Formation

[Pounds of ozone (O_3) equivalent per ton of waste disposed.]

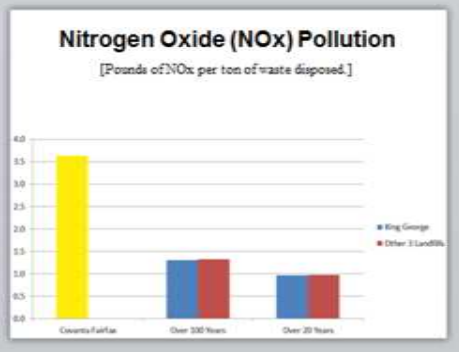


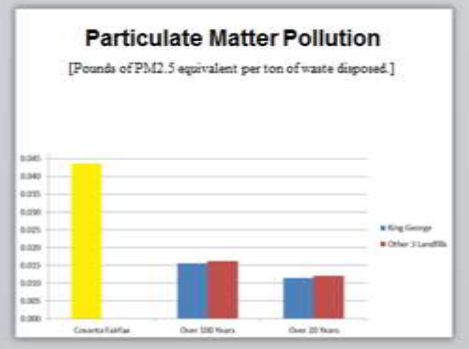
Global Warming Pollution

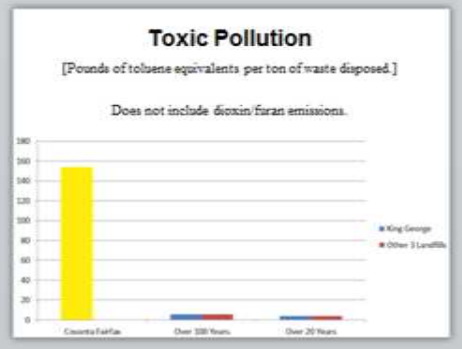
[Pounds of CO_2 equivalent per ton of waste disposed.]

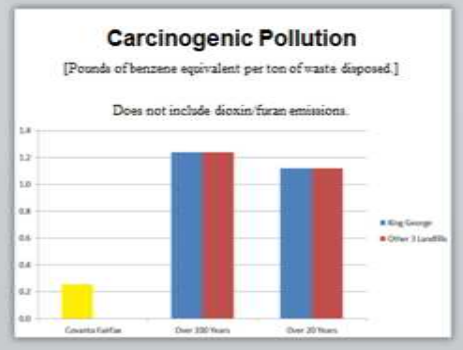


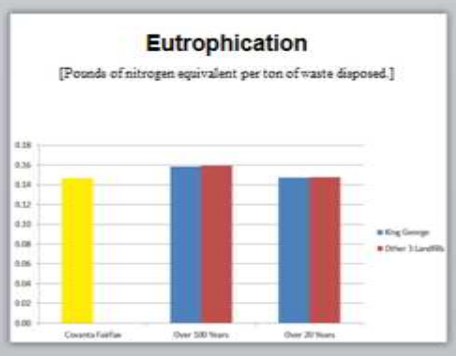
Recap!

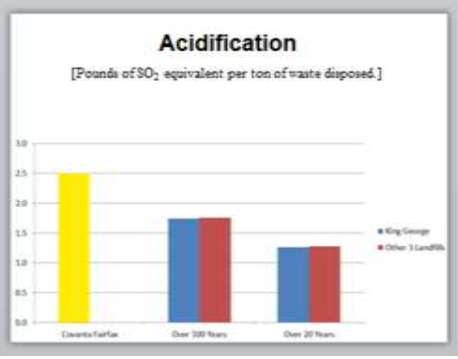

Nitrogen Oxide (NOx) Pollution
[Pounds of NOx per ton of waste disposed.]
King George
Other 3 Landfills
Covanta Fairfax
Over 100 Years
Over 20 Years

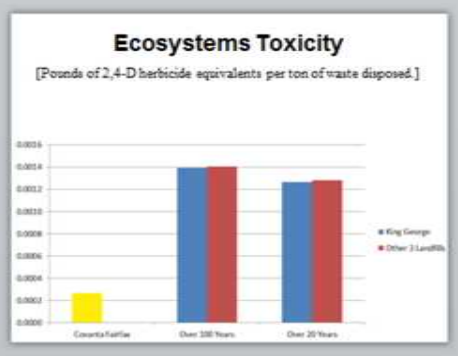

Particulate Matter Pollution
[Pounds of PM2.5 equivalent per ton of waste disposed.]
King George
Other 3 Landfills
Covanta Fairfax
Over 100 Years
Over 20 Years

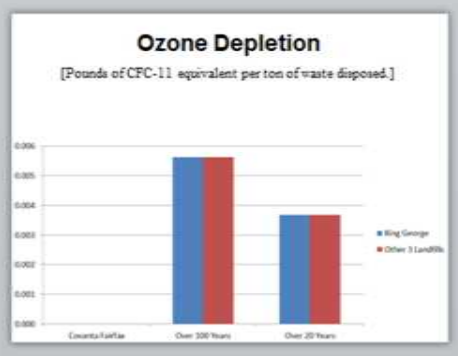

Toxic Pollution
[Pounds of toluene equivalents per ton of waste disposed.]
Does not include dioxin/furan emissions.
King George
Other 3 Landfills
Covanta Fairfax
Over 100 Years
Over 20 Years

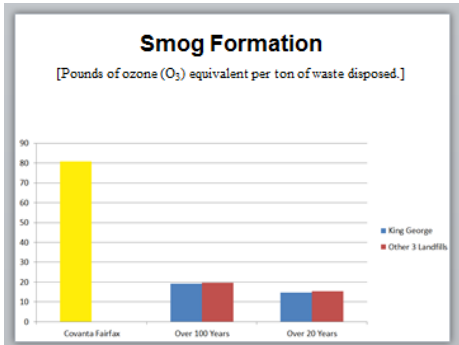

Carcinogenic Pollution
[Pounds of benzene equivalent per ton of waste disposed.]
Does not include dioxin/furan emissions.
King George
Other 3 Landfills
Covanta Fairfax
Over 100 Years
Over 20 Years

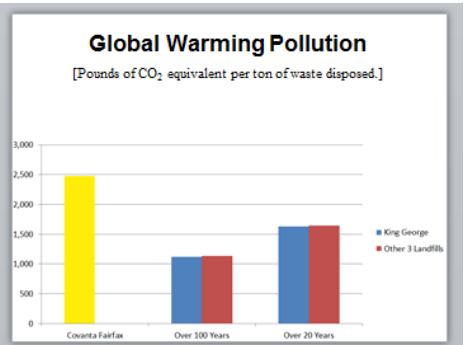

Eutrophication
[Pounds of nitrogen equivalent per ton of waste disposed.]
King George
Other 3 Landfills
Covanta Fairfax
Over 100 Years
Over 20 Years


Acidification
[Pounds of SO_2 equivalent per ton of waste disposed.]
King George
Other 3 Landfills
Covanta Fairfax
Over 100 Years
Over 20 Years


Ecosystems Toxicity
[Pounds of 2,4-D herbicide equivalents per ton of waste disposed.]
King George
Other 3 Landfills
Covanta Fairfax
Over 100 Years
Over 20 Years

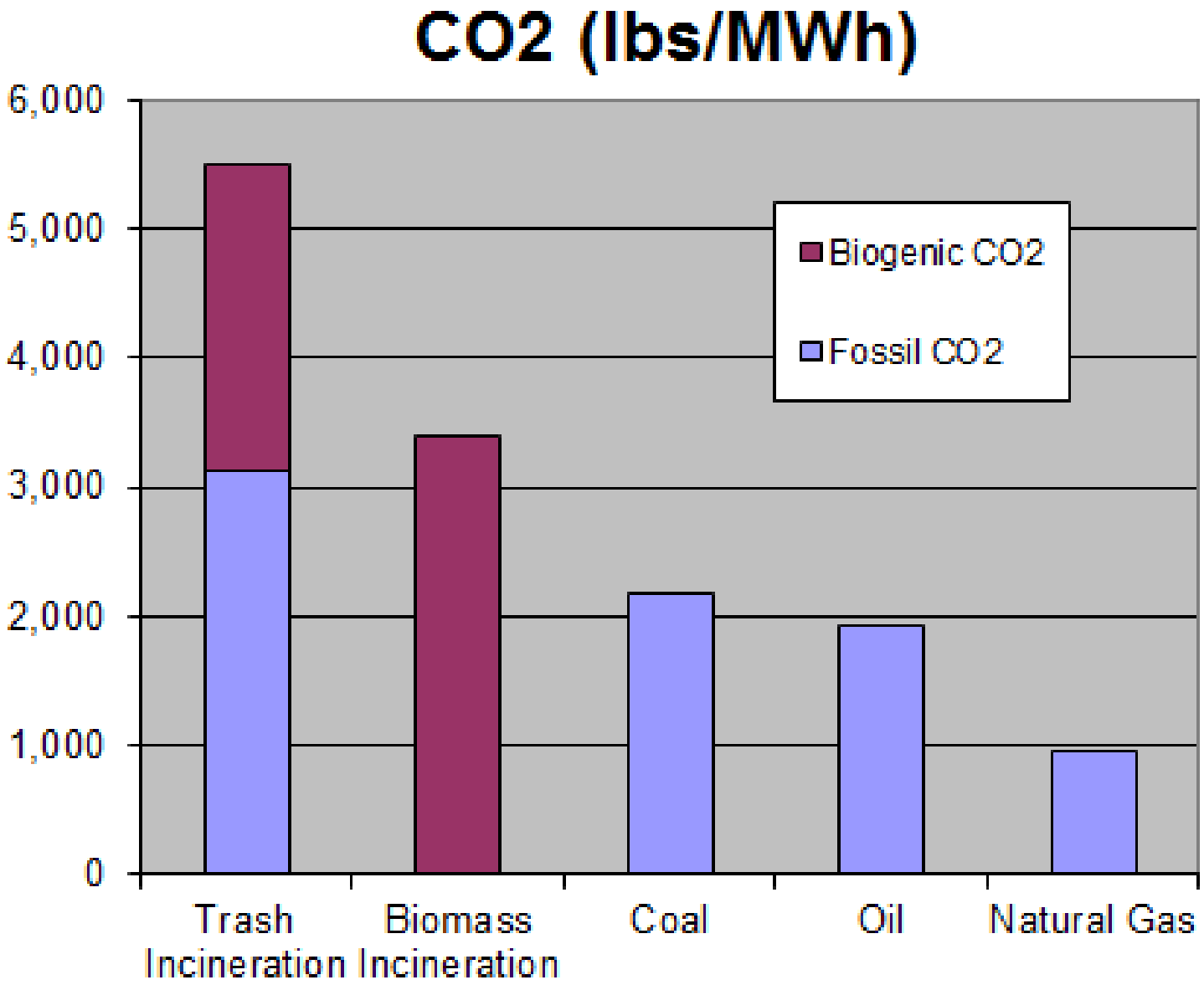

Ozone Depletion
[Pounds of CFC-11 equivalent per ton of waste disposed.]
King George
Other 3 Landfills
Covanta Fairfax
Over 100 Years
Over 20 Years


Smog Formation
[Pounds of ozone (O_3) equivalent per ton of waste disposed.]
King George
Other 3 Landfills
Covanta Fairfax
Over 100 Years
Over 20 Years


Global Warming Pollution
[Pounds of CO_2 equivalent per ton of waste disposed.]
King George
Other 3 Landfills
Covanta Fairfax
Over 100 Years
Over 20 Years

Global Warming Pollution

Smokestack CO2 Emissions from U.S. Power Plants

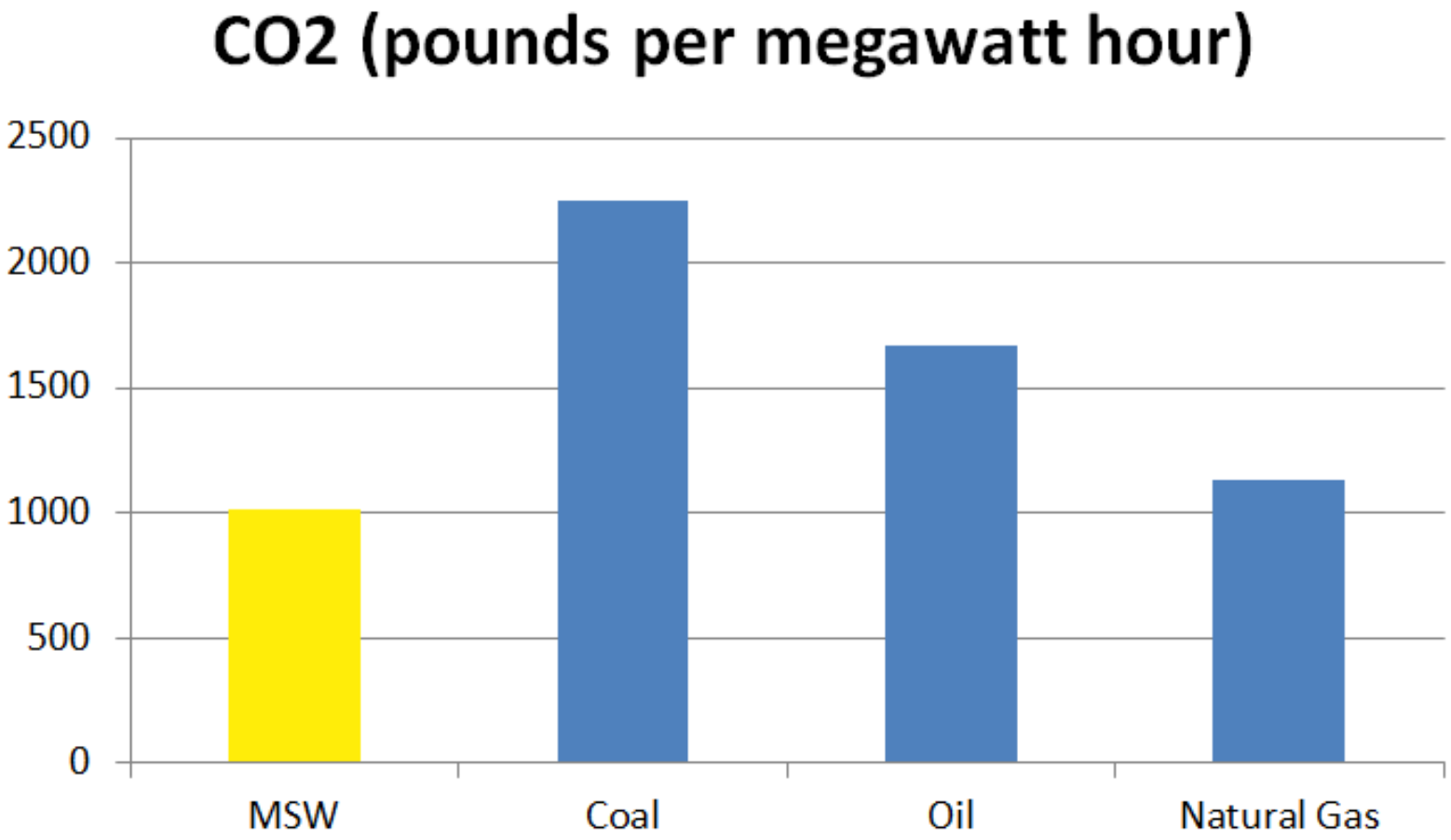


Data is in pounds of CO2 per unit of energy produced (lbs/MWh)

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

Global Warming Pollution

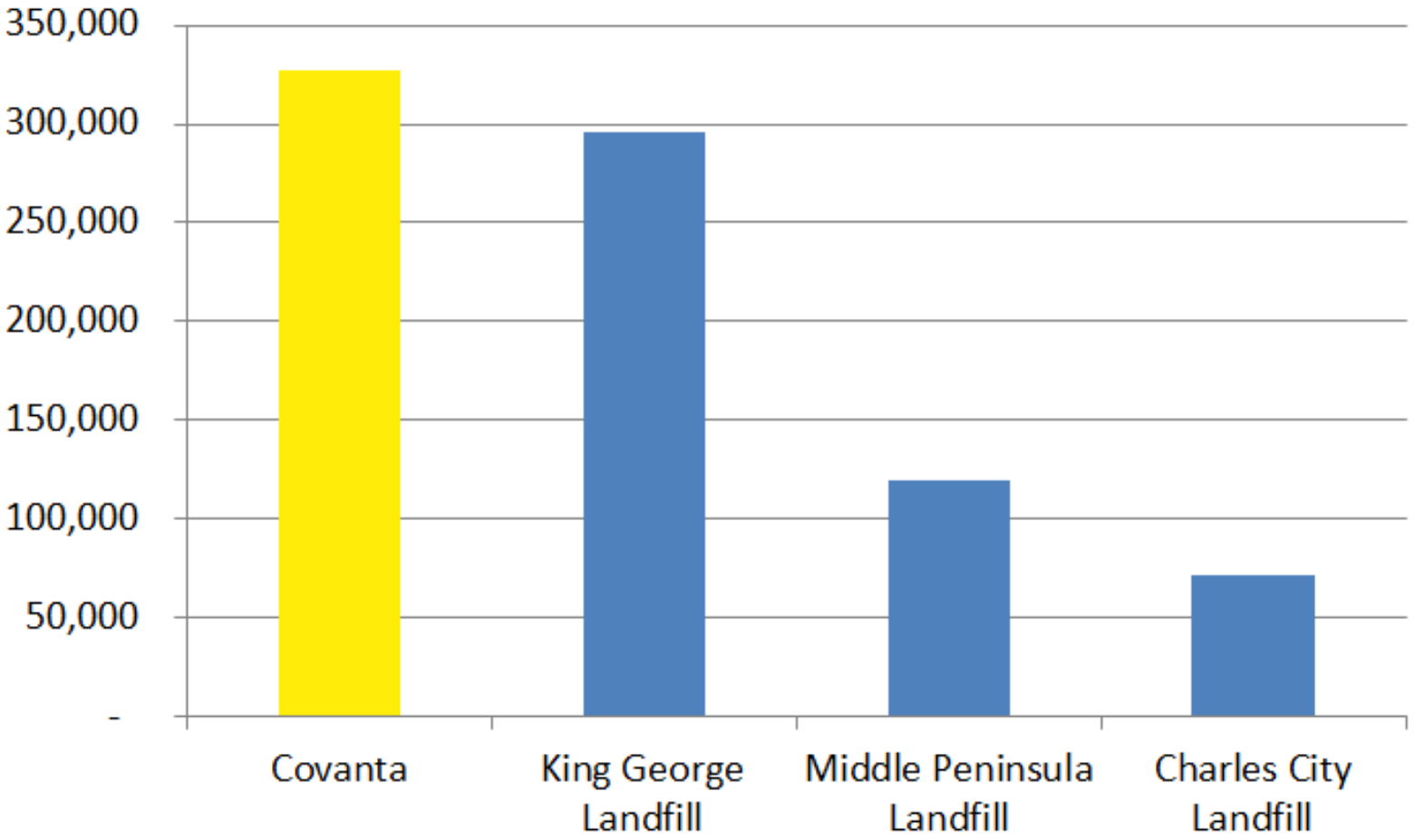
[EPA Public Relations on MSW Incineration]



Global Warming Pollution

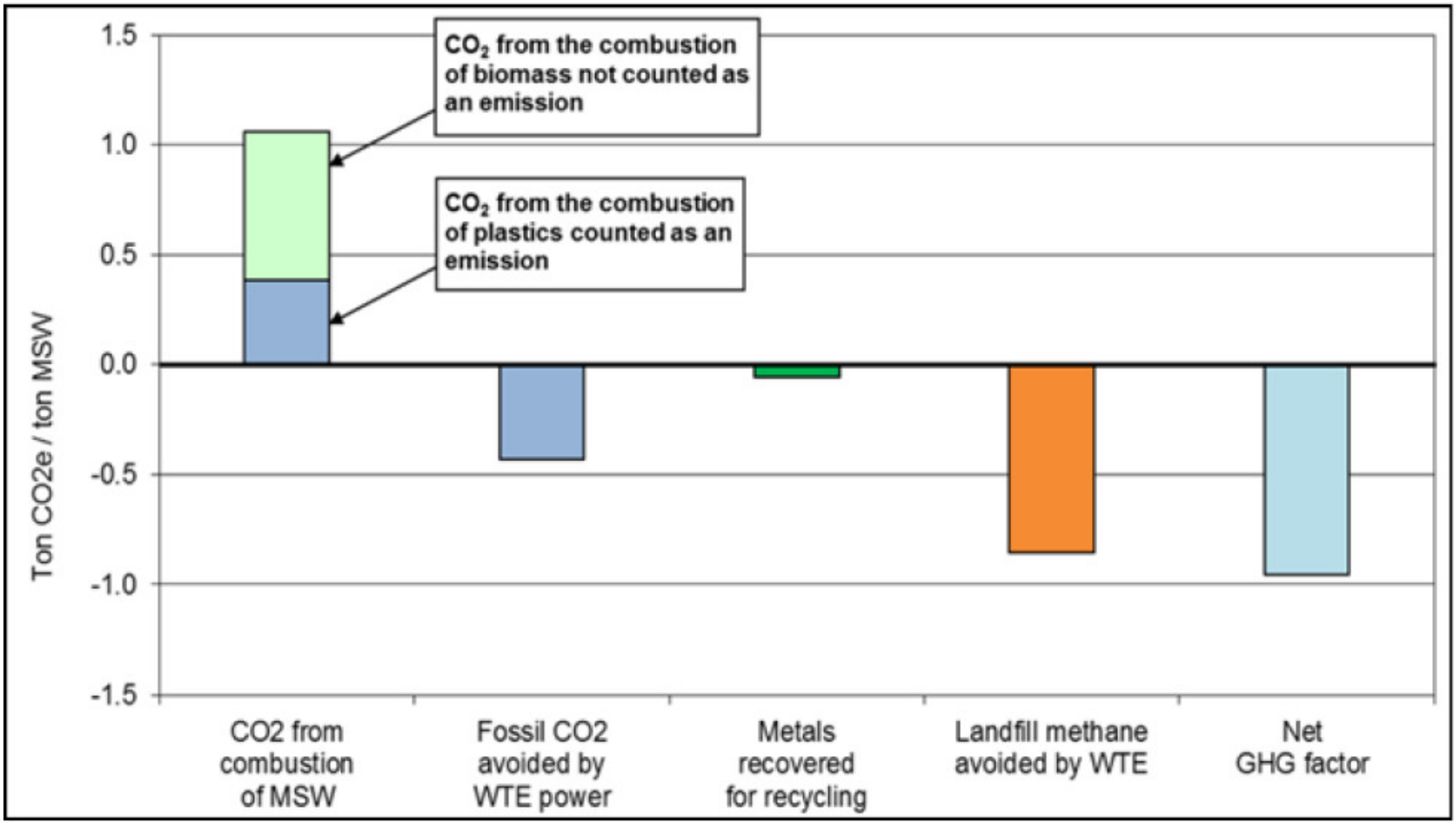
[EPA FLIGHT Data in 2015 metric tons CO2 equivalent.]

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

Nuclear	**44.3%**
Coal	**24.9%**
Natural gas	**19.7%**
Hydro	**5.8%**
Trash incineration	**1.9%**
Wind	**1.5%**
Solar	**1.0%**
Biomass & Landfill gas	**0.6%**
Oil	**0.3%**

Evaluating Energy Displacement

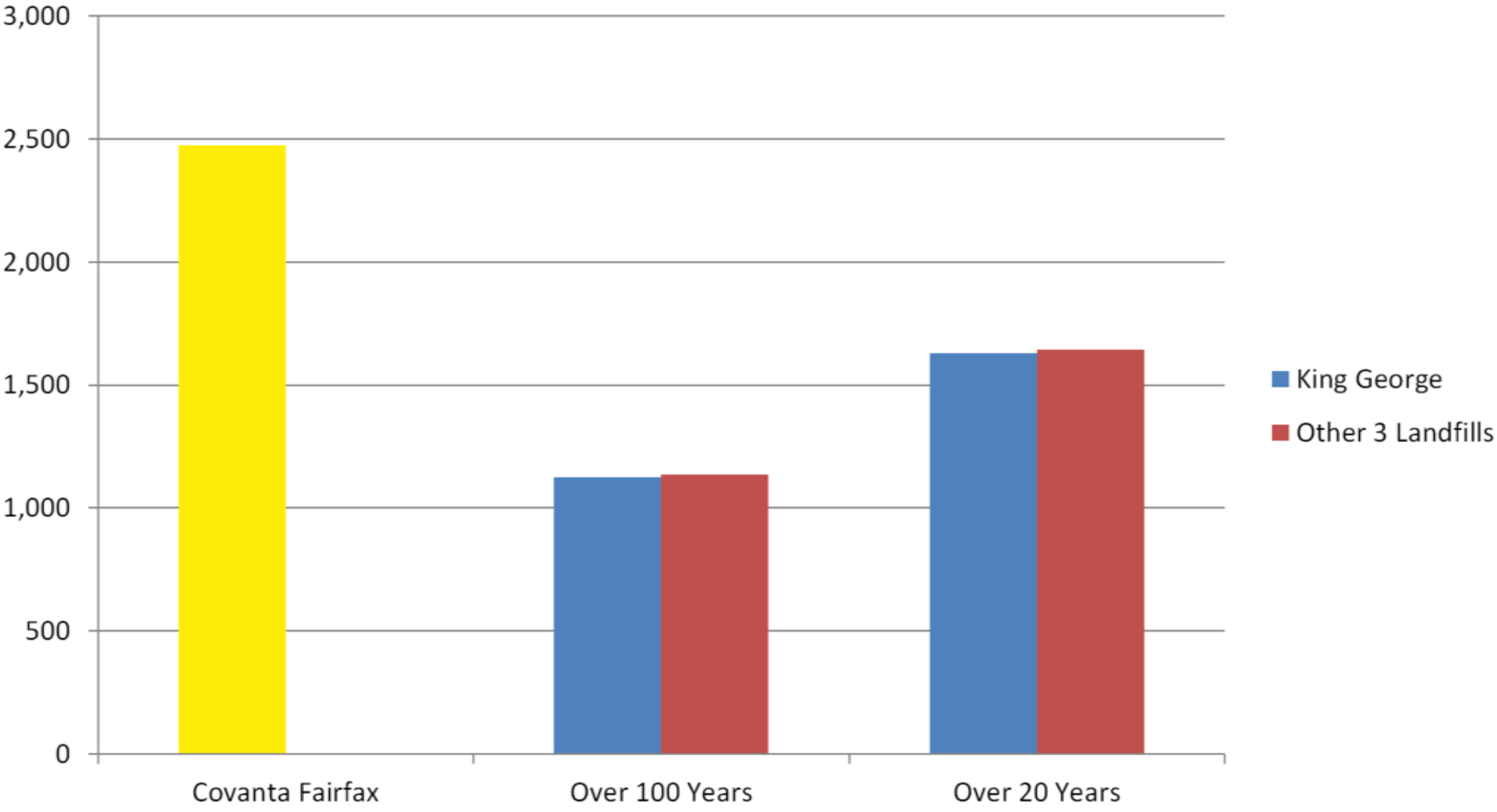
Wind displacement is a fair assumption.

- 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 CO_2 equivalent per ton of waste disposed.]

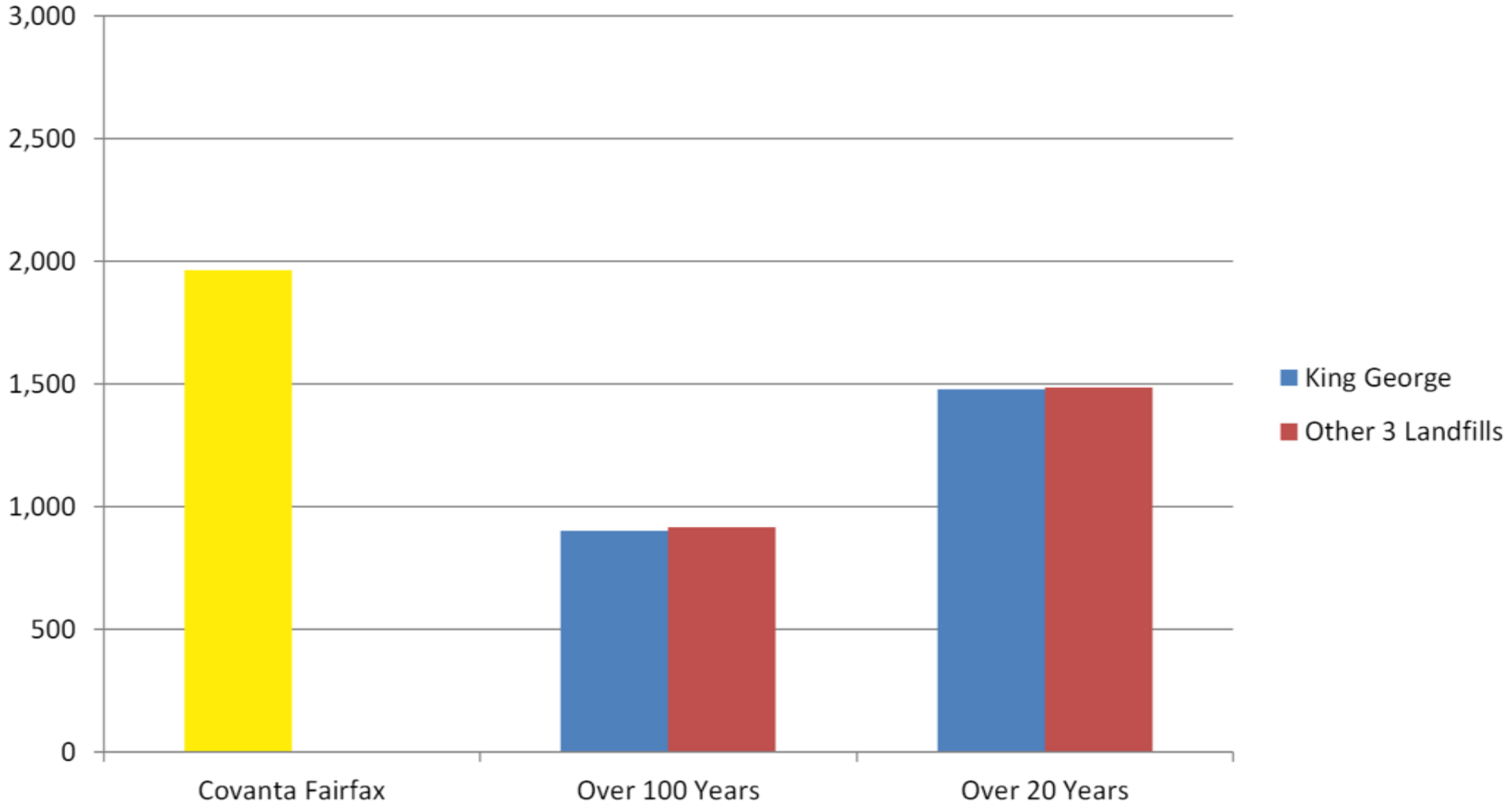
(Displacing wind / no energy displacement factored in)



Global Warming Pollution

[Pounds of CO_2 equivalent per ton of waste disposed.]

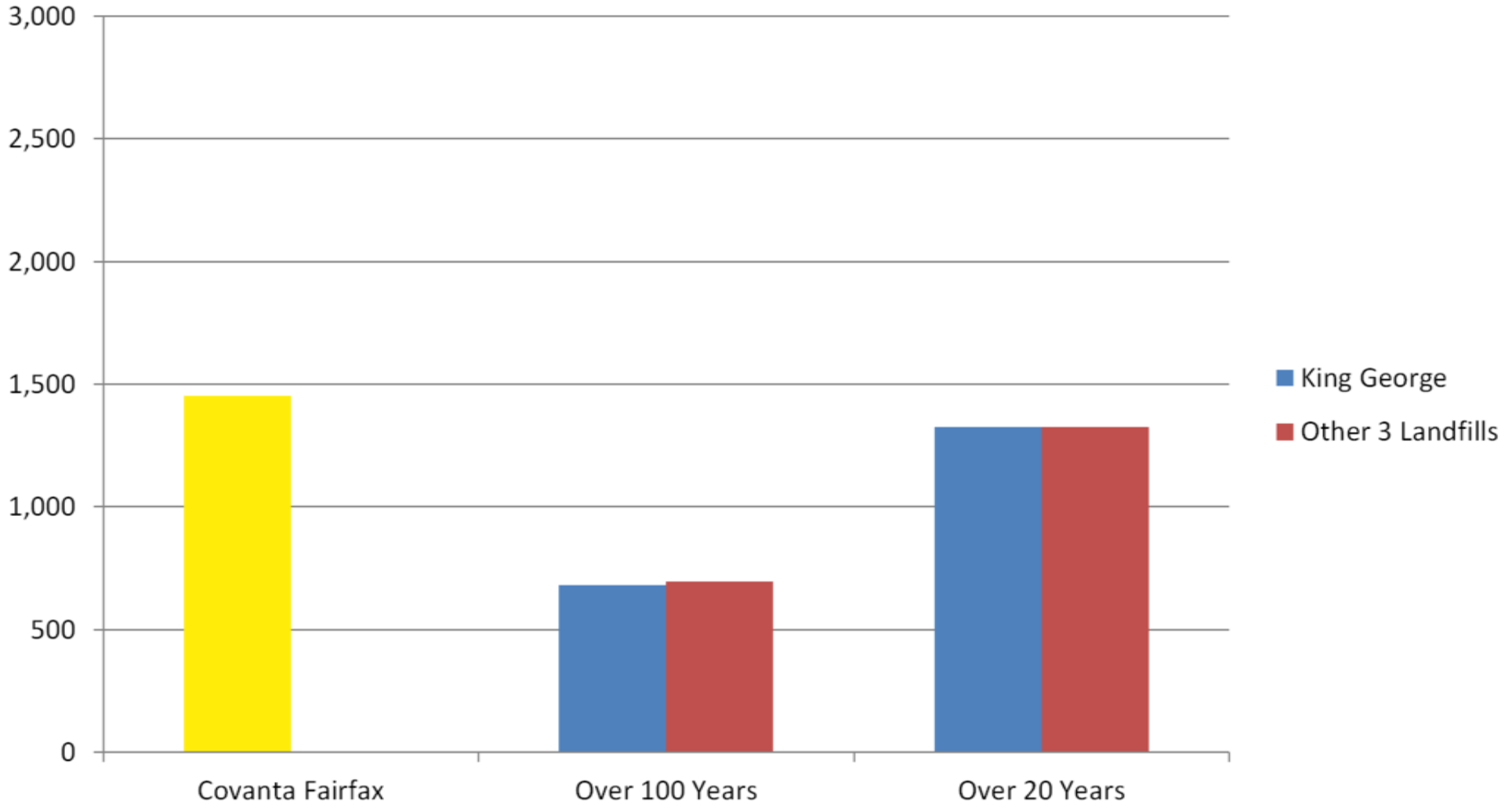
(Displacing Natural Gas)



Global Warming Pollution

[Pounds of CO_2 equivalent per ton of waste disposed.]

(Displacing Coal)



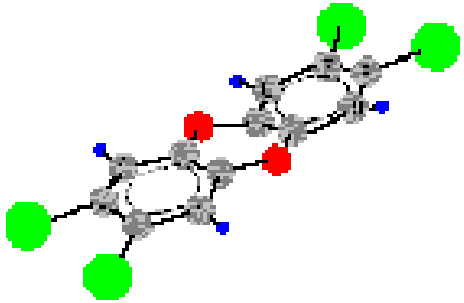
Evaluating Energy Displacement

- 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.

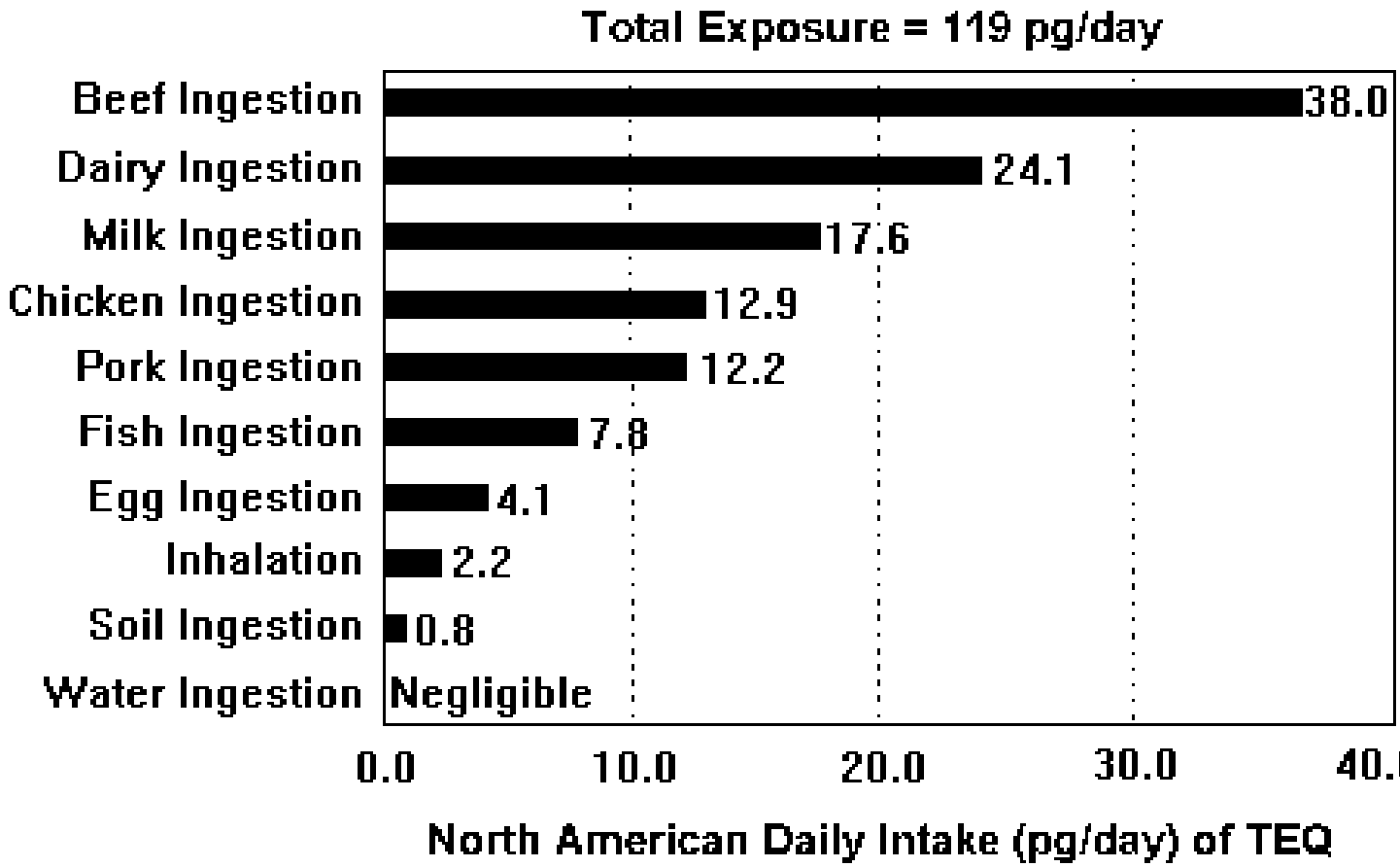
Dioxin Facts

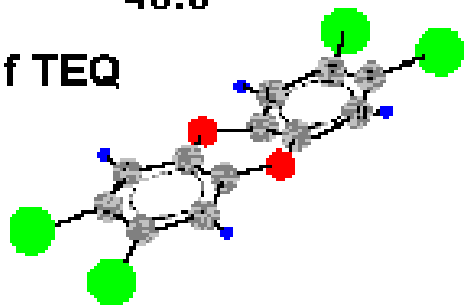
- Dioxins and furans are the most toxic chemicals known to science. They are highly toxic even in miniscule amounts.
- Dioxins cause infertility, learning disabilities, endometriosis, birth defects, sexual reproductive disorders, damage to the immune system, cancer and more.
- 93% of dioxin exposure is from eating meat and dairy products.

www.ejnet.org/dioxin/



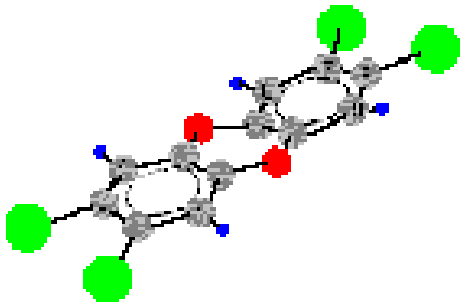
Exposure to Dioxins





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^{o} C)

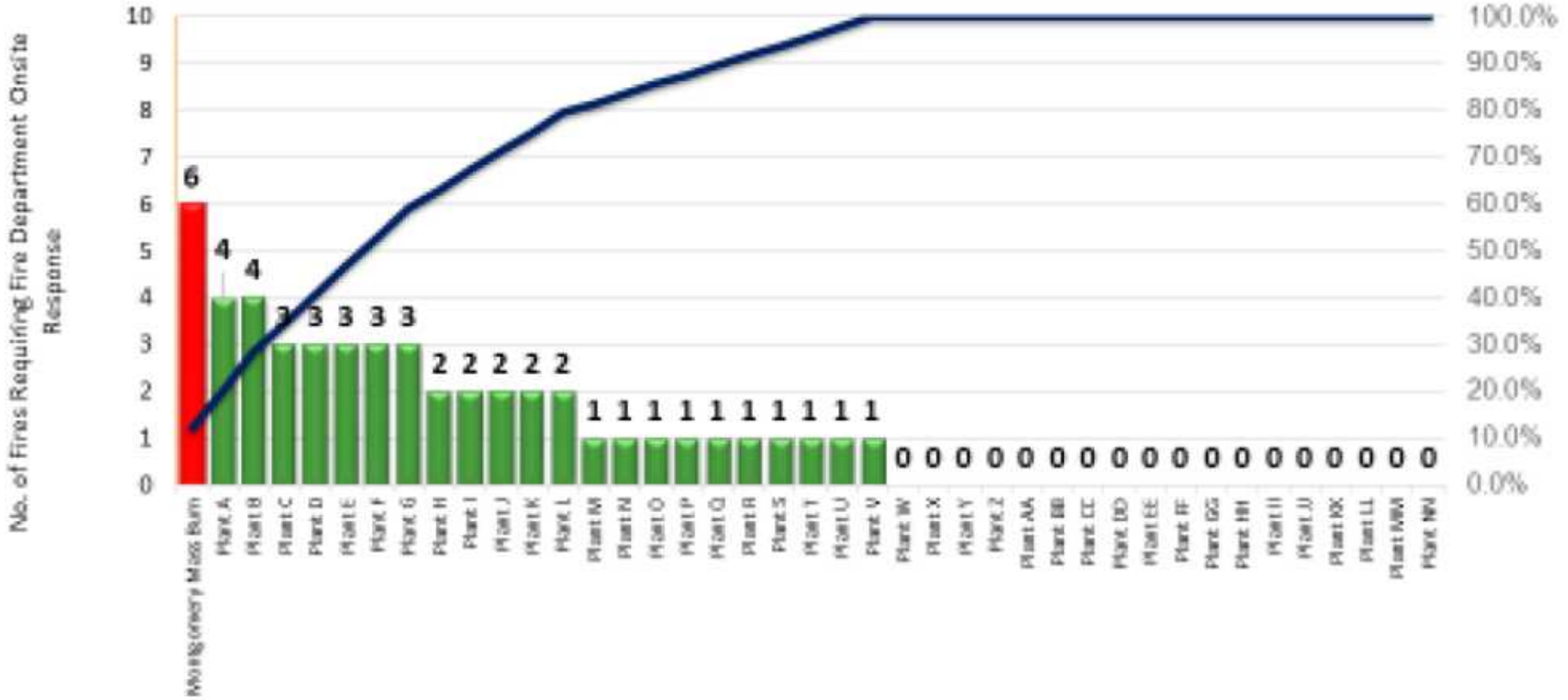


“In our industry, and in the waste industry as a whole, fires are becoming more prevalent.”

-Mark Harlacker – Covanta’s Commercial Business Director for Mid-Atlantic Region, 4/26/2017 testimony before DC City Council

Covanta Mass Burn 5 Year Fire History

No. of Fires Requiring Fire Department Onsite Response



COVANTA
Powering Today. Protecting Tomorrow.

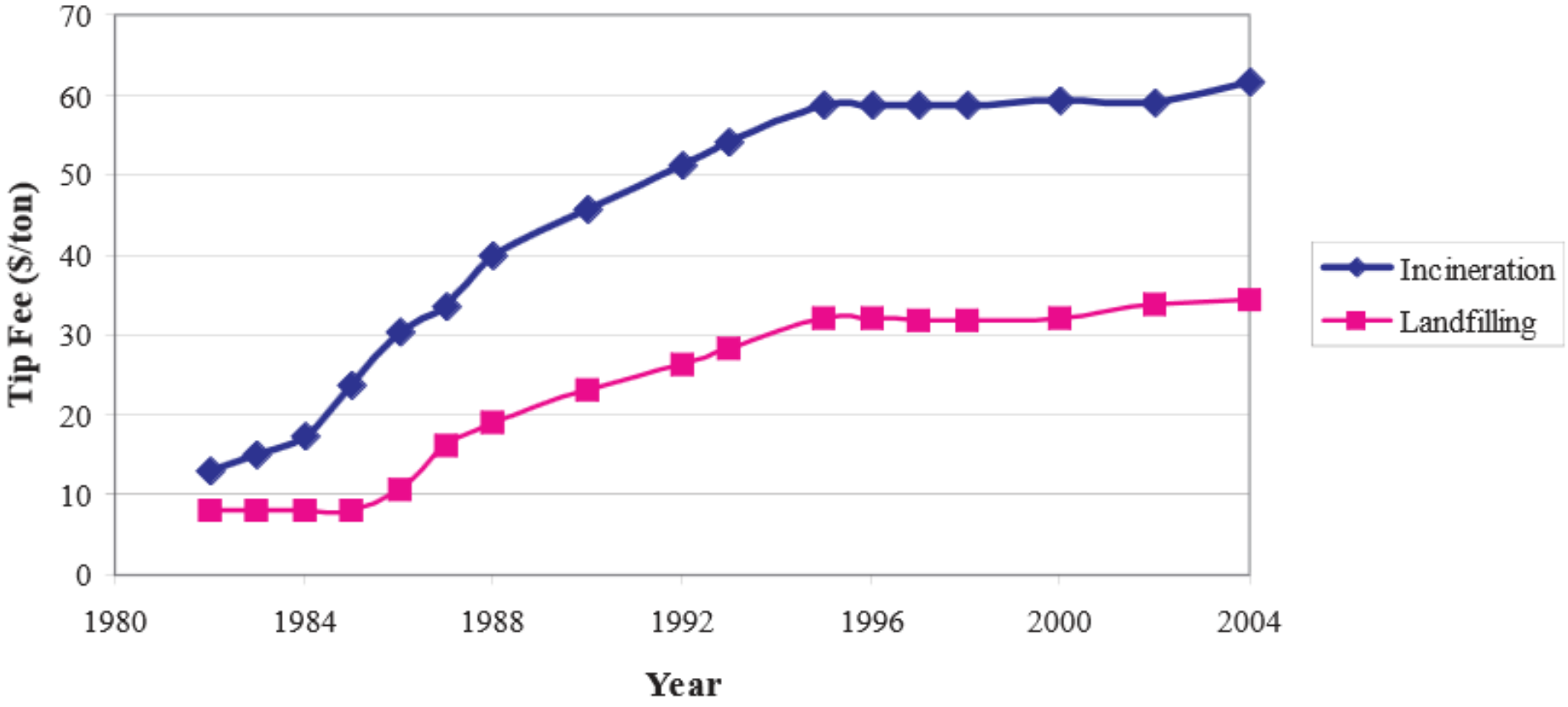
Most Expensive Way to Manage Waste

"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

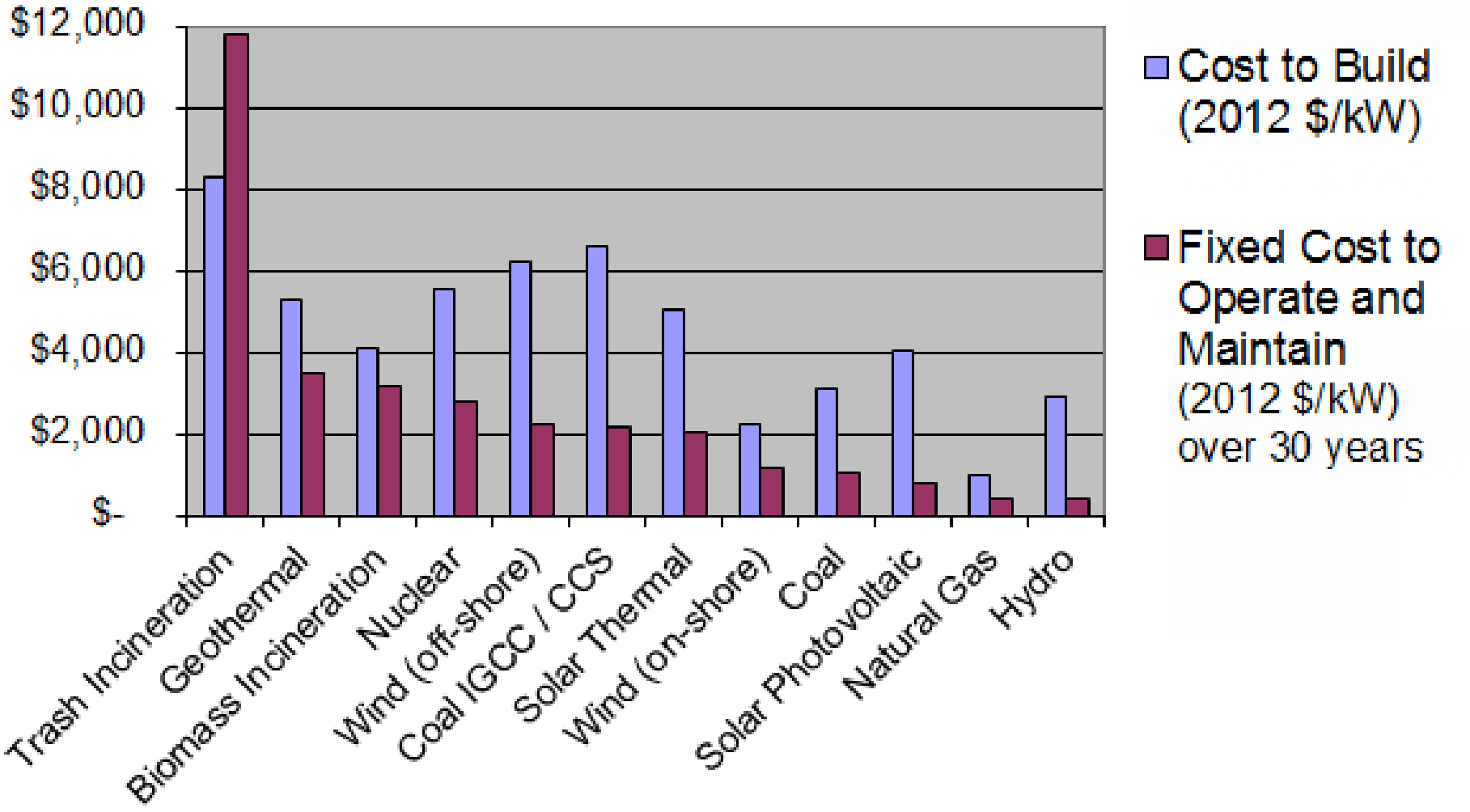
Most Expensive Way to Manage Waste

Figure 3. Landfill and Incinerator Tip Fees



Source: National Solid Waste Management Association 2005 Tip Fee Survey, p4.
www.environmentalistseveryday.org/docs/Tipping-Fee-Bulletin-2005.pdf

Most Expensive Way to Make Energy



Source: "Updated Capital Cost Estimates for Utility Scale Electricity Generating Plants," Energy Information Administration, April 2013, p.6, Table 1. Full report here: www.eia.gov/forecasts/capitalcost/pdf/updated_capcost.pdf

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 landfilling

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)

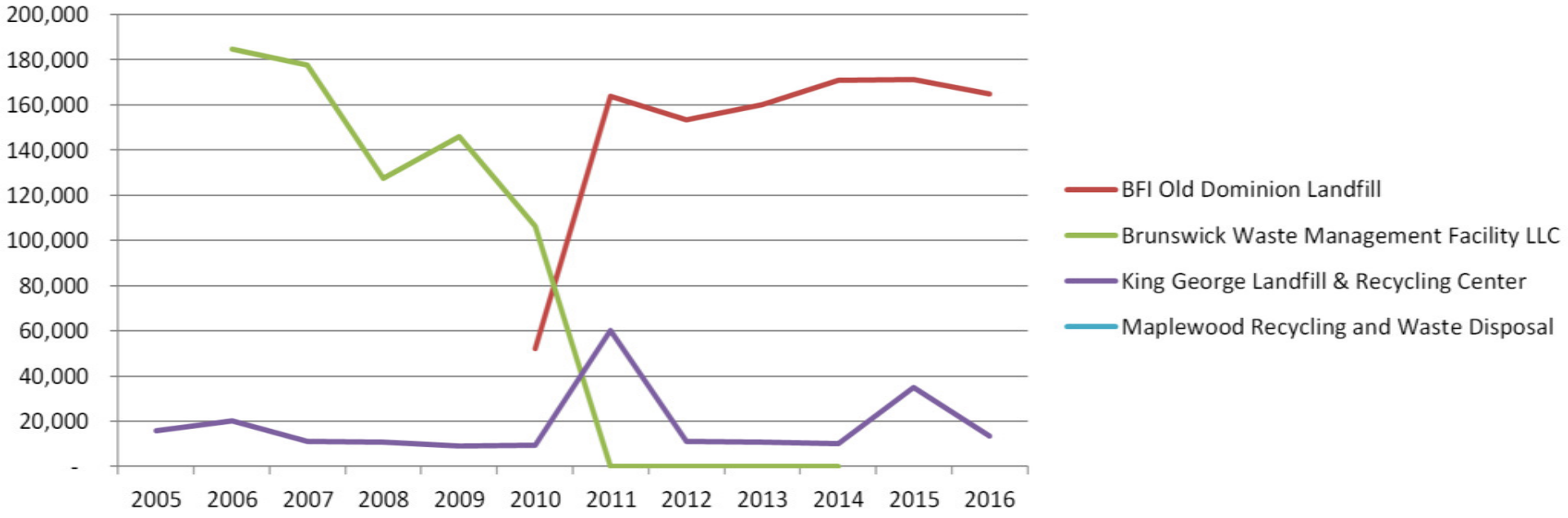
3. Anaerobic digestion → landfill
   odor, leachate and air emissions highly minimized

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.

Where MCRRF Ash Has Been Going

(tons/year)



Maplewood Landfill took in only 43 tons of ash, all in 2015, and thus isn't visible on this chart.

Landfill Options in VA

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

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

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

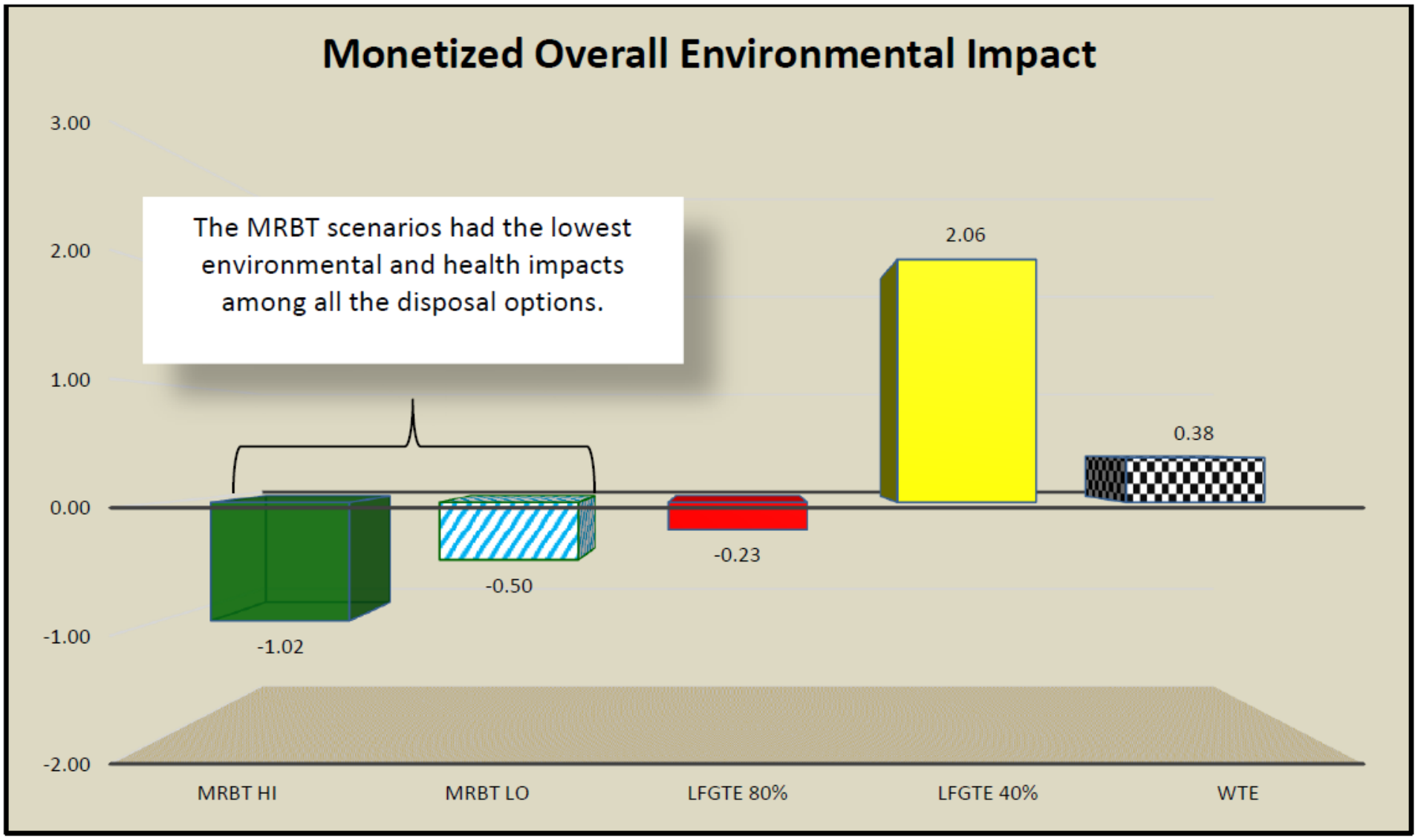
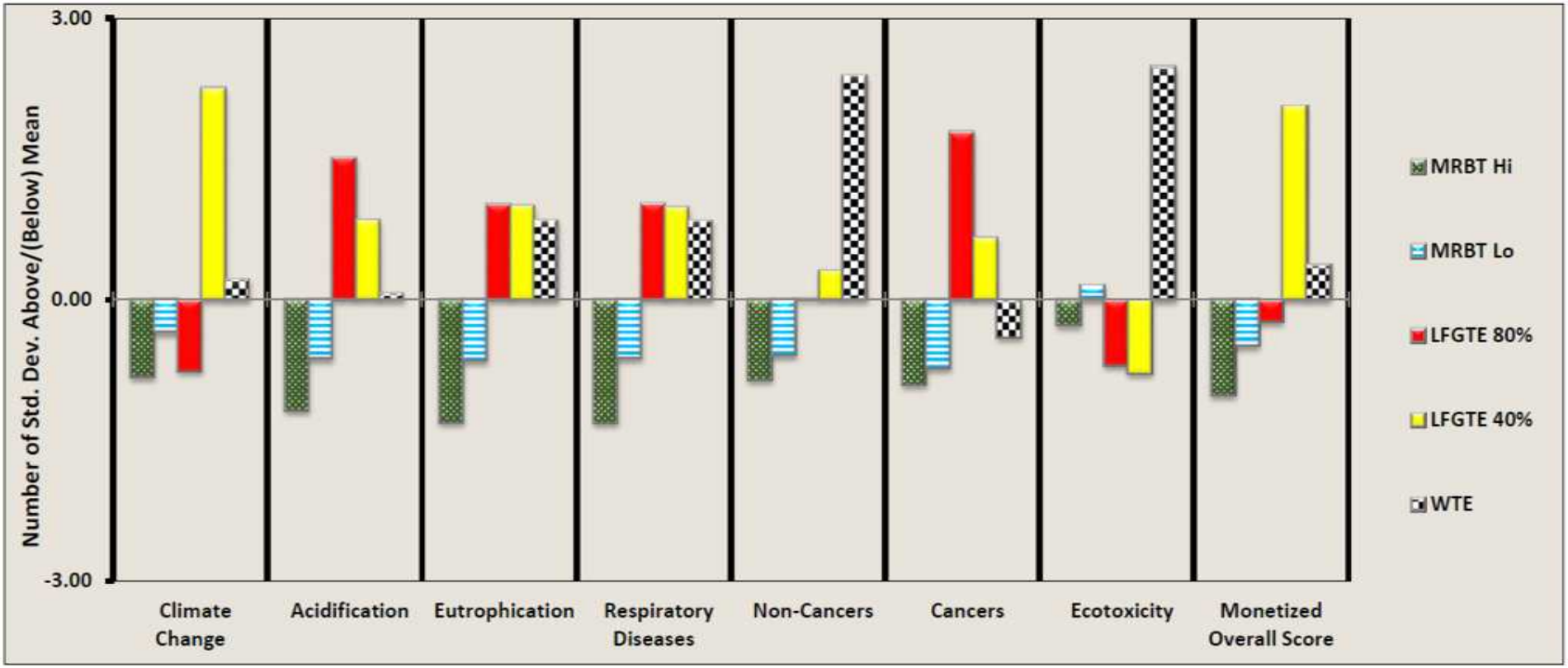

Monetized Overall Environmental Impact
The MRBT scenarios had the lowest environmental and health impacts among all the disposal options.
3.00
2.00
1.00
0.00
-1.00
-2.00
-1.02
-0.50
-0.23
2.06
0.38
MRBT HI
MRBT LO
LFGTE 80%
LFGTE 40%
WTE

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
  - www.GreenAction.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

Energy Justice Network

www.EnergyJustice.net

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