B’More Green: Targeting Toxic Waste

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Abstract

Baltimore City is home to 35 facilities involved in manufacturing, chemical manufacturing, electric power generation, metal mining, and hazardous waste treatment.[11] The implications of climate change on toxic chemicals make it clear that this is an issue that will affect Baltimore City. Therefore, we sought out to answer the following business question: how can we better understand the future of sustainability in Baltimore City by analyzing toxic waste release and the highest contributing industrial facilities from 2016-2019? Our primary stakeholder is the Baltimore Office of Sustainability (BOS), a Baltimore City agency that implements sustainability initiatives.[2]

Our proposed solution is the creation of an initiative called “B’more Green" under BOS. Similar to the Climate Action Plan (CAP) and Disaster Preparedness and Planning Project (DP3), two climate change related plans also under BOS, B’more Green will follow their framework guidelines to specifically target toxic waste release.[1] To streamline our efforts to target the industrial facilities, we will be using the Environmental Protection Agency’s (EPA) Waste Management Hierarchy.[3] The ultimate goal is to increase the proportion of source reduction and recycling combined being used to 60% within facilities by 2030. The concrete steps to achieve this will be through accountability of facilities through Environmental Control Board (ECB) citations and fines, shift to more efficient systematic recycling process, and educational advocacy to include community engagement.[13] B’more Green holds great promise for an optimistic outlook on the future of Baltimore City. Without the analysis and our proposed future steps, there will be continued unaddressed adverse health effects and unknown long-term environmental consequences.

Background

The necessity to promote sustainable practices in the encroaching threat of climate change has never felt so urgent. The Intergovernmental Panel on Climate Change (IPCC) has stated that there will be global warming of 1.5˚C by 2030-2050,[5] with the World Meteorological Organization (WMO) warning that this year will be one of the three warmest years on record.[7]

We will be focusing on toxic waste management as it relates to the release of toxic waste. The release of toxic chemicals is when the chemical is emitted to the environment via air or water, or placed in a land disposal as opposed to recycling or treatment.[11] Our primary stakeholder is the Baltimore Office of Sustainability (BOS), a Baltimore City agency that implements sustainability initiatives.[2]

Baltimore City is home to 35 facilities involved in manufacturing, chemical manufacturing, electric power generation, metal mining, and hazardous waste treatment.[11] The implications of climate change on toxic chemicals make it clear that this is an issue that will affect Baltimore City. First, rising temperatures will allow certain chemicals to more easily vaporize, entering the air stream at a faster rate. Second, chemicals that are endocrine disruptors will hinder the ability of humans and animals to

adapt to temperature changes. Lastly, the increase in moisture will cause chemicals in the air to drop to the ground via rain or snow, dissolve in water bodies, and bind tightly to soil to persist longer.[4 6]

While the future may initially appear bleak, there are strides being made to mitigate the effects of climate change. Facilities in the U.S. are mandated to report their management and release of toxic chemicals. Such data — including how much of each chemical is released and/or managed through recycling, energy recovery, and treatment — is processed annually by the Toxics Release Inventory (TRI) Program[11] under the U.S. Environmental Protection Agency (EPA). This data has been instrumental in allowing for transparency and providing the pathways to keep facilities accountable in disclosing this information. Since 1976, the EPA has overseen the release of toxic waste.[12 14] The Resource Conservation and Recovery Act (RCRA) gives the U.S. agency the "authority to handle hazardous waste from cradle to grave,"[3] which ecompasses toxic waste as well.

There are currently two plans in motion that are aimed toward addressing various aspects of climate change in Baltimore City. The first is the Climate Action Plan (CAP) that is aimed at reducing the amount of greenhouse gas emissions needed for daily life.[1] The second is the Disaster Preparedness and Planning Project (DP3) which is an effort to address existing hazards and prepare for predicted hazards.[1] While these are both tangible calls to action, we believe that there is an unfilled need to address toxic waste release from industrial facilities.

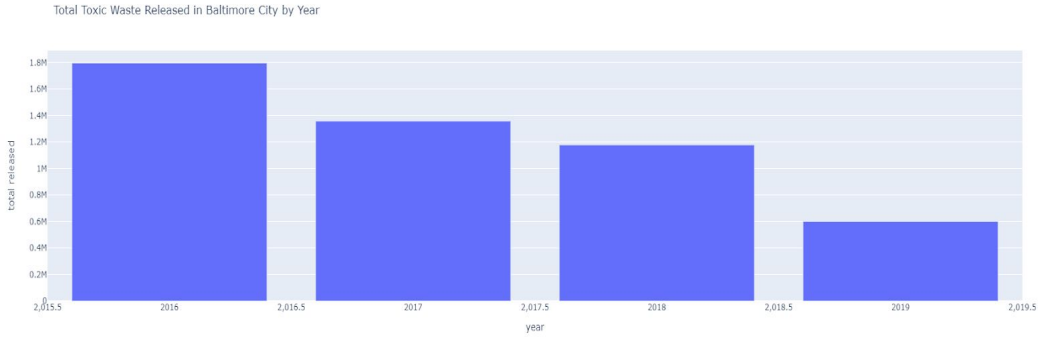
All in all, climate change will continue to exacerbate the effect of toxic chemicals which is why it is crucial that we examine ways to combat the amount of toxic chemicals that are being added to the environment. In order to create a sustainable future in Baltimore City, toxic waste should be managed to allow for its re-usage and re-enter to a facility's production cycle. This report will outline the recommendation we plan to present to the Baltimore Office of Sustainability regarding the release and recycling of toxic waste in Baltimore City.

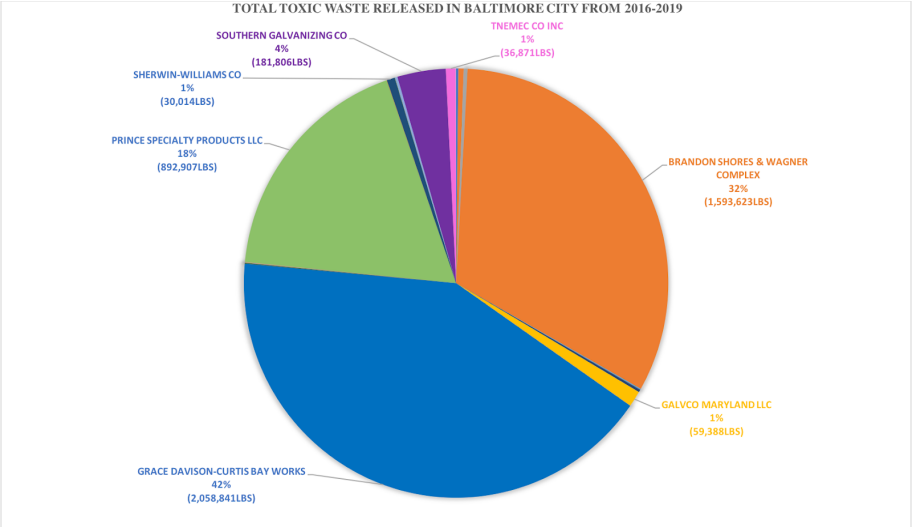
Data Findings and Interpretations

We approached our data analysis with the aim to see how we can better understand the future of sustainability in Baltimore City by analyzing toxic waste release and the highest contributing industrial facilities from 2016-2019. We downloaded Basic Data Files from the TRI program online for Baltimore counties in Maryland, with a focus on Baltimore City.[8] We utilized a combination of Python to create bar graphs, and the Pivot Tool function in Excel to create bar graphs and a pie chart. We chose these data visualization forms over other forms as it presented the data in a clear manner.

Our data chooses to look at information provided from the facilities in this period of time as it allows us to determine whether there are any overall trends. When looking at only Baltimore City facilities below, we can see that a downward trend is evident. Facilities in Baltimore went from releasing 1.8 million pounds of toxic waste in 2016 to

releasing 600 thousand pounds of toxic waste in 2019, which is a 67% reduction in overall waste released.

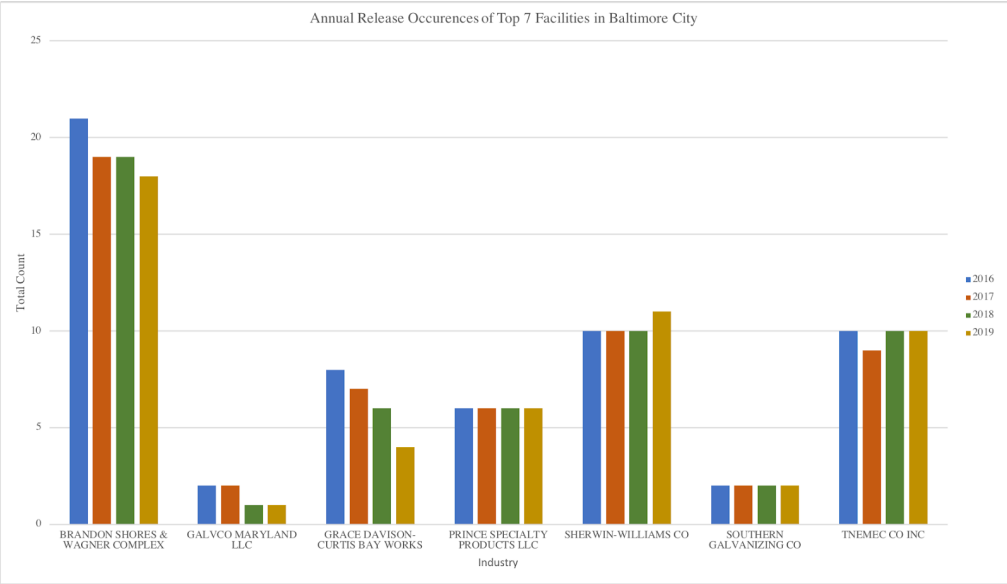




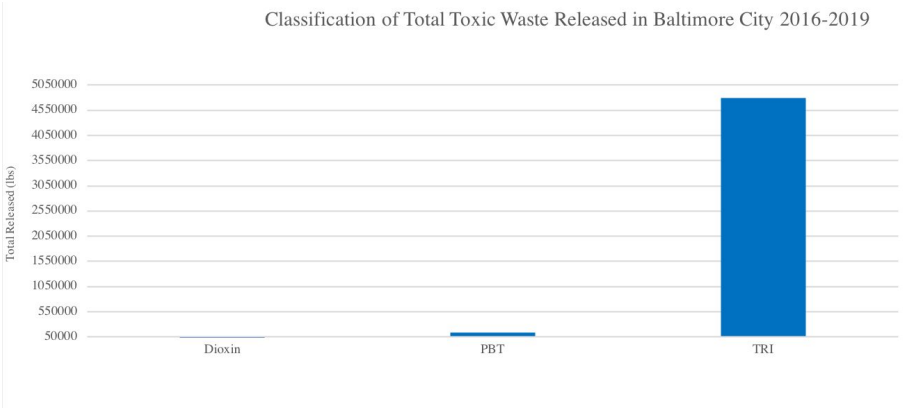
We created the pie chart above to look at the total amount of toxic waste waste released in pounds over the period of four years. The facilities labelled in the chart are the facilities that contributed at least 1% of the 4.9 million pounds of toxic waste that was released in Baltimore City from 2016-2019. The top contributor was chemical company WR Grace's waste management facility Grace Davison-Curtis Bay Works at 2.06 million. The second leading contributor was electric power generation facility Brandon Shores & Wagner Complex with 1.59 million. The third top contributing facility was metal manufacturing company Prince Specialty Products with its 892 thousand pounds of toxic waste released.

The bar graph below shows the toxic waste releases over the four years for our top seven facilities, in which our top three facilities accounted for 92.2% of total releases in 2019. We can see the release amount for Grace Davison-Curtis Bay Works and Brandon Shores & Wagner Complex has declined over the four years. For Prince Speciality Products and the other top facilities, the release amount appears to be fairly

constant but the top contributing facilities lowering the amount of waste released shows that it is possible.



Lastly, we looked at the type of chemicals that were included as part of the toxic waste released. We found that 2.7% of all toxic chemicals released over the four years were Persistent Bioaccumulative Toxic (PBT) chemicals which remain in the environment and build up in body tissue.[10] Most significantly, 97.3% of all toxic chemicals released were a part of TRI-listed chemicals which each chemical causing one or more of the following: cancer, chronic human health effects, adverse acute human health effects, and adverse environmental effects.[10]



There were no issues with manipulating data given that there were no data anomalies. Given that our data analysis shows the amount of toxic chemicals being released, the top contributing facilities, and the prevalence of the issue in Baltimore City, our recommendation addressing the toxic waste releases from these facilities is important for both human and environmental health.

Recommendation for the Baltimore Office of Sustainability

Proposed Solution

Our proposed solution is the creation of an initiative called “B’more Green" under the Baltimore Office of Sustainability (BOS). Similar to the Climate Action Plan (CAP) and Disaster Preparedness and Planning Project (DP3), two climate change related plans also under BOS, B’more Green will follow their framework guidelines to specifically target toxic waste release.[1] To streamline our efforts to target the industrial facilities with the greatest contributions to toxic waste release, we will be using the Environmental Protection Agency’s (EPA) Waste Management Hierarchy.[3] This is a model of what waste management methods should be prioritized. EPA encourages facilities to first eliminate waste at its point source (source reduction). For other generated waste, the second preferred management method is recycling, followed by energy recovery, treatment, and as a last resort, disposing of or otherwise releasing waste. B’more Green will focus on the top two recommended waste management methods which include source reduction and recycling.[3]

Long Term Goals

The long term solutions entail source reduction efforts that will prompt manufacturing facilities to shift to a more efficient and greener systematic recycling process. Furthermore, B’more Green will implement accountability among toxic waste releasing facilities through citations and fines with the partnership of the Baltimore Environmental Control Board (ECB).[13] The creation of a subdivision task force within B’more Green will serve to evaluate feedback, assess whether regulations are followed, and report to the ECB to implement consequences for violations. The ultimate goal is to increase the proportion of source reduction and recycling being used combined to 60% within facilities by 2030.

Short Term Goals

The short term goals entail connecting with grassroots environmental justice partners. A major focus is community engagement since the top seven highest contributing toxic waste facilities are near residential areas. This initiative serves as an outlet for us to serve as a liaison between the Baltimorean communities and key decision makers. Allowing community input and feedback to be included at every step of the decision making process will propel us in creating a safer and healthier environment tailored towards the residents of Baltimore. This starts with public health educational advocacy on bringing awareness about the toxic waste in communities. Because 98.5% of the toxic waste released is via air, the adverse health effects of the toxic waste release can often go unnoticed for prolonged periods of time. Therefore, educating the residential areas near the on-site waste treatment facilities about health effects, toxicology, and future steps to reduce consequences is a crucial short-term goal of B’more Green.

Estimated Timeline

The first step is getting the creation of B’more Green approved under the BOS. Not only is working with BOS important but working including Baltimorean residents in

the frameworking process is crucial is ensuring that this initiative will work to solve the reality of the situation for residents. Next, we must network and propose to grassroots environmental justice organizations partnership in our mission. Expanding this network will serve to expand the stakeholders and pressure facilities across the city to comply with the initiative regulations. Moving forward, we will be speaking with individual facilities to educate what the overarching mission is moving forward, the thresholds of toxic waste release permissible, and time progression in achieving a healthier environment will look like.

Measures of Progress

Quantitative metrics are critical in measuring progress and ensuring that our goals are being accomplished. We will continue to monitor the total toxic waste released in Baltimore City since this will serve as an indicator of overall progress. On the microlevel, we will be looking at the proportion breakdown of what toxic waste management methods individual facilities are using. Greater proportions of source reduction and recycling used among facilities will indicate to us that progress is being made in reducing toxic waste release. The monitoring of data for total toxic waste release will be done annually while the proportion monitoring will be conducted semiannually. As mentioned previously, the ultimate goal is to increase the proportion of source reduction and recycling being used combined to 60% within facilities by 2030.

Estimated Cost

The proposed estimated cost for the creation of B'more Green is $500,000. To reduce costs, the group of professional and experts that will form the B'more Green advisory task force will be small which will account for 10% of the budget. The cost of public health advocacy educational campaign materials, tool kits, and promotion will be 20% of the budget. Additionally, the funding and resources that will be given to individual grassroots partnerships will comprise 10% of the budget. Lastly, the rest of the 60% of our estimated cost will go towards policy change, lobbying and legal action lawsuits, regulation of facilities, laboratory work, data monitoring, and business analytics. Outside funding for our specific initiative will not necessarily be needed since this initiative would be funded directly under the Baltimore Office of Sustainability and not dependent on individual private investors.

Framework and Informational Analysis

Based on our retrospective analysis over the past four years and community input, we understand where the focal problem areas are. Additionally, through continued informational analysis and monitoring of the facilities while conducting our initiative, we will be able to shift and tailor toward imminent changes. Additionally, because we are following successful precedent frameworks such as the CAP that have shown 15% decrease in emission over their estimated timeline, B'more Green holds great promise for an optimistic outlook on the future of Baltimore City[2]. Without the analysis that we have done and the proposed future steps, there would be continued unaddressed

adverse health effects and unknown long-term environmental consequences in the next five years due to the toxic waste.

Appendix
Additional Reading

IPCC AR5 Climate Change 2014: Mitigation of Climate Change

> *"AR5 Climate Change 2014: Mitigation of Climate Change." IPCC, Apr. 2014, www.ipcc.ch/report/ar5/wg3/.*

WMO State of the Global Climate 2020

> *"State of the Global Climate 2020." World Meteorological Organization, 16 Dec. 2020, www.storymaps.arcgis.com/stories/6942683c7ed54e51b433bbc0c50fbdea.*

IPCC Special Report: Global Warming of 1.5 ºC

> *"Global Warming of 1.5 ºC." Intergovernmental Panel on Climate Change, 18 Oct. 2018, www.ipcc.ch/sr15/.*

Step-by-Step Excel Data Manipulation and Data Visualizations
all visualizations are located in the repository but not all visualizations are included in the final report
I. Data Manipulation
1. Downloaded the Basic Data Files from the Toxics Release Inventory Program online for Baltimore, Maryland for the years 2016, 2017, 2018, and 2019
2. Filtered through the columns to only include data pertaining to "Year," "Facility," "City," "Zip Code," "Parent Company Name," "Industry Sector," "Classification," "Carcinogen," and "Total Releases"
3. Inputted another column labelled "State" to add 'MD' to all greater Baltimore county rows and 'Baltimore City' to all Baltimore City specific rows
4. Filtered the columns to include Baltimore City only and exclude all other counties
II. Creating a Pivot Table and Data Visualizations for all Baltimore City facilities
1. Inputted a Pivot Table for the Baltimore City data
A. "Total Toxic Waste Released in Baltimore City 2016-2019 by Facility"
1. Columns: Year
2. Rows: Facility
3. Values: Sum of Total Releases
4. Inserted bar graph
B. "Classification of Total Toxic Waste Released in Baltimore City 2016-2019"

1. Rows: Classification
2. Values: Sum of Total Releases
3. Inserted bar graph

C. “Total Count of Release Occurrences in Baltimore City 2016-2019”

1. Rows: Facility
2. Values: Count of Total Releases
3. Inserted bar graph

D. “Total Toxic Waste Released in Baltimore City by Industry Sector”

1. Columns: Year
2. Rows: Industry Sector
2. Values: Sum of Total Releases
3. Inserted bar graph

III. Creating the Pie Chart for “Total Toxic Waste Released in Baltimore City 2016-2019”

1. Manually inputted new table with facility name and the total amount released from 2016-2019
2. Filtered out facilities that had not released any toxic waste during the four-year span
3. Inputted a pie chart
4. Removed labels for any facilities that had contributed less than 1% of overall releases
5. Calculated the amount released in pounds according to their respective percentages and added them to the pie chart

IV. Creating a Pivot Table and Data Visualizations for Top 7 Baltimore City facilities

1. Filtered the data to only include the top 7 Baltimore City facilities by contributing amount which is Southern Galvanizing Co, Sherwin Williams, Tnemec, Brandon Shores, Galvco, Grace Davidson Curtis Bay, Prince Specialty

1. Inputted a Pivot Table for the Top 7 Baltimore City facilities data

A. “Total Toxic Waste Released in Baltimore City by Top 7 Facilities”

1. Rows: Facility
2. Values: Sum of Total Releases
3. Inserted bar graph

B. “Total Toxic Waste Released in Baltimore City by Top 7 Facilities”

1. Rows: Facility
2. Values: Sum of Total Releases
3. Inserted line graph

C. “Annual Release Occurrences of Top 7 Facilities in Baltimore City”

1. Columns: Year

2. Rows: Facility

2. Values: Count of Total Releases

3. Inserted bar graph

V. Creating a Pivot Table and Data Visualizations for Baltimore City facilities vs. overall Maryland facilities

1. Unfiltered original data to include both Baltimore City and overall Maryland facilities

2. Inputted pivot chart

3. Copied over data to another sheet

4. Inserted two bar graphs for “Total Toxic Waste Released in Baltimore City” and “Total Toxic Waste Released in Maryland”

5. Added a linear trendline to both graphs

Contact Information for Baltimore City

Baltimore Office of Sustainability

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Fax: 410-244-7358.

Environmental Control Board

Phone: (410) 369-6909

Address: 200 E Lexington St Ste 100, Baltimore, MD 21202

Works Cited

[1]“Baltimore & Climate Change.” *Baltimore & Climate Change*, www.baltimoresustainability.org/baltimore-climate-change/

[2]“Baltimore Office of Sustainability.” *Baltimoresustainability.org*, www.baltimoresustainability.org/.

[3]EPA. “Summary of the Resource Conservation and Recovery Act.” *EPA*, Environmental Protection Agency, 28 July 2020, www.epa.gov/laws-regulations/summary-resource-conservation-and-recovery-act?fbclid=IwAR26ezJ4fXgmOvtMq6THQb7Z9YjHkGx5TNSRkKDV2eaj8Hgof5YSsf-lVZs.

[4]Healthy Building Network. “Five Reasons Why Climate Change and Toxic Chemicals Are Connected.” *Healthy Building Network*,

healthybuilding.net/blog/533-five-reasons-why-climate-change-and-toxic-chemicals-are-connected

[5]"Global Warming of 1.5 ºC." *Intergovernmental Panel on Climate Change*, 18 Oct. 2018, www.ipcc.ch/sr15/.

[6]*Krishnan, Niranjana, et al. "How Climate Change Can Alter the Toxicity of Chemicals." Envirobites, 28 Jan. 2019, envirobites.org/2019/01/07/how-climate-change-can-alter-the-toxicity-of-chemicals/*

[7]*State of the Global Climate 2020*, World Meteorological Organization, 16 Dec. 2020, storymaps.arcgis.com/stories/6942683c7ed54e51b433bbc0c50fbdea.

[8]"TRI Basic Data Files: Calendar Years 1987-2019." *EPA*, Environmental Protection Agency, 24 Oct. 2020, www.epa.gov/toxics-release-inventory-tri-program/tri-basic-data-files-calendar-years-1987-2019?fbclid=IwAR1laQcF8nDxq3v5qIHJpjxuiuvEHdgbXkVp1pItCdYDRDrnS_eNykgMHUw.

[9]"TRI Factsheet: State – Maryland." *EPA*, Environmental Protection Agency, Oct. 2020, enviro.epa.gov/triexplorer/tri_factsheet.factsheet_forstate?pstate=MD.

[10]"TRI-Listed Chemicals." *EPA*, Environmental Protection Agency, 29 Oct. 2020, www.epa.gov/toxics-release-inventory-tri-program/tri-listed-chemicals.

[11]"Toxics Release Inventory (TRI) Program." *EPA*, Environmental Protection Agency, 13 Nov. 2020, www.epa.gov/toxics-release-inventory-tri-program.

[12]"U.S. EPA Fines Three Southern California-Based Companies $170,000 for Hazardous Waste Violations." *EPA*, Environmental Protection Agency, 16 Dec. 2019, www.epa.gov/newsreleases/us-epa-fines-three-southern-california-based-companies-170000-hazardous-waste?fbclid=IwAR0zno04b2mg-gdvYpSCPyDgLoVsFwnoLHP05cXz2-RebuzWPFqDOJNylwA.

[13]"Welcome to the Environmental Control Board." *Environmental Control Board*, 17 Apr. 2020, ecb.baltimorecity.gov/.

[14]Wolters, Claire. "Toxic Waste, Explained." *National Geographic*, 26 June 2019, www.nationalgeographic.com/environment/global-warming/toxic-waste/.