ITS68404 Data Visualization

Assignment 2 (40%)

Semester September 2024

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Marking Rubric

Criteria	Excellent (8 – 10)	Good (6 – 7)	Average (4-5)	Poor (0-3)	Your Score
Editorial Thinking (**Individual**)	Editorial Thinking is comprehensive and complete in all aspect	Editorial Thinking is good and cover most aspect	Editorial Thinking is average and cover some aspect	Editorial Thinking is poor and incomplete	
Data Representation (**Individual**)	Visualizations are beautiful, relevant and effective	Visualizations are relevant and effective	Visualizations are relevant	Visualizations are not relevant	
Interactivity (**Individual**)	Interactivity is excellent, relevant and effective	Interactivity is good, relevant and effective	Interactivity is average and relevant	Interactivity is poor and not relevant	
Annotation (**Individual**)	Annotation is excellent, relevant and effective	Annotation is good, relevant and effective	Annotation is average and relevant	Annotation is poor and not relevant	
Colour (**Individual**)	Colour is excellent, relevant and effective	Colour is good, relevant and effective	Colour is average and relevant	Colour is poor and not relevant	
Composition (**Individual**)	Composition is excellent, relevant and effective	Composition is good, relevant and effective	Composition is average and relevant	Composition is poor and not relevant	
Storytelling	Storytelling is excellent, relevant and effective	Storytelling is good, relevant and effective	Storytelling is average and relevant	Storytelling is poor and not relevant	
References	15 and more recent references	11-15 recent references	6-10 recent references	Less than 5 recent references	
Presentation (**Individual**)	Interesting and highlight important points	Good presentation	Average presentation	Poor presentation	
				TOTAL	/90

NOTE: Total marks will be adjusted to a maximum of **40%** allocated for this assignment.

Contents

Daniel Lim

Editorial thinking

Angle

The dashboard utilizes 3 types of visualization which together depict the story of chemical emissions in Delaware. The bar chart captures total emissions associated with counties and is good at depicting places like New Castle with highest totals, and places like Sussex to visualize there are generally lower total emissions. The line chart takes these same county totals depicting whether the pollution appears to be getting better or worse over time. The Treemap is also a great way to break down individual counties and show proportional visualization of the x and y axes simultaneously. Taken all together, the three types of visualization do a good job of transitioning from exploration to telling a story, where does pollution exist most, how is it changing, and who is being affected?

Framing

The fields selected from the dataset were intended to provide anchors for visualization in space and time. REPYR (reporting year) tracks the temporal series aspect of the line chart. CALC_REL_B (total releases) was used in the bar chart for county score comparisons, and size levels of each county in the Treemap. FAC_COUNTY provides the spatial context for the facility for emissions. P_INDEX was the variable in the dataset that provides chemical risk aspect, and the sequential color scale used in all visualizations. By filtering out facilities with zero releases and focusing only on the facilities with the greatest releases, visualizations are directed to where the highest risk may lie in Delaware.

Focus

This editorial thinking will highlight Delaware's most vulnerable communities and high emission sites. The final visualization will help to show Where the danger zones are, what chemicals are involved, and who is being impacted. The aim is to tell it openly and have evidence supported narrative that creates a basis for stakeholders to act, with clearly framed, focused data. These will provide a strong basis for influencing the editorial direction, in terms of targeting the most vulnerable communities or harmful toxic waste.

Data representation

Figure 1: Delaware Chemical Emissions Dashboard

The layout of the dashboard was designed to allow for an easier flow from overview to drill down. At the very top of the dashboard, a horizontal layout of a bar chart and line chart allows users to quickly navigate both the ranking of chemical emissions by county and emissions trends over time. A treemap is available below the bar chart and line chart allowing the proportional context of each county's contribution to total emissions. A collapsible filter pane to the left allows filtering by year and chemical, and both charts will dynamically update to the user's selection. The spatial sequence of the dashboard layout has a storytelling component and engages the user with a sense of discovering the intended goal while implicitly creating a story within a story of a beginning, middle, and end.

Interactivity

Without question, interactivity is the most important part of the success of the dashboard. Clicking on a country bar in the bar chart updates all the charts to the same county. A user can also click on a year in the line chart and then filter by county or chemical in the treemap that will filter the dashboard completely, giving the user the ability to compare emissions from multiple locations and through time almost effortlessly. The user is in charge of timing using the year slider and does not require technical ability from the user in their exploration of trends and hotspots, and the user can see interrelatedness across multiple dimensions of the dashboard translating into their own interests.

Annotation

Like all the features, the annotation features are not ostentatiously but are intentionally applied. The overall title provides orientation to the user of the dashboard as they can see they are searching for the top polluter; they can also funnel the user's framing of a data story. Callouts and markers in the line chart help illustrate and reinforce meaningful insights like the spike in emissions related to New Castle in 2016. In the treemap, cell labels are displayed that give immediate access to counties and chemicals without needing to hover, which allows users to quickly interpret the treemap.

Color

The color scheme applied consistently across all views is simple and useful. A sequential blue-teal gradient was used to map to average P_INDEX hazard values, and it lends itself as highly attentionally showing the most hazardous or impactful areas in each view. A one-to-one color mapping of each county individually in the line chart, allows a clear differentiation of overlapping trends by counties and shows an overall sense of flow as opposed to indistinguishable color representations for accessibility.

Composition

The overall composition of the dashboard underscores the balance of clarity, transparency, and space. The charts were lined up and spaced appropriately so that there was no variability of spacing between the charts. There was minimal space taken by axes and labels to reduce clutter yet still display how the bars were sorted and whether one stacked trend. The line chart has a vertically aligned overlay for the legend that balances size by taking use of horizontal space for its unique spatial content, but it does not hide the trend of lines. The treemap cells are produced as CALC_REL_B, where the ability of the lines and the spacing created gives distance to be easy to recognize counties when minimized to small size.

Ling Lee Choon

Editorial thinking

Angle

It examines whether the apparent success of Delaware's air-pollution policy over the past decade has created an under-the-radar environmental trade-off — increased reliance on the land-based disposal of chemicals. Rather than a pure focus on total emissions or a particular industry, the editorial approach diverts the attention to the kind of environmental pathway on which it relies to do that: air, water, or land. The main question is: "Does the total pollution resulting from industrial activities actually decrease, or is it only being rerouted, from one environmental compartment to a different one?" This angle seeks to reveal broader systemic issues — regulations that address one type of pollution inadvertently create blind spots in others. By characterizing toxic management through impact pathways, the initiative aims to support a deeper interpretation of pollution control under SDG 12.4.

Frame

The dataset is sourced from U.S. EPA's Toxics Release Inventory (TRI), covering total chemical releases to air, water and land in Delaware from 2012 to 2020. The chosen variables (TOTAL_TO_AIR, TOTAL_TO_WATER, TOTAL_TO_LAND) for comparison were transformed into the long format, with REPYR as time dimension. Three Tableau visualizations were created to enable various levels of analysis: The stacked area chart demonstrates how each pathway's total discharge volume has evolved over time, an interactive donut chart reveals the percentage distribution in the year chosen, and the slope chart highlights how pathway dominance changed between 2012 and 2020. These visualizations were chosen to not only show long-term trends, but also to break them down at interesting points in time, which may be the focus of policy questions and stakeholder interpretations.

Focus

The analysis showed that while air discharges fell steeply after 2015, land-based discharges started to increase consistently after 2017. By 2020, land-based discharges became the dominant disposal method for the first time, accounting for 54.2% of total releases, surpassing air. In comparison, water discharges did not have significant changes at the same period. This pattern hints at a displacement effect — that air pollution control regulations might have caused industries to push their emissions into land-based disposal, which is typically less visible and weeklies regulated. The data also poses ethical and regulatory questions: Are we solving an environmental problem only to create another one? Is it simply because air quality is more noticeable, but not land pollution? Such concerns amplify the SDG 12.4 call for chemical governance "over the lifecycle, of chemicals, including in production, transport, use and disposal," regardless of which segment is successful in a single domain of the environment. It takes a step back to look at the bigger picture: If we don't regulate broadly, industries may be free to evolve in ways that work against sustainability.

Data representation

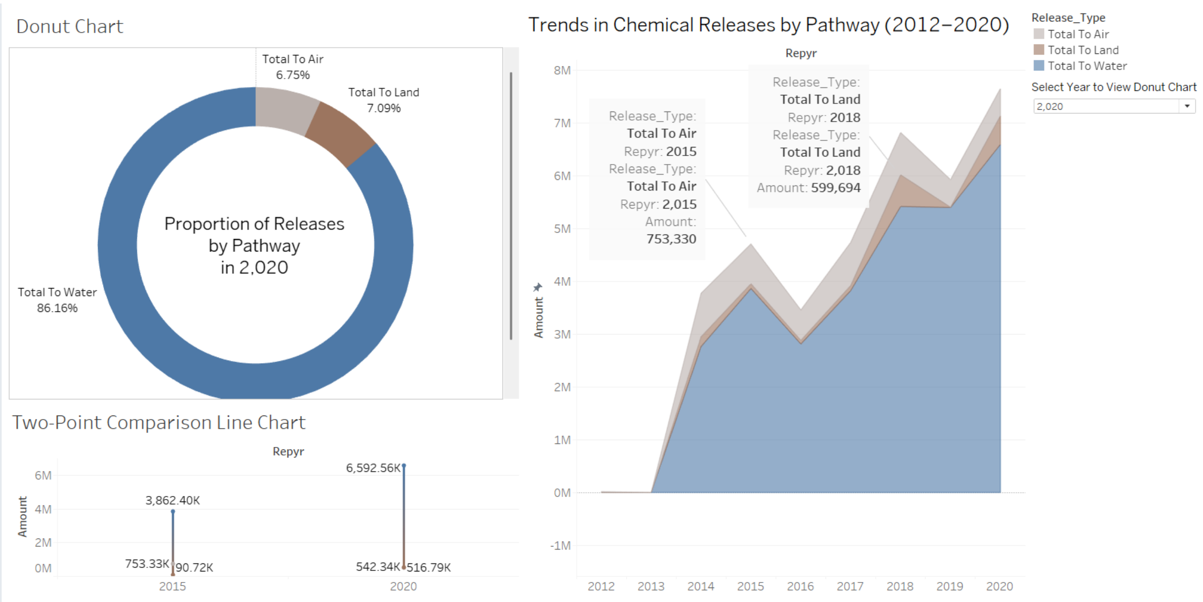

Figure 2: trends in Chemical Releases by Pathway (2012-2020)

This dashboard has shown up 3 visualizations which are Donut chart, Slope chart and stacked area chart. At top of the dashboard, the donut chart provides a visual representation of how chemical releases are distributed across different pathways for a chosen year. Below, The Line Chart shows the comparison between the years 2015 and 2020. It highlights the change of each of the pathway volumes over time. And last stacked area graph provides an overview of chemical discharge trends across all three pathways from 2012 to 2020. It highlights a peak in air emissions around 2015, followed by a steady rise in land-based discharges after 2018.

Interactivity

A Tableau dashboard containing an interactive donut chart that changes with a year selection parameter. Donut chart: When a year is chosen (from 2012-2020), the donut chart updates to reflect the proportional distribution of chemical discharges across the three release pathways – air, water, and land – for that chosen year. This interaction lets users explore how the proportion of each pathway has evolved over time, and can help to prompt further exploration. For example if we choose 2020, the diagram shows that releases into the environment from sources on land was by far the most important contributor with over 54% of total emissions, indicating that a significant change in the waste management strategy has occurred. The interactivity encourages people to discover the changing patterns of pollution firsthand in real time and contributes to storytelling by enabling personalized moments of discovery.

Annotation

Strategic annotation was used throughout the visuals to emphasize important data points and shifts. In the stack area chart, the year 2015 has been labelled to highlight when air emissions peaked and the year 2020 was annotated to indicate when land overtook air as the dominant pathway. In the two-year comparison line chart (2015 vs 2020), colour-coded lines show changes in total discharges for each pathway, with land increasing and air decreasing. It highlights how air, once dominant as the most popular method of release, receded starkly and how land-based discharges increased incrementally to replace it. The difference in the decreasing and increasing trends could imply the possible transference of waste among environmental media. The donut chart is accompanied by percent labels on each slice so that they can immediately see which pathway contributes most in a year. In tooltips you can see also the amount in pounds and % share. These annotations enhance the visual clarity and facilitate the user to understand the primary findings.

Colour

Colour choice was deliberate and semantically relevant in all images. In colour, air is grey, water is blue, and land is brown; each representing the natural watery, and earthy qualities of the myth. These colours are baked into all charts and filters to keep colour themes consistent and increase visual comprehension. The palette was also checked for accessibility, so it is accessible for people with vision impairment and colour-blindness. Semantic Colour Not only enables effortless reading but also improves visual storytelling by letting design amplify meaning.

Composition

Thought behind the dashboard is wire-framed, from top to bottom with easy-navigational structure to maintain story flow. To start, the mad donut chart at the top shows the pie of discharges for the chosen year. Below these, the stacked area chart displays trends over the entire time frame (2012–2020) and the Two-Point Comparison Line Chart gives a compressed view of the entirety of pathway changes between 2015 and 2020. Year filter is on the right-hand side of the donut for quick access and easy data filtration. Visual bring one another to sit and support overview and deep dive in harmony. Text boxes were added to title each visual and to relate it to the theme of SDG 12.4.

Farouq Fayez Faky:

Editorial Thinking:

Angle:

The core angle of the Delaware Chemical Release management dashboard is “Do Delaware’s high output industries always generate the most environmental risks?” This questions probes whether industries with substantial chemical release volume will consistently translate into the highest pollution intensity when scaled against their production output by using RTP (Release to production index) metric rather than just labelling these sectors as environmental offense and exploring possibilities, this analysis focus shifts to conclusively determines that the high output does not uniformly translate to greatest environmental harms with some NAICS industries pricing more efficient in managing in pollutant discharge per unit production. The angle identified which industries and facilitated manage high production with responsible chemical release practices while providing a clear yes or no answer to guide regulatory action and policy changes. As for the top 3 NAICS chosen they are the petroleum industry, chemical industry and food manufacturing industry according to the EPA TRI report at 2020 (EPA, 2020). This can be presented clearly by using three visualization which were selected due to their strength, to begin with a grouped bar chart will rank industries by their respective RTP across the years with the x axis showing the years while y axis showing the RTP to enable easy identification of high RTP industries every year. In addition, a stacked area chart will track RTP trends over the years for the top NAICS codes with the x-axis showing years and the y-axis showing the RTP while highlighting cumulative pollution intensity. Lastly, a tree map is used to visualize facility specific contributions with box sizes that are proportional to average RTP and coloured indicating NAICS industries and spotlighting which harmful chemicals released each industry.

Frame:

The main analysis is framed as “ A Decade of Industrial Environmental Impact in Delaware (2012-2020), which sets a temporal scope and focuses on Delaware’s industrial sector this can be done by drawing metrics like CalcRelB (Total calculated release), P index (production index), Total to water, facility name, chem name, NAICS and Year then RTP is calculated as the ratio between CalcrelB and production index to normalize pollution intensity across industries which will ensure a fair assessment regardless of their output scale. Moreover, to maintain consistency the data will be aggregated yearly especially for RTP to provide a clear view of environmental risk per production unit. Then the frame will set boundaries by filtering the NAICS codes: include the top 3 NAICS code by RTP which are 325, 324 and 311 for comprehensive industry comparison and then for time period data will be aggregated annually from 2012-2020 to capture temporal trends. Moreover, for the Chemical name the high occurrence chemicals like nitrated and methanol will be prioritized which are top 10 chemicals and the P index will be filtered to only include values > 0 to avoid division errors while calculating RTP. Lastly, for the grouped chart an average reference line will provide a benchmark to address the top industries RTP performance against overall mean and would offer immediate insight into each industry whether they are below or higher than average.

Focus:

The findings conclusively establish that high output industries do not always bear the greatest environmental burden with significant variation in RTP performance across trop Delaware's sectors, the bar chart has confirmed that petroleum and coal products (NAICS 324 with an RTP peak of 155,855 in 2019 was the most polluting industry per unit production which proves high output amplified its environmental impact due to poor emission control. On the other hands the food manufacturing industry (NAICS 311) despite having a notable RTP spoke in 2016 which was driven by nitrate compounds which demonstrated a less sever burden due to its narrower pollutant profile and occasional inefficiencies rather than systemic failures while for the chemical management industry with a steady with its diverse chemical releases showed moderate impact but then the chemicals were managed (EPA, 2020).

To mitigate high risk industries with high RTP's, like NAICS 325 and 324 facilities, consideration of advanced wastewater treatment, stronger chemical management methods, and implementing stronger policies may be reasonable investments and it has been echoed by Delaware senate stressing on tougher enforcement (Johnson, 2025) like the Delaware accountability bill which increases penalties based upon increased offense to force industries to decrease their emissions (Johnson, 2025). Features such as NAICS/chemical filters and time sliders allow stakeholders to interact with trends, The answer is, unequivocally yes only for petroleum industry but no for the rest high RTP industries which proves the fact a one size fit all emission policy won't cut it for industries like petroleum industry which may require more aggressive policies to mitigate the RTP being elevated.

Data Representation:

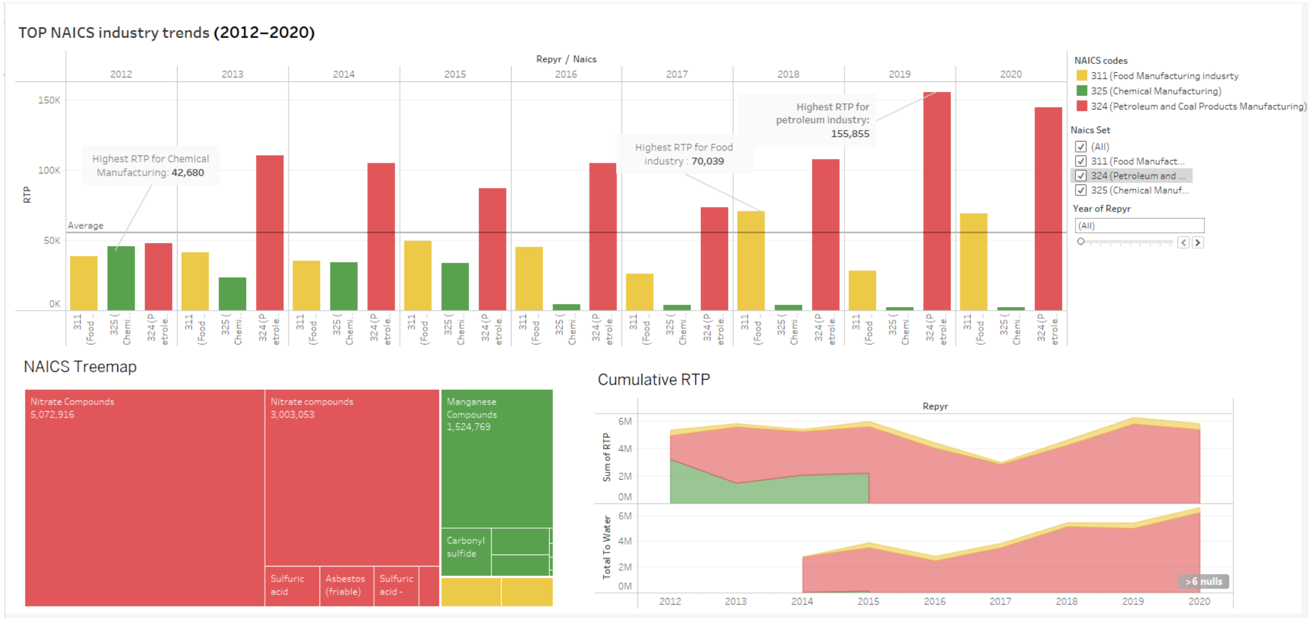

Figure 3: Top NAICS industry trends Dashboard

Interactivity:

The Delaware TRI dashboards will include different kinds of interactivity to deepens the user engagement with the RTP data across all 3 top NAICS industries from 2012-2020, there are few purposeful interactive features like a year filter which allows user to select which specific years , a NAICS code filter to isolate the industries like petroleum industry and then a chemical compound filter that help to zoom in the pollutants in that tree map, these features will enhance the understanding of the data by enabling tailored analysis without overwhelming the users as the dashboard maintain a clear focus on the RTP trends. In addition, with a tooltip on the bar chart which will provide RTP trends as the user hover each chart and the stacked area chart will support a click to expand segments and year and NAICS action filter to aid the user in viewing individual industry contribution which ensures interactivity supports the user rather than confusing them (Gorczynski, 2024).

Annotation

The bar chart has helpful annotations such as "Highest RTP for Petroleum: 155,855 (2019)" that draw attention to important data points, and the labels on the treemap detail the largest RTP with highest pollutants (e.g., "Nitrate Compounds: 5,072,916 units") with NAICS color coded information to ensure clarity then the NAICS legend also provides color coding (for example, yellow is 311, red 325, green 324), and there is a short opening statement outlining the purpose of the dashboard: to examine whether industries producing high-load outputs face the greatest environmental impacts, and the annotations assist in containing that process, so that viewers can understand the peak RTPs (e.g., Food Manufacturing: 70,039 in 2016) without too much prior knowledge, while still encouraging viewers to investigate on their own (Tselova, 2023).

Color

The TRI dashboard color choices are intentional and made to promote visual impact and understanding. For the bar chart and stacked area chart the yellow, red, and green colours correspond to the NAICS code 311 (Food Manufacturing), NAICS code 325 (Chemical Manufacturing), and NAICS code 324 (Petroleum and Coal Products Manufacturing). These distinct colors are used to clearly identify regulated industries and are intended intentionally with great contrast to maximize visual attention and impact towards the RTP as positioned in the columns (i.e., red 155,855 in 2019). When considering the treemap, the treemap relies only on the red, yellow, and green colour palettes and uses RTP within each of these base colours to show a relative pollutant volume by adjusting the size based on RTP (e.g., big square box for nitrate compounds at 5,072,916 units and each treemap relies on the 3 colours red, yellow and green to display NAICS and relies on RTP to display quantity by size, which was used to impede understanding without overwhelming the viewer (Coalter, 2020).

Composition

The design of the TRI dashboard is space-efficient in developing a cohesive storytelling experience regarding RTP trends. The top left area contains a bar chart that uses vertical bars to demonstrate annual RTP peaks (i.e. 325 is 42,680 in 2013), spaced away from adjacent annotations to avoid shading and ensure annotations can be read, and enjoyable viewing. A treemap uses a two-dimensional rectangular arrangement to convey chemical volumes (i.e. a large block for nitrate compounds), which can use nested sections by NAICS affiliations that allows for sectioned dimensions and overview and a stacked area chart on the right uses a horizontal timeline (2012-2020) with a cumulative area for RTP growth to 300,000 (yellow, red, green), complete with grid lines for scaling purposes, but minimizes clutter. The filters are small in a sidebar and imposed less disruption in the overall layout of other elements. A balanced colour scheme and aligned axes amongst charts promotes a cohesive visual flow. Lastly, all the elements (data, annotation, and interactivity including tab selection) promote a coherent and visual wholeness to help viewers come to a final understanding of the environmental impact of industry (Mokkup.ai, 2023).

Rayhana Jamil

Editorial Thinking

Angle

The angle of my editorial thinking will take place surrounding the concern of public health in Delaware and the question of responsibility that local government, given the amount of chemical dumping that takes place in the state. Nitrate compounds are the single most released chemical in Delaware, and while treatment options do exist, it is critical for human well-being to uncover the magnitude at which these compounds are dumped, and where that is done. Nitrate toxicity, or poisoning (Medicover Hospitals, n.d.) is described to be especially risky for infants, as it can lead to death. This dashboard provides interactive, fact-driven information so people can educate themselves, and government officials, NGOs, or anyone in power can make a change to stop these harmful practices.

Frame

This dashboard is framed around the understanding of how nitrate compounds are managed in Delaware, specifically through the lens of public health concern and environmental responsibility. It organises the dataset into a few core questions:

"What chemicals are most released in Delaware?"

This gives the audience a baseline understanding of what is being released into their water, air, and land, and how significant nitrates are in terms of total pollution.

"How much nitrates are released into the Delaware environment each year?"

Observing the annual trends can give the audience a sense of how the problem is progressing, whether policies are working or not, and if they need to fight harder against this issue.

"How and where are these nitrate compounds being treated?"

This explores responsibility and accountability, as on-site treatment implies direct responsibility, while off-site treatment raises concerns about shifting responsibility and issues in transparency.

"How safe are these practices?"

This question can’t be simply answered, but through interactive data visualisations, users can see for themselves and do their own research on what nitrate dumping levels are really considered safe for human life.

The following fields were used:

- Calc Rel B: Total chemical releases in pounds (lbs).
- Chem Name: Names of all chemicals that were released into the Delaware environment.
- Fac County: The Delaware county in which the specified facility is located.
- Total To Air: Total chemical releases into the air, in pounds (lbs).
- Total To Land: Total chemical releases onto land, in pounds (lbs).
- Total To Water: Total chemical releases into water, in pounds (lbs).
- Off Tre: Amount of chemical treated off-site, in pounds (lbs).
- On Tre B: Amount of chemical treated on-site, in pounds (lbs).

The visualisations include:

- Treemap of top 10 released chemicals, utilising Chem Name and Calc Rel B.
- Interactive heatmap of Delaware showing total releases, separated by county. User can choose to see total to air, land, or water.
- Interactive line graph of total nitrates released. Total To Air, Total To Land, Total To Water are all used, as well as a new parameter created called Unsafe Nitrate Threshold. This is interactive as the user can pick a body of water in Delaware, and the Unsafe Nitrate Threshold will change depending on the water volume, to show how much nitrates need to be dumped into that body of water for the concentration to become unsafe for humans.
- Line graph of Calc Rel B, Off Tre, On Tre B, showing the treatment methods versus total release.

Focus

The focus of this editorial thinking and dashboard is to give users an interactive tool that can help them evaluate the real-world safety of nitrate pollution in Delaware. Rather than simply just visualising how much is released or treated, the dashboard asks an actionable question: Are these nitrate levels safe for Delaware? This focus is executed through the interactive line graph containing total releases through all mediums, and a line dubbed Unsafe Nitrate Threshold. This line dynamically adjusts based on the user's selection and calculations made using the contaminant levels stated by EPA (2018) and the actual body of water's volume to transform a vague statistic of 10 mg/L into something more concrete and understandable, as it can be directly compared to the actual amounts released. It tells the user directly, in plain language, that this amount of nitrates needs to be dumped in this body of water for it to become unsafe. This can empower more than just the public, as it can highlight to policy makers that real change needs to be made and to NGOs and advocacy groups to support this cause. The focus is not simply on how much is being released or treated, but rather the scale at which it happens, and the impact it has on human and environmental health.

Data Representation:

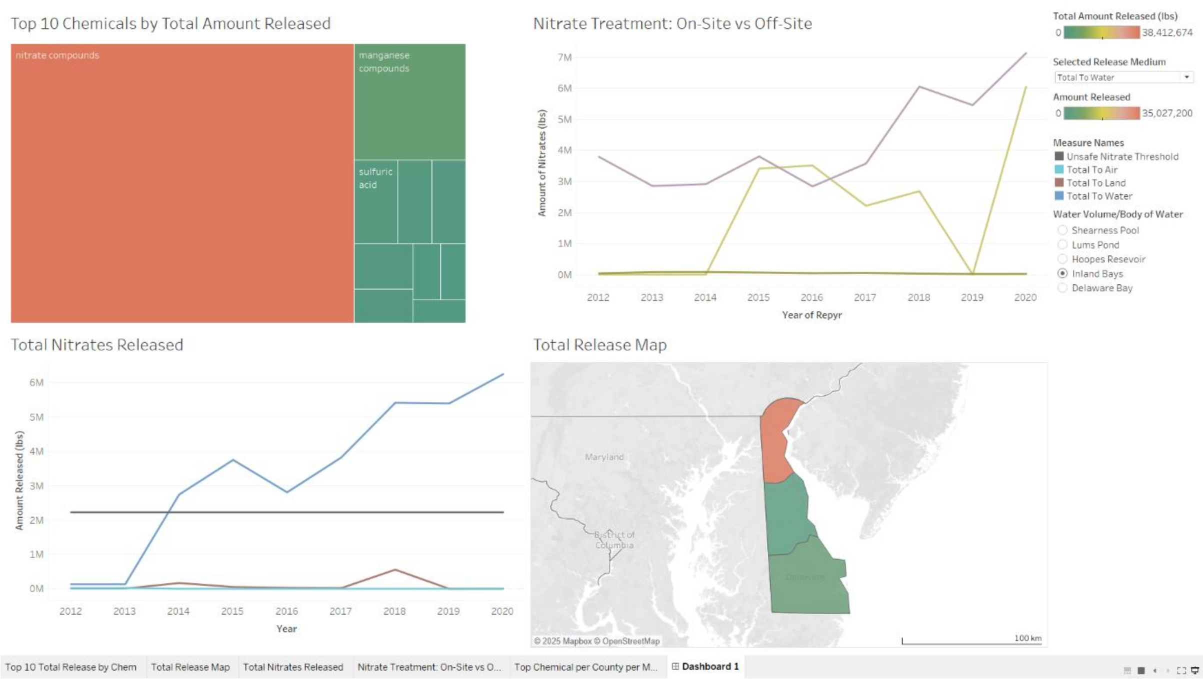

Figure 4: Nitrate Compounds trends

This dashboard shows 4 visualisations in an equal rectangular layout, each designed with a different perspective on nitrate compound management in Delaware. The top left shows a treemap of the top 10 most released chemicals, forming the users' initial understanding of where nitrate compounds rank in overal chemical pollution. The bottom right shows an interactive heatmap of Delaware, where users can explore the total chemical releases by county and medium (air, land, and water). The top right shows the trend in nitrate treatment over time, broken down into off-site and on-site treatment, revealing how facilities are managing the chemicals and the responsibility. Finally, the bottom left shows the nitrate dumping levels to all mediums versus a dynamic safety threshold, calculated by using the selected body of water's volume to calculate a concentration of over 10mg/L. This can encourage the audience to explore whether certain practices may pose a threat to public health.

Interactivity

There are two visualisations within this dashboard that boast interactivity, but each of the four do need a certain level of user interaction to convey more information (e.g. hovering). The user can select between a list of release mediums, hover over counties, and select a body of water in Delaware to dynamically change the visualisations. In particular, the custom parameter Unsafe Nitrate Threshold updates based on what is seemingly just a string of text, and returns a reference line that can change the tone of the visualisation. This level of exploration makes this dashboard practical, functional and more engaging.

Annotation

At first glance, there is limited use of text annotations on all of the charts. Titles, axis labels, legends and dropdown lists are all utilised in a clear, consistent manner, ensuring the visuals are not overwhelmed or confusing. Upon hovering over each visualisation, more information is give, such as chemical name, county name, total release amount, total amount treated, and unsafe threshold. This, again, is one of the more notable in this section. When hovering above the Unsafe Nitrate Threshold line, more context is given, where the maximum contaminant level allowed (EPA, 2018) is shared, as well as a simple sentence explaining how much nitrates would need to be dumped in the selected body of water for it to be over the maximum contaminant level allowed.

Color

There are two main colour palettes used in this dashboard. One being a temperature scale, used to emphasise the sheer difference in values, as is seen in the Top 10 Chemicals by Total Amount Released. In this treemap it can be seen that nitrate compounds are a bright orange, while the second largest is green. On the scale you can see that there should be yellow in the middle. The fact that this is entirely skipped out gives a sense of scale on the issue. The Total Nitrates Released line graph leans more on the cooler side, with blues and purples used. This is to illustrate the mediums, as there is air, land and water. There are no clashes in colours, and the dashboard maintains a clean, readable visual style.

Composition

The layout flows from general to specific. It starts with the big picture: what chemicals are being released and where. Then it moves into treatment methods and nitrate-specific tracking. Finally, it gives users a tool to dig into whether those levels are actually dangerous. Each chart has space and isn’t cramped while visual elements are grouped in a way that makes sense — chemical types are together, water releases and treatment data are close, and the most interactive tool (the Unsafe Nitrate Threshold Line) is given its own area. This makes the entire dashboard quite cohesive and readable.

Maria Baswaid

Editorial Thinking

Angle

Around 63.5 tons of trash are dumped into innocent civilians' neighborhoods *every second* (Yatoo, A., 2023). This has resulted in 9 million people dying each year due to indirect chemical exposure (Naidu et al., 2021). The people who climb the career ladder do it by trampling the health and lives of others. For those who have the power to share it with the world, it becomes a duty to call out the companies that are neglecting their moral compass for a quick money grab.

For this reason, this angle aims to visualize and expose the factories that are littering the environment via an environmental rating score, showcasing their exact practices and the magnitude of results coming from them. To contrast the negative sentiment, other companies will be praised for their good environmental scores as well. By adding these positive companies, this will better highlight the *contrast* between the worst and the best practices created and show the magnitude of how much more damaging the negative environmental factories are. All graphs used from here on will be created on the path to support this mission.

To begin with, it is harder to commit to climate activism when people's attention spans are getting shorter and shorter. Studies show most adults can only maintain 8 seconds of focus (Bair, K., & Balliet, K., 2020). Most visualizations today are plain, and strict structured, which usually offputs people from looking at them. For this reason, the graphs chosen for this visualization aim to break the mold of normal conventions. Instead of cluttering the view of the user with four to five graphs, two types of graphs will be used instead as this number is quick enough to get the message across and capture attention being stand-alone by themselves.

The first graph type will be a bubble chart, which will be used to rank the companies in terms of environmental impact. Unlike rankings made in bar charts for example, a bubble chart is unconventional with its round features, unusual to what most people are used to seeing in regular, serious infographics, which is sure enough to gain at least some novelty for those looking through on a casual setting. With its interesting shape, and its ability to grow and shrink its circles, it is capable of helping to visualize the environmental magnitude of each factory label through size and color indicated by the green index environmental rating. This angle does not want to strictly rank each company as in bar charts, but instead to hold them accountable all at once, only focusing on the *magnitude* of their environmental practices. This makes it more intuitive to how things are noticed in real life as most objects are not always listed and ordered. The unsorted unconventionality of this graph makes it feel quite similar to daily habits and eases the user into something more relevant to what they have always been doing on a subconscious level.

There will be two versions of this, one bubble group indicated to praise companies who have done positively regarding their environmental estimates, displaying them in one honorable batch, while the other shows those who litter, neglect nature, and exploit health. Both of which will be distinguished by color of plots to separate them.

Pie chart: As for the pie chart, it will not be used like usual. This angle aims to break the mold of visualization and display things from "out of the box". It is known that pie charts are used for their simple structure, easy enough to get a message quickly and efficiently. However, this is not the aim of this graph in this angle. The pie charts will be "blocked" from view initially.

In order to push the limits of visualization, it is best to think not just what info will be shown, but how. How will people react to this? How's the path to get the message across? Behavior is largely influenced by **intrigue and curiosity.** This one emotion is the thing compelling humanity to seek information the very first factor behind why someone does anything.

Because of this, the *bubble chart* will only act as the point of entry, where users may see visuals and be curious in looking at them. Then comes the ***pie chart***. First, it will be displayed with the most packed information, intentionally obscuring it from the viewing of any individual data.

Once the user is intrigued enough in the bubble visuals, they will be prompted to select a circle in the bubble chart. This action will simplify and reveal the pie chart content inside.

Only with interactivity then will the pie chart reveal its mystery as it will contain information sectioned to each company's practices such as the *chemicals they emit, if they recycle*, and how much it brings down their rating level in *environmental scores.*

Justification: In marketing, diversion of expectations is called the novelty effect which enhances the memory and makes things less forgettable for the user (Frank, D., & Kafkas, A., 2021). For this reason, the pie chart was chosen as the perfect candidate for a *twist* on the viewer, as they would not be expecting such a *simple* chart to be so densely packed at first. Therefore, adding additional motivation to their need to interact with the graphs to find out what data is visualized inside. As this chart is made for simple visuals, it has an extraordinary ability to become densely packed and unreadable so easily, making it an ideal choice for making it completely **anonymous** at first, then through filtering quickly switch back to clear simple data when needed.

Frame

Data must be capped to its basic form for users to gain the most important information first. The number of companies available for the user spans over 100 different names, this would overwhelm the user and cause unaesthetic visualizations, for this reason, a limit of *15 best and 15 worst* companies is capped on both bubble charts and pie charts for optimal results in viewer retention.

Not to mention, the different columns ranging all the way between offsite treatment, and onsite treatment with onsite recycling... then offsite recycling... would only guarantee overloading the user. For this reason, the column chosen to give information on chemicals inside the pie chart is the Process Type column which is a dimension that helps summarize whether a chemical was released, recycled, or treated in one word only. That would show enough vital information and important practices without jargon to the viewer. Moreover, the visuals will span the entirety of the dataset. There are no barriers to the number of years as the more data used, the better it is to visualize patterns.

For both positive and negative bubble charts, Fac Name will be used as the label to title each circle into its respective place. The Green Index (environmental rating) will be used to color each circle with a deeper color where the more intense it is in positive/negative direction (e.g.

deeper green for higher positive while deeper red for negative). The filters have already been discussed above with 15 top/bottom Fac Names according to Green Index.

The *Green Index* will be used for *size* in the positive plot alone. However, the problem lies with the negative plot. As the green index can go **below 0**, Tableau does not notice this sizing error as it caps out with one single size thrown to a zero (no negative sizes). For this reason, all sizes will be considered equal on the negative side, impacting visuals. This calls for *a calculated field* which would take the **absolute** value of Green Index and then set it to size through "SUM([Sizing])". This will solve the negative issue, and this plot will be shown appropriately with larger negative values now having larger sizes in circles.

Anonymity: As the filters for bubble and pie charts have been discussed, the variables can be next. The *pie chart* is a tricky problem; its whole goal is to keep simple. However, this project's goal is to make it as intense as possible at first. For the sake of anonymity and complication, a measure value such as Green Index will be chosen as the color variable. Given the colors are to not be set to be intense, but soothing enough such as the black, grey, and white gradient to not overwhelm with the many variables caused by the Green Index measure. For the rest of the variables: Fac Name, and Chem Name, and Process Type (recycled, treated, released) will be used as details.

Reveal - Filters/Variables: Once the user clicks on the specific company name in a bubble chart (filter action), the pie chart will be filtered to only show the information regarding the specific company name, Fac Name is uniform across the chart now, so it does not cause issues for the partitioning of the pie. While *Chem Name* and *Process Type* in the selected Fac Name are now the **only columns** partitioning the chart, making the design look simpler and easier to read. As Green Index is correlated with Process Type, it does not pause any risk to the overall chart complexity either since high Green Index = Recycling directly and both once filtered to Fac Name will *occupy the same area and color*, simplifying design and removing the anonymity of the chart to be readable again.

Focus

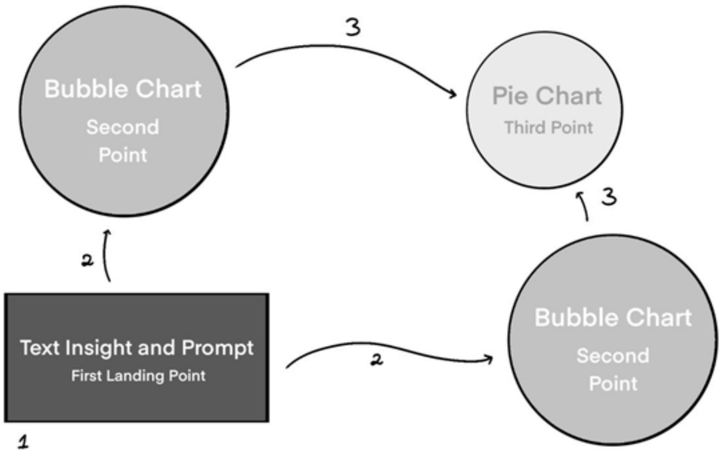

Figure 5: Viewer Focus Flow Model

Attention Flow: For the focus, all attention will fall down on the text prompt first. As the graph follows a heavy feeling tone at first glance, this text will be a guide that will prompt the user on what the graph is about and where to look *first*. It will follow a sentence such as "Are your favorite companies an Eco-Fraud? Select a bubble to find out." All of which will be supported by an annotation directing the viewer to one of the bubble charts. The makes the focus shift to the magnitude of environmental impact caused by each company where the user may now choose any one of the factory names to see if they want to see more information regarding their practices.

Before all this, the pie chart was overloaded to anonymize the data, as discussed. This fades it into the background and gives way for the user to focus on information from the first two points (text and bubble chart), making it the last third point of landing.

After the name is chosen, the pie chart's focus will shift from the complex jargon used to anonymize it and transform into more comprehensible, simple data tied to the selected factory partitioned by process type and chemical names. According to psychology, humans attention is subconsciously directed to movement (Nizamoglu, H., & Urgen, B. A., 2023), the *shift* in the pie chart will cause the viewer's attention to be directed to it *last.*

Bubble Chart Focus: All 15 factory names in each graph will be shown initially, however, to maintain retention of the viewer, the bubble charts will be minimized. This will cause smaller data to lose their labels, leaving behind only the names with greater Green Index ranking as they are the largest and do not lose their labels from minimizing the space. This helps put the most significant values in front of viewers, and the most interesting ones since most companies with great environmental efforts may be well known **locally** to the people in Delaware, giving a sense of *familiarity* to the visuals

The user will be confused if they are bombarded with all the names of more unknown companies. For this reason, factory names such as CRODA, BALTIMORE AIRCOIL, and ORIENT CORP will be the only names presented when minimizing as they have the highest green index scores allowing them to be the main focus up until then. The same goes for negative batches such as PRINCE MINERALS, ALLEN HARIM, and VEOLIA RED LION as they have the largest negative scores. All other factory label names will be shown only as pure circles so as not take away from the focus on the highest, more well-known companies that may capture interest more.

For example, Baltimore Aircoil (a positive green company) has a reputation in pioneering modern evaporative cooling and was regarded on the *ASHRAE Hall of Fame* (Baltimore Aircoil Company, 2023). As the primary intended audience is people in Delaware, this will make it acknowledged by locals for its environmental efforts and would pull them and draw them to click on it, finding out it has the highest environmental index of 271.

Afterwards, the viewer's focus shifts on details of other companies. As their curiosity heightens to know about their other local companies, graph users will be capable of browsing through other factory bubbles by hovering over them or selecting them, showing their names and respective green index score.

Pie Chart Focus: This chart acts as the main actuator of shifting the tone from a more feeling scenery to a more detailed reading logic of data. When unlocked, it handles an *individual focus* tailored to a specific company's practices. For example, if a user selects Baltimore Aircoil, the pie chart will adjust accordingly to show that their highest chemicals used are chromium, nickel, and cobalt compounds, all of which are shown as recycled. The user will learn that this information is what places them as the pioneer company with the highest green index.

Data Representation:

Figure 6: Environmental Impact Dashboard

On the basis of environmental impact, the dashboard was sculpted into the symbols of nature. The vines on the right represent the budding forests and greenery that the positive companies help protect. Each company lays down and away from the white frame signaling it as a "fruit to be picked" by the viewer. To the lower right, the negative companies lay on the barren lands and broken soil they have caused. They represent the rocks and shriveled stones left behind the parched and poisoned nature.

All of this is represented by an anonymized pie chart resting on a tree stump. Being between the good and bad, it lays the middle ground as it shows a tree (symbol of life) being cut off and withered on the inside edges, symbolizing the death of health.

Interactivity

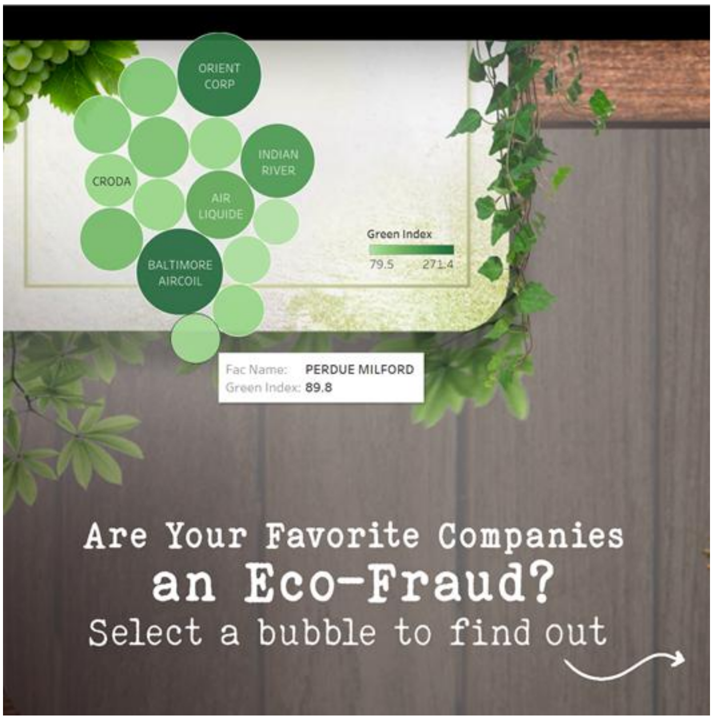

Figure 7: Hovering Interaction

For the first part of interactivity, hovering over any company name will give more detailed information of its exact green index details and company name. As shown above, some company names were left empty to keep the focus on important ones intact. This hovering will enable the viewer to look through more hidden names and explore through different company data.

In the following page, a *filter action* was created in order to give further insight into each factory's practices. Once a company is selected from any of the bubble charts, the pie chart will accommodate it by showing the company's information regarding the processes, index, and chemicals used.

Figure 8: Filter Action

The direction of the filter action follows a one way path from bubble chart to pie chart. Two actions are created for each negative and positive factories to affect results in the pie. This would help in adjusting to more curious readers that want to know beyond just the green index of a factory, giving them insights into their chosen company's practices in higher detail.

Annotations

As for the annotations, the pie chart is a mystery to be unraveled, and the only way to get the viewer to be interested is to spark that emotion by asking them a question. Moreover, since this project is extremely interactive and only shows the full info once an action is taken, judging the viewer's knowledge, they will be lost at first. That is why a guide of "select a bubble to find out" is directed at them to better facilitate the flow and help give them a nudge to the right direction.

Overall, they were intentionally created simply with short arrows. In visualizations and dashboards specifically, a concept of white space is utilized to keep each visual spaced out enough for the viewer to understand what's happening. This is used in "paradoxical brands" or brands with two different sides to them. It is shown that viewers *need time and space to process* the two contrasting ideas to fully retain the info in memory (Huang, X., 2024). This matches the exact mission this graph strives for as it shows a paradoxical good vs evil companies image, and the user will need time to understand the comparative ideas. Thus, the annotations are kept with short arrows as it already drives the user across. The "select a bubble" text prompts the user to start looking for them, the mini arrow acts only a rough pointer to help guide the eye and as to not clutter the image further.

Moreover, only one bubble chart was annotated to as per the principle of focus, the lighter an object is, the more it demands attention. This makes the positive companies already stand out too harshly and takes away focus from the negative ones. The annotation serves to guide the viewer and draw attention to selecting the negative companies as well as to not make them miss out on any vital information. This is largely tied with color as discussed below.

Color

Figure 9: Color Inspiration Choices

The colors to this were chosen on a basic rule in literature. The lighter hues were applied to the beneficial factories while darker colors were assigned to the damaging companies. This is often a pattern in media and fiction where heroes are depicted with white, while villains are associated with darker colors (Ngo, Q. 2020).

Moreover, the above figure shows the inspiration coming from different objects in nature. The shape of a bubble chart's is extremely flexible, and a simple color shift would fit it into looking similar to several categories of objects. As shown above, grape green was chosen for the environmentally friendly while a dead and dull brown for those who make the land barren.

Expanding on the principles of focus, studies show that lighter colors signal the brain harsher, making it focus its full attention on it (Cvetojević, S., & Dedijer, S., 2024). This would make the positive company graph too eye-grabbing. To not overload the user with color, the negative chart was muted into softer tones. It was originally meant to be a brighter, radioactive color to signify danger. However, with the annotations already directing attention to it, it had to become less centered to preserve focus on the given graphs in a way that would strike a balance in harmony.

Composition

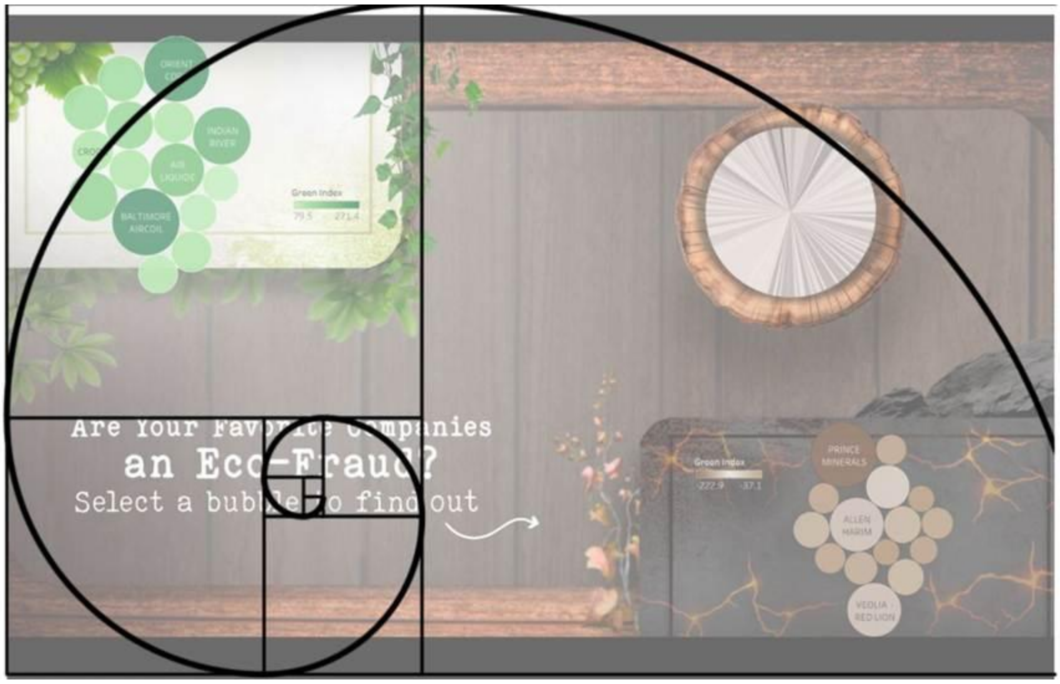

Figure 10: Golden Ratio Composition

Known as the golden Phi (φ), the golden ratio represents a mathematical formula created to pull the eye in a calculated flow that feels natural (Choi et al., 2023). Using this, the graphs were laid out according to the curve. When the objects did not underline the borders, it was to simply drive away attention from the positive graph to balance the focus on other objects. As for the annotations, it was intended to transition into the brown graph which had to break the curve and adjust the eye accordingly. Another trick used was the aspect ratio letterboxing (black borders on top and bottom) which is used in movies to emphasis the cinematic appeal of media shown helping making the graphs pop out more in terms of composition (Zurauskienė, R., & Valatkeviciutė, I., 2024), making this graph more than just a simple visualization.

Storytelling

Introduction

As the clock ticks into the hours of a new age poisoned with wasteful toxicity, we find ourselves drawn into the sustainable development goals (SDGs) established by the United Nations in 2015... They were *far too ambitious,* far too hopeful for humanity's future, specifically SDG 12.4 that's been calling for environmentally safe and managed chemicals and waste by 2020 to protect the air, water and land from harmful releases. (United Nations, 2015). Yet, we have already passed the **deadline.** This lateness only intensifies the urgency that time is ticking, and actions must be created fast lest all that is left for humanity is rubble and waste.

Additionally, toxic release has continued to pose even greater global threats which led to the increasing mortality rates of 9 million innocent people per year, detrimental especially in industrialized areas like, *Delaware,* the chemical capital of the world dubbed to its's 19^{th} century legacy and presence of the major chemical research hubs (Hoffecker & Munroe, 2025).

The UNEP, United Nations Environmental Programme, have hypothesized that this shortfall of managing waste could be due to the lack of urgency from political leaders, and that the data to bring awareness to the public is missing. How can you trust these companies to fully be transparent? Waste can easily be disposed of informally or illegally therefore it could lead to masking the true scale of the crisis unless shown directly (UNEP, 2024).

The story emerges from the deep curiosity about these health and environmental issues posed by tracking and reducing hazardous waste to safeguard local sustainability and public well-being (Espinoza, 2020). We bet that your journey is fuelled by questions that demand answers: How have emission trends evolved over the past decade? What patterns emerge in the air, water and soil contamination and how are nitrated managed? Which industrial giants are the primary driver to pollution? Are the companies claiming eco friendliness truly held accountable?

All these questions are armed by a series of dashboards with each focusing on a specific lends regarding Delaware’s toxic waste management which sets us out to weave a story that takes place in Delaware from the 2012-2020 with an eye towards critical decision ahead by 2025, as this report is more than just data points and uncovering patterns, it’s a call to inform governance assistance and awake public awareness while addressing the critical gap in reliable, accessible and clearly communicated waste management data.

A Decade of Data: The Truth

Figure 11: Delaware Chemical Emissions Dashboard

To start with, a longer-term perspective on environmental injustice has unfolded over nearly a decade, offering more than just a set of disconnected numbers, but an accompanying regional context, chemical trends, and temporal vectors. Imagine the weight of a ton, now multiply this by eight million times over. From 2012 to 2020, this was the exact weight of over 8 million pounds of toxic chemicals to be released all over the state of Delaware. However, this is not the final total that will shock you about this data as the trend of release has continued to rise even further and is not showing signs of stopping.

New Castle's Persistent Curse

New Castle County, home to Delaware's largest population, faces nearly 40% of the toxic release burden. Indeed, New Castle reported 3.2 million pounds of toxic emissions from 2012-2020, which represents 38.9% of New Castle's total emissions at the state level; this was neither a peak nor an outlier. It was a continued trend of emissions remaining constant, confirmed year after year, fluctuating by about 100,000 pounds a year between 350,000 and 450,000 pounds. New Castle continues to be the worst affected victim of this calamity to this day, harnessing the largest population and the largest debt in health.

The dashboard indicates that this isn't a coincidence that New Castle is cursed with bad toxicity but has been *allowed* to happen. A drop in emissions in 2016? The data makes it clear that it was possibly due to "frequent flaring, strong odors, and noise" from the Delaware City Refinery as well as reports of equipment failure that year (Read, 2025). This shows the signs of neglect and regulatory stagnation present in the county.

Chemicals and their Human Cost

Now, for the chemicals. Almost half of the compounds were nitrate compounds linked to agricultural runoff and industrial processes, in addition to sulfuric acid (over 700,000 pounds), manganese (around 430,000 pounds), and lead (over 180,000 pounds) compounds. It's no wonder it becomes clearer that it is toxic. This is not just an environmental issue; it's also a health issue and a timeline. According to the American Lung Association, "people living in Delaware's largest city and surrounding counties are at increased risk of premature death and illness from ozone and particle pollution." (American Lung Association, 2020). Vulnerable communities include children, the elderly, the asthmatic, and other lung conditions, many of whom live closest to the source. Improvements were tried. Where Sussex County saw a 20% reduction in emissions efforts, New Castle saw no significant change made.

A Call for Proper Actions

The state is already aware of the issue. DNREC has committed to "reducing emissions in all sectors by promoting clean energy, improving building efficiency, and reducing transportation emissions." (DNREC). However, the dashboard indicates the flawed progress has not been applied equally. The places with the most emissions that are suffering the most have seen the least progress. And that is what makes the dashboard so powerful. It doesn't just show emissions; it shows inequity. It shows where harm is aggregated. It shows that emissions did not just increase and decrease on a graph; they increased and decreased on someone's street, in someone's school, beside someone's lungs. New Castle was not just behind; it was left behind. This highlights the ill-practices behind this state and how many regulations may have been lax with their waste release compliance. Unless ruled with an iron fist, many environment-criminals will continue running on the loose.

Chemical Releases and their Pathway

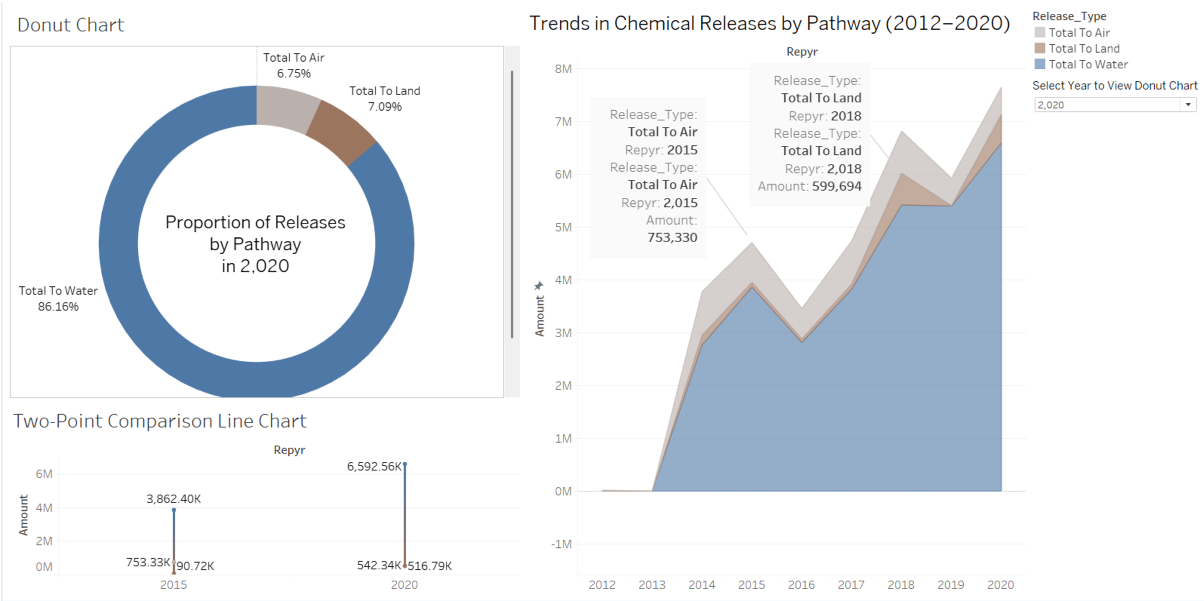

Figure 12: Trends in Chemical Releases by Pathway (2012-2020)

Industries across Delaware discharged millions of pounds of toxic chemicals into the environment from 2012 to 2020. How they managed to do so — and by what environmental means — changed drastically over the years. Air was the release method most typical at the start of the interval. By 2020 that had been eclipsed by water that was taking the lead in chemical releases. This evolution is more than a technological transformation — it's emblematic of deeper currents in environmental regulation, industrial strategy and unintended trade-offs.

In 2012 air releases were a significant source of emissions in Delaware compared to water and land pathways, which were approximately equivalent. Yet air releases fell over the next eight years — most notably after 2015 — from 750,000-plus pounds in 2015 to about 516,790 pounds in 2020 (U.S. EPA, 2024). Meanwhile, discharges to water have risen fairly steadily, overtaking all other pathways by 2016 and ticking up to 6.59 million pounds in 2020. Land-based discharges were steady and low during the whole period.

These patterns are also revealed in the stacked area chart, which illustrates the increasing dominance of water relative to air across time. The 2020 donut chart highlights this assertion – 86.16% of all chemical releases in that year were released into water, while land and air received only 7.09% and 6.75%, respectively. The comparison line chart - comparing 2015 and 2020 values - makes it easy to see the way usage by industrial dischargers has gone.

This is more than an operational shift; it may have a displacement effect, because more stringent air pollution controls caused industries to move their waste to water — a less publicly visible and less potentially regulated form of waste disposal. Instead of cutting overall pollution, industries may have merely moved it around on the environmental chessboard.

Unmasking the Nitrate challenge

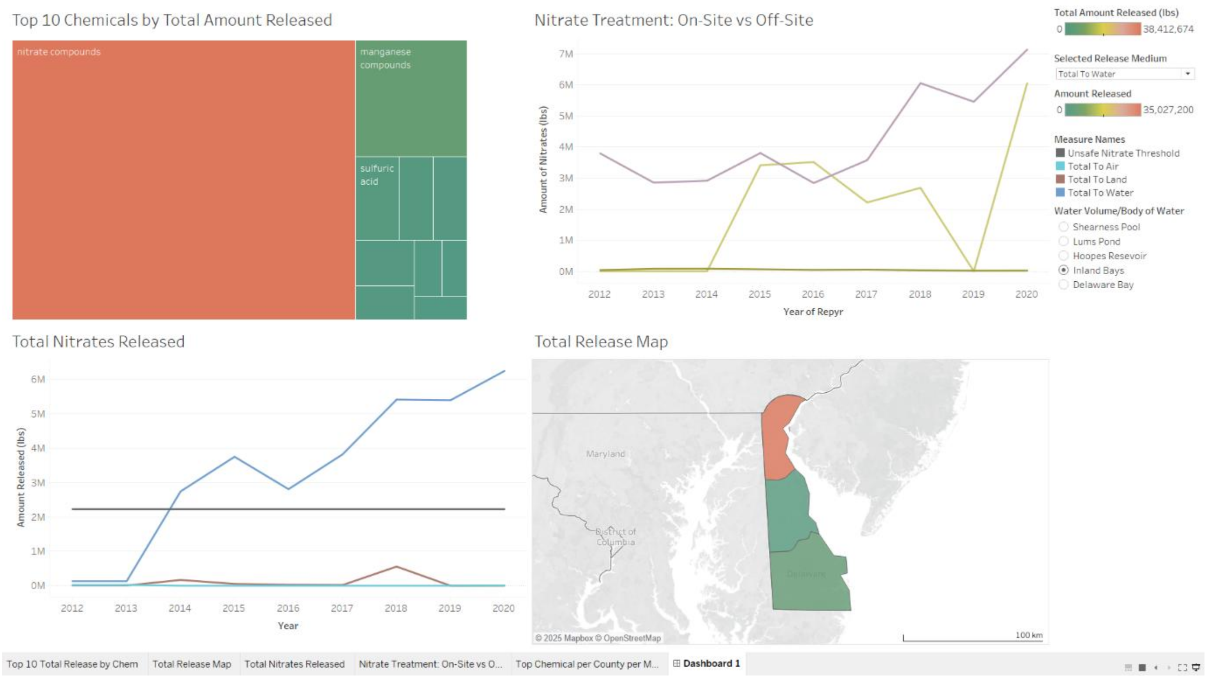

Figure 13: Nitrate Compounds trends

Let’s assess the impact of this. Nitrate is nicknamed “the silent killer” as its release in small quantities is invisible, but on long term with such large amounts seeping into water, air, and soil, causes cancer and congenital side effects, altering the DNA formation of not only one generation, but the next... and the next... spanning over five generations of gene damage (Salehzadeh et al. 2020). According to the US Environmental Protection Agency’s (EPA’s) Toxics Release Inventory, nitrates have been the most released chemical compound in Delaware for several years (EPA, 2023). While these releases are often permitted and tracked, the scale at which it is done raises serious concerns about public health (Medicover Hospitals, 2025), along with safety and long-term environmental damage. The EPA sets a safety limit of 10 mg/L of nitrates in drinking water (EPA, 2018), yet much of Delaware’s bodies of water are regular spots for industrial releases that bring nitrate levels dangerously close to the threshold. This can be seen in sheer volume within the heatmap visualisation.

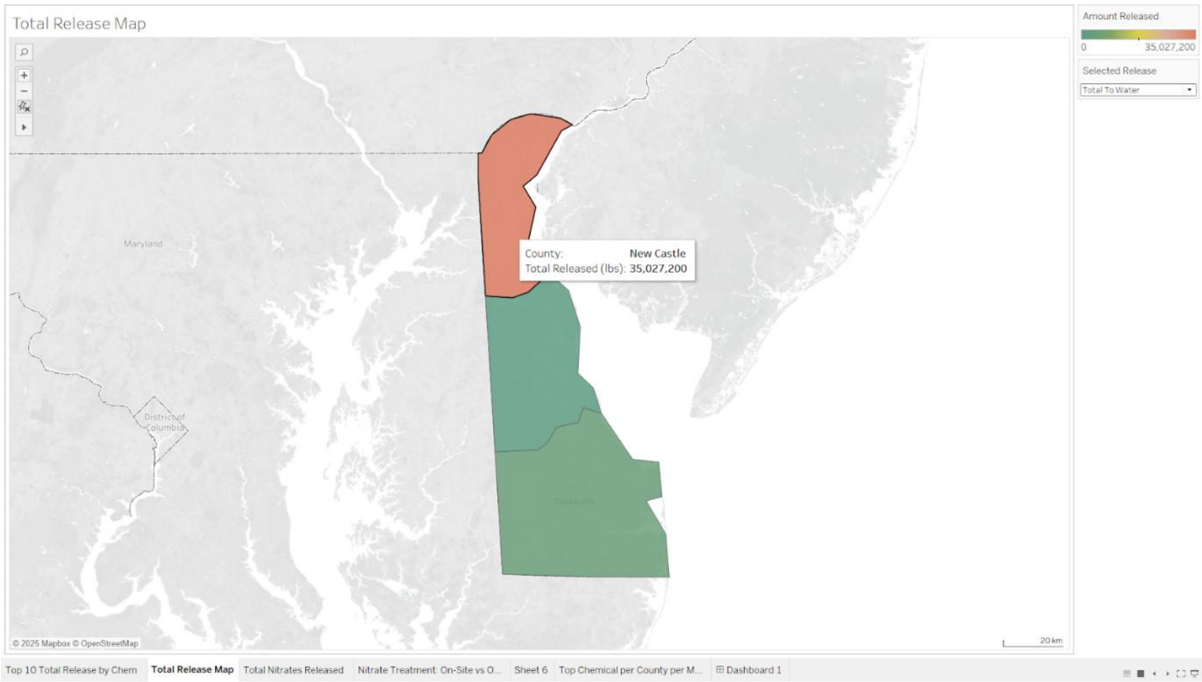

Figure 14: Geographic map for total releases

A key concern with this is how these nitrate compounds are managed — whether on-site by the facility that produces and releases them, or off-site by third parties. The latter brings up questions surrounding oversight, accountability, and transparency (DNREC, 2024). Despite having regulations in place, the total volume of released nitrates remains high, coming to a peak in 2020, with over 6 million pounds released only into water (EPA, 2023). People living near these sites remain unaware of the risks that these chemical releases can lead to, especially in infants, as it can cause methemoglobinemia (blue baby syndrome), a life-threatening condition that limits the blood's ability to carry oxygen (Medicover Hospitals, 2025).

To help bring awareness to the public, this interactive data dashboard was created. The dashboard allows users to view nitrate release trends over time, compare the volume of on-site versus off-site treatment, and explore how the lakes and bays they know could be affected by these chemical releases. The last feature mentioned lets users select a body of water in Delaware and simulate how much nitrate released into it would render it unsafe. This dynamic model helps visualise the relationship between chemical dumping and water quality, making abstract figures more concrete.

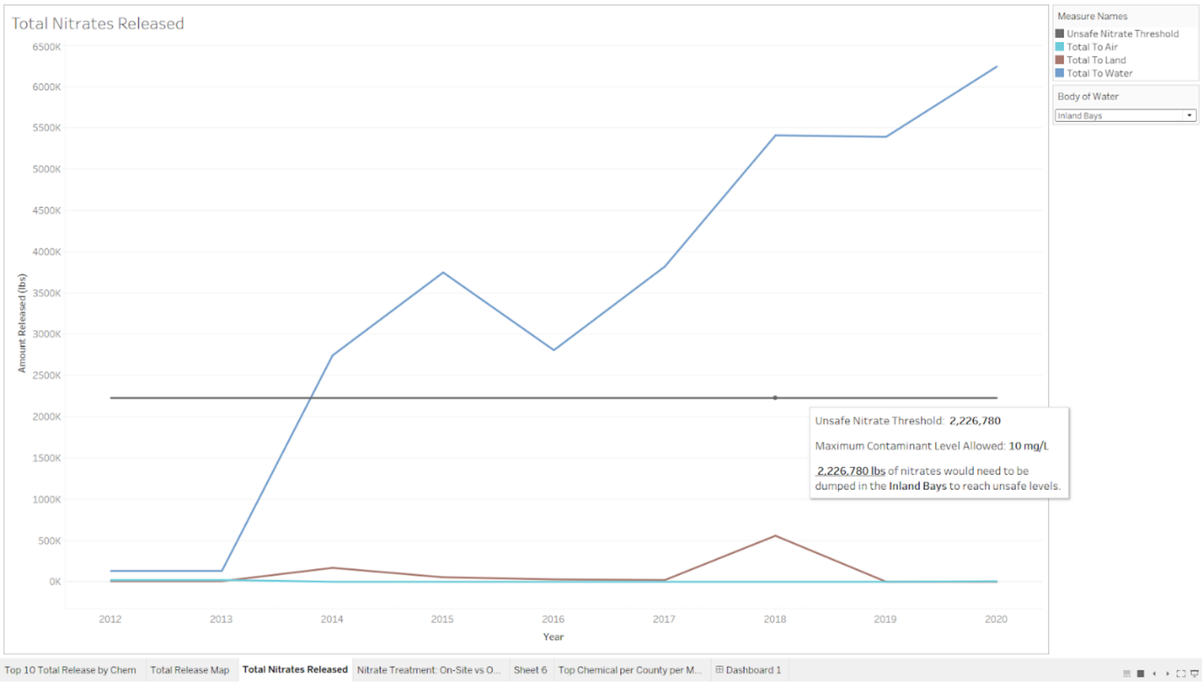

Figure 15: Total nitrates released line chart

But the story goes beyond data visualization — it is a public health concern. In rural areas, especially, residents often rely on well water and may not have access to regular testing or water treatment. Many people living near these facilities do not know what chemicals are being released near them — or the potential health consequences. Tools like the dashboard can help build awareness, but they also raise an essential question: if we know where the dumping is happening, and how much is happening, why are these practices still allowed to continue at such a scale?

This story invites communities of people, environmental groups, and policymakers to reflect: How much is too much? And at what point does legal dumping become a moral and public health failure? Making nitrate pollution visible is the first step toward holding polluters accountable — and protecting the health of Delaware's water, people, and future.

The Industrial Giants Driving the Waste

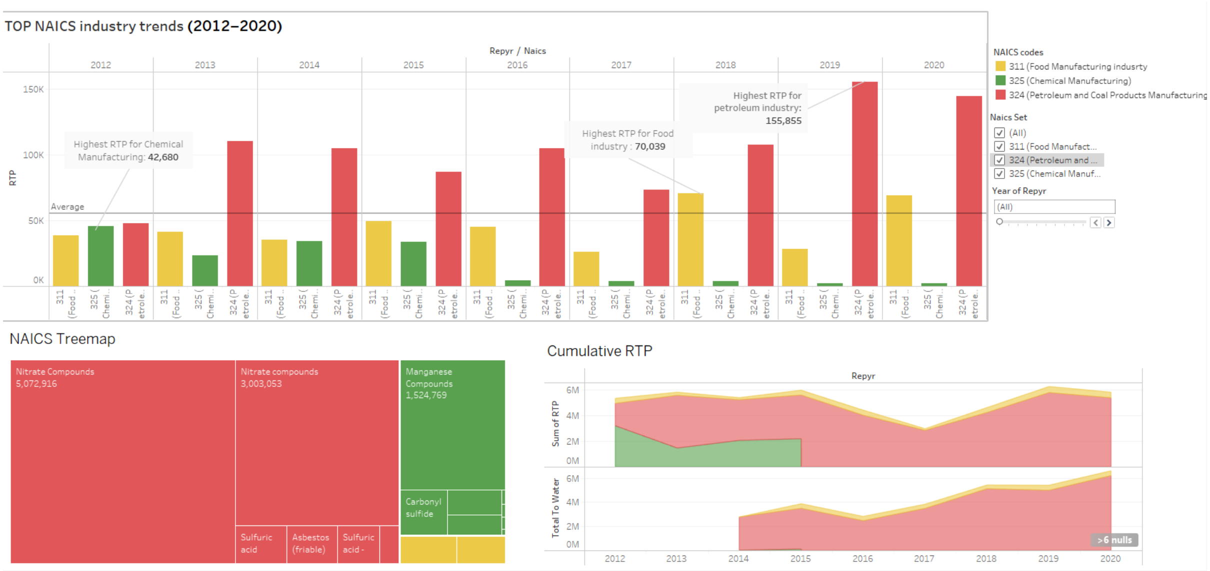

Figure 16: Top NAICS industry emission trends

Which industry types are the criminals behind all these releases? We turn the attention to the top 3 NAICS (North American Industry Classification System) industry trends dashboards. It is best to be immersed in the intricate web of Delaware's industrial landscape where the petroleum and coal manufacturing sector (NAICS 324) stands out as an undeniable titan. The bar chart reveals a compelling narrative with RTP which has skyrocketed to an impressive 155,855 by 2020, a figure that dwarfs the peaks of both the chemical manufacturing industry with 42,680 RTP in 2013 and the food manufacturing industry with a lower peak barely exceeding 20,000 RTP.

Moreover, it has been seen that year after year the red bars representing the petroleum industry have been increasing, casting it's shadows on the chemical and food manufacturing industries which is due to a Pre-EV world where most daily necessities, cars, stoves etc required oil suggesting the need for a change of policy to decrease the release per production ratio.

On the bottom left, the tree map amplifies the chemical released dominance with nitrate compounds that had a staggering 5,72 million tons due to the petroleum refinery process (kunak, 2025) and manganese compounds that contributed around 1.52 million tons due to the chemical manufacturing industry (EPA, 2025). The conclusions are clear it is that the petroleum industry is the pulsating heart of Delaware's environmental impact and to decrease it multiple response action will need to be taken which in 2025, like rigorous policy enforcement to ensure Delaware's accountability bill which increases penalties based upon increased offense to force industries to decrease their emissions, only then we may be able to reduce the environmental impact of the industrial behemoths and move Delaware forward in a more sustainable direction (Johnson, 2025).

The Ones Behind It All

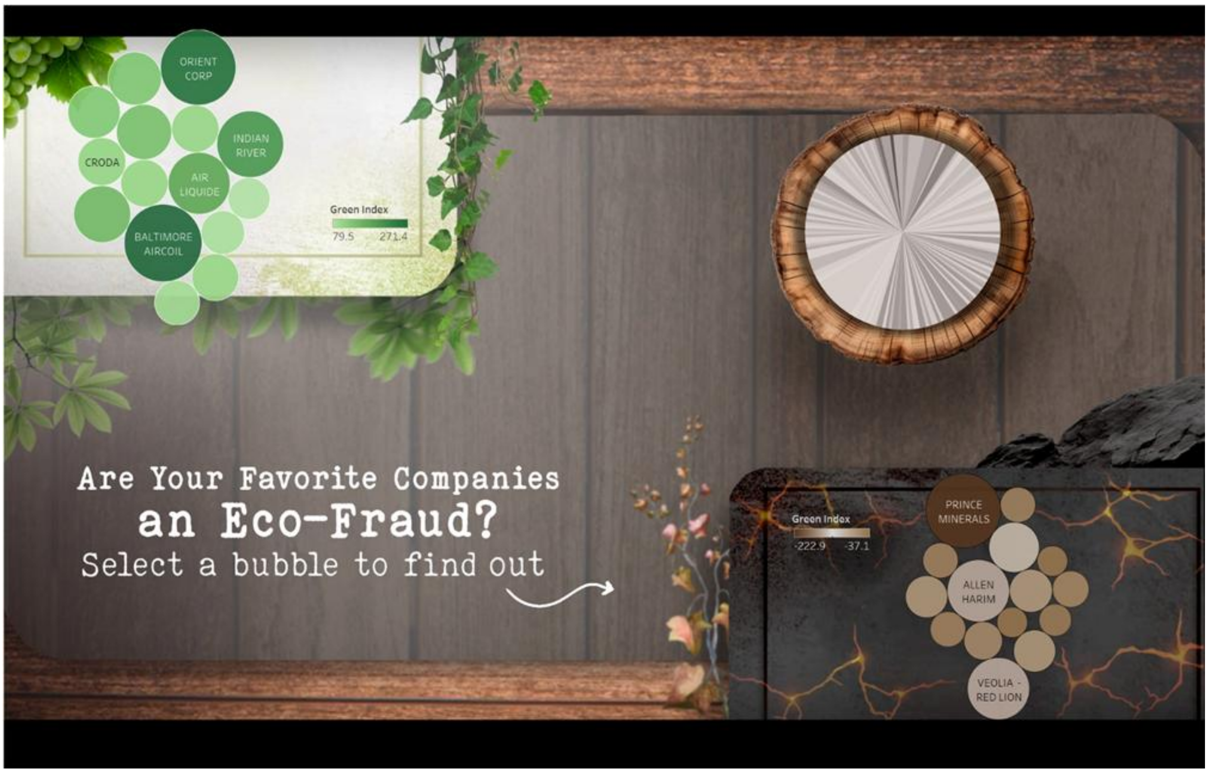

Figure 17: Environmental Impact Dashboard

As 63 tons are dumped every second, by the time you finish reading this paragraph, there would have existed well over ***3 million tons*** of chemicals dumped into every ocean, sky, and eventually the veins flowing through every innocent bystander's heart and system (Yatoo, A., 2023).

As the company sectors have already been discussed earlier, now is the time to turn it on a more personal level. Who are the names behind poisoning the health of every living being?

Greenwashing is the term used when a company claims to be pure in environmental efforts but is misleading people behind closed doors (Netto, S. 2020). This diagram serves to show the truth in its rawest form. No more lies and no more deceit. Once the bubble charts are clicked, the pie chart will reveal all the industry secrets and bypass their maneuvered tricks to bypass environmental laws.

These companies must be called out directly. Face-to-face with their names, practices, and everything listed in the open or else nothing will change. What are you waiting for? Do any of the names above seem familiar? Let us help with the interaction by investigating the top negative contributor, Prince Minerals.

Figure 18: Chemical and facility information

As shown above, manganese, one of the most toxic and highly released minerals that could cause jaundice and liver damage from only 5.6 m/L in prolonged use. A chemical so toxic even the WHO withdrew its safety limit to lessen its presence (Gandhi, D., 2022), and they release it up to *seventy-fold* more than they recycle as if it is nothing.

Prince Minerals had a history of being a fraud, spanning from their prior company, Vibrantz, claiming green environmental efforts, only to get caught in a lawsuit recently for dumping 1,4-dioxane, a carcinogen, contaminating almost 208 bodies of water. (Hughes Hubbard & Reed LLP., 2023). Instead of facing this scandal head on, they changed their name as a rebrand, and to this day continue their awful practices under a new mask.

This story is not unique, but one of many that Delaware and the world must deal with. It is only that most of these companies are hidden under the guise of secrecy and maneuvering around laws. Now that this passage has come to an end, there exists the 3 million added tons of waste in the world, more than when you started reading. This article aims to have geared you with knowledge regarding the toxic release practices as it finally revealed those under the mask. It is up to the viewer now to decide. Let this be a call for action, to expose and stand ground against such industries. *We are already past the deadline* and time keeps on ticking, so embellish every second of it to fight against this corruption for a livable and breathable world where humanity doesn't need to keep being injected with poison as it dances between life and death.

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