Benjamin Hartung

From: Susanna Martin [redacted]
Sent: Thursday, September 8, 2022 4:32 PM
To: Benjamin Hartung
Subject: Philadelphia Air Management Regulation VI for Toxic Air Contaminants

Dear Benjamin.Hartung@phila.gov,

Thank you for your efforts to better regulate toxic air pollution and reduce cancer risks from pollution emitted by large industrial facilities in Philadelphia.

The proposed regulations must be strengthened to truly ensure they achieve meaningful health protections for Philadelphians. Making simple but important changes consistent with the current science will make a real difference in preventing cancer, birth defects, and other serious health impacts from toxic air pollution in our city - especially in neighborhoods already overburdened by industrial pollution.

AMS should require an assessment of the cumulative impacts on human health of multiple air toxics from a facility. It is not adequate to individually consider the impact of each known carcinogen emitted by a facility. It would be more protective to aggregate the total carcinogenic pollutants emitted by a facility to establish the total cancer risk.

In addition, Air Management Services (AMS) should lower the health hazard benchmark used to decide when to require a risk mitigation plan or to deny a permit. AMS should require a risk mitigation plan when the combined cancer risk of a proposed facility is 10-in-1 million or more. AMS should deny a permit when the combined cancer risk of a proposal is 25-in-1 million or more.

The proposed guidelines require that the risk mitigation plan “minimize” and “manage” the health risk posed, but appear not to require or ensure actual pollution or health risk reduction. The regulation should require the adoption of additional specific pollution control and reduction measures, such as fugitive emissions controls, hazard or chemical phase-out or elimination, community buffer requirements, and fenceline monitoring. Furthermore, any permit, plan or license approved with a risk mitigation plan should include requirements for emission measurement, air monitoring and reporting to ensure compliance. The plan should also include clear consequences for not following the requirements.

The proposed regulation does not provide for public input on health risk assessments or risk mitigation plans for facilities that affect surrounding communities. AMS should explicitly provide for public review and comment to ensure community feedback can be incorporated in a timely way into decisions about the permit, license, or plan.

The Air Pollution Control Board should commit to review the rule every five years, after public notice and comment to ensure it reflects the best available science and is strengthened as needed to protect public health, particularly the health of children and fenceline communities.

I urge you to strengthen this rule in the above ways to better protect public health and advance environmental justice in Philadelphia. Thank you for your consideration.

Sincerely,
Susanna Martin

[redacted]

Benjamin Hartung

From: Tamara Cohen [redacted]
Sent: Saturday, August 6, 2022 6:14 AM
To: Benjamin Hartung
Subject: Philadelphia Air Management Regulation VI for Toxic Air Contaminants

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Dear Benjamin.Hartung@phila.gov,

As a resident of Philadelphia, a parent and a religious leader I write to thank you for your efforts to better regulate toxic air pollution and reduce cancer risks from pollution emitted by large industrial facilities in Philadelphia and to encourage your commitment and vigilance in doing so.

The proposed regulations must be strengthened to truly ensure they achieve meaningful health protections for Philadelphians. Making simple but important changes consistent with the current science will make a real difference in preventing cancer, birth defects, and other serious health impacts from toxic air pollution in our city - especially in neighborhoods already overburdened by industrial pollution.

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I urge you to strengthen this rule in the above ways to better protect public health and advance environmental justice in Philadelphia. Thank you for your consideration.

Sincerely,

Tamara Cohen
[redacted]

Benjamin Hartung

From: Theresa Heinsler [redacted]
Sent: Friday, September 9, 2022 11:09 AM
To: Benjamin Hartung
Subject: Philadelphia Air Management Regulation VI for Toxic Air Contaminants

Dear Benjamin.Hartung@phila.gov,

Thank you for your efforts to better regulate toxic air pollution and reduce cancer risks from pollution emitted by large industrial facilities in Philadelphia.

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I urge you to strengthen this rule in the above ways to better protect public health and advance environmental justice in Philadelphia. Thank you for your consideration.

Sincerely,
Theresa Heinsler

[redacted]

Benjamin Hartung

From: Timothy Duncan [redacted]
Sent: Saturday, August 6, 2022 1:19 AM
To: Benjamin Hartung
Subject: Philadelphia Air Management Regulation VI for Toxic Air Contaminants

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I urge you to strengthen this rule in the above ways to better protect public health and advance environmental justice in Philadelphia. Thank you for your consideration.

Sincerely,
Timothy Duncan

[redacted]

Benjamin Hartung

From: Tina Horowitz [redacted]
Sent: Tuesday, September 6, 2022 12:21 PM
To: Benjamin Hartung
Subject: Philadelphia Air Management Regulation VI for Toxic Air Contaminants

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I urge you to strengthen this rule in the above ways to better protect public health and advance environmental justice in Philadelphia. Thank you for your consideration.

Sincerely,
Tina Horowitz

[redacted]

Benjamin Hartung

From: Vaughn Campbell [redacted]
Sent: Wednesday, August 24, 2022 7:51 PM
To: Benjamin Hartung
Subject: Philadelphia Air Management Regulation VI for Toxic Air Contaminants

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I urge you to strengthen this rule in the above ways to better protect public health and advance environmental justice in Philadelphia. Thank you for your consideration.

Sincerely,
Vaughn Campbell

[redacted]

Benjamin Hartung

From: Vicki Jenkins [redacted]
Sent: Saturday, August 6, 2022 10:10 AM
To: Benjamin Hartung
Subject: Philadelphia Air Management Regulation VI for Toxic Air Contaminants

____

Dear Benjamin.Hartung@phila.gov,

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I urge you to strengthen this rule in the above ways to better protect public health and advance environmental justice in Philadelphia. Thank you for your consideration.

Sincerely,
Vicki Jenkins

[redacted]

Benjamin Hartung

From: Vincent Prudente [redacted]
Sent: Saturday, August 6, 2022 8:37 PM
To: Benjamin Hartung
Subject: Philadelphia Air Management Regulation VI for Toxic Air Contaminants

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I urge you to strengthen this rule in the above ways to better protect public health and advance environmental justice in Philadelphia. Thank you for your consideration.

Sincerely,
Vincent Prudente

[redacted]

Benjamin Hartung

From: Walter Bilderback [redacted]
Sent: Tuesday, August 23, 2022 9:33 AM
To: Benjamin Hartung
Subject: Philadelphia Air Management Regulation VI for Toxic Air Contaminants

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I urge you to strengthen this rule in the above ways to better protect public health and advance environmental justice in Philadelphia. Thank you for your consideration.

Sincerely,
Walter Bilderback

[redacted]

Benjamin Hartung

From: Wesley Merkle [redacted]
Sent: Monday, September 5, 2022 10:36 AM
To: Benjamin Hartung
Subject: Philadelphia Air Management Regulation VI for Toxic Air Contaminants

Dear Benjamin.Hartung@phila.gov,

Thank you for your efforts to better regulate toxic air pollution and reduce cancer risks from pollution emitted by large industrial facilities in Philadelphia.

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I urge you to strengthen this rule in the above ways to better protect public health and advance environmental justice in Philadelphia. Thank you for your consideration.

Sincerely,
Wesley Merkle

[redacted]

Benjamin Hartung

From: Will Fraser [redacted]
Sent: Monday, August 8, 2022 10:37 AM
To: Benjamin Hartung
Subject: Philadelphia Air Management Regulation VI for Toxic Air Contaminants

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I urge you to strengthen this rule in the above ways to better protect public health and advance environmental justice in Philadelphia. Thank you for your consideration.

Sincerely,
Will Fraser

[redacted]

Benjamin Hartung

From: William Haegele [redacted]
Sent: Saturday, August 6, 2022 9:39 AM
To: Benjamin Hartung
Subject: Philadelphia Air Management Regulation VI for Toxic Air Contaminants

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Dear Benjamin.Hartung@phila.gov,

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Sincerely,
William Haegele

[redacted]

Benjamin Hartung

From: William Michael Piccinni [redacted]
Sent: Monday, August 8, 2022 2:38 PM
To: Benjamin Hartung
Subject: Philadelphia Air Management Regulation VI for Toxic Air Contaminants

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Sincerely,
William Michael Piccinni

[redacted]

From: Charles McPhedran
To: Benjamin Hartung
Subject: RE: Comments on Air Management Regulation VI
Date: Monday, August 29, 2022 4:23:49 PM
Attachments: ATT00001.gif
Att.1 Data_Download_ECHO_7_15_2022_Major sources.xlsx
Att.2 Data_Download_ECHO_7_15_2022_Minor-Synth Minor-Unknown.xlsx
Att.3 Philadelphia major-area-minor sources + Justice40_08-03-2022.pdf
Att.4 Justice40 designations for Eastwick neighborhood.xlsx
Att.5 Eastwick Justice40_08-03-2022.pdf
Att.6 Eastwick race_08-08-2022.pdf
Att.7 OEHHA 2012 Guidelines for Risk Assessment Technical Support Document [excerpts].pdf
Att.8 Cleaner Air Oregon- How do agencies determine what is a health risk .pdf
Att.9 Cleaner Air Oregon Risk Action Levels Tables.pdf
Att.10 Cleaner Air Oregon Risk Action Levels Flowchart.pdf
Att.11 Cleaner Air Oregon Toxicity Reference Values and Risk-Based Concentrations.pdf

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Ben—

Thanks for following up. I'm attaching all the docs. to this message. Please let me know if that works.

Charley

Charles McPhedran, Esq.
[redacted]

From: Benjamin Hartung <benjamin.hartung@phila.gov>
Sent: Friday, August 26, 2022 12:14 PM
To: Charles McPhedran [redacted]
Subject: RE: Comments on Air Management Regulation VI

This message originated outside of Earthjustice. Please use caution before opening attachments or links.

Hi Charles,

Would it be possible to re-send the appendix in a regular zip folder? I am having trouble opening the

7z file.

Thank you,
Ben

From: Charles McPhedran [redacted]
Sent: Tuesday, August 9, 2022 10:45 AM
To: Benjamin Hartung <Benjamin.Hartung@phila.gov>
Cc: [redacted]
Subject: Comments on Air Management Regulation VI

Please see attached comments on Proposed Air Management Regulation VI, submitted by Clean Air Council, Interfaith Power and Light, Citizens for Pennsylvania's Future, and Earthjustice. A zip folder of attachments to these comments is also attached to this email.

Thanks to the Board and AMS for consideration of these comments. Please contact me or any of the commenting organizations with questions or for more information.

Charles McPhedran, Esq.
[redacted]

August 9, 2022

Mr. Benjamin Hartung
Benjamin.Hartung@phila.gov
Philadelphia Department of Public Health

Re: Comments on the Proposed Amendments to Air Management Regulation VI

Dear Mr. Hartung,

We are pleased that the Air Pollution Control Board, Department of Public Health, and Air Management Services are incorporating health considerations into the air permitting and licensing process with a goal to better protect public health. Commenters support the Board's recognition of the need to include a health risk assessment requirement.

Commenters recommend that the Board and Department listen to public comments offered at the hearing, and make improvements to the rule and guidelines to provide stronger health protection for Philadelphia residents and ensure that the Department fully and faithfully implements all clean air requirements.[1]

Commenters have members and constituents who live, work, and whose children play and attend school in Philadelphia neighborhoods with sources of air pollution regulated under these rules. Commenters are concerned about community members' exposure to toxic air pollution and associated health risks. Commenters are particularly concerned about the cumulative effects of multiple types and sources of pollutants that Philadelphians face, because health risks from air pollution are additive and some communities are overburdened with many different sources of pollution. Commenters urge the Board to strengthen the proposed regulations to ensure that they meaningfully protect the health of frontline communities and sensitive groups.

In particular, Commenters urge the Board to:

- Include meaningful opportunities for public input and public participation on the health risk assessment and risk mitigation plans;
- Commit to review and revise these regulations every five years;
- Assess cumulative risk from a source and look at multipathway exposure using currently available methods;
- Reduce the undue risk benchmarks because the proposed benchmarks do not provide adequate protection from toxic air pollution;
- Adjust the risk assessment approach and benchmarks to account for sensitive populations such as children;
- Clarify and strengthen risk mitigation plans to assure actual pollution reduction and control;
- Ensure the rules adequately protect Philadelphia residents from toxic air pollution.

[1] These comments address Amendments to Air Management Regulation VI (Control of Emissions of Toxic Air Contaminants/ "Control of Air Toxics and Risk Assessment") (as approved by the Air Pollution Control Board, filed May 2, 2022), scheduled for a public hearing on Aug. 10, 2022, and for which notice was provided on July 11, 2022 at https://www.phila.gov/media/20220711110610/AMR-VI-Public-Hearing-Notice-7.11.2022.pdf.

Commenters reserve the right to revise and supplement these comments.

INTRODUCTION

The Proposed Air Management Regulation VI ("AMR VI") takes a critical step in ensuring the consideration of health impacts as part of the air permitting and licensing process. In updating its rules, Air Management Services ("AMS") is one of the only local permitting authorities to recognize the strong need to address health risks from air toxics in its air permitting framework. We also appreciate that the City of Philadelphia is taking an important step to evaluate health threats in air permitting, as this should also be addressed state-wide.

However, the proposed regulation and guidelines have major gaps that could fail to address substantial health risks for neighboring communities and sensitive populations, even from a heavily polluting facility. The proposed regulations do not provide for adequate public participation, which prevents the community from having a chance to participate meaningfully in the permitting process. The current risk benchmark of 100-in-1 million from a single pollutant would not effectively address the cumulative health impacts of pollution, would allow too much risk to be considered acceptable, and is based on a method that has critical gaps in how risks are calculated that could leave sensitive populations such as children facing high health threats. AMS should clarify and strengthen its case-by-case review and risk mitigation plan requirements to ensure that permittees take adequate steps to reduce their harmful emissions. The Board should also commit to review and revise these standards on a regular basis to ensure the regulation and guidelines are kept up-to-date with the latest science.

As the Department (including AMS) recognizes, these regulations are strongly needed. Commentators agree and also believe the regulations could be strengthened to better protect public health strategically and effectively.

As the Department is aware and is working to address: the Philadelphia metro area is considered one of the most polluted regions in the United States,[2] the City has consistently been listed in the top ten "asthma capitals" in the country,[3] and the citywide cancer rate exceeds the national average.[4] Some communities are disproportionately burdened. For example, Black and Hispanic children have asthma-related hospitalization rates five times higher than that of non-Hispanic white children.[5] The City of Philadelphia has acknowledged the environmental injustices

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[2] Grant Hill, *Why the air quality in Philly might be worse than we know*, WHYY (May 2, 2021), https://whyy.org/articles/why-the-air-quality-in-philly-might-be-worse-than-we-know/.

[3] *Asthma Capitals 2021: The Most Challenging Places to Live with Asthma*, ASTHMA & ALLERGY FOUND. OF AM. (2021), https://www.aafa.org/asthma-capitals/.

[4] *Cancer Data and Statistics*, CDC (June 6, 2022), https://www.cdc.gov/cancer/dcpc/data/index htm; *Cancer in Philadelphia Neighborhoods*, Drexel Urban Health Collaborative (accessed July 22, 2022), https://drexel-uhc.shinyapps.io/cancer_in_philadelphia_neighborhoods/ (to see the citywide cancer rate, click into any neighborhood).

[5] *A Look at Children's Environmental Health in Philadelphia*, CTR. OF EXCELLENCE IN ENV'T TOXICOLOGY (Oct. 8, 2021), https://ceet.upenn.edu/a-look-at-childrens-environmental-health-in-philadelphia/#:~:text=In%20Philadelphia%2C%2021%25%20of%20children,mold%2C%20and%20even%20cleaning%20products.

experienced by certain communities and has taken initial steps to address them, including through the formation of the Environmental Justice Advisory Committee.[6] The Philadelphia City Council has introduced a bill recognizing the need to protect communities from cumulative impacts of pollution and environmental injustice -- the Community Health Act.[7] Now in this action, it's important for the Health Department to show this is a unified, full city government effort by issuing a strong rule and health benchmarks to protect public health and advance environmental justice.

The following recommendations include straightforward, easy to implement adjustments that the Board can make to the proposed regulation that would lead to stronger health protections for Philadelphia communities. And the Department, through Air Management Services, has the authority to implement and strengthen these regulations to protect the "health and welfare of the City's inhabitants" by limiting emissions based on the "anticipated effect on air quality in the neighborhood, area, and region" and considering cumulative impacts and "density of sources of air contaminants."[8]

We hope these comments will help the Air Pollution Control Board consider ways to strengthen the rule and guidelines before promptly finalizing action to protect the health of all Philadelphians and truly serve as a leader in the field.

DETAILED COMMENTS

1. The Rules Need to Assure Protection from Air Toxics for Philadelphia Residents.

Philadelphia is currently home to over two dozen major sources and hundreds of additional facilities that emit toxic contaminants into the air.[9] Philadelphia residents – particularly vulnerable individuals and people in overburdened communities – experience severe health impacts from these emissions. For example, a study of children living in Philadelphia found that 21% have asthma, over twice the national rate, and outdoor air pollution is one of the major contributors.[10] Philadelphia residents living near the now-closed PES oil refinery – which had

[6] *City Launches Environmental Justice Advisory Commission*, City of Phila. (Feb. 2, 2022), https://www.phila.gov/2022-02-02-city-launches-environmental-justice-advisory-commission/.

[7] *New Environmental Justice Legislation will Proactively Protect Community Health*, City Council Phila. (Feb. 2, 2022), https://phlcouncil.com/new-environmental-justice-legislation-will-proactively-protect-community-health/.

[8] PHILA., PA., CODE § 3-101(1)(d); *id.* § 3-301(9); *id.* § 3-302(2)(b).

[9] *ECHO Facility Search – Enforcement and Compliance Data*, Media Program = Air, List of Major Emissions facilities in Philadelphia, U.S. EPA (downloaded July 15, 2022), https://echo.epa.gov/facilities/facility-search (Attachment 1); *ECHO Facility Search – Enforcement and Compliance Data*, Media Program = Air, List of Synthetic Minor Emissions & Minor Emissions & Emissions Classification Unknown facilities in Philadelphia, U.S. EPA (downloaded July 15, 2022), https://echo.epa.gov/facilities/facility-search (Attachment 2). *See also* Map of *Major and Area/Minor Sources in Philadelphia, Pennsylvania (with Justice 40 Designations)* (Aug. 2022), created by R. Winz, Earthjustice (Attachment 3).

[10] *A Look at Children's Environmental Health in Philadelphia*, CTR. OF EXCELLENCE IN ENV'T TOXICOLOGY (Oct. 8, 2021), https://ceet.upenn.edu/a-look-at-childrens-environmental-health-in-philadelphia/#:~:text=In%20Philadelphia%2C%2021%25%20of%20children,mold%2C%20and%20even%20cleaning%20products.

been responsible for 72% of toxic air emissions in Philadelphia[11] – spent decades breathing in its toxic emissions and are still exposed to high levels of benzene from the site.[12]

It is commendable that the Board has recognized the need to assess and limit health risks from permitted facilities in order to protect the health of residents who have been exposed to high levels of air toxics for years. However, unless the Department strengthens them, it is unclear if the proposed regulations will do enough to reduce cancer risk from toxic air emissions and to ensure needed protection from heavily polluting sources of pollution. To ensure that the regulations prevent new or existing major polluting facilities from releasing dangerous amounts of air toxics, the improvements discussed are necessary.

A. Philadelphia residents experience negative health consequences from the City's existing sources of toxic air emissions, and certain communities facing environmental injustice bear the brunt of these health consequences.

This rule is critically needed in Philadelphia because many residents already experience negative health consequences from the City's existing sources of toxic air pollution, and these health impacts are not distributed equally in the population.

Overall, Philadelphia's air quality has significant room for improvement: according to the American Lung Association, the Philadelphia-Reading-Camden, PA-NJ-DE-MD area is one of the 25 most polluted regions in the United States.[13] The city also has a cancer rate of 473 per 100,000 people[14] – 34 (or 7.5%) higher than the national average.[15] However, these health impacts are not distributed evenly: some parts of the city have cancer rates as high as 612 per 100,000[16] (32.9% higher than the national average), the average life expectancy between the City's neighborhoods can vary by as much as twenty years,[17] and Black Philadelphians have the highest death rate and shortest life expectancy of any group.[18]

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[11] *Fumes Across the Fence-Line*, NAACP & Clean Air Task Force 25 (Nov. 2017), https://cdn.catf.us/wp-content/uploads/2017/11/21094509/CATF_Pub_FumesAcrossTheFenceLine.pdf.

[12] Sophia Schmidt, *Years after shutdown, cancer-causing chemical still detected at former refinery site*, WHYY (May 17, 2022), https://whyy.org/articles/cancer-causing-chemical-benzene-found-pes-refinery-site-south-philadelphia/.

[13] Grant Hill, *Why the air quality in Philly might be worse than we know*, WHYY (May 2, 2021), https://whyy.org/articles/why-the-air-quality-in-philly-might-be-worse-than-we-know/; Am. Lung Ass'n, https://www.lung.org/research/sota/city-rankings/most-polluted-cities (ranking the area 18th for particle pollution which can include heavy metals and other toxics, including carcinogens).

[14] *Cancer in Philadelphia Neighborhoods*, Drexel Urban Health Collaborative (accessed July 22, 2022), https://drexel-uhc.shinyapps.io/cancer_in_philadelphia_neighborhoods/ (to view the citywide cancer rate, click on any neighborhood).

[15] *Cancer Data and Statistics*, CDC (June 6, 2022), https://www.cdc.gov/cancer/dcpc/data/index htm.

[16] *Cancer in Philadelphia Neighborhoods*, Drexel Urban Health Collaborative (accessed July 22, 2022), https://drexel-uhc.shinyapps.io/cancer_in_philadelphia_neighborhoods/.

[17] CLOSE TO HOME: THE HEALTH OF PHILADELPHIA'S NEIGHBORHOODS, DREXEL URBAN HEALTH COLLABORATIVE & PHILA. DEP'T OF PUB. HEALTH (Summer 2019), https://www.phila.gov/media/20190801133844/Neighborhood-Rankings_7_31_19.pdf.

[18] 2021 HEALTH OF THE CITY: PHILADELPHIA'S COMMUNITY HEALTH ASSESSMENT 4, PHILA. DEPT. OF PUB. HEALTH (July 18, 2022), https://www.phila.gov/media/20220718132807/HealthOfTheCity-2021.pdf .

Philadelphians also experience high asthma rates and the City has consistently been in the top ten "asthma capitals" in the United States according to the Asthma Allergy Foundation of America.[19] The City's rate of asthma-related hospitalizations for children is 59 per 10,000 children.[20] However, certain populations are disproportionately impacted: Non-Hispanic Black and Hispanic children have asthma-related hospitalization rates five times higher than that of non-Hispanic white children, and asthma-related hospitalizations are highest in low-income, minority Southwest and North Philadelphia neighborhoods.[21] These health impacts from poor air quality also amplify other public health issues. For example, those with compromised respiratory systems are far more likely to get very sick from COVID-19.[22]

Certain communities are overburdened with pollution and experience worse health outcomes than other parts of the City. One such overburdened community is Eastwick, a predominantly Black neighborhood located in Southwest Philadelphia. Eastwick faces pollution exposure from the adjacent Clearview Landfill (a Superfund site),[23] Philadelphia International Airport, and I-95, as well as from the now-closed Philadelphia Energy Solutions refinery.[24] The community has a liver cancer rate 109% higher than expected for Pennsylvania.[25] The Eastwick neighborhood overall is in the 87th percentile for asthma among adults 18 years and older.[26] Additionally, several major sources and many area (or so-called minor) sources of air toxics are located around the community.[27] In fact, Justice40 data (an initiative of the Biden-Harris Administration's Council on Environmental Quality) also reveals that Eastwick is in the 93rd overall percentile for

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[19] *Asthma Capitals 2021: The Most Challenging Places to Live with Asthma*, ASTHMA & ALLERGY FOUND. OF AM. (2021), https://www.aafa.org/asthma-capitals/.

[20] *A Look at Children's Environmental Health in Philadelphia*, CTR. OF EXCELLENCE IN ENV'T TOXICOLOGY (Oct. 8, 2021), https://ceet.upenn.edu/a-look-at-childrens-environmental-health-in-philadelphia/#:~:text=In%20Philadelphia%2C%2021%25%20of%20children,mold%2C%20and%20even%20cleaning%20products.

[21] *Id*.

[22] *COVID-19: People with Certain Medical Conditions*, CDC (May 2, 2022), https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/people-with-medical-conditions.html.

[23] *Eastwick*, CTR. OF EXCELLENCE IN ENV'T TOXICOLOGY, https://ceet.upenn.edu/target-communities/eastwick/.

[24] Jessica R. Murray & Marilyn Howarth, *Evaluating Cancer Risks for Eastwick*, UNIV. OF PA. (July 2019), https://ceet.upenn.edu/wp-content/uploads/2019/07/160603_eastwick-poster-Jessica-Murray-1.pdf.

[25] *Id*.

[26] Population-weighted percentiles for the Eastwick neighborhood yield an overall percentile of 0.8682 across the 18 census tracts within the three identified zip codes that 1) have their center in one of the zip codes, and 2) have > 0 population. Justice40 Tracts May 2020, ArcGIS (May 31, 2022), https://www.arcgis.com/home/item.html?id=990e8d269a0348cba9ae28b344d2957d (hereinafter Justice40). Justice40 is a tool developed and used by the Federal government to ensure that at least 40 percent of Federal investment in key areas is routed to communities that are "marginalized, underserved, and overburdened by pollution." *Climate and Economic Justice Screening Tool; Beta*, COUNCIL ON ENV'T QUALITY (accessed Aug. 3, 2022), https://screeningtool.geoplatform.gov/en/#3/33.47/-97.5. A census tract is considered "disadvantaged" by the Justice40 screening tool if 1) the census tract is above the threshold for one or more environmental or climate indicators, *and* 2) the tract is above the threshold for socioeconomic indicators. Census tracts in the Eastwick neighborhood are most commonly considered disadvantaged using the criteria of health burdens, critical clean water and waste infrastructure, and reduction and remediation of legacy pollution, among other categories. *Id.*

[27] *See* Spreadsheet of *Justice 40 Designations for Eastwick Neighborhood* (Attachment 4) (Justice40 data from *Climate and Economic Justice Screening Tool; Beta*, COUNCIL ON ENV'T QUALITY (accessed July 15, 2022), https://screeningtool.geoplatform.gov/en/#3/33.47/-97.5); Map of *Justice40 and Major and Area/Minor Sources in Eastwick Neighborhood of Philadelphia* (Aug. 2022), created by R. Winz, Earthjustice (Attachment 5); Map of *Racial Demographics and Major and Area/Minor Sources in Eastwick Neighborhood of Philadelphia* (Aug. 2022), created by R. Winz, Earthjustice (Attachment 6).

proximity to Risk Management Plan facilities.[28] Another overlapping impact community members face is PM2.5 in the air – Eastwick is in the 81st percentile for this criterion.[29] All of these criteria and others identified by the Justice40 initiative negatively impact the health and safety of Eastwick residents.

From child asthma hospitalizations to cancer risks, Philadelphia residents experience negative health consequences from the City's air pollution, including toxics. Several communities with serious environmental justice concerns bear the brunt of these health consequences. Therefore, there is a critical need to consider the disproportionate health effects of air pollution during the permitting process. However, without strengthening the rule, AMR VI may not have as meaningful an impact as intended on protecting public health in overburdened neighborhoods.

B. The Board should strengthen the rule and guidelines to assure protection from heavily-polluting industrial facilities.

To ensure that the proposed rule will have the intended impact and protect the health of Philadelphians, the Board should consider recommendations in these comments. In addition, the Board should commit to the regular five-year review these comments request, to evaluate improvements needed after real-world application and assessment of the impact of the rule and guidelines.

There are currently hundreds of existing facilities that contribute significantly to existing air pollution, and it is important for the Board to evaluate and address the health risks that both existing and new heavily polluting facilities that might be proposed in the future would pose. The Board should choose to ensure the rule protects the health of Philadelphians by making key improvements these comments request.

i. The cancer risk benchmark is so high that, even after adding background cancer risk, a heavily-polluting, health-harming facility is unlikely to exceed the "undue burden" benchmark.

The total cancer risk values in AirToxScreen demonstrate that the proposed benchmarks are far too high. As a result, cancer risk from air toxics in Philadelphia could increase under AMR VI in ways that would not protect local neighborhoods.

AirToxScreen adds long-term risk from air toxics emissions from different sources to estimate total cancer risk and noncancer health risk. According to AirToxScreen, most census tracts in Philadelphia have a cancer risk of 30-in-1 million, and four tracts have a cancer risk of 40-in-1 million (rounded to the nearest 10).[30]

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[28] *Id*.
[29] *Id*.
[30] *See AirToxScreen Mapping Tool (based on 2017 emissions)*, U.S. EPA, https://epa.maps.arcgis.com/apps/dashboards/fb6e6b70c7e2480c8ef88cc8e9c061ac. The 2017 AirToxScreen national cancer risk dataset shows that the "entire US" national average total cancer risk is 30-in-1 million. Only 16% of all census tracts nationwide have a total cancer risk above 30-in-1 million and 0.17% of all census tracts

However, the actual cancer risk individuals face from breathing air toxics may be much greater than AirToxScreen indicates because AirToxScreen does not include: cancer risks associated with diesel particulate matter; non-inhalation pathways; exposures and risks very close to sources and at "hotspots"; risks from increased emissions related to equipment startups, shutdowns, malfunctions, and upsets; or variations on risks within tracts, among other gaps.[31]

Even though AirToxScreen is an underestimate, it demonstrates why AMR VI's cancer risk benchmark is far too high. Philadelphia already has hundreds of sources of toxic air pollution that contribute to high asthma rates, cancer risk, and other health risks documented above. However, according to AirToxScreen, the total combined cancer health risk from all sources and all pollutants ranges between 30- and 40-in-1 million. If the new guidelines allow new facilities to cause a cancer risk of up to 100-in-1 million *per pollutant*, then the guidelines would allow local health risk from pollution to increase far above current levels without protective action, and so reducing the benchmarks is important to assure the Board's intended positive impact from this rule and guidelines.

The harmful health effects from toxic pollution are already felt in many neighborhoods, but the proposed AMR VI guidelines could even allow new facilities to emit additional toxic pollution that greatly increase the health risks Philadelphians face without mitigation, while suggesting inaccurately and unjustly that communities are safe. Therefore, the current AirToxScreen cancer rates demonstrate clearly that a 100-in-1 million cancer risk benchmark per pollutant is far too high.

ii. <u>The current regulations and guidelines could allow some new major industrial plants to emit toxic air pollutants at harmful levels unless the "undue risk" benchmark is reduced.</u>

The existing health risk assessment methodology and benchmark could allow for major industrial plants that emit high levels of harmful air pollution to be built directly adjacent to already-overburdened communities without mitigation for air toxics. To avoid this concerning outcome, the Board must reduce the health risk benchmarks and implement the other recommendations in this comment.

The proposed benchmarks would likely not prevent new heavily polluting sources – even a refinery – from being constructed in Philadelphia without appropriate health mitigations. For example, in the 2015 residual risk review for petroleum refineries, the EPA concluded that the combined inhalation cancer risks from a petroleum refinery is approximately 100-in-1 million and this type of source can cause a chronic non-cancer target organ-specific hazard index of less than 1.[32] If a petroleum refinery's *total* cancer risk would likely not be assessed as greater than

have been identified as having a total cancer risk at or above 100-in-1 million. *See 2017 AirToxScreen National Cancer Risk by Pollutant (xlsx)*, U.S. EPA, https://www.epa.gov/AirToxScreen/2017-airtoxscreen-assessment-results#nationwide.

[31] *AirToxScreen Frequently Asked Questions, at General Assessment* at Question 1, U.S. EPA (Mar. 3, 2022), https://www.epa.gov/AirToxScreen/airtoxscreen-frequent-questions.

[32] Petroleum Refinery Sector Risk and Technology Review and New Source Performance Standards, 80 Fed. Reg. 75,178, 75,186–87 (Dec. 1, 2015). EPA's risk assessment underestimated these risks but it is still worth noting as

100-in-1 million, then its pollutant-specific cancer risk calculated in AMS's health risk assessment would not exceed 100-in-1 million or be automatically denied as an "undue risk," even when adding background cancer risk to the health risk assessment.[33] Similarly, EPA has found that an ethane cracker or ethylene production facility causes at least about 100-in-1 million cancer risk to the person most exposed to inhalation of air pollution from all carcinogens combined.[34] Other types of major industrial facilities that emit many different toxic air contaminants also may cause a substantial amount of harm and cancer risk – but if the chemical impacts are assessed in isolation, the new rule could have little or no effect, and might not even require a massive polluter to implement a risk mitigation plan. Philadelphia neighborhoods – such as those in Southwest Philadelphia – have already suffered the incredible health harms of living next to a refinery for far too long, and the Board should recognize these historic and ongoing impacts by strengthening the rule so that no new similarly health-harming facility could be built in or next to overburdened communities without, at least, mitigation for toxic air pollution.

The Board should reduce the benchmarks to ensure that they are set at a level to protect local residents from existing and potential future increases in the pollution of facilities that could create large health risks to nearby residents.

Additionally, the too-high benchmarks mean that a Philadelphia neighborhood already exposed to multiple sources of toxic pollution could still have new (or expansions of existing) industrial facilities – such as chemical plants, incinerators, and metal facilities – receive permits for operation that would result in large health risks without toxics protection. With the guidelines assessing risk pollutant-by-pollutant, and because many sources emit a long list of carcinogens in various amounts, it is not clear that one of these facilities would even exceed the 10-in-1 million benchmark for requiring a risk mitigation plan – even though, in total or cumulatively they could cause serious cancer risk. This would be simply unacceptable from a public health protection perspective.

Therefore, AMR VI and the Technical Guidelines must be strengthened. For highly toxic polluting facilities, AMS should ensure that there will be at least a risk mitigation plan and a meaningful health risk assessment that looks at the total risk to a community. Commenters also support the Board's determination that, at some point, enough is enough – neighborhoods should simply not be subjected to more toxic air and more health impacts, and some permits should be denied outright. Unfortunately, the new guidelines would fail to ensure protection from even the most hazardous facilities, and therefore they must be modified and the benchmarks must be reduced to have a meaningful impact.

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a marker for why the rule is too weak. *See, e.g.*, Cumulative Risk Assessment Comments of Air Alliance Houston et al. (2013), https://downloads.regulations.gov/EPA-HQ-ORD-2013-0292-0133/attachment_1.pdf (summarizing various gaps in EPA health risk assessment approach under the Clean Air Act air toxics program).

[33] As stated above, the EPA and a number of air agencies have found that there are undue health risks well below AMS's proposed 100-in-1 million proposed "undue risk" benchmark.

[34] 85 Fed. Reg. 40,386, 40,392 (July 6, 2020).

2. The Board should ensure meaningful opportunities for public input and public participation on the health risk assessments and risk mitigation plans.

We urge the Board to include in the rule and guidelines a process that provides the public with an opportunity to review and comment on the required health risk assessment and risk mitigation plans as part of the permit review. Neither AMR VI nor the Technical Guidelines currently provide for public input on the health risk assessments or the risk mitigation plans. There is no required public meeting where the public can ask questions and provide testimony about a health risk assessment and mitigation plan. There is also no defined process for the public to challenge a decision by AMS that a risk assessment is not required, that certain mitigation measures are not required, or that a permit or license does not cause unacceptable risk.

AMR VI and the guidelines should be updated to ensure that the public has an opportunity to review, comment on, and, as necessary, challenge the health risk assessments and risk mitigation plans. Including these procedural safeguards will ensure transparency, allow for important information to be added to the record, and generate important public feedback. Furthermore, AMS should be required to respond to public comments to ensure the final action is based on a rational explanation based on all facts in the record. These changes will strengthen AMR VI by giving the public a voice in the process and ensuring permitting decisions are made with all relevant information.

Additionally, the health risk assessments and risk mitigation plans must be made available for comment during other stages of permitting so that the public has the information necessary to make informed comments.

A. Health risk assessments and risk mitigation plans should be available for comment during the Title V operating permit public comment period and public hearing.

Under AMR XIII, Title V operating permits must undergo a 30-day public comment period and a public hearing.[35] However, there is no requirement in the proposed regulation or guidelines that the risk assessment and risk mitigation plan be available for public review and comment as part of this public input process. Without access to the risk assessment and risk mitigation plans, the public will not have a meaningful opportunity to comment on the proposed Title V operating permits because they will not have access to all the relevant permitting information. Therefore, the Board should add a provision to make the health risk assessment and risk mitigation plan available to the public before the Title V permit public comment period by releasing it with the draft permit public notice.

[35] PHILA., PA., Air Management Regulation XIII (Sept. 6, 1995) (incorporating by reference 25 Pa. § 127.521(e)).

B. Health risk assessments and mitigation plans should be available for comment during the Installation Permit and Plan Approval 30-day public comment period.

Installation permits and plan approvals occur in a permitting process that occurs before AMS grants operating permits.[36] As part of this permitting process, there is a 30-day public comment period, an opportunity for opposing individuals to file protests, and an optional hearing.[37] However, there is no requirement in the proposed regulation or guidelines that the risk assessment and risk mitigation plan are available for public review and comment as part of the process.

Without access to the risk assessment and risk mitigation plans, the public will not have a meaningful opportunity to comment on the installation permit and plan approval. Since non-Title V operating permits are exempt from AMR VI's requirements,[38] it is critical that the public has a meaningful opportunity to comment on the installation permit and plan approval – which requires giving the public access to all relevant permitting information including the health risk assessment and risk mitigation plans. Therefore, the Board should make the health risk assessment and mitigation plan available to the public with the draft permit notice before the installation permit and plan approval public comment period.

C. The Department of Public Health's Environmental Justice Policy supports strengthening the mechanism for public participation on risk assessments and risk mitigation plans.

Although the Department of Public Health has an Environmental Justice Policy, this policy alone would not provide the public with an adequate opportunity to review and comment on the AMR VI health risk assessments or risk mitigation plan. Therefore, the Board should strengthen the public participation requirements in the AMR VI rule and guidelines to advance the goals of this policy and support transparency of government action in Philadelphia.

The Environmental Justice Policy does not provide meaningful opportunities for community input and comment. Instead, it provides for public outreach, public information distribution, and public meetings when a permit application would allow a major air emitting source in or near an "area of concern."[39] However, the "purpose of the meeting is to inform the residents of an environmental justice area of the scope and nature of the project in a timely, interactive manner."[40] That requirement for a meeting is not a sufficient avenue for public input on the risk assessment or mitigation on a potential project under the proposed rule, and the policy does not require AMS or the applicant to respond to any community concerns raised at the meeting. Thus,

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[36] See *Guide to Air Pollution and Asbestos Abatement Permits and Licenses*, AIR MGMT. SERV. 5 (Jan. 7, 2011), https://www.phila.gov/media/20181108103114/Guide_to_Air_Pollution_and_Asbestos_Abatement_Permits_and_Licenses.pdf for a basic guide to air pollution permitting (operating permits "are required after a company has been issued a permit to install equipment by AMS and AMS has inspected the equipment and determined that it meets the conditions of its permit to install").

[37] PHILA., PA., Air Management Regulation XIII (Sept. 6, 1995) (incorporating by reference 25 Pa. § 127.44–46).

[38] PHILA., PA., Air Management Regulation VI at II.C(4-5) & III.A(3) (proposed May 2, 2022) [hereinafter Proposed AMR VI].

[39] ENVIRONMENTAL JUSTICE POLICY, PHILA. DEPT. OF PUB. HEALTH & AIR MGMT. SERV. (2018), https://www.phila.gov/media/20181108181235/Environmental-_Justice_Brochure.pdf.

[40] *Id*.

this policy alone does not adequately provide for public participation on the health risk requirements proposed here, and the AMR VI regulation and guidelines should be strengthened to provide meaningful public participation.

3. The Board should commit to review and revise these regulations every 5 years.

The Board should commit to review and revise AMR VI and the guidelines every 5 years to protect public health and apply the best available science in any updates to the rules. Although the final AMR VI and guidelines may be based on AMS's current understanding of the science, knowledge of the health impacts of pollution is constantly expanding. For example, the EPA will soon release new guidelines for analyzing cumulative risks,[41] which could provide additional guidance and justification for modifying AMR VI to better assess cumulative impacts.

Therefore, the Board should review and revise AMR VI every **5 years** to strengthen the standards as necessary to ensure that the regulations protect public health, particularly the health of children and fenceline community members, and are consistent with the best-available science and understanding of risk.

In the review, the Board should undergo a public notice and comment period and commit to assessing relevant factors such as:

- Whether any additional air pollutants pose cancer and/or non-cancer (acute and chronic) health risks and should be added to the list.
- Whether any reporting thresholds should be adjusted.
- Whether the Unit Risk Factor ("URF") or Reference Concentration ("RfC") values for different pollutants should be updated to reflect current science, and whether these values should be updated to account for other exposure pathways or risks to vulnerable groups such as children.
- Whether the benchmarks should be reduced.
- Whether the risk assessment and benchmarks should be altered to assess cumulative impacts from multiple pollutants from one source, or multiple pollutants from several sources.
- Whether the public has an adequate opportunity to comment on risk assessments and risk mitigation plans.
- The kinds of mitigation that have been put in place and any other health protection that has occurred as a result of AMR VI.
- Whether risk mitigation plans and AMR VI are working as they should be to reduce exposure to pollution and minimize health risk.
- Whether AMR VI should be expanded to cover more permits, and whether the existing permit exemptions should be removed.

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[41] The anticipated Guidelines for Cumulative Risk Assessment: Planning and Problem Formulation are not yet publicly available but are anticipated to come out in 2022. *See, e.g.*, Maria Hegstad, *EPA Readies Long-Stalled Cumulative Risk Guide for Release by Year's End*, INSIDEEPA (Sept. 15, 2021), https://insideepa.com/daily-news/epa-readies-long-stalled-cumulative-risk-guide-release-year-s-end. The guidelines will be based in part on a 2013 EPA Request for Information on cumulative risk assessment. 78 Fed. Reg. 25,440 (May 1, 2013) (comments available at https://www.regulations.gov/document/EPA-HQ-ORD-2013-0292-0001/comment).

4. AMS should strengthen the risk assessment guidelines to solidify the core foundation and value of the rule because scientific methods that could strengthen the Board's proposed approach to risk benchmarks are readily available.

Although requiring a health-risk assessment is a critical step to protect the health of Philadelphia residents, the proposed risk benchmarks and the methodology behind the risk calculations underlying the Amendment to AMR VI mean that residents – particularly children and other sensitive groups – could still be exposed to dangerous levels of air pollution.

The guidelines only analyze individual risks from individual pollutants, and should assess the cumulative risk or impact of all pollutants that a single source releases to the greatest extent feasible. The guidelines also allow for extremely high risk to come from a single permitted or licensed source. But the Board should instead account for the fact that that some parts of Philadelphia have multiple sources that contribute to unhealthy air pollution and health risks. The guidelines only require applicants to assess health risks from inhalation – and it is important and scientifically possible to assess the impact of air pollution exposure through other pathways. The guidelines can and should also address the particular vulnerability to toxic air pollution that children and other community members face based on age of exposure, socioeconomic disparities, and other factors. In addition, it is important for the guidelines to acknowledge gaps, such as not appearing to address health risks from fugitive emissions, and factor this, at least, into the benchmarks, or the risk assessment approach will undercount the risk community members actually experience.

The Board should reduce the cancer risk benchmark in the guidelines for risk mitigation and for unacceptability, because allowing up to a 100-in-1 million cancer risk from either a single pollutant from one source, or even from multiple pollutants from a source, is far too high. The Board should follow the best science and combine health risks from a single source and require risk mitigation from any single source that causes a combined cancer risk of 10-in-1 million or more, and deny any permit that causes a combined cancer risk of 25-in-1 million or more. If the Board decides to keep its current pollutant-by-pollutant approach, the Board should recognize an undue health hazard if cancer risk reaches 10-in-1 million and require risk mitigation for any cancer risk above 1-in-1 million from any single pollutant.

The Board should also follow the best science and either combine non-cancer risk hazard quotients or reduce the non-cancer hazard quotient benchmark to 0.1 to best reflect the additive nature of non-cancer risk. These comments provide information showing that these method improvements are available, in use elsewhere, and we hope they will be helpful to the Department as it is considering improvements to the rule and guidelines.

<u>A. The Board should combine inhalation risks from multiple pollutants emitted by a source or its rule will not adequately protect against the most serious harm.</u>

i. <u>The Board should require facilities to calculate cancer risk for the entire facility rather than for each individual pollutant.</u>

Cancer risk is additive, but the current risk assessment procedures only look at cancer risk individually for each contaminant, considered in isolation, instead of the total cancer risk from inhalation of all pollution from the source under review.[42] To adequately protect public health, the Board should combine cancer risk from all pollutants emitted by a source in its risk assessment.

The Technical Guidelines do not incorporate the latest science on cancer risk. Research shows that additional exposure to carcinogens causes additional cancer risk, such that the cancer risks are additive.[43] EPA has codified this scientific principle in its air toxics rules and AirToxScreen, and its method for combining cancer risk is readily available.[44] Additionally, other permitting programs that account for health risks in their air permitting – namely Oregon, the South Coast Air Quality Management District, and the Bay Area Air Quality Management District – all assess combined cancer risks from a source.[45]

By not requiring facilities to combine cancer risk from all emitted toxic air contaminants from a single source, the current guidelines potentially allow an unacceptably high cancer risk from a single facility. The current guidelines allow each contaminant to cause up to a 100-in-1 million cancer risk. Because many facilities emit multiple contaminants that each cause health risks, looking at the cancer risks separately could significantly undercount the overall health impacts and allow a single source to cause an unacceptable lifetime cancer risk to Philadelphians.

To remedy this, the Board should follow current science, the EPA, and other programs that assess combined cancer risks from multiple pollutants.

ii. <u>If the Board assesses combined cancer risk for a facility, the Board should reduce the "undue hazard" cancer risk benchmark to 25-in-1 million.</u>

Even if the Board combines cancer risk from multiple pollutants, using a 100-in-1 million cancer risk benchmark allows too much risk and the benchmark should be reduced to 25-in-1 million. Philadelphia residents already experience higher cancer rates than the national average,[46] and allowing up to 100-in-1 million added cancer risk from air pollution from each facility is too much additional risk.

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[42] *Technical Guidelines for Air Management Regulation VI*, AIR MGMT. SERV. III.C–D (Apr. 28, 2022) (hereinafter Technical Guidelines).

[43] *See, e.g.*, Cal. EPA OEHHA, *Risk Assessment Guidance Manual* 1-5, 2-4, 8-13 (Feb. 2015), https://oehha.ca.gov/media/downloads/crnr/2015guidancemanual.pdf ("Cancer risks from all carcinogens addressed in the HRA [health risk assessment] are added."); "Cancer risks from different substances are treated additively in risk assessment generally, and in the Hot Spots Program in part because many carcinogens act through the common mechanism of DNA damage.").

[44] *See, e.g.*, *Final Residual Risk Assessment for the Petroleum Refining Sector* 34, EPA-HQ-OAR-2010-0682-0800 (Dec. 1, 2015) ("To combine risks across multiple carcinogens, our assessments use the mixtures guidelines' … default assumption of additivity of effects, and combine risks by summing them using the independence formula in the mixtures guidelines.") (citing EPA, Guidelines for the Health Risk Assessment of Chemical Mixtures, EPA-630-R-98-002 (1986); EPA, Supplementary Guidance for Conducting Health Risk Assessment of Chemical Mixtures 73, 125 & A-9, EPA-630/R-00-002 (2000)).

[45] See Detailed Comment 3.A.ii for a detailed discussion of these permitting programs.

[46] *Cancer in Philadelphia Neighborhoods*, Drexel Urban Health Collaborative (accessed July 22, 2022), https://drexel-uhc.shinyapps.io/cancer_in_philadelphia_neighborhoods/; *Cancer Data and Statistics*, CDC (June 6, 2022), https://www.cdc.gov/cancer/dcpc/data/index.htm.

There is scientific consensus that carcinogens have no safe level of human exposure and EPA has long recognized this.[47] AMS recognized this fact in the 2021 Philadelphia Air Quality Report.[48] Congress also acknowledged this as part of the need to protect public health from cancer-causing air pollution in enacting the 1990 Clean Air Act Amendments.[49] Therefore, allowing up to a combined 100-in-1 million cancer risk from any one source still does not provide adequate protection from toxic air pollution, causing particular harm to children and communities already exposed to multiple sources simultaneously.

Other air toxics programs recognize this, and both combine cancer risk from multiple pollutants and use a lower benchmark. For example, Oregon's Cleaner Air Oregon program regulates the emissions of toxic air contaminants from facilities based on cancer and non-cancer health risks,[50] and requires permittees to calculate the combined excess cancer risk they cause.[51] Any new facilities that have a total cancer risk above 10-in-1 million must meet the Toxics Lowest Achievable Emissions Rate – the rate of emissions which reflects the most stringent emission limitation which is achieved in practice by a source in the same class or category of sources – regardless of cost.[52] New sources with a total cancer risk above 25-in-1 million are automatically denied permits.[53] Additionally, existing sources with an excess cancer risk above 50-in-1 million must meet the Toxic Best Available Control Technology standards.[54]

The Bay Area Air Quality Management District also looks at combined cancer risk by combining "all past, present, and foreseeable future sources within a 1,000 foot radius (or beyond where appropriate) from the fence line of a source, or from the location of a receptor, plus the contribution from the project."[55] A multi-source combined cancer risk of over 100-in-1 million is considered significant, and applicants exceeding this level must apply mitigation measures and recalculate cancer risk to get below it.[56] Additionally, a cancer risk from all pollutants from a single source (rather than all sources) above 10-in-1-million is considered significant and requires mitigation measures to get below the action benchmark.[57]

The South Coast Air Quality Management District also looks at combined risk from each source.[58] If combined cancer risk from a source exceeds 25-in-1 million, the applicant is required

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[47] *See, e.g.*, *NRDC v. EPA*, 824 F.2d 1211, 1215 (D.C. Cir. 1987) (citing 50 Fed. Reg. 46,880, 46,896 (Nov. 13, 1985)).

[48] *Philadelphia's 2021 Air Quality Report* 30, AIR MGMT. SERV., https://www.phila.gov/media/20220712150708/2021_AirQualityReport_Final.pdf ("a number of these pollutants are known or suspected to be carcinogenic, and there is no known 'safe concentration").

[49] *See* S. Rep. No. 101-228, at 175, reprinted in 1990 U.S.C.C.A.N. 3385, 3560 ("Federal Government health policy since the mid-1950s has been premised on the principle that there is no safe level of exposure to a carcinogen").

[50] Cleaner Air Oregon Program is defined at OR. ADMIN. R. 340-245.

[51] Risk Assessment Procedures, OR. ADMIN. R. 340-245-0050 (Nov. 18, 2021).

[52] OR. ADMIN. R. 340-245-8010 at tbl. 1 (Nov. 17, 2021).

[53] *Id*.

[54] *Id*.

[55] *CEQA Air Quality Guidelines*, BAY AREA AIR QUALITY MGMT. DIST. 5-16 (May 2017), https://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/ceqa_guidelines_may2017-pdf.pdf?la=en.

[56] *Id*. at 1-5.

[57] *Id*. at 2-4 to 2-5, 5-3.

[58] *See Risk Assessment Procedures for Rules 1401, 1401.1 & 212*, S. COAST AIR QUALITY MGMT. DIST. 3 (Sept. 1, 2017), https://www.aqmd.gov/docs/default-source/permitting/rule-1401-risk-assessment/riskassessproc-v8-1.pdf?sfvrsn=12.

to implement risk reduction measures to reduce cancer risk below 25-in-1 million or to the lowest achievable level.[59]

To best protect the health of Philadelphians, the Board should follow the best science, the EPA, and other air toxics programs that consider health risks and combine the cancer risk from different pollutants in its risk assessments. Additionally, the Board should reduce the "unacceptable" cancer risk benchmark for combined cancer risk to 25-in-1 million and deny permits that cannot meet this standard to prevent sources from posing an undue health hazard to the public.

iii. Hazard quotients from multiple pollutants should be added to create target organ specific hazard indexes because the current guidelines ignore the additive effects of non-cancer risk.

The Technical Guidelines assess long- and short-term non-cancer risk by using a hazard quotient benchmark of 1.0 for each individual pollutant.[60] However, pollutants that cause harm to the same human target organ system should be assessed together, not in isolation.

The guidelines should require the hazard quotient for each pollutant to be added to create a target organ hazard index for all chronic pollutants causing similar harm. This approach is supported by science. For example, the California Office of Environmental Health Hazard Assessment found that "[t]he potential neurotoxicity of arsenic in children, possibly in combination with other environmental agents, is also a concern. Studies in mice (Meija et al., 1997) indicate combined effects of lead and arsenic on the central nervous system that were not observed with either metal alone."[61]

In its air toxics rules, the EPA regularly adds hazard quotients for chemicals that affect the same target organ/organ system or act by similar toxicological processes to generate a Target Organ Specific Hazard Index ("TOSHI"). For example, in its recent refineries risk assessment, the EPA assessed the combined impact of non-cancer risk that operates on the same target organ from different chemicals.[62] The EPA also looked at cumulative chronic non-cancer risk for different chemicals that affect the same target organ system in its Miscellaneous Organic Chemical Manufacturing risk assessment.[63] EPA's method for creating a combined chronic health risk index value is readily available and would be easy to implement.

The Board should follow the best available science and apply these principles and methods to implement a mechanism for assessing the total acute non-cancer risk, adding the impacts of different pollutants on the same organ systems. In addition to adopting a Target Organ Specific

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[59] *AB 2588 and Rule 1402 Supplemental Guidelines,* S. COAST AIR QUALITY MGMT. DIST. 11, App. D at D-2 (Oct. 2020), https://www.aqmd.gov/docs/default-source/planning/risk-assessment/ab-2588-supplemental-guidelines.pdf?sfvrsn=13.

[60] Technical Guidelines III.C–D.

[61] Cal. EPA, OEHHA, *Prioritization of Toxic Air Contaminants - Children's Environmental Health Protection Act, Arsenic and Arsenic Compounds* at Arsenic-2 (Part II) (Oct. 2001).

[62] Final Residual Risk Assessment for the Petroleum Refining Source Sector, EPA-HQ-OAR-2010-0682-0800.

[63] National Emission Standards for Hazardous Air Pollutants: Miscellaneous Organic Chemical Manufacturing Residual Risk and Technology Review, 85 Fed. Reg. 49,084, 49,093–4 (Aug. 12, 2020).

Hazard Index, the hazard quotient benchmark should also be reduced to protect public health. Individuals are exposed to pollutants from multiple sources, and the current guidelines do not look at the existing background non-cancer risk.[64] Reducing the hazard quotient benchmark for combined non-cancer risk would prevent a single source from causing high combined non-cancer health risks on top of high background risks.

B. If the Board continues to look at health risks for individual pollutants in its risk assessment, it must greatly reduce the risk benchmarks.

i. If the Board uses individual pollutant cancer risks in its risk assessment, it should reduce the unacceptable cancer risk benchmark to 10-in-1 million.

The Board should reduce the cancer risk benchmark for unacceptability because allowing up to a 100-in-1 million cancer risk from any one pollutant is far too high and does not provide adequate protection from toxic air pollution, which causes particular harm to children and neighborhoods that are exposed to multiple pollutants and sources simultaneously. Instead, the Board should require risk mitigation for any cancer risk above 1-in-1 million from any single pollutant and recognize an unacceptable undue hazard if cancer risk reaches 10-in-1 million from any single pollutant.

Since the current guidelines do not look in the aggregate or cumulatively at cancer risk from the same source, the proposed regulations allow a single source to emit multiple different pollutants that *each* have up to a 100-in-1 million cancer risk. This could allow a single source to create an additional cancer risk of *well above 100-in-1 million* for the neighboring communities that already are exposed to risks from other sources, due to emission of multiple pollutants that each contribute to varying levels of cancer risk. If the Board chooses to continue to assess risk pollutant-by-pollutant, it must therefore greatly reduce the cancer risk benchmark to avoid a single source having a hazardously high combined cancer risk from multiple pollutants.

Multiple EPA programs consider a 1-in-1 million cancer risk from a single pollutant to be unreasonable. In implementing the Toxic Substances Control Act ("TSCA"), EPA's toxic chemicals office ("OPPT") is now recognizing the need to employ an "unreasonable risk" benchmark of 1-in-1 million to protect consumers and fenceline communities from exposure to a toxic chemical.[65] Under this EPA approach, action will be required to protect consumers or fenceline communities if risk from a single pollutant exceeds the 1-in-1 million cancer level for consumers or fenceline communities.

To prevent communities from experiencing a high combined cancer risk from a single facility, the Board should require risk mitigation for any cancer risk above 1-in-1 million from any single

[64] Technical Guidelines App. A p. 22.

[65] *See* EPA Draft TSCA Screening Level Approach for Assessing Ambient 19 Air and Water Exposures to Fenceline Communities, EPA-744-D-22-001 at 62 tbl. 3-1, 91 tbl. 3-13 (Jan. 2022) (applying a 1-in-1 million cancer risk threshold for consumers and fenceline communities in TSCA risk evaluations), https://www.epa.gov/system/files/documents/2022-01/draft-fenceline-report_sacc.pdf; U.S. EPA, Risk Evaluation for 1-Bromopropane at 278 (Aug. 2020) ("For consumer bystander exposure, EPA used the following benchmark for determining the acceptability of the cancer risk: 1x10-6: the probability of 1 chance in 1 million of an individual developing cancer").

pollutant based on the proposed guidelines and recognize an undue health hazard if cancer risk reaches 10-in-1 million from any single pollutant.

ii. <u>If the Board does not add non-cancer health risks, the Board should reduce the non-cancer hazard quotient benchmark from 1 to 0.1.</u>

The Technical Guidelines currently consider an individual pollutant hazard quotient less than or equal to 1 to present a "negligible risk" that requires no further action.[66] However, allowing a hazard quotient of 1 from any one pollutant without a risk mitigation plan is too much risk due to additive impacts from multiple pollutants and sources and the higher impact on sensitive groups.

Pollutants often impact the same organ systems or have synergistic effects.[67] Because the current guidelines assess the hazard quotient pollutant-by-pollutant, the overall non-cancer risk caused by one source could be quite high even if no single pollutant causes a hazard quotient of 1. The EPA has addressed this issue in the Superfund program, which uses a Regional Screening Level of 0.1 as the target hazard quotient for individual pollutants because "when multiple contaminants of concern are present at a site or one or more are present in multiple exposure media, the total hazard index could exceed 1.0 if each [individual pollutant's risk] were screened at the HQ of 1.0."[68]

The need for a lower benchmark is especially important because the current guidelines do not assess the non-cancer risk for vulnerable populations. Sensitive populations, such as children, may experience a higher level of health risks from pollutants – the science is clear that "children are not 'little adults'" when it comes to toxic chemicals.[69] A hazard quotient benchmark of 0.1 helps ensure that these sensitive groups are also protected.

The Board should therefore follow a similar approach to EPA's Superfund program and reduce the non-cancer risk benchmark to require a risk mitigation plan when any pollutant's hazard quotient is greater than 0.1. This would ensure that very high combined hazard quotients are not considered "negligible" because the risk comes from several different pollutants. A hazard quotient benchmark of 0.1 would also help offset the underestimation of risk to children and other vulnerable populations.

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[66] Technical Guidelines III.C–D.

[67] *See, e.g.*, *Science and Decisions: Advancing Risk Assessment* 177, National Research Council, National Academy of Sciences (2009), http://www nap.edu/catalog.php?record id=12209 ("The underlying scientific and risk-management considerations point to the need for unification of cancer and noncancer approaches in which chemicals are put into a common analytic framework regardless of type of outcome.").

[68] *Regional Screening Levels Frequent Questions*, U.S. EPA (May 2022), https://www.epa.gov/risk/regional-screening-levels-frequent-questions.

[69] *Pesticides in the Diets of Infants and Children* 3, NAT'L RSCH. COUNCIL (1993).

C. In calculating the health risk, the guidelines should add total background risk for both cancer and non-cancer risk to best assess the overall health impacts fenceline communities experience.

i. A source's cancer risk should be combined with the *total* AirToxScreen background cancer risk to protect overburdened communities.

Because cancer risk is additive, to protect the health of overburdened communities the guidelines must assess the combined health impact of the source's emissions and the already existing air pollution. Otherwise, highly overburdened communities could continue to be exposed to new sources of air pollution that further increase their health risks.

The guidelines partially assess this combined risk for cancer. To calculate the "Total Cancer Risk" in the risk assessment, the guidelines require the applicant to add the project/facility pollutant-specific cancer risk to the "background cancer risk" from the facility's census tract using the current AirToxScreen.[70] This demonstrates that the Board already recognizes that cancer risk must be combined for a single pollutant (and it should apply an additive approach for all carcinogenic risk, as discussed above). However, it is unclear what AirToxScreen number the "background cancer rate" refers to. EPA's AirToxScreen provides information on total cancer risk from all pollutants affecting a particular census tract, as well as total cancer risk for each individual pollutant.[71] AirToxScreen also provides a "background cancer risk" number, but this represents county-level estimates for certain toxics coming from outside the modeling domain.

Because cancer risk is additive, the *total* existing cancer risk number in AirToxScreen best represents the cancer risk the community already faces from stationary air sources that a source would be adding to. Therefore, the Board should clarify the guidelines to ensure that "background cancer risk" means the total existing cancer risk (from all carcinogens in the air) according to AirToxScreen.

ii. The Board should also acknowledge the additive nature of non-cancer risk and combine a source's cancer risk with the AirToxScreen background non-cancer hazard quotient.

Although the Board already acknowledges the additive nature of cancer risk by including the AirToxScreen background risk, it must also acknowledge that non-cancer risk is also additive and combine a source's non-cancer hazard quotient with the AirToxScreen background non-cancer risk.

In addition to listing local cancer risk, AirToxScreen provides a "hazard index" that estimates non-cancer health risks by summing the hazard quotients for each index.[72] AirToxScreen recognizes that a total combined index best reflects the actual non-cancer risk, noting that a

[70] Technical Guidelines III.C–D.

[71] For more information on the AirToxScreen data, *see Technical Support Document: EPA's Air Toxics Screening Assessment*, EPA (Mar. 2022), https://www.epa.gov/system/files/documents/2022-03/airtoxscreen_2017tsd.pdf.

[72] *See AirToxScreen Frequent Questions* at Risk Question 4, U.S. EPA, https://www.epa.gov/AirToxScreen/airtoxscreen-frequent-questions#risk4 (describing what the non-cancer "hazard index" means).

combined “hazard index (HI) of 1 or lower means air toxics are unlikely to cause adverse noncancer health effects over a lifetime of exposure.”[73]

Currently, the guidelines do not consider the additive nature of non-cancer risk and look at a source’s pollutant-specific non-cancer hazard quotient in isolation from the background risk. The Board should extend its own “background” cancer risk approach to non-cancer risk and require applicants to add the background non-cancer risk to the source’s non-cancer risk. This would follow the best science on non-cancer risk and better protect Philadelphia communities that are already overburdened and experiencing high non-cancer risks from air pollution.

D. The Board should consider multiple pathways of air pollution exposure from a source to more accurately assess the true risk community members face from toxic air pollution.

The Technical Guidelines only look at health risk due to inhalation, and not risk from other pathways that the public is exposed to from a stationary source’s air pollution. However, air contaminants fall on backyards, community gardens, playgrounds, people’s homes, and nearby waterways, and can persist in fish and locally grown vegetables, leading to other pathways of exposures to air pollution, like ingestion.

EPA and other regulators have recognized that looking at risk from other pathways of air pollution is a necessary component of an air toxics assessment for an air emitter. For example, EPA performed a multipathway risk assessment for petroleum refineries and regularly does this for all air toxics rules for which the Clean Air Act requires a health risk assessment.[74] California’s California Office of Environmental Health Hazard Assessment (“OEHHA”) has recognized that soil ingestion, dermal exposure to contaminated soil, and breast milk consumption are all “mandatory exposure pathways” that must be evaluated for residential receptors, and recommends a multipathway assessment for metals based on current science.[75] And the National Academy of Sciences acknowledges that “[b]ecause exposure to a specific chemical is rarely confined to a single route (although one route might dominate), the total exposure must be calculated by summing air (inhalation), dermal, and dietary (food and water) intakes. For example, pollutants that begin as ‘air pollutants’ can generate substantial exposures through other media if they can move from air to water, soil, or vegetation.”[76]

Many common air pollutants, including metals like lead, arsenic, hexavalent chromium, nickel, mercury, cadmium, manganese, beryllium, selenium, and other persistent, bioaccumulative pollutants like naphthalene have a significant potential for deposition and retention within the

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[73] *Id.*

[74] *See, e.g.*, *Final Residual Risk Assessment for the Petroleum Refining Source Sector* 12, EPA-HQ-OAR-2010-0682-0800 (Dec. 1, 2015) (“The EPA conducted a screening analysis examining the potential for significant human health risks ***due to exposures via routes other than inhalation (i.e., ingestion)***”) (emphasis added).

[75] *See Air Toxics Hot Spots Program Guidance Manual (SRP Draft)* 8-10, Cal. EPA OEHHA (Feb. 2015), https://oehha.ca.gov/media/downloads/crnr/2015guidancemanual.pdf; *see also Air Toxics Hot Spots Program Risk Assessment Guidelines: Technical Support Document for Exposure Assessment and Stochastic Analysis* App. E at E-5, E-10 to E-12, tbl. E3, Cal. EPA (Aug. 2012), http://www.oehha.ca.gov/air/hot_spots/tsd082712.html (Attachment 7).

[76] *Science and Judgment in Risk Assessment* 595, NATIONAL RESEARCH COUNCIL (1994), https://nap nationalacademies.org/catalog/2125/science-and-judgment-in-risk-assessment.

environment.[77] Air emissions of these compounds therefore present a risk to nearby communities via dermal, ingestion, and other non-inhalation pathways that are currently not being considered in the risk assessment. Philadelphia residents – particularly in North and Southwest neighborhoods – already are at high risk of lead exposure as a result of lead deposition from air pollution, lead paint, and industry,[78] and the multipathway health risks from air toxics emissions that further increase this risk must be accounted for and mitigated.

Critically, incorporating multipathway exposures into AMR VI risk assessments can be straightforward and easy to implement. In Oregon, the Department of Environmental Quality and the Health Authority evaluate potential toxic air contaminant health risks from stationary air sources.[79] For contaminants likely to cause multipathway exposures (contaminants that can build up in the body and contaminants that can stay in the environment for a long time), Oregon uses a pollutant-specific multipathway adjustment factor based on the risk of multipathway exposure.[80] This factor increases the toxicity reference value so that the final calculated health risk better reflects the higher health risk from multiple pathways.[81] This process allows Oregon to easily account for the increased risk of exposure without requiring applicants to do a separate analysis.

A simple adjustment to the AMR VI Technical Guidelines' "Risk Characterization" procedure could fix this risk calculation gap for pollutants likely to have multipathway exposure. Following Oregon's lead, the current guidelines' "pollutant-specific inhalation unit risk factor" and short- and long-term "pollutant-specific reference concentration" values could be increased using an adjustment factor to account for other pathways of exposure for certain air pollutants.[82]

The Board should decide to consider multiple pathways of air pollution exposure from a source or it will underestimate the risk and other harm community members face in the real world from toxic air pollution. If the Board does not consider multiple pathways, it should reduce the action benchmark for pollutants that have a significant potential for deposition and retention within the environment to account for the unaddressed risks from these pollutants.

E. The risk screenings and risk mitigation plans should address fugitive emissions or they will undercount exposure and risk.

It is not clear whether the required risk screenings will assess risk from fugitive emissions. For installation permit/plan approval application risk screenings, the guidelines state that "[t]he

[77] For extensive documentation on the rationale for multipathway analysis for these compounds and multipathway exposure parameters, please review the OEHHA 2012 Guidelines for Exposure Assessment (Attachment 7).

[78] *See* Katherine Unger Baillie, *Lead toxicity risk factors in Philadelphia*, PENN TODAY (Apr. 12, 2022), https://penntoday.upenn.edu/news/lead-toxicity-risk-factors-philadelphia.

[79] *See, e.g.*, *Cleaner Air Oregon: How do agencies determine what is a health risk?*, OR. DEPT. OF ENV'L QUALITY, https://www.oregon.gov/deq/FilterDocs/caohowagenciesdet.pdf (downloaded Aug. 8, 2022) (Attachment 8); *Risk Action Tables, OAR 340-245-8010*, OR. DEPT. OF ENV'L QUALITY, https://secure.sos.state.or.us/oard/viewAttachment.action?ruleVrsnRsn=283416 (downloaded Aug. 8, 2022) (Attachment 9); *How Risk Action Levels Work*, OR. DEPT. OF ENV'L QUALITY, https://www.oregon.gov/deq/FilterDocs/cao-RALFlowchart.pdf (downloaded Aug. 8, 2022) (Attachment 10).

[80] *Cleaner Air Oregon Toxicity Reference Values and Risk-Based Concentrations* 3, OR. DEPT. OF ENV'L QUALITY, https://www.oregon.gov/deq/FilterDocs/cao-trv-rbc.pdf (downloaded Aug. 8, 2022) (Attachment 11).

[81] *Id*.

[82] *See* Technical Guidelines App. A, pp. 21–22.

screening results provided for each exhaust stack or emission point will indicate whether any further risk assessment will be required."[83] Similarly, for Title V permit risk screenings, the guidelines require that "modeling protocol must estimate the impact of each toxic air contaminant that will be emitted from all stacks / emission points within the facility."[84]

The guidelines do not define "emission points," and it is unclear whether this requires the applicant to assess risk from fugitive emissions – the emissions from a facility that do not pass through a stack, chimney, or vent.[85] Even a small amount of additional risk from unaccounted-for or underestimated fugitive emissions could push the health risk assessment above the "negligible risk," requiring further action. Therefore, excluding fugitive emissions from the risk assessment would undermine risk assessments and could lead to health risks exceeding the guideline limits.

The Board should modify the proposed regulation and require applicants to properly account for fugitive emissions in their risk screening and refined risk assessments and also require applicants to consider fugitive emissions reduction measures in risk mitigation plans. If the Board does not require applicants to account for fugitive emissions, then the health risk benchmarks should be lowered to account for the strong likelihood that fugitive emissions are causing a higher cancer and non-cancer risk than calculated.

Additionally, it is unclear what emissions data the risk assessments will use or whether any actual measurement or monitoring will be required for existing sources to verify emission estimates used in the risk assessment. The guidelines allow for use of fenceline monitoring data but do not require its use or the use of emission test data if available. The Board should clarify what emission data will be used for the risk assessments and should require monitoring for verification wherever EPA approved monitoring methods are available.[86]

F. To protect the actual Philadelphians affected by a proposed source, the Board should adjust the guidelines to ensure that sensitive populations such as children are considered in the risk calculations.

i. The Board should require a full demographics evaluation as part of the health risk assessment.

The refined risk assessment requires the evaluation of health risks at sensitive and vulnerable receptors located within the modeling grid.[87] However, the guidelines do not require any assessment of community demographics such as age, health burdens, or socioeconomic vulnerability factors, or the number of existing sources already located in an area as part of the

[83] Technical Guidelines III.A.1, p. 11.
[84] Technical Guidelines III.D, p. 16.
[85] *See, e.g.,* 40 C.F.R. § 70.2 (defining "fugitive emissions" as "those emissions which could not reasonably pass through a stack, chimney, vent, or other functionally-equivalent opening").
[86] For example, *see* EPA Method 325A, B for various volatile organic compounds. https://www.epa.gov/emc/method-325a-volatile-organic-compounds-fugitive-and-area-sources-sampler-deployment-and-voc; https://www.epa.gov/emc/method-325b-volatile-organic-compounds-fugitive-and-area-sources-sampler-preparation-and.
[87] Technical Guidelines III.B, p. 13.

risk assessment or mitigation. Many of these data points are readily available in EPA's EJ Screen Tool and in the Council of Environmental Quality's Justice40 screening tool.[88]

The Board should modify the health risk assessment guidelines to fully account for the fact that people can be more vulnerable to toxic pollution due to various physiological, societal, demographic, and exposure history differences, and can therefore experience greater health risk from the same amount of a toxic chemical exposure.[89] Performing a risk assessment that is meaningful for communities who already face a significant amount of pollution and for communities concerned about environmental justice "requires an ability to evaluate multiple agents or stressors simultaneously—to consider exposures not in isolation but in the context of other community exposures and risk factors."[90] For example, communities with minority and lower income populations and communities with higher-than-average levels of cancer, respiratory, and other health problems, as well as a lack of access to health care, are likely to be more vulnerable to the impact of toxic air pollution.[91]

The health risk assessment requirements must assess the greater health risk based on socioeconomic status found in epidemiological research studies.[92] As the National Academy of Sciences has recognized, "there is growing epidemiologic evidence of interactions between environmental stressors and place-based and individual-based psychosocial stressors, driven in part by the spatial and demographic concordance between physical and chemical environmental exposures and socioeconomic stressors," and there is also a growing field of information on social epidemiology, which addresses the relationship between social factors and disease in human populations.[93] Data describing these factors are available from the Center for Disease Control's Environmental Public Health Tracking Program, the U.S. Agency for Toxic Substances and Disease Registry, state and local health agencies, and academic researchers.[94]

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[88] *See EJScreen: Environmental Justice Screening and Mapping Tool*, U.S. EPA https://www.epa.gov/ejscreen; CEQ, Climate and Economic Justice Screening Tool (Aug. 3, 2022), https://screeningtool.geoplatform.gov/en/#3/33.47/-97.5.

[89] *See, e.g.*, *Science and Decisions: Advancing Risk Assessment* 135-39, 145-51, National Research Council, National Academy of Sciences (2009), http://www nap.edu/catalog.php?record_id=12209 (explaining that "[h]ow the population responds to chemical insults depends on individual responses, which vary among individuals"; and "[i]f the sensitive people constitute a distinct group either because of their numbers or because of identifiable characteristics—such as ethnicity, genetic polymorphism, functional or health status, or disease—they should be considered for separate treatment in the overall risk assessment"); *id.* at 112 (noting that EPA's guidelines do not address variability due to factors "such as age, ethnic group, socioeconomic status, or other attributes," and explaining that "there is a need for a nonzero default to address the variation in the population expected in the absence of chemical-specific data"); *see also id*. at 134 (discussing various factors and recommending that "much more emphasis needs to be placed on describing the ranges of susceptibility and risk"); *see also id.* at 177-82, 196.

[90] *Id*. at 214-15.

[91] *See, e.g.*, Ramya Chari et al*., Integrating Susceptibility into Environmental Policy: An Analysis of the National Ambient Air Quality Standard for Lead*, 9 INT. J. ENVIRON. RES. PUBLIC HEALTH 1078 & nn.5-10 (2012) (citing research).

[92] *Science and Decisions: Advancing Risk Assessment* 109-10 & tbl. 4-1, National Research Council, National Academy of Sciences (2009), http://www nap.edu/catalog.php?record_id=12209 (describing the need to consider increased susceptibility due to prior and concurrent exposures; and to "social and economic factors"); *id.* at 220-21 (describing ways to assess cumulative risk including by consideration of "epidemiologic concepts" and information, and by considering "what the burden of disease is in the context of simultaneous exposure to a number of stressors"); *id.* at 230 (discussing the role of epidemiology and surveillance data).

[93] *Id*. at 230-33.

[94] *Id*. at 232 (describing data available on health status and patterns of diseases and exposures).

The Board should consider and use such information in its risk assessment guidelines.

In addition to looking at the demographic census data on race, ethnicity, poverty level, and similar factors, the Board should also assess the starting point or baseline health status of the affected individuals and communities using the best available data at a local and national level, including the baseline cancer levels, respiratory problems, and health problems associated with the toxic chemicals emitted by a source category. Doing so would follow EPA's statements in the 2014 Second Integrated Urban Air Toxics Report that more work is needed to reduce excess cancer risks in urban areas.[95]

Alternatively, for a simpler approach, the Board could use adjustment factors that increase the calculated cancer risk because more sensitive groups are present. For example, to calculate its cancer risk, EPA, and states including Cleaner Air Oregon use an early-life adjustment factor for carcinogenic contaminants that can have a greater toxicity to infants or children.[96]

If the Board declines to account for the variations in health risk by demographic group, then it should reduce the benchmarks for allowable cancer risks. Allowing up to a 100-in-1-million cancer risk per pollutant is already too high and having such a high benchmark without accounting for demographic variations would ignore the particular harm to many vulnerable Philadelphia residents.

ii. To calculate the hazard quotient for non-cancer risk, the Board should require the use of age-dependent adjustment factors and child-specific reference concentrations (RfC) where available because the current guidelines do not account for the increased vulnerability of sensitive populations to toxic exposure.

From the materials provided on the proposed amendments to the rule and guidelines, it is unclear whether the Reference Concentrations (RfCs) account for the increased susceptibility of children either through use of an additional factor or through the use of a child-specific health reference value. The Board should ensure the guidelines account for early exposure and the greater risk to children in the AMR VI risk assessments.

Science clearly shows that "[e]nvironmental contaminants can affect children quite differently than adults, both because children may be more highly exposed to contaminants and because they are often more vulnerable to the toxic effects of contaminants."[97] The EPA has recognized

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[95] *Second Integrated Urban Air Toxics Report to Congress* xiv-xv, U.S. EPA (Aug. 21, 2014), https://www.epa.gov/sites/default/files/2014-08/documents/082114-urban-air-toxics-report-congress.pdf.

[96] *Cleaner Air Oregon Toxicity Reference Values and Risk-Based Concentrations* 3, OR. DEPT. OF ENV'L QUALITY, https://www.oregon.gov/deq/FilterDocs/cao-trv-rbc.pdf (Attachment 11); *Technical Support Document for Cancer Potency Factors: Methodologies for Derivation, Listing of Available Values, and Adjustments to Allow for Early Life Stage Exposures* 3-4, 50-51, Cal. EPA, OEHHA, (May 2009), http://www.oehha.ca.gov/air/hot_spots/2009/TSDCancerPotency.pdf, and http://oehha.ca.gov/air/hot_spots/tsd052909 html; *Final Residual Risk Assessment for the Petroleum Refining Source Sector*, EPA-HQ-OAR-2010-0682-0800 (Dec. 1, 2015).

[97] AMERICA'S CHILDREN & THE ENV'T 8, U.S. EPA (3d ed. 2013), https://www.epa.gov/sites/default/files/2015-06/documents/ace3_2013.pdf.

the need "to think in terms of the broad range of early life, pre-natal and post-natal, environmental exposures that may affect the incidence of disease or alter development."[98]

In describing how AMR VI's RfCs were established, the technical guidelines refer to the EPA's Integrated Risk Assessment System ("IRIS").[99] Most of EPA's IRIS toxicity threshold values (reference concentrations and reference doses) used for chronic non-cancer risk assessment do not incorporate the latest science on increased susceptibility of children.[100] EPA and other state risk assessments like the California Office of Environmental Health Hazard Assessment include age-dependent adjustment factors in the cancer risk assessment to account for increased vulnerability to carcinogens in childhood.[101] In addition, OEHHA does have some child-specific health values that include reference doses for cadmium, chlordane, heptachlor, manganese, methoxychlor, nickel, and pentachlorophenol, and a benchmark for lead. A full list, with links to each scientific determination document, is available online.[102] OEHHA has generated these child-specific reference values based on the latest science to take into account children's greater exposure and greater vulnerability.

The Board should ensure that the guidelines use RfCs and age-dependent adjustment factors that account for the greater susceptibility of children, rather than ignore the greater vulnerability and health risks Philadelphia's children face from air pollution.

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[98] Guide to Considering Children's Health When Developing EPA Actions: Implementing Executive Order 13045 and EPA's Policy on Evaluating Health Risks to Children, U.S. EPA (2006), https://www.epa.gov/sites/default/files/2014-05/documents/epa_adp_guide_childrenhealth.pdf.

[99] Technical Guidelines App. A, at 21.

[100] OEHHA has explained why child-specific reference doses or values are needed and provided a list of chemicals. *See, e.g., Prioritization of Toxic Air Contaminants - Children's Environmental Health Protection Act*, Cal. EPA, OEHHA (Oct. 2001), https://oehha.ca.gov/air/report/document-available-prioritization-toxic-air-contaminants-childrens-environmental-health; Development of Health Criteria for School Site Risk Assessment Pursuant to Health and Safety Code 901(g): Identification of Potential Chemical Contaminants of Concern at California School Sites, Final Report, Cal. EPA, OEHHA (June 2002), https://oehha.ca.gov/risk-assessment/development-health-criteria-school-site-risk-assessment-pursuant-health-and-safety.

[101] *Supra* note 103. OEHHA also uses an additional adjustment factor to account for fetal/in-utero exposure, an approach that AMS should also adopt for Philadelphia. *Technical Support Document for Cancer Potency Factors*, OEHHA (May 2009), https://oehha.ca.gov/media/downloads/crnr/tsdcancerpotency.pdf.

[102] *Table of all Child-Specific Reference Doses (chRDs) Finalized to Date*, OEHHA (last updated June 22, 2010), http://oehha.ca.gov/public_info/public/kids/chrdtable.html.

5. The Board should strengthen the requirements for how it will use the risk assessment to ensure the risk information turns into meaningful health protections in permits, plans, and licenses.

A. Case-by-case review requirements for installation permits/plan approval applications must be clarified.

For new and modified sources (installation permits/plan approvals), the guidelines require a "case-by-case review" when the cancer risk from a refined risk assessment for an individual pollutant is between 1- and 100-in-1 million.[103] Although "case-by-case review" is not defined anywhere in the guidelines, mention of it is followed by a parenthetical saying, "[s]ee Section IV," which outlines risk mitigation plan procedures.[104] However, it is not clear whether or not a risk mitigation plan is required as part of a case-by-case review. As a result, it is possible that a facility could have a 99-in-1-million cancer risk from one or multiple pollutants, but that no risk mitigation plan would be required.

To protect public health, the Board should resolve this ambiguity by requiring a risk mitigation plan for installation permits/plan approval applications when cancer risk from a single pollutant exceeds 1-in-1-million, or at least 10-in-1-million. This would align the installation permit/plan approval application risk guidelines with the proposed risk assessment guidelines for Title V facilities, which require risk mitigation plans – not a case-by-case review – for cancer risks above the benchmark.[105]

However, if the Board uses a 10-in-1-million benchmark for requiring risk mitigation plans, then it should require a case-by-case review for both Title V permits and installation permits/plan approval applications when the cancer risk is between 1- and 10-in-1 million. Otherwise, a facility that emits multiple pollutants that each have a cancer risk close to a 10-in-1-million could potentially avoid having to create a risk mitigation plan, even if the facility causes a substantial combined cancer risk.

B. The risk mitigation plan and other requirements resulting from the assessment must be strengthened to ensure pollution reduction and control.

The guidelines set out requirements for risk mitigation plans, but these requirements must be strengthened to ensure the plans result in pollution prevention and health risk reduction.

The guidelines require that the risk mitigation plan "minimize[]" and "manage[]" the health risks posed and account for the results of the refined risk assessment.[106] While the guidelines allow for the adoption of important health risk mitigation measures such as additional air pollution controls, operational changes, and increasing dispersion, they do not specifically require pollution reduction or health risk mitigation measures.

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[103] Technical Guidelines III.C, p. 13.
[104] *Id.*
[105] Technical Guidelines III.D.1, p. 16.
[106] Technical Guidelines IV, p. 18–19.

To ensure that the risk mitigation plan serves its purpose of reducing health risk, the guidelines should require applicants undergoing risk mitigation planning to consider additional specific pollution control and reduction measures, including fugitive emissions controls, hazard or chemical phase-out or elimination, community buffer requirements, and fenceline monitoring with fenceline corrective action levels. Requiring applicants to analyze the pollution reduction potential of these options will ensure that the applicant and the Board understand what pollution control and reduction measures are effective and should be adopted in the risk mitigation plan.

AMR VI could also adopt the approach taken by the Oregon Department of Environmental Quality. In its Cleaner Air Oregon risk assessment requirement for new facilities, new sources with a combined cancer risk greater than 10-in-1 million must install a Toxics Best Available Control Technology (with no consideration of cost) or perform a Toxics Lowest Achievable Emissions Rate analysis to receive a permit. This is an easy to implement method to ensure that sources that cause higher cancer risks take tangible steps to reduce emissions.

The guidelines should also set out specific standards for what factors make a risk mitigation plan "acceptable." Although the AMR VI FAQ document states that "[i]f the risk level is too high, the facility will need to modify the application to reduce the risk to an approvable level,"[107] "too high" and "appropriate level" are not defined and specific details should be added to the guidelines to ensure that risk mitigation plans require actual, enforceable risk reductions. These standards should ensure that measures or controls are required that would reduce cancer risk and protect public health. Creating standards for acceptability also increases transparency for permittees and the public and prevents arbitrary or inconsistent decisions about acceptability.

Lastly, the guidelines should also ensure that any permit, plan, or license approved with a risk mitigation plan includes terms or conditions that include regular emission measurement, air monitoring and reports to the Board and to the public to ensure compliance, and root cause analysis, corrective action, and other clear consequences if exceedances occur or if the plan is not followed. Such measures will ensure permittees are accountable and allow AMS, permittees, and the community to assess the effectiveness of risk mitigation plans.

C. Exceptions to the rule are not appropriately justified, and exempted facilities could harm public health.

The proposed AMR VI only applies to Title V Operating Permits as well as Installation Permits/Plan Approvals for any new or modified source.[108] Non-Title V operating permits are exempt from AMR VI's risk assessment requirements and undergo permitting subject to AMR XIII. Operation of sources at a facility pursuant to annual or indefinite permits and activities that require a Dust Control Permit are also exempt.[109] These exemptions are not justified in the regulations and should be removed.

[107] Frequently Asked Questions for Air Management Regulation VI Amendment, AMS (July 2022), https://www.phila.gov/media/20220728141756/AMR-VI-FAQ-7-22-2022-Final.pdf.
[108] Proposed AMR VI at II.C(4)-(5) & III.A(3); Technical Guidelines III.A.
[109] Proposed AMR VI at II.C(1)–(5).

The Board gives no rational justification or an explanation of these exemptions or why they will not harm public health. For example, exempting non-Title V operating permits undermines the purpose of this regulation. Currently operating, non-Title V sources could still emit up to 10 tons/year for a single hazardous air pollutant ("HAP") or 25 tons/year for any combination of HAPs.[110] Because these sources already exist, they do not require installation permits/plan approvals. Therefore, these types of sources are not covered by AMR VI despite potentially releasing large quantities of HAP that could cause cancer risks in exceedance of what is permissible under AMR VI. The Board should amend AMR VI to remove these exemptions for annual, indefinite, and non-Title V operating permits.

The exemption of facilities that receive dust control permits is also problematic. Sites where toxic compounds like lead are present may pose a significant health risk to the adjacent community if the soil is disturbed. Lead in soil is prevalent in Philadelphia and is not distributed evenly across the city: residents in North and Southwest Philadelphia are at highest risk of lead exposure.[111] Such sites are currently exempt from AMR VI if they receive a dust control permit.[112] However, dust control permits do not require health risk assessments or risk mitigation plans based on potential health impacts.[113]

The guidelines also exempt certain types of facilities that can cause harm from performing a health risk assessment, such as natural gas boilers with up to a 50 million BTU per hour capacity.[114] Although the guidelines says that the Department has "determined that the potential air toxic contaminant emissions" from the exempt sources are below the benchmark limit, or that the Department "performed a health risk analysis … and determined that risk levels are acceptable," [115] these analyses are not included in the regulation documents. Public transparency is critical, and the Department should reconsider this exemption, explain their conclusion and publish the analyses that led to this conclusion.

6. The Air Pollution Control Board has the authority to implement these measures.

The Department of Public Health and the Air Pollution Control Board have the authority to implement and strengthen the proposed AMR VI regulations and guidelines.

The City of Philadelphia Department of Public Health's mission "is to protect and promote the health of all Philadelphians and to ***provide a safety net for the most vulnerable.***"[116] As part of its duty to protect public health, the Department is tasked with implementing the Air Management Regulations and does so through the Division of Air Management Services.

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[110] *See Title V Operating Permits: Who Has to Obtain a Title V Permit?*, U.S. EPA (May 25, 2022), https://www.epa.gov/title-v-operating-permits/who-has-obtain-title-v-permit.
[111] *See* Katherine Unger Baillie, *Lead toxicity risk factors in Philadelphia*, PENN TODAY (Apr. 12, 2022), https://penntoday.upenn.edu/news/lead-toxicity-risk-factors-philadelphia.
[112] Proposed AMR VI at II.C(1).
[113] PHILA., PA., Air Management Regulation II (June 11, 2022).
[114] Technical Guidelines App. B, p. 23.
[115] *Id.*
[116] *About Us*, PHILA. DEPT. OF PUB. HEALTH (June 4, 2020) (emphasis added), https://www.phila.gov/departments/department-of-public-health/about-us/.

Protecting public health is at the heart of the Department and Board's responsibility under the Air Management Code. A key purpose of the Code is to protect the "health and welfare of the City's inhabitants," recognizing that the "emission of toxic air contaminants into the community increases the risks respecting acute and long-term health effects."[117] To do this, Philadelphia's Air Management Code prohibits the discharge of air contaminants into the atmosphere "which result in or cause air pollution" and grants the Board and Department broad authority to create and enforce air management regulations.[118] For example, the Board can promulgate regulations to limit, control, or prohibit "the emission of air contaminants to the atmosphere from any sources."[119] The Department is authorized to deny or modify a permit based on "anticipated effect on air quality in the neighborhood, area, and region."[120] Therefore, the Board and Department have the authority to implement limitations on emissions, including mitigation based on the local health risk, and deny permits to applicants who exceed these limits. These emissions limits should be developed at levels to best protect the health and welfare of the City's inhabitants, using the best available science and most protective measures.

The Board also has the authority to consider cumulative impacts in permitting decisions. The Board is given the authority to control and limit the density of sources of air contaminants by restricting "… new installations, or expansion of existing facilities and operations that will aggravate or create air pollution" and designating "areas where the present density of sources of air contaminants is such that the expansion of existing processes or operations and/or the installation of new processes or operations, in these areas may be prohibited or restricted."[121] Therefore, the Board is authorized to consider the combined impact of multiple sources on air pollution when permitting and is authorized to prohibit or limit sources if the existing, combined air pollution is already elevated.

The Air Management Code also supports the need for public participation provisions in AMR VI. In the Air Management Code's legislative findings, the City Council found that "individuals who live or work in the City have a right to information concerning the health effects associated with the toxic air contaminants to which they are exposed."[122] Thus, ensuring that the public has an opportunity to review and comment on the AMR VI health risk assessments and risk mitigation plans is consistent with the core legislative findings underlying the statute.

AMS and the Board have a responsibility to follow the best available science and to fulfill basic principles of sound administrative law and reasoned decisionmaking when implementing "reasonable regulations as may be necessary and appropriate" to perform their duties.[123] Strengthening the AMR VI as discussed in these comments would advance these core objectives and help ensure the Board fulfills its duty as an agency charged with protecting the public interest and public health.

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[117] PHILA., PA., CODE § 3-101(1)(d)–(e).
[118] *Id.* § 3-201(1)(c).
[119] *Id.* § 3-302(1).
[120] *Id.* § 3-301(9).
[121] *Id.* § 3-302(2)(b).
[122] *Id.* § 3-101(1)(h).
[123] *Id*. Home Rule Charter § 8-407.

Finally, the Environmental Rights Amendment of the Pennsylvania Constitution states that "[t]he people have a right to clean air. . ."[124] With delegated authority from the state to regulate air emissions, the Board and AMS must establish standards that protect Philadelphia residents' constitutional right to clean air.

Therefore, the Department and Board have the authority and responsibility to implement emissions regulations that are strong enough to protect the health of City residents, address cumulative impacts from multiple sources, and provide for adequate public participation.

CONCLUSION

We appreciate that the Board has taken the necessary step of considering the health impacts of emissions in its air permitting framework. For the reasons explained above, Commenters urge the Board to strengthen the regulation and guidelines to better protect the health of all Philadelphia residents, and finalize this promptly so it can take effect. Without the requested changes, the amended AMR VI and guidelines will not adequately protect the most overburdened communities and the most vulnerable residents, including Philadelphia's children.

Commenters appreciate the Board's time and consideration of these comments. We would be happy to meet to discuss any of these recommendations or concerns. For more information regarding these comments, please contact any of the undersigned organizations.

Sincerely,

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Clean Air Council
[redacted]

Amani Reid
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Interfaith Power and Light
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Jessica R. O'Neill
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Charles McPhedran, Senior Attorney
Emma Cheuse, Senior Attorney*
Michelle Mabson, Staff Scientist**
Ebony Griffin, Senior Legislative Counsel
Robyn Winz, Senior Research and Policy Analyst
Earthjustice
[redacted]

[124] PA. CONST. art. 1, § 27.

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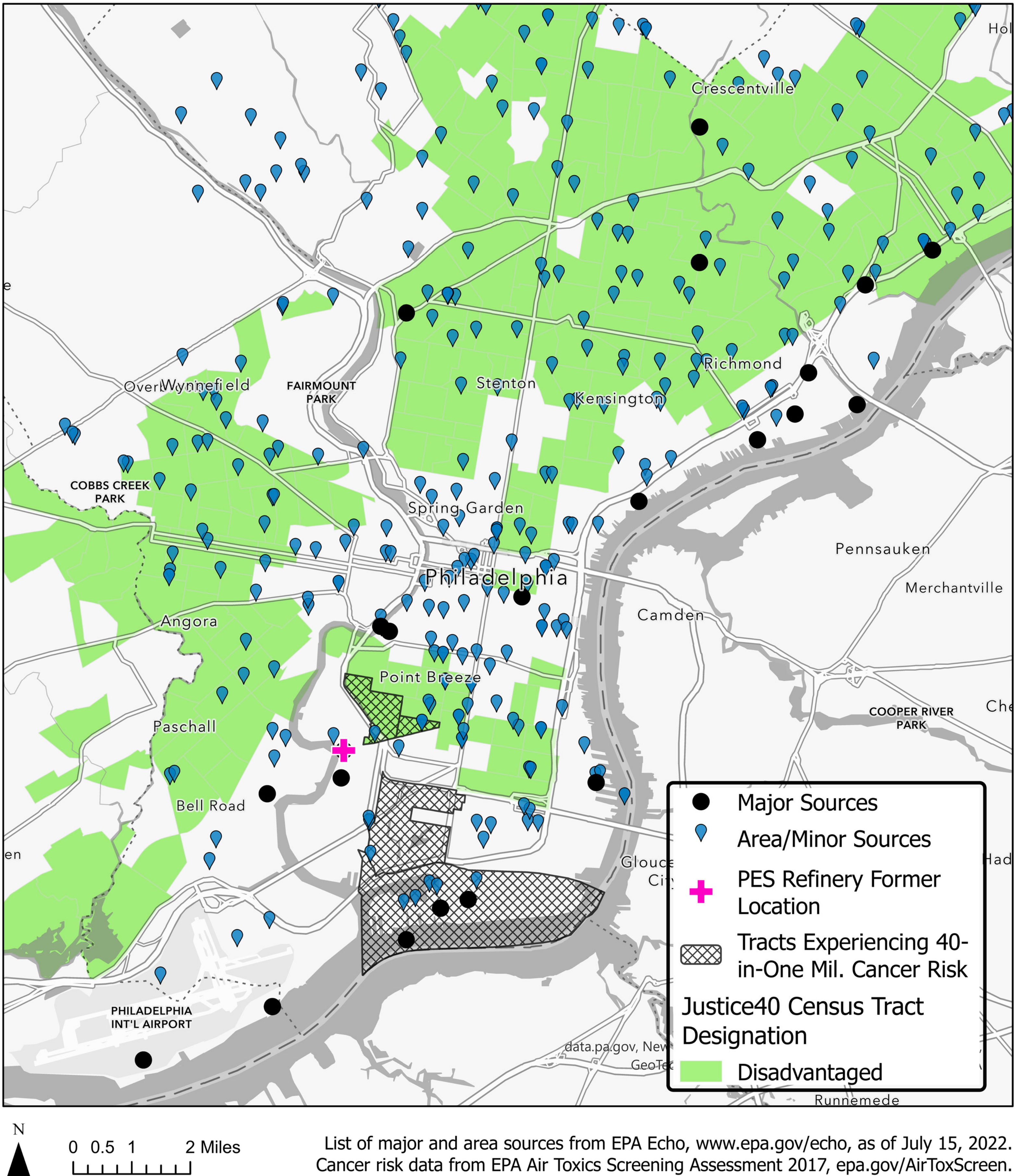
*** Non-lawyer Earthjustice signatories contributed to the scientific, research and factual portions of this document. Earthjustice also appreciates the valuable assistance provided on these comments by Sage Lincoln, Earthjustice Law Clerk 2022 (University of Pennsylvania Law School, Class of 2023).*

List of Attachments

1	*ECHO Facility Search – Enforcement and Compliance Data*, Media Program = Air, List of Major Emissions facilities in Philadelphia, U.S. EPA (downloaded July 15, 2022), https://echo.epa.gov/facilities/facility-search
2	*ECHO Facility Search – Enforcement and Compliance Data*, Media Program = Air, List of Synthetic Minor Emissions & Minor Emissions & Emissions Classification Unknown facilities in Philadelphia, U.S. EPA (downloaded July 15, 2022), https://echo.epa.gov/facilities/facility-search
3	Map of *Major and Area/Minor Sources in Philadelphia, Pennsylvania (with Justice 40 Designations)* (Aug. 2022), created by R. Winz, Earthjustice
4	Spreadsheet of *Justice 40 Designations for Eastwick Neighborhood* (Justice40 data from *Climate and Economic Justice Screening Tool; Beta*, Council on Env't Quality (accessed July 15, 2022), https://screeningtool.geoplatform.gov/en/#3/33.47/-97.5);
5	Map of *Justice40 and Major and Area/Minor Sources in Eastwick Neighborhood of Philadelphia* (Aug. 2022), created by R. Winz, Earthjustice
6	Map of *Racial Demographics and Major and Area/Minor Sources in Eastwick Neighborhood of Philadelphia* (Aug. 2022), created by R. Winz, Earthjustice
7	*Air Toxics Hot Spots Program Risk Assessment Guidelines: Technical Support Document for Exposure Assessment and Stochastic Analysis*, Cal. EPA (Aug. 2012), http://www.oehha.ca.gov/air/hot_spots/tsd082712.html
8	*Cleaner Air Oregon: How do agencies determine what is a health risk?*, Or. Dept. of Env'l Quality, https://www.oregon.gov/deq/FilterDocs/caohowagenciesdet.pdf (downloaded Aug. 8, 2022)
9	*Risk Action Tables, OAR 340-245-8010*, Or. Dept. of Env'l Quality, https://secure.sos.state.or.us/oard/viewAttachment.action?ruleVrsnRsn=283416 (downloaded Aug. 8, 2022)
10	*How Risk Action Levels Work*, Or. Dept. of Env'l Quality, https://www.oregon.gov/deq/FilterDocs/cao-RALFlowchart.pdf (downloaded Aug. 8, 2022)
11	*Cleaner Air Oregon Toxicity Reference Values and Risk-Based Concentrations*, Or. Dept. of Env'l Quality, https://www.oregon.gov/deq/FilterDocs/cao-trv-rbc.pdf

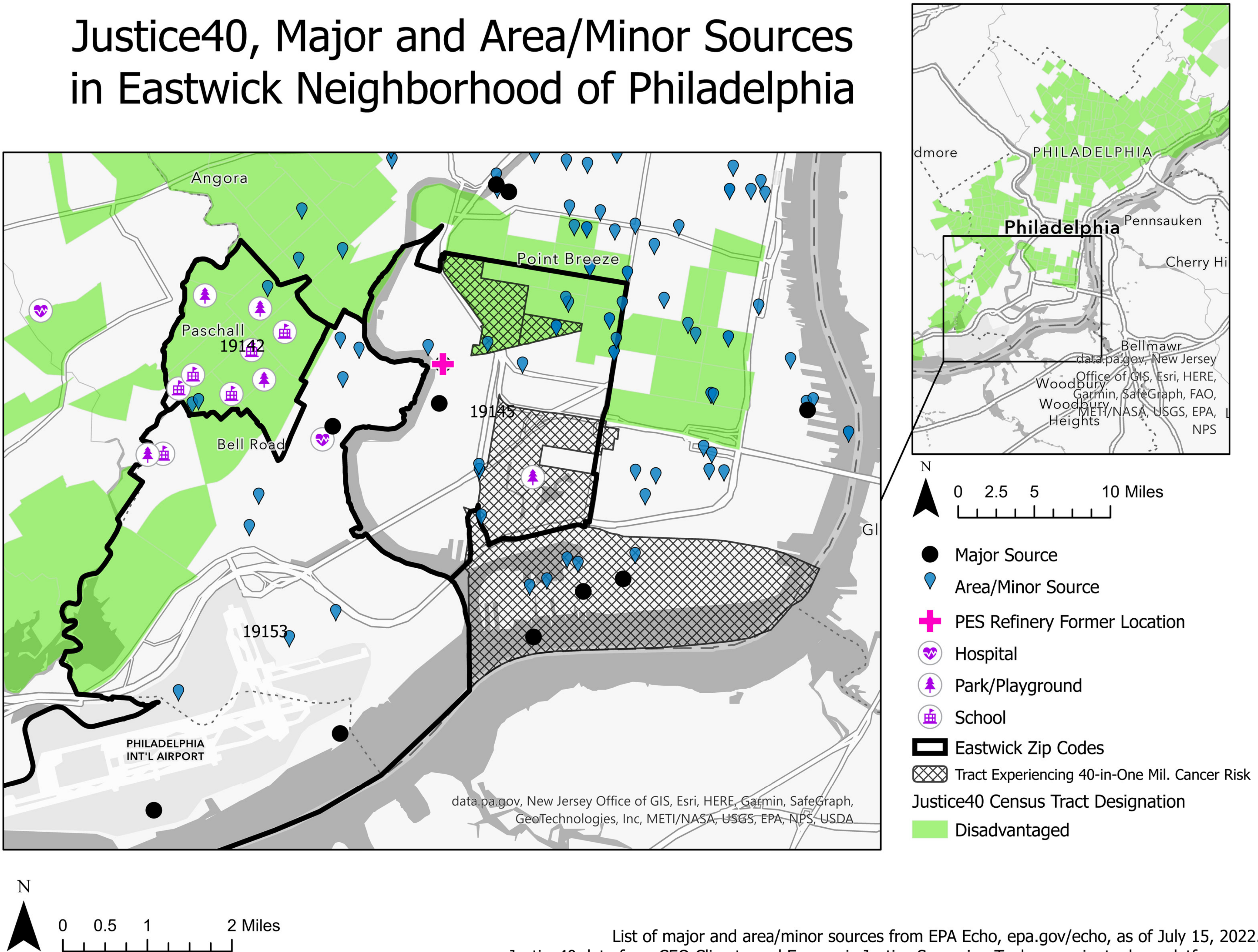
Additional materials referenced in these comments are available from Commenters by request.

Justice40, Major and Area/Minor Sources in Philadelphia, Pennsylvania



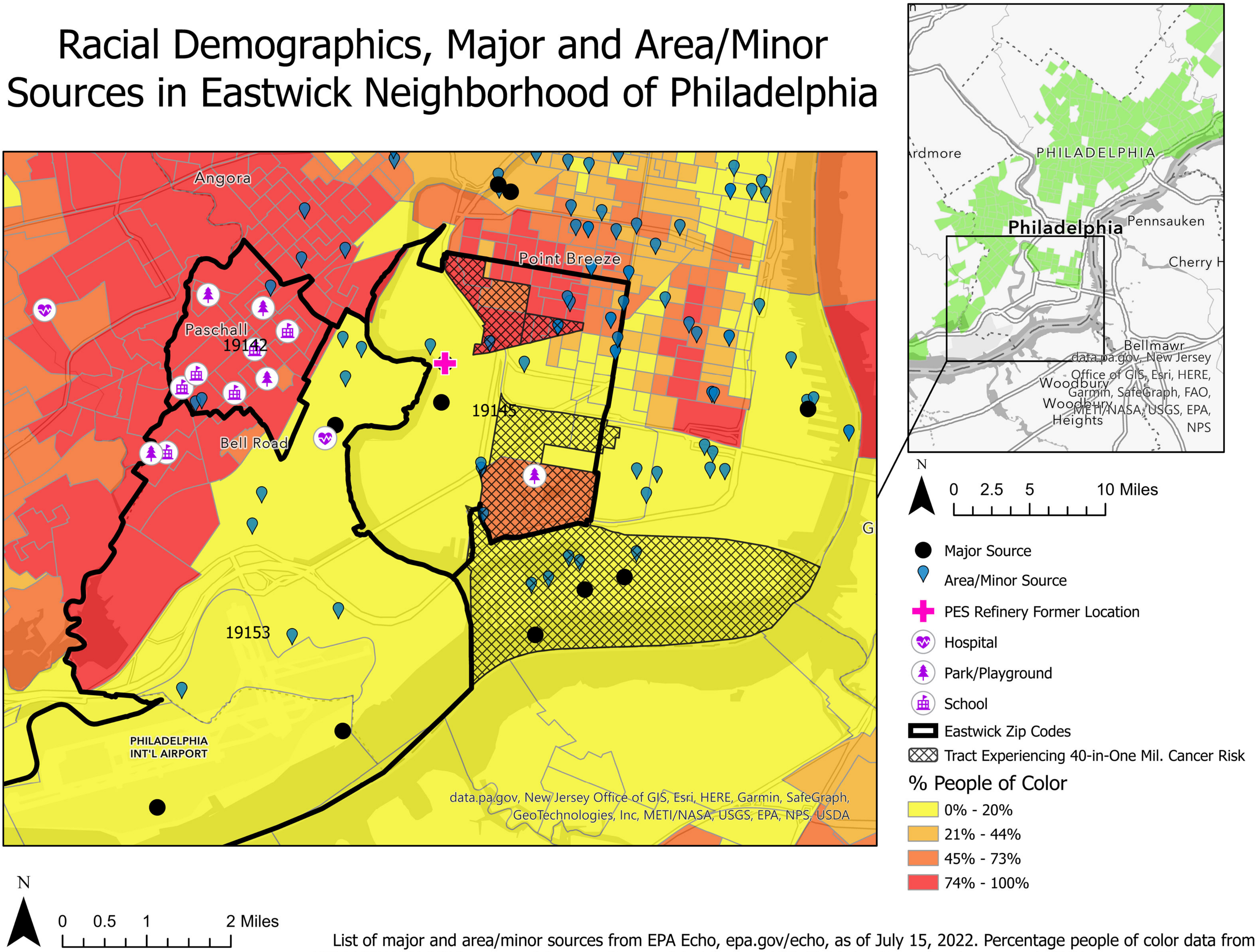
List of major and area sources from EPA Echo, www.epa.gov/echo, as of July 15, 2022.
Cancer risk data from EPA Air Toxics Screening Assessment 2017, epa.gov/AirToxScreen.
Justice40 data from CEQ Climate and Economic Justice Screening Tool, screeningtool.geoplatform.gov.

Justice40, Major and Area/Minor Sources in Eastwick Neighborhood of Philadelphia



List of major and area/minor sources from EPA Echo, epa.gov/echo, as of July 15, 2022.
Justice40 data from CEQ Climate and Economic Justice Screening Tool, screeningtool.geoplatform.gov.

Racial Demographics, Major and Area/Minor Sources in Eastwick Neighborhood of Philadelphia



List of major and area/minor sources from EPA Echo, epa.gov/echo, as of July 15, 2022. Percentage people of color data from EPA EJSCREEN 2020, epa.gov/ejscreen. Cancer risk data from EPA Air Toxics Screening Assessment 2017, epa.gov/AirToxScreen.

Facility Name	ICIS-Air ID
ADVANSIX (FORMERLY HONEYWELL/FRANKFORD PLT)	PAPAM0004210101551
CARDONE IND INC/AUTO PARTS REMFG PLT 11-	PAPAM0004210103887
CHILDRENS HOSP OF PHILA/ PHILA	PAPAM0004210108069
EXELON GENERATING CO/RICHMOND	PAPAM0004210104903
EXELON GENERATION CO/DELAWARE STA	PAPAM0004210104901
EXELON GENERATION CO/SCHUYLKILL STA	PAPAM0004210104904
EXELON GENERATION CO/SOUTHWARK	PAPAM0004210104905
GRAYS FERRY COGEN PARTNERSHIP/PHILA	PAPAM0004210104944
KINDER MORGAN LIQUIDS TERM/PHILA	PAPAM0004210105003
MIPC LLC/ PHILA	PAPAM0004210105004
NAVAL SURFACE WARFARE CENTER - PHILADELPHIA DIVISION	PAPAM0004210109724
NEWMAN & CO/PAPER RECYCLER	PAPAM0004210103489
NORTHEAST WPCP/PHILA	PAPAM0004210109513
PBF LOGISTICS PRODUCTS TERMINAL/67TH ST	PAPAM0004210105013
PES/SCHUYLKILL TANK FARM	PAPAM0004210101517
PHILA GAS WORKS/RICHMOND PLT	PAPAM0004210104922
PHILA PRISON SYS/CORR FAC	PAPAM0004210109519
PHILADELPHIA SHIP REPAIR	PAPAM0004210101597
PHILLY SHIPYARD INC (PSI) [FORMERLY AKER SHIPYARD]	PAPAM0004210101569
SUN CHEM CORP/HUNTING PARK PLT	PAPAM0004210102052
SUNOCO PARTNERS MKT & TERM LP/FT MIFFLIN	PA000469846
TEMPLE UNIV HEALTH SCIENCES CAMPUS/STEAM	PAPAM0004210108906
TEMPLE UNIV/ MAIN CAMPUS	PAPAM0004210108905
UNITED PARCEL SVC INC/PHILA AIR HUB	PA000523443
UNIV OF PA/PHILA	PAPAM0004210108912
VICINITY ENERGY EDISON/PHILA	PAPAM0004210104902
VICINITY ENERGY EFFICIENCY PA, LLC	PAPAM0004210110459
VICINITY ENERGY/SCHUYLKILL STA	PAPAM0004210104942

Street Address	City	State	Zip Code
4700 BERMUDA ST	PHILADELPHIA	PA	19137
5660 RISING SUN AVE	PHILADELPHIA	PA	191202511
34TH & CIVIC CENTER BLVD	PHILADELPHIA	PA	19104
3901 N DELAWARE AVE	PHILADELPHIA	PA	191371905
1325 N BEACH ST	PHILADELPHIA	PA	191254310
2800 CHRISTIAN ST	PHILADELPHIA	PA	19137
2501 S DELAWARE AVE	PHILADELPHIA	PA	191484299
2600 CHRISTIAN ST	PHILADELPHIA	PA	191462316
3300 N DELAWARE AVE	PHILADELPHIA	PA	191346300
4210 G ST	PHILADELPHIA	PA	191244821
5001 S BROAD ST	PHILADELPHIA	PA	191121403
6101 TACONY ST	PHILADELPHIA	PA	191352998
3899 RICHMOND ST	PHILADELPHIA	PA	191371415
6850 ESSINGTON AVENUE	PHILADELPHIA	PA	191533420
3144 W PASSYUNK AVE	PHILADELPHIA	PA	191455208
3100 E VENANGO ST	PHILADELPHIA	PA	191346113
8001 STATE RD	PHILADELPHIA	PA	191362908
5195 S 19TH STREET	PHILADELPHIA	PA	19112
PHILA NAVAL BUS CTR	PHILADELPHIA	PA	19112
3301 W HUNTING PARK AVE	PHILADELPHIA	PA	191321836
4 HOG ISLAND RD	PHILADELPHIA	PA	19153-3809
3401 N BROAD ST	PHILADELPHIA	PA	191405103
1009 W MONTGOMERY AVE	PHILADELPHIA	PA	191226019
1 HOG ISLAND RD	PHILADELPHIA	PA	19153-3809
3451 WALNUT ST	PHILADELPHIA	PA	191046205
908 SANSOM ST	PHILADELPHIA	PA	191075238
2600 CHRISTIAN ST.	PHILADELPHIA	PA	19146
2600 CHRISTIAN ST	PHILADELPHIA	PA	191462316

FRS ID	Latitude	Longitude	MACT Subparts	TRI IDs
110038495768	40.008039	-75.070917	DDDDD, F, FFFF, G, H	19137LLDSGMARGA
110000336636	40.03795	-75.1119	MMMM	19120MCRDN5660R
110001120144	39.94776	-75.19391		
110000336958	39.98539	-75.072951		19137RCHMN3901N
110000336716	39.9671	-75.1269		19125DLWRG1325B
110000337029	39.943446	-75.190734		19146SCHYL2800C
110001069254	39.91383	-75.13747		19148STHWR2501S
110000744990	39.9425	-75.1886		19146TRGNP2600C
110001203448	39.97874	-75.09763	DDDDD, EEEE, R	
110000872299	40.012261	-75.111969	R	
110032890209	39.89003	-75.17587		
110001203402	40.01463	-75.05434		19135NWMNN6101T
110001076978	39.99141	-75.08503		
110002065997	39.911701	-75.218773	R	
110000336994	39.9147	-75.2005		19145TLNTC3144P
110000878756	39.98361	-75.088364		
110041235865	40.031275	-75.021765	M	
110046100544	39.884062	-75.184375	II	
110006368206	39.89168	-75.169055	DDDDD, II	
110000336761	40.00273	-75.18434		19129GNRLP3301H
110012692407	39.871389	-75.2175	6B	
110064224735	40.00469	-75.15224		
110001223104	39.979354	-75.151017		
110001100291	39.861275	-75.249374		
110000880547	39.952619	-75.192879		
110001224648	39.949037	-75.155787		19107TRGNP91591
110000744990	39.9425	-75.1886		19146TRGNP2600C
110000744990	39.9425	-75.1886		19146TRGNP2600C

TRI HAP Releases (lb/yr) (2	Population Density (3 mile)	County
137657	11786.31	PHILADELPHIA COUNTY
	14782.67	PHILADELPHIA COUNTY
	17957.33	PHILADELPHIA COUNTY
	8794.23	PHILADELPHIA COUNTY
	15192.98	PHILADELPHIA COUNTY
	16995.7	PHILADELPHIA COUNTY
	10828.2	PHILADELPHIA COUNTY
	17194.04	PHILADELPHIA COUNTY
	10741.37	PHILADELPHIA COUNTY
	15501.05	PHILADELPHIA COUNTY
	5471.2	PHILADELPHIA COUNTY
	10079.92	PHILADELPHIA COUNTY
	10693.94	PHILADELPHIA COUNTY
	9056.86	PHILADELPHIA COUNTY
26372	12213.61	PHILADELPHIA COUNTY
	10102.09	PHILADELPHIA COUNTY
	8414.97	PHILADELPHIA COUNTY
	3229.09	PHILADELPHIA COUNTY
	6150.9	PHILADELPHIA COUNTY
1029	12215.97	PHILADELPHIA COUNTY
	993.2	PHILADELPHIA COUNTY
	15714.04	PHILADELPHIA COUNTY
	16128.54	PHILADELPHIA COUNTY
	1332.52	PHILADELPHIA COUNTY
	18123.07	PHILADELPHIA COUNTY
	16791.47	PHILADELPHIA COUNTY
	17194.04	PHILADELPHIA COUNTY
	17194.04	PHILADELPHIA COUNTY

Percent Low Income (3 mile)	Percent People of Color (3 mil
52.72	68.59
52.12	84
44.77	62.53
52.17	67.76
48.11	61.63
43.19	58.93
38.86	48.98
43.56	59.61
56.29	71.89
56.49	81.11
40.71	44.19
48.54	62.94
55.15	71.29
46.2	72.36
42.72	59.71
55.93	70.87
41.08	47.76
39.08	38.74
39.63	43.6
53.25	77.21
32.4	52.33
55.88	79.2
49.19	63.75
33.71	46.56
45.43	63.62
41.62	52.52
43.56	59.61
43.56	59.61

DFR URL

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https://echo.epa.gov/detailed-facility-report?fid=PAPAM0004210108912
https://echo.epa.gov/detailed-facility-report?fid=PAPAM0004210104902
https://echo.epa.gov/detailed-facility-report?fid=PAPAM0004210110459
https://echo.epa.gov/detailed-facility-report?fid=PAPAM0004210104942

Facility Name	ICIS-Air ID
1501 PROGRESS CLEANERS	PAPAM0004210101742
2601 APARTMENTS	PAPAM0004210106552
60 MINUTE CLEANERS	PAPAM0004210101841
819 CLEANER'S	PAPAM0004210101770
A & M CLEANERS	PAPAM0004210101831
A H VOIGT INC	PAPAM0004210103337
ABRAMS METAL CO	PAPAM0004210144009
ACRAC ICE INC	PAPAM0004210144019
ADAM'S FABRICARE CLEANERS	PAPAM0004210101729
ADAM'S FABRICARE CLEANERS	PAPAM0004210101707
ADAMS RUN DRY CLEANERS	PAPAM0004210101832
AL FRESCO CLEANERS	PAPAM0004210101833
ALBERT EINSTEIN MED CTR/HOSP	PAPAM0004210108034
ALEXANDER WOODWORK	PAPAM0004210103014
ALL-BRITE METAL FINISHING INC	PAPAM0004210103441
ALMAR FRENCH CLEANERS	PAPAM0004210195006
ALMAR FRENCH CLEANERS	PAPAM0004210101743
AMERICAN BAG & PAPER CORP	PAPAM0004210103016
AMERICAN CLEANERS	PAPAM0004210101744
AMERICAN VALET SERVICE	PAPAM0004210101745
ARDEX LAB INC/CLEANING & POLISHING PREP	PAPAM0004210103487
ARIA HEALTH/TORRESDALE CAMP	PAPAM0004210108076
ARWAY LINEN RENTAL	PAPAM00042101T0121
ASHBOURNE CLEANERS	PAPAM0004210101715
ASHLAND CHEMICAL	PAPAM0004210102103
ASTRAZENECA PA	PAPAM0004210110026
AT&T CORPORATION	PAPAM00042101T0084
ATLANTIC METALS	PAPAM0004210102007
ATOCHEM INC	PAPAM0004210144002
AWARDS CLEANERS	PAPAM0004210101705
BAMBI ONE HOUR CLEANERS	PAPAM0004210195022
BAMBI ONE HOUR CLEANERS	PAPAM0004210101725
BAMBI ONE HOUR CLEANERS	PAPAM0004210195012
BARTASH PUBLICATIONS	PAPAM0004210102281
BELL CLEANERS	PAPAM0004210101746
BELLEVUE ASSOCIATES (COGENERATION PLANT)	PAPAM0004210106513
BELMONT CENTER FOR TREATMENT	PAPAM0004210108067
BEST CLEANERS	PAPAM0004210101726
BETTY BRITE CLEANERS	PAPAM0004210101747
BETTY BRITE ONE HOUR	PAPAM0004210101827
BETTY BRITE ONE HOUR	PAPAM0004210101826
BIG SAVE CLEANERS	PAPAM0004210101823
BLUE CROSS TOWERS	PAPAM0004210106969
BOB'S PLACE CLEANERS	PAPAM0004210101808
BOBBY SCHORR	PAPAM0004210101825
BONLYNN CLEANERS	PAPAM0004210101727

BRIGHT SUN CLEANERS	PAPAM0004210101830
BROAD STREET CLEANERS	PAPAM0004210101738
BROOKS PROVISIONS INC	PAPAM0004210144018
BUNNY CLEANERS	PAPAM0004210101749
BUNNY CLEANERS	PAPAM0004210195007
BUSTLETON DRY CLEANERS	PAPAM0004210101712
C&K CLEANERS	PAPAM0004210101740
CALBAR INC.	PAPAM0004210102246
CARDINALS CLEANERS	PAPAM0004210101719
CAROUSEL CLEANERS	PAPAM0004210101721
CASTOR DRY CLEANERS	PAPAM0004210101724
CATALANT PHARMA SOLUTIONS LLC	PAPAM0004210103119
CHATHAM APTS	PAPAM0004210106623
CHELTEN CLEANERS	PAPAM0004210101750
CHELTENHAM CLEANERS	PAPAM0004210101751
CHELTENHAM ONE HOUR CUSTOM CLEANERS	PAPAM0004210195018
CHESTNUT HILL COLLEGE	PAPAM0004210109028
CHESTNUT HILL HOSP/PHILA	PAPAM0004210108038
CHOI'S BETTER CLEANERS	PAPAM0004210195016
CHOI'S BETTER CLEANERS	PAPAM0004210101752
CHRIS'S CLEANERS	PAPAM0004210101835
CINDERELLA CLEANERS	PAPAM0004210101837
CINTAS PHILADELPHIA (JEFFERSON)	PAPAM0004210110536
CINTAS PHILADELPHIA (SANDMEYER)	PAPAM00042101T0125
CITIZENS BANK PARK/PHILA	PAPAM00042101T0147
CITY OF PHILA 88360	PAPAM0004210109565
CLASSIC BODY WORX	PAPAM0004210107606
CLASSIC CLEANERS	PAPAM0004210101840
CLEAN EARTH OF PHILA LLC/PHILA	PAPAM0004210102148
COATING & CONVERTING TECH CORP/ADHESIVE	PAPAM00042101T0114
COLONIAL BEEF COMPANY	PAPAM0004210144025
COLONIAL CLEANER	PAPAM0004210101731
COMMANDER NAVY REGION MIDATLANTIC/HOST S	PAPAM0004210109707
CONNELLY CONTAINERS	PAPAM0004210102009
CONOCO FUELS	PAPAM0004210105002
CONRAIL/S PHILA MATERIAL BULKYARD	PAPAM0004210104003
CONSOLIDATED DRAKE PRESS	PAPAM0004210103414
CONSTITUTIONAL HEALTH PLAZA	PAPAM0004210108016
COYNE TEXTILE SERVICES	PAPAM0004210107295
CRAMCO INC.	PAPAM0004210102212
CROSS CONNECT SOLUTIONS	PAPAM0004210110213
CROWN CLEANERS & DRYERS	PAPAM0004210101701
DAISY CLEANERS	PAPAM0004210101706
DALLAS CLEANERS INC	PAPAM0004210195000
DANNY'S CLEANER	PAPAM0004210101753
DAWSONS CLEANERS	PAPAM0004210101829
DEER MEADOWS	PAPAM0004210108002

DELAVAU LLC	PAPAM0004210102270
DELAWARE AVE COLD STORAGE	PAPAM0004210144022
DELAWARE VALLEY RECYCLING	PAPAM0004210105128
DENARDO'S INC	PAPAM0004210100129
DGM POLISHING & REFINISHING	PAPAM0004210109754
DIETZ & WATSON INC/PHILA	PAPAM0004210102094
DO WELL CLEANERS	PAPAM0004210101824
DOMESTIC LINEN SUPPLY CO INC	PAPAM0004210107212
DORAL DRY CLEANERS	PAPAM0004210101800
DREXEL UNIVERSITY	PAPAM0004210108902
DREXEL UNIVERSITY/QUEEN LANE CAMPUS	PAPAM0004210108578
ECO-ENERGY DISTRIBUTION SERVICES	PAPAM0004210110438
EDWARD E GOLDBERG & SONS	PAPAM0004210105105
EMERALD ONE HOUR CLEANER	PAPAM0004210101755
ETKINS ONE HOUR CLEANER	PAPAM0004210101713
FALLS CTR/IRONSTONE	PAPAM0004210108037
FASHION EXPERT DRY CLEANERS	PAPAM0004210101756
FEDERAL BUR OF PRISONS/ PHILA COURT	PAPAM0004210109726
FEDERAL RESERVE BANK/PHILA	PAPAM0004210106020
FELIX CLEANER	PAPAM0004210101757
FESMIRE HAULING	PAPAM0004210144033
FIDELITY CLEANERS	PAPAM0004210195028
FIDELITY ONE HOUR CLEANER	PAPAM0004210101758
FISHTOWN CLEANERS	PAPAM0004210101845
FITZGERALD CLEANERS	PAPAM0004210101834
FLAIR CLEANERS	PAPAM0004210101799
FLASH ONE HOUR CLEANERS	PAPAM0004210101732
FOX CHASE CANCER CTR/PHILA	PAPAM0004210108070
FOX CLEANERS	PAPAM0004210101728
FR JUDGE R C H S	PAPAM0004210109021
FRANKFORD CANDY CO	PAPAM0004210103115
FRANKFORD CLEANERS	PAPAM0004210101815
FRANKFORD CLEANERS	PAPAM0004210101842
FRANKFORD CLEANERS	PAPAM0004210101838
FRANKFORD HOSPITAL ARIA	PAPAM0004210108046
FRANKFORD PLATING INC	PAPAM0004210102277
FREEDOM INTERNATIONAL TRUCK	PAPAM0004210107732
FREEMAN CLEANERS INC	PAPAM0004210101759
FRIENDLY ONE HOUR CLEANERS	PAPAM0004210101820
FRIENDS CLEANERS	PAPAM0004210101716
FRIENDS HOSP/PHILA	PAPAM0004210108031
FRONTIDA BIOPHARM INC (FORMERLY MUTUAL PHARMACEUTICAL INC)	PAPAM0004210102258
GALLELLI TAILORS	PAPAM0004210101760
GARFIELD INDUSTRIES	PAPAM0004210102156
GEM CLEANERS	PAPAM0004210101797
GERMANTOWN HOME	PAPAM0004210108041
GILWAY CLEANERS	PAPAM0004210101813

GIRARD COLL/BOARDING SCH	PAPAM0004210108918
GIRARD MED CTR/PHILA	PAPAM0004210108044
GOOD HUMOR CORPORATION	PAPAM0004210144021
GREYHOUND LINES	PAPAM0004210103210
GROSS METALS	PAPAM0004210102256
GRYPHIN CO	PAPAM0004210102062
H S CLEANER	PAPAM0004210195001
H5 DATA CENTERS	PAPAM0004210110499
HAHNEMANN HOSP/PHILA	PAPAM0004210108054
HAPPY CLEANERS	PAPAM0004210101761
HAPPY DRY CLEANING & LAUNDRY	PAPAM0004210195005
HCP	PAPAM0004210110087
HELLEN'S CLEANERS	PAPAM0004210101846
HENRY'S CLEANERS	PAPAM0004210195019
HI-LAD CLEANERS	PAPAM0004210101821
HILLOCK ANODIZING INC	PAPAM0004210104179
HILLOCK ANODIZING, INC.	PAPAM0004210109755
HOLIDAY CLEANERS	PAPAM0004210101702
HOLMESBURG PRISON	PAPAM0004210109518
HOPE CLEANERS	PAPAM0004210101801
HOST CLEANERS	PAPAM0004210101762
HOUR GLASS CLEANERS	PAPAM0004210101807
HP HOOD PENN MAID/PHILA	PAPAM00042101T0047
HYGRADE FOOD PROD	PAPAM0004210103402
ICS CORP	PAPAM0004210102504
INEOS COMPOSITES US/PHILA	PAPAM0004210103062
IVY HILL CLEANERS	PAPAM0004210195024
J & J FIRST COUNTY CLEANERS	PAPAM0004210101818
J-BRITE CLEANERS	PAPAM0004210195021
J-BRITE CLEANERS	PAPAM0004210101764
JAE'S CLEANERS	PAPAM0004210101720
JAMES ABBOTT INC	PAPAM0004210102278
JAMES CLEANERS	PAPAM0004210101763
JEANES HOSP/PHILA	PAPAM0004210108011
JEFFERSON UNIVERSITY EAST FALLS CAMPUS	PAPAM0004210108924
JER-MAR METAL CO	PAPAM0004210144008
JERITH MANUFACTURING CO INC	PAPAM0004210102102
JOHN'S ONE HOUR CLEANERS	PAPAM0004210101765
JOHN'S ONE HOUR DRY CLEANERS	PAPAM0004210195015
JOWITT AND RODGERS CO/STATE RD FAC	PAPAM0004210103154
JWS DELAVAU CO	PAPAM0004210102115
KIESLING-HESS	PAPAM0004210102164
KINDER MORGAN POINT BREEZE TERMINAL / PHILA	PAPAM0004210110029
KINGSBURY COMPANY	PAPAM0004210103704
KIRKBRIDE CTR/PSYCHIATRIC HOSP	PAPAM0004210108024
KWAK'S DRY CLEANERS	PAPAM0004210101754
KWIKLEEN	PAPAM0004210101768

LASALLE UNIV/W OLNEY AVE	PAPAM0004210108929
LASALLE WEST CAMPUS/PHILA	PAPAM0004210108039
LAVEROCK CLEANERS	PAPAM0004210101796
LEE'S CLEANERS	PAPAM0004210101839
LEE'S CLEANERS	PAPAM0004210101769
LEE'S CLEANERS	PAPAM0004210101836
LEO'S CLEANERS	PAPAM0004210101844
LIBERTY GAS STATION	PAPAM00042101G4022
LINCOLN FINANCIAL FIELD	PAPAM0004210110441
LINN 1 HR CLEANERS	PAPAM0004210101772
LINN-1 HOUR CLEANERS	PAPAM0004210195010
LOVE & CARE CLEANERS	PAPAM0004210101816
LUIGI'S ONE HOUR CLEANERS	PAPAM0004210101708
LUKOIL	PAPAM00042101G4018
LY'S CLEANERS	PAPAM0004210101723
MAGEE CLEANERS	PAPAM0004210101739
MARTIN METAL SPECIALTIES	PAPAM0004210103493
MARTINS CLEANERS	PAPAM0004210101798
MATERIALS PROCESSING CORPORATION	PAPAM0004210110344
MAYFAIR CLEANERS	PAPAM0004210101819
MCI INC (VERIZON BUSINESS)	PAPAM0004210100029
MERCY HOSP OF PHILA/54TH ST	PAPAM0004210108043
METHODIST HOSP/PHILA	PAPAM0004210108047
MICHAEL'S CLEANERS	PAPAM0004210195023
MID ATLANTIC SOCIAL SECURITY CENTER	PAPAM0004210110512
MLJ INDUSTRIES T/A PAWS TO HEAVEN	PAPAM0004210103899
MODEL FINISHING CO/PHILA	PAPAM0004210103514
MODERN OFFICE EQUIPMENT	PAPAM0004210103192
MORRIS IRON AND STEEL CO INC	PAPAM0004210120238
MR. PARK ANTON CRY CLEANERS	PAPAM0004210101730
MT AIRY ONE HOUR CLEANERS	PAPAM0004210101733
NATIONAL PUBLISHING CO	PAPAM0004210103609
NATIONAL REFRIGERANT	PAPAM0004210144001
NAVAL FOUNDRY AND PROPELLER CTR/PHILA	PAPAM0004210109702
NAVSSES	PAPAM0004210109725
NAVY YARD PEAKER STATION	PAPAM0004210110540
NAZARETH HOSP/PHILA	PAPAM0004210108008
NELSON CLEANERS	PAPAM0004210101773
NEW CLASSIC CLEANERS	PAPAM0004210101814
NEW HOLLYWOOD CLEANERS	PAPAM0004210101774
NEW SPRING CLEANERS	PAPAM0004210101737
NICHOLAS SCRAP METAL INC	PAPAM0004210144010
NIGRO INC	PAPAM0004210100132
NOBLE CLEANERS	PAPAM0004210101711
NORMAN APPLIANCES	PAPAM0004210144011
NORTH WEST INCINERATOR	PAPAM0004210109505
NORTHEAST METAL TRADERS INC	PAPAM0004210102047

NOVICK CLEANERS	PAPAM0004210195017
NOVICK CLEANERS	PAPAM0004210101775
NU JAYLON CLNR	PAPAM110004851857
NU-WAY CLEANERS	PAPAM0004210195020
NU-WAY DISCOUNT CLEANERS	PAPAM0004210101776
OK CLEANERS	PAPAM0004210101717
OLYMPIC CLEANERS	PAPAM0004210110383
ONE HOUR CLEANERS	PAPAM0004210101806
ORIANNA COMM TRUCK CO	PAPAM0004210103656
P&J ONE HOUR CLEANERS	PAPAM0004210101777
PA COLLEGE OF OPTMTY	PAPAM0004210108907
PA CONV CTR/ARCH ST	PAPAM0004210110092
PA CONVENTION CTR ANNEX/BROAD ST	PAPAM0004210110353
PACK'S CLEANERS	PAPAM0004210101778
PACKS CLEANERS & CO	PAPAM0004210195026
PARK N CLEAN INC.	PAPAM0004210101805
PARK TOWNE PLACE APT/PHILA	PAPAM0004210106526
PARKLANE CUSTOM CLEANERS	PAPAM0004210101709
PARKSIDE CLEANERS	PAPAM0004210101810
PAULS 1 HR DRY CLEANERS	PAPAM0004210101811
PAYLESS CLEANERS	PAPAM0004210101803
PAYLESS CLEANERS	PAPAM0004210101710
PECO	PAPAM0004210104940
PECO ENERGY/S COLUMBUS BLVD	PAPAM0004210104907
PELHAM PLAZA CLEANERS	PAPAM0004210101780
PENN FISHING TACKLE	PAPAM0004210103226
PHILA GAS WORKS/PASSYUNK PLT	PAPAM0004210104921
PHILA INTL AIRPORT/PHILA	PAPAM0004210109502
PHILA SCHOOL DISTRICT_- NORTHEAST HIGH	PAPAM0004210108802
PHILA SCHOOL DISTRICT_- WASHINGTON HGH	PAPAM0004210108803
PHILA THERM - WILLOW	PAPAM0004210104906
PHILA WATER DEPT/STP SW	PAPAM0004210109515
PHILA. HOUSING AUTHORITY-RAYMOND ROSEN	PAPAM0004210109409
PHILADELPHIA APPLIANCE RECYCLING	PAPAM0004210144007
PHILADELPHIA CREMATORIES	PAPAM0004210103377
PHILADELPHIA PUBLIC SERVICES BUILDING	PAPAM0004210120220
PHILADELPHIA THERMAL DEVELOPMENT CORP	PAPAM0004210104908
PHILADELPHIA ZOO	PAPAM0004210109739
PHILADELPHIAN CONDOMINIUMS/PHILA	PAPAM0004210106512
PHILADELPHIAS FINEST DRY CLEANERS	PAPAM0004210101736
PREMIER CONCRETE	PAPAM0004210102187
PRESB MED CTR/PHILA	PAPAM0004210108023
PRIDE CLEANING & LAUNDRY VILLAGE	PAPAM0004210195025
PRIDE CLEANING LAUNDRY VILLAGE	PAPAM0004210101781
PROFESSIONAL DRY CLEANERS	PAPAM0004210101782
PTR BALER AND COMPACTOR/PHILA	PAPAM0004210103506
PUROLITE INC/MFG CHEM	PAPAM0004210101617

QUAKER CITY DRY CLEANERS	PAPAM0004210101718
QUAKER VALLEY MEATS	PAPAM0004210144016
RAYS DRY CLEANERS	PAPAM0004210101802
RECON AUTOMOTIVE MFG	PAPAM0004210102269
RICHARD S. BURNS AND COMPANY INC.	PAPAM00042101T0162
RICHARDS APEX INC/LUBE MFG PLT	PAPAM0004210103820
RIFF TAILORING	PAPAM0004210101783
RIMS CLEANERS	PAPAM0004210101809
RITTENHOUSE CLEANERS	PAPAM0004210101847
RIVER PARK HOUSE ASSOCIATES	PAPAM0004210106523
RIVERSIDE MATERIALS INC/ASPHALT PLT	PAPAM0004210101421
ROIS MFG CO.	PAPAM0004210103664
RON'S ONE HOUR CLEANER	PAPAM0004210101784
RON'S ONE HOUR CLEANERS	PAPAM0004210195014
ROSE ONE HOUR CLEANER	PAPAM0004210101785
ROTO-DIE COMPANY INC/ROTOMETRICS	PAPAM0004210103375
ROXBORO DRY CLEANERS	PAPAM0004210101700
ROXBOROUGH MEM HOSP/PHILA	PAPAM0004210108021
ROYAL CLEANERS	PAPAM0004210101722
RR DONNELLEY/BAUM PLT	PAPAM0004210103908
RYDER TRUCK RENTAL INC/BLUEGRASS RD	PAPAM0004210102030
S D RICHMAN SONS INC	PAPAM0004210144005
SAINT JOSEPHS UNIV/PHILA	PAPAM0004210108904
SAM'S CLEANERS	PAPAM0004210101786
SAM'S CLEANERS & DYERS	PAPAM0004210195013
SAM'S JUNK CO	PAPAM0004210144006
SAVAGE SERVICE CORP	PAPAM0004210102222
SEOUL'S CLEANERS	PAPAM0004210101787
SEPTA	PAPAM0004210144024
SEPTA - ALLEGHENY BUS DEPOT	PAPAM0004210144028
SEPTA - CALLOWHILL BUS DEPOT	PAPAM0004210144029
SEPTA - COMLY BUS FACILITY	PAPAM0004210104175
SEPTA - ELMWOOD TROLLEY SHOP	PAPAM0004210110337
SEPTA - GERMANTOWN BRAKE SHOP	PAPAM0004210104177
SEPTA - MIDVALE BUS DEPOT	PAPAM0004210144032
SEPTA - OVERBROOK MAINTENANCE FACILITY	PAPAM0004210110336
SEPTA - POWELTON AVE RR YARD	PAPAM0004210144030
SEPTA - ROBERTS AVE RR YARD	PAPAM0004210144031
SEPTA ALLEGHENY	PAPAM0004210104174
SEPTA BERRIDGE/COURTLAND MAINT SHOP	PAPAM0004210104172
SHAW'S AUTO PARTS	PAPAM0004210144014
SHELMIRE CLEANERS	PAPAM0004210101741
SIMKAR LIGHTING CO.	PAPAM0004210103874
SIMON'S GETTY	PAPAM0004210144003
SISTERS OF ST JOSEPH & CHESTNUT HILL COL	PAPAM0004210109039
SJA CONSTRUCTION INC	PAPAM0004210101418
SMITH EDWARDS DUNLAP CO/ALLEGHENY AVE	PAPAM0004210102255

SOUTHEASTERN PENNSYLVANIA TRANSPORTATION	PAPAM0004210101573
SPC PENROSE AVE FAC	PAPAM0004210105101
SPD ELECTRICAL SYSTEMS	PAPAM005
SPECIALTY REFRIGERATION SERVICE	PAPAM0004210144023
ST CHRISTOPHERS HOSP FOR CHILDREN/PHILA	PAPAM0004210108576
ST. MARIA GORETTI RCHS	PAPAM0004210109042
STANTON CLEANERS	PAPAM0004210101704
STELLA'S ONE HOUR CLEANERS	PAPAM0004210101788
STENTON CLEANERS	PAPAM0004210101789
STRAND CLEANERS	PAPAM0004210101790
SUBURBAN ONE HOUR CLEANER	PAPAM0004210101791
SUBURBAN ONE HOUR CLEANERS	PAPAM0004210195002
SUNGARD RECOVERY SVC INC/BROAD ST PHILA	PAPAM0004210103321
SUNNY CLEANERS	PAPAM0004210101804
SUNNY DRY CLEANERS	PAPAM0004210101766
SUNOCO GAS STATION	PAPAM0004210109745
SUNOCO/BELMONT REMEDIATION SYS	PAPAM0004210101508
SUNRISE CLEANERS	PAPAM0004210101703
SWAN ONE HOUR CLEANER	PAPAM0004210101817
SYE'S FABRIC CARE INC.	PAPAM0004210101792
T&I CLEANERS	PAPAM0004210101828
TARGET CLEANER'S_INC	PAPAM0004210101793
TASTEPOINT	PAPAM00042101T0119
TASTY BAKING CO/PHILA NAVY YARD	PAPAM0004210110236
TDPS MATERIALS INC/ASPHALT PLT	PAPAM0004210101416
TEMPLE UNIV EPISC HOSP/LEHIGH AVE	PAPAM0004210108053
THE COMCAST CENTER	PAPAM0004210110483
THE KLEENERS	PAPAM0004210101794
THE STERLING APARTMENT HOMES	PAPAM0004210110319
THE VANGUARD GROUP, INC	PAPAM0004210102010
THOMAS JEFFERSON UNIV/PHILA	PAPAM0004210108901
THOMAS JEFFERSON UNV	PAPAM0004210109716
TIERPOINT - PHILADELPHIA	PAPAM0004210110343
TOPPER ONE HOUR CLEANER	PAPAM0004210101795
TRANSFLO TERMINAL SERVICES	PAPAM0004210104009
TRIPLE SEVEN ICE COMPANY	PAPAM0004210144020
UNIV OF THE SCIENCES IN PHILA/PHILA	PAPAM0004210108915
UNIVERSITY CITY SCIENCE CENTER	PAPAM0004210110469
US BANKNOTE CORP	PAPAM0004210103366
US MINT/PHILA	PAPAM0004210109703
VA MED CTR AND NHCU/PHILA	PAPAM0004210109705
VA MEDICAL CENTER	PAPAM0004210144026
VALET CLEANERS	PAPAM0004210101779
VERIZON CHESTNUT HILL	PAPAM0004210110156
VERIZON LOCUST CENTRAL OFFICE	PAPAM0004210110102
VERIZON MKT CTRL OFC/RACE ST	PAPAM0004210101014
VERIZON NEPTUNE CENTRAL OFFICE	PAPAM0004210110161

VERIZON ORCHARD CENTRAL	PAPAM0004210110162
VERIZON SHERWOOD	PAPAM0004210104934
VILLAGE CLEANERS	PAPAM0004210101734
VIP CLEANERS	PAPAM0004210101822
WADE TECHNOLOGY INC	PAPAM0004210103437
WAYNE CLEANERS	PAPAM0004210101843
WAYNE JUNCTION DRY CLEANERS	PAPAM0004210101735
WEBER DISPLAY & PACKAGING	PAPAM0004210103481
WEST PHILA R C H S GIRLS	PAPAM0004210109015
WILLIAM J GREEN JR FED BLDG/GSA	PAPAM0004210109723
WUXI APPTEC INC	PAPAM00042101T0135
YE OLD CLEAN'RY	PAPAM0004210101771
ZENTIS (FORMERLY SWEET OVATIONS LLC/TOMLINSON RD)	PAPAM0004210102016

Street Address	City	State
1501 N. BROAD ST.	PHILADELPHIA	PA
2601 PENNSYLVANIA AVENUE	PHILADELPHIA	PA
1123 W. LOUDEN STREET	PHILADELPHIA	PA
2001 S. OPAL ST.	PHILADELPHIA	PA
4832 SPRUCE STREET	PHILADELPHIA	PA
2914 N 16TH STREET	PHILADELPHIA	PA
58TH ST & WOODLAND AVE	PHILADELPHIA	PA
5478 ARLINGTON STREET	PHILADELPHIA	PA
2000 HAMILTON ST	PHILADELPHIA	PA
8214 ROOSEVELT AVE	PHILADELPHIA	PA
6201 N. FRONT STREET	PHILADELPHIA	PA
3665 N. MARVINE STREET	PHILADELPHIA	PA
YORK & TABOR	PHILADELPHIA	PA
1529 PARRISH	PHILADELPHIA	PA
2148 E TUCKER AVENUE	PHILADELPHIA	PA
7621 OGONTZ AVENUE	PHILADELPHIA	PA
7621 OGONTZ	PHILADELPHIA	PA
GRANT & ASHTON	PHILADELPHIA	PA
161 SUSQUEHANNA AVE	PHILADELPHIA	PA
6556 GERMANTOWN AVE	PHILADELPHIA	PA
2050 BYBERRY RD	PHILADELPHIA	PA
RED LION & KNIGHTS RD	PHILADELPHIA	PA
1696 FOULKROD ST	PHILADELPHIA	PA
6700 HAVERFORD AVE.	PHILADELPHIA	PA
DELA & BIGLER STS	PHILADELPHIA	PA
3001 RED LION ROAD	PHILADELPHIA	PA
500 SOUTH 27TH STREET	PHILADELPHIA	PA
ORTHODOX & DEL RIVER	PHILADELPHIA	PA
3 PENN PARKWAY	PHILADELPHIA	PA
5711 RIDGE AVE	PHILADELPHIA	PA
2439 S BROAD STREET	PHILADELPHIA	PA
2439 S. BROAD ST	PHILADELPHIA	PA
1541 S BROAD STREET	PHILADELPHIA	PA
5400 GRAYS AVE	PHILADELPHIA	PA
4845 BROWN ST.	PHILADELPHIA	PA
200 S BROAD ST.	PHILADELPHIA	PA
4200 MONUMENT AVE.	PHILADELPHIA	PA
604 S. 60TH ST.	PHILADELPHIA	PA
5001 WYNNEFIELD AVE.	PHILADELPHIA	PA
9910 FRANKFORD AVE.	PHILADELPHIA	PA
8915 KREWSTOWN ROAD	PHILADELPHIA	PA
3849 ARAMINGO AVE	PHILADELPHIA	PA
1901 MARKET ST.	PHILADELPHIA	PA
269 S. 10TH ST	PHILADELPHIA	PA
422 S. 2ND STREET	PHILADELPHIA	PA
8522 GERMANTOWN AVE.	PHILADELPHIA	PA

2800 N. FRONT STREET	PHILADELPHIA	PA
1541 S. BROAD ST.	PHILADELPHIA	PA
3445 S FRONT STREET	PHILADELPHIA	PA
2038 S. 3RD ST.	PHILADELPHIA	PA
2038 S 3RD STREET	PHILADELPHIA	PA
10871 BUSTLETON AVE.	PHILADELPHIA	PA
7134 FRANKFORD AVE.	PHILADELPHIA	PA
2626 N. MARTHA ST.	PHILADELPHIA	PA
5415 TORRESDALE AVE	PHILADELPHIA	PA
6912 TORRESDALE AVE.	PHILADELPHIA	PA
7961 CASTOR AVE.	PHILADELPHIA	PA
3001 RED LION ROAD	PHILADELPHIA	PA
135 S 20TH ST.	PHILADELPHIA	PA
300 W. CHELTEN AVE.	PHILADELPHIA	PA
470 W. CHELTENHAM AVE.	PHILADELPHIA	PA
5TH ST & CHELTENHAM AVE	PHILADELPHIA	PA
9700 GERMANTOWN AVENUE	PHILADELPHIA	PA
8835 GERMANTOWN AVE	PHILADELPHIA	PA
6725-27 OGONTZ AVENUE	PHILADELPHIA	PA
6725 OGONTZ AVE.	PHILADELPHIA	PA
1217 N. 52ND STREET	PHILADELPHIA	PA
3164 N. 6TH STREET	PHILADELPHIA	PA
4700 W JEFFERSON ST	PHILADELPHIA	PA
10080 SANDMEYER LANE	PHILADELPHIA	PA
1001 PATTISON AVE	PHILADELPHIA	PA
2900 N 29TH STREET	PHILADELPHIA	PA
9902 BUSTLETON AVE	PHILADELPHIA	PA
9456 STATE ROAD	PHILADELPHIA	PA
3201 S 61ST ST	PHILADELPHIA	PA
80 E MORRIS ST	PHILADELPHIA	PA
3333 S 3RD STREET	PHILADELPHIA	PA
3100 FRANKFORD AVE	PHILADELPHIA	PA
700 ROBBINS ST	PHILADELPHIA	PA
4368 MAIN ST	PHILADELPHIA	PA
PIER 124	PHILADELPHIA	PA
PIER 122 SOUTH	PHILADELPHIA	PA
5050 PARKSIDE	PHILADELPHIA	PA
1930 S BROAD ST	PHILADELPHIA	PA
4825 BROWN STREET	PHILADELPHIA	PA
2200 E. ANN ST.	PHILADELPHIA	PA
401 NORTH BROAD STREET	PHILADELPHIA	PA
7128 RIDGE AVE.	PHILADELPHIA	PA
9879 BUSTLETON AVE	PHILADELPHIA	PA
7806 LIMEKILN PIKE	PHILADELPHIA	PA
1911 N. 54TH ST.	PHILADELPHIA	PA
5718 LANSDOWNE AVENUE	PHILADELPHIA	PA
8301 ROOSEVELT BLVD	PHILADELPHIA	PA

10101 ROOSEVELT BLVD	PHILADELPHIA	PA
2204 S DELAWARE AVENUE	PHILADELPHIA	PA
3107 S. 61ST ST	PHILADELPHIA	PA
1930 S 20TH STREET	PHILADELPHIA	PA
8301 TORRESDALE AVENUE	PHILADELPHIA	PA
5701 TACONY ST	PHILADELPHIA	PA
505 W. SUSQUEHANNA	PHILADELPHIA	PA
4100 FRANKFORD AVE	PHILADELPHIA	PA
2417 WELSH RD	PHILADELPHIA	PA
33RD AND MARKET STREETS	PHILADELPHIA	PA
2900 W QUEEN LN	PHILADELPHIA	PA
4099 SOUTH CHRISTOPHER COLUMBUS BLVD.	PHILADELPHIA COUNTY	PA
3100 E ONTARIO ST.	PHILADELPHIA	PA
21ST & STENTON	PHILADELPHIA	PA
4932 BROAD STREET	PHILADELPHIA	PA
3300 HENRY AVE	PHILADELPHIA	PA
4160 MONUMENT RD.	PHILADELPHIA	PA
700 ARCH ST	PHILADELPHIA	PA
100 N 6TH ST	PHILADELPHIA	PA
335 SPRING GARDEN AVE	PHILADELPHIA	PA
5200 COMLEY STREET	PHILADELPHIA	PA
1620 COTTMAN AVENUE	PHILADELPHIA	PA
1620 COTTMAN AVE.	PHILADELPHIA	PA
717 EAST GIRARD AVENUE	PHILADELPHIA	PA
5603-07 WALNUT STREET	PHILADELPHIA	PA
5612 CHEW ST	PHILADELPHIA	PA
401 S 60TH ST	PHILADELPHIA	PA
7701 BURHOLME AVE	PHILADELPHIA	PA
7343 ELMWOOD AVE.	PHILADELPHIA	PA
SOLLY AND ROWLAND AVES	PHILADELPHIA	PA
2101 WASHINGTON AVE	PHILADELPHIA	PA
3126 WILLITS RD	PHILADELPHIA	PA
1900 GRANT AVE	PHILADELPHIA	PA
4004 WOODHAVEN ROAD	PHILADELPHIA	PA
4900 FRANKFORD AVE	PHILADELPHIA	PA
2505 ORTHODOX STREET	PHILADELPHIA	PA
6601 NEW STATE RD.	PHILADELPHIA	PA
1052 RENNARD ST.	PHILADELPHIA	PA
344 LONEY ST.	PHILADELPHIA	PA
6733 HAVERFORD AVE.	PHILADELPHIA	PA
4641 ROOSEVELT BLVD	PHILADELPHIA	PA
1100 ORTHODOX ST	PHILADELPHIA	PA
816 OAK LANE AVE.	PHILADELPHIA	PA
810 E CAYUGA	PHILADELPHIA	PA
546 W. CARPENTER LANE.	PHILADELPHIA	PA
6950 GERMANTOWN	PHILADELPHIA	PA
3134 WILLITS RD	PHILADELPHIA	PA

GIRARD & CORINTHIAN AVE	PHILADELPHIA	PA
8TH & GIRARD	PHILADELPHIA	PA
700 S 43RD STREET	PHILADELPHIA	PA
710 N. DELAWARE AVE.	PHILADELPHIA	PA
221 W. GLENWOOD AVE.	PHILADELPHIA	PA
3501 RICHMOND ST.	PHILADELPHIA	PA
1435 VERNON ROAD	PHILADELPHIA	PA
1500 SPRING GARDEN STREET	PHILADELPHIA	PA
230 N BROAD ST	PHILADELPHIA	PA
1101 E. MT AIRY AVE.	PHILADELPHIA	PA
1101 E MOUNT AIRY AVENUE	PHILADELPHIA	PA
833 CHESTNUT STREET	PHILADELPHIA	PA
2000 SOUTH STREET	PHILADELPHIA	PA
4205 CHESTNUT STREET	PHILADELPHIA	PA
5553 LANSDOWNE AVE	PHILADELPHIA	PA
5101 COMLY ST	PHILADELPHIA	PA
5101 COMLY STREET	PHILADELPHIA	PA
6511 RIDGE AVE	PHILADELPHIA	PA
8215 TORRESDALE AVE	PHILADELPHIA	PA
5906 RISING SUN AVE	PHILADELPHIA	PA
1231 PT. BREEZE AVE.	PHILADELPHIA	PA
7173 STENTON AVE.	PHILADELPHIA	PA
10975 DUTTON RD	PHILADELPHIA	PA
8400 EXECUTIVE	PHILADELPHIA	PA
2225 RICHMOND ST	PHILADELPHIA	PA
2801 S COLUMBUS BLVD	PHILADELPHIA	PA
3224 CHELTENHAM AVENUE	PHILADELPHIA	PA
7956 DUNGAN RD	PHILADELPHIA	PA
609-31 S 5TH STREET	PHILADELPHIA	PA
609 S. 5TH ST.	PHILADELPHIA	PA
6600 TORRESDALE AVE.	PHILADELPHIA	PA
2105 E WISHART STREET	PHILADELPHIA	PA
2514 W. LEHIGH AVE.	PHILADELPHIA	PA
7600 CENTRAL AVE	PHILADELPHIA	PA
4201 HENRY AVENUE	PHILADELPHIA	PA
1737 WASHINGTON AVE	PHILADELPHIA	PA
14400 MCNULTY ROAD	PHILADELPHIA	PA
651 S. 60TH ST.	PHILADELPHIA	PA
651-53 S 60TH STREET	PHILADELPHIA	PA
9400 STATE RD	PHILADELPHIA	PA
2140 GERMANTOWN AVE	PHILADELPHIA	PA
300 W BRISTOL ST	PHILADELPHIA	PA
6310 PASSYUNK AVE	PHILADELPHIA	PA
10385 DRUMMOND ROAD	PHILADELPHIA	PA
111 N 49TH ST	PHILADELPHIA	PA
705 W. GIRARD AVE	PHILADELPHIA	PA
6125 WOODLAND AVE.	PHILADELPHIA	PA

1900 W OLNEY AVE	PHILADELPHIA	PA
600 E PENN ST	PHILADELPHIA	PA
5165 OXFORD AVE.	PHILADELPHIA	PA
2855 HOLME AVENUE	PHILADELPHIA	PA
2554 GERMANTOWN AVE	PHILADELPHIA	PA
6110 LANSDOWNE AVE.	PHILADELPHIA	PA
7966 VERREE ROAD	PHILADELPHIA	PA
1600 S. DELAWARE AVE.	PHILADELPHIA, CITY OF	PA
1 LINCOLN FINANCIAL WAY	PHILADELPHIA	PA
2100 S. 15TH ST.	PHILADELPHIA	PA
2100 S 15TH STREET	PHILADELPHIA	PA
6386 CASTOR AVE.	PHILADELPHIA	PA
11722 BUSTLETON AVE	PHILADELPHIA	PA
9100 FRANKFORD AVENUE	PHILADELPHIA, CITY OF	PA
6830 CASTOR AVE.	PHILADELPHIA	PA
6604 FRANFORD AVE.	PHILADELPHIA	PA
7327 STATE RD.	PHILADELPHIA	PA
7172 OGONTZ AVE	PHILADELPHIA	PA
10551 DECATUR ROAD	PHILADELPHIA	PA
6330 RISING SUN AVE	PHILADELPHIA	PA
401 N BROAD ST SUITE 105	PHILADELPHIA	PA
501 S 54TH ST	PHILADELPHIA	PA
2301 S BROAD ST	PHILADELPHIA	PA
1126 S BROAD STREET	PHILADELPHIA	PA
300 SPRING GARDEN STREET	PHILADELPHIA	PA
5301 TACONY STREET	PHILADELPHIA	PA
4949 COTTMAN AVE	PHILADELPHIA	PA
7330 STATE ROAD	PHILADELPHIA	PA
7345 MILNOR ST	PHILADELPHIA	PA
7569 HAVERFORD AVE.	PHILADELPHIA	PA
7205 GERMANTOWN AVE	PHILADELPHIA	PA
232 S 24TH ST	PHILADELPHIA	PA
11401 ROOSEVELT BLVD	PHILADELPHIA	PA
1701 KITTY HAWK AVE	PHILADELPHIA	PA
U.S. NAVY YARD	PHILADELPHIA	PA
1900 KITTYHAWK AVE	PHILADELPHIA	PA
2601 HOLME AVE	PHILADELPHIA	PA
1052 E. LYCOMING AVE.	PHILADELPHIA	PA
735 RED LION RD.	PHILADELPHIA	PA
2846 N. 22ND ST.	PHILADELPHIA	PA
8006 GERMANTOWN AVE.	PHILADELPHIA	PA
2069 E SILVER ST	PHILADELPHIA	PA
939-41 WASHINGTON AVENUE	PHILADELPHIA	PA
15501 BUSTLETON AVE.	PHILADELPHIA	PA
2829 KENSINGTON AVE	PHILADELPHIA	PA
DOMINO & UMBRIA	PHILADELPHIA	PA
7345 MILNOR ST	PHILADELPHIA	PA

414 OAK LANE ROAD	PHILADELPHIA	PA
414 OAK LANE RD	PHILADELPHIA	PA
3241 RIDGE AVE	PHILADELPHIA	PA
2020 W PASSYUNK AVENUE	PHILADELPHIA	PA
2020 W. PASSYUNK AVE	PHILADELPHIA	PA
7530 HAVERFORD AVE.	PHILADELPHIA	PA
4280 FRANKFORD AVE	PHILADELPHIA	PA
45 W. CHELTEN AVE.	PHILADELPHIA	PA
8950 STATE ROAD	PHILADELPHIA	PA
7542 FRANKFORD AVE.	PHILADELPHIA	PA
1200 W GODFREY	PHILADELPHIA	PA
1101 ARCH ST	PHILADELPHIA	PA
111 N BROAD ST	PHILADELPHIA	PA
1519 WADSWORTH DRIVE	PHILADELPHIA	PA
1519 WADSWORTH AVENUE	PHILADELPHIA	PA
6351 ROOSEVELT BLVD.	PHILADELPHIA	PA
2200 BENJAMIN FRANKLIN PKWY	PHILADELPHIA	PA
1363 PHILMONT AVE.	PHILADELPHIA	PA
4056 W. GIRARD AVE.	PHILADELPHIA	PA
1805 N. 54TH STREET	PHILADELPHIA	PA
330 OREGON AVE.	PHILADELPHIA	PA
15200 BUSTLETON AVE	PHILADELPHIA	PA
2800 CHRISTIAN ST	PHILADELPHIA	PA
2610 S COLUMBUS BLVD	PHILADELPHIA	PA
6555 GREENE ST.	PHILADELPHIA	PA
3028 HUNTING PARK	PHILADELPHIA	PA
3100 W PASSYUNK AVE	PHILADELPHIA	PA
INDUSTRIAL HWY	PHILADELPHIA	PA
COTTMAN & ALGON	PHILADELPHIA	PA
11100 BUSTLETON AVENUE	PHILADELPHIA	PA
9TH & WILLOW STREETS	PHILADELPHIA	PA
8200 ENTERPRISE AVE	PHILADELPHIA	PA
2110 N. 23RD STREET	PHILADELPHIA	PA
620 ERIE AVE	PHILADELPHIA	PA
7350 STATE ROAD	PHILADELPHIA	PA
400 NORTH BROAD STREET	PHILADELPHIA	PA
3000 PELTZ ST.	PHILADELPHIA	PA
3400 W GIRARD AVE	PHILADELPHIA	PA
2401 PENNSYLVANIA AVE	PHILADELPHIA	PA
4904 BALTIMORE AVE.	PHILADELPHIA	PA
PIER 2 GIRARD POINT	PHILADELPHIA	PA
51 N 39TH ST	PHILADELPHIA	PA
1605-07 WADSWORTH AVENUE	PHILADELPHIA	PA
1605 E. WADSWORTH	PHILADELPHIA	PA
2832 N. 5TH ST.	PHILADELPHIA	PA
2207 E ONTARIO ST	PHILADELPHIA	PA
3620 G ST	PHILADELPHIA	PA

7544 HAVERFORD AVE.	PHILADELPHIA	PA
3101 S 3RD STREET	PHILADELPHIA	PA
1200 S. 16TH ST.	PHILADELPHIA	PA
3250 S. 76TH ST.	PHILADELPHIA	PA
4300 RISING SUN AVENUE	PHILADELPHIA	PA
4202-24 MAIN ST	PHILADELPHIA	PA
314 S. 5TH ST.	PHILADELPHIA	PA
2203 SOUTH ST.	PHILADELPHIA	PA
1703 PINE STREET	PHILADELPHIA	PA
3600 CONSHOHOCKEN AVE.	PHILADELPHIA	PA
2870 E ALLEGHENY AVE	PHILADELPHIA	PA
406 E MEMPHIS STREET	PHILADELPHIA	PA
1221 S. 19TH ST.	PHILADELPHIA	PA
1221 S 19TH STREET	PHILADELPHIA	PA
5432 CHESTER AVE.	PHILADELPHIA	PA
2850-78 COMLY ROAD	PHILADELPHIA	PA
8919 RIDGE AVE	PHILADELPHIA	PA
5800 RIDGE AVE	PHILADELPHIA	PA
6391 OXFORD AVE.	PHILADELPHIA	PA
9985 GANTRY RD	PHILADELPHIA	PA
9751 BLUE GRASS RD	PHILADELPHIA	PA
2435 WHEATSHEAF LANE	PHILADELPHIA	PA
54TH & CITY AVE	PHILADELPHIA	PA
1548 S. 18TH	PHILADELPHIA	PA
1801 TASKER STREET	PHILADELPHIA	PA
4824 MERION AVE	PHILADELPHIA	PA
52 E OREGON AVE	PHILADELPHIA	PA
9351 KREWSTOWN ROAD	PHILADELPHIA	PA
1234 MARKET STREET	PHILADELPHIA	PA
26TH & ALLEGHENY AVE	PHILADELPHIA	PA
352 N 59TH STREET	PHILADELPHIA	PA
PENN STREET AND COMLY STREET	PHILADELPHIA	PA
7311 ELMWOOD AVE	PHILADELPHIA	PA
6725 GERMANTOWN AVENUE	PHILADELPHIA	PA
4301 WISSAHICKON AVE	PHILADELPHIA	PA
5320 W JEFFERSON ST	PHILADELPHIA	PA
32ND & MARKET STS	PHILADELPHIA	PA
341 W ROBERTS AVE	PHILADELPHIA	PA
2700 ALLEGHENY AVE	PHILADELPHIA	PA
200 W WYOMING AVE	PHILADELPHIA	PA
4750 JAMES STREET	PHILADELPHIA	PA
7428 FRANFORD AVE.	PHILADELPHIA	PA
601 E. CAYUGA ST.	PHILADELPHIA	PA
7958 ROOSEVELT BOULEVARD	PHILADELPHIA	PA
9701 GERMANTOWN AVE	PHILADELPHIA	PA
3600 S 26TH STREET	PHILADELPHIA	PA
2867 E ALLEGHENY AVE	PHILADELPHIA	PA

341-342 ROBERTS AVE	PHILADELPHIA	PA
26TH STREET AND PENROSE AVENUE	PHILADELPHIA	PA
13500 ROOSEVELT BOULEVARD	PHILADELPHIA	PA
3301 S GALLOWAY STREET	PHILADELPHIA	PA
ERIE AVE & FRONT ST	PHILADELPHIA	PA
10TH & MOORE STS.	PHILADELPHIA	PA
ROXBOROUGH AND MANAYNK AVES.	PHILADELPHIA	PA
3227 KENNSINGTON AVE.	PHILADELPHIA	PA
6358 STENTON AVE.	PHILADELPHIA	PA
1307 W. VENANGO	PHILADELPHIA	PA
6061_OGONTZ_AVE	PHILADELPHIA	PA
6063 OGONTZ AVENUE	PHILADELPHIA	PA
401 N BROAD ST STE 600	PHILADELPHIA	PA
2100 S. 6TH STREET	PHILADELPHIA	PA
2706 W. ALLEGHENY AVE.	PHILADELPHIA	PA
RICHMOND & ALLEGHENY	PHILADELPHIA	PA
2700 W PASSYUNK AVE	PHILADELPHIA	PA
6109 RIDGE AVE	PHILADELPHIA	PA
719_ADAMS AVE	PHILADELPHIA	PA
1226 S 12TH ST.	PHILADELPHIA	PA
2006 S. 7TH STREET	PHILADELPHIA	PA
3724 N. BROAD ST.	PHILADELPHIA	PA
7800 HOLSTEIN AVENUE	PHILADELPHIA	PA
4300 S 26TH ST	PHILADELPHIA	PA
3870 N 2ND ST	PHILADELPHIA	PA
100 E LEHIGH AVE	PHILADELPHIA	PA
1701 JOHN F KENNEDY BLVD	PHILADELPHIA	PA
610 LANCASTER AVE.	PHILADELPHIA	PA
1815 JFK BLVD	PHILADELPHIA	PA
2101 HORNIG ROAD	PHILADELPHIA	PA
11 & WALNUT ST	PHILADELPHIA	PA
10TH & WALNUT STS	PHILADELPHIA	PA
4775 LEAGUE ISLAND BOULEVARD	PHILADELPHIA	PA
1716 W. SUSQUEHANNA AVE.	PHILADELPHIA	PA
36TH AND MOORE ST	PHILADELPHIA	PA
777 PATTISON AVENUE	PHILADELPHIA	PA
600 S 43RD ST	PHILADELPHIA	PA
3711 MARKET STREET	PHILADELPHIA	PA
11600 CAROLINE RD.	PHILADELPHIA	PA
151 N INDEPENDENCE MALL E	PHILADELPHIA	PA
3900 WOODLAND AVE	PHILADELPHIA	PA
UNIVERSITY & WOODLAND AVENUES	PHILADELPHIA	PA
12329 ACADEMY ROAD	PHILADELPHIA	PA
8318 GERMANTOWN AVE	PHILADELPHIA	PA
1631 ARCH STREET	PHILADELPHIA	PA
900 RACE ST	PHILADELPHIA	PA
11016 KNIGHTS ROAD	PHILADELPHIA	PA

2210 LOTT AVENUE	PHILADELPHIA	PA
5650 CHESTNUT ST	PHILADELPHIA	PA
3239 POWELTON AVE.	PHILADELPHIA	PA
413 N. 63RD STREET	PHILADELPHIA	PA
445 N11TH ST	PHILADELPHIA	PA
5001 WAYNE AVENUE	PHILADELPHIA	PA
4500 N. 20TH ST.	PHILADELPHIA	PA
3500 RICHMOND STREET	PHILADELPHIA	PA
45TH & CHESTNUT STS	PHILADELPHIA	PA
600 ARCH ST	PHILADELPHIA	PA
4751 LEAGUE ISLAND BLVD	PHILADELPHIA	PA
23 S. 19TH ST.	PHILADELPHIA	PA
1741 TOMLINSON RD	PHILADELPHIA	PA

Zip Code	FRS ID	Latitude	Longitude	MACT Subpa
19122	110013671767	39.97657	-75.15832	M
19130	110001208407	39.96855	-75.18092	
19140	110001070634	40.02552	-75.14287	M
19145	110013668664	39.92666	-75.17841	M
19143	110020497746	39.95375	-75.21926	M
19132	110001220081	39.99798	-75.15701	
19143	110002065906	39.93241	-75.22459	
191313115	110001222677	39.98612	-75.23463	
19130	110017843280	39.96226	-75.17127	M
19152	110004851544	40.059557	-75.044409	M
19120	110020497755	40.04529	-75.11927	M
19140	110001054019	40.00847	-75.14669	M
19141	110001220170	40.03694	-75.14464	
19104	110001219967	39.96929	-75.16249	
19125	110057830389	39.98407	-75.1216	N
19150	110001051101	40.07052	-75.15734	M
19150	110001051101	40.07052	-75.15734	M
19114	110005975686	40.07414	-75.01676	
19122	110001070527	39.98363	-75.13557	M
00000	110013669459	40.0501	-75.18438	M
191163016	110000336592	40.10995	-75.00286	
19114	110001144609	40.07201	-74.98102	WWWWW
19124	110046273581	40.01647	-75.079977	
19151	110001020742	39.97244	-75.25325	M
19104	110000337047	39.909557	-75.130454	
19114	110056437084	40.083	-75.00081	
19146	110039621914	39.94623	-75.18421	
19137	110000336967	39.99204	-75.06886	
19154	110011616233	39.96785	-75.35674	
19128	110001052618	40.02743	-75.20968	M
19147	110001092950	39.92016	-75.17061	M
19148	110001092950	39.92016	-75.17061	M
19147	110001010815	39.93059	-75.16832	M
19143	110004878115	39.93366	-75.21708	
00000	110004834341	39.966225	-75.217467	M
19102	110000921539	39.94899	-75.16432	
19131	110001218263	40.002189	-75.215003	
19143	110004853793	39.9522	-75.24279	M
19131	110001033961	39.99148	-75.22528	M
19114	110004840691	40.06369	-74.984931	M
19115	110001033952	40.082607	-75.049587	M
19137	110018863933	39.99658	-75.09091	M
19102	110001218566	39.83047	-75.42392	
19107	110022793707	39.941429	-75.147203	M
19147	110059933559	39.9426	-75.145493	M
19118	110004862881	40.0764	-75.20707	M

19133	110001067648	39.99256	-75.13055	M
19148	110013671482	39.93059	-75.16832	M
19148	110001213017	39.90447	-75.15181	
19148	110001210984	39.92209	-75.15107	M
19148	110001210984	39.92209	-75.15107	M
19129	110001127058	40.110823	-75.024533	M
19135	110004825011	40.03526	-75.04379	M
00000	110001012877	39.98464	-75.12252	
19124	110001010584	40.01405	-75.06658	M
19135	110007792674	40.02618	-75.04283	M
19152	110012162989	40.06143	-75.05639	M
19114	110001209996	40.083	-75.00081	
19103	110001211493	39.9508	-75.17374	
00000	110001067639	40.0303	-75.18039	M
19126	110013669495	40.055245	-75.125902	M
19126	110007222282	40.05644751	-75.13848702	M
19118	110001125292	40.08488	-75.22868	
191182718	110001127520	40.07907	-75.21342	
19126	110001211019	40.05704	-75.14937	M
19126	110001211019	40.05704	-75.14937	M
19131	110020497773	39.9719	-75.22597	M
19133	110020582029	39.9998	-75.14054	M
19131	110070050160	39.97538	-75.21611	
19116	110070050035	40.11146	-75.03307	
19148	110028717770	39.904546	-75.166947	
19132	110001208602	40.00013	-75.17791	
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191533502	110000919784	39.9206	-75.21425	
191481411	110024522462	39.92626	-75.14588	
19148	110001213008	39.90465	-75.15435	
19134	110004839177	39.99182	-75.11268	M
191115008	110001213197	40.045995	-75.092606	
19127	110001203144	40.02567	-75.22418	
19148	110001203439	39.91464384	-75.15402855	
19101	110001211475	39.941069	-75.144792	
19131	110001053984	39.9802	-75.21991	
191452328	110001013643	39.92664	-75.16919	
19131	110000841876	39.966263	-75.217096	
19134	110001212287	39.9886	-75.11336	
19108	110064521860	39.95995	-75.16196	
19128	110001048731	40.044991	-75.231257	M
19115	110004851571	40.092787	-75.031713	M
19150	110001014866	40.071006	-75.161129	M
19131	110001054082	39.98623	-75.23198	M
19139	110001015650	39.97638	-75.23597	M
19152	110001208470	40.061866	-75.042806	

19154	110044317628	40.094876	-75.014746	
19148	110001222686	39.919234	-75.140388	
19474	110004871559	39.92192	-75.21748	
19145	110001008864	39.92728	-75.17886	
19136	110057700867	40.03898	-75.01804	N
191354311	110000336887	40.01667	-75.05	
19122	110018863942	39.98448	-75.14212	M
19124	110001218227	40.00724	-75.09106	
19114	110017843379	40.070615	-75.03165	M
19104	110012172291	39.95561	-75.18948	
19128	110001033916	40.02043	-75.18041	
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19134	110006623653	39.98124	-75.09298	
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19141	110001139349	40.02833	-75.14704	M
191291121	110001208997	40.01313	-75.183865	
19131	110013674489	40.00256	-75.21487	M
191061548	110001104787	40.37547	-75.29499	
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19135	110040631313	40.013987	-75.05607	
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19111	110013669994	40.05487	-75.07242	M
19125	110028009401	39.97195	-75.1254	JJJ
19139	110020497764	39.95794	-75.23354	M
19138	110017843681	40.04451	-75.16323	M
19143	110017843388	39.9554	-75.24213	M
191112437	110000818312	40.07355	-75.09028	
19142	110013671375	39.91338	-75.24281	M
19136	110007213489	40.04448244	-75.02327125	
19146	110001218183	39.93927	-75.17823	
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19115	110001021288	40.08433	-75.03527	M
19154	110001139848	40.086714	-74.971704	M
19124	110007792022	40.020211	-75.080318	WWWWW
19137	110001052253	40.00257	-75.07715	N
191352993	110000997360	40.02008	-75.04306	
19116	110013671393	40.11201	-75.01556	M
19111	110017843397	40.07635	-75.08571	M
19151	110012162943	39.9726	-75.25428	M
191242343	110010284922	40.027854	-75.099857	
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19126	110004852277	40.055306	-75.131903	M
19124	110000818811	40.01501	-75.11042	
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19119	110001209692	40.05612	-75.18763	
19152	110004848700	40.05779	-75.01501	M

19121	110021110885	39.97289	-75.17031	
19001	110039621905	39.97049	-75.14998	
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19123	110017625738	39.961023	-75.137003	
19135	110012172326	40.00452	-75.13312	
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191021121	110001007516	39.9571	-75.1627	
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19136	110001214418	40.037592	-75.020705	
60000	110001039313	40.04421	-75.10235	M
19146	110001035273	39.93669	-75.17741	M
19138	110004839630	40.059103	-75.164704	M
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19125	110001023008	39.97344	-75.11899	
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19132	110001087813	39.99632	-75.17288	M
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191533517	110044905145	39.91672	-75.21703	
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19132	110013671865	39.99791	-75.16709	M
19118	110013671455	40.070897	-75.200922	M
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19134	110001221883	39.9919	-75.12172	
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19126	110001211028	40.05459	-75.12517	M
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19144	110017843707	40.03476	-75.17577	M
19136	110006821136	40.04258	-75.00046	
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19104	110001203340	40.04708	-75.13951	
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19149	110004840389	40.034917	-75.069867	M
191303601	110001217031	39.960443	-75.175221	
19116	110001038822	40.131853	-75.010714	M
19104	110004851107	39.97389	-75.20621	M
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19148	110017843770	39.914545	-75.153624	M
19116	110017843734	40.13377	-75.00986	M
19146	110000337029	39.943446	-75.190734	
191484208	110001202172	39.913578	-75.137663	
19119	110013668799	40.043071	-75.190681	M
19132	110000336798	40.00478	-75.1791	T
191455208	110007746341	39.920946	-75.202402	
19153	110007027289	39.875624	-75.245164	
19111	110001114277	40.055342	-75.073238	
19116	110001224657	40.113664	-75.022544	
19104	110002064685	39.95897	-75.1535	
191533813	110000542119	39.88613	-75.21825	
19121	110012172308	39.987339	-75.170819	
19134	110001205614	40.006398	-75.11694	
00000	110018859546	40.02693	-75.02957	
19130	110000878774	39.95995	-75.16197	
19146	110001218192	39.94162	-75.19057	
19104	110070251782	39.97516	-75.19504	
191303010	110001212330	39.96611	-75.17805	
00000	110001072026	39.94816	-75.22156	M
19103	110001209969	40.02369	-75.2359	
191042640	110000818544	39.9576	-75.19947	
19150	110001078280	40.08079	-75.17231	M
19150	110001078280	40.08079	-75.17231	M
19133	110001015641	39.99444	-75.13969	M
191342615	110001022768	39.99368	-75.10398	
191341321	110000336878	40.0044	-75.1145	JJJ

19151	110004851526	39.97808	-75.26689	M
191485614	110006821207	39.9068	-75.15389	
19146	110017843743	39.93613	-75.17047	M
19153	110000819614	39.90141	-75.23143	
19140	110064430511	40.01593	-75.12964	
19127	110011777274	40.02388	-75.22045	
19106	110013668824	39.94448	-75.15024	M
19146	110004836964	39.9453	-75.17876	M
19102	110001052645	39.94619	-75.17011	JJJ
19131	110001222338	40.00417	-75.20252	
191345908	110001209120	39.98247	-75.10098	
19125	110001202877	39.9742	-75.13196	
19146	110001211000	39.9364	-75.17527	M
19146	110001211000	39.9364	-75.17527	M
19143	110004848755	39.93887	-75.22405	M
15154	110020994496	40.10006	-74.99646	N
19128	110001026096	40.06926	-75.2406	M
191281737	110004878552	40.02876	-75.21043	
19151	110000989388	40.045441	-75.088377	M
191151001	110001053234	40.11046	-75.04985	
191141001	110004862630	40.08049	-75.02385	
19137	110017824112	39.996532	-75.088976	
19131	110013836279	39.992753	-75.239723	
19146	110004851633	39.93137	-75.17473	M
19146	110001210993	39.93128	-75.17475	M
19131	110001205605	39.973899	-75.218219	
19148	110028011023	39.913923	-75.136511	
19115	110013671204	40.087626	-75.044828	M
191073780	110064198826	39.822291	-75.41907	
19132	110007214889	40.00411	-75.17226	
19138	110001213437	39.967127	-75.237646	
19149	110063619455	40.03007	-75.07424	
19142	110007777174	39.913812	-75.241726	
19119	110004854239	40.05306	-75.186	
19140	110000819320	40.01291	-75.1691	
19131	110004826591	39.98079	-75.229	
19104	110007222647	39.95547	-75.18827	
19140	110055617275	40.10784	-75.15189	
19129	110044317646	40.00432	-75.17401	
191401530	110000818848	40.02203	-75.12831	
19137	110001210626	40.008468	-75.075177	
19136	110001072393	40.03834	-75.03667	M
19120	110001088073	40.01845	-75.13719	
19152	110001206178	40.056309	-75.047521	
191182633	110012162827	40.08525	-75.22926	
19145	110044317619	39.90465	-75.19363	
191345903	110001213393	39.982486	-75.100993	

19140	110055617275	40.10784	-75.15189	
19145	110006522192	39.905313	-75.193724	
19116	110000336627	40.11131	-74.99256	
19148	110010716859	39.90768	-75.1553	
19134	110041235142	40.00769	-75.12728	
19148	110007770812	39.92714	-75.16206	
19128	110001053387	40.02753	-75.21656	M
19134	110013671240	39.99702	-75.11243	M
19138	110001066015	40.06018	-75.16653	M
19140	110001011645	40.00748	-75.15027	M
19141	110004838604	40.04779	-75.15097	M
19141	110004838604	40.04779	-75.15097	M
191081002	110038444528	39.95958	-75.16205	
19148	110004856031	39.92256	-75.15665	M
19132	110013673177	40.00434	-75.17416	M
191450000	110010285039	39.98299	-75.10141	
191455205	110000744366	39.921363	-75.192212	
19128	110004851303	40.03377	-75.21554	M
19124	110001142291	40.03254	-75.10626	M
19147	110001027638	39.93421	-75.16372	M
19148	110004825262	39.92385	-75.15797	M
19140	110001048973	40.009964	-75.151065	M
19153	110070543999	39.89729	-75.23305	
191121608	110043237716	39.898667	-75.193291	
191403334	110006826079	40.00843	-75.13124	
191251012	110012516330	39.9909	-75.13088	
19103	110070551557	39.95402	-75.16837	
19104	110013672490	40.034838	-75.5738	M
19103	110070740292	39.95421	-75.169971	
19116	110070029427	40.1128	-74.99758	
19107	110040631297	39.94778	-75.16028	
19107	110038444537	39.82212	-75.41052	WWWWW
19112	110071241296	39.89247011	-75.17677667	
19121	110013669315	39.98702	-75.16183	M
19145	110064847741	39.91864593	-75.18626054	
19148	110000566557	39.90409	-75.16347	
191044418	110030479131	39.94682	-75.20873	
19104	110071241176	39.96048492	-75.19739036	
19154	110001069673	40.09702	-75.00491	
191061819	110041225251	39.95396	-75.14789	N
191044551	110030479756	39.94983	-75.20117	O
19104	110030479756	39.94983	-75.20117	
19154	110001027273	40.096124	-74.976498	M
19118	110044317557	40.07473	-75.20427	
19103	110044317637	39.95494	-75.16762	
191072407	110040631288	39.95528	-75.15496	
19114	110044317566	40.07829	-74.97824	

19115	110044317575	40.08509	-75.02568	
19139	110063619838	39.959692	-75.234815	
19104	110013672515	39.96038	-75.18931	M
19151	110004853187	39.96927	-75.24538	M
19123	110010704121	39.96071	-75.15633	N
19144	110002450259	40.02542	-75.1677	M
19140	110013672524	40.02303	-75.15801	M
19134	110001203395	39.98666	-75.09438	
19139	110001026773	39.95682	-75.2118	
191061611	110023737134	39.95276	-75.14993	
19112	110018897988	39.89363	-75.16701	
19103	110001052903	39.95265	-75.17173	M
191163847	110008996088	40.10475	-75.01579	

TRI IDs	TRI HAP Releases (lb/yr) (2	Population Density (3 mile)	County
		16529.1	PHILADELPHIA COUNTY
		17169.06	PHILADELPHIA COUNTY
		15225.44	PHILADELPHIA COUNTY
		13714.3	PHILADELPHIA COUNTY
		15538.17	PHILADELPHIA COUNTY
		14929.48	PHILADELPHIA COUNTY
		13673.64	PHILADELPHIA COUNTY
		10996.1	PHILADELPHIA COUNTY
		17922.76	PHILADELPHIA COUNTY
		10145.98	PHILADELPHIA COUNTY
		13310.59	PHILADELPHIA COUNTY
		15801.25	PHILADELPHIA COUNTY
		13233.86	PHILADELPHIA COUNTY
		17400.02	PHILADELPHIA COUNTY
		13924.93	PHILADELPHIA COUNTY
		8652.85	PHILADELPHIA COUNTY
		8652.85	PHILADELPHIA COUNTY
		7320.56	PHILADELPHIA COUNTY
		15425.15	PHILADELPHIA COUNTY
		9295.94	PHILADELPHIA COUNTY
19116MPRLM2050B	1032	4614.14	PHILADELPHIA COUNTY
		5141.74	PHILADELPHIA COUNTY
		13834	PHILADELPHIA COUNTY
		11362.99	PHILADELPHIA COUNTY
19148SHLND2801S	8898	9411.6	PHILADELPHIA COUNTY
		5984.42	PHILADELPHIA COUNTY
		17487.89	PHILADELPHIA COUNTY
19137TLNTC3100E		8973.51	PHILADELPHIA COUNTY
		3117.29	PHILADELPHIA COUNTY
		6839.75	PHILADELPHIA COUNTY
		12030.64	PHILADELPHIA COUNTY
		12030.64	PHILADELPHIA COUNTY
		13409.17	PHILADELPHIA COUNTY
		14746.67	PHILADELPHIA COUNTY
		14783.07	PHILADELPHIA COUNTY
		16981.5	PHILADELPHIA COUNTY
		9236.57	PHILADELPHIA COUNTY
		13244.91	PHILADELPHIA COUNTY
		10758.32	PHILADELPHIA COUNTY
		5443.91	PHILADELPHIA COUNTY
		6745.13	PHILADELPHIA COUNTY
		12432.37	PHILADELPHIA COUNTY
		3034.7	PHILADELPHIA COUNTY
		14910.31	PHILADELPHIA COUNTY
		15194.63	PHILADELPHIA COUNTY
		4923.63	PHILADELPHIA COUNTY

		15219.28	PHILADELPHIA COUNTY
		13409.17	PHILADELPHIA COUNTY
		9400.35	PHILADELPHIA COUNTY
		12091.92	PHILADELPHIA COUNTY
		12091.92	PHILADELPHIA COUNTY
		4075.15	PHILADELPHIA COUNTY
		11474.13	PHILADELPHIA COUNTY
19125CLBRN2626N		14094.5	PHILADELPHIA COUNTY
		11874.15	PHILADELPHIA COUNTY
		10509.73	PHILADELPHIA COUNTY
		10608.08	PHILADELPHIA COUNTY
		5984.42	PHILADELPHIA COUNTY
		17579.16	PHILADELPHIA COUNTY
		11520.85	PHILADELPHIA COUNTY
		11852.01	PHILADELPHIA COUNTY
			PHILADELPHIA COUNTY
		2714.08	PHILADELPHIA COUNTY
		4159.89	PHILADELPHIA COUNTY
		11144.62	PHILADELPHIA COUNTY
		11144.62	PHILADELPHIA COUNTY
		12884.4	PHILADELPHIA COUNTY
		15628.18	PHILADELPHIA COUNTY
		13880.46	PHILADELPHIA COUNTY
		3692.19	PHILADELPHIA COUNTY
		8935.58	PHILADELPHIA COUNTY
		12778.41	PHILADELPHIA COUNTY
		5401.58	PHILADELPHIA COUNTY
		5328.91	PHILADELPHIA COUNTY
		12052.82	PHILADELPHIA COUNTY
19148CTNGC8MRRI	5201	12474.77	PHILADELPHIA COUNTY
		9432.29	PHILADELPHIA COUNTY
		13953.15	PHILADELPHIA COUNTY
		13252.45	PHILADELPHIA COUNTY
		5402.67	PHILADELPHIA COUNTY
			PHILADELPHIA COUNTY
		14870.6	PHILADELPHIA COUNTY
		12941.25	PHILADELPHIA COUNTY
		12927.5	PHILADELPHIA COUNTY
		14814.76	PHILADELPHIA COUNTY
		13570.69	PHILADELPHIA COUNTY
		18393.5	PHILADELPHIA COUNTY
		4226.88	PHILADELPHIA COUNTY
		5913.53	PHILADELPHIA COUNTY
		8384.43	PHILADELPHIA COUNTY
		11284.83	PHILADELPHIA COUNTY
		11840.57	PHILADELPHIA COUNTY
		9884.69	PHILADELPHIA COUNTY

	5689.05	PHILADELPHIA COUNTY
	11857.68	PHILADELPHIA COUNTY
	11981.12	PHILADELPHIA COUNTY
	13790.5	PHILADELPHIA COUNTY
	8534.23	PHILADELPHIA COUNTY
19135DTZWT5701T	9868.63	PHILADELPHIA COUNTY
	15685.4	PHILADELPHIA COUNTY
	14289.54	PHILADELPHIA COUNTY
	8548.39	PHILADELPHIA COUNTY
	18179.38	PHILADELPHIA COUNTY
	11859.07	PHILADELPHIA COUNTY
		PHILADELPHIA COUNTY
	10458.85	PHILADELPHIA COUNTY
	10910.51	PHILADELPHIA COUNTY
	14462.36	PHILADELPHIA COUNTY
	11643.17	PHILADELPHIA COUNTY
	9194.58	PHILADELPHIA COUNTY
	1009.19	PHILADELPHIA COUNTY
	17365.13	PHILADELPHIA COUNTY
	17498.95	PHILADELPHIA COUNTY
	10188.17	PHILADELPHIA COUNTY
	11592.55	PHILADELPHIA COUNTY
	11592.55	PHILADELPHIA COUNTY
	14751.78	PHILADELPHIA COUNTY
	13076.31	PHILADELPHIA COUNTY
	11626.31	PHILADELPHIA COUNTY
	13001.78	PHILADELPHIA COUNTY
	8079.23	PHILADELPHIA COUNTY
	7750.18	PHILADELPHIA COUNTY
		PHILADELPHIA COUNTY
	15974.43	PHILADELPHIA COUNTY
	8170.16	PHILADELPHIA COUNTY
	6543.3	PHILADELPHIA COUNTY
	4196	PHILADELPHIA COUNTY
	13948.52	PHILADELPHIA COUNTY
	11647.03	PHILADELPHIA COUNTY
	9752.35	PHILADELPHIA COUNTY
	4379.22	PHILADELPHIA COUNTY
	7513.41	PHILADELPHIA COUNTY
	11278.3	PHILADELPHIA COUNTY
	15159.75	PHILADELPHIA COUNTY
	15245.21	PHILADELPHIA COUNTY
	11812.77	PHILADELPHIA COUNTY
19124GRFLD810EA	15486.07	PHILADELPHIA COUNTY
	8398.17	PHILADELPHIA COUNTY
	8551.81	PHILADELPHIA COUNTY
	8161.63	PHILADELPHIA COUNTY

		16479.68	PHILADELPHIA COUNTY
		17318.16	PHILADELPHIA COUNTY
19104KRFTN43RDB		16766.38	PHILADELPHIA COUNTY
		16990.46	PHILADELPHIA COUNTY
		15606.09	PHILADELPHIA COUNTY
19134THGLBRICHM		11188.96	PHILADELPHIA COUNTY
		7707.5	PHILADELPHIA COUNTY
			PHILADELPHIA COUNTY
		18309.73	PHILADELPHIA COUNTY
		7206.2	PHILADELPHIA COUNTY
		7206.2	PHILADELPHIA COUNTY
		0	PHILADELPHIA COUNTY
		16717.62	PHILADELPHIA COUNTY
		16815.87	PHILADELPHIA COUNTY
		11932.33	PHILADELPHIA COUNTY
19135HLLCK5101C		10336.21	PHILADELPHIA COUNTY
19135HLLCK5101C		10336.21	PHILADELPHIA COUNTY
		5315.09	PHILADELPHIA COUNTY
		8759.94	PHILADELPHIA COUNTY
		13655.91	PHILADELPHIA COUNTY
		15299.64	PHILADELPHIA COUNTY
		9533.96	PHILADELPHIA COUNTY
		5369.49	PHILADELPHIA COUNTY
19153HYGRD8400E		2596.23	PHILADELPHIA COUNTY
		13513.91	PHILADELPHIA COUNTY
19148SHLND2801S	8898	9411.6	PHILADELPHIA COUNTY
		6796.4	PHILADELPHIA COUNTY
		9550.8	PHILADELPHIA COUNTY
		15046.56	PHILADELPHIA COUNTY
		15046.56	PHILADELPHIA COUNTY
		10506.15	PHILADELPHIA COUNTY
		13751.03	PHILADELPHIA COUNTY
		13431.21	PHILADELPHIA COUNTY
		9035.12	PHILADELPHIA COUNTY
		9364.81	PHILADELPHIA COUNTY
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		13294.08	PHILADELPHIA COUNTY
		13294.08	PHILADELPHIA COUNTY
19135JWTTR9400S		5464.87	PHILADELPHIA COUNTY
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19154KNGSB10385	0	5697.99	PHILADELPHIA COUNTY
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		12166.76	PHILADELPHIA COUNTY

		12416.9	PHILADELPHIA COUNTY
		12245.5	PHILADELPHIA COUNTY
		14386.57	PHILADELPHIA COUNTY
		9909.97	PHILADELPHIA COUNTY
		15435.41	PHILADELPHIA COUNTY
		11543.36	PHILADELPHIA COUNTY
		8409.52	PHILADELPHIA COUNTY
		14750.23	PHILADELPHIA COUNTY
		8214.42	PHILADELPHIA COUNTY
		12794.61	PHILADELPHIA COUNTY
		12794.61	PHILADELPHIA COUNTY
		13165.11	PHILADELPHIA COUNTY
		3851.04	PHILADELPHIA COUNTY
		7455.66	PHILADELPHIA COUNTY
		12693.63	PHILADELPHIA COUNTY
		11983.18	PHILADELPHIA COUNTY
		9493	PHILADELPHIA COUNTY
		9812.77	PHILADELPHIA COUNTY
		5722.22	PHILADELPHIA COUNTY
		13070.38	PHILADELPHIA COUNTY
		18412.12	PHILADELPHIA COUNTY
		13923.19	PHILADELPHIA COUNTY
		12261.95	PHILADELPHIA COUNTY
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		17404.95	PHILADELPHIA COUNTY
		11687.65	PHILADELPHIA COUNTY
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		8937.78	PHILADELPHIA COUNTY
		9631.35	PHILADELPHIA COUNTY
		7966.96	PHILADELPHIA COUNTY
		17765.54	PHILADELPHIA COUNTY
		5484.85	PHILADELPHIA COUNTY
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19112SDDSNCODE1	0	5851.1	PHILADELPHIA COUNTY
		4638.93	PHILADELPHIA COUNTY
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		15623.06	PHILADELPHIA COUNTY
		4298.39	PHILADELPHIA COUNTY
		13867	PHILADELPHIA COUNTY
		6023.7	PHILADELPHIA COUNTY
		14210.94	PHILADELPHIA COUNTY
		14304.19	PHILADELPHIA COUNTY
		3306.75	PHILADELPHIA COUNTY
		14620.18	PHILADELPHIA COUNTY
		3593.91	PHILADELPHIA COUNTY
		8937.78	PHILADELPHIA COUNTY

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		11940.48	PHILADELPHIA COUNTY
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		13502.55	PHILADELPHIA COUNTY
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		9979.16	PHILADELPHIA COUNTY
		14660.5	PHILADELPHIA COUNTY
		12043.83	PHILADELPHIA COUNTY
		6537.03	PHILADELPHIA COUNTY
		10608.14	PHILADELPHIA COUNTY
		12253.46	PHILADELPHIA COUNTY
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		2662.72	PHILADELPHIA COUNTY
		7021.24	PHILADELPHIA COUNTY
		7021.24	PHILADELPHIA COUNTY
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		3405.31	PHILADELPHIA COUNTY
		15168.32	PHILADELPHIA COUNTY
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		11347.23	PHILADELPHIA COUNTY
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19146SCHYL2800C		16995.7	PHILADELPHIA COUNTY
		10827.1	PHILADELPHIA COUNTY
		9307.62	PHILADELPHIA COUNTY
19132PNNFS3028W	774	12479.42	PHILADELPHIA COUNTY
		13727.89	PHILADELPHIA COUNTY
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		11627.68	PHILADELPHIA COUNTY
		3957.69	PHILADELPHIA COUNTY
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		14856.29	PHILADELPHIA COUNTY
		15365.09	PHILADELPHIA COUNTY
		9420.7	PHILADELPHIA COUNTY
		18393.87	PHILADELPHIA COUNTY
		17004.72	PHILADELPHIA COUNTY
		15783.81	PHILADELPHIA COUNTY
		17455.29	PHILADELPHIA COUNTY
		15402.92	PHILADELPHIA COUNTY
		4617.27	PHILADELPHIA COUNTY
		17439.68	PHILADELPHIA COUNTY
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		6976.68	PHILADELPHIA COUNTY
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19134PRLTC3620G	1550	0	PHILADELPHIA COUNTY

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19127RCHRD42022	5889.44	PHILADELPHIA COUNTY
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	16730.05	PHILADELPHIA COUNTY
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	5211.5	PHILADELPHIA COUNTY
	2845.31	PHILADELPHIA COUNTY
	6655.19	PHILADELPHIA COUNTY
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	3833.02	PHILADELPHIA COUNTY
	6866.69	PHILADELPHIA COUNTY
	12170.65	PHILADELPHIA COUNTY
	8932.36	PHILADELPHIA COUNTY
	14091.49	PHILADELPHIA COUNTY
	14069.96	PHILADELPHIA COUNTY
	13782.32	PHILADELPHIA COUNTY
	10826.55	PHILADELPHIA COUNTY
	5882.37	PHILADELPHIA COUNTY
	2788.04	DELAWARE COUNTY
	13164.4	PHILADELPHIA COUNTY
	12149	PHILADELPHIA COUNTY
	13164.82	PHILADELPHIA COUNTY
	7798.42	PHILADELPHIA COUNTY
	8932.99	PHILADELPHIA COUNTY
	13697.24	PHILADELPHIA COUNTY
	12028.54	PHILADELPHIA COUNTY
	18219.76	PHILADELPHIA COUNTY
	4343	PHILADELPHIA COUNTY
	12933.78	PHILADELPHIA COUNTY
	15896.04	PHILADELPHIA COUNTY
	12268.79	PHILADELPHIA COUNTY
	10837.73	PHILADELPHIA COUNTY
19120CYGSTPHILA	15972.7	PHILADELPHIA COUNTY
	10705.16	PHILADELPHIA COUNTY
	2667.81	PHILADELPHIA COUNTY
	8805.54	PHILADELPHIA COUNTY
	11705.66	PHILADELPHIA COUNTY

		4343	PHILADELPHIA COUNTY
		8940.75	PHILADELPHIA COUNTY
19116SPDTC13500		4411.95	PHILADELPHIA COUNTY
		10106.1	PHILADELPHIA COUNTY
		15830.74	PHILADELPHIA COUNTY
		12627.51	PHILADELPHIA COUNTY
		6098.39	PHILADELPHIA COUNTY
		14385.23	PHILADELPHIA COUNTY
		9418.48	PHILADELPHIA COUNTY
		15885.33	PHILADELPHIA COUNTY
		11675.08	PHILADELPHIA COUNTY
		11675.08	PHILADELPHIA COUNTY
		18412.14	PHILADELPHIA COUNTY
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		12906.7	PHILADELPHIA COUNTY
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		5898.99	PHILADELPHIA COUNTY
		14952.59	PHILADELPHIA COUNTY
		13890.8	PHILADELPHIA COUNTY
		12121.79	PHILADELPHIA COUNTY
		15867.48	PHILADELPHIA COUNTY
		4729.79	PHILADELPHIA COUNTY
		7209.76	PHILADELPHIA COUNTY
		15834.65	PHILADELPHIA COUNTY
		15226.9	PHILADELPHIA COUNTY
		17984.67	PHILADELPHIA COUNTY
		1253.08	PHILADELPHIA COUNTY
		18023.79	PHILADELPHIA COUNTY
		4357.95	PHILADELPHIA COUNTY
		16578.76	PHILADELPHIA COUNTY
		2600.58	PHILADELPHIA COUNTY
			PHILADELPHIA COUNTY
		15485.79	PHILADELPHIA COUNTY
			PHILADELPHIA COUNTY
		9038.74	PHILADELPHIA COUNTY
		16699.9	PHILADELPHIA COUNTY
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19154SBNKN11600		5543.82	PHILADELPHIA COUNTY
19106NTDST151NI	0	17582.75	PHILADELPHIA COUNTY
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		17586.7	PHILADELPHIA COUNTY
		4247.7	PHILADELPHIA COUNTY
		5391.22	PHILADELPHIA COUNTY
		18107.74	PHILADELPHIA COUNTY
		17813.76	PHILADELPHIA COUNTY
		4674.3	PHILADELPHIA COUNTY

	6511.75	PHILADELPHIA COUNTY
	12821.68	PHILADELPHIA COUNTY
	18003.24	PHILADELPHIA COUNTY
	11911.72	PHILADELPHIA COUNTY
	18360.78	PHILADELPHIA COUNTY
	13605.77	PHILADELPHIA COUNTY
	14499.14	PHILADELPHIA COUNTY
	11253.54	PHILADELPHIA COUNTY
	16271.65	PHILADELPHIA COUNTY
	17365.13	PHILADELPHIA COUNTY
	6582.4	PHILADELPHIA COUNTY
	17848.52	PHILADELPHIA COUNTY
1911WSWTVT1741T	4985.18	PHILADELPHIA COUNTY

Percent Low Income (3 mile)	Percent People of Color (3 mil
48.2	62.52
45.96	64.12
55.97	90.11
38.99	50.99
47.71	76.05
55.19	76.1
48.97	76.63
46.26	74.55
44.35	58.67
39.37	50.85
48.38	84.93
57.51	82.06
50.39	89.47
46.88	61.05
57.04	74.1
34.89	76.2
34.89	76.2
31.75	35.38
53.4	70.57
37.72	74.25
27.14	28.84
27.22	30.53
52.83	72.34
43.03	73.65
39.57	47.22
29.11	31.73
43.59	58.68
51.01	66.2
11.1	14.76
36.04	60.56
36.83	46.93
36.83	46.93
37.56	48.42
46.92	71.35
47.94	75.53
42.06	53.36
45.52	72.23
49.33	80.97
45.95	72.75
28.04	29.85
33.69	41.39
56.58	74.88
31.5	41.97
39.16	49.6
39.31	49.94
25.6	59.35

57.41	77.46
37.56	48.42
39.78	47.95
37.71	49.23
37.71	49.23
26.86	29.84
44.46	57.74
57.03	74.3
50.77	67.51
45.35	57.97
39.75	54.17
29.11	31.73
42.97	56.04
46.39	81.13
44.31	83.65
15.95	34.93
22.75	53.77
42.13	84.04
42.13	84.04
48.76	77.72
56.22	77.91
48.52	75.29
27.01	30.42
36.69	44.14
54.07	76.84
28.88	32.88
28.69	30.53
46.17	68.91
37.76	49.94
39.43	47.28
58.76	77.54
46.57	72.55
27.12	47.38
39.06	49.89
48.52	75.69
37.28	47.74
47.92	75.44
58.75	76.51
44.75	57.29
22.13	38.15
29.56	33.49
34.51	75.26
46.6	74.19
47.84	77.64
38.54	49.09

28.13	30.64
38.3	49.55
46.62	70.53
39.02	51.26
39.59	44.68
47.34	61.24
52.46	69.37
55.89	75.98
35.09	41.77
45.58	63.48
51.73	81.73
56.43	71.64
42.66	85.2
54.41	90.54
52.69	78.99
45.42	72.16
15.47	8.24
42.81	54.2
45.52	57.94
48.88	63.72
42.76	61.79
42.76	61.79
50.22	64.5
49.59	80.84
44.39	84.91
49.24	80.81
36.97	59.96
46.49	79.03
41.25	55.07
36.3	39.78
30.69	36.33
25.68	28.59
52.17	72.1
54.28	70.58
46.13	59.08
26.18	28.07
35.38	55.62
42.56	73.23
53.58	79
54.37	76.97
44.13	84.86
56.2	81
35.73	69.97
35.79	71.74
36.28	39.74

46.05	61.79
47.58	61.18
45.45	67.9
45.5	57.82
58.05	81.49
57.46	74.13
32.64	72.24
43.87	56.09
32.34	71.57
32.34	71.57
41.65	52.77
42.15	55.23
47.64	71.76
48.35	77.9
48.93	63.99
48.93	63.99
27.28	46.73
40.47	46.38
47.67	77.55
40.3	53.85
39.35	81.95
28.59	31.13
43.4	78.61
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39.57	47.22
29.59	66.74
38.11	54.34
39.5	49.66
39.5	49.66
46.38	59.98
58.73	77.21
53.95	74.32
37.89	61.48
45.69	74.55
40.08	52.67
49.31	81.05
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29	30.8
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56.92	84.48
46.13	70.54
28.66	31.4
47.82	76.16
47.6	61.22
49.66	79.55

48.32	88.76
46.42	86.55
51.63	73.34
38.36	46.5
54.42	73.61
45.95	76.24
36.75	54.58
49.44	63.46
38.3	45.35
37.23	47.67
37.23	47.67
46.92	68.28
24.8	26.6
34.62	37.41
45.43	65.25
46.03	61.61
43.46	54.32
38.56	80.46
28.96	31.02
46.08	73.98
44.64	57.13
49.52	80.67
36.85	47
39.01	50.38
45.44	57.85
51.8	67.57
43.8	54.98
43.32	54
42.65	52.12
37.43	66.35
34.57	70.11
43.52	57.9
28	30.99
41.51	46.8
41.76	47.62
41.9	47.77
39.52	50.98
56.46	80.08
28.13	32.48
54.61	75.42
29.87	65.3
57.91	75.82
38.77	49.4
23.18	23.31
58.46	77.96
18.7	29.71
42.65	52.12

44.43	83.71
44.43	83.71
52.66	74.19
39.32	51.24
39.32	51.24
38.16	67.84
55.29	75.57
45.5	82.28
32.15	34.61
42.75	54.9
46.29	87.71
27.23	42.4
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30.19	68.22
30.19	68.22
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37.12	47.55
23.16	23.36
43.19	58.93
38.86	48.95
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43.64	60.95
37.13	64.84
42.66	61.87
25.95	28.61
45.18	56.98
45.08	76.84
50.81	68.32
57.47	81.23
43.11	53.48
44.75	57.29
43.67	60
48.05	71.02
45.53	62.46
47.71	76.45
22.75	39.92
46.97	68.21
29.9	67.62
29.9	67.62
55.81	76.34
58.19	76.82
57.57	80.55

37.99	67.49
38.56	47.19
38.95	50.95
47.56	83.15
57.06	84.4
30.95	52.53
40.43	50.57
42.65	56.6
42.01	54.06
48.37	72.7
57.83	73.74
49.96	64.95
39.8	52.9
39.8	52.9
48.9	77.36
28.51	30.4
15.74	25.04
35.05	59.18
46.46	70.69
25.63	30.41
30.28	34.59
56.18	74.11
42.69	71.32
38.45	50.51
38.45	50.49
48.5	75.88
38.96	48.96
31.08	37.85
34.77	47.3
54.85	78.56
48.6	79.13
48.88	69.04
46.7	79.31
36.63	72.91
56.37	83.98
48.35	76.71
45.56	63
19.03	45.01
54.81	78.73
56.58	86.63
53.73	70.29
43.23	55.81
57.1	85.87
40.7	53.95
15.82	34.14
44.34	59.84
57.83	73.75

19.03	45.01
44.16	59.72
26.6	27.64
37.93	46.73
57.89	82.37
37.33	47.42
32.45	54.86
58.45	78.54
38.92	81.26
56.9	81.41
45.47	87.46
45.47	87.46
44.64	57.13
37.1	47.89
54.8	78.75
57.95	73.96
41.53	55.8
30.62	52.82
53.37	81.63
38.43	49.35
37.05	47.58
57.5	83.2
46.7	82.26
45.58	59.73
57.78	82.59
56.8	76.67
43.18	55.59
9.18	20.67
43.33	55.99
26.45	27.61
41.54	52.29
37.79	51.31
51.33	67.87
37.41	44.84
45.72	68.48
28.36	31.03
43.25	54.64
45.97	66.34
45.97	66.34
26.71	30.11
27.64	62.12
43.28	55.75
43.59	55.08
26.9	30.11

29.84	33.65
49.59	80.74
46.47	65.64
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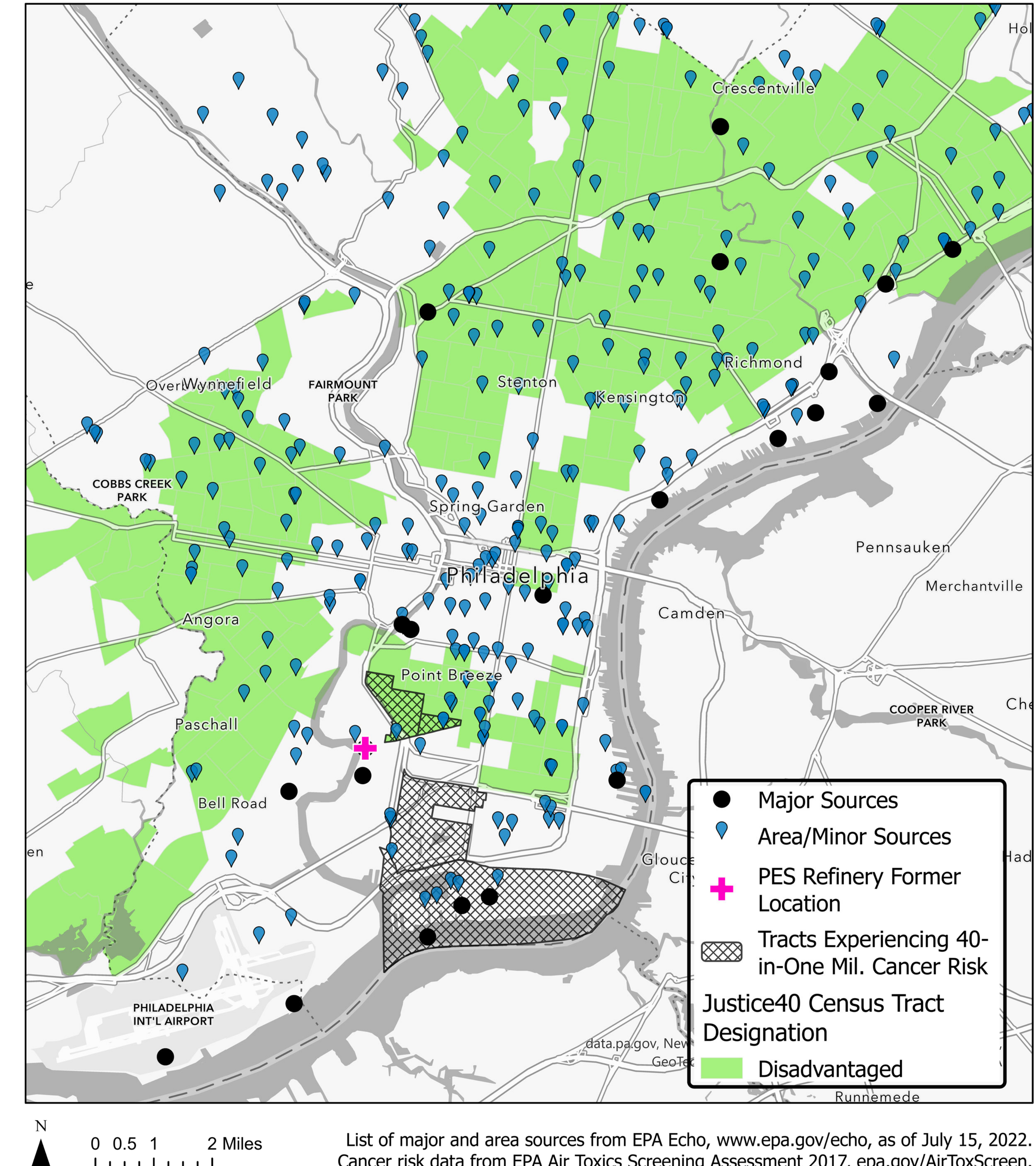
Justice40, Major and Area/Minor Sources in Philadelphia, Pennsylvania



List of major and area sources from EPA Echo, www.epa.gov/echo, as of July 15, 2022.
Cancer risk data from EPA Air Toxics Screening Assessment 2017, epa.gov/AirToxScreen.
Justice40 data from CEQ Climate and Economic Justice Screening Tool, screeningtool.geoplatform.gov.

FID	2010 FIPS Code	State/Territory	County Name	Total population	Diagnosed diabetes among adults aged greater than or equal to 18 years (percentile)
12603	42045980000	Pennsylvar	Delaware (	0	0
14259	42101003800	Pennsylvar	Philadelph	3,943	0.37
14301	42101980400	Pennsylvar	Philadelph	0	0
14393	42101003600	Pennsylvar	Philadelph	6,924	0.92
14394	42101003701	Pennsylvar	Philadelph	5,896	0.86
14395	42101003702	Pennsylvar	Philadelph	4,102	0.77
14398	42101003902	Pennsylvar	Philadelph	5,822	0.35
14471	42101005400	Pennsylvar	Philadelph	1,646	0.86
14472	42101005500	Pennsylvar	Philadelph	6,341	0.82
14473	42101005600	Pennsylvar	Philadelph	1,095	0.85
14474	42101006000	Pennsylvar	Philadelph	6,670	0.87
14475	42101006100	Pennsylvar	Philadelph	2,860	0.88
14476	42101006200	Pennsylvar	Philadelph	4,530	0.79
14477	42101006300	Pennsylvar	Philadelph	4,162	0.91
14503	42101003901	Pennsylvar	Philadelph	6,639	0.44
14570	42101006400	Pennsylvar	Philadelph	4,230	0.85
14572	42101006600	Pennsylvar	Philadelph	3,133	0.98
14573	42101006700	Pennsylvar	Philadelph	7,001	0.73
14653	42101980900	Pennsylvar	Philadelph	0	0
14656	42101003001	Pennsylvar	Philadelph	4,177	0.7
14757	42101037300	Pennsylvar	Philadelph	5,838	0.26
Weighted Average Percentiles:					**0.7113**

Current asthma among adults aged greater than or equal to 18 years (percentile)	Coronary heart disease among adults aged greater than or equal to 18 years (percentile)	Diesel particulate matter exposure (percentile)	Energy burden (percentile)	Expected agricultural loss rate (Natural Hazards Risk Index) (percentile)
0	0	0	0	0.4
0.65	0.6	0.87	0.46	0
0	0	0	0	0.12
0.97	0.85	0.86	0.87	0
0.96	0.45	0.88	0.84	0
0.95	0.57	0.88	0.78	0
0.7	0.59	0.88	0.46	0
0.93	0.51	0.74	0.38	0.45
0.94	0.43	0.73	0.72	0.22
0.99	0.53	0.75	0.83	0
0.97	0.66	0.76	0.85	0
0.94	0.64	0.78	0.94	0
0.99	0.37	0.77	0.95	0
0.98	0.6	0.75	0.98	0
0.73	0.53	0.89	0.56	0
0.98	0.45	0.74	0.96	0
0.99	0.94	0.8	0.98	0
0.97	0.31	0.8	0.95	0
0	0	0.83	0	0.63
0.57	0.37	0.89	0.63	0
0.57	0.47	0.91	0.27	0
0.8682	**0.5418**	**0.8242**	**0.7436**	**0.0251**

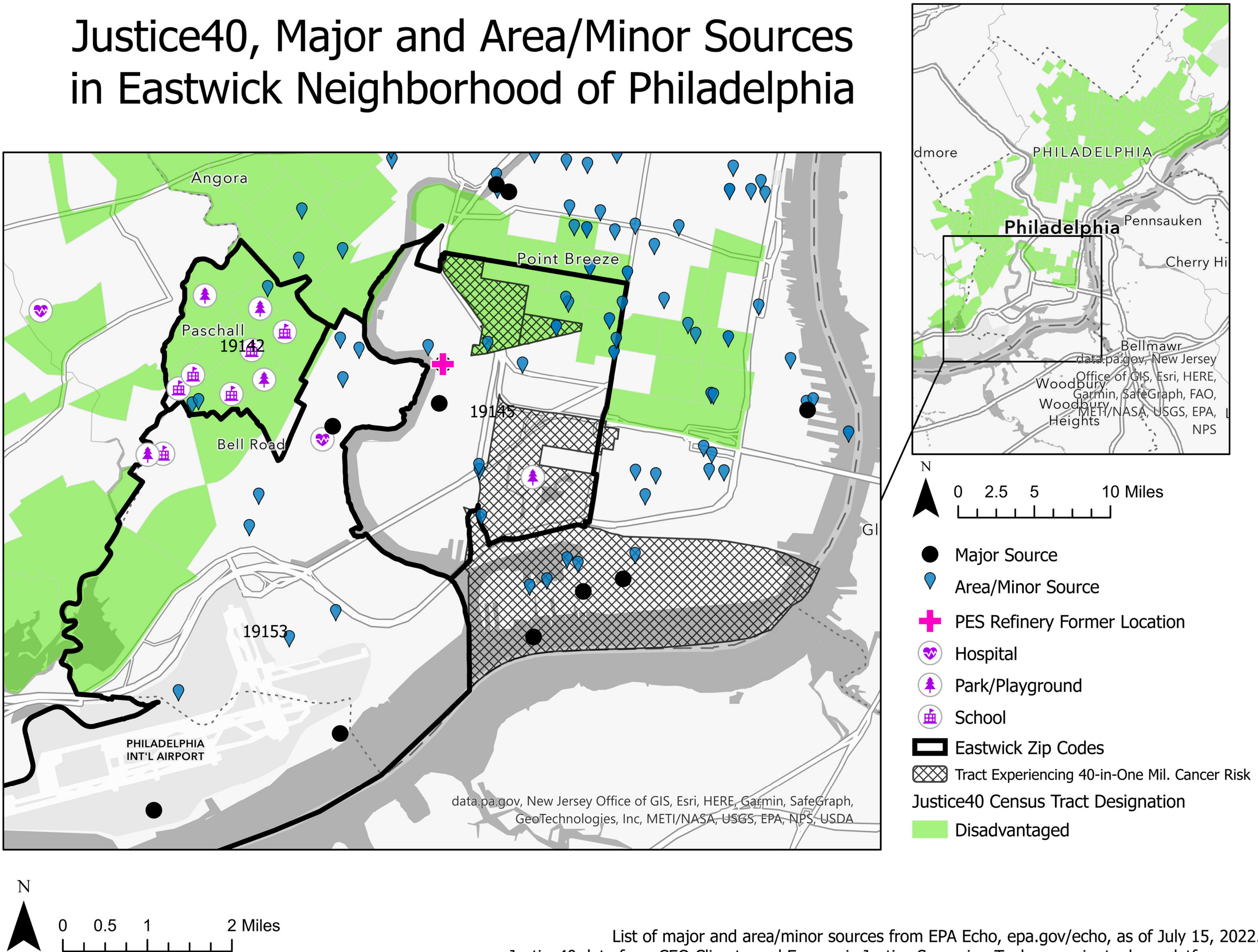
Expected building loss rate (Natural Hazards Risk Index) (percentile)	Expected population loss rate (Natural Hazards Risk Index) (percentile)	Housing burden (percent) (percentile)	Low life expectancy (percentile)	Linguistic isolation (percent) (percentile)
0.98	0	0	0	0
0.28	0.61	0.64	0.3	0.62
0.97	0	0	0	0
0.18	0.61	0.84	0.81	0.84
0.19	0.61	0.91	0.98	0.72
0.2	0.61	0.88	0.76	0.88
0.31	0.61	0.64	0.55	0.67
0.97	0.88	0.86	0.54	0.79
0.95	0.92	0.77	0.48	0.68
0.99	0.97	0.83	0.98	0.53
0.81	0.75	0.86	0.43	0.72
0.23	0.61	0.89	0.85	0.71
0.18	0.61	0.97	0.79	0.77
0.2	0.62	0.88	0.84	0.81
0.23	0.61	0.73	0.53	0.86
0.24	0.65	0.89	0.94	0.86
0.18	0.61	0.93	0.95	0.84
0.19	0.61	0.88	0.91	0.78
0.98	0.77	0	0	0
0.19	0.61	0.68	0.79	0.9
0.92	0.73	0.56	0.27	0.78
0.3895	**0.6647**	**0.8044**	**0.6821**	**0.7723**

Low median household income as a percent of area median income (percentile)	Median value ($) of owner-occupied housing units (percentile)	PM2.5 in the air (percentile)	Percent individuals age 25 or over with less than high school degree	Percent of individuals < 100% Federal Poverty Line (percentile)
0	0	0.73	0	0
0.59	0.57	0.81	0.082035306	0.23
0	0	0.76	0	0
0.98	0.34	0.82	0.235806051	0.94
0.9	0.24	0.82	0.150566289	0.76
0.95	0.29	0.82	0.233815689	0.8
0.56	0.57	0.81	0.10393384	0.4
0.71	0.45	0.76	0.153636364	0.69
0.63	0.32	0.79	0.125542064	0.56
0.96	0.29	0.78	0.213406293	0.85
0.87	0.24	0.8	0.254694271	0.83
0.94	0.19	0.81	0.102162162	0.82
0.95	0.07	0.81	0.218941304	0.93
0.97	0.04	0.81	0.3	0.95
0.87	0.55	0.81	0.148383257	0.77
0.97	0.09	0.81	0.145194274	0.9
0.98	0.05	0.82	0.218065693	0.95
0.91	0.11	0.82	0.194379391	0.89
0	0	0.8	0	0
0.77	0.5	0.82	0.164379085	0.74
0.3	0.77	0.79	0.070027372	0.12
0.8106	**0.3268**	**0.8087**	**0.1725**	**0.7186**

Percent of individuals below 200% Federal Poverty Line (percentile)	Percent pre-1960s housing (lead paint indicator) (percentile)	Proximity to NPL sites (percentile)	Proximity to Risk Management Plan (RMP) facilities (percentile)	Proximity to hazardous waste sites (percentile)
0	0.01	0	0	0
0.32	0.97	0.86	0.97	0.89
0	0.01	0	0	0
0.92	0.84	0.8	0.96	0.91
0.84	0.97	0.87	0.96	0.9
0.88	0.9	0.85	0.96	0.9
0.35	0.99	0.93	0.98	0.88
0.67	0.39	0.96	0.89	0.6
0.55	0.61	0.92	0.9	0.62
0.81	0.65	0.93	0.9	0.63
0.73	0.74	0.89	0.9	0.68
0.85	0.87	0.86	0.9	0.8
0.91	0.99	0.86	0.9	0.76
0.93	0.89	0.86	0.89	0.7
0.66	0.96	0.93	0.97	0.89
0.93	0.95	0.84	0.85	0.71
0.95	0.85	0.82	0.83	0.77
0.8	0.86	0.82	0.88	0.81
0	0.01	0.93	0.92	0.79
0.83	0.98	0.94	0.96	0.89
0.21	0.6	0.86	0.98	0.85
0.7127	**0.8508**	**0.8734**	**0.9272**	**0.8046**

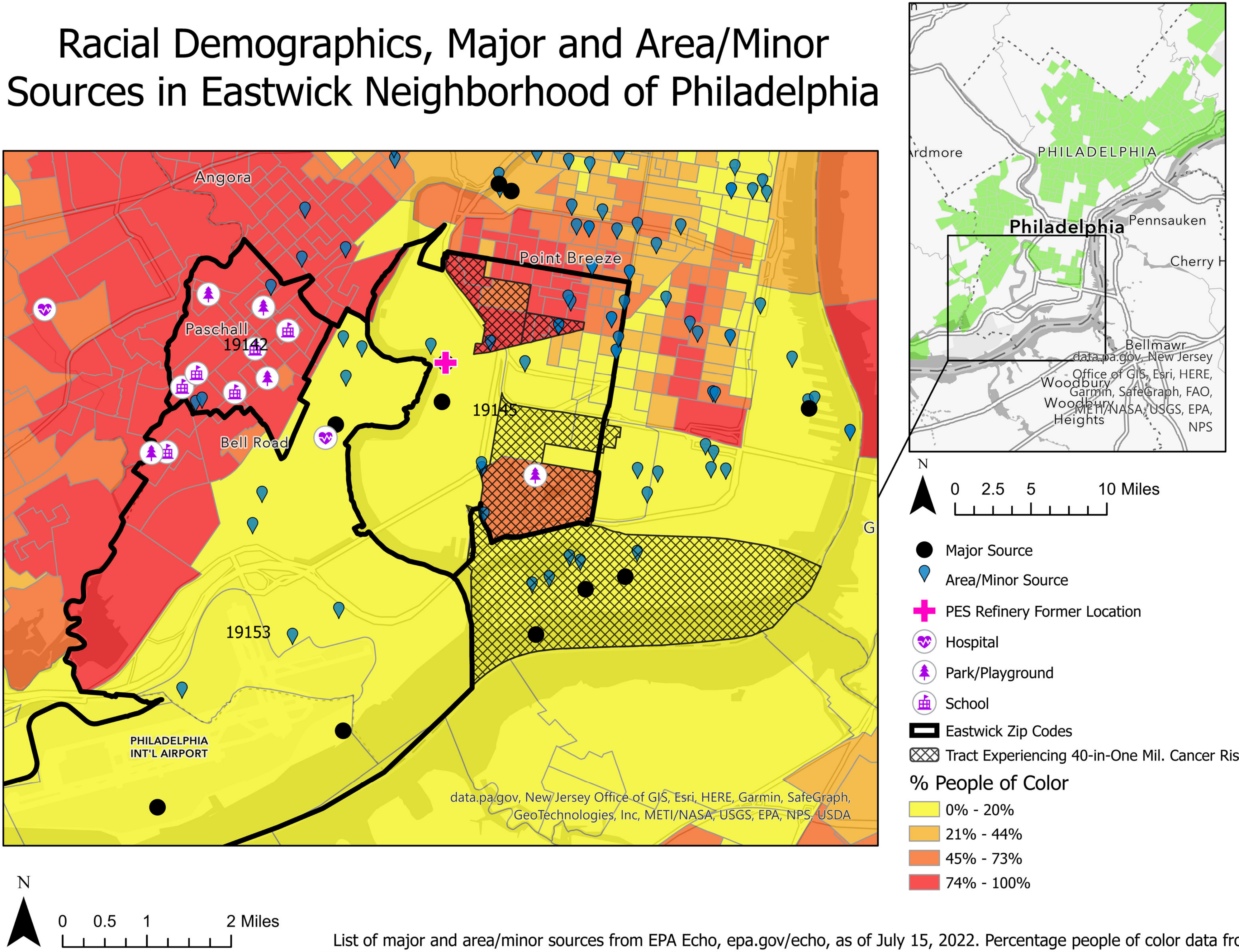
Traffic proximity and volume (percentile)	Unemployment (percent) (percentile)	Wastewater discharge (percentile)
0	0	0
0.84	0.78	0.99
0	0	0
0.96	0.96	0.99
0.74	0.96	0.99
0.85	0.94	0.99
0.92	0.72	0.99
0.77	0.76	0.11
0.74	0.71	0.11
0.77	0.93	0.09
0.76	0.71	0.98
0.77	0.88	0.99
0.62	0.93	0.99
0.73	0.98	0.99
0.8	0.79	0.99
0.81	0.89	0.98
0.69	0.92	0.99
0.79	0.9	0.99
0.97	0	0.99
0.74	0.47	0.99
0.91	0.26	0.99
0.7990	**0.7931**	**0.8944**

Justice40, Major and Area/Minor Sources in Eastwick Neighborhood of Philadelphia



List of major and area/minor sources from EPA Echo, epa.gov/echo, as of July 15, 2022.
Justice40 data from CEQ Climate and Economic Justice Screening Tool, screeningtool.geoplatform.gov.

Racial Demographics, Major and Area/Minor Sources in Eastwick Neighborhood of Philadelphia



List of major and area/minor sources from EPA Echo, epa.gov/echo, as of July 15, 2022. Percentage people of color data from EPA EJSCREEN 2020, epa.gov/ejscreen. Cancer risk data from EPA Air Toxics Screening Assessment 2017, epa.gov/AirToxScreen.

Air Toxics Hot Spots Program Risk Assessment Guidelines

Technical Support Document for Exposure Assessment and Stochastic Analysis

August 2012

Secretary for Environmental Protection
California Environmental Protection Agency
Matthew Rodriquez

Director
Office of Environmental Health Hazard Assessment
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Final

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Exposure Assessment and Stochastic Analysis

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Air Toxics "Hot Spots" Program Risk Assessment Guidelines

Technical Support Document for

Exposure Assessment and Stochastic Analysis

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Appendix E Determination of Chemicals for Multipathway Analysis

E.1 Introduction

The AB-2588 program assesses the risk from airborne chemicals that are often emitted by facilities at high temperature and pressure in the presence of particulate matter. Some of these chemicals will be emitted and remain in vapor form. The inhalation cancer risk and noncancer hazard from such volatile chemicals are likely to be much greater than the risk from other possible exposure pathways. Other chemicals, such as semi-volatile organic or metal toxicants, can either be emitted as particles, form particles after emission from the facility, or adhere to existing particles. Some chemicals will partition between the vapor and particulate phases. Some chemicals such as PAHs have been found to have a portion of the particle associated mass in reversible equilibrium with the vapor phase and a portion irreversibly bound (Eiceman and Vandiver, 1983). Chemicals in the particulate phase can be removed from the atmosphere by settling, which can be enhanced by coalescence into larger particles with greater mass.

There are a number of exposure pathways by which humans may be exposed to airborne chemicals in addition to inhalation. Particulate associated chemicals can be deposited directly onto soil, onto the leaves of crops, or onto surface waters. Crops may also be contaminated by root uptake of chemicals. Livestock such as chickens, pigs and cows may be contaminated by inhalation of such chemicals or by consumption of contaminated feed, pasture, or surface waters. Humans may be exposed to these chemicals through inhalation, consumption of crops, soil, surface waters, meat, eggs and dairy products. Infants may be exposed through consumption of human breast milk.

E.2 Criteria for Selection of Chemicals for Multipathway Analysis

Chemicals listed in Appendix A, “Substances for Which Emissions Must be Quantified” that have been previously reported to be emitted by facilities in California under the Air Toxics “Hot Spots” Act were considered as candidates for multipathway analysis. From the chemicals meeting this criteria, chemicals which had been considered in the past to be multipathway chemicals or were thought to be likely candidates were selected for further analysis. We evaluated the extent to which chemicals might be particle bound. Two models were used to determine the fraction of airborne chemical that is in the particle phase, the Junge-Pankow adsorption model and the Koa absorption model.

E.2.1 The Junge-Pankow Adsorption Model as a Means of Determining Gas-Particle Partitioning

Junge (1977) developed a theoretical model for the partitioning of the exchangeable fraction of an airborne chemical between the vapor and particulate phases in the ambient air.

$$\theta = \frac{bS^{(p)}}{P^s_L + bS^{(p)}} \qquad \textbf{(Eq. E-1)}$$

Where:

θ = fraction of the total mass of chemical on the particle phase (unitless)

b = a constant (mm Hg cm^3/cm^2)

$S^{(p)}$ = total surface area of particle per unit volume of air (cm^2/cm^3)

P^s_L = saturation pressure of the liquid chemical at ambient temperature (mm Hg)

Junge (1977) did not distinguish between solid and liquid phase vapor pressures. Pankow (1987) recognized the importance of using the liquid phase vapor pressure. When the chemical of interest is a solid at the temperature of interest, the subcooled liquid vapor pressure must be used. The subcooled liquid vapor pressure is an extrapolation of the saturated liquid vapor pressure below the melting point where the compound actually exists as solid (Boethling and McKay, 2000). The subcooled liquid vapor pressure can be estimated using the following equation:

$$P^s_L/P^s_s = \exp[\Delta S_f\,(T_m\text{-}T)/RT]/RT \qquad \textbf{(Eq. E-2)}$$

Where:

P^s_L = sub cooled liquid vapor pressure of the liquid chemical at ambient temperature (Pascal).

P^s_s = saturated vapor of the solid at room temperature

ΔS_f = entropy of fusion (J/mol K)

T_m = melting point temperature (K)

T = ambient temperature (K)

R = gas constant (8.3143 joules/K mole)

Values for ΔS_f may be obtained in the literature. In cases where a literature value is not available a default value of 56.45 has been suggested by Boethling and McKay (2000).

The percentage of the total mass of chemical (vapor plus particulate fraction) is determined by multiplying θ times 100. The percentage of the total mass of chemical that is in particulate phase is determined in part by the concentration of particles in the air. For our purposes, we used an average concentration of particles in urban air determined by Whitby (1978). The concentration of particles was 1.04 X 10^{-4} $\mu g/cm^3$. The surface area per μg of particle was assumed to be 0.05 $cm^2/\mu g$. Thus the $S^{(p)}$ is calculated to be 5.2 X 10^{-6} cm^2/cm^3. The value of b used is the default value of 0.1292 mm Hg cm^3/cm^2 recommended by Pankow (1987).

It should be noted that the particle bound associated fraction of some semi-volatile organic toxicants has been found to consist of a non-exchangeable fraction and a fraction which equilibrates with the vapor phase (Bidleman and Foreman, 1987). The equation of Junge (1977) only addresses the exchangeable fraction. This means that the actual fraction of the total mass that is particle bound material may be somewhat higher than the theoretical model which Junge (1977) proposed. The partitioning of semi-volatile organic toxicants between the vapor phase and particles has been experimentally investigated by Bidleman et al. (1986) and Bidleman and Foreman (1987). High volume sampling has been done in several cities in which the particulate and vapor fractions have been collected on filters and adsorbents. This work has supported the validity of the theoretical model of Junge (1977).

The Junge (1977) and Pankow (1987) model appears to be a reasonable model to determine which chemicals emitted by facilities in the AB-2588 program should undergo multipathway analysis. The liquid or subcooled liquid vapor pressure at ambient temperatures determines the fraction of chemical that will be particle associated. The vapor pressure is available for most of the chemicals for which the determination needs to be made.

It should be noted that the Junge (1977) model was designed to look at the partitioning of chemicals between the particle and vapor phases under equilibrium conditions in the atmosphere. The initial conditions under which particle formation may occur as chemicals are emitted into the atmosphere may be different from the conditions assumed by Junge (1977). The chemicals of concern in the AB-2588 program may be emitted at high temperatures and pressures in the presence of a high concentration of particulate matter. Such conditions may favor partitioning of mass toward the particulate fraction. It is also possible that such conditions might favor the formation of a greater fraction of non-exchangeable particle associated chemical which is not taken into account in the Junge (1977) equation. The rapid cooling from high temperature to ambient temperature may also influence the percent of total mass which is particle bound in ways that are not accounted for in the simple equilibrium model of Junge (1977).

E.2.2 The Octanol-Water Partition Coefficient as a Means of Determining Gas-Particle Partitioning

In the past 15 years, there have been advances in the understanding of the partitioning of semi-volatile organic compounds between the gas phase and the organic condensed phase on airborne particles, using the octanol-water partition coefficient as a predictor of gas particle partitioning in the environment. Because the equation for estimating partitioning involves the octanol/air partition coefficient (K_{OA}), this model is referred to as the K_{OA} absorption model, while the Junge-Pankow is known as an adsorption model. Several studies have described the octanol/air partition coefficients for chlorobenzenes, PCBs, DDT, PAHs and polychlorinated naphthalenes (PCNs) (Harner and MacKay, 1995; Komp and McLachlan, 1997; Harner and Bidleman, 1998).

K_{OA} is defined as $K_{OA} = C_o/C_A$, where C_o (mol/L) is the concentration of the compound in 1-octanol and C_A (mol/L) is the gaseous concentration at equilibrium. For the calculation, K_{OA} can be derived as $K_{OA} = K_{OW}/K_{AW} = K_{OW}RT/H$, where K_{OW} is the octanol/water partition coefficient, K_{AW} is the air/water partition coefficient, H is the Henry's Law constant (J/mol), R is the ideal gas constant (J/mol/K), and T is the absolute temperature (degrees K) (Komp and McLachlan, 1997).

The particle/gas partition coefficient (K_P) is defined as $K_P = C_p/C_g$, where C_p is the concentration on particles (ng/µg of particles), and C_g is the gas-phase concentration (ng/m^3 of air) (Harner and Bidleman, 1998). The relation between K_P and K_{OA} is defined as:

$$\log K_P = \log K_{OA} + \log f_{om} - 11.91 \quad \textbf{(Eq. E-3)}$$

where, f_{om} = organic matter fraction of the particles.

The fraction (ø) of compound in the particle phase is

$$ø = K_P (TSP) / [1 + K_P (TSP)] \quad \textbf{(Eq. E-4)}$$

where, TSP = total suspended particle concentration.

Using f_{om} = 20% (Harner and Bidleman, 1998) and the afore-mentioned average concentration of particles in urban air determined by Whitby (1978), TSP = 1.04 x 10^{-4} μg/cm^3 = 104 μg/m^3 , we obtained the percentage of compound on particles (ø x 100) for selected chemicals through the K_{OA} absorption model, presented as the last column in Table E.1 below. For many chemicals, the values compare well with those obtained with the Junge-Pankow adsorption model.

A number of studies have been published which evaluated gas-particle partitioning in the urban environment under equilibrium conditions where there were existing particles from a variety of sources (e.g. diesel exhaust, road dust). Existing particles are thought to have a lipid bilayer into which gaseous chemicals can equilibrate. There is some question whether chemicals emitted from a stack would have time to interact with existing urban particles before reaching nearby receptors. Also, in some cases particulate matter in the air around facilities may not be present in very high concentrations.

E.3 Fraction in particle phase to be considered for multipathway analysis

OEHHA has decided that if either the Koa model or the Junge-Pankow model shows a chemical as $\geq$ 0.5% particle-bound, we will consider it for multipathway assessment. The 0.5% is a relatively small percentage of the total mass. This percentage was chosen in part to compensate for the uncertainties involved in extrapolation of the Junge (1977) model to the conditions under which particles may be formed in the stacks of facilities. Thus chemicals with vapor pressures greater than 1.34×10^{-4} mm Hg at 25° C will not be considered for multipathway analysis. An exception to this rule is the inclusion of hexachlorobenzene (HCB) for multipathway analysis, even though its calculated percentage of total mass in the particulate phase is expected to be below 0.5%. The criteria for including HCB are discussed in Section E.3 below. It should be noted that the chemicals for which noninhalation pathway risks are a significant fraction of the total risk are metals, PAH's, PCB's, polychlorinated dibenzo-p-dioxins and furans. These chemicals have much higher percentages of total mass in the particulate fraction than 0.5%.

There are some toxic compounds without measurable vapor pressure at 25°C such as the metals and their compounds. These metals include lead, mercury compounds, nickel, selenium, fluoride, beryllium, arsenic, chromium VI and cadmium. These toxicants are included on the list of chemicals for multipathway analysis.

In Table E.1 we have calculated the air/particle partition coefficients of the compounds emitted by facilities for which it appeared possible that a significant fraction of the total mass could be in the particulate fraction. In cases where the saturated vapor pressure at a temperature at or near ambient temperature (25°C) is not available; the air/particle coefficient can be calculated using modern tools such as USEPA's SPARC.

For PAHs, consideration for multipathway analysis is largely confined to PAHs with 4 or more fused rings because a significant fraction of their total mass is in the particle phase. Naphthalene contains 2 fused rings and is included in the Hot Spots program as a carcinogen. However, it does not have a significant percentage of its total mass in the particle phase, so is not considered for multipathway analysis. The PAHs with 3 fused rings (e.g., phenanthrene, fluorine, acenaphthene) are also predominantly found in gaseous form and the data are currently too limited or inadequate to list any of them as carcinogens. Laboratory studies of sludge-amended soils containing PAHs have also shown significant loss through volatilization only for PAHs with less than 4 fused rings (Wild and Jones, 1993). Thus, speciated analysis for PAHs that include only the compounds with 4 or more fused rings can be used for multipathway assessment.

Table E1 Calculation of Air/Particle Coefficients and Percent of Particle Associated Total Mass for Selected Chemicals.

Chemical	Vapor Pressure (mm Hg)	Temp. (°C)	Ref. (Vapor Press.)	Air/Particle Partition Coefficient (θ)	% Particle Phase	
					Junge-Pankow model	K_{OA} model
4,4-Methylene dianiline	1.0	197	1	NA	NA	31.5
o-Cresol	0.28*	38.2,	2	2.44×10^{-6}	2.44×10^{-4}	4.65×10^{-3}
m-Cresol	0.39**	25	2	1.71×10^{-6}	1.71×10^{-4}	6.64×10^{-3}
p-Cresol	0.37**	25	2	1.81×10^{-6}	1.81×10^{-4}	5.45×10^{-3}
Cellosolve	5.63***	25	3	1.19×10^{-7}	1.19×10^{-5}	6.38×10^{-5}
Cellosolve acetate	2.12***	25	3	3.17×10^{-7}	3.19×10^{-5}	3.40×10^{-5}
Mercury (elemental)	1.20×10^{-3}***	25	4	5.6×10^{-4}	0.056	NA****
Hexachlorocyclo-hexanes (Lindane)	1.18×10^{-4}**	20	5	5.66×10^{-3}	0.57	6.39×10^{-2}
Phthalates						
Diethylhexylphthalate	1.97×10^{-7}***	25	3	7.73×10^{-1}	77.3	98.9
Chlorobenzenes						
Chlorobenzene	12.2***	25	6	5.53×10^{-8}	5.53×10^{-6}	1.09×10^{-5}
p-Dichlorobenzene	0.65***	25	6	1.03×10^{-6}	9.93×10^{-5}	9.96×10^{-5}
m-Dichlorobenzene	2.30***	25	6	1.03×10^{-6}	1.03×10^{-4}	4.24×10^{-5}
o-Dichlorobenzene	0.39***	25	6	1.71×10^{-6}	1.71×10^{-4}	6.53×10^{-5}
1,2,3-Trichlorobenzene	0.39*	40	6	1.71×10^{-6}	1.71×10^{-4}	3.30×10^{-4}
1,2,4-Trichlorobenzene	0.45*	38	6	1.48×10^{-6}	1.48×10^{-6}	2.88×10^{-4}
1,2,3,4-Tetrachloro-benzene	6.58×10^{-2}*		6	1.02×10^{-5}	1.02×10^{-3}	1.39×10^{-3}
1,2,3,5-Tetrachloro-benzene	0.14*		6	4.82×10^{-6}	4.82×10^{-4}	3.41×0^{-4}
Pentachlorobenzene	6.67×10^{-3}*	25	6	1.01×10^{-4}	1.01×10^{-2}	7.36×10^{-3}
Hexachlorobenzene	2.96×10^{-4}*	25	6	2.96×10^{-4}	2.96×10^{-2}	1.53×10^{-2}

Table E1 Calculation of Air/Particle Coefficients and Percent of Particle Associated Total Mass for Selected Chemicals.

Chemical	Vapor Pressure (mm Hg)	Temp. (°C)	Ref. (Vapor Press.)	Air/Particle Partition Coefficient (θ)	% Particle Phase	
					Junge-Pankow model	K_{OA} model
PAHs						
Naphthalene (2 fused rings)	0.31*	25	7	2.14×10^{-6}	2.14×10^{-4}	3.46×10^{-4}
Acenaphthene (3 fused rings)	3.02×10^{-3}*	25	7	2.23×10^{-5}	2.23×10^{-3}	4.34×10^{-3}
Acenaphthylene (3 fused rings)	6.67×10^{-3}	25	7	1.00×10^{-4}	0.01	7.55×10^{-3}
Anthracene (3 fused rings)	4.2×10^{-6}*	25	7	1.57×10^{-2}	1.57	6.78×10^{-2}
Benzo[a]anthracene (4 fused rings)	4.07×10^{-6}*	25	7	1.42×10^{-1}	14.2	8.15
Chrysene (4 fused rings)	8.81×10^{-8}**	25	7	8.84×10^{-1}	88.4	4.82×10^{-5}
Benzo[a]pyrene (5 fused rings)	9.23×10^{-8}	25	7	8.79×10^{-1}	87.9	60.2
Benzo[b]fluoranthene (5 fused rings)	1.59×10^{-7}	25	7	8.09×10^{-1}	80.9	NA****
Benzo[k]fluoranthene (5 fused rings)	3.7×10^{-8}*	25	7	9.48×10^{-1}	94.8	79.9
Dibenz[a,h]-anthracene (5 fused rings)	6.07×10^{-11}**	25	7	1.00×10^{0}	100	NA****
Indeno[1,2,3cd]-pyrene (6 fused rings)	1.19×10^{-9}**	25	8	9.98×10^{-1}	99.8	NA****
Chlorophenols						
Pentachlorophenol	1.73×10^{-3}*	25	2	3.88×10^{-4}	3.88×10^{-2}	76.9
2,4,6-Trichlorophenol	2.8×10^{-02}*	25	2	2.34×10^{-5}	2.34×10^{-3}	NA****
2,4,5-Trichlorophenol	4.59×10^{-02}*	25	2	1.46×10^{-5}	1.46×10^{-3}	NA****
Nitrosoamines						
N-Nitrosodiethylamine	8.60×10^{-1}***	20	1	7.81×10^{-7}	7.81×10^{-5}	2.67×10^{-5}
N-Nitroso-dimethylamine	8.1***	20	2	8.29×10^{-8}	8.29×10^{-6}	NA****
N-Nitroso-diphenylamine	4.12×10^{2}**	25	2	1.63×10^{-9}	1.63×10^{-7}	NA****
N-Nitrosodi-n-butylamine	3.0×10^{-2}***	20	9	2.24×10^{-5}	2.24×10^{-3}	NA****
N-Nitrosodi-n-propylamine	4.15×10^{-1}***	20	2	1.62×10^{-6}	1.62×10^{-4}	2.75×10^{-4}
N-Nintrosopyrrolidine	7.2×10^{-02}***	20	9	9.2×10^{-6}	9.2×10^{-4}	NA****

Table E1 Calculation of Air/Particle Coefficients and Percent of Particle Associated Total Mass for Selected Chemicals.

Chemical	Vapor Pressure (mm Hg)	Temp. (°C)	Ref. (Vapor Press.)	Air/Particle Partition Coefficient (θ)	% Particle Phase	
					Junge-Pankow model	K_{OA} model
PCBs						
Aroclor 1016	1.50×10^{-3}*	25	6	4.48×10^{-4}	4.48×10^{-2}	1.63×10^{-3}
Aroclor 1221	1.50×10^{-2}*	25	6	4.48×10^{-5}	4.48×10^{-3}	6.53×10^{-4}
Aroclor 1232	4.05×10^{-3}***	25	6	1.66×10^{-4}	0.17	2.84×10^{-3}
Aroclor 1242	4.13×10^{-4}***	25	6	1.63×10^{-4}	0.16	1.13×10^{-2}
Aroclor 1248	3.33×10^{-4}***	25	6	1.66×10^{-3}	0.17	5.17×10^{-2}
Aroclor 1254	7.73×10^{-5}***	25	6	8.62×10^{-3}	0.86	0.142
Aroclor 1260	4.40×10^{-6}***	25	6	1.32×10^{-1}	13.2	1.23
Dioxins and Furans						
2,3,7,8 Tetrachloro-dibenzo-p-dioxin	4.5×10^{-7}*	20	7	5.97×10^{-1}	59.7	10.7
2,3,7,8 Tetrachloro-dibenzofuran	9.21×10^{-7}*	25	7	9.97×10^{-1}	99.7	5.18
1,2,3,4,7 Pentachloro-dibenzodioxin	5.9×10^{-7}**	25	7	5.42×10^{-1}	54.2	85.7
2,3,4,7,8 Pentachloro-dibenzofuran	1.63×10^{-7}*	25	7	4.22×10^{-1}	42.2	28.4
1,2,3,4,7,8 Hexachlorodibenzo-p-dioxin	5.89×10^{-9}*	25	7	9.17×10^{-1}	91.7	78.7
1,2,3,4,7,8 Hexachloro-dibenzofuran	6.07×10^{-8}*	25	7	9.89×10^{-1}	98.9	30.4
1,2,3,4,6,7,8 Heptachlorodibenzo-p-dioxin	7.68×10^{-9}*	25	7	9.76×10^{-1}	97.6	83.3
1,2,3,4,6,7,8 Heptachloro-dibenzofuran	1.68×10^{-8}*	25	7	9.76×10^{-1}	97.6	52.8
1,2,3,4,7,8,9 Heptachloro-dibenzofuran	9.79×10^{-9}*	25	7	9.87×10^{-1}	98.7	NA****
1,2,3,4,5,6,7,8 Octachloro-dibenzofuran	1.95×10^{-9}*	25	7	9.97×10^{-1}	99.7	97.1

Table E1 Calculation of Air/Particle Coefficients and Percent of Particle Associated Total Mass for Selected Chemicals.

Chemical	Vapor Pressure (mm Hg)	Temp. (°C)	Ref. (Vapor Press.)	Air/Particle Partition Coefficient (θ)	% Particle Phase	
					Junge-Pankow model	K_{OA} model
1,2,3,4,5,6,7,8 Octachlorodibenzo-p-dioxin	$2.08x10^{-9}$*	25	7	$9.97x10^{-1}$	99.7	93.6

1. IARC, 1986;
2. McKay et al. 1992a;
3. McKone et al., 1993;
4. Cohen et al., 1994;
5. ATSDR, 2005;
6. McKay et al., 1992b;
7. McKay et al., 1992c;
8. Montgomery and Welkom, 1990;
9. Klein, 1982

*Indicates subcooled liquid vapor pressure
**Indicates subcooled liquid vapor pressure estimated according to Boethling and McKay, 2000, page 238.
***Indicates Psat liquid (substance is a liquid at 25 °C)
****Not available because Kow and/or Henry's Law constant not found

For the nitrosamines, we were not able to locate saturated vapor pressures for N-nitrosomethylethylamine, N-nitrosomorpholine, and N-nitrosopiperidine. We were able to find saturated vapor pressures for N-nitrosodiethylamine, N-nitrosdimethylamine, N-nitrosodiphenylamine, N-nitrosodi-n-butylamine, N-nitrosodi-n-propylamine and N-nitrosopyrrolidine. None of these compounds had particle associated percentages above 0.5%. N-nitrosopyrrolidine was structurally similar to N-nitrosomorpholine and N-nitrosopiperidine. N-nitrosopyrrolidine has a particle associated percentage of 9.2×10^{-4}. This is well below the 0.5% that we selected as our cutoff. We therefore felt that N-nitrosomorpholine and N-nitrosopiperidine were unlikely to have a particle bound percentage above 0.5% and thus we excluded these compounds from multipathway consideration. N-nitrosomethylethylamine did not appear likely to have a particle bound percentage above N-nitrosodiethylamine, N-nitrosodimethylamine or N-nitrosodi-n-butylamine. All of these nitrosamines are well below the 0.5% cutoff.

Table E2. Chemicals for Which Multipathway Risks Need to be assessed.

4,4'-methylene dianiline[1]

creosotes

diethylhexylphthalate

hexachlorobenzene

hexachlorocyclohexanes

pentachlorophenol

PAHs (including but not limited to the following:)[2]

- benz[a]anthracene
- benzo[b]fluoranthene
- benzo[j]fluoranthene
- benzo[k]fluoranthene
- benzo[a]pyrene
- dibenz[a,h]acridine
- dibenz[a,j]acridine
- 7H-dibenzo[c,g]carbazole
- 7,12-dimethylbenz[a]anthracene
- 3-methylcholanthrene
- 5-methylchrysene
- dibenz[a,h]anthracene
- dibenzo[a,e]pyrene
- dibenzo[a,h]pyrene
- dibenzo[a,i]pyrene
- dibenzo[a,l]pyrene
- chrysene
- indeno[1,2,3-cd]pyrene

PCBs[3]

Polychlorinated dibenzo-p-dioxins {PCDDs} (including but not limited to the following, but excluding dioxins with less than four chlorines:)[4]

- 2,3,7,8 tetrachlorodibenzo-p-dioxin
- 1,2,3,7,8 pentachloro-p-dioxin
- 1,2,3,4,7,8 hexachlorodibenzo-p-dioxin
- 1,2,3,6,7,8 hexachlorodibenzo-p-dioxin
- 1,2,3,7,8,9 hexachlorodibenzo-p-dioxin
- 1,2,3,4,6,7,8 heptachlorodibenzo-p-dioxin
- 1,2,3,4,5,6,7,8 Octachlorodibenzo-p-dioxin

Table E2. Chemicals for Which Multipathway Risks Need to be Assessed (Cont.).

Polychlorinated dibenzofurans {PCDFs} (including but not limited to the following, but excluding dibenzofurans with less than four chlorines:)[4]

- 2,3,7,8 tetrachlorodibenzofuran
- 1,2,3,7,8 pentachlorodibenzofuran
- 2,3,4,7,8 pentachlorodibenzofuran
- 1,2,3,4,7,8 hexachlorodibenzofuran
- 1,2,3,6,7,8 hexachlorodibenzofuran
- 1,2,3,7,8,9 hexachlorodibenzofuran
- 2,3,4,6,7,8 hexachlorodibenzofuran
- 1,2,3,4,6,7,8 heptachlorodibenzofuran
- 1,2,3,4,7,8,9 heptachlorodibenzofuran
- 1,2,3,4,5,6,7,8 Octachlorodibenzofuran

Metals, semi-metals and inorganic compounds

- arsenic and arsenic compounds
- beryllium and beryllium compounds
- cadmium and cadmium compounds
- soluble compounds of chromium VI
- fluoride and soluble fluoride compounds
- lead and inorganic lead compounds
- inorganic mercury compounds
- nickel and nickel compounds
- selenium and selenium compounds

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[1] The saturated vapor pressure at 25°C or close to 25°C is not available to our knowledge. The other evidence available, a melting point of 91.5°C and a boiling point of 398-399 °C (Merck, 1989) indicate that it is very likely that a very significant fraction of the chemical emitted into the air would be in the particulate phase. In addition the vapor pressure at 197 °C is only 1 mm (IARC, 1986).

[2] PAHs with three or more fused rings (Table E2) are to be assessed for multipathway analysis. If PAH mixtures are reported instead of speciated PAHs, then the cancer potency of the entire mixture should be treated the same as benzo(a)pyrene.

[3] PCBs is inclusive of all Aroclor mixtures. The information in Table E1 indicates that some of the Aroclor mixtures do not have significant air/particle coefficients. However, it is difficult to determine vapor pressures on mixtures of compounds. OEHHA therefore is proposing to include all of the Aroclors in the list of chemicals for multipathway analysis. The percentage of some individual PCBs in the particulate phase has been measured in air samples (Horstmann and McLachlan, 1998). The particulate phase of tetrachlorinated PCBs (PCB 152) can be expected to be around 1.4%, and increasing to 11.3% for the heptachlorinated PCBs (PCB 180)

[4] From OEHHA analysis (Table E1), it is clear that all polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans should be included in the multipathway analysis.

Table E3 Specific Pathways to be Analyzed for Multipathway Chemicals

Chemical	Soil Ingestion.	Dermal	Meat, Milk & Egg Ingest	Fish Ingestion	Exposed Veg. Ingest.	Leafy Veg. Ingest.	Protected. Veg. Ingest.	Root Veg. Ingest.	Water Ingest	Breast Milk Ingestion.
4,4'-methylene dianiline	X	X			X	X			X	
Creosotes	X	X	X	X	X	X			X	
Diethylhexylphthalate	X	X	X	X	X	X			X	
Hexachlorocyclohexanes	X	X	X	X	X	X			X	
Hexachlorobenzene	X	X	X	X	X	X			X	
PAHs	X	X	X	X	X	X			X	X
PCBs	X	X	X	X	X	X			X	X
Pentachlorophenol[a]										
Dioxins & furans	X	X	X	X	X	X			X	X
Inorganic arsenic & cmpds	X	X	X	X	X	X	X	X	X	
Beryllium & compounds	X	X	X	X	X	X	X	X	X	
Cadmium & compounds	X	X	X	X	X	X	X	X	X	
Chromium VI & cmpds	X	X	X[b]	X	X	X	X	X	X	
Lead & compounds	X	X	X	X	X	X	X	X	X	X
Inorganic mercury cmpds	X	X	X	X	X	X	X	X	X	
Nickel & compounds	X	X	X	X	X	X	X	X	X	
Fluoride & compounds	X	X	X		X	X	X	X	X	
Selenium and cmpds	X	X	X	X	X	X	X	X	X	

[a] To be assessed by pathway
[b] Cow's milk only. No multipathway analysis for meat and egg ingestion

OEHHA is recommending that all of the chemicals chosen for multipathway analysis be included in the soil ingestion and dermal pathways. The soil t1/2 values needed to determine concentration in the soil are found in Appendix G. The variates need for the dermal pathway are found in Chapter 6 and Appendix F.

The meat (beef, chicken, pork), cow's milk and egg pathways are listed in one column because the lipid solubility and half-life in the body are common factors which determine if these compounds will be present in these three pathways in appreciable concentrations in the fat of meat, milk and eggs.

E.4 Evidence for Inclusion of Hexachlorobenzene for Multipathway Assessment

In the previous Hot Spots Guidance document, semi-volatile substances with less than 0.5% of their total mass in the particle-associated fraction was not considered for multipathway analysis. Although this is a reasonable cut-off for semi-volatile substances predominantly in the gas phase, an exception is made for hexachlorobenzene (HCB). From Table E1, the Junge model shows HCB with a particle/gas ratio of only 0.0296% at 25 ^{o}C. Normally, this would exclude HCB from multipathway analysis. However, actual field measurements of the air/particle partitioning of HCB in Table E.4 shows that the compound is often found in particle form above 0.5%.

The greater than expected particle fraction for HCB is a likely result of environmental conditions at the locations assessed for HCB. The adsorption of HCB on aerosols and subsequent deposition depends on the vapor pressure, the amount and surface area of aerosol particles, and the relevant environmental temperature (Ballschmiter and Wittlinger, 1991). Colder temperatures and greater airborne particulate levels would increase the particle/gas ratio of HCB. In fact, Ballschmiter and Wittlinger (1991) suggested that the particle fraction found at -8 ^{o}C (3.5%) in a rural region will be similar to the particle fraction in urban areas with higher particulate levels and an air temperature of 15 ^{o}C.

Table E.4. Field study vapor/particle distributions of HCB

Study	**Particle fraction Concentration (% particle)**	**Gas phase Concentration (% gas)**
Popp et al., 2000[a]		
Leipzig area	0.8 pg/Nm^3 (0.9%)	83.1 pg/Nm^3 (99.1%)
Roitzsch area	0.5 pg/Nm^3 (0.3%)	145.6 pg/Nm^3 (99.7%)
Greppin area	2.6 pg/Nm^3 (0.9%)	280.6 pg/Nm^3 (99.1%)
Horstmann and McLachlan, (1998)[b]	0.43 pg/m^3 (0.2%)	210 pg/m^3 (99.8%)
Lane et al., 1992[c]		
Turkey lake	3 pg/m^3 (4.1%)	71 pg/m^3 (95.9%)
Pt. Petre	2 pg/m^3 (2.8%)	69 pg/m^3 (97.2%)
Ballschmiter and Wittlinger, 1991[d]	4 pg/m^3 (3.5%)	110 pg/m^3 (96.5%)
Bidleman et al., 1987[e]		
20 ^{o}C	(nd)[f] (0.1%)	(nd) (99.9%)
0 ^{o}C	(nd) (0.7%)	(nd) (99.3%)

[a] Air samples collected near chlorobenzene-contaminated sites of Bitterfeld region in Germany over a two-week period during the summer of 1998.
[b] Air samples collected over one year in a forest clearing in Germany from May 1995 to April 1996.
[c] Air samples collected during spring, summer, and fall of 1987 in rural regions of Ontario, Canada.
[d] Air sample taken at a mean ambient temperature of -8 ^{o}C outside a small village near a major road in Germany
[e] Data collected from Stockholm, Denver and Columbia. Vapor phase component possibly overestimated due to volatilization (blowoff) from the particle phase in the sampler.
[f] No concentration data was provided.

In addition, Foreman and Bidleman (1987) have suggested that field measurements of HCB particle fractions may be greater than in laboratory settings because sources in the environment includes combustion-derived HCB particle incorporation. Similar to dioxins, combustion of organic material that includes chlorinated substances has been suggested as a primary source of HCB.

Nevertheless, the minor particle fraction of the HCB results in Table E.4 may still not be sufficient to support a multipathway analysis. However, when the extreme environmental persistence of this compound relative to other predominantly gaseous semi-volatile substances (i.e., nitrosamines and chlorophenols) is taken into account, it appears that even a fraction of the compound depositing in the particle bound phase could result in measurable levels in sediment and soil with possible accumulation over time. Field studies at Lake Superior, a relatively pristine water body in which organics deposit primarily from atmospheric sources, have found that HCB accumulated in water, sediment and fish tissue samples (Eisenreich et al., 1981). In particular, the strong retention of HCB to sediment particulates in the water allowed much of the historical burden to become immobilized in bottom sediments, with a concomitant reduction in the levels of HCB found in the surface waters.

More evidence for HCB's persistence in soil was observed in a laboratory study. Arial application of HCB in a greenhouse with simulated pasture conditions showed that HCB volatilized fairly rapidly from plant and soil surfaces (Beall, 1976). Only 3.4% of HCB remained in the top 2 cm of soil 19 months after spraying. Residues on the grass grown in the soil volatilized considerably faster, with only 1.5% remaining on the plants after two weeks, and <0.01% at 19 months. However, no significant reduction in HCB was found in the deeper 2-4 cm layer of soil after 19 months, showing HCB to be persistent within the soil, including a resistance to microbial degradation and leaching. The immobilization of HCB within the soil is due to its high Kow, leading to strong adsorption to the soil organic fraction.

E.5 Summary

The theoretical model of Junge (1977) uses the liquid or subcooled liquid vapor pressure to determine the percentage of the total airborne mass of chemical that is particulate. The Koa model uses the octanol-water coefficient as a predictor of gas particle partitioning in the environment. Chemicals with 0.5% of the total mass or more in the particulate fraction at 25°C by either model are considered for multipathway analysis by OEHHA. A list of multipathway chemicals for the AB-2588 program is provided in Table E2. The percentage of the total mass in the particulate phase and the air/particle partition coefficients for these chemicals and a few other selected chemicals are presented in Table E1.

E.6 References

ATSDR, (2005). Toxicological Profile for Hexachlorocylcohexanes. US Department of Health and Human Services, Agency for Toxic Substances and Disease Registry: Atlanta, GA. (as cited by the Intermedia Transport Predictor software developed for the California Air Resources Board by Yorem Cohen, Arthur Winer and Robert Van de Water, UCLA.)

Ballschmiter K, Wittlinger R. (1991). Interhemisphere exchange of hexachlorocyclohexanes, hexachlorobenzene, polychlorobipheneyls, and 1,1-trichloro 2,2-bis(p-chlorolophenyl)ethane in the lower troposphere. Environ Sci Technol 25(6):1103-1111.

Beall ML Jr. (1976). Persistence of aerially applied hexachlorobenzene on grass and soil. J Environ Qual 5:367-369.

Bidleman, T F (1986). Vapor-particle partitioning of semivolatile organic compounds: Estimates from field collections. Environ. Sci. Technol. 20:1038-1043.

Bidleman, T F, Foreman, W T (1987). Vapor-particle partitioning of semivolatile organic compounds. in Sources and Fates of Aquatic Pollutants, Hites, R.A. and Eisenreich, S.J., eds., American Chemical Society: Washington DC, pp 27-56.

Bidleman T F, Idleman, TF, Wideqvist U, Jansson B, Soderlund R. (1987). Organochlorine Pesticides and polychlorinated biphenyls biphenyls in the atomosphere of southern Sweden. Atmos Environ 21 (3):641-654.

Boethling R, McKay D (2000) Handbook of Property Estimation Methods for Chemicals, Environmental Health Sciences, Lewis: Boca Raton

Budavari S, ed. The Merck Index Encyclopedia of Chemicals, Drugs and Biologicals, N.J., Merck and Co. Inc., Rahway, N.J., p469, 1989.

Cohen Y, Winer A M, Creelman L, Stein E, Kwan A, Chu, J (1994). Development of Intermedia Transfer Factors for Toxic Air Pollutants, California Air Resources Board Contract No. A032-170, vol I-VII.

Eiceman G A, Vandiver V J (1983). Adsorption of polycyclic aromatic hydrocarbons on fly ash from a municipal incinerator and a coal-fired plant. Atmos. Environ. 17: 461-465.

Eisenreich S J, Looney B B, Thornton J D. (1981). Airborne organic contaminants in the Great Lakes ecosystem. Environ Sci Tech 15(1):30-38.

Forman WT, Bidleman TF (1987). An experimental system for investigating vapor-particle partitioning of trace organic pollutants. Environ Sci Technol.; 21 (9):869-875.

Harner T, Bidleman TF (1998). Octanol-air partition coefficient for describing particle/gas partitioning of aromatic compounds in urban air. Environ. Sci. Technol.; 32(10):1494-1502

Harner T, MacKay D (1995). Measurement of octanol-air partition coefficients for Chlorobenzenes, PCBs, and DDT. Environ. Sci. Technol.; 29(6):1599-1606

Hortsmann M, McLachlan M S (1998). Atmos deposition of semivolatile organic compounds to two forest canopies. Atmos. Environ.; 32(10):1799-1809.

IARC (1986). Monographs on the Evaluation of the Carcinogenic Risk or Chemicals to Man. World Health Organization, International Agency for Research on Cancer: Geneva. 1972 - present. (multivolume work) 39:348. (as cited by the Intermedia Transport Predictor software developed for the California Air Resources Board by Yorem Cohen, Arthur Winer and Robert Van de Water, UCLA.).

IARC (1986).Monographs on the Evaluation of the Carcinogenic Risk or Chemicals to Man. Geneva: World Health Organization, International Agency for Research on Cancer, 1972-Present, V. 39, p. 348.

Junge, C. E. (1977). Basic considerations about trace constituents in the atmosphere as related to the fate of global pollutants. in Fate of Pollutants in the Air and Water Environments Part 1, Mechanism of Interaction Between Environments and Mathematical Modeling and The Physical Fate of Pollutants, Volume 8 Advances in Environmental Science and Technology., Suffet, I. H. ed., John Wiley and Sons: New York., pp 1-25.

Klein RG (1982). Toxicol. 23:135-48. (as cited by the Hazardous Substances Data Bank, National Library of Medicine, October, 1996)

Komp P, McLachlan MS (1997). Octanol/air partitioning of Polychlorinated Biphenyls. Environ Toxicol Chem.; 16(12):2433-2437

Lane DA, Johnson ND, Hanely MJ, et al. (1992). Gas-and particle-phase concentrations of alpha-hexachlorocyclohexane, gamma-hexachlorocyclohexane, and hexachlorobenzene in Ontario air. Environ Sci Technol 26(1):126-133.

Mckay, D., Shiu W-Y., and Ma K-C (1992). Illustrated Handbook of Physical-Chemical Properties and Environmental Fate for Organic Chemicals, Volume IV Oxygen, Nitrogen, and Sulfur Containing Compounds. CRC Lewis: Boca Raton,

Mckay D, Shiu Y-W, Ma K-C (1992) Illustrated Handbook of Physical-Chemical Properties and Environmental Fate for Organic Chemicals: Monoaromatic Hydrocarbons, Chlorobenzenes and PCBs Vol. 1. Lewis Publishers: Chelsea, MI.

Mckay D, Shiu W-Y and Ma K-C (1992). Illustrated Handbook of Physical-Chemical Properties and Environmental Fate for Organic Chemicals: Polynuclear Aromatic Hydrocarbons, Polychlorinated Dioxins and Dibenzofurans, Vol. 3. Lewis Publishers: Chelsea, MI.

McKone TE, Daniels JI, Chiao FF, Hsieh DPH (1993) Intermedia Transfer Factors for Fifteen Toxic Pollutants Released in Air Basins in California. California Air Resources Board, Report No. UCRL-CR-115620. (as cited by the Intermedia Transport Predictor software developed for the California Air Resources Board by Yorem Cohen, Arthur Winer and Robert Van de Water, UCLA.)

Montgomery JH, Welkom LM (1990) Groundwater Chemicals Desk Reference. Lewis Publishers: Chelsea, MI. (as cited by the Intermedia Transport Predictor software developed for the California Air Resources Board by Yorem Cohen, Arthur Winer and Robert Van de Water, UCLA.)

Pankow, JF (1987). Review and comparative analysis of the theories on partitioning between the gas and aerosol phases in the atmosphere. Atmos. Environ. 21: 2275-2284.

Popp P, Brüggemann L, Keil P, Thuss U, Weiss H. 2000. Chlorobenzenes and hexachlorocyclohexanes (HCHs) in the atmosphere of Bitterfeld and Leipzig (Germany). Chemosphere. 41(6):849-55.

Whitby, K T (1978). The physical characteristics of sulfur aerosols. Atmos. Environ. 12: 135-159.

Wild, SR, Jones, K.C. 1993. Biological losses of polynuclear aromatic hydrocarbons (PAHs) from soils freshly amended with sewage sludge. Environ Toxicol Chem 12:5-12.

Appendix E Determination of Chemicals for Multipathway Analysis 1

E.1 Introduction 1

E.2 Criteria for Selection of Chemicals for Multipathway Analysis 1

E.2.1 The Junge-Pankow Adsorption Model as a Means of Determining Gas-Particle Partitioning 2

E.2.2 The Octanol-Water Partition Coefficient as a Means of Determining Gas-Particle Partitioning 4

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Cleaner Air Oregon: How do agencies determine what is a health risk?

The Cleaner Air Oregon program developed by the Oregon Department of Environmental Quality and the Oregon Health Authority evaluates potential air toxics health risks to people near industrial and commercial facilities, and reduces those risks below action levels adopted in law or rules. The diagram shows how scientific information about air toxics is used to create health-based values, called "risk-based concentrations" that agencies can use to assess risks and protect Oregonians.

How do agencies determine risk from individual toxic air contaminants from a facility? The agencies use toxicity reference values, or "TRVs", to assess these risks. Each air toxic has a specific TRV that has been set by federal and authoritative sources like EPA, using the best available science. A TRV is the concentration of an air toxic that may cause health problems. Each air toxic has several TRVs, depending on the type of health effect and whether exposure is for a long period of time (a "chronic" exposure) or short period of time (an "acute" exposure). TRVs only consider health risks related to breathing in the air toxic. Each air toxic can have up to three different TRVs- one for chronic cancer, chronic noncancer, and acute noncancer.

How do agencies know they are using the best available science to assess risk? A number of governmental scientific agencies have developed TRVs. These authoritative sources sometimes have slightly different TRVs for the same chemical. The diagram lists the agencies selected for chronic TRVs used in Cleaner Air Oregon. DEQ and OHA selected the most recently published TRVs from the list of agencies to ensure that chronic TRVs are based on the most recent review of scientific studies by an authoritative source. DEQ and OHA used different strategies to select TRVs from among authoritative sources for chronic and acute TRVs.

What is a Risk-Based Concentration? Risk is a combination of how harmful a contaminant is (toxicity), and how and for how long a person might come into contact with the contaminant (exposure). DEQ and OHA use these TRVs to determine the "toxicity" part of risk. To determine the "exposure" part of risk, the agencies apply "exposure factors" that adjust the TRV. Factors considered in determining exposure include 1) exposure time, frequency and duration, 2) early-life exposure, and 3) multi-pathway exposure. These exposure factors will change the TRV. The final "adjusted" TRV is called a Risk Based Concentration, or RBC.

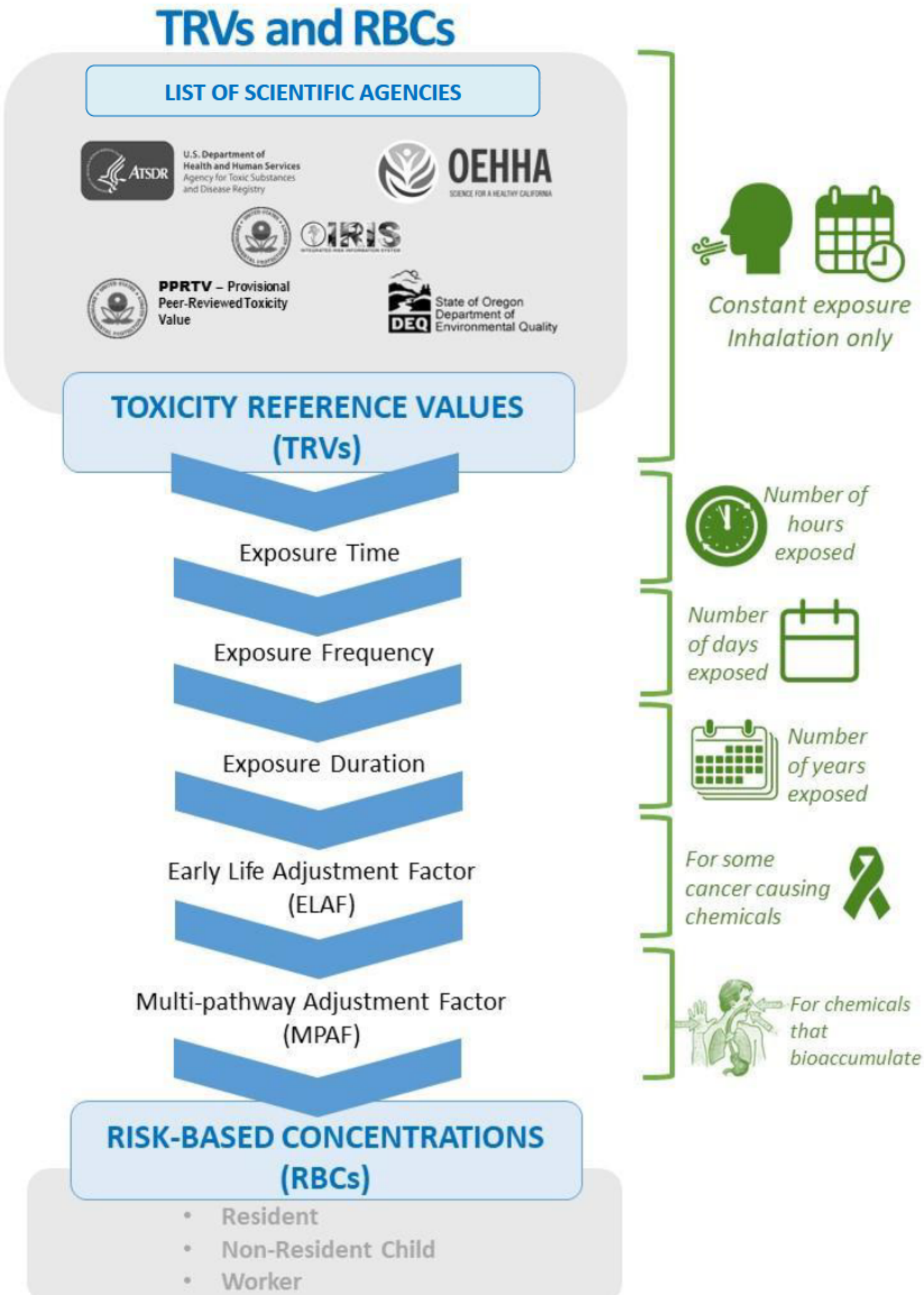
RBCs are the numbers agencies will use to evaluate health risks from individual air toxics emissions, and determine whether the risk is above a level requiring a facility to take some action. There are separate RBCs for cancer risk, chronic (long-term exposure) noncancer risk, and acute (short-term exposure of 24 hours or less) noncancer risk.

The diagram shows how the selection of TRVs, when adjusted by exposure factors, results in risk-based concentrations.

How do other states determine risk from air contaminants? The approach DEQ and OHA are using to calculate RBCs is consistent with other state and federal programs, and with DEQ's existing Cleanup Program. The agencies will use RBCs to calculate risks for an individual facility. Calculated risks for a facility would then be compared with Risk Action Levels, the levels at which facilities must take action to reduce risk.

The Cleaner Air Oregon Toxicity Reference Values and Risk-Based Concentrations fact sheet provides a more detailed explanation on the selection of scientific agencies and strategies used to develop risk-based concentrations for chronic and acute TRVs.

Diagram: Process to Identify Risk-Based Concentrations



OAR 340-245-8010
Table 1
Risk Action Levels†

Applicability	Risk Action Level	Excess Cancer Risk per Million	Noncancer Hazard Index
New and Reconstructed Source	Aggregate TEU Level	0.5	0.1
	Source Permit Level	0.5	0.5
	Community Engagement Level	5	1
	TLAER Level	10	1
	Permit Denial Level	25	1
Existing Source	Aggregate TEU Level	2.5	0.1
	Source Permit Level	5	0.5
	Community Engagement Level	25	1
	TBACT Level	50	5[a] or 3[b] or Risk Determination Ratio of 1.0[c]
	Risk Reduction Level	200	10[a] or 6[b] or Risk Determination Ratio of 2.0[c]
	Immediate Curtailment Level	500	20[a] or 12[b] or Risk Determination Ratio of 4.0[c]

Footnotes for OAR 340-245-8010 Table 1:

† Facility risk that is equal to or less than the values in the table is considered compliant with the Risk Action Level. Risk Action Levels are considered consistent with benchmarks in Oregon Laws 2018, chapter 102 (Senate Bill (SB) 1541 (2018)).

a) If all toxic air contaminants emitted by the source are identified as HI5 in OAR 340-247-8010, Table 2, and OAR 340-245-8010, Table 2.

b) If all toxic air contaminants emitted by the source are identified as HI3 in OAR 340-247-8010, Table 2, and OAR 340-245-8010, Table 2.

c) If toxic air contaminants emitted by the source include contaminants listed as both HI3 and HI5 in OAR 340-247-8010, Table 2, and OAR 340-245-8010, Table 2, and a Risk Determination Ratio is required to be calculated under OAR 340-245-0200.

OAR 340-245-8010
Table 2
Risk-Based Concentrations

			Non cancer TBACT RAL [m]	Residential Chronic		Non-Residential Chronic				Acute
				Cancer RBC[a]	Non-cancer RBC[a]	Child Cancer RBC[a]	Child Non-cancer RBC[a]	Worker Cancer RBC[a]	Worker Non-cancer RBC[a]	Non-cancer RBC[a]
CASRN[b]	Chemical	Notes		(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)
75-07-0	Acetaldehyde		HI3	0.45	140	12	620	5.5	620	470
60-35-5	Acetamide			0.050		1.3		0.60		
67-64-1	Acetone		HI3		31,000		140,000		140,000	62,000
75-05-8	Acetonitrile		HI3		60		260		260	
107-02-8	Acrolein		HI5		0.35		1.5		1.5	6.9
79-06-1	Acrylamide	g	HI3	0.0059	6.0	0.062	26	0.12	26	
79-10-7	Acrylic acid		HI3		1.0		4.4		4.4	6,000
107-13-1	Acrylonitrile		HI3	0.015	5.0	0.38	22	0.18	22	220
309-00-2	Aldrin			0.00020		0.0053		0.0024		
107-05-1	Allyl chloride		HI3	0.17	1.0	4.3	4.4	2.0	4.4	
7429-90-5	Aluminum and compounds	1	HI5		5.0		22		22	
7664-41-7	Ammonia		HI3		500		2,200		2,200	1,200
62-53-3	Aniline		HI5	0.63	1.0	16	4.4	7.5	4.4	
7440-36-0	Antimony and compounds	1	HI3		0.30		1.3		1.3	1.0
140-57-8	Aramite			0.14		3.7		1.7		
7440-38-2	Arsenic and compounds	1	HI3	2.4E-05	0.00017	0.0013	0.0024	0.00062	0.0024	0.20
7784-42-1	Arsine		HI3		0.015		0.066		0.066	0.20
1332-21-4	Asbestos	I		4.3E-06		0.00011		5.2E-05		
103-33-3	Azobenzene			0.032		0.84		0.39		
71-43-2	Benzene		HI3	0.13	3.0	3.3	13	1.5	13	29
92-87-5	Benzidine (and its salts)	g		4.2E-06		4.4E-05		8.6E-05		
100-44-7	Benzyl chloride		HI3	0.020	1.0	0.53	4.4	0.24	4.4	240
7440-41-7	Beryllium and compounds	1	HI3	0.00042	0.0070	0.011	0.031	0.0050	0.031	0.020
111-44-4	*Bis*(2-chloroethyl) ether (BCEE)		HI3	0.0014		0.037		0.017		120
542-88-1	*Bis*(chloromethyl) ether		HI5	7.7E-05		0.0020		0.00092		1.4

OAR 340-245-8010
Table 2
Risk-Based Concentrations

			Non cancer TBACT RAL [m]	Residential Chronic		Non-Residential Chronic				Acute
				Cancer RBC[a]	Non-cancer RBC[a]	Child Cancer RBC[a]	Child Non-cancer RBC[a]	Worker Cancer RBC[a]	Worker Non-cancer RBC[a]	Non-cancer RBC[a]
CASRN[b]	Chemical	Notes		(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)
117-81-7	*Bis*(2-ethylhexyl) phthalate (DEHP)	c		0.080		11		5.0		
75-25-2	Bromoform			0.91		24		11		
74-83-9	Bromomethane (methyl bromide)		HI3		5.0		22		22	3,900
106-94-5	1-Bromopropane (n-propyl bromide)		HI3	0.48	33	12	150	5.7	150	1,700
106-99-0	1,3-Butadiene		HI3	0.033	2.0	0.86	8.8	0.40	8.8	660
78-93-3	2-Butanone (methyl ethyl ketone)		HI3		5,000		22,000		22,000	5,000
78-92-2	*sec*-Butyl alcohol		HI3		30,000		130,000		130,000	
7440-43-9	Cadmium and compounds	c, l	HI3	0.00056	0.0050	0.014	0.037	0.0067	0.037	0.030
105-60-2	Caprolactam		HI3		2.2		9.7		9.7	50
75-15-0	Carbon disulfide		HI3		800		3,500		3,500	6,200
56-23-5	Carbon tetrachloride		HI3	0.17	100	4.3	440	2.0	440	1,900
463-58-1	Carbonyl sulfide		HI3		10		44		44	660
57-74-9	Chlordane		HI3	0.010	0.020	0.26	0.088	0.12	0.088	0.20
108171-26-2	Chlorinated paraffins	j		0.040		1.0		0.48		
7782-50-5	Chlorine		HI3		0.15		0.66		0.66	170
10049-04-4	Chlorine dioxide		HI3		0.60		2.6		2.6	2.8
532-27-4	2-Chloroacetophenone		HI5		0.030		0.13		0.13	
108-90-7	Chlorobenzene		HI3		50		220		220	
75-68-3	1-Chloro-1,1-difluoroethane		HI3		50,000		220,000		220,000	
75-45-6	Chlorodifluoromethane (Freon 22)		HI3		50,000		220,000		220,000	
75-00-3	Chloroethane (ethyl chloride)		HI3		30,000		130,000		130,000	40,000
67-66-3	Chloroform		HI3		300		1,300		1,300	490
74-87-3	Chloromethane (methyl chloride)		HI3		90		400		400	1,000

OAR 340-245-8010
Table 2
Risk-Based Concentrations

			Non cancer TBACT RAL [m]	Residential Chronic		Non-Residential Chronic				Acute
				Cancer RBC[a]	Non-cancer RBC[a]	Child Cancer RBC[a]	Child Non-cancer RBC[a]	Worker Cancer RBC[a]	Worker Non-cancer RBC[a]	Non-cancer RBC[a]
CASRN[b]	Chemical	Notes		($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
95-83-0	4-Chloro-*o*-phenylenediamine			0.22		5.7		2.6		
76-06-2	Chloropicrin		HI3		0.40		1.8		1.8	29
126-99-8	Chloroprene		HI3	0.0033	20	0.087	88	0.040	88	
95-69-2	*p*-Chloro-*o*-toluidine			0.013		0.34		0.16		
18540-29-9	Chromium VI, chromate and dichromate particulate	c, d	HI3	3.1E-05	0.083	0.00052	0.88	0.0010	0.88	0.30
7738-94-5	Chromium VI, chromic acid aerosol mist and chromium trioxide	c, d	HI3	3.1E-05	0.0021	0.00052	0.022	0.0010	0.022	0.0050
7440-48-4	Cobalt and compounds	l	HI3		0.10		0.44		0.44	
148†	Coke oven emissions	g		0.00095		0.0100		0.019		
7440-50-8	Copper and compounds	l	HI3							100
120-71-8	*p*-Cresidine			0.023		0.60		0.28		
1319-77-3	Cresols (mixture), including *m*-cresol, *o*-cresol, *p*-cresol		HI3		600		2,600		2,600	
135-20-6	Cupferron			0.016		0.41		0.19		
74-90-8	Cyanide, hydrogen		HI3		0.80		3.5		3.5	340
110-82-7	Cyclohexane		HI3		6,000		26,000		26,000	
50-29-3	DDT	e		0.010		0.27		0.12		
615-05-4	2,4-Diaminoanisole			0.15		3.9		1.8		
95-80-7	2,4-Diaminotoluene (2,4-toluene diamine)			0.00091		0.024		0.011		
333-41-5	Diazinon		HI3							10
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	g	HI3	9.8E-05	0.20	0.0010	0.88	0.0020	0.88	1.9
106-46-7	*p*-Dichlorobenzene (1,4-dichlorobenzene)		HI3	0.091	60	2.4	260	1.1	260	12,000
91-94-1	3,3'-Dichlorobenzidine			0.0029		0.076		0.035		
75-34-3	1,1-Dichloroethane (ethylidene dichloride)			0.63		16		7.5		

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			Non cancer TBACT RAL [m]	Residential Chronic		Non-Residential Chronic				Acute
				Cancer RBC[a]	Non-cancer RBC[a]	Child Cancer RBC[a]	Child Non-cancer RBC[a]	Worker Cancer RBC[a]	Worker Non-cancer RBC[a]	Non-cancer RBC[a]
CASRN[b]	Chemical	Notes		(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)
156-60-5	*trans*-1,2-dichloroethene		HI3							790
75-09-2	Dichloromethane (methylene chloride)		HI3	59	600	620	2,600	1,200	2,600	2,100
78-87-5	1,2-Dichloropropane (propylene dichloride)		HI3		4.0		18		18	230
542-75-6	1,3-Dichloropropene		HI3	0.25	32	6.5	140	3.0	140	36
62-73-7	Dichlorvos (DDVP)		HI5		0.54		2.4		2.4	18
60-57-1	Dieldrin			0.00022		0.0057		0.0026		
200[†]	Diesel particulate matter		HI3	0.10	5.0	2.6	22	1.2	22	
111-42-2	Diethanolamine		HI3		0.20		0.88		0.88	
112-34-5	Diethylene glycol monobutyl ether		HI3		0.10		0.44		0.44	
111-90-0	Diethylene glycol monoethyl ether		HI5		0.30		1.3		1.3	
75-37-6	1,1-Difluoroethane		HI5		40,000		180,000		180,000	
60-11-7	4-Dimethylaminoazobenzene			0.00077		0.020		0.0092		
68-12-2	Dimethyl formamide		HI3		80		350		350	
57-14-7	1,1-Dimethylhydrazine		HI3							0.49
121-14-2	2,4-Dinitrotoluene			0.011		0.29		0.13		
123-91-1	1,4-Dioxane		HI3	0.20	30	5.2	130	2.4	130	7,200
122-66-7	1,2-Diphenylhydrazine (hydrazobenzene)			0.0045		0.12		0.055		
1937-37-7	Direct Black 38			7.1E-06		0.00019		8.6E-05		
2602-46-2	Direct Blue 6			7.1E-06		0.00019		8.6E-05		
16071-86-6	Direct Brown 95 (technical grade)			7.1E-06		0.00019		8.6E-05		
298-04-4	Disulfoton		HI3							6.0
106-89-8	Epichlorohydrin		HI3	0.043	3.0	1.1	13	0.52	13	1,300
106-88-7	1,2-Epoxybutane		HI5		20		88		88	
140-88-5	Ethyl acrylate		HI3		8.0		35		35	

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			Non cancer TBACT RAL [m]	Residential Chronic		Non-Residential Chronic				Acute
				Cancer RBC[a]	Non-cancer RBC[a]	Child Cancer RBC[a]	Child Non-cancer RBC[a]	Worker Cancer RBC[a]	Worker Non-cancer RBC[a]	Non-cancer RBC[a]
CASRN[b]	Chemical	Notes		(μg/m^3)	(μg/m^3)	(μg/m^3)	(μg/m^3)	(μg/m^3)	(μg/m^3)	(μg/m^3)
100-41-4	Ethyl benzene		HI3	0.40	260	10	1,100	4.8	1,100	22,000
106-93-4	Ethylene dibromide (EDB, 1,2-dibromoethane)		HI3	0.0017	9.0	0.043	40	0.020	40	
107-06-2	Ethylene dichloride (EDC, 1,2-dichloroethane)		HI3	0.038	7.0	1.0	31	0.46	31	
107-21-1	Ethylene glycol		HI3		400		1,800		1,800	2,000
111-76-2	Ethylene glycol monobutyl ether		HI3		82		360		360	29,000
110-80-5	Ethylene glycol monoethyl ether		HI3		70		310		310	370
111-15-9	Ethylene glycol monoethyl ether acetate		HI3		60		260		260	140
109-86-4	Ethylene glycol monomethyl ether		HI3		60		260		260	93
110-49-6	Ethylene glycol monomethyl ether acetate		HI3		1.0		4.4		4.4	
75-21-8	Ethylene oxide	g	HI3	0.00020	30	0.0021	130	0.0040	130	160
96-45-7	Ethylene thiourea			0.077		2.0		0.92		
239[†]	Fluorides	c	HI3		2.3		20		20	240
7782-41-4	Fluorine gas		HI3							16
50-00-0	Formaldehyde		HI3	0.17	9.0	4.3	40	2.0	40	49
111-30-8	Glutaraldehyde		HI5		0.080		0.35		0.35	4.1
76-44-8	Heptachlor			0.00077		0.020		0.0092		
1024-57-3	Heptachlor epoxide			0.00038		0.010		0.0046		
118-74-1	Hexachlorobenzene			0.0020		0.051		0.024		
87-68-3	Hexachlorobutadiene			0.045		1.2		0.55		
608-73-1	Hexachlorocyclohexanes (mixture) including but not limited to:	c		0.00017		0.018		0.0084		
319-84-6	Hexachlorocyclohexane, *alpha-*	c		0.00017		0.018		0.0084		

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			Non cancer TBACT RAL [m]	Residential Chronic		Non-Residential Chronic				Acute
				Cancer RBC[a]	Non-cancer RBC[a]	Child Cancer RBC[a]	Child Non-cancer RBC[a]	Worker Cancer RBC[a]	Worker Non-cancer RBC[a]	Non-cancer RBC[a]
CASRN[b]	Chemical	Notes		($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
319-85-7	Hexachlorocyclohexane, *beta-*	c		0.00017		0.018		0.0084		
58-89-9	Hexachlorocyclohexane, *gamma-* (Lindane)	c		0.00060		0.065		0.030		
77-47-4	Hexachlorocyclopentadiene		HI3		0.20		0.88		0.88	110
67-72-1	Hexachloroethane		HI3		30		130		130	58,000
822-06-0	Hexamethylene-1,6-diisocyanate		HI5		0.069		0.30		0.30	0.21
110-54-3	Hexane		HI3		700		3,100		3,100	
302-01-2	Hydrazine		HI3	0.00020	0.030	0.0053	0.13	0.0024	0.13	5.2
7647-01-0	Hydrochloric acid		HI3		20		88		88	2,100
7664-39-3	Hydrogen fluoride	c	HI3		2.1		19		19	16
7783-06-4	Hydrogen sulfide		HI3		2.0		8.8		8.8	98
78-59-1	Isophorone		HI3		2,000		8,800		8,800	
67-63-0	Isopropyl alcohol		HI3		200		880		880	3,200
98-82-8	Isopropylbenzene (cumene)		HI3		400		1,800		1,800	
7439-92-1	Lead and compounds	c, 1	HI3		0.15		0.66		0.66	0.15
108-31-6	Maleic anhydride		HI5		0.70		3.1		3.1	
7439-96-5	Manganese and compounds	1	HI3		0.090		0.40		0.40	0.30
7439-97-6	Mercury and compounds	c, 1	HI3		0.077		0.63		0.63	0.60
67-56-1	Methanol		HI3		4,000		18,000		18,000	28,000
101-14-4	4,4'-Methylene *bis*(2-chloroaniline) (MOCA)			0.0023		0.060		0.028		
101-77-9	4,4'-Methylenedianiline (and its dichloride)		HI5	0.00030	20	0.023	88	0.010	88	
101-68-8	Methylene diphenyl diisocyanate (MDI)		HI3		0.080		0.35		0.35	12
108-10-1	Methyl isobutyl ketone (MIBK, hexone)		HI3		3,000		13,000		13,000	
624-83-9	Methyl isocyanate		HI3		1.0		4.4		4.4	

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			Non cancer TBACT RAL [m]	Residential Chronic		Non-Residential Chronic				Acute
				Cancer RBC[a]	Non-cancer RBC[a]	Child Cancer RBC[a]	Child Non-cancer RBC[a]	Worker Cancer RBC[a]	Worker Non-cancer RBC[a]	Non-cancer RBC[a]
CASRN[b]	Chemical	Notes		(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)
80-62-6	Methyl methacrylate		HI5		700		3,100		3,100	
1634-04-4	Methyl *tert*-butyl ether		HI3	3.8	8,000	100	35,000	46	35,000	8,000
90-94-8	Michler's ketone			0.0040		0.10		0.048		
91-20-3	Naphthalene	c	HI3	0.029	3.7	0.76	16	0.35	16	200
365†	Nickel compounds, insoluble	f	HI3	0.0038	0.014	0.10	0.062	0.046	0.062	0.20
368†	Nickel compounds, soluble	f	HI3		0.014		0.062		0.062	0.20
7697-37-2	Nitric acid		HI5							86
98-95-3	Nitrobenzene		HI3	0.025	9.0	0.65	40	0.30	40	
79-46-9	2-Nitropropane		HI3		20		88		88	
924-16-3	N-Nitrosodibutylamine			0.00032		0.0084		0.0039		
55-18-5	N-Nitrosodiethylamine	g		5.9E-05		0.00062		0.0012		
62-75-9	N-Nitrosodimethylamine	g		0.00013		0.0013		0.0026		
86-30-6	N-Nitrosodiphenylamine			0.38		10		4.6		
156-10-5	*p*-Nitrosodiphenylamine			0.16		4.1		1.9		
621-64-7	N-Nitrosodipropylamine			0.00050		0.013		0.0060		
10595-95-6	N-Nitrosomethylethylamine			0.00016		0.0041		0.0019		
59-89-2	N-Nitrosomorpholine			0.00053		0.014		0.0063		
100-75-4	N-Nitrosopiperidine			0.00037		0.0096		0.0044		
930-55-2	N-Nitrosopyrrolidine			0.0017		0.043		0.020		
8014-95-7	Oleum (fuming sulfuric acid)		HI3							120
56-38-2	Parathion		HI3							0.020
87-86-5	Pentachlorophenol			0.20		5.1		2.4		
108-95-2	Phenol		HI3		200		880		880	5,800
75-44-5	Phosgene		HI3		0.30		1.3		1.3	4.0
7803-51-2	Phosphine		HI3		0.80		3.5		3.5	
7664-38-2	Phosphoric acid		HI5		10		44		44	
12185-10-3	Phosphorus, white		HI3		9.0		40		40	20

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			Non cancer TBACT RAL [m]	Residential Chronic		Non-Residential Chronic				Acute
				Cancer RBC[a]	Non-cancer RBC[a]	Child Cancer RBC[a]	Child Non-cancer RBC[a]	Worker Cancer RBC[a]	Worker Non-cancer RBC[a]	Non-cancer RBC[a]
CASRN[b]	Chemical	Notes		(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)
85-44-9	Phthalic anhydride		HI3		20		88		88	
447†	Polybrominated diphenyl ethers (PBDEs)	h	HI3							6.0
1336-36-3	Polychlorinated biphenyls (PCBs)	c		0.00053		0.020		0.0092		
645†	Polychlorinated biphenyls (PCBs) TEQ	c	HI3	1.0E-09	1.3E-07	9.0E-08	2.6E-05	4.2E-08	2.6E-05	
32598-13-3	PCB 77 [3,3',4,4'-tetrachlorobiphenyl]	c	HI3	1.0E-05	0.0013	0.00090	0.26	0.00042	0.26	
70362-50-4	PCB 81 [3,4,4',5-tetrachlorobiphenyl]	c	HI3	3.4E-06	0.00042	0.00030	0.085	0.00014	0.085	
32598-14-4	PCB 105 [2,3,3',4,4'-pentachlorobiphenyl]	c	HI3	3.4E-05	0.0042	0.0030	0.85	0.0014	0.85	
74472-37-0	PCB 114 [2,3,4,4',5-pentachlorobiphenyl]	c	HI3	3.4E-05	0.0042	0.0030	0.85	0.0014	0.85	
31508-00-6	PCB 118 [2,3',4,4',5-pentachlorobiphenyl]	c	HI3	3.4E-05	0.0042	0.0030	0.85	0.0014	0.85	
65510-44-3	PCB 123 [2,3',4,4',5'-pentachlorobiphenyl]	c	HI3	3.4E-05	0.0042	0.0030	0.85	0.0014	0.85	
57465-28-8	PCB 126 [3,3',4,4',5-pentachlorobiphenyl]	c	HI3	1.0E-08	1.3E-06	9.0E-07	0.00026	4.2E-07	0.00026	
38380-08-4	PCB 156 [2,3,3',4,4',5-hexachlorobiphenyl]	c	HI3	3.4E-05	0.0042	0.0030	0.85	0.0014	0.85	
69782-90-7	PCB 157 [2,3,3',4,4',5'-hexachlorobiphenyl]	c	HI3	3.4E-05	0.0042	0.0030	0.85	0.0014	0.85	
52663-72-6	PCB 167 [2,3',4,4',5,5'-hexachlorobiphenyl]	c	HI3	3.4E-05	0.0042	0.0030	0.85	0.0014	0.85	
32774-16-6	PCB 169 [3,3',4,4',5,5'-hexachlorobiphenyl]	c	HI3	3.4E-08	4.2E-06	3.0E-06	0.00085	1.4E-06	0.00085	
39635-31-9	PCB 189 [2,3,3',4,4',5,5'-heptachlorobiphenyl]	c	HI3	3.4E-05	0.0042	0.0030	0.85	0.0014	0.85	
646†	Polychlorinated dibenzo-*p*-dioxins (PCDDs) & dibenzofurans (PCDFs) TEQ	c	HI3	1.0E-09	1.3E-07	9.0E-08	2.6E-05	4.2E-08	2.6E-05	

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			Non cancer TBACT RAL [m]	Residential Chronic		Non-Residential Chronic				Acute
				Cancer RBC[a]	Non-cancer RBC[a]	Child Cancer RBC[a]	Child Non-cancer RBC[a]	Worker Cancer RBC[a]	Worker Non-cancer RBC[a]	Non-cancer RBC[a]
CASRN[b]	Chemical	Notes		(µg/m³)	(µg/m³)	(µg/m³)	(µg/m³)	(µg/m³)	(µg/m³)	(µg/m³)
1746-01-6	2,3,7,8-Tetrachlorodibenzo-*p*-dioxin (TCDD)	c	HI3	1.0E-09	1.3E-07	9.0E-08	2.6E-05	4.2E-08	2.6E-05	
40321-76-4	1,2,3,7,8-Pentachlorodibenzo-*p*-dioxin (PeCDD)	c	HI3	1.0E-09	1.3E-07	9.0E-08	2.6E-05	4.2E-08	2.6E-05	
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo-*p*-dioxin (HxCDD)	c	HI3	1.0E-08	1.3E-06	9.0E-07	0.00026	4.2E-07	0.00026	
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-*p*-dioxin (HxCDD)	c	HI3	1.0E-08	1.3E-06	9.0E-07	0.00026	4.2E-07	0.00026	
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-*p*-dioxin (HxCDD)	c	HI3	1.0E-08	1.3E-06	9.0E-07	0.00026	4.2E-07	0.00026	
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-*p*-dioxin (HpCDD)	c	HI3	1.0E-07	1.3E-05	9.0E-06	0.0026	4.2E-06	0.0026	
3268-87-9	Octachlorodibenzo-*p*-dioxin (OCDD)	c	HI3	3.4E-06	0.00042	0.00030	0.085	0.00014	0.085	
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	c	HI3	1.0E-08	1.3E-06	9.0E-07	0.00026	4.2E-07	0.00026	
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	c	HI3	3.4E-08	4.2E-06	3.0E-06	0.00085	1.4E-06	0.00085	
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	c	HI3	3.4E-09	4.2E-07	3.0E-07	8.5E-05	1.4E-07	8.5E-05	
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	c	HI3	1.0E-08	1.3E-06	9.0E-07	0.00026	4.2E-07	0.00026	
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	c	HI3	1.0E-08	1.3E-06	9.0E-07	0.00026	4.2E-07	0.00026	
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	c	HI3	1.0E-08	1.3E-06	9.0E-07	0.00026	4.2E-07	0.00026	

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Table 2
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			Non cancer TBACT RAL [m]	Residential Chronic		Non-Residential Chronic				Acute
				Cancer RBC[a]	Non-cancer RBC[a]	Child Cancer RBC[a]	Child Non-cancer RBC[a]	Worker Cancer RBC[a]	Worker Non-cancer RBC[a]	Non-cancer RBC[a]
CASRN[b]	Chemical	Notes		(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	c	HI3	1.0E-08	1.3E-06	9.0E-07	0.00026	4.2E-07	0.00026	
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	c	HI3	1.0E-07	1.3E-05	9.0E-06	0.0026	4.2E-06	0.0026	
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	c	HI3	1.0E-07	1.3E-05	9.0E-06	0.0026	4.2E-06	0.0026	
39001-02-0	Octachlorodibenzofuran (OCDF)	c	HI3	3.4E-06	0.00042	0.00030	0.085	0.00014	0.085	
401[†]	Polycyclic aromatic hydrocarbons (PAHs)	c, g, n		4.3E-05		0.0016		0.0030		
191-26-4	Anthanthrene	c, g		0.00011		0.0039		0.0076		
56-55-3	Benz[a]anthracene	c, g		0.00021		0.0078		0.015		
50-32-8	Benzo[a]pyrene	c, g	HI3	4.3E-05	0.0020	0.0016	0.0088	0.0030	0.0088	0.0020
205-99-2	Benzo[b]fluoranthene	c, g		5.3E-05		0.0020		0.0038		
205-12-9	Benzo[c]fluorene	c, g		2.1E-06		7.8E-05		0.00015		
191-24-2	Benzo[g,h,i]perylene	c, g		0.0047		0.17		0.34		
205-82-3	Benzo[j]fluoranthene	c, g		0.00014		0.0052		0.010		
207-08-9	Benzo[k]fluoranthene	c, g		0.0014		0.052		0.10		
218-01-9	Chrysene	c, g		0.00043		0.016		0.030		
27208-37-3	Cyclopenta[c,d]pyrene	c, g		0.00011		0.0039		0.0076		
53-70-3	Dibenz[a,h]anthracene	c, g		4.3E-06		0.00016		0.00030		
192-65-4	Dibenzo[a,e]pyrene	c, g		0.00011		0.0039		0.0076		
189-64-0	Dibenzo[a,h]pyrene	c, g		4.7E-05		0.0017		0.0034		
189-55-9	Dibenzo[a,i]pyrene	c, g		7.1E-05		0.0026		0.0051		
191-30-0	Dibenzo[a,l]pyrene	c, g		1.4E-06		5.2E-05		0.00010		
206-44-0	Fluoranthene	c, g		0.00053		0.020		0.038		
193-39-5	Indeno[1,2,3-cd]pyrene	c, g		0.00061		0.022		0.043		

OAR 340-245-8010
Table 2
Risk-Based Concentrations

			Non cancer TBACT RAL [m]	Residential Chronic		Non-Residential Chronic				Acute
				Cancer RBC[a]	Non-cancer RBC[a]	Child Cancer RBC[a]	Child Non-cancer RBC[a]	Worker Cancer RBC[a]	Worker Non-cancer RBC[a]	Non-cancer RBC[a]
CASRN[b]	Chemical	Notes		(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)
3697-24-3	5-Methylchrysene	c, g		4.3E-05		0.0016		0.0030		
7496-02-8	6-Nitrochrysene	c, g		4.3E-06		0.00016		0.00030		
7758-01-2	Potassium bromate			0.0071		0.19		0.086		
1120-71-4	1,3-Propane sultone			0.0014		0.038		0.017		
123-38-6	Propionaldehyde		HI5		8.0		35		35	
115-07-1	Propylene		HI5		3,000		13,000		13,000	
6423-43-4	Propylene glycol dinitrate		HI5		0.27		1.2		1.2	20
107-98-2	Propylene glycol monomethyl ether		HI3		7,000		31,000		31,000	
75-56-9	Propylene oxide		HI3	0.27	30	7.0	130	3.2	130	3,100
572[†]	Refractory ceramic fibers	i	HI5		0.030		0.13		0.13	
7783-07-5	Selenide, hydrogen		HI3							5.0
7782-49-2	Selenium and compounds	l	HI3							2.0
7631-86-9	Silica, crystalline (respirable)		HI5		3.0		13		13	
1310-73-2	Sodium hydroxide		HI3							8.0
100-42-5	Styrene		HI3		1,000		4,400		4,400	21,000
7664-93-9	Sulfuric acid		HI5		1.0		4.4		4.4	120
505-60-2	Sulfur mustard		HI3							0.70
7446-11-9	Sulfur trioxide		HI5		1.0		4.4		4.4	120
630-20-6	1,1,1,2-Tetrachloroethane			0.14		3.5		1.6		
79-34-5	1,1,2,2-Tetrachloroethane			0.017		0.45		0.21		
127-18-4	Tetrachloroethene (perchloroethylene)		HI3	3.8	41	100	180	46	180	41
811-97-2	1,1,1,2-Tetrafluoroethane		HI3		80,000		350,000		350,000	
62-55-5	Thioacetamide			0.00059		0.015		0.0071		
7550-45-0	Titanium tetrachloride		HI3		0.10		0.44		0.44	10
108-88-3	Toluene		HI3		5,000		22,000		22,000	7,500

OAR 340-245-8010
Table 2
Risk-Based Concentrations

			Non cancer TBACT RAL [m]	Residential Chronic		Non-Residential Chronic				Acute
				Cancer RBC[a]	Non-cancer RBC[a]	Child Cancer RBC[a]	Child Non-cancer RBC[a]	Worker Cancer RBC[a]	Worker Non-cancer RBC[a]	Non-cancer RBC[a]
CASRN[b]	Chemical	Notes		(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)
26471-62-5	Toluene diisocyanates (2,4- and 2,6-)		HI3	0.091	0.021	2.4	0.092	1.1	0.092	0.071
8001-35-2	Toxaphene (polychlorinated camphenes)			0.0031		0.081		0.038		
71-55-6	1,1,1-Trichloroethane (methyl chloroform)		HI3		5,000		22,000		22,000	11,000
79-00-5	1,1,2-Trichloroethane (vinyl trichloride)			0.063		1.6		0.75		
79-01-6	Trichloroethene (TCE, trichloroethylene)	g	HI3	0.20	2.1	3.5	9.2	2.9	9.2	2.1
88-06-2	2,4,6-Trichlorophenol			0.050		1.3		0.60		
96-18-4	1,2,3-Trichloropropane		HI5		0.30		1.3		1.3	1.8
121-44-8	Triethylamine		HI3		200		880		880	2,800
526-73-8	1,2,3-Trimethylbenzene		HI3		60		260		260	
95-63-6	1,2,4-Trimethylbenzene		HI3		60		260		260	
108-67-8	1,3,5-Trimethylbenzene		HI3		60		260		260	
51-79-6	Urethane (ethyl carbamate)	g		0.0020		0.021		0.041		
7440-62-2	Vanadium (fume or dust)		HI3		0.10		0.44		0.44	0.80
1314-62-1	Vanadium pentoxide		HI3	0.00012	0.0070	0.0031	0.031	0.0014	0.031	30
108-05-4	Vinyl acetate		HI3		200		880		880	200
593-60-2	Vinyl bromide		HI5		3.0		13		13	
75-01-4	Vinyl chloride	g, k	HI3	0.11	100	0.22	440	2.7	440	1,300
75-35-4	Vinylidene chloride		HI3		200		880		880	200
1330-20-7	Xylene (mixture), including *m*-xylene, *o*-xylene, *p*-xylene		HI3		220		970		970	8,700

Footnotes for OAR 340-245-8010 Table 2:

† Chemical designated by DEQ ID number.
a) RBC = Risk-Based Concentration
b) CASRN = Chemical Abstracts Service Registry Number, or DEQ ID if there is no CASRN.
c) Chronic RBCs include factors for multipathway risk.

d) The RBCs presented for chromium are applicable to hexavalent chromium. In the absence of data indicating otherwise, assume that any total chromium (i.e., unspeciated) that is measured or modeled is entirely in the hexavalent form. Determine, based on information about the source of emissions, whether hexavalent chromium is emitted in aerosol or particulate form, and apply the corresponding RBC. Because there are no RBCs for trivalent chromium, a source determined to be emitting only trivalent chromium cannot be shown to pose an unacceptable risk, so the risk in this case will be considered acceptable.

e) DDT RBCs apply to the sum of DDT, DDE, and DDD compounds.

f) As recommended by DEQ's Air Toxics Science Advisory Committee (ATSAC) in 2018, the two categories of nickel compounds contain the following specific nickel compounds:
Soluble nickel compounds are considered to be emitted mainly in aerosol form, to be less potent carcinogens than insoluble nickel compounds, and include nickel acetate, nickel chloride, nickel carbonate, nickel hydroxide, nickelocene, nickel sulfate, nickel sulfate hexahydrate, nickel nitrate hexahydrate, nickel carbonate hydroxide.
Insoluble nickel compounds are considered to be emitted mainly in particulate form, to be more potent carcinogens than soluble nickel compounds, and to include nickel subsulfide, nickel oxide, nickel sulfide, nickel metal.

g) RBCs adjusted to protect early-life exposure to infants and children because chemical is carcinogenic by a mutagenic mode of action.

h) RBCs apply to octabrominated diphenyl ethers (CASRN 32536-52-0) and pentabrominated diphenyl ethers (CASRN 32534-81-9), including BDE-99.

i) RBCs for asbestos and refractory ceramic fibers are in units of fibers/cm^3.

j) Chlorinated paraffins of average chain length of C12, approximately 60% chlorine by weight.

k) DEQ followed the ATSAC recommendation to develop a vinyl chloride TRV that already includes early-life exposure.

l) An inorganic chemical designated with "and compounds" indicates that the RBC applies to the sum of all forms of the chemical, expressed as the inorganic element.

m) Noncancer TBACT RAL = noncancer Toxics Best Available Control Technology Risk Action Level, OAR 340-245-8010, Table 1.

n) Because RBCs for PAHs were developed using TRVs for benzo[a]pyrene, apply PAH RBCs to summed benzo[a]pyrene toxicity equivalents for carcinogenic PAHs. If individual PAHs are not evaluated, apply PAH RBCs to total PAH concentrations.

OAR 340-245-8010 Table 3

Level 1 Risk Assessment Dispersion Factors

Table 3A: Stack Emission Dispersion Factors for Annual Exposure (μg/m³ / pounds/year)

Stack	Exposure Location Distance (meters)											
Ht (m)	50	60	70	80	90	100	110	120	130	140	150	160	170
5	0.0033	0.0026	0.0021	0.0017	0.0014	0.0012	0.0010	0.00088	0.00076	0.00066	0.00058	0.00051	0.00046
10	0.0014	0.0012	0.0011	0.00094	0.00084	0.00075	0.00068	0.00062	0.00057	0.00052	0.00048	0.00044	0.00041
15	0.00075	0.00061	0.00054	0.00049	0.00044	0.00040	0.00037	0.00034	0.00031	0.00029	0.00027	0.00025	0.00024
20	0.00072	0.00054	0.00035	0.00031	0.00028	0.00026	0.00023	0.00022	0.00020	0.00019	0.00017	0.00016	0.00015
25	0.00050	0.00041	0.00035	0.00025	0.00019	0.00018	0.00016	0.00015	0.00014	0.00013	0.00012	0.00012	0.00011
30	0.00037	0.00030	0.00026	0.00023	0.00019	0.00013	0.00012	0.00011	0.00010	0.000096	0.000090	0.000085	0.000080
35	0.00030	0.00023	0.00019	0.00017	0.00015	0.00013	0.00011	0.000081	0.000075	0.000071	0.000068	0.000064	0.000061
40	0.00023	0.00019	0.00015	0.00013	0.00012	0.00011	0.000096	0.000081	0.000064	0.000054	0.000051	0.000049	0.000047
45	0.00018	0.00016	0.00013	0.00011	0.000095	0.000085	0.000078	0.000072	0.000063	0.000053	0.000042	0.000038	0.000037
50	0.00014	0.00013	0.00011	0.000090	0.000077	0.000068	0.000062	0.000057	0.000053	0.000048	0.000042	0.000035	0.000029

Stack	Exposure Location Distance (meters)											
Ht (m)	180	190	200	250	300	350	400	450	500	600	700	800	1000
5	0.00041	0.00037	0.00034	0.00023	0.00017	0.00013	0.00010	0.000084	0.000071	0.000052	0.000040	0.000032	0.000022
10	0.00038	0.00035	0.00033	0.00023	0.00017	0.00013	0.000098	0.000078	0.000064	0.000047	0.000036	0.000029	0.000021
15	0.00023	0.00021	0.00020	0.00016	0.00013	0.00010	0.000083	0.000069	0.000057	0.000041	0.000032	0.000025	0.000018
20	0.00014	0.00014	0.00013	0.00010	0.000086	0.000073	0.000062	0.000053	0.000046	0.000035	0.000027	0.000021	0.000015
25	0.00010	0.000096	0.000091	0.000072	0.000059	0.000051	0.000044	0.000039	0.000034	0.000027	0.000022	0.000018	0.000013
30	0.000075	0.000071	0.000068	0.000053	0.000044	0.000037	0.000032	0.000028	0.000025	0.000021	0.000017	0.000014	0.000010
35	0.000058	0.000055	0.000052	0.000042	0.000034	0.000029	0.000025	0.000022	0.000019	0.000016	0.000014	0.000011	0.000008
40	0.000045	0.000043	0.000041	0.000033	0.000028	0.000023	0.000020	0.000018	0.000016	0.000013	0.000011	0.000009	0.000007
45	0.000036	0.000034	0.000033	0.000027	0.000023	0.000019	0.000017	0.000015	0.000013	0.000011	0.000009	0.000008	0.000006
50	0.000027	0.000026	0.000026	0.000022	0.000019	0.000016	0.000014	0.000012	0.000011	0.000009	0.000007	0.000006	0.000005

Table 3B: Stack Emission Dispersion Factors for 24 hour Exposure (μg/m³ / pounds/day)

Stack	Exposure Location Distance (meters)											
Ht (m)	50	60	70	80	90	100	110	120	130	140	150	160	170
5	8.3	7.1	6.1	5.2	4.4	3.8	3.2	2.7	2.4	2.1	1.8	1.6	1.4
10	3.8	3.4	3.1	2.8	2.6	2.4	2.2	2.1	2.0	1.8	1.7	1.6	1.5
15	1.8	1.6	1.6	1.5	1.4	1.3	1.2	1.1	1.1	1.00	0.95	0.91	0.87
20	1.6	1.3	0.91	0.86	0.82	0.77	0.73	0.69	0.65	0.62	0.59	0.56	0.54
25	0.97	0.93	0.85	0.64	0.52	0.50	0.48	0.46	0.44	0.42	0.40	0.38	0.36
30	0.62	0.59	0.57	0.55	0.49	0.34	0.32	0.31	0.30	0.29	0.28	0.27	0.26
35	0.42	0.41	0.39	0.38	0.37	0.34	0.29	0.22	0.21	0.21	0.20	0.20	0.19
40	0.30	0.29	0.28	0.28	0.27	0.26	0.25	0.22	0.17	0.15	0.15	0.15	0.14
45	0.22	0.22	0.21	0.21	0.20	0.20	0.19	0.19	0.17	0.16	0.12	0.11	0.11
50	0.16	0.16	0.16	0.16	0.16	0.15	0.15	0.14	0.14	0.13	0.12	0.10	0.082

Stack	Exposure Location Distance (meters)											
Ht (m)	180	190	200	250	300	350	400	450	500	600	700	800	1000
5	1.3	1.2	1.1	0.72	0.55	0.44	0.36	0.30	0.26	0.20	0.16	0.13	0.092
10	1.4	1.3	1.3	0.91	0.67	0.50	0.38	0.30	0.25	0.18	0.14	0.12	0.088
15	0.83	0.80	0.77	0.64	0.53	0.43	0.36	0.30	0.25	0.18	0.13	0.10	0.075
20	0.52	0.49	0.48	0.40	0.35	0.31	0.27	0.23	0.20	0.16	0.12	0.096	0.064
25	0.35	0.34	0.32	0.27	0.23	0.21	0.19	0.17	0.15	0.12	0.100	0.082	0.057
30	0.25	0.24	0.23	0.19	0.17	0.15	0.13	0.12	0.11	0.095	0.078	0.066	0.048
35	0.18	0.18	0.17	0.15	0.13	0.11	0.099	0.090	0.083	0.072	0.062	0.053	0.040
40	0.14	0.14	0.13	0.11	0.10	0.088	0.078	0.070	0.064	0.056	0.049	0.044	0.033
45	0.11	0.11	0.10	0.092	0.081	0.072	0.065	0.058	0.053	0.045	0.040	0.036	0.028
50	0.081	0.080	0.079	0.072	0.065	0.059	0.053	0.048	0.044	0.037	0.032	0.029	0.024

Use of stack emission dispersion factors in a Level 1 screening risk assessment:

For each Toxics Emissions Unit, select the appropriate stack height and distance from the stack to nearest exposure locations approved by DEQ. For each exposure location, find the corresponding annual dispersion factor in Table 3A. For each toxic air contaminant, multiply the annual toxic air contaminant emission rate (in pounds/year) by the dispersion factor. Divide the product by the RBC for all the toxic air contaminants for the appropriate exposure location in OAR 340-245-8010 Table 2. Add up the resulting ratios for all Toxic Emissions Units for each exposure location. Compare the results with the Risk Action Levels in OAR 340-245-8010 Table 1. Repeat the process for daily emission rates (in pounds/day) using Table 3B at the acute exposure location.
For a stack height between the values shown in the table, either use the next lowest stack height, or interpolate the dispersion factor. For an exposure location distance between the values shown in the table, either use the next lowest distance, or interpolate the dispersion factor. For stack heights greater than 50 meters, use the appropriate dispersion factor for 50 meters. For exposure locations greater than 1,000 meters from the stack, use the appropriate dispersion factor at 1,000 meters. In the absence of a known stack height and exposure location distance, use as a default the annual dispersion factor (0.0033 $\mu g/m^3$ / pounds/year) and daily dispersion factor (8.3 $\mu g/m^3$ / pounds/day) for a stack height of 5 meters and an exposure location distance of 50 meters.
A Level 1 Risk Assessment will not be approved if the source is located near elevated terrain that DEQ determines could invalidate the assumptions used to develop the Level 1 Risk Assessment tool.

Stat. Auth.: ORS 468.020, 468.065, 468A.025, 468A.040, 468A.050, 468A.070, 468A.155
Stats. Implemented: ORS 468.065, 468A.010, 468A.015, 468A.025, 468A.035, 468A.040, 468A.050, 468A.070, and 468A.155

OAR 340-245-8010 Table 3

Level 1 Risk Assessment Dispersion Factors

Table 3C: Fugitive Emission Dispersion Factors for Annual Exposure (µg/m³ / pounds/year)

Building Area	Building	Exposure Location Distance (meters)												
(1,000 ft2)	Height (ft)	50	60	70	80	90	100	110	120	130	140	150	160	170
≤3	≤20	0.0045	0.0033	0.0026	0.0020	0.0017	0.0014	0.0012	0.0010	0.00089	0.00078	0.00069	0.00062	0.00056
>3 to 6	≤20	0.0044	0.0032	0.0025	0.0020	0.0016	0.0014	0.0012	0.0010	0.00088	0.00077	0.00069	0.00061	0.00055
>3 to 6	>20	0.0041	0.0031	0.0024	0.0019	0.0016	0.0013	0.0011	0.0010	0.00086	0.00076	0.00067	0.00060	0.00054
>6 to 10	≤20	0.0044	0.0033	0.0025	0.0020	0.0017	0.0014	0.0012	0.0010	0.00088	0.00077	0.00069	0.00062	0.00055
>6 to 10	>20	0.0037	0.0028	0.0022	0.0018	0.0015	0.0013	0.0011	0.0010	0.00083	0.00074	0.00066	0.00059	0.00053
>10 to 15	≤20	0.0044	0.0033	0.0025	0.0020	0.0017	0.0014	0.0012	0.0010	0.00088	0.00077	0.00069	0.00062	0.00055
>10 to 15	>20	0.0034	0.0027	0.0021	0.0018	0.0015	0.0012	0.0011	0.00093	0.00081	0.00072	0.00064	0.00058	0.00052
>15 to 30	≤20	0.0043	0.0032	0.0025	0.0020	0.0016	0.0014	0.0012	0.0010	0.00088	0.00077	0.00069	0.00061	0.00055
>15 to 30	>20	0.0034	0.0027	0.0021	0.0018	0.0015	0.0012	0.0011	0.00093	0.00082	0.00072	0.00065	0.00058	0.00052
>30	>20	0.0022	0.0018	0.0015	0.0013	0.0011	0.0010	0.00086	0.00076	0.00068	0.00061	0.00055	0.00050	0.00046
Building Area	Building	Exposure Location Distance (meters)												
(1,000 ft2)	Height (ft)	180	190	200	250	300	350	400	450	500	600	700	800	1000
≤3	≤20	0.00050	0 00046	0.00042	0.00029	0.00021	0.00016	0.00013	0.00010	0.000087	0.000064	0.000049	0 000039	0.000027
>3 to 6	≤20	0.00050	0 00046	0.00042	0.00028	0.00021	0.00016	0.00013	0.00010	0.000087	0.000064	0.000049	0 000039	0.000027
>3 to 6	>20	0.00049	0 00045	0.00041	0.00028	0.00021	0.00016	0.00013	0.00010	0.000087	0.000064	0.000049	0 000039	0.000027
>6 to 10	≤20	0.00050	0 00046	0.00042	0.00028	0.00021	0.00016	0.00013	0.00010	0.000087	0.000064	0.000049	0 000039	0.000027
>6 to 10	>20	0.00048	0 00044	0.00041	0.00028	0.00020	0.00016	0.00013	0.00010	0.000086	0.000064	0.000049	0 000039	0.000027
>10 to 15	≤20	0.00050	0 00046	0.00042	0.00028	0.00021	0.00016	0.00013	0.00010	0.000087	0.000064	0.000049	0 000039	0.000027
>10 to 15	>20	0.00048	0 00044	0.00040	0.00028	0.00020	0.00016	0.00012	0.00010	0.000086	0.000063	0.000049	0 000039	0.000027
>15 to 30	≤20	0.00050	0 00046	0.00042	0.00028	0.00021	0.00016	0.00013	0.00010	0.000087	0.000064	0.000049	0 000039	0.000027
>15 to 30	>20	0.00048	0 00044	0.00040	0.00028	0.00020	0.00016	0.00013	0.00010	0.000086	0.000063	0.000049	0 000039	0.000027
>30	>20	0.00042	0 00039	0.00036	0.00025	0.00019	0.00015	0.00012	0.00010	0.000083	0.000061	0.000048	0 000038	0.000027

Table 3D: Fugitive Emission Dispersion Factors for 24 hour Exposure (µg/m³ / pounds/day)

Building Area	Building	Exposure Location Distance (meters)												
(1,000 ft2)	Height (ft)	50	60	70	80	90	100	110	120	130	140	150	160	170
≤3	≤20	4.8	3.7	2.9	2.4	2.0	1.7	1.4	1.2	1.1	0.97	0.87	0.78	0.71
>3 to 6	≤20	4.1	3.1	2.5	2.0	1.7	1.4	1.2	1.1	0.95	0.84	0.76	0.68	0.62
>3 to 6	>20	3.5	2.8	2.2	1.9	1.6	1.3	1.2	1.0	0.90	0.80	0.72	0.65	0.59
>6 to 10	≤20	4.0	3.1	2.5	2.0	1.7	1.4	1.2	1.1	0.94	0.84	0.75	0.68	0.62
>6 to 10	>20	3.3	2.6	2.1	1.8	1.5	1.3	1.1	0.97	0.86	0.77	0.69	0.63	0.57
>10 to 15	≤20	4.0	3.1	2.4	2.0	1.7	1.4	1.2	1.1	0.94	0.84	0.75	0.68	0.62
>10 to 15	>20	2.9	2.4	2.0	1.6	1.4	1.2	1.1	0.93	0.83	0.74	0.67	0.61	0.56
>15 to 30	≤20	3.7	2.9	2.3	1.9	1.6	1.4	1.2	1.0	0.92	0.82	0.74	0.67	0.61
>15 to 30	>20	2.9	2.3	1.9	1.6	1.4	1.2	1.0	0.92	0.82	0.74	0.67	0.60	0.55
>30	>20	1.8	1.5	1.3	1.2	1.0	0.92	0.82	0.73	0.66	0.60	0.55	0.51	0.47
Building Area	Building	Exposure Location Distance (meters)												
(1,000 ft2)	Height (ft)	180	190	200	250	300	350	400	450	500	600	700	800	1000
≤3	≤20	0.65	0.59	0.55	0.38	0.29	0.22	0.18	0.15	0.13	0.095	0.074	0.060	0.043
>3 to 6	≤20	0.57	0.52	0.48	0.33	0.25	0.20	0.16	0.13	0.11	0.083	0.065	0.053	0.038
>3 to 6	>20	0.54	0.50	0.46	0.32	0.24	0.19	0.15	0.13	0.11	0.081	0.064	0.052	0.037
>6 to 10	≤20	0.56	0.52	0.48	0.33	0.25	0.20	0.16	0.13	0.11	0.083	0.065	0.053	0.038
>6 to 10	>20	0.53	0.48	0.45	0.31	0.24	0.19	0.15	0.12	0.11	0.080	0.063	0.051	0.036
>10 to 15	≤20	0.56	0.52	0.48	0.33	0.25	0.19	0.16	0.13	0.11	0.083	0.065	0.053	0.038
>10 to 15	>20	0.51	0.47	0.43	0.31	0.23	0.18	0.15	0.12	0.10	0.078	0.062	0.050	0.035
>15 to 30	≤20	0.55	0.51	0.47	0.33	0.25	0.19	0.16	0.13	0.11	0.083	0.065	0.053	0.037
>15 to 30	>20	0.51	0.47	0.43	0.31	0.23	0.18	0.15	0.12	0.10	0.078	0.062	0.050	0.035
>30	>20	0.43	0.40	0.37	0.27	0.21	0.17	0.14	0.12	0.098	0.075	0.059	0.048	0.034

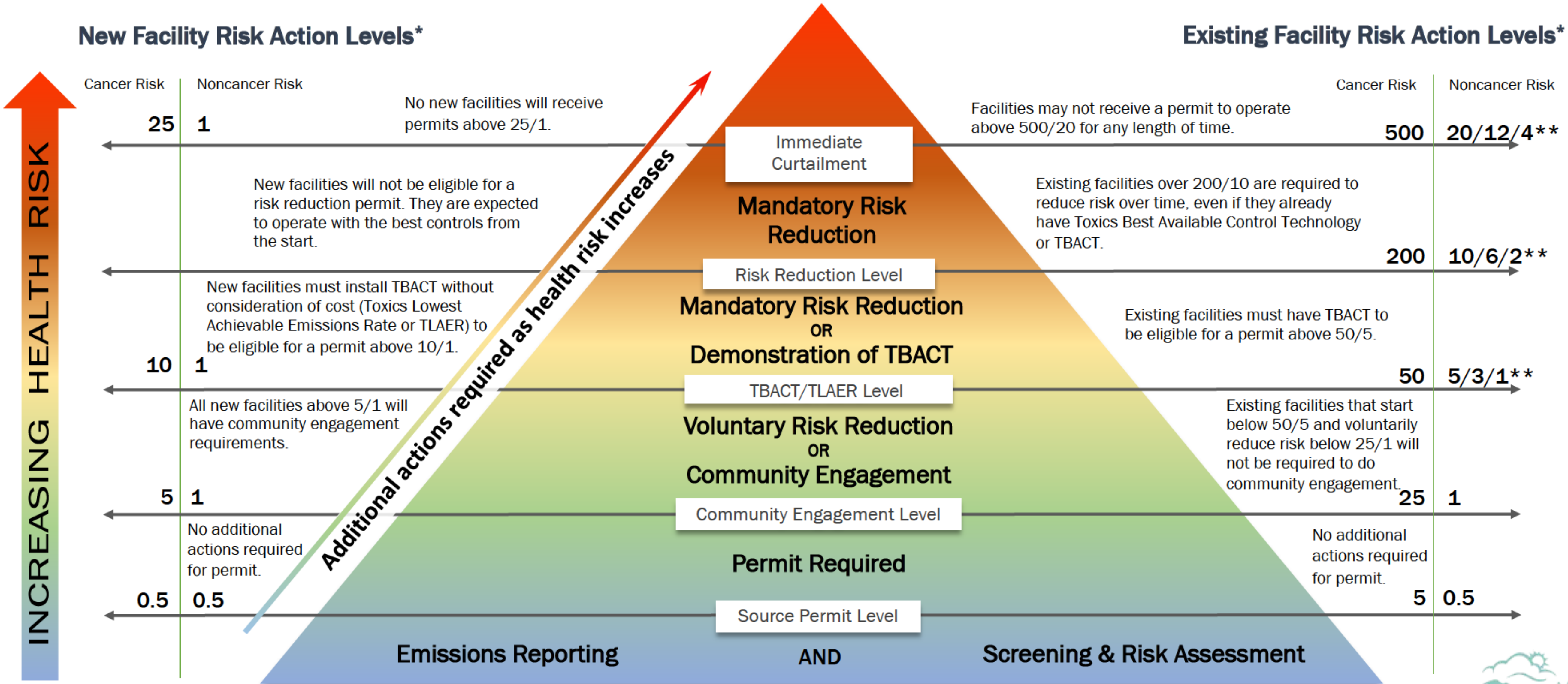
Use of fugitive emission dispersion factors in a Level 1 screening risk assessment:

For each Toxics Emissions Unit, select the appropriate building dimensions and distance from building to nearest exposure locations approved by DEQ. For each exposure location, find the corresponding annual dispersion factor in Table 3C. For each toxic air contaminant, multiply the annual toxic air contaminant emission rate (in pounds/year) by the dispersion factor. Divide the product by the RBC for all the toxic air contaminants for the appropriate exposure location in OAR 340-245-8010 Table 2. Add up the resulting ratios for all Toxic Emissions Units for each exposure location. Compare the results with the Risk Action Levels in OAR 340-245-8010 Table 1. Repeat the process for daily emission rates (in pounds/day) using Table 3D at the acute exposure location.
For an exposure location distance between the values shown in the table, either use the next lowest distance, or interpolate the dispersion factor. For exposure locations greater than 1,000 meters from the building, use the appropriate dispersion factor at 1,000 meters. In the absence of known building dimensions and exposure location distance, use as a default, the annual dispersion factor (0.0045 µg/m³ / pounds/year) and daily dispersion factor (4.8 µg/m³ / pounds/day) for a building area of ≤3,000 ft2, height of ≤20 ft, and exposure location distance of 50 meters.
A Level 1 Risk Assessment will not be approved if the source is located near elevated terrain that DEQ determines could invalidate the assumptions used to develop the Level 1 Risk Assessment Dispersion Factors.

Stat. Auth.: ORS 468.020, 468.065, 468A.025, 468A.040, 468A.050, 468A.070, 468A.155
Stats. Implemented: ORS 468.065, 468A.010, 468A.015, 468A.025, 468A.035, 468A.040, 468A.050, 468A.070, and 468A.155

How Risk Action Levels Work

For Cleaner Air Oregon, facilities would be required to assess potential health risks of emissions to their neighbors. **Risk Action Levels (RALs)** determine the specific actions required of facilities that pose different levels of health risk. Facilities with higher health risks would be required to take more actions to reduce risk and keep their neighbors informed. Risk Action Levels are different for new and existing facilities. The state legislature set statutory benchmark RALs through 2029. After 2029, RALs for existing facilities will be reevaluated.



*There are separate Risk Action Levels for cancer risk and risk of other health effects because scientists assess and describe these risks differently.

- **Cancer Risk** is described in terms of the number of excess cancer cases in 1 million lifetimes that may be caused by long-term exposure to a specific chemical concentration.
- **Noncancer Risk** is presented as a Hazard Index and is assessed for both chronic and short term health effects (acute). A Hazard Index below 1 means the facility is below the level that is expected to harm health. ** The values 1, 2, and 4 represent Risk Determination Ratios as calculated under OAR 340-245-0200(5).

Cleaner Air Oregon Toxicity Reference Values and Risk-Based Concentrations

Explanation of Authoritative Sources of Toxicity Reference Values Used in Cleaner Air Oregon

The Cleaner Air Oregon program developed by the Oregon Department of Environmental Quality and the Oregon Health Authority evaluates potential toxic air contaminant risks to people near industrial and commercial facilities, and reduces those risks below action levels adopted in law or rules. The agencies use toxicity reference values, or TRVs, to assess these risks. A TRV is the concentration of a toxic air contaminant below which health effects are not expected to occur, even in sensitive people, based on the best available science. A TRV depends on the type of health effect and whether exposure is for a long or short period of time. TRVs used for toxic air contaminants only consider health risks related to breathing in the toxic air contaminant. A toxic air contaminant could have up to three different TRVs:

- **Chronic cancer TRV** is the air concentration of a toxic air contaminant that contributes no more than 1 in 1 million additional cancer risk when that air is breathed all the time over a lifetime.
- **Chronic noncancer TRV** is the level below which no noncancer health effects are expected over a year or more of constantly breathing that air.
- **Acute noncancer TRV** is the level below which no noncancer health effects are expected over 24 hours or less of breathing that air.

How Cleaner Air Oregon selects TRVs

A number of governmental scientific agencies have developed TRVs, and they use different names for their TRVs. These authoritative sources do not all have TRVs for every toxic air contaminant. Sometimes, multiple authoritative sources have slightly different TRVs for the same toxic air contaminant. This is often because they have different schedules for reviewing the underlying science and updating their TRVs. DEQ and OHA used different strategies to select TRVs from among authoritative sources for chronic and acute TRVs. The authoritative sources all assume the same exposure time when developing their chronic TRVs and their scientific processes are equally rigorous. DEQ and OHA selected the most recently published TRV from among the authoritative sources listed in Table 1 for each toxic air contaminant. This ensures that chronic TRVs are based on the most recent review of scientific studies by an authoritative source.

Table 1. Authoritative scientific agencies for selecting chronic toxicity reference values

Name of agency	Name of Chronic TRV	TRV Available
Oregon Department of Environmental Quality	Ambient Benchmark Concentration*	cancer and noncancer
U.S. Environmental Protection Agency Integrated Risk Information System (IRIS)	Inhalation Unit Risk (IUR)	cancer
	Reference Concentration (RfC)	noncancer
EPA Provisional Peer Reviewed Toxicity Values (PPRTV)	IUR	cancer
	RfC	noncancer
U.S. Agency for Toxic Substances and Disease Registry (ATSDR)	Chronic Minimal Risk Levels	noncancer
California EPA Office of Environmental Health Hazard Assessment (OEHHA)	IUR	cancer
	Chronic Reference Exposure Level	noncancer

**Note: DEQ Ambient Benchmark Concentrations are derived from a review of existing TRVs, and generally not by a separate peer review of scientific literature.*

Through an existing technical advisory committee to DEQ, the Air Toxics Science Advisory Committee (ATSAC), DEQ has established a set of Ambient Benchmark Concentrations (ABCs) as chronic TRVs for 55 toxic air contaminants. These ABCs were adopted in rule and published on May 11, 2018. This makes them the most recently published TRVs for each toxic air contaminant for which an ABC has been established. It is important to note that the ATSAC only considered values from the authoritative sources shown in Table 1. DEQ does not intend to develop, or ask ATSAC to develop, its own TRVs.

Acute TRVs are different because fewer authoritative sources create them and because the authoritative sources make different assumptions about how long people are exposed. Health risks from inhaling toxic air contaminants are the result of how concentrated the contaminants are in the air and the amount of time people spend breathing them. DEQ and OHA assume 24 hours of exposure for acute TRVs. CAO is not intended to be a mechanism to address emergency situations where exposures of less than an hour could affect health. There are other mechanisms to address emergency situations caused by very high accidental releases. Therefore, DEQ and OHA selected acute TRVs from among authoritative sources by preference for which authoritative source used assumptions about exposure times that best matched DEQ and OHA's assumed exposure time of 24 hours. Table 2 shows the authoritative sources listed in order of preference based on how well their TRVs match DEQ and OHA's assumed 24-hours of exposure.

Table 2. Order of authoritative scientific agencies for acute noncancer toxicity reference values

Order of Preference	Name of agency	Name of Acute TRV	Assumed Exposure Time
1	Oregon Department of Environmental Quality	Short-term Guideline Concentrations	24 Hours
2	U.S. Agency for Toxic Substances and Disease Registry	Acute Minimal Risk Levels	Less than 2 weeks (includes 24 hours)
3	California EPA Office of Environmental Health Hazard Assessment	Acute Reference Exposure Level	1 Hour
4	U.S. Agency for Toxic Substances and Disease Registry	Intermediate Minimal Risk Levels	2 Weeks to 1 year

Rationale for using TRVs from authoritative agencies

1. **The agencies included in the hierarchy tables go through extensive peer-reviewed processes** to establish health-based TRVs using the best available science and research. They convene panels of scientists with expertise in the chemicals being evaluated. For each chemical, these expert panels spend years reviewing hundreds of scientific studies to evaluate the weight of scientific evidence. The evaluations are then shared for public comment. This public process is lengthy and requires substantial investments of federal tax dollars.
2. **Establishing new TRVs is beyond the capacity of agencies in Oregon.** In order to establish new TRVs, Oregon would have to undergo a rigorous and costly process, similar to the one mentioned above. That kind of work is far beyond the current capacity of state agencies and would result in state tax dollars being spent to do work that is already being done at the federal level. The results of a state level review would likely confirm the conclusions of other authoritative sources.
3. **Other states confidently rely on agency TRVs** as the basis for health-based industrial toxic air contaminant programs. Programs in Washington State, New Jersey, Rhode Island, Massachusetts, New Hampshire, New York, Georgia, Minnesota, Michigan, and North Carolina all rely primarily on TRVs from the EPA and U.S. Agency for Toxic Substances and Disease Registry. However, these states do not all draw from these sources in the exact same order.

How Cleaner Air Oregon's Risk-Based Concentrations Are Developed from Toxicity Reference Values

Risk is a combination of how harmful a contaminant is (toxicity), and how and for how long a person might come into contact with the contaminant (exposure). When they develop TRVs, the authoritative sources do so using an assumption of constant exposure to a toxic air contaminant. These authoritative sources have also developed steps to adjust TRVs to match more common real-life exposure scenarios, such as adults working 40 hours per week. DEQ and OHA used TRVs from the authoritative sources in the tables above to calculate adjusted values, called "risk-based concentrations," or RBCs. RBCs are the tool agencies will use to evaluate health risks from individual facility toxic air contaminant emissions, and determine whether the risk is above a level requiring a facility to take some action. Graphic 1 shows how selection of TRVs result in identified risk-based concentration levels.

Approach used to calculate Cleaner Air Oregon RBCs

DEQ and OHA developed RBCs for each toxic air contaminant for which an authoritative source has established a TRV. The agencies then applied adjustment factors appropriate for calculating RBCs as shown in Graphic 1. There are separate RBCs for cancer risk, chronic (long-term exposure) noncancer risk, and acute (short-term exposure of 24 hours or less) noncancer risk.

Adjustment Factors

The agencies apply adjustment factors to TRVs in order to convert TRVs to RBCs that consider both toxicity and amount of exposure to a toxic air contaminant. DEQ and OHA used the following adjustment factors to calculate cancer and chronic noncancer RBCs. Adjustment factors are not appropriate or necessary for acute RBCs, which are concerned with health effects that may occur from short periods of exposure (generally less than one day).

- ***Exposure time, frequency and duration***. Exposure time is the number of hours per day exposed. Exposure frequency is the number of days per year exposed and exposure duration is the number of years exposed. The amount of risk often depends on how often and for how long a person is exposed to a toxic air contaminant. For example, a worker exposed to a toxic air contaminant for 8 hours/day for 25 years has less exposure, and therefore less risk than a resident exposed for 24 hours/day for 70 years.
- ***Early-life exposure***. An early-life adjustment factor is used for some cancer-causing (carcinogenic) contaminants. These carcinogens may have greater toxicity to infants or children than is reflected in the related TRV.
- ***Multi-pathway exposure***. A multi-pathway adjustment factor (MPAF) for exposure considers other ways people could be exposed to a contaminant. Some toxic air contaminants can be deposited on soil where someone may be exposed to the contaminants by routes other than inhalation. MPAFs are only used for contaminants that can build up in the body (bioaccumulate) and contaminants that can stay a long time in the environment.

Using RBCs in Cleaner Air Oregon

The approach DEQ and OHA use to calculate RBCs is consistent with other state and federal programs, and with DEQ's existing Cleanup Program. The agencies will use RBCs to calculate risks for an individual facility. Calculated risks for a facility would then be compared with Risk Action Levels (RALs), the levels at which facilities must take action.

Graphic 1. Process to identify Risk-Based Concentrations