California Council for Environmental and Economic Balance
101 Mission Street, Suite 1440, San Francisco, California 94105
415-512-7890 phone, 415-512-7897 fax, www.cceeb.org

March 29, 2018

Karen Magliano
Director, Office of Community Air Protection
Air Resources Board
Submitted Electronically

RE: AB 617 Community Air Protection Program Framework Concept Paper

Dear Director Magliano,

On behalf of the members of the California Council for Environmental and Economic Balance (CCEEB), we submit the following comments on the AB 617 Community Air Protection Program Framework Concept Paper ("Concept Paper"). CCEEB supported the passage of AB 617, and shares with the California Air Resources Board (CARB) the belief that this is the most significant piece of air quality legislation in the past thirty years. We are committed to working with CARB, the state's air districts, and legislative leaders on successful design and implementation of AB 617 so as to achieve real and meaningful risk reductions in communities highly burdened by local air pollution.

Our main points regarding the Concept Paper are as follows:

- **Standardized guidance on data interpretation is needed.** CARB and the air districts should work with stakeholders to develop and provide guidance on how to interpret the data collected by AB 617 community monitoring programs.

- **Community identification and prioritization should be based on air pollution data** that indicates the level of exposure from ambient air.

- **CARB must implement applicable mobile source elements** and be part of the process as air districts develop Community Emissions Reduction Plans (CERPs).

- **Measures in the CERPs must be cost effective and consistent with the Health & Safety Code.** The Technology Clearinghouse, meant to describe appropriate tools and measures for the statewide strategy and CERPs, should be consistent with Health and Safety Code requirements for Best Available Control Technology, Best Available Retrofit Control Technology, and AB 617, including tests for cost effectiveness and technological feasibility, as required by law and determined by responsible air districts.

- **Program Goals should be clearly articulated.** CARB should provide guidance on how air districts, with community partners, affected sources, and local government, can establish program goals and quantify results so as to determine program success.

- **The State must establish equitable and sustainable sources of funding for program success.** CARB should acknowledge the funding needs of the air districts responsible for implementation of AB 617 community monitoring and the CERPs, and work with the districts and public stakeholders to identify and secure sustained and equitable sources of program funding.

What follows is an in-depth discussion of these key points, along with additional comments related to specific sections of the Concept Paper, as well as a few comments on the *DRAFT Process and Criteria for 2018 Community Selections* document.

CAP Program Concept Paper – Comments by Section

Section 1. Preface

AB 617 seeks to reduce high cumulative exposure burdens in prioritized communities. While efforts taken as part of the Community Air Protection (CAP) Program should be expected to reduce disparities between highly burdened and non-highly burdened communities, it is important to recognize that the goal is to reduce risk from exposures, not to eliminate all relative differences. For example, two communities could have relative differences in ambient air concentrations, yet both communities could be non-burdened and not warrant action under AB 617. To clarify intent, CCEEB recommends the following change to page 1:

> "~~The bill recognizes that~~ While California has seen tremendous improvement in air quality, some communities still ~~suffer greater impacts than others~~ experience high cumulative exposure burdens and more needs to be done."

Section II. Public Health Imperative for AB 617

CCEEB recommends that CARB provide meaningful context for health risks from exposure to criteria and toxic air pollutants. At a minimum, we suggest the following changes to page 3:

> "Ozone levels have dropped over 40 percent in the South Coast region since 1990 and diesel particulate matter, which accounts for over two thirds of the

> total known statewide air toxics cancer risk ~~in the State~~, has dropped nearly 70 percent over this same period. ~~Additionally, California is on its way to exceeding its 2020 GHG emissions reduction target~~. Statewide cancer risk from airborne toxics is estimated to be about [NUMBER], whereas total lifetime cancer risk in the United States from all causes is about 40 percent[1] or 400,000-in-a-million."

In addition to expanding useful risk communication, CCEEB believes that greenhouse gas programs, which are meant to control *global* pollutants, are outside the scope of AB 617 and should not be unintentionally conflated with local health impacts caused by direct exposure to criteria and toxic emissions.

Section III. Guiding Principles

CCEEB generally supports the ten Guiding Principles, and suggests the following changes to clarify intent and align the principles with AB 617 requirements.

In order to recognize that some measures could reduce exposures and emissions (e.g., altering truck routes or traffic patterns), we suggest:

> "Implement community-focused actions to reduce emissions of and exposures to criteria air pollutants and toxic air contaminants in order to improve public health in disadvantaged communities most impacted by air pollution."

In order to be consistent with AB 617 consultation requirements[2], we suggest:

> "Develop a strong collaborative relationship between local community groups, air districts, CARB, affected industries, local governments, and other stakeholders."

In order to be consistent with AB 617 requirements for the statewide strategy and Community Emission Reduction Programs (CERPs),[3] we suggest:

> "Support investments that are cost effective and technologically feasible to advance the deployment of ~~the~~ clean~~est~~ mobile and stationary source technologies within impacted communities in order to maximize emissions reductions ~~including a focus on zero emission technologies where feasible~~."

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[1] https://www.cancer.org/content/dam/cancer-org/online-documents/en/pdf/reports/california-facts-figures-2017.pdf. The American Cancer Society estimates lifetime cancer risk is 41 percent for US men and 38.1 percent for US women (2017).

[2] See Sections 42705.5(b) and 44391.2(c)(2).

[3] See Section 44391.2(c)(2).

Section V. Identification and Selection of Communities

CCEEB agrees that many types of data will be needed to identify and prioritize communities with "high exposure burdens" and "high cumulative pollution exposure burden[s]."[4] As such, when identifying communities, emphasis must be placed on risk-based air pollution data that indicates the level of exposure.[5] Ideally, use of other criteria related to more general population characteristics should be applied either as a second screen to prioritize communities already identified for high exposure levels, or as a separate analysis to show how different communities can benefit from the program.

We recommend that CARB articulate a hierarchy of available evidence to help guide air districts and public stakeholders and ensure consistency since some data will be more directly relevant in assessing exposure burdens. For example:

[4] AB 617 on *Identifying and Prioritizing Communities:*

For Community Monitoring: "the state board shall select, concurrent with the monitoring plan, in consultation with the districts and based on an assessment of the locations of sensitive receptors and disadvantaged communities, the highest priority locations around the state to deploy community air monitoring systems, which shall be communities with high exposure burdens for toxic air contaminants and criteria air pollutants." *Health and Safety Code, Section 42705.5(c)*

For Community Emissions Reduction Programs: "On or before October 1, 2018, the state board shall prepare, in consultation with the Scientific Review Panel on Toxic Air Contaminants, the districts, the Office of Environmental Health Hazard Assessment, environmental justice organizations, affected industry, and other interested stakeholders, a statewide strategy to reduce emissions of toxic air contaminants and criteria air pollutants in communities affected by a high cumulative exposure burden." *H.&S.C. Section 44391.2(b)*

[5] CCEEB makes a distinction between mass emissions for criteria pollutants – typically expressed as pounds or tons per day or per year – and exposure estimates for toxic air contaminants (TACs) – typically expressed as lifetime cancer risk or Health Index value. Mass emissions for criteria pollutants can be compared to health-based ambient air standards set by the federal EPA or the state air board. Risk estimates for TACs are set by the air board for statewide programs or by air districts for stationary source rules, following risk assessment guidelines developed by the Office of Health Hazard Assessment. For air toxics, mass emissions fail to indicate the potency level of the chemical emitted or the duration of exposure, both of which affect health risks. CCEEB believes the appropriate metric should be used for each pollutant.

Use of Reported Public Health Data
Public health and socioeconomic indicators may be appropriate for assessing potential community vulnerability to air-related impacts, but any data used must be clearly correlated to air emissions. CCEEB recognizes the many challenges in aligning currently available reported public health data with air emissions. Care must be taken since county and zip code data is not granular enough to indicate air impacts within a community, and health endpoints may be overwhelmed by the influence of independent and more predominant factors to disease outcomes.

An example of this problem can be seen by looking at the correlation analysis for CalEnviroScreen done by the Office of Environmental Health Hazard Assessment, which shows a clear lack of correlation between air quality indicators and health outcomes. This lack of correlation should *not* be interpreted as evidence that no causal relationship exists, but rather that the data we have is not robust enough to show the expected association. (Please see Appendix A.) This limitation with existing statewide data is one of the reasons why CCEEB believes that air quality data should be prioritized over other types of data that may be less informative in terms of selecting the most highly burdened communities.

The most scientifically sound and straightforward approach to evaluating health impacts is to look at estimated health risks due to air pollution exposures. A common form of this approach is used in evaluating health benefits from air quality management plans. Another more novel and detailed form was used by the BAAQMD in its CARE modeling,[6] which itself was based in part on U.S. EPA's Environmental Benefits Mapping and Analysis Program.[7]

Use of CalEnviroScreen Ranking
CARB and air districts should avoid double counting that could arise if using criteria that replicate indicators already embedded in CalEnviroScreen (CES). This includes, but is not limited to, data on public health outcomes, total cancer risk, and socio-economic factors.

Balancing Air Quality Data
Page 6 of the supplemental document *DRAFT Process and Criteria for 2018 Community Selections* lists sources of air quality data to be included in community evaluations. However, several of the proposed data sources are duplicative in that they estimate emissions from the same sources, whereas similar data for other source types may be missing or less robust. CCEEB recommends that CARB provide guidance on how to

[6] See http://www.baaqmd.gov/~/media/Files/Planning%20and%20Research/CARE%20Program/Documents/ImpactCommunities_2_Methodology.ashx?la=en.
[7] See https://www.epa.gov/benmap.

manage these overlapping lines of evidence to avoid double counting and bias, and address potential data gaps for source categories suspected of significantly contributing to community ambient air concentrations.

Enforcement Data Can Be Misleading

CCEEB strongly disagrees that notice of violations (NOVs) are useful data, since many NOVs result from ministerial or minor errors that do not result in excess emissions. We believe that the ratio of such "paper" errors compared to emissions-related violations is quite high. Moreover, use of NOVs would likely add a de facto bias in favor of communities with large stationary sources, which are frequently inspected and must comply with complex administrative and reporting rules, as compared to those with high concentrations of area or mobile sources but where the number of inspections could be far fewer. Similarly, a large number of enforcement actions could be indicative of a robust or focused enforcement program at work rather than a community with a high cumulative exposure burden. Because of this bias, CCEEB believes enforcement data would unintentionally skew community selection results.

At a minimum, CARB and the air districts should have wide latitude when considering enforcement data, relying on local knowledge of sources and information on compliance trends for the source types most commonly found in a given community.[8] Raw data on the number of NOVs issued or enforcement actions taken does not paint an accurate picture of enforcement issues within a community, or whether those enforcement issues are driving high exposures burdens.

Section VI. Strategies to Reduce Emissions and Exposures

CCEEB recommends amending the first paragraph to include state and district air toxics programs and making minor additions to clarify that planning efforts result in regulations to directly control emissions. We suggest the following for the discussion on page 9:

> "Identifying strategies for reducing criteria air pollutants and air toxics at the community level is critical for establishing a strong statewide framework for action. Existing air quality planning efforts such as the California State Implementation Plan Strategy, Mobile Source Strategy, California Sustainable Freight Action Plan, Short-Lived Climate Pollutant Reduction Strategy, and Climate Change Scoping Plan, will be the foundation for further reducing emissions and exposure within communities across the State. Air districts also

[8] For example, compliance with ARB's Truck and Bus Rule is 69 percent in total, but only 50 percent for small fleets with only one to three trucks. This type of analysis could be more important for communities with a large number of small fleets than the total number of NOVs issued. See CARB's 2016 Enforcement Report.

have ongoing planning efforts that will further reduce emissions within their respective air basins and drive adoption of rules and regulations to control stationary source emissions. Additionally, both CARB and air districts directly regulate toxic air contaminants through the Air Toxics Hot Spots Program and air toxic control measures, with further environmental review and mitigation of risk required by lead agencies under CEQA. "

Multi-Layered Suite of Strategies

Major sources in non-attainment areas are subject to all feasible control measures, expedited BARCT implementation under AB 617, and recently updated air toxics rules that substantially increase the stringency of those programs. The analysis presented on page 18 of the Concept Paper provides a useful starting point for air districts in determining what gaps exist in current regulations, and could help identify opportunities where enforceable agreements can achieve additional or accelerated reductions beyond agency rules. We suggest the following change on page 10:

"Regulatory actions along with focused enforcement to ensure effective implementation of both new and existing regulations within specific communities. Whenever feasible, the strategy should consider enforceable agreements as a means to achieve reductions."

Focused use of incentive funds will be another important mechanism to achieve emission reductions. Incentives can be used to advance both the development and deployment of cleaner technologies, and can help equipment owners and operators reduce emissions. We suggest the following change to clarify the roles of incentives on page 10:

"Coordinated incentive funding to provide investments in cleaner technologies and accelerated engine and equipment turnover, along with needed infrastructure and other complementary elements to support complete and sustainable technology solutions."

CCEEB agrees with the multi-layered approach described in the Concept Paper, which recognizes that each community "will require a different combination of strategies based upon the nature of each air quality challenge…" However, we believe that the approaches listed on pages 10-11 should represent a menu or suite of available options rather than "a minimum starting point," and that each CERP will be different. We suggest the following change on page 10:

"~~While~~ Each community will require a different combination of strategies based upon the nature of each air quality challenge; the strategies outlined below provide~~s~~ a ~~minimum starting point for~~ menu of options that can be used in an assessment of appropriate actions."

Section VII. Criteria for Community Action Plans

CARB should amend Section VII and specify how it will implement the applicable mobile source elements as part of the Community Emissions Reduction Plans (CERPs). CCEEB recommends that this be addressed, noting that AB 617 specifies that, "[t]he [community emission reduction] programs shall result in emissions reductions in the community based on monitoring or other data," and that, "[i]n implementing the [community emission reduction] program, the district and the state board shall be responsible for measures consistent with their respective authorities."[9]

In discussion at the Riverside AB 617 Technical Workshop on February 28, 2018, staff stated that CARB will not propose community-specific measures as part of the CERPs, but would instead rely on implementation of existing statewide programs to reduce mobile and area sources. While CCEEB agrees with this approach as it relates to regulatory actions—and generally believes that regulations should be applied consistently statewide or regionally—we believe that CARB must be "at the table" as the districts develop and implement the CERPs, and be responsible for measures consistent with its authority. Such measures could include focused enforcement and inspections, compliance assistance to local businesses, and prioritization of incentive funds in AB 617 communities. We ask staff and the Board to reconsider CARB's role in AB 617 and add steps CARB will take to participate in the development and implementation of the CERPs.

VII.A. Health-based Air Quality Goals

CCEEB appreciates the discussion on page 14 that describes the multi-factorial nature of diseases associated with exposure to air pollutants, and the independent contribution that structural determinants of health have on disease outcomes. CCEEB believes that health-based air quality goals should be based on reductions in emissions from the highest contributing sources of risk in a community, and that goals should be quantifiable whenever possible.

However, CCEEB recommends that CARB provide greater detail on what an end goal would look like, and how air districts can work with public stakeholders to establish achievable emission targets, based on community monitoring and other data, source apportionment, and community inventories developed for AB 617 purposes. Clearly articulated program goals, along with required AB 617 analyses—including but not limited to those mentioned above—will form the basis for selecting appropriate and feasible timeframes for action.

[9] H.&S.C. Section 44391.2(c)(4) and (5) and (6).

Section VIII. Criteria for Community Air Monitoring

VIII.A. Community Air Monitoring Objectives and Methods
As CARB develops the statewide plan for community air monitoring, CCEEB hopes to work with staff and other stakeholders to identify and define appropriate technologies and techniques to achieve the various objectives of each community. We suggest that staff develop a simple framework or matrix that describes how different monitoring approaches match different objectives, including information on the following aspects:

- Objective(s) to be addressed
- Pollutants and sources to be measured
- Suitable technologies and techniques for monitoring
- Spatial coverage
- Duration of monitoring
- Timing period of measurements taken
- Who manages equipment, sampling and data
- Uses of data
- Costs for deploying and maintaining
- Limitations of the system

Different approaches to air monitoring will require different standards for data, and result in different quality data. Additionally, poorly designed studies or systems, inadequate or inappropriate data collection and data management, and other issues related to quality control and quality assurance could arise. To ensure data integrity, CCEEB recommends that staff work with stakeholders and technology experts to develop clear standards and QAQC protocols for any AB 617 community monitoring system, and that these systems be operated by air districts that can regularly conduct QAQC audits and provide accountability that all QAQC steps are being properly taken.

VIII.B. Community Air Monitoring Plan Elements
CCEEB recommends the following additions to Table 1 on page 26, which outlines the thirteen proposed elements for air monitoring plans:

> [Add element] Develop and advance sensor and monitoring technology, working towards common platforms and open source systems.
>
> "Develop quality control procedures and conduct regular QAQC, reporting results to the public as part of annual reporting."
>
> "Manage, validate, and store data"
>
> "Communicate results and provide access to stored data"

VIII.C. Community Engagement
CCEEB supports the establishment of a community steering committee in each community selected for air monitoring and CERPs, and appreciates the approach that CARB proposes in the Concept Paper. Broad participation by communities, affected sources, local government, and other interested groups in the planning stage should help foster collaborative and innovative approaches, leverage local knowledge about sources of emissions and sensitive receptors, and minimize uncertainties or challenges later on during implementation phases. It is important for the long-term success of AB 617 that initial community programs are seen as inclusive, effective, fair, and equitable, with the greatest degree of buy-in among all community stakeholders.

CCEEB believes the steering committees should be advisory bodies, where air districts, CARB and other responsible parties can discuss ideas and proposals. However, decision-making authority can and must rest with the governing boards of the air districts, which will ultimately be accountable for the success of community plans, and the state air board in its oversight of district AB 617 programs.

Section IX. Additional Implementation Elements

While this section addresses the funding needs of communities wishing to engage in AB 617 programs, it misses discussion of funding needed for the air districts to implement these same programs. This is a vitally important implementation element; we recommend that a subsection be added to Section IX that addresses it. CCEEB is committed to working with the districts, CARB, and other public stakeholders to identify and secure sustained program funding, and believes that the current lack of ongoing funding must to be explicitly acknowledged so that it can be appropriately addressed.

IX.C. Statewide System of Annual Emissions Reporting
Page 32 of the Concept Paper states that the statewide reporting framework is meant to "support air district and community needs." CCEEB recommends that CARB consider the needs of reporting entities, which strongly support user-friendly and consistent reporting programs and calculation methodologies that result in the most accurate data possible. In addition to regulatory needs for emissions reporting, such as payment of fees and compliance with district permits and rules, stationary sources have a vested interest in ensuring that publicly available emissions data is both accurate and consistent from agency to agency. CCEEB recommends that CARB add a discussion of stationary sources to subsection IX.C and that it make the following change to page 31:

> "New requirements under AB 617 will work hand-in-hand with efforts underway as part of AB 197 and include: consistent annual reporting of criteria air pollutant and toxic air contaminant emissions for specified large facilities."

IX.D. Technology Clearinghouse

AB 617 directs CARB to establish a Technology Clearinghouse "that identifies the best available control technology and best available retrofit control technology for criteria air pollutants, and related technologies for the control of toxic air contaminants."[10] In regards to the community plans, AB 617 states that the CERPs must "achieve emissions reductions for the location selected using cost-effective measures" identified through CARB's assessment of available BACT, BARCT, and T-BACT technologies.

CCEEB is concerned that staff are moving well beyond the stated purpose of AB 617, in that staff propose including "forward-looking information on the next generation of ultra-low or zero emissions technologies to support continued emissions control technology advancement."[11] In presentations at the recent AB 617 Technical Workshops, staff illustrated what is meant by next generation technology by showing the transition from an internal combustion engine to a fuel cell, and from a power plant to battery storage. Neither of those scenarios are BACT, BARCT or T-BACT under Health and Safety Code requirements, nor would they be cost effective under AB 617 for purposes of the CERPs. CCEEB is not clear why technology switching, such as staff's examples, would be proposed for the clearinghouse. We recommend that staff remove those references from the Concept Paper, and convene a technical working group to advise staff on appropriate BACT, BARCT and T-BACT technologies that should be included.

Under the Background on page 33, CCEEB recommends replacing "facility" and "facilities" with "source" and "sources" since district permits are for sources, not facilities. We also recommend that this subsection clarify that allowable emissions limits or thresholds are based on maximum feasible control for a source.

IX.F. Resources for Community Air Monitoring

CCEEB hopes that CARB will build on ongoing work at EPA's Office of Research and Development and South Coast's AQ-Spec Laboratory, while avoiding redundancies in activity and focus.

Under the subsection *Leverage Advanced Air Monitoring Technology* on page 37, CCEEB recommends removing the example of methane monitoring. Methane emissions have no direct local health impacts; instead, monitoring is conducted to better characterize GHG emissions and identify GHG hotspots. CCEEB does not believe this is germane to AB 617 and should be removed.

Under the subsection *Support Community Science* on page 38, CCEEB recommends that CARB provide technical support beyond the online resources described. Towards this

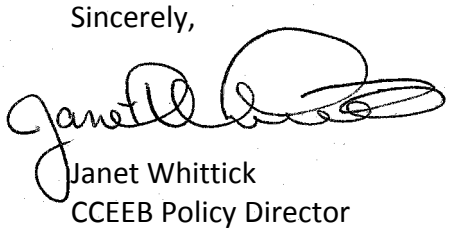
[10] AB 617, Section 3.
[11] Page 32.

end, we suggest CARB commit to directly advising community-based organizations on how to design air quality studies and deploy air sensor and monitoring networks, including steps needed for effective QAQC. CARB should also consider providing communities with information and resources so that communities can build effective partnerships with public agencies, academic and research institutions, nongovernmental organizations, and other groups that can support community-monitoring efforts.

CCEEB appreciates the opportunity to provide these comments on the Concept Paper, and looks forward to continuing our work with CARB, the air districts, legislative leaders, and other public stakeholders on developing and implementing AB 617. We further wish to acknowledge the tireless efforts of you and your staff, along with Assistant Secretary Eady, in ensuring an inclusive and robust public participation process, especially given the aggressive timelines set forth by AB 617.

Should you or your staff have any questions or wish to discuss our comments in more detail, please contact me at janetw@cceeb.org or (415) 512-7890 ext. 111.

Sincerely,



Janet Whittick
CCEEB Policy Director

cc: Veronica Eady, CARB
Jack Broadbent, BAAQMD
Wayne Nastri, SCAQMD
Seyed Sadredin, SJVAPCD
Alan Abbs, CAPCOA
Gerald D. Secundy, CCEEB
Bill Quinn, CCEEB
Kendra Daijogo, The Gualco Group, Inc. and CCEEB consultant

Sensitivity Analysis of
CalEnviroScreen 3.0 Indicators

October 2017

Table 1. Spearman's correlation coefficients (ρ) between indicator CES 3.0 raw scores.*

			Ozone	PM2.5	Diesel	Pesticides	Toxic Releases	Traffic	Drinking Water	Cleanup Sites	Groundwater Threats	Hazardous Waste Sites	Impaired Water Bodies	Solid Waste Sites	Asthma	Low Birth Weight	Cardiovascular Disease	Education	Linguistic Isolation	Poverty	Unemployment	Housing Burden
Pollution Burden	Exposures	Ozone	1																			
		PM2.5	0.39	1																		
		Diesel	-0.17	0.40	1																	
		Pesticides	0.08	-0.10	-0.37	1																
		Toxic Releases	0.08	**0.60**	0.47	-0.23	1															
		Traffic	-0.09	0.26	0.49	-0.30	0.39	1														
		Drinking Water	**0.58**	0.42	-0.06	0.17	0.14	0.00	1													
	Environmental Effects	Cleanup Sites	-0.11	0.13	0.25	-0.01	0.17	0.15	0.01	1												
		Groundwater Threats	-0.32	-0.05	0.15	0.08	0.00	0.11	-0.13	0.45	1											
		Hazardous Waste Sites	-0.13	0.11	0.32	-0.03	0.22	0.25	-0.03	0.46	0.39	1										
		Impaired Water Bodies	-0.29	-0.22	-0.08	0.12	-0.13	-0.02	-0.19	0.11	0.22	0.12	1									
		Solid Waste Sites	0.02	0.02	-0.06	0.18	0.07	0.00	0.12	0.31	0.29	0.29	0.17	1								
Population Characteristics	Sensitive Populations	Asthma	0.11	0.15	0.22	-0.04	0.07	0.01	0.02	0.14	0.11	0.09	-0.07	0.08	1							
		Low Birth Weight	0.09	0.20	0.22	-0.11	0.15	0.11	0.07	0.08	0.00	0.09	-0.09	0.03	0.34	1						
		Cardiovascular Disease	0.39	0.20	0.04	0.06	0.07	-0.07	0.20	0.05	-0.03	0.02	-0.13	0.09	**0.72**	0.24	1					
	Socioeconomic Factors	Education	0.18	0.32	0.24	0.02	0.21	0.10	0.23	0.20	0.10	0.13	-0.11	0.19	**0.56**	0.35	0.48	1				
		Linguistic Isolation	-0.02	0.34	0.43	-0.13	0.32	0.28	0.10	0.23	0.14	0.19	-0.09	0.09	0.30	0.28	0.19	**0.72**	1			
		Poverty	0.21	0.26	0.21	-0.02	0.11	0.06	0.19	0.19	0.13	0.12	-0.11	0.16	**0.56**	0.33	0.44	**0.83**	**0.60**	1		
		Unemployment	0.30	0.19	0.05	0.02	0.03	-0.04	0.20	0.06	0.02	0.01	-0.08	0.10	0.47	0.27	0.45	**0.53**	0.27	**0.61**	1	
		Housing Burden	0.04	0.21	0.34	-0.19	0.22	0.26	0.07	0.16	0.11	0.15	-0.08	0.08	0.38	0.28	0.22	**0.58**	**0.53**	**0.71**	0.41	1

*Spearman's correlation coefficient measures the degree to which two indicators tend to vary together. Values near -1 mean the indicators are strongly inversely related. Values of 1 mean the indicators are positively correlated. Values of 0 mean there is no clear relationship between the indicators. Strong and moderate correlations are shown in bold. Pairs with missing values were omitted from the analysis.

Table 1. Spearman's correlation coefficients (ρ) between indicator raw scores.*

			Ozone	PM2.5	Diesel PM	Pesticides	TRI	Traffic	Cleanup sites	Groundwater threats	Impaired water bodies	Waste sites	Age	Asthma	Low Birth Weight	Education	Linguistic isolation	Poverty	Race/ ethnicity
Pollution Burden	Exposures	Ozone	1																
		PM2.5	0.44	1															
		Diesel PM	0.10	**0.71**	1														
		Pesticides	0.07	0.05	-0.07	1													
		TRI	-0.01	0.16	0.17	0.00	1												
		Traffic	0.04	0.39	**0.62**	0.12	0.23	1											
	Environmental Effects	Cleanup sites	-0.03	0.34	0.48	0.10	0.37	**0.62**	1										
		Groundwater threats	-0.15	0.21	0.36	0.15	0.24	**0.62**	**0.66**	1									
		Impaired water	-0.31	-0.07	0.06	0.26	0.05	0.24	0.22	0.34	1								
		Waste sites	0.07	0.11	0.04	0.15	0.27	0.25	0.37	0.42	0.16	1							
Population Characteristics	Sensitive Populations	Age	0.08	-0.22	-0.38	0.11	-0.06	-0.24	-0.22	-0.15	-0.05	-0.01	1						
		Asthma	0.11	0.03	-0.07	-0.06	0.20	-0.12	0.07	0.06	-0.09	0.09	0.05	1					
		Low Birth Weight	0.11	0.28	0.32	-0.16	0.02	0.22	0.15	0.08	-0.06	0.01	-0.12	0.06	1				
	Socioeconomic Factors	Education	0.21	0.30	0.16	0.27	0.20	0.16	0.25	0.23	0.01	0.23	-0.01	0.40	0.03	1			
		Linguistic isolation	0.06	0.46	**0.56**	0.20	0.18	**0.50**	0.47	0.43	0.11	0.14	-0.21	0.10	0.17	**0.61**	1		
		Poverty	0.17	0.14	-0.04	0.08	0.14	-0.08	0.10	0.11	-0.09	0.16	0.05	**0.50**	-0.03	**0.67**	0.37	1	
		Race /ethnicity	0.12	**0.53**	**0.57**	0.21	0.28	**0.50**	0.49	0.41	0.07	0.18	-0.28	0.22	0.24	**0.65**	**0.82**	0.38	1

*Spearman's correlation coefficient measures the degree to which two indicators tend to vary together. Values near -1 mean the indicators are strongly inversely related. Values of 1 mean the indicators are positively correlated. Values of 0 mean there is no clear relationship between the indicators. Strong and moderate correlations are shown in bold. Pairs with missing values were omitted from the analysis.