Integrating Environmental Justice Metrics into Baltimore's Environmental Impact Assessments: Addressing Community-Level Risk Disparities

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ABSTRACT

Baltimore's environmental challenges, ranging from toxic air emissions to inequitable industrial zoning, disproportionately affect historically marginalized communities. Current Environmental Impact Assessments (EIAs) emphasize technical outcomes, but fail to capture disparities in exposure, health, and socioeconomic vulnerability. This paper proposes a systematic integration of environmental justice (EJ) metrics into Baltimore's EIAs, drawing on national frameworks, comparative urban practices, and a case study of West Baltimore. By embedding EJ indicators into scoping, baseline analysis, prediction, and mitigation stages, Baltimore can align environmental policy with equity and justice goals.

Keywords: Environmental justice, environmental impact assessment, Baltimore, West Baltimore, equity metrics, urban planning, sustainability

INTRODUCTION

Baltimore has long been recognized as a city grappling with environmental inequities. Poor air quality, contaminated waterways, and inequitable industrial zoning have created conditions where vulnerable communities bear disproportionate burdens. These challenges are not evenly distributed; instead, they cluster in historically marginalized neighborhoods such as West Baltimore. Current EIAs in Baltimore emphasize technical outcomes, but fail to capture community level disparities. This omission perpetuates inequities, as assessments overlook the lived realities of residents most affected by environmental hazards. Baltimore ranks among the top ten U.S. cities for toxic air emissions per capita [1]. Water quality assessments show a continuing decline in the Baltimore Harbor, Tidal Patapsco, Jones Falls and Gwynns Falls watersheds [2]. Industrial zoning practices exacerbate inequities, with chemicals and heavy metals entering neighborhoods during storm events [3]. This paper asks: How can EJ metrics be systematically integrated into Baltimore's EIAs to align policy with equity and justice goals? Environmental justice (EJ) has been formally defined by the U.S. Environmental Protection Agency (EPA) as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies [13]. The National Environmental Justice Advisory Council (NEJAC), established in 1993, provides independent advice to the EPA Administrator on the integration of EJ into agency programs and policies, emphasizing both distributive justice (fair outcomes) and procedural justice (fair processes) [11][12]. As mentioned above, Baltimore's current Environmental Im- pact Assessments (EIAs) remain narrowly focused on technical outcomes, such as air, water, and land use. For example, the Baltimore City Department of Public Works has issued regulatory mandates and watershed pollution reduction plans that emphasize compliance with federal Total Maximum Daily Load (TMDL) requirements, but these assessments rarely incorporate community level disparities or cumulative health impacts [1]. Similarly, the city's Climate Action Plan Update (2024) acknowledges environmental inequities, but does not embed EJ metrics systematically into its planning framework [2]. Comparative urban practices demonstrate the feasibility of EJ integration. In Los Angeles, the City Planning Department launched an

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Environmental Justice Policy Program in 2023 to centralize EJ concerns within its General Plan, supported by performance metrics and community outreach [15][16]. Los Angeles County's Community Health Profiles further document how decades of land use decisions have disproportionately exposed low income communities of color to pollution, shaping health disparities [14]. New York City has also advanced EJ integration. The Environmental Justice NYC (EJNYC) Report and Mapping Tool released in 2024 provides a comprehensive citywide assessment of EJ issues, visualizing how environmental hazards intersect with health impacts in disadvantaged communities [7][10]. The NYC Environmental Justice Alliance has documented extreme disparities in air quality, with particulate matter (PM2.5) levels in South Bronx neighborhoods measured at up to 18–49 times higher than government monitors reported [9]. These examples illustrate how EJ metrics can be embedded into urban planning and public health assessments, offering models for Baltimore to emulate. It is therefore the objective of this paper to show that, while Baltimore's EIAs remain largely technical and compliance driven, frameworks and tools exist, both nationally and in peer cities, that can demonstrate how EJ metrics can highlight inequities and guide mitigation strategies, and that the absence of systematic EJ integration in Baltimore will demonstrate the need for methodological innovation and governance reform.

METHODOLOGY

A systematic approach to EJ integration requires several steps:

A. Metric Identification

EJ indicators should capture pollution burden, health out- comes, and socioeconomic vulnerability. Pollution burden includes air toxins, water contamination, and proximity to hazardous facilities. Health outcomes encompass life expectancy, chronic disease prevalence, and asthma rates. Socioeconomic vulnerability includes income, housing stability, and access to services.

B. Data Sources

Reliable datasets are also essential. Sources include U.S. Census data, EPA EJScreen, Maryland's MDEnviroScreen, Baltimore City Health Department reports, and community surveys. These datasets provide both quantitative and quali- tative insights.

Integration Strategy

EJ metrics must be embedded into each stage of the EIA process:

Scoping: Identify vulnerable communities and potential disparities.

Baseline Analysis: Document existing conditions, including cumulative exposures.

Impact Prediction: Model how proposed projects will affect EJ indicators.

Mitigation: Develop strategies to reduce disparities and monitor outcomes.

Analytical Tools: GIS mapping can visualize disparities, while cumulative impact analysis can quantify risks. Risk models can predict health outcomes under different scenarios. These tools make EJ integration both rigorous and actionable [6].

RESULTS

Case Study: West Baltimore

West Baltimore provides a great example of how cumulative environmental and social stressors converge to produce measurable disparities in health and quality of life.

Life Expectancy Gap: According to the Baltimore City Health Equity Report (2025), neighborhoods such as Sand town-Winchester and Greater Edmondson Village report average life expectancies as low as 62–66 years,

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compared to 75–83 years in wealthier areas such as Roland Park and Guilford [9]. This nearly 20 year gap reflects possible dis- parities in exposure to pollutants, access to healthcare, and socioeconomic conditions.

Air Quality Burden: Community based monitoring projects, including Breathe Baltimore, deployed sensors across South and West Baltimore in 2024–2025. These sensors docu- mented elevated levels of fine particulate matter (PM2.5) and nitrogen oxides, largely attributable to traffic density along major corridors and emissions from industrial facilities such as the Wheelabrator incinerator [1]. Asthma prevalence in West Baltimore exceeds the citywide average, with hospitalization rates for children nearly double those in more affluent neighborhoods [9].

Water Contamination: Blue Water Baltimore's 2025 Re- port Card found worsening grades in the Patapsco, Jones Falls, and Gwynns Falls watersheds, which run directly through West Baltimore [2]. Aging sewer and stormwater infrastructure contributes to frequent overflows, sending bacteria, heavy metals, and trash into waterways. These discharges increase risks of gastrointestinal illness and degrade recreational water quality.

Flooding Risks: Impervious surfaces cover more than 45 percent of Baltimore's landscape, intensifying runoff dur- ing storm events. West Baltimore neighborhoods, such as Irvington, experienced severe flooding in 2018, prompting installation of green stormwater infrastructure. A Stillmeadow Community Fellowship project in 2025 treated 11,000 gallons of stormwater before it entered Maiden's Choice Run, demonstrating the potential of community led interventions [8].

Industrial Zoning Hazards: Residents of West Baltimore live adjacent to scrapyards, salvage yards, and industrial facilities that discharge pollutants during storm events. The Vermont Law Review (2024) documented how chemicals and heavy metals are washed into neighborhoods "every rainy day,", underscoring the inadequacy of stormwater permits and enforcement [3].

Cumulative Stressors: Beyond physical pollutants, West Baltimore communities face overlapping social stressors, including housing instability, concentrated poverty, and limited access to green space. These factors amplify vulnerability to environmental hazards and contribute to the observed health disparities.

Taken together, these conditions illustrate how EJ metrics could reshape EIA outcomes by prioritizing mitigation in historically overburdened neighborhoods. For example, cumulative impact analysis could reveal how industrial emissions, traffic density, and stormwater runoff interact to create disproportionate risks. Mitigation strategies could then target these intersections, ensuring interventions address both environmental and social determinants of health.

Policy and governance implications

Institutional integration of EJ metrics requires Baltimore's agencies to adopt a unified framework rather than fragmented approaches. Embedding EJ indicators into planning boards, permitting processes, and city assessments would ensure that equity is treated as a measurable standard rather than symbolic language [1][2]. Community participation is central. West Baltimore res- idents have already engaged in grassroots monitoring and stormwater projects, demonstrating how local knowledge can strengthen assessments. Formalizing these efforts within EIAs would build trust and accountability [9]. Transparency and accountability must also be emphasized. EJ metrics should be enforceable, with thresholds tied to project approval. Aligning Baltimore's approach with EPA EJ Screen and NEJAC recommendations would provide consistency while tailoring standards to local conditions [11][12]. To strengthen governance, Baltimore could establish an Environmental Justice Advisory Board composed of community leaders, public health experts, and technical specialists. Such a body would provide oversight, ensure EJ metrics are consistently applied, and serve as a bridge between residents and policymakers. This model mirrors similar advisory councils in Los Angeles and New York, which have proven effective in embedding EJ into long-term planning [14][15].

Challenges And Limitations

With all this, Baltimore still faces several barriers to systematically integrating EJ metrics into its Environmental Impact Assessments. These challenges reflect both technical and political realities that must be addressed for successful implementation.

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Data Gaps: Incomplete datasets hinder comprehensive analysis. Stormwater monitoring remains inconsistent, particularly in industrial zones, and health statistics are often aggregated at scales too broad to capture neighbor- hood level disparities [8].

Political Resistance: Developers and policymakers frequently push back against EJ integration, citing cost concerns and potential delays. Similar resistance has been observed in debates over stormwater fees and zoning reforms [2].

Technical Complexity: Tools such as GIS mapping, cumulative risk models, and health outcome projections demand expertise. Yet results must remain accessible to policymakers and communities, requiring user friendly dashboards and simplified reporting [6].

Institutional Fragmentation: Baltimore's governance structure is decentralized, with multiple agencies responsible for different aspects of environmental management. Without coordination, EJ integration risks being uneven or symbolic [1].

Community Trust: Historical neglect and inequitable policy decisions have eroded trust between West Baltimore residents and city institutions. Without visible improvements, such as cleaner air, reduced flooding, or better health outcomes, EJ integration risks being perceived as symbolic [9].

So, while EJ integration offers a pathway to equity, Balti- more must overcome significant barriers in data infrastructure, political will, technical capacity, and institutional coordination. Addressing these challenges will require sustained investment, transparent reporting, and community led monitoring to build credibility and ensure measurable progress.

Future Work

Several areas warrant further development to strengthen the integration of EJ metrics into Baltimore's EIAs. More detailed, neighborhood level environmental and health data, particularly from community based monitoring and local surveys, would provide the resolution needed to capture disparities that citywide datasets often mask. Establishing clear, enforceable EJ thresholds within the EIA process would also help translate equity goals into measurable regulatory standards.

Advancing analytical tools is another priority. Incorporating cumulative risk models and scenario based impact projections would support more rigorous evaluations of how proposed projects interact with existing burdens. Improving coordination among city agencies is equally important, as consistent application of EJ metrics depends on shared frameworks, data systems, and review procedures.

Finally, long term community involvement and transparent reporting mechanisms must be formalized. Participatory monitoring programs, accessible EJ dashboards, and structured feedback processes can help rebuild trust and ensure that EJ integration leads to visible improvements in environmental and health outcomes.

CONCLUSION

Integrating EJ metrics into Baltimore's EIAs ensures assessments are both scientifically rigorous and socially just. West Baltimore's disparities, from toxic emissions to health inequities, make it a powerful case study for reform. By embedding EJ indicators into scoping, baseline analysis, pre- diction, and mitigation stages, Baltimore can move beyond compliance driven assessments toward a model that actively reduces inequities. The evidence presented demonstrates that EJ integration is not only feasible, but necessary. Cities such as Los Angeles and New York have already begun embedding EJ into planning and public health frameworks, showing that Baltimore can adapt similar strategies to its own context. Doing so would allow policymakers to identify cumulative risks, prioritize vulnerable communities, and enforce accountability through measurable standards. Moreover, EJ integration offers broader benefits. It strength- ens community trust by validating lived experiences, enhances resilience against climate change by addressing vulnerabilities in infrastructure, and promotes long term sustainability by aligning environmental policy with equity goals. These outcomes extend

beyond environmental management, con- tributing to public health, housing stability, and economic opportunity. Future research should continue to expand EJ metrics into related domains, such as climate resilience, housing equity, and transportation planning. These areas are critical for addressing the broader determinants of health and equity in urban environments, ensuring that Baltimore's environmental governance evolves in step with the city's social and economic needs. In conclusion, Baltimore has the opportunity to become a national leader in environmental justice by integrating EJ metrics into its EIAs. The case study presented, and others, show the urgency of reform and provides a roadmap for how equity can be operationalized in environmental governance.

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