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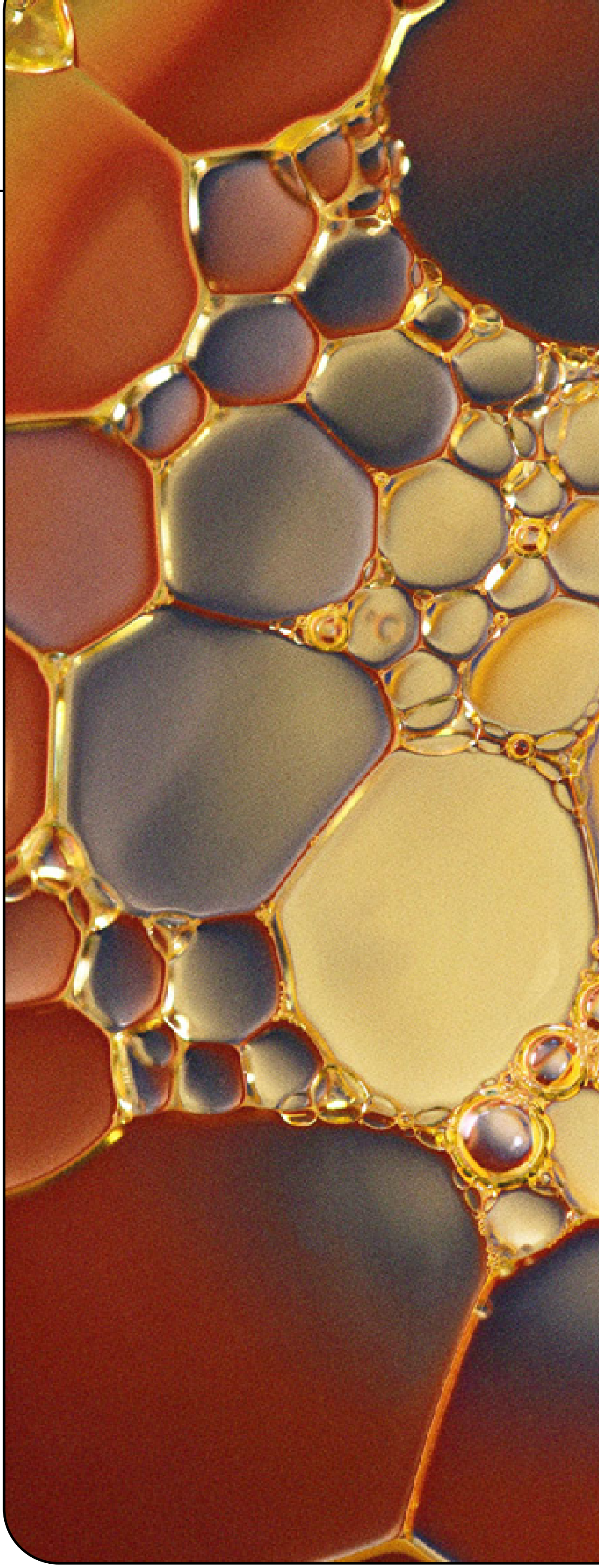
Chemical and Environmental Justice Impacts Methodology

Habitable's approach to measuring the environmental justice impacts of chemicals in the building product supply chain.



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Framework

This document outlines Habitable's methodology to measure chemical and environmental justice impacts of materials used in building products across their life cycle.

Starting with the principles of environmental justice and green chemistry, we developed a framework that includes the five major criteria outlined below. Several of these criteria are derived from both sets of principles. However, some environmental justice concepts are not covered within the principles of green chemistry—in particular, the idea of universal protection from toxics for all people (see the Appendix for more information).

We use publicly available information to measure how each chemical/material of interest aligns with or diverges from these criteria. Some criteria are general to the chemical/material (the chemicals required to make it), and some are specific to the facilities where the chemical/material is made (e.g., specific quantities of pollution released, whether the facilities abide by regulations). Below, we describe the process used to evaluate these criteria.

Definitions

ENVIRONMENTAL JUSTICE

The Environmental Justice Health Alliance for Chemical Policy Reform (EJHA) defines environmental justice (EJ) as a set of principles and a grassroots-led movement that "arose in response to the disproportionate exposure of communities of color and low-income communities to harmful pollution, toxic sites and facilities, and other health and environmental hazards."[1] Read more about the Principles of Environmental Justice.

GREEN CHEMISTRY

The U.S. Environmental Protection Agency (EPA) defines green chemistry as "the design of chemical products and processes that reduce or eliminate the use or generation of hazardous substances" throughout the product life cycle.[2] Read more about the Principles of Green Chemistry.

Criteria for assessing health and environmental justice impacts based on selected environmental justice and green chemistry principles.

1. Avoid Hazardous Chemicals

In order to understand the hazardous chemicals used to manufacture a chemical/material, Habitable researchers first identify what chemicals are used in its production. Information on chemical inputs and outputs comes from a range of sources including: life cycle inventories; academic papers and books; government agency reports; patents; and manufacturer literature. Catalysts, substances that initiate or speed up a chemical reaction without being consumed, may vary widely and are excluded from the analysis.

Researchers then identify associated human health and physical hazards using the Pharos database,[3] which uses the GreenScreen for Safer Chemicals methodology.[4]

Chemicals are considered hazardous if they are identified as:

- high hazard carcinogens, mutagens, reproductive or developmental toxicants, or endocrine disruptors
- high or moderate hazard respiratory sensitizers
- high or very high hazard for acute toxicity

We also consider persistent, bioaccumulative toxicants (PBTs) using select authoritative hazard lists: the European Union's European Chemical Substances Information System PBT List and the EPA's National Waste Minimization Program Priority PBTs.[5,6] Chemicals that are reactive or flammable can present immediate dangers and increase the potential for incidents that harm workers and surrounding communities, so we consider high and very high hazards for these physical properties as well. In addition, volatile chemicals may pose a higher potential for exposure than less volatile or nonvolatile chemicals. Volatility is determined primarily using EPA's Comptox.[7] See the Appendix for descriptions of these hazards.

For this criterion, we do not include an in-depth analysis of the most upstream impacts (e.g., fossil fuel extraction/refining, mineral mining, farming of biological materials). However, we do identify the primary origins of the inputs for the chemical/material (e.g., fossil fuels, minerals, or biological materials).

WHY AVOID HAZARDOUS CHEMICALS?
When hazardous chemicals are used, they can impact people and the environment throughout their life cycle. Workers who extract these materials, process them, and use them to manufacture products, as well as communities near facilities where each step of the process takes place, can be impacted. Chemicals can contribute to the development of diseases such as cancer and asthma, disrupt human reproductive systems, and harm children's health.

2. Prevent Accidents

Habitable's research identifies incidents involving both specific chemicals/materials as well as the chemicals used in their production. For research conducted in 2024 or later, we primarily rely on the Coalition to Prevent Chemical Disasters Chemical Incident Tracker, which has documented hazardous chemical incidents in the United States since January 2021.[10] Our earlier research drew on government reports and media coverage documenting worker injuries and community impacts.

WHY PREVENT ACCIDENTS?
Nonroutine events like equipment failures or weather-related incidents (e.g., hurricanes, extreme temperatures, fires) can lead to greater impacts on workers and communities and can disrupt daily life for residents. For example, hurricanes and the resultant flooding and power outages have caused fires and additional hazardous releases from industrial facilities.[8,9]

Identify Facilities

The remaining criteria are facility-specific, so in order to analyze these criteria, we first identify facilities where the chemical/material of interest is manufactured.

Many sources may have information on who makes a particular chemical/material and where.

For example:

- Market reports can help identify key manufacturers. While these reports are often expensive to access, free summaries can provide useful information.
- EPA's Chemical Data Reporting[11] can also provide information on manufacturers, specific locations, and amounts manufactured—although data are often confidential.
- Chemical industry news or local news sources about facility expansions, supply issues, or price hikes will sometimes identify the production location for a particular chemical and facility capacity.
- A chemical manufacturer's website will often list manufacturing locations generally and sometimes provide information on what is manufactured where.
- Product literature such as Environmental Product Declarations (EPDs) can include location information related to product inputs.

Because Habitable's research is focused on chemicals/materials used in building products, we may limit the scope to facilities that manufacture a variation of the material that is likely to be used in such products. Facility lists are based on analysis of best available data and may not fully capture all relevant facilities. See our material summaries for specific scoping notes.

3. Prevent Pollution and Waste

Once we identify where manufacturing takes place, we review EPA's Toxics Release Inventory (TRI)[12] for facility-level information on pollution and waste. Focusing specifically on chemicals related to production of the chemical/material of interest, we compile TRI data for on-site releases to air and water, as well as the total waste reported. We highlight air and water releases specifically because there is a greater potential for exposure from these releases than from other on-site waste management practices; however, all hazardous chemical waste can result in exposure and is an indication of inefficiencies within the system.

Waste includes both releases and disposal through various methods, such as energy recovery, treatment, landfilling, and injection into underground wells. Energy recovery means that the chemical is burned to generate heat or energy for use at the facility.[13] Treatment often means incineration, though it can include other methods meant to destroy the chemical.[13] Burning of hazardous chemicals can lead to additional hazardous releases.[14,15] Chemicals reported as recycled are excluded from our analysis. We consider the average annual waste and releases over the past five years with data at the time of the research.

This approach has a number of limitations:

- There is not typically enough publicly available information on production volumes to calculate the amount of waste or releases for a given output of chemical/material.
- Manufacturing can have multiple steps, and not all facilities perform all steps on site.
- Other processes on site may use the same chemicals and also contribute to releases and waste.
- TRI reporting requirements do not include all toxic chemicals used in the United States, and chemicals must be reported only when they are released above established thresholds. Consequently, there may be additional releases attributable to the chemical/material's manufacturing that are not included in our analysis.
- Since facilities self-report releases, the way in which manufacturers account for and report releases may vary. Self-reporting has been found to undercount releases.[16]

As a result, release and waste information is not directly comparable between facilities or between chemical/materials. However, greater amounts of hazardous releases, regardless of production volume of products, can still translate to greater overall impacts on surrounding communities and the environment.

WHY PREVENT POLLUTION AND WASTE?
During manufacturing, hazardous chemical waste can be released into the air or water, or collected and disposed of, impacting surrounding communities.

4. Abide By Environmental Regulations

While much more needs to be done from a regulatory perspective to safeguard communities, workers, and the environment, adherence to current regulations can provide some protection from dangerous pollution and chemicals. We analyze EPA data on regulatory compliance for each facility using EPA's Enforcement and Compliance History Online tool (ECHO).[17] Here, the EPA reports data on facility compliance with environmental regulations related to clean air, clean water, and hazardous waste for the most recent 12 quarters (3 years).

It is important to note that noncompliance can be discovered only by inspections and enforcement, but the EPA lacks resources to inspect every facility.[18] Therefore, periods without violations may simply reflect a lack of inspection and do not necessarily mean a facility is in compliance.

WHY ABIDE BY ENVIRONMENTAL REGULATIONS?
Irregularly enforced and consistently violated regulations fail to protect all individuals equally from toxic chemicals and violate people's fundamental right to clean air, water, and land.

5. Prevent Disproportionate and Cumulative Impacts

We analyze demographic information for the communities surrounding each facility using EPA's EJScreen tool,[29,a] which reports data from the U.S. Census Bureau American Community Survey (ACS).

Facility location is based on the latitude and longitude reported in TRI for each facility appearing in that inventory. For facilities not found in TRI, Facility Registry Service (FRS)–reported latitude and longitude are used. For research prior to 2024, the street address was used for facilities not in TRI. Some of the latitude/longitude information in TRI and FRS may not accurately reflect the center of the facility.

For the purposes of this analysis, we consider those living within a three-mile radius of a facility's latitude and longitude to be within the fenceline zone. Note that some facilities are very large and a three-mile radius from a single point may not adequately capture the full population within three miles of all edges of the facility. There is no single recognized definition of "fenceline community," and others living, working, or going to school outside the three-mile radius may also be impacted by chemical releases. Releases to the environment may travel different distances depending on many factors, including properties of the chemical itself, wind speed, temperature, and whether the release is via air or water.

We analyze the percentage of people of color (broken down by race and ethnicity), low-income households, and limited English-speaking households in the fenceline communities compared with the U.S. average in EJScreen. In addition, because children are affected by chemical exposures more than adults due to their smaller size and their still-developing bodies,[30,31] we also report the percentage of children (less than age 18) in fenceline communities compared with the nation overall.[b]

WHY PREVENT DISPROPORTIONATE AND CUMULATIVE IMPACTS?

A fenceline community or frontline community is a neighborhood located near a chemical plant, industrial facility, or distribution center and directly affected by associated noise, odors, chemical emissions, heavy-duty diesel emissions, and operations.[19–21]

Communities of color, Indigenous communities, low-income populations, and children disproportionately bear the burden of these impacts.[22–27]

Communities "are often exposed to multiple pollutants from multiple sources at the same time, which contribute to negative health outcomes in the community. The risks and impacts caused by the pollutants, both individually and when combined with each other and social vulnerabilities, are called cumulative impacts."[28] High concentrations of industrial facilities, contaminated sites, and other sources of pollutants near homes can all contribute to cumulative impacts.

To gain a broader understanding of who is impacted by the manufacturing of each chemical/material of interest, we combine demographic information for the fenceline communities for all facilities that make the chemical/material and then compare this with the United States overall. In some cases, multiple facilities for the same chemical/material are located near each other. To avoid double counting some of the population in these cases, we use the EJScreen mapper to draw the combined fenceline zone for that area and obtain the data to include in overall demographics of the chemical/material's combined fenceline communities.

Note that there can be significant regional variations in demographics among states and locales. Comparing fenceline community demographics with more localized data can highlight disparities in addition to those observed on a national level. This level of comparison is beyond the scope of this research. For examples, see the following reports: Case Study on Isocyanates in Spray Polyurethane Foam and Case Study on Glass Fibers in Fiberglass Insulation.

This analysis is not intended to identify specific environmental justice communities, but provides a screening level analysis of a chemical or material's potential EJ impacts.

While the impacts of specific processes discussed above are important to consider, it is also imperative to understand the cumulative impacts that communities experience. To screen for a chemical/material's contributions to cumulative impacts, we analyze EPA's TRI data on additional hazardous chemical releases from other processes at the facilities of interest. We also identify all TRI-reporting facilities within the cities where the facilities of interest are located and calculate the total hazardous chemical releases reported to EPA in each city for the most recently reported year.

This should not be considered a comprehensive analysis of the many other stressors that cumulatively affect community health, but it provides some information on the cumulative impacts experienced by these communities.

EPA EJScreen Definitions

PEOPLE OF COLOR

"Individuals who list their racial status as a race other than white alone and/or list their ethnicity as Hispanic or Latino. That is, all people other than non-Hispanic white-alone individuals. The word 'alone' in this case indicates that the person is of a single race, not multiracial."

LOW-INCOME HOUSEHOLD

"A household whose income is less than or equal to twice the poverty level."

LIMITED ENGLISH-SPEAKING HOUSEHOLD

"A household in which no one age 14 or over speaks English at least 'very well' as reported in the U.S. Census Bureau's ACS."

For details on how EJScreen estimates demographics, see the EPA's EJScreen Technical Documentation.[32]

Research Details

This analysis only considers impacts in the United States. It does not include impacts from the energy required for manufacturing. It also does not consider the chemical or environmental justice impacts of all chemicals/materials that go into making a finished product or impacts of that product during use or at its end of life.

a At the time of publication, the EJScreen tool has been taken down from EPA's website. A backup of the data with some of the same capabilities is available through the Public Environmental Data Partners.

b EJScreen provides demographic data compared to the average across U.S. Census blocks for percentage of people of color, low-income households, and limited English-speaking households. These numbers are used to compare these particular demographics. EJScreen does not provide Census block averages broken down by specific race and ethnicity or for children under the age of 18. For these comparisons, we used the percentage for each demographic in the U.S. as a whole, taken from Census data of the same time period. All comparisons are referred to as "U.S. overall" in our analysis.

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Table A1. Criteria for assessing chemical and environmental justice impacts based on selected green chemistry and environmental justice principles

PRINCIPLES OF GREEN CHEMISTRY	PRINCIPLES OF ENVIRONMENTAL JUSTICE	CRITERIA
• Designing chemicals, processes, and products with little or no toxicity to humans or the environment • Using inherently safer chemistry to minimize potential for chemical accidents	• Ceasing the production of all toxics • Ensuring the right of all workers to a safe and healthy work environment • Protecting all people from extraction, production, and disposal of toxics and hazardous wastes that threaten the fundamental right to clean air, land, water, and food	**Avoid hazardous chemicals**
• Using inherently safer chemistry to minimize potential for chemical accidents	• Ensuring the right of all workers to a safe and healthy work environment	**Prevent accidents**
• Preventing pollution and waste	• Protecting all people from extraction, production, and disposal of toxics and hazardous wastes that threaten the fundamental right to clean air, land, water, and food	**Prevent pollution and waste**
	• Protecting all people from extraction, production, and disposal of toxics and hazardous wastes that threaten the fundamental right to clean air, land, water, and food • Basing public policy on mutual respect and justice for all peoples, free from any form of discrimination or bias	**Abide by environmental regulations**
	• Basing public policy on mutual respect and justice for all peoples, free from any form of discrimination or bias • Affirming the fundamental right to self-determination for all peoples • Protecting all people from extraction, production, and disposal of toxics and hazardous wastes that threaten the fundamental right to clean air, land, water, and food	**Prevent disproportionate and cumulative impacts**

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Table A2. Human health and physical hazards and descriptions

HAZARD	DESCRIPTION
Carcinogen	Can cause cancer or contribute to the development of cancer.
Mutagen	Can cause or increase the rate of mutations, which are changes in genetic material in cells that in some cases may be transmitted to offspring. This can result in cancer and birth defects.
Reproductive Toxicant	Can disrupt the male or female reproductive system—changing sexual development, behavior, or functions; decreasing fertility; or resulting in loss of the fetus during pregnancy.
Developmental Toxicant	Can cause harm to the developing child, including birth defects, low birth weight, and biological or behavioral problems that appear over time.
Endocrine Disruptor	Can interfere with hormone communication between cells (the endocrine system), which controls metabolism, development, growth, reproduction, and behavior. Linked to health effects such as obesity, diabetes, male and female reproductive disorders, and altered brain development, among others.
Respiratory Sensitizer	Can result in high sensitivity such that small quantities trigger asthma, rhinitis, or other allergic reactions in the respiratory system. These compounds can exacerbate current asthma, and some have been shown to cause the disease itself.
Acutely Toxic Chemical	Can be fatal on contact, ingestion, or inhalation for humans and other mammals.
PBT (Persistent, Bioaccumulative Toxicant)	Persistent chemicals (P) do not break down readily from natural processes. Bioaccumulative chemicals (B) build up in organisms, concentrating as they move up the food chain. Toxic chemicals (T) are associated with one or more health hazards.
Reactive Chemical	May spontaneously ignite or explode on its own or in contact with water.
Flammable Chemical	Can be easily ignited and is capable of burning rapidly.
Volatile Chemical	Volatility is an indication of how easily chemicals evaporate at normal temperature and pressure. For this study, we use the European Union definition for determining whether an organic chemical is volatile. This definition is based on boiling point: Organic compounds with an initial boiling point below or equal to 250°C at standard atmospheric pressure (101.3 kPa) are considered volatile organic compounds. Because inorganic compounds that are volatile can also be hazardous and may also have increased potential for exposures when they are volatile, we use this boiling point cutoff to identify both organic and inorganic volatile compounds.