

PFAS Body Burden and the Uneven Distribution of Industrial Chemical Exposure

An evidence synthesis · Holistic Quality LLC

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Disclaimer. A synthesis of the published scientific and government-monitoring literature. **Not medical advice;** not peer-reviewed. Associations described are **not** assertions of causation unless a cited source establishes one. Every quantitative claim is cited so a reader can verify it independently.

How this was produced. AI-assisted literature review and drafting, then human-verified: each figure was checked against a fetched primary or authoritative source (CDC/ATSDR, EPA, peer-reviewed journals), and any figure that could not be traced to such a source was reworded to what the source supports or removed. Four claims carried over from an earlier advocacy draft were corrected or dropped in this pass; each correction is stated where it occurs and summarized in §4.

Executive summary

Industrial chemicals are measurable in the bodies of essentially the entire US population, and the burden is not evenly distributed. The clearest case is per- and polyfluoroalkyl substances (PFAS): the CDC's National Health and Nutrition Examination Survey (NHANES) finds that **nearly all people in the United States have measurable PFAS in their blood**. These compounds persist because the carbon-fluorine bond is among the strongest single bonds in organic chemistry, so even after production phase-outs the majority of the population — including people born after those phase-outs — still carries detectable amounts.

Exposure to polluting industrial facilities is, separately, patterned by race and income. A nationally representative study found Black Americans significantly more likely than white Americans to live within a mile of a polluting facility, a disparity that persisted after adjusting for income and education. Louisiana's "Cancer Alley" is the acute domestic example: a 2025 peer-reviewed study using measured (not modeled) air concentrations found cancer risks in the corridor well above the EPA's own estimates, and in 2023 the EPA itself found significant evidence of disproportionate impacts on Black residents.

The honest frame is **associational**. Biomonitoring establishes **presence and distribution**, not individual causation; the proximity and cancer-risk findings are strong ecological

associations vulnerable to confounding. What the record does support is that industrial chemical exposure is **ubiquitous, persistent, and concentrated among populations with the least capacity to change it.**

1. The biomonitoring record: exposure is measurable and near-universal

Since the 1999–2000 cycle, NHANES has measured serum PFAS in a nationally representative subsample of the US population aged 12 and older — the longest continuous population record of these compounds in the country. The headline finding, in the CDC/ATSDR's own words, is unambiguous: "**Nearly all people in the U.S. have PFAS in their blood.**" [1]

The record is not static. An analysis of NHANES data from 1999 through March 2020 shows that serum concentrations of several *legacy* PFAS — the long-chain compounds (PFOA, PFOS) that were the subject of early-2000s production phase-outs — have declined substantially over two decades. But decline is not disappearance: the compounds remain widely detectable, more than 96% of adolescents (a group that includes people born after the phase-outs began) still had measurable legacy PFAS, and the weighted detection frequency was highest for perfluoroheptane sulfonic acid (PFHpS) at **78.2%**. [2] The population is carrying a persistent chemical signature of exposures that in some cases predate the individuals measured.

The persistence is a matter of chemistry, not merely of continued use. The carbon-fluorine bond is one of the strongest single covalent bonds in organic chemistry; that stability is precisely what makes PFAS useful (heat, water, and stain resistance) and what earns them the label "forever chemicals" — they resist the environmental and metabolic breakdown that clears most organic compounds from the body and the environment. [3]

PFAS are one well-characterized slice of a much broader picture. The CDC's National Biomonitoring Program assesses the US population's exposure to a broad range of environmental chemicals and their metabolites in blood and urine. The consistent finding across chemical classes is that measurable exposure to industrial and combustion chemicals is ubiquitous in the general population; the scientifically open questions are *which* chemicals, at *what* concentrations, and with what health significance — not *whether* they are present. [4]

2. The exposure is not evenly distributed

Presence is near-universal; proximity to the sources of that exposure is not. A nationally representative analysis linking the Americans' Changing Lives cohort to EPA's Toxics Release Inventory found that **38.1% of Black respondents lived within one mile of a polluting industrial facility, versus 28.4% of white respondents.** The disparity is not merely a proxy for income: after adjusting for household income and education, Black respondents still had **1.38 times the odds** of such proximity (adjusted OR = 1.38; 95% CI 1.10–1.72). That is, socioeconomic position explains part of the racial gap but not all of it. The disparity is sharper

in some regions than the national average suggests — 58% versus 35% in Midwestern metropolitan areas, and 30% versus 14% in the suburban South. [5]

Correction applied (from the source draft). The adjusted disparity is an **odds ratio of 1.38**, which at the study's baseline proximity translates to roughly a 12-13% higher probability; the source draft's larger percentage reflected a common misreading of an odds ratio as a risk ratio. And these figures are from **Mohai et al. (2009)**, not the author the advocacy source implied.

The same pattern appears at the most contaminated sites in the country. In FY2022, roughly **half** of the population living within one mile of a Superfund (National Priorities List) site were people of color — a disproportion relative to the national demographic baseline. [6] Proximity is not dose, and dose is not disease; but proximity is where dose is highest and where the regulatory system's attention is most consequential.

3. Cancer Alley: the acute domestic case

The starkest domestic concentration of industrial exposure is the roughly **85-mile Mississippi River corridor between New Orleans and Baton Rouge**, long known as "Cancer Alley," which sits alongside some **200 fossil-fuel and petrochemical operations**. [7] Louisiana statewide hosts over 300 manufacturing facilities, more than 150 petrochemical plants, and 15 refineries. [8]

What distinguishes the most recent evidence is method. A 2025 study led by Johns Hopkins researchers used **measured ambient air concentrations** rather than the EPA's modeled, industry-reported emissions — the difference that matters, because self-reported emissions inventories can understate real exposure. The corridor concentrates the burden: it is only **12% of the state's land area but contains 45% of the facilities reporting air releases to the TRI and 57% of their mass emissions**. Measured cancer risks ran **up to 11.6× higher than the EPA's 2020 AirToxScreen estimates (median ~5×)**, a gap the authors attribute largely to measured-versus-modeled ethylene oxide. Three compounds — **ethylene oxide, chloroprene, and formaldehyde** — together account for **63-96.9%** of estimated cancer risk across census tracts, with ethylene oxide dominant. [9]

Corrections applied (from the source draft). An advocacy claim of a large multiplier on the EPA acceptable cancer rate is **dropped** — the figure does not appear in the cited study, whose maximum modeled tract risk is on the order of ~5.6× the acceptable ceiling (560 vs. 100 in a million). The "96%" figure is stated as the paper's actual **range, 63-96.9%**. A "25% of US petrochemical production" figure that traces to a 2012 baseline is omitted as dated.

The equity dimension has been engaged by the regulator itself. In 2023 the EPA found **"significant evidence"** that Louisiana regulators' actions or inactions "have resulted and continue to result in disparate adverse impacts on Black residents" of the corridor. The agency subsequently closed the Title VI investigation without binding action — a reminder that a finding of disparate impact and a durable remedy are different things. [10]

4. What the evidence supports — and what it does not

This is the crux, and it deserves to be stated plainly. Two kinds of claim are in play, and they carry very different evidentiary weight.

Established. Biomonitoring establishes that industrial chemicals — PFAS foremost among them — are **present in nearly everyone**, and that legacy PFAS **persist for decades despite phase-outs**. The distributional findings establish that **proximity to polluting facilities is patterned by race and income**, and that this pattern survives adjustment for socioeconomic status. These are among the better-supported claims in environmental epidemiology: national biomonitoring with published detection frequencies, and a nationally representative proximity analysis with a confidence interval.

Not established by this record. That a given person's measured PFAS level, or their residential proximity, **caused** a given disease. The proximity and cancer-risk findings are strong **ecological and epidemiological associations**, but they are vulnerable to (i) **unmeasured confounding** — socioeconomic position above all, which correlates with many independent health risks; (ii) **exposure misclassification** — ambient concentration is not personal dose, and residential address is not lifetime exposure; and (iii) for the corridor cancer estimates, the **usual limits of risk modeling**, even when the inputs are measured rather than reported. The 2025 corridor study is unusually strong precisely because it replaces modeled inputs with measurements, but it estimates *risk*, not observed *incidence*.

The defensible synthesis: industrial chemical exposure is **ubiquitous, persistent, and inequitably distributed**, and the acute-corridor evidence is strong enough to warrant the regulatory attention it is beginning to receive — while **individual causal and precise quantitative-attribution claims remain unsupported by this record**. Overstating the causal claim does not strengthen the case; it hands the strongest counter-argument to anyone who wants to dismiss the well-supported distributional one.

5. Key gaps

- **Personal versus ambient exposure.** Biomonitoring gives internal dose for PFAS but not for the corridor air toxics; the corridor studies give ambient concentration but not personal dose. The two are rarely measured in the same people.
- **Health significance of population-typical PFAS levels.** Detection frequency is well characterized; the dose-response relationship between *typical* serum PFAS concentrations and specific health outcomes is far less settled and is where most of the scientific contest lies.
- **Mixtures and cumulative effect.** The biomonitoring program detects hundreds of co-occurring chemicals; almost all toxicology and epidemiology treats them one at a time. Cumulative and interactive effects across the real mixture are largely unquantified.
- **Confounding by socioeconomic position.** The distributional findings are robust; disentangling the independent contribution of chemical exposure from the many other health risks that track income and race remains the central methodological challenge.

6. Priority research directions

- Paired **internal-dose and ambient-exposure** measurement in the same corridor residents, to connect the biomonitoring and geographic literatures.
 - **Longitudinal** follow-up of the NHANES PFAS record against incident disease, with pre-registered analyses to constrain the causal question.
 - **Observed-incidence** studies (cancer registries) in the corridor to test the modeled-risk estimates against real outcomes.
 - **Mixture-aware** toxicology and epidemiology that treat co-exposure as the exposure of record rather than a nuisance.
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How to cite

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A summary of this work is published at holisticquality.io/research/pfas-body-burden.

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All citations independently verified against their published sources (fetch-no-memory, 2026-07-02). Presence and distribution are established; individual causation is not asserted. Health-effect statements reflect the cited source's own language.

Disclosures

Competing interests. The author is the founder and principal of Holistic Quality LLC, the commercial publisher of this report, which develops regulator-facing safety-data and compliance products in areas that include environmental and chemical exposure; a sibling property, the Institute for Cognitive Sovereignty, may cite this work in public advocacy. These constitute a competing interest. Mitigation: every claim was independently source-verified (fetch-no-memory), four claims from the earlier advocacy draft were corrected or dropped in this pass, the limits of the evidence are stated throughout, and the author retained sole editorial control.

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