

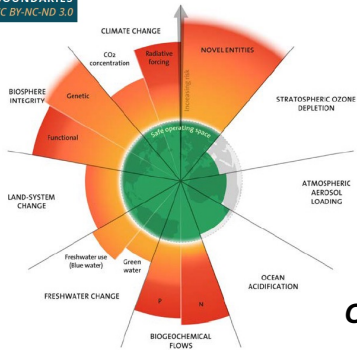


**Bend the Curve**  
HEALTH • CLIMATE • JUSTICE

# Green Chemistry and Biobased Manufacturing – Unsung Marketing Advantage or Potential Future Liability?

Planetary Boundaries are now Exceeded for both Novel Entities (Chemical Pollution) & Climate Change

THE 2023 UPDATE TO THE PLANETARY BOUNDARIES  
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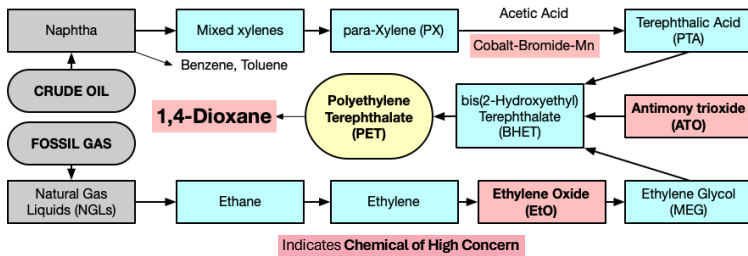
## Supply Chain Accountability

**Climate** – Scope 3 emissions

**Chemicals** – it's coming!

CREDIT: Arrote for Stockholm Resilience Centre, based on analysis in Richardson et al. 2023.

## Fossil PET Production Releases Chemicals of High Concern



**Ethylene oxide** – Production poses significant cancer risk to workers and 7 million Gulf Coast residents. Health risks won't be extinguished by emission controls due by 2026. Fugitive air emissions are underestimated by up to an order of magnitude (Robinson et al., *ES&T*, 2024).

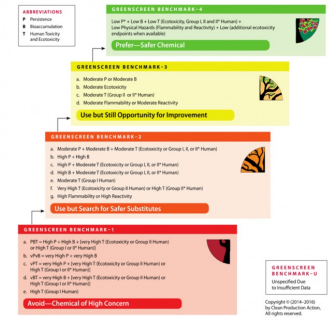
## TRENDS: Consumers and Regulators are Demanding Safer Chemistry

- Rapid phase-out of most **PFAS** (per- and polyfluoroalkyl substances)
- Ban on most uses of chlorinated solvents **MeCl<sub>2</sub>** and **TCE** under TSCA
- **Vinyl chloride** likely to be named a high-priority chemical under TSCA
- **Benzene** fenceline monitoring near 136 US facilities raises concerns
- Expanded monitoring kicks-in in 2026 for **ethylene oxide** (used to make PET), **ethylene dichloride** and vinyl chloride (used to make PVC), chloroprene, and **1,3-butadiene** (used in SBR, ABS, nitrile and more)

## Metrics for Chemical Hazard Assessment to Track Progress

IMPLICATIONS	
<b>A</b>	Low hazard and low risk
<b>B</b>	Some moderate hazards but low risk
<b>C</b>	Moderate hazard, moderate risk or uncertainty that could result in moderate risk
<b>D</b>	Moderate to high hazard; emerging regulatory risk (classification may be based on a chemical desgrouping approach)
<b>F</b>	High hazards and high risk in most scenarios
<b>U</b>	CHA completed with excessive data gaps, rating is not possible
<b>?</b>	Request a CHA to inform decision

ChemFORWARD.org



GreenScreenChemicals.org

## RED CHEMISTRY – MARKETING LIABILITY

- Bio-BTX – Benzene is a known human carcinogen
- Bio-PVC – Both EDC and VCM cause cancer
- FDCA/PEF made with HCl and chlorinated solvents
- PHAs extracted with chlorinated solvents

## GREEN CHEMISTRY MARKETING ADVANTAGE: EtO-Free Bio-Monoethylene Glycol (BioMEG)

**UPM** will produce BioMEG from second-generation cellulosic feedstock (wood) at its Leuna, Germany biorefinery

**Sustainea** announced the largest U.S. BioMEG plant for Lafayette, Indiana (October 7, 2024) based on corn sugar

Each company's approach avoids ethylene oxide (EtO). (However, BioMEG from **India Glycols** still relies on EtO.)

**Next-Gen BioMEG** = **RENEWABLE Fossil-Free** and **SAFER CHEMISTRY Toxic-Free** **Both Advantages should be Marketed!**