

Supply Chain Chemical Footprints

CASE STUDY: The Chemical Footprint of a Plastic Bottle

Measuring and Tracking Chemical Footprints panel,

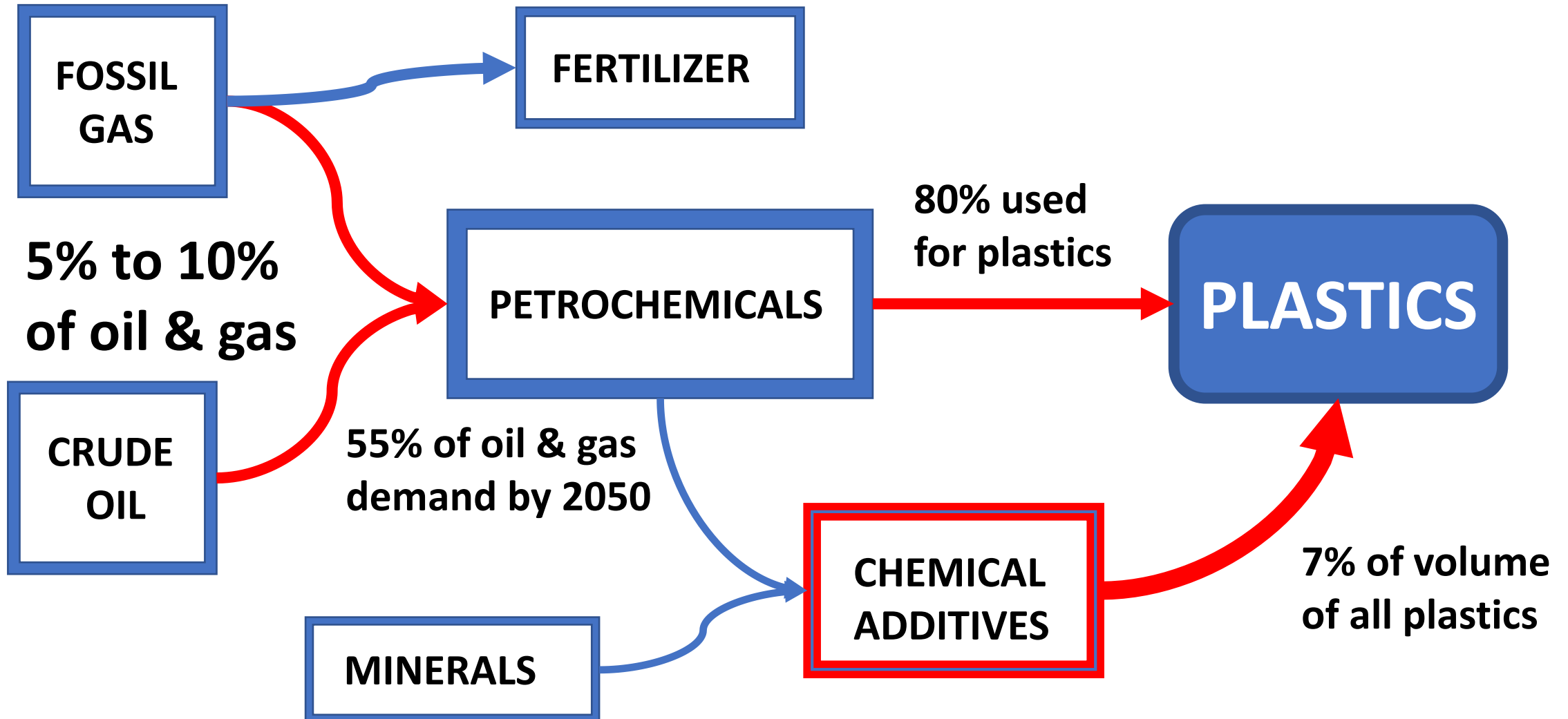
BizNGO Annual Meeting, Oakland, California, 6 December 2023

Mike Belliveau, Founder, President & Executive Director



Solutions for a
Toxic-Free Tomorrow

Petrochemical Plastics Drive Demand



Slashing Demand for Petrochemical Plastics

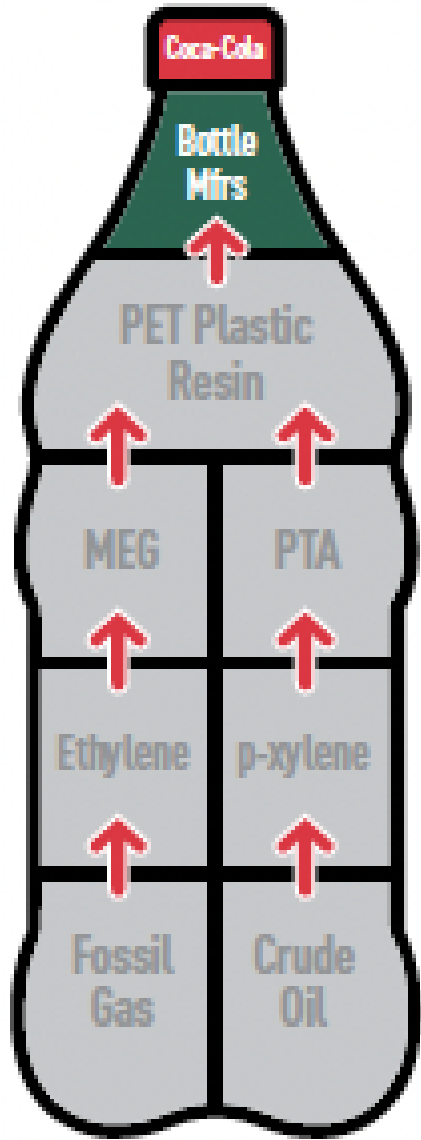
Unseating the Fossil Horsemen of the Apocalypse?



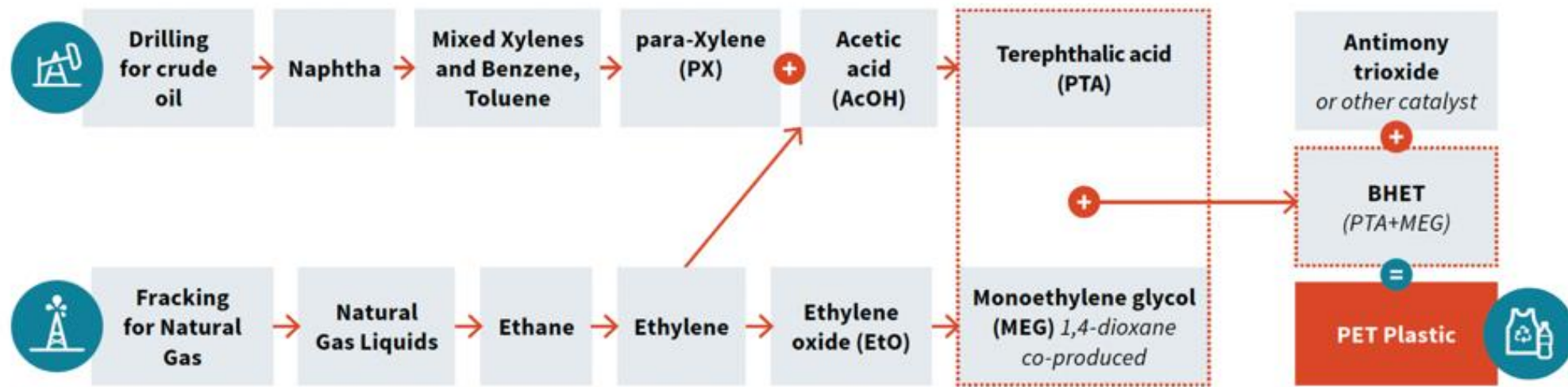
Four Horsemen of the Apocalypse, an 1887 painting by [Viktor Vasnetsov](#). From left to right are Death, Famine, War, and Conquest; the [Lamb](#) is at the top.



- **CLIMATE CRISIS**
- **ILL HEALTH**
- **INJUSTICE**
- **WASTED RESOURCES**



Know the Process Flow – What are the steps in making PET plastic?



Map the Chemical Supply Chain – PET Plastic in North America

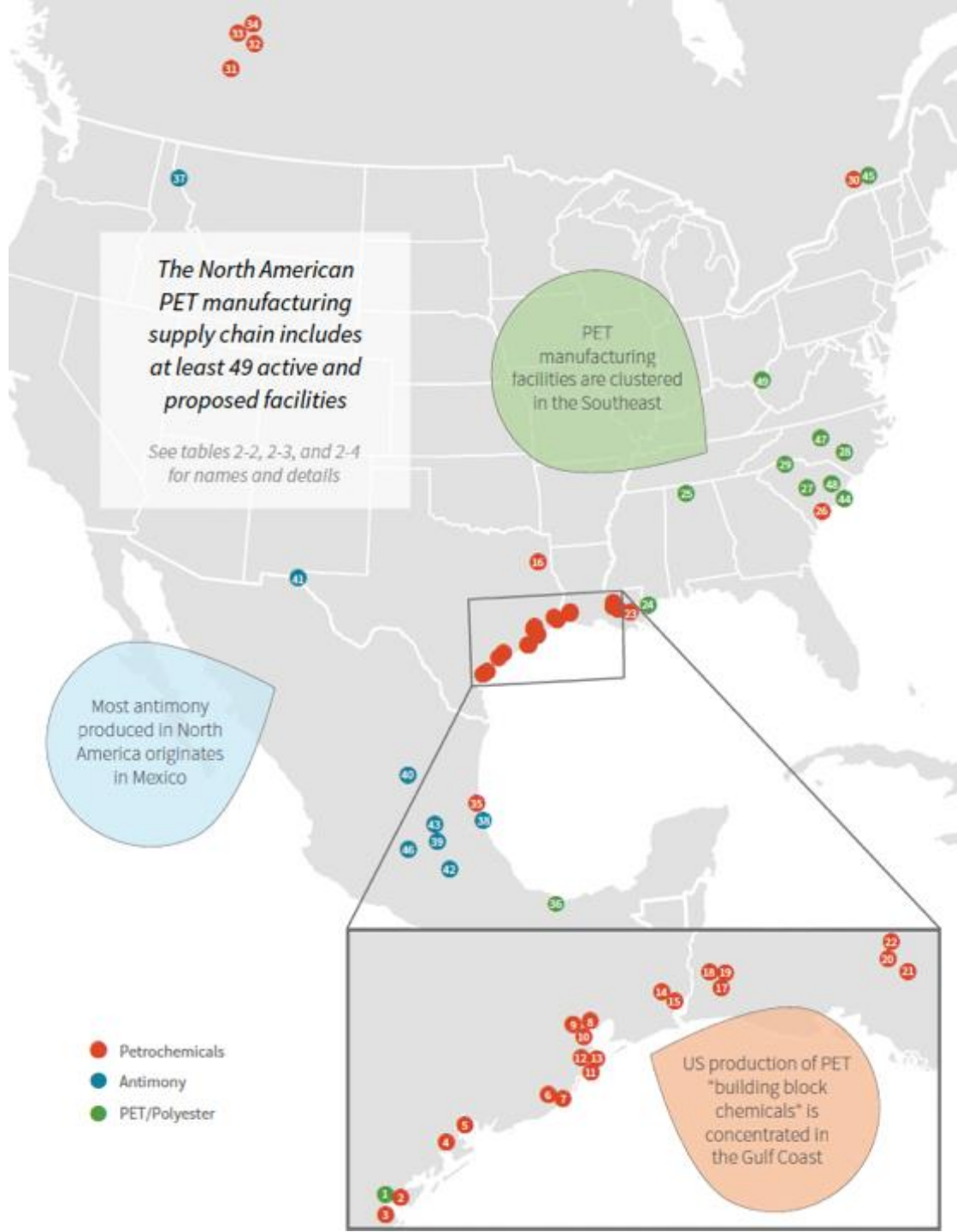
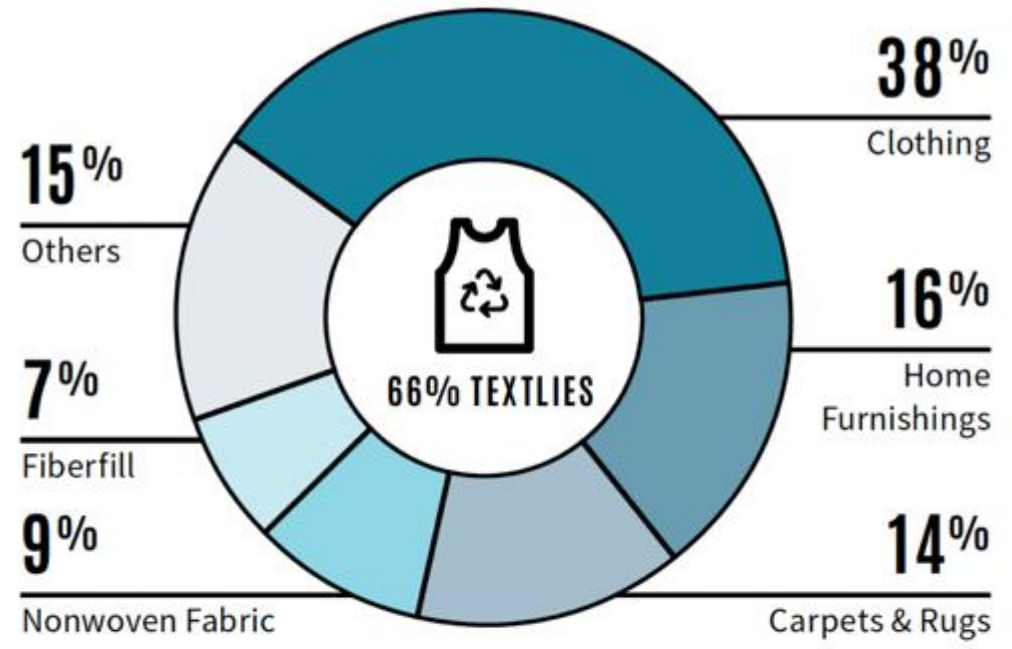
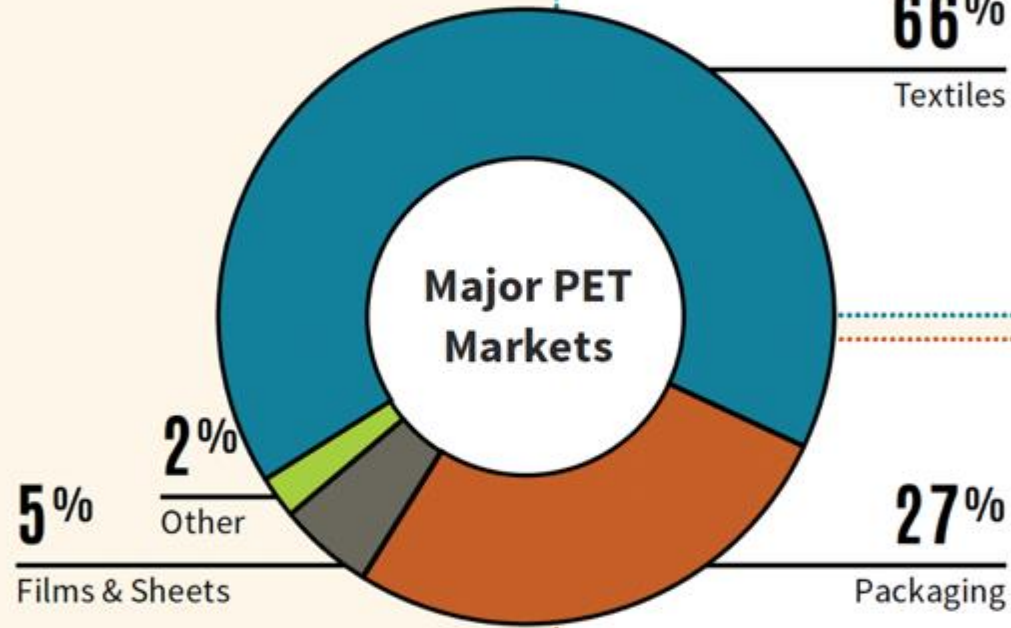
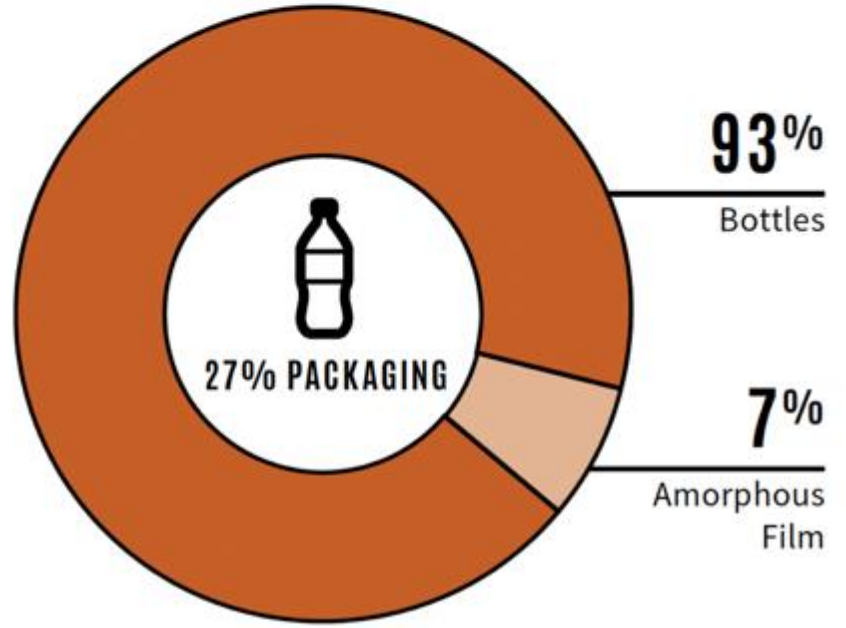


Figure 2-3. Polyester Clothing and Plastic Bottles Dominate PET Use



21 million metric tons in 2019 – polyester makes up 54% of all fiber use globally



21 million metric tons in 2019 – including more than 500 billion beverage bottles!

Global production of PET / polyester in 2019: 83 million metric tons – more than any other single type of plastic

UNSUSTAINABLE

Among most recyclable plastics

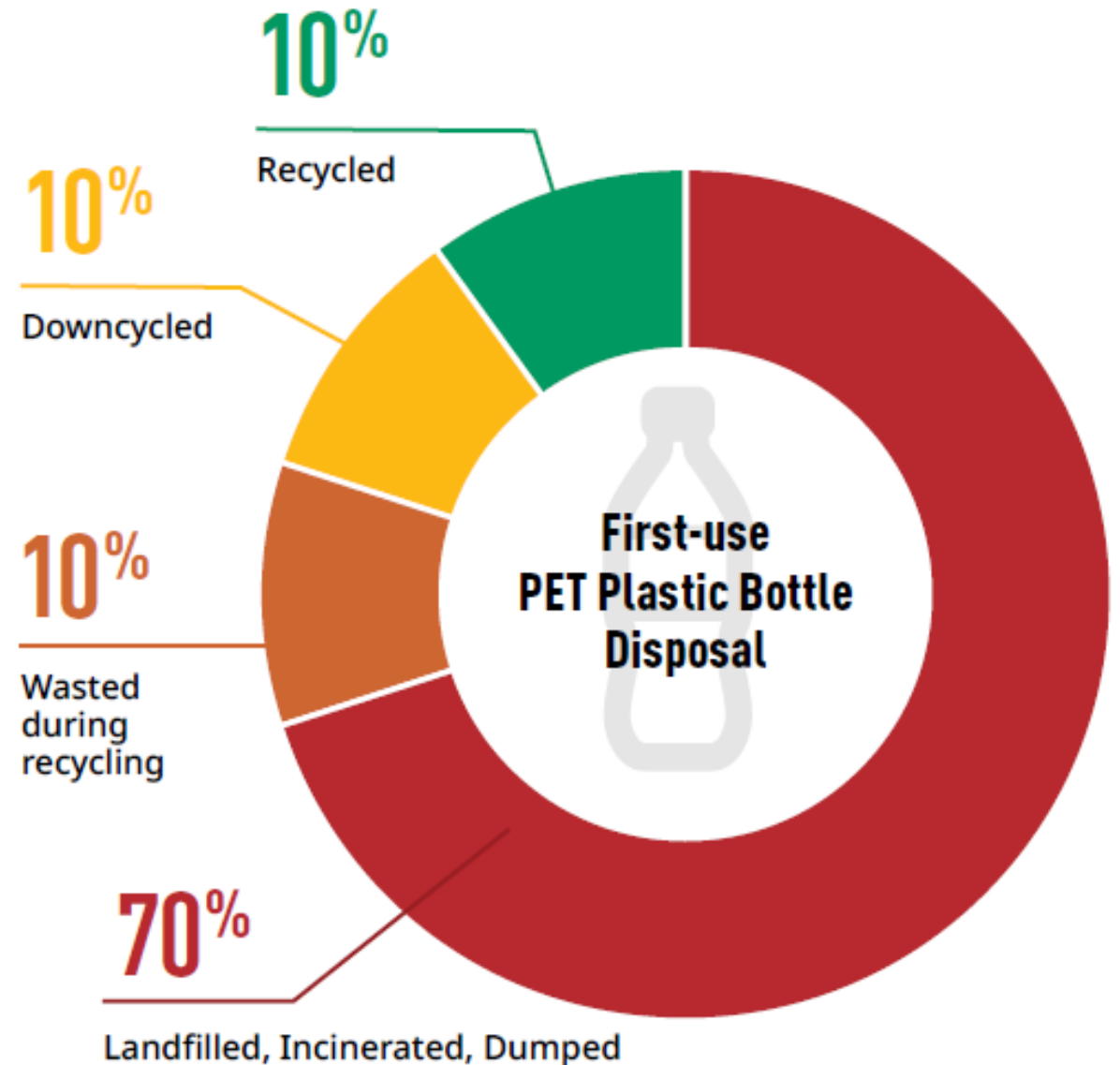
70% wasted; 30% collected

Only 10% of PET plastic bottles go back to bottles

NEW RESEARCH: Mechanical recycling of bottles produces **benzene** and **styrene** as byproducts. Non-detectable in virgin PET. Levels increase with recycled content. Migrates out from bottles. Probably due to PVC and PS contamination.

Source: Thoden van Velzen et al. (2020) *Packaging Technology and Science* <https://doi.org/10.1002/pts.2528>

Figure 2. Where Do PET Plastic Bottles Go After a Single Use?



BRAND OWNER BEVERAGE BRAND	DRINK TYPE	ANTIMONY IN BEVERAGE (PPB)
THE COCA-COLA COMPANY		
Coca Cola	Soda	2.20
Diet Coke	Soda	1.22
Honest Tea (w/ lemonade)	Tea	1.07
Simply Lemonade	Juice	0.96
Powerade Fruit Punch	Energy	0.88
Dasani	Water	0.17
PEPSICO, INC.		
Gatorade Blue Raspberry	Energy	1.78
Mountain Dew	Soda	1.38
Diet Pepsi	Soda	1.10
Pepsi	Soda	0.98
Tropicana Orange*	Juice	0.56
Aquafina	Water	0.19

Consumer Health Hazard: Antimony

Antimony levels in 40% of the plastic-bottled beverages tested exceeded the California Public Health Goal for drinking water

KEURIG DR PEPPER INC.		
Motts Apple Juice	Juice	0.98
Dr Pepper		0.85
7up	Soda	0.82
Diet Dr Pepper	Soda	0.79
Snapple Peach tea	Tea	0.50
NESTLÉ S.A.		
Perrier	Water	1.58
OCEAN SPRAY CRANBERRIES, INC.		
Ocean Spray 100% Juice	Juice	0.46
CAMPBELL SOUP COMPANY		
V8	Juice	3.45

PET resin – Major Source of 1,4-Dioxane

- Probable human carcinogen
- Persistent in water

The PET plastics industry is the largest 1,4-dioxane polluter of any other industry in the United States.



<https://pulse.ncpolicywatch.org/2022/04/08/chemical-facility-reports-its-the-source-of-latest-14-dioxane-spike-in-greensboro/#sthash.ww3GFenN.dpbs>



PETROCHEMICAL BUILDING BLOCK:

MONOETHYLENE GLYCOL

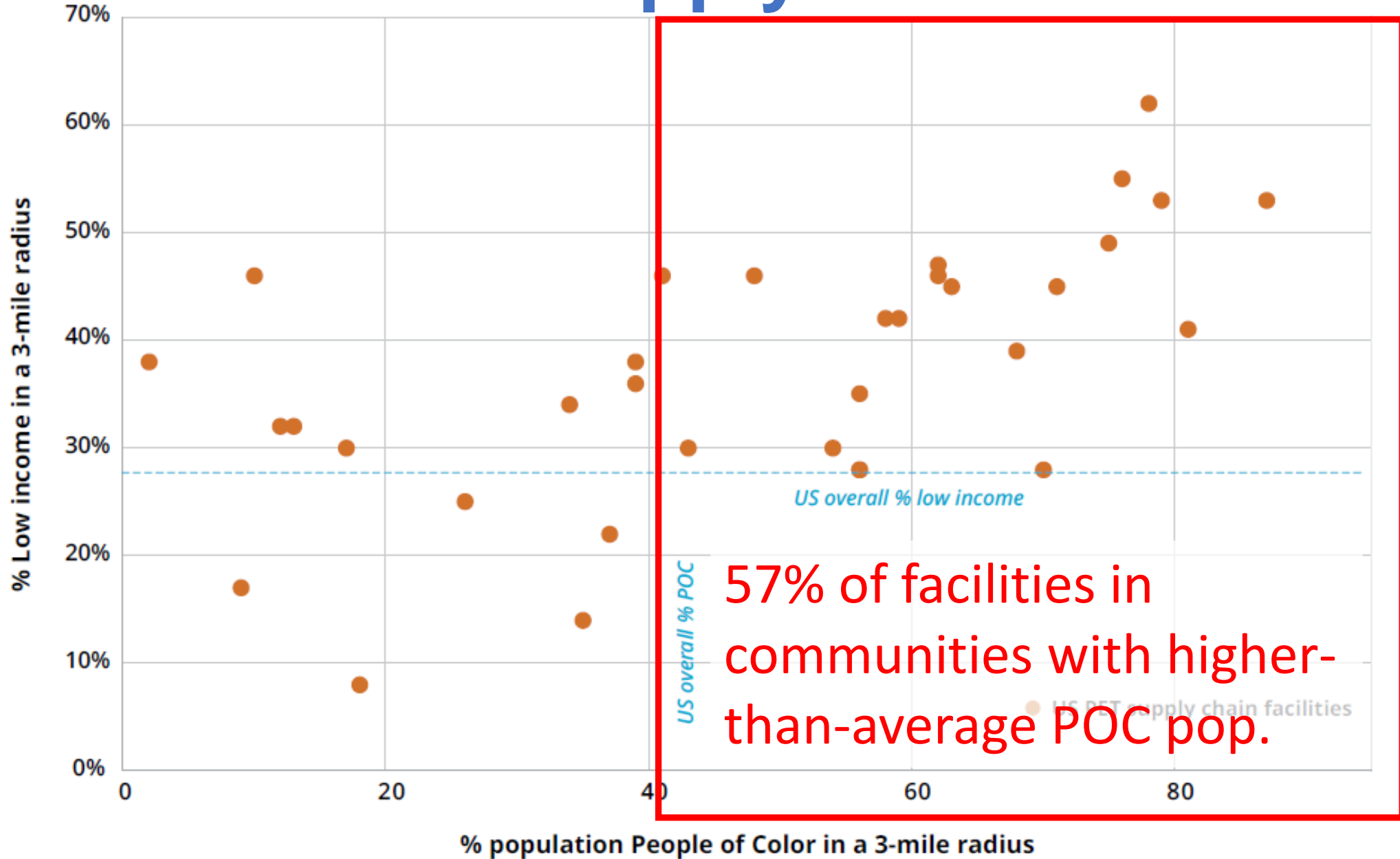


**The use of PET plastic is a major driver
for the production and air emissions of
cancer-causing ethylene oxide**

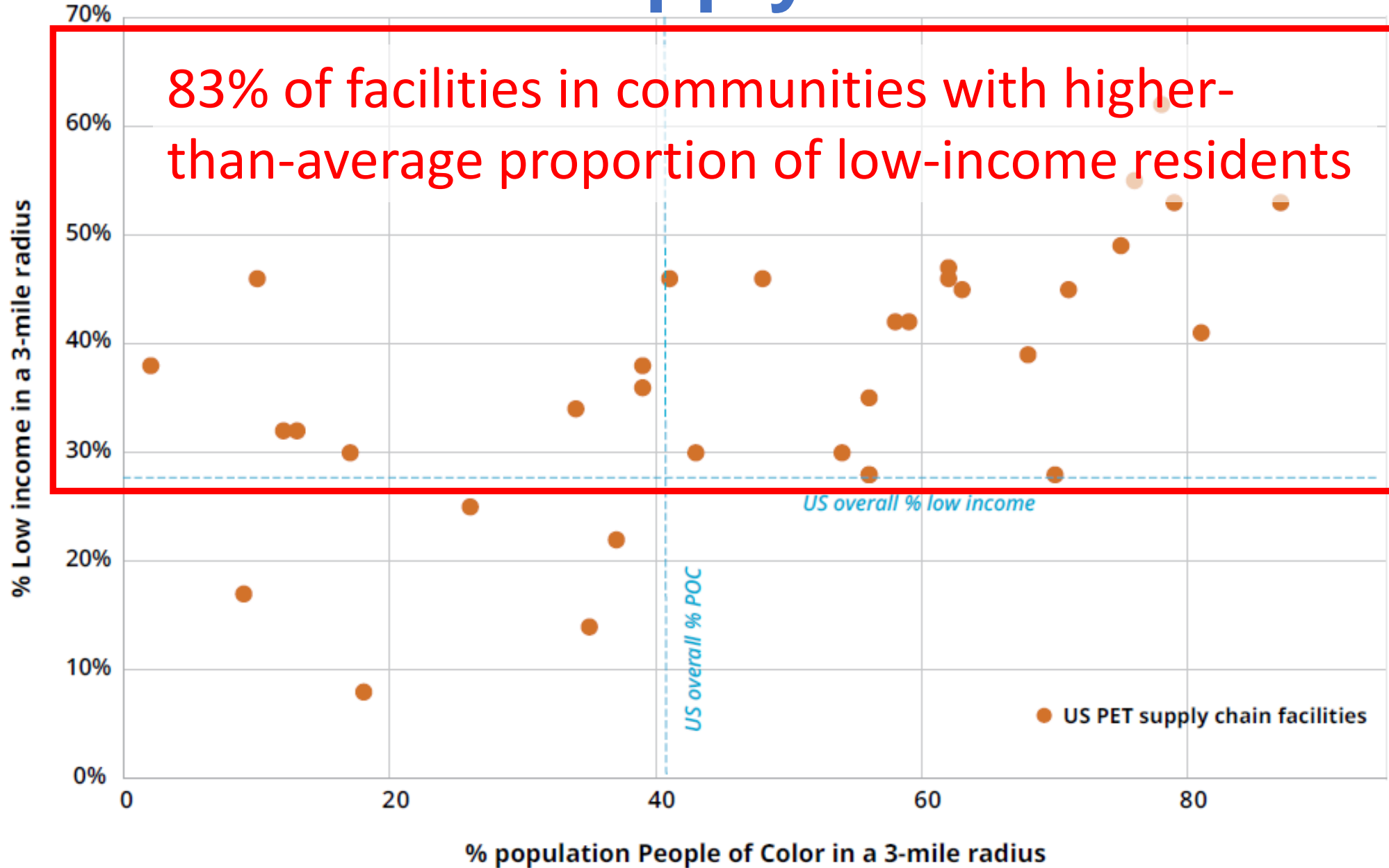
Ethylene Oxide (EtO) – Major Cancer Risk

- **Known human carcinogen – leukemia, lymphoma, breast cancer**
- Responsible for 79% of U.S. cancer risk from hazardous air pollutants
- US EPA upheld its finding that EtO is sixty times more potent as a cancer-causing substance than previously thought, in Dec. 2022
- *EtO air emissions will be reduced by less than 70%* if recently adopted rules (NESHAP) under the Clean Air Act are fully enforced
- **EPA failed to require leakless valves** at chemical manufacturing plants to eliminate so-called fugitive emissions from leaking equipment
- **More than 3 million people will still face serious cancer risk** from EtO exposure after rule adoption (at the one-in-one-million risk level)

UNJUST: US supply chain locations

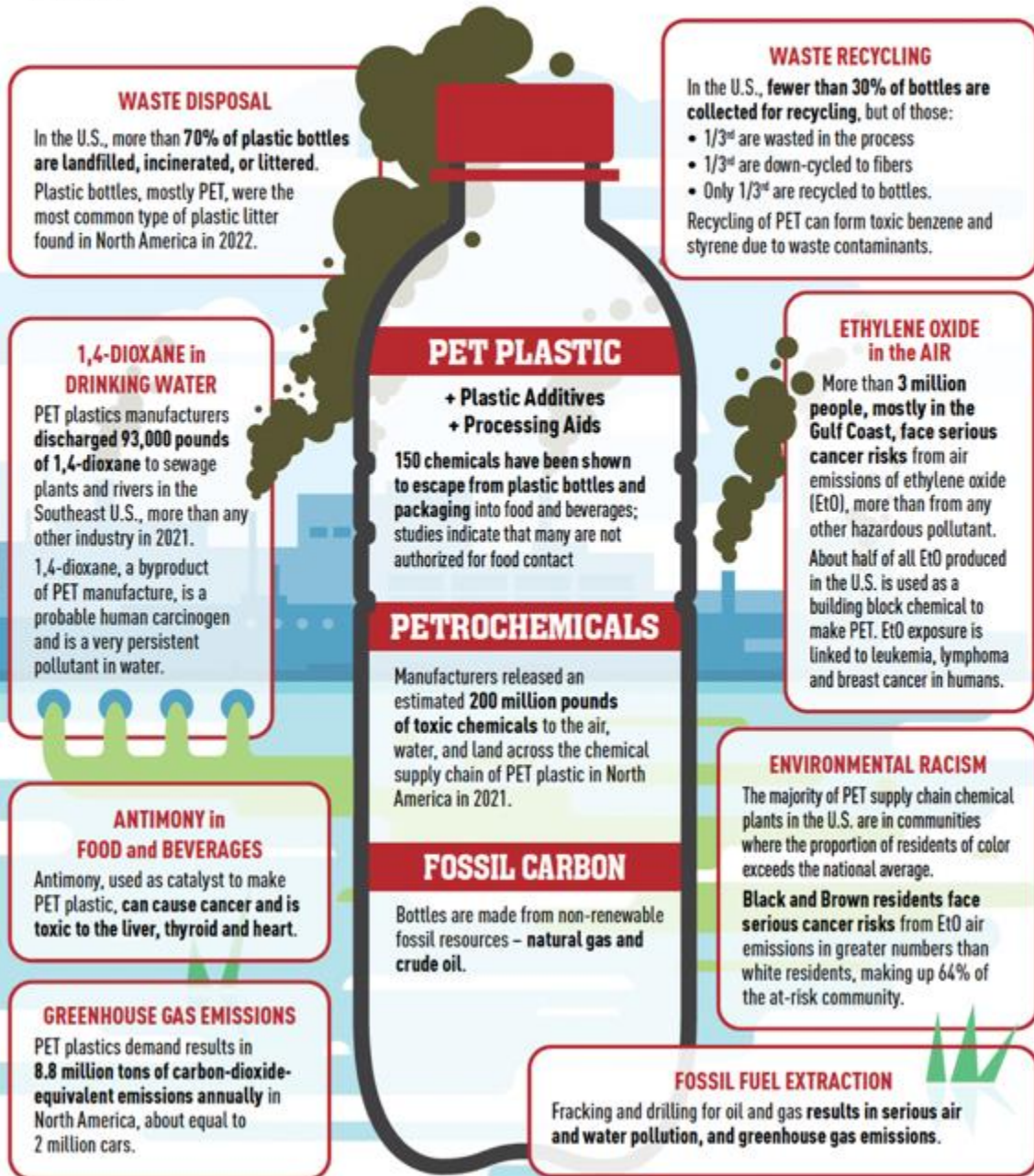


UNJUST: US supply chain locations



HIDDEN HAZARDS:

FIGURE 1. THE CHEMICAL FOOTPRINT OF A PLASTIC BOTTLE



Every plastic product has a chemical footprint

UNSAFE:

Six known or probable human carcinogens are uniquely associated with the production, use, or disposal of polyethylene terephthalate (PET) plastic

UNJUST:

The PET-plastics related health burden falls heaviest on Brown, Black, and lower income people who live and work near chemical and plastics plants, with similar population-wide disparities from exposures to consumers of color and young children

UNSUSTAINABLE:

More than 99% of PET plastic is derived from **fossil carbon** from oil and gas; only 11% of PET and polyester in U.S. is ever collected for **recycling**; and **greenhouse gas emissions** from PET are projected to double in the next decade

US NGO calls for removal of cancer-causing chemicals from PET production

NEWS | 23 May 2023
Group urges beverage industry, EPA to address metals, 1,4 dioxane and other substances



A New Report Details the Climate, Health and Human Rights Impacts of a Plastic Bottle

<https://foodprint.org/blog/impacts-of-a-plastic-bottle/>

<https://grist.org/accountability/plastic-bottles-harm-human-health-at-every-stage-of-their-life-cycle/>

Plastic bottles harm human health at every stage of their life cycle

A new report says beverage companies like Coca-Cola must be “held accountable for the supply chain impacts of their plastics.”



Soeren Stache / Picture Alliance via Getty Images

Thank You

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