

# Empowering Our Independence from Petrochemicals II: Health Harms

---

Patricia M. DeMarco

Claire Cohen, M.D.

June 22, 2023

**Sponsored by:** Black Appalachian Coalition  
and Ohio River Valley Institute





# PETROCHEMICAL LUNCH & LEARN SERIES

PHOTO: MARK DIXON

JOIN THE BLACK APPALACHIAN COALITION FOR A **FIVE-PART WEBINAR SERIES** ON EMPOWERING OUR INDEPENDENCE FROM PETROCHEMICALS:

**I. Overview** | May 25, 2023 @ 12 PM

*The sources and uses of petrochemicals, the history of the petrochemicals industry, and lost opportunities and costs.*

**II. Health Harms** | June 22, 2023 @ 12 PM

*Air, water, and land pollution and its direct & indirect effects on human health.*

**III. What We Can Control** | July 27, 2023 @ 12 PM

*How to avoid unhealthy petrochemical exposures, including labeling and food choices.*

**IV. Better Choices** | August 24, 2023 @ 12 PM

*Building a fossil-free future: developing renewable energy, regenerative agriculture, recycling, and sustainable design.*

**V. Action Plan** | September 28, 2023 @ 12 PM

*Policy changes, community choices, and personal choices.*

**FOLLOW THE LINK BELOW**  
TO JOIN ALL FIVE EVENTS:

[bit.ly/petrochemical-lunch-and-learn-series](https://bit.ly/petrochemical-lunch-and-learn-series)

# Empowering Our Independence from Petrochemicals II: Health Harms

- **Patricia DeMarco**- connecting petrochemical contamination of air, water and land to health direct and indirect outcomes
- **Dr. Claire Cohen**- Impact on communities of color from her experience in medical practice
- Q/A- put questions in the “Chat”



*Air pollution disproportionately affects people of color across the vast majority of emission sources, including industry, gas- and diesel-fueled motor vehicles and construction, according to new findings. Credit: [Mark Wilson Getty Images](#)*

# We All Know That Cigarette Smoke and Alcohol Are Bad For Us. What About Other Substances in Our Environment?



# Petrochemicals cause Pollution at all phases

- Extraction
- Refining
- Transportation
- Use
  - Combustion as fuels for power and industry
  - Chemical manufacturing for pharmaceuticals, pesticides, herbicides & fertilizers
  - Plastics production,
  - Use and disposal as waste

Fracking natural gas



Mountaintop removal mining



Oil train derailed



Chemical refining



Coal fired power plant



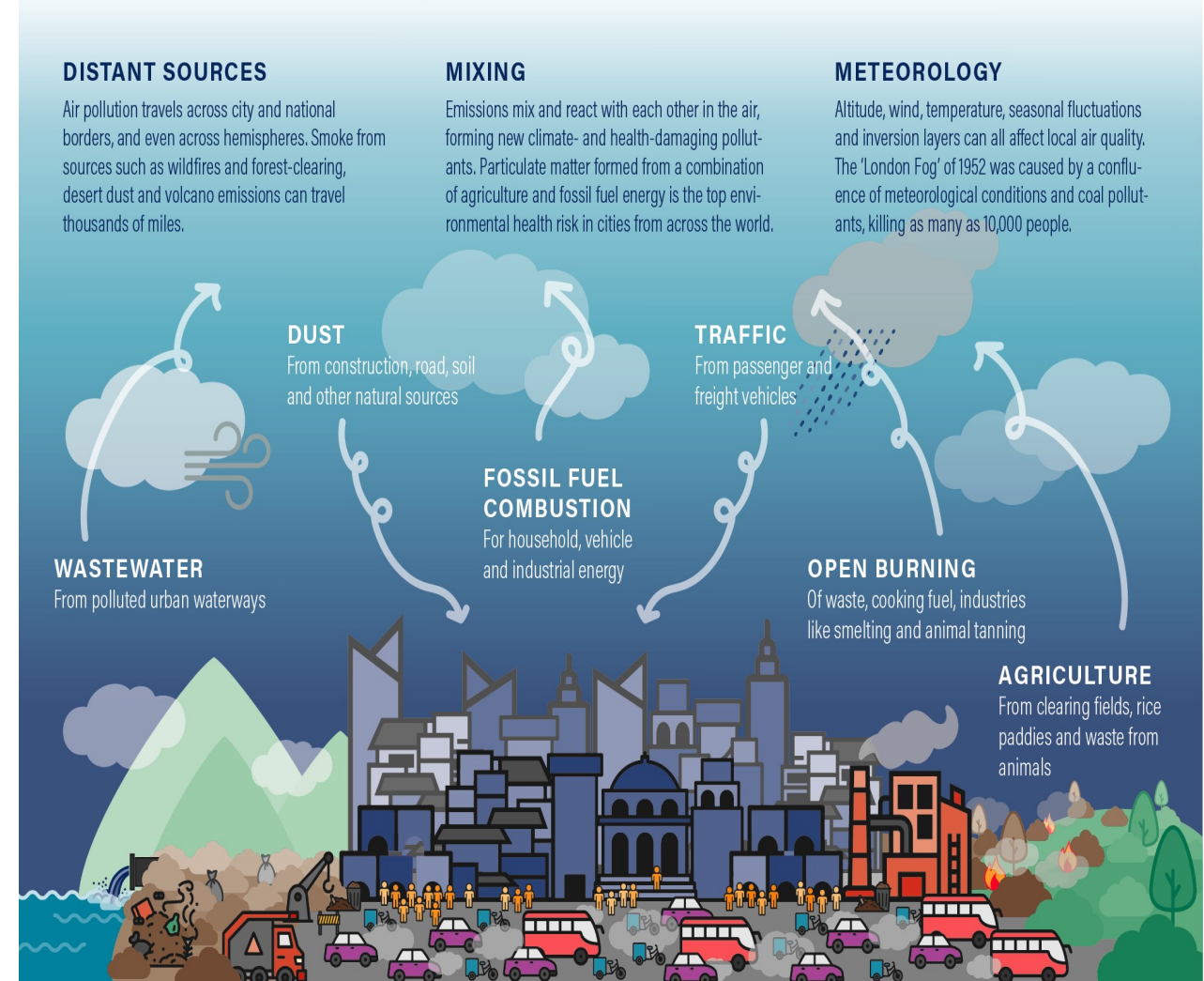
Plastics production- Shell



Plastic waste

# Air Pollution Sources

- **Natural Sources:** fires, volcanoes, lightning
- **Fossil fuel combustion:** power plants, industries, sewage treatment, residential and commercial heating and cooking
- **Transportation:** cars, trucks, railroads, shipping, buses, motorcycles
- **Agriculture:** ruminants, pesticides, fertilizer, herbicides



# Air Pollution-Major Air Pollutants

## Major Pollutants:

- **Carbon Dioxide -CO<sub>2</sub> = 48 million tons/yr (Climate change has health harms also)**
- **Volatile Organic Compounds –VOCs & PAH= 15 million tons/yr**
- Nitrogen Oxide NO<sub>x</sub> = 11 million tons/yr
- Sulfur Dioxide SO<sub>x</sub> = 9 million tons/yr
- Particulates PM 10 = 8 million tons/yr
- Particulates PM 2.5 = 6million tons/yr

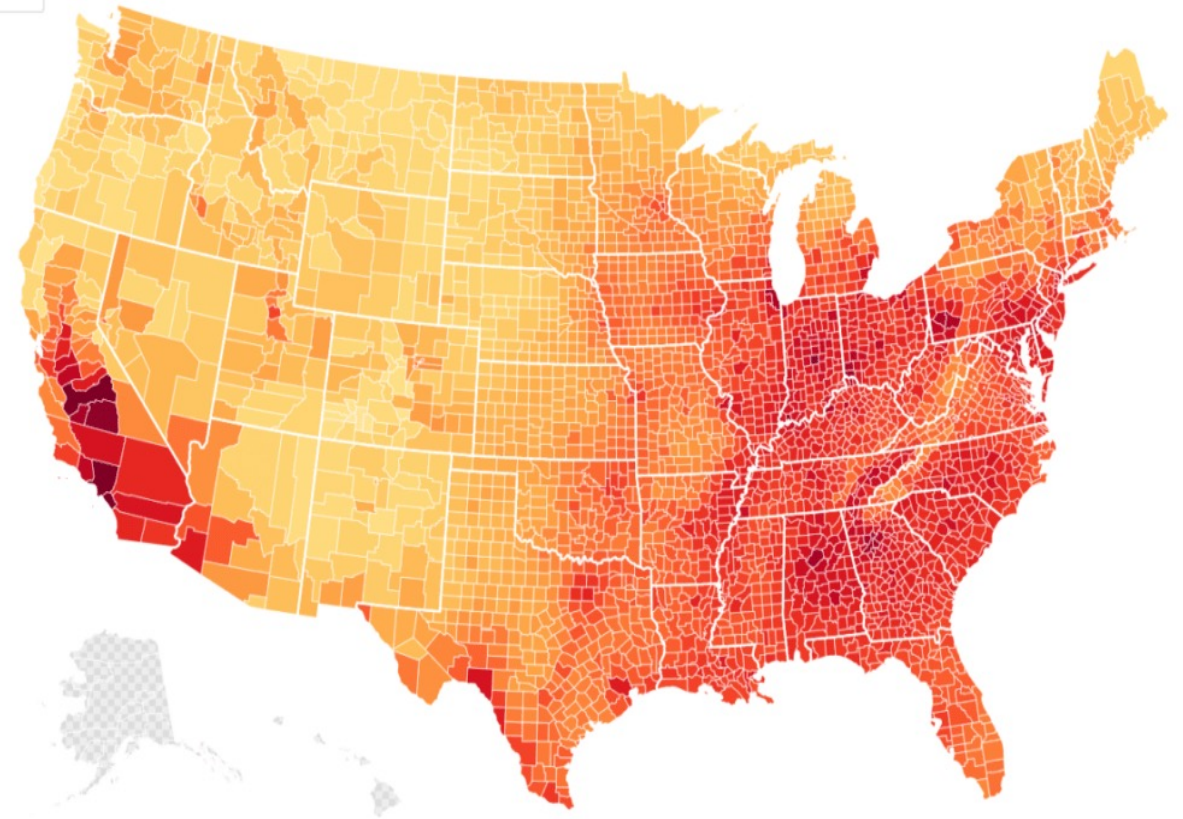
<https://www.nps.gov/subjects/air/sources.htm>

### Counties with the worst air pollution

Mapping average fine particulate matter pollution, 2000-2016. Fine particulate matter pollution consists of microscopic particles that come from burning fossil fuels; it can cause respiratory conditions in people who live in heavily polluted areas.

0 15

Search..



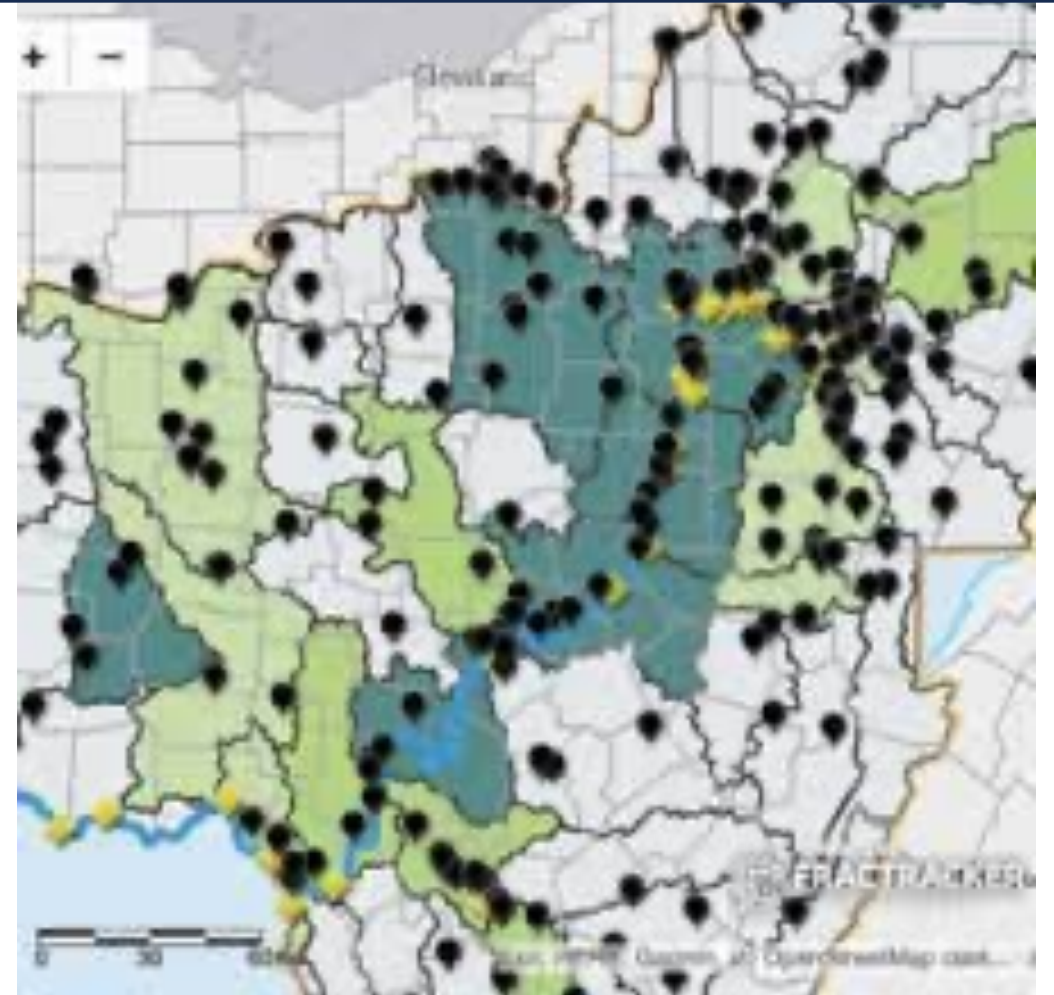
Source: FindCare, Wu et al. 2020, U.S. Census Bureau • Alaska and Hawaii are not included in the study.

# Petrochemical industry water pollutants

Allowed within EPA Regulation:

- Petrochemical facilities are permitted to annually discharge ***over 500,000 pounds of toxic pollutants into the Ohio River Basin within Ohio, Pennsylvania, and West Virginia.***
- Including benzene, vinyl chloride, and trichloroethylene and over 100 other chemicals

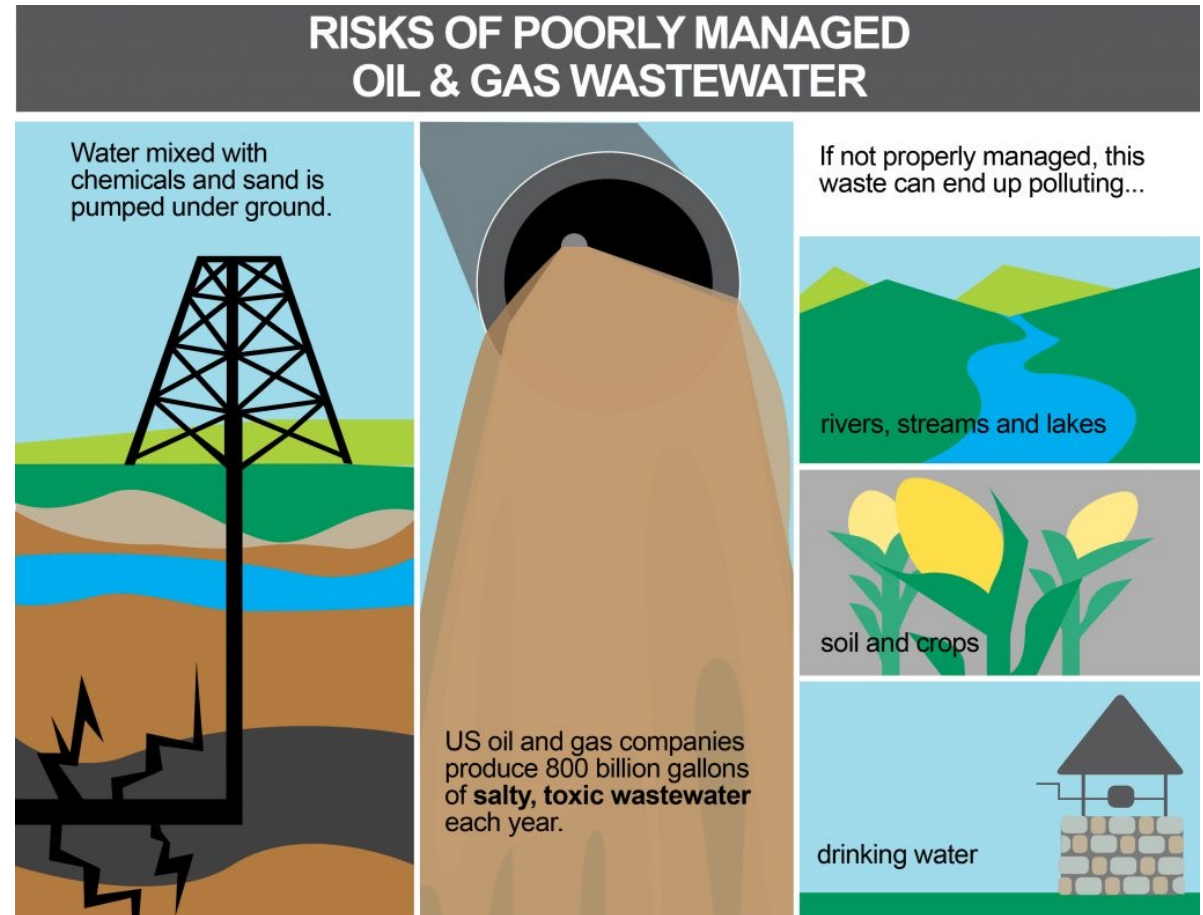
<https://earthworks.org/blog/petrochem-toxics-in-the-ohio-river-basin/>





# Water Pollution: Petrochemical Industry sources

- **Oil Refineries:** 81 refineries across the country discharged over 15.7 million pounds of nitrogen, 60,000 pounds of selenium, and 1.6 billion pounds of chlorides, sulfates, and other dissolved solids into U.S. waterways in 2021.
- **Plastics and Chemical Manufacturing:** plastic resins, PFAS “forever chemicals,” synthetic fibers (rayon, polyester, etc.), benzene, solvents, salts, nitrogen compounds, oil and grease, and metals like aluminum, zinc, and lead
- **Plastics molding:** phthalates, PFAS, nitrogen, N,N-Dimethylformamide, and microplastics
- **Chemical fertilizer:**
- **Pesticide manufacturing:**
- **Metal smelting:**
- **Inorganic chemicals:** vinyl chloride, phosphorous, dioxins, manganese, PCBs



<https://environmentalintegrity.org/industrial-water-pollution-standards/>

[https://www.biologicaldiversity.org/campaigns/fracking/pdfs/Colborn\\_2011\\_Natural\\_Gas\\_from\\_a\\_public\\_health\\_perspective.pdf](https://www.biologicaldiversity.org/campaigns/fracking/pdfs/Colborn_2011_Natural_Gas_from_a_public_health_perspective.pdf)

# Land Pollution from Petrochemicals

- **Agriculture**-petrochemical-based pesticide, herbicide, fertilizer – contaminate soils, reduce biodiversity in soil organisms; contaminate some foods

(See EWG Dirty Dozen and Safe 15  
<https://www.ewg.org/foodnews/dirty-dozen.php> )

- **Spills and leaks**- oil and coal
- **Indirectly** from transportation fuels, from dust deposition and water transport in precipitation
- **Illegal dumping** –especially plastics
- **Mining and drilling** (Especially fracking)
- **Superfund Sites**



Pesticide Application



Oil spilled on ground



Plastic debris on shoreline



Petrochemicals leaking onto road

<https://www.nationalacademies.org/news/2022/09/land-based-runoff-remains-top-source-of-oil-in-the-ocean-says-new-report>

<https://www.pollutionsolutions-online.com/news/soil-remediation/18/breaking-news/fracking-could-cause-greater-levels-of-soil-pollution/30718>

# The Chemical “Stew” in our Blood



Mount Sinai School of Medicine in New York,  
in collaboration with the Environmental Working Group and Commonweal.  
“Body Burden-The Pollution in People. EWG Report 2005. see [www.ewg.org](http://www.ewg.org)

- 167 chemicals found in bio-monitoring studies
- 76 cause cancer in humans or animals
- 94 are toxic to the brain and nervous system
- 79 cause birth defects or abnormal development.
- ***The dangers of exposure to these chemicals in combination has never been studied.***

# Petrochemical pollution pathways into our body:

## Three principal access methods:

- **Inhalation**- Affected by air pollution and air-borne contaminants
- **Ingestion**- pollution of water and food from transport of pollutants, contamination of the food chain; water-soluble pollutants
- **Contact**- absorption through skin by contact or occupational exposure (eg. Bisphenol -A absorbed from handling thermo-fax paper such as receipts)

**Physical conditions:** climate change induced heat adds stress to vulnerable people, or people exposed occupationally to outdoor conditions



Land Pollution



Water Pollution



Air Pollution



Contact



Ingestion



Inhalation

# Respiration: Direct Health Harms

## Long term direct effects of air pollution:

Respiratory and cardiovascular system:

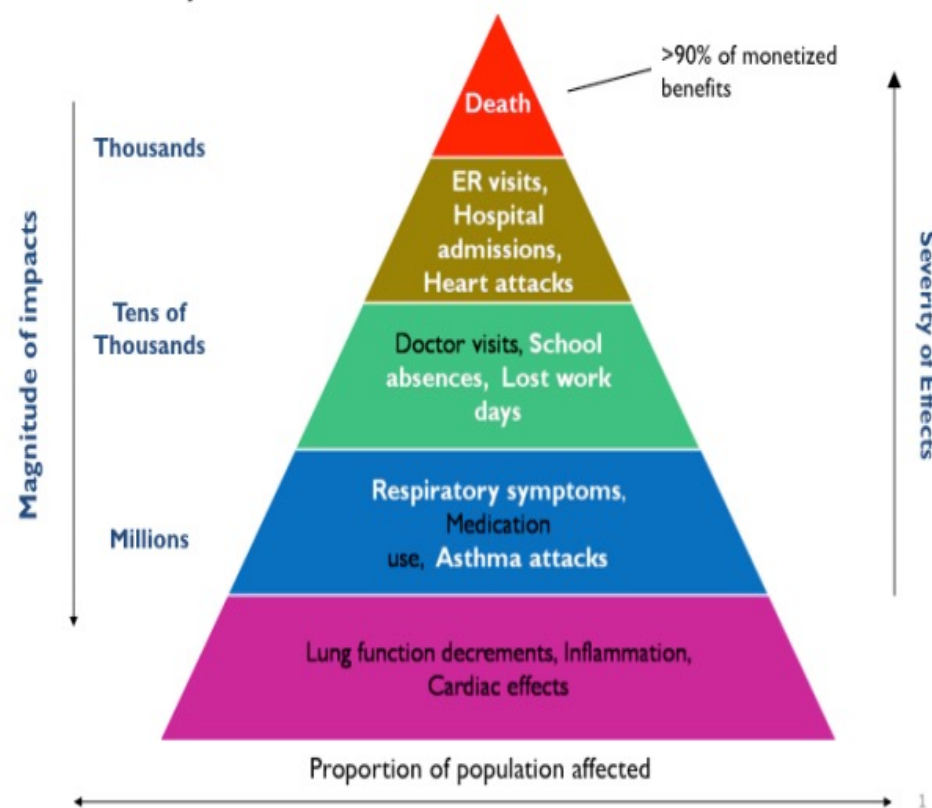
Asthma, hypertension, coronary artery disease, heart attack, stroke.

Oxone and Particulate pollution can cause chest pain, coughing, throat irritation, congestion and reduced lung function


Children, older adults, persons with asthma, and immunocompromised persons are most vulnerable to air quality impacts.

<https://www.niehs.nih.gov/health/topics/agents/air-pollution/index.cfm>

A “Pyramid of Effects” from Air Pollution

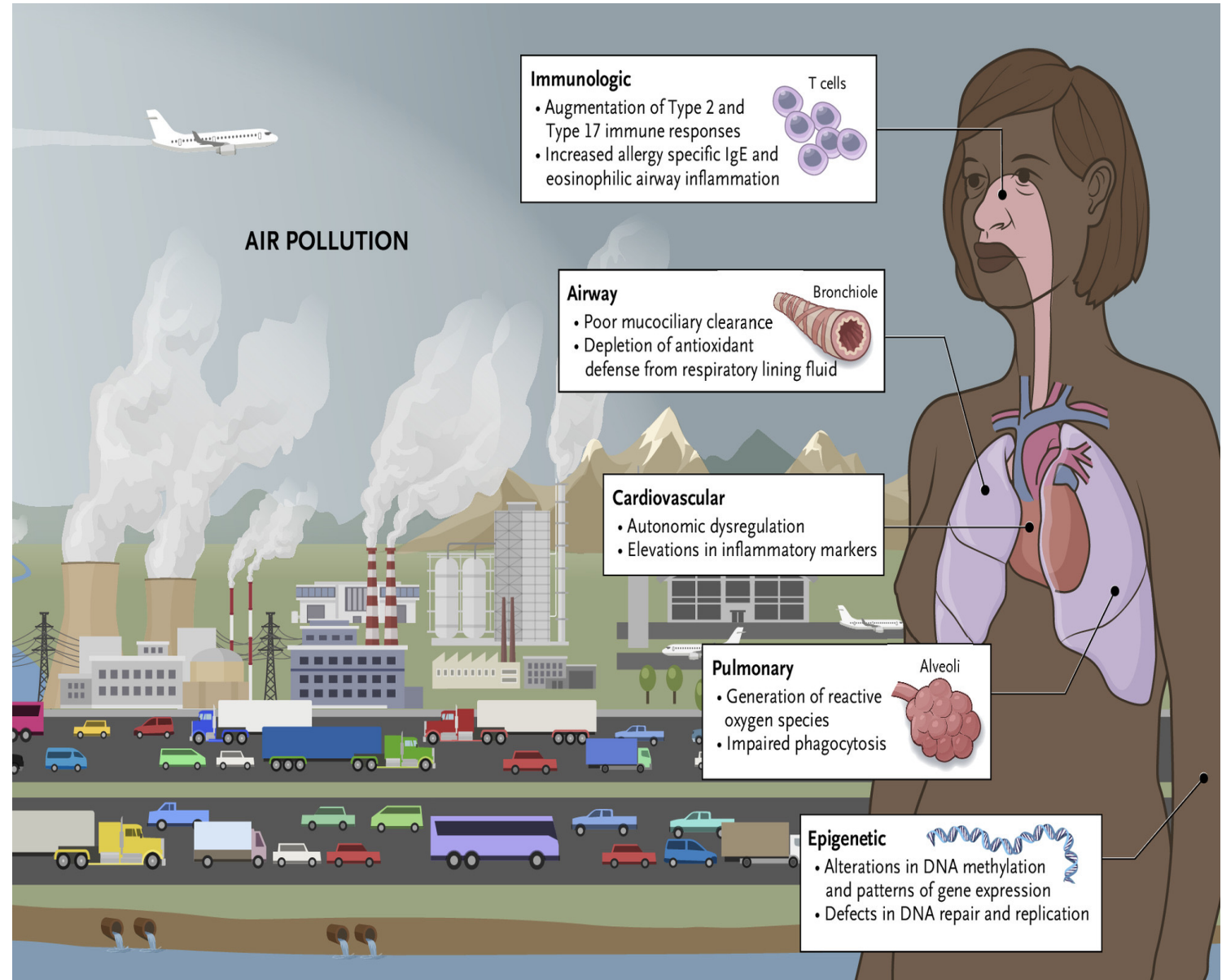


# Air Pollution- Indirect Health Harms

- 
- Long-term exposure to air pollution (PM, NO<sub>x</sub>, O<sub>3</sub> and PAH)
  - Immune System disruption
  - Airway and respiratory damage
  - Cardiovascular damage
  - Pulmonary functions compromised
  - Epi-genetic damage- DNA repair impeded
  - Cancer and strokes.

<https://evidence.nejm.org/doi/full/10.1056/EVIDra2200068>

6/22/23



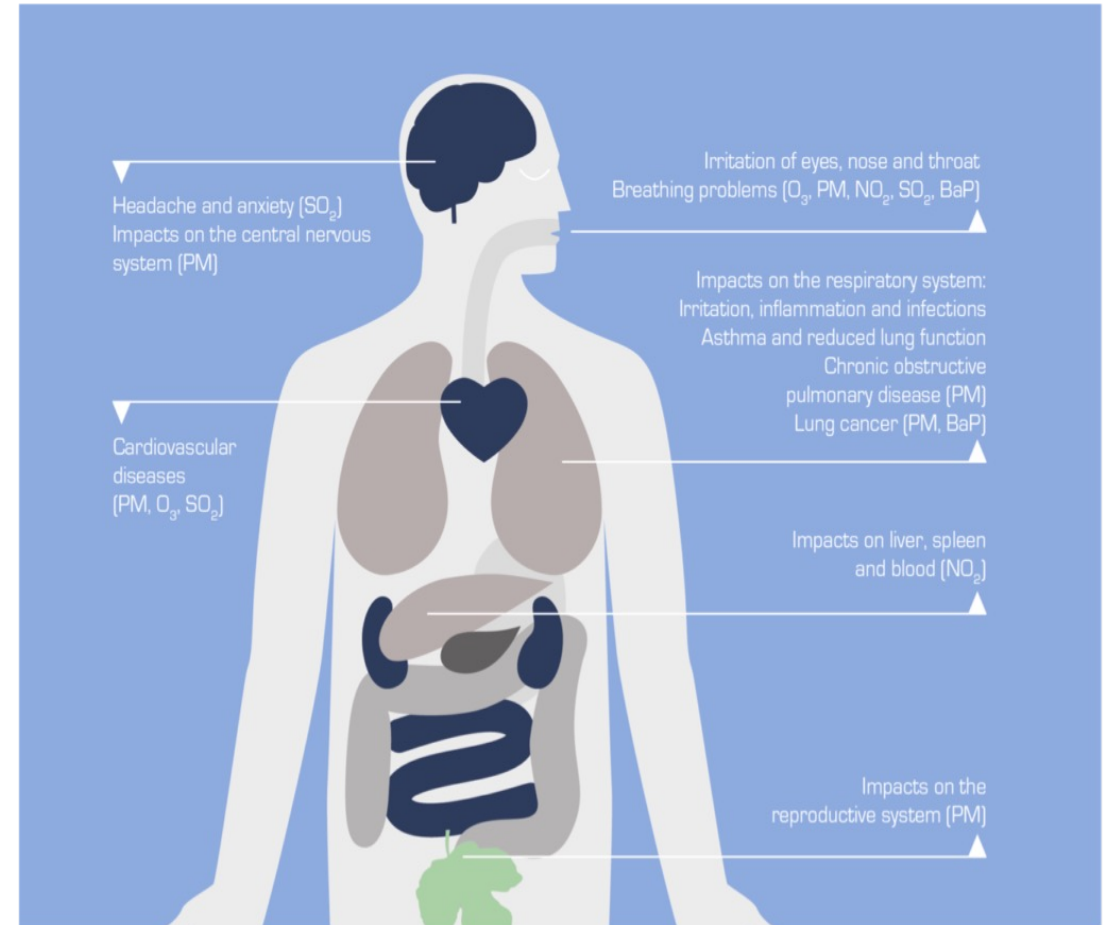
<https://patriciademarco.com>

14

# Petrochemical Water Pollution- Health Harms

## Health harms associated:

- **Higher risk of cancers** in bone, brain, liver, bladder, breast and pancreas
- **Adverse Birth Outcomes-** preterm birth, low birth weight, miscarriages, stillbirth and birth defects
- **Chronic kidney disease** – glomerulonephritis
- **Endocrine Disruption-** developmental and reproductive health disruptions
- **Nosebleeds, headaches and nausea**



<https://e360.yale.edu/features/fracking-gas-chemicals-health-pennsylvania>

<https://environmentalintegrity.org/wp-content/uploads/2023/01/Refinery-water-pollution-report-EMBARGOED-until-1.26.23.pdf>

# Examples: Endocrine Disrupting Chemicals

## HERBICIDES

2,4,-D  
2,4,5,-T  
Alachlor  
Amitro  
Atrazine  
Linuron  
Metribuzin  
Nitrofen  
Trifluralin

## FUNGICIDES

Benomyl  
Ethylene thiourea  
Fenarimol  
Hexachlorobenzene  
Mancozeb  
Maneb  
Metiram - complex  
Tri-butyl-tin  
Vinclozolin  
Zineb

## METALS

Cd,Ar,Sn...

## INSECTICIDES

Aldicarb  
beta-HCH  
Carbaryl  
Chlordane  
Chlordecone  
DBCP  
Dicofol  
Dieldrin  
DDT and metabolites  
Endosulfan  
Heptachlor / H-epoxide  
Lindane (gamma-HCH)  
Malathion  
Methomyl  
Methoxychlor  
Oxychlordane  
Parathion  
Synthetic pyrethroids  
Transnonachlor  
Toxaphene

## INDUSTRIAL CHEMICALS

Bisphenol - A  
Polycarbonates  
Butylhydroxyanisole  
Cadmium  
Chloro- & Bromo-diphenyl  
Dioxins  
Furans  
Lead  
Manganese  
Methyl mercury  
Nonylphenol  
Octylphenol  
PBDEs  
PCBs  
Pentachlorophenol  
Penta- to Nonylphenols  
Perchlorate  
PFOA  
p-tert-Pentylphenol  
Phthalates  
Styrene

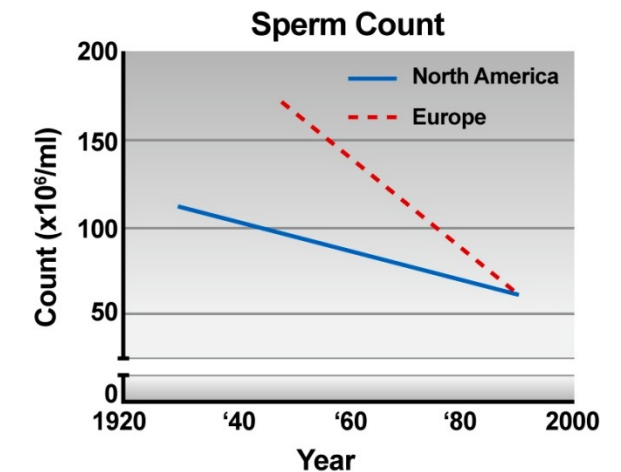
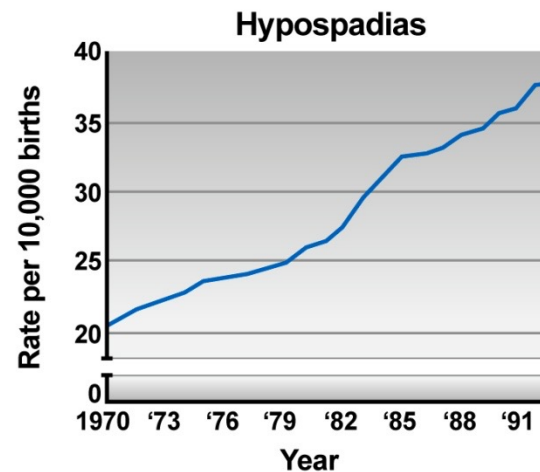
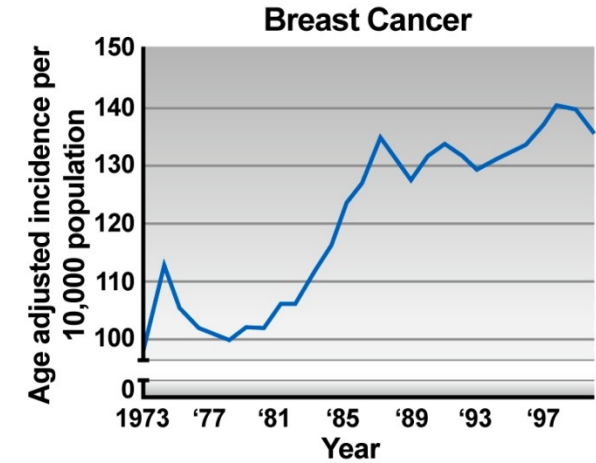
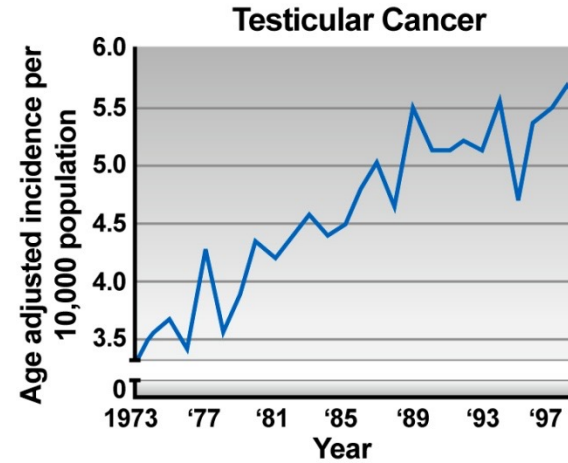
*Testosterone synthesis inhibitor*  
*Thyroid hormone disruptor*

*Estrogen receptor agonist*  
*Androgen receptor antagonist*



# Should We Be Concerned?

- Evidence of endocrine disruption is mounting in the general population
- Restrictions on petrochemical industry are fought vehemently by multinational corporations vested in continuing to use fossil resources
- People are exposed without their awareness, or consent.



Sharpe and Irvine, 2004

<https://ehp.niehs.nih.gov/doi/10.1289/ehp.1306695>

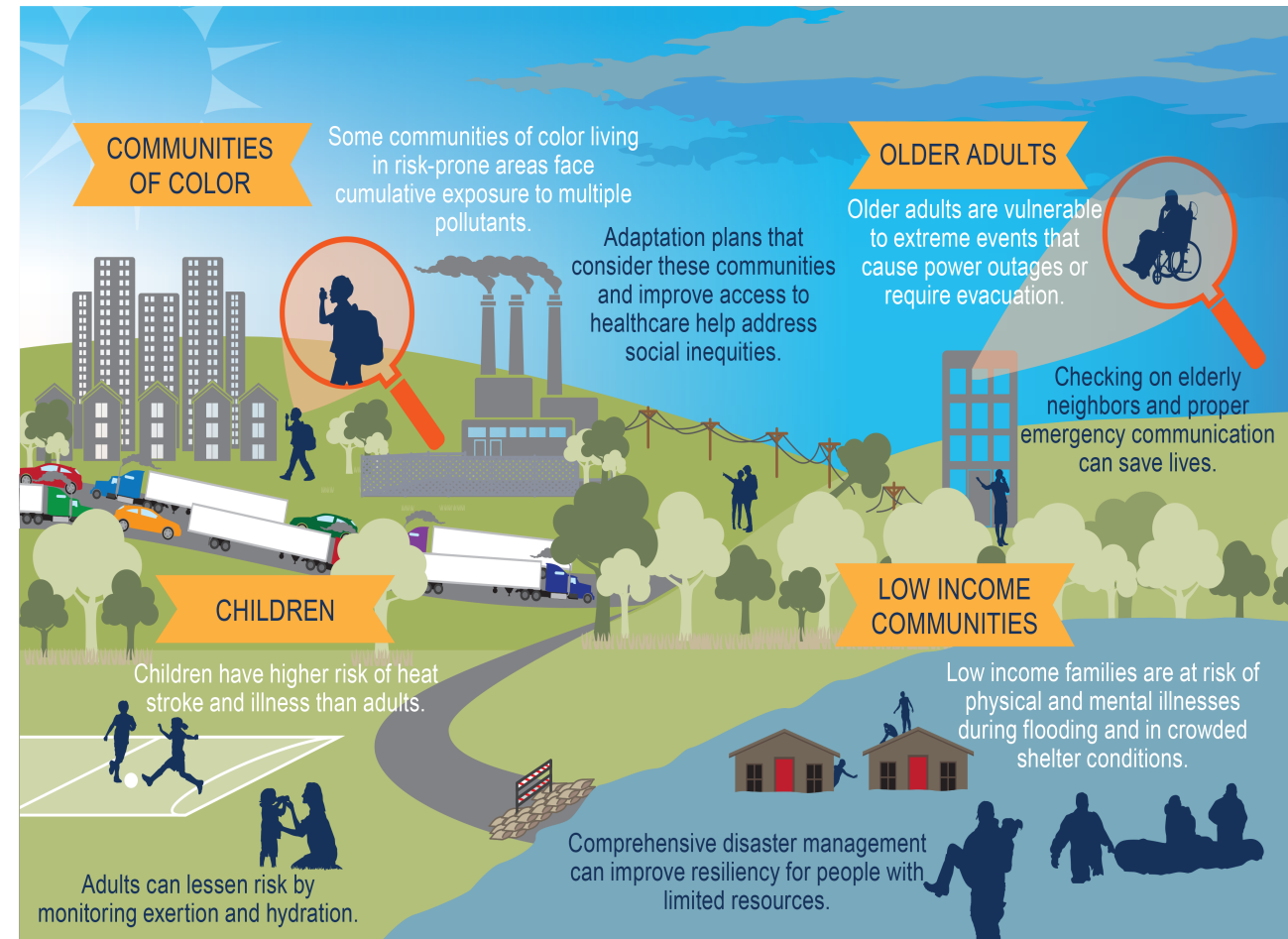
# Health Harms from Climate Change

Petrochemicals are the largest contributor to climate change

- Changes in air and water quality exacerbate respiratory illnesses
- Heat stress, especially among outdoor workers
- Increase in range and viability of disease vectors like mosquitoes, ticks and bacteria
- Increase in transmission of infectious diseases
- Increased dangers from disasters like floods, fires and drought
- Mental distress from apprehension about climate future

<https://nca2018.globalchange.gov/chapter/14/>

## Vulnerable Communities:



# Healthy people require a healthy environment

## Within a mile of petrochemical facilities:

- 18-22% of children have asthma compared to 8-11% nationally
- Pregnancy-related maternal mortality is 41% compared to 13.7% average nationally
- Life expectancy is reduced and income growth is slowed in communities where petrochemical facilities are located
- Substantial risk factor for many negative outcomes in individuals' **lifetime**, such as deficit hyperactivity disorders, asthma, lower test scores, lower schooling attainment, lower earnings, and higher rates of social welfare program participation



*Phipps "Homegrown" garden program*

- ➔ Shift the regulatory framework from permitting how much **toxin is allowed** into the air, water and soil
- ➔ To a regulatory framework that has focus on **approving only non-toxic materials and benign production systems**

<https://www.kff.org/racial-equity-and-health-policy/issue-brief/racial-disparities-in-maternal-and-infant-health-current-status-and-efforts-to-address-them/>

<https://health.gov/healthypeople/objectives-and-data/browse-objectives/environmental-health>

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6875147/>