

# **Petrochemical Disasters on Our Warming Planet:**

**Disability Centered Guidance  
for Emergency Planning**



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## Framing

When a disaster strikes, like a chemical spill or an explosion, the immediate question is whether the air is safe to breathe and the water is safe to drink. Elected officials and corporations alike are quick to declare an area “safe” without considering the diverse needs of its community members - including those who are disabled.

[Evacuation plans](#) often fail to consider those who cannot easily leave their homes, whether due to disabilities or lack of accessible transportation. [Shelters](#) must comply with ADA requirements, at a minimum, for people with disabilities to maintain their independence in times of crisis. The long-term effects of exposure to petrochemicals can even lead to new disabilities or exacerbate existing health conditions. This creates a vicious cycle where the most [at risk](#) become even more susceptible to harm. Most people with disabilities never even return home, [according to](#) Census data. This is why inclusive disaster planning and accessible communication are lifelines for the disabled community.

Climate-driven extreme weather events are making petrochemical disasters more common and severe and yet disaster guidance typically fails to incorporate the specific needs of those most at risk - people with disabilities.

According to the National Council on Disability, people with disabilities are “2 to 4 times more likely to be injured or killed in a natural disaster than those who are not disabled.” To address this problem, People Over Petro and the Partnership for Inclusive Disaster Strategies collaborated with disabled disaster survivors and organizational partners to develop guidance that considers the specific barriers facing people with disabilities during and after a disaster.

The guidance, which includes recommendations to ensure disaster communications, response, evacuation, and service delivery consider the needs of people with disabilities, is designed for individuals, local governments, industry, and emergency response agencies.

# Overview and History

## Brief Overview of the Petrochemical Industry

The primary focus of the petrochemical industry is on using oil and gas as raw materials to manufacture various chemicals and plastics. Its activities include:

- feedstock production, crude oil and gas processing into basic petrochemical building blocks like naphtha, ethane, and propane.
- chemical production, transforming these building blocks into intermediate and finished chemicals like ethylene, propylene, benzene, methanol, and ammonia.
- polymer production, using these chemicals to manufacture plastics like polyethylene, polypropylene, and polyvinyl chloride (PVC).

Plastics, detergents, fertilizers, explosives, blue hydrogen, synthetic fabrics, paints, and flooring are among the many products made out of petrochemicals. These products are building blocks for various industries, including construction, textiles, packaging, healthcare, agriculture and fuels.

## What is a Petrochemical Disaster?

Petrochemical disasters can be the result of climate change-fueled disasters, such as extremely high winds, lightning strikes, and earthquakes. They can also be caused by deterioration and neglect of our nation's transportation systems, lack of maintenance or malfunctions of equipment, improper handling and disposal, acts of sabotage or terrorism, and government failure.

The consequences of petrochemical disasters can be devastating for humans and the environment. Their impacts range from immediate death and injury to long-term health issues and damage to infrastructure and ecosystems.

Examples of petrochemical disasters include:

- Transportation accidents, such as a train derailment that was carrying petrochemicals. There are 1300 train derailments per year.
- Explosions and fires, which can have a variety of causes, like a malfunction of equipment or processes, and burning petrochemicals, often produce smoke and fumes containing toxic and irritating chemicals, posing risks to human health and the environment.
- Spills and leaks, which can cause immediate and long-term health and environmental implications.

Visit [spilltracker.org](https://spilltracker.org) to find out more about recent spills and leaks.

Among the worst petrochemical disasters to affect the United States are:

- 2023 - Current: Norfolk Southern train derailment and chemical disaster, East Palestine, Ohio
- 2019 - Current: Fairmont fracking water treatment facility Fairmont, West Virginia
- 2014: MCMH Chemical Spill, Ohio River Basin, Elk River West Virginia
- 1951 - Current: C8 Teflon and forever chemical pollution Parkersburg, West Virginia and downstream Ohio River
- 2010: Deepwater Horizon explosion and oil spill, Gulf of Mexico: largest oil spill in U.S. history; 11 dead, 17 injured; widespread environmental damage and economic losses
- 2005: BP America Refinery explosion, Texas City, Texas: 15 dead, 180 injured; \$200M in loss of refinery property
- 1989: Exxon Valdez oil spill, Alaska: contaminated the Alaskan coastline and caused devastating loss of marine life

Petrochemical disasters can significantly impact the communities in which they occur, putting human health and safety, the environment, and the economy at risk.

Exposure from breathing toxic air, skin contact, and ingestion of petrochemicals can cause immediate effects like respiratory difficulties, skin irritation, and even death. Long-term exposure can lead to cancer, conditions present at birth, and other health conditions. Leaks and spills can lead to explosions or fires, contaminate drinking water, ecosystems, harm or kill off wildlife, and disrupt vital natural processes. Petrochemical disasters can have significant negative impacts on humans, damage infrastructure, disrupt businesses, and require costly cleanup efforts, which sometimes last for years.

## Guidance for Individuals

Petrochemical disasters can significantly impact the communities in which they occur, putting human health and safety, the environment, and the economy at risk.

Exposure to petrochemicals by breathing toxic air, skin contact, or ingestion can cause immediate effects like respiratory difficulties, skin irritation, and even death. Long-term exposure can lead to cancer, congenital anomalies, and other health conditions. Leaks and spills can lead to explosions or fires, contaminate drinking water ecosystems, harm or kill off wildlife, and disrupt vital natural processes. Disasters can damage infrastructure, disrupt businesses, and require costly cleanup efforts that sometimes last years.

Every disaster is different, and the best course of action will vary depending on specific circumstances. Sheltering in place is generally the most common response to petrochemical disasters, to avoid exposure to toxic substances which may be present in the air and/or water supply.

### Important Tips for Receiving Information

- Keep phones and tablets charged at all times. If you have extra charging devices/battery packs for these devices, keep them charged, too.
- If possible, keep a battery or hand-crank radio available to stay informed about emergencies. These are critically important when cellphone, landline, and electric services fail.
- Download the [FEMA App](#) to sign up to receive emergency alerts for your area.
- Visit your county/parish emergency management page to subscribe to local emergency alert systems and connect to social media accounts.
- Apps, alerts, and social media will also provide information and instructions from local government on shelter-in-place orders, evacuation orders and open shelters, points of distribution of emergency supplies, and other resources for assistance.
- It's also important to monitor local news and weather reports for updates on potential chemical hazards, and for instructions from your local government.
- Download the [NIOSH Pocket Guide to Chemical Hazards App](#) to learn about exposure routes, PPE, and first aid recommendations.
- Research Mutual Aid funding opportunities in your community. Look to local non-profit organizations, mutual aid groups, and community funds for potential assistance and information.
- Keep numbers of who to call to report accidents or get answers, local, state and national emergency management services.

## Prepare in Advance

According to the Oil and Gas Watch database there are 520 petrochemical infrastructure facilities operating in the United States. These facilities include infrastructure to transport, store, process, and refine petrochemicals from its raw components, oil and gas, into more than 6000 products.<sup>1</sup>

- Use this Fractracker [Map](#) to find out if you live close to a refinery or petrochemical processing plant.<sup>2</sup> This information can help you plan ahead for sheltering in place, and for evacuating to a safer place, such as a community shelter, hotel or motel, or a family member's or friend's home.
- If you have a personal or family emergency preparedness plan, especially for sheltering in place, be sure you have enough drinking water, non-perishable food, and any necessary medical supplies for each member of your household, including service animals and pets.
- Review your evacuation routes. If you have access to GPS mapping, check your routes for any current construction or obstacles, and find alternate routes, if necessary. Find evacuation guidance [here](#).
- Review this [report](#) from Earthworks about Petrochemicals in the Ohio River Valley.<sup>3</sup>

## Prioritize Your Safety in a Petrochemical Disaster

Remember, every situation is unique, and the best course of action may vary depending on the specific circumstances. The most important thing is to follow the instructions of the local government.

- If you receive an alert from your local authorities that any type of petrochemical disaster has happened in your community, follow all instructions they give, including anything about sheltering in place or evacuation. Utilize your support network to assist you with these actions.
- N95 equivalent masks are not effective protection for all chemical exposures, [Organic vapor masks](#) can provide minimum protection depending on the type of chemical.
- Follow boil water and do not drink water advisories.
- If sheltering in place, close all windows and chimney vents tightly, turn off air-conditioning, and wait for an all-clear from community authorities. For more information, see [Additional Guidance from the CDC](#).
- If you are not in your home, follow workplace or facility management and local government instructions for this type of event.

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<sup>1</sup><https://www.energy.gov/sites/prod/files/2019/11/f68/Products%20Made%20From%20Oil%20and%20Natural%20Gas%20Infographic.pdf>

<sup>2</sup> <https://maps.fractracker.org/latest/?appid=756ed11ed30945c79bf0d741404d5144>

<sup>3</sup> <https://earthworks.org/wp-content/uploads/2021/10/Ohio-River-Basin-Petrochemical-Toxics-sm.pdf>

- If you are in your car, keep your radio on and follow directions from local authorities and turn off all outside ventilation.
- Prioritize safety over belongings. Leave non-essential items behind if instructed to evacuate quickly.
- Have a [go bag](#) of essential items for your family and pet<sup>4</sup>
- Continually monitor local news and weather, and the social media accounts of your local government. This is the best way to stay informed about the disaster. As the crisis stabilizes, you may learn of community outreach efforts to replenish emergency supplies, such as water and food.
- When the crisis has passed, local authorities will issue an all clear announcement, and provide any additional information or instructions for staying safe. Keep in mind that elected officials and corporations alike are quick to declare an area “safe” without considering the diverse needs of its community members - including those who are disabled.
- When flooding occurs, chemicals can be picked up by water and can cause potential exposure to skin. They can also become airborne and cause chemicals to be breathed in.

## Additional Resources for Preparedness and Planning:

[All Hazards Disaster Tips from the Partnership for Inclusive Disaster Strategies](#)

## Understanding and Advocating For Your Rights After a Petrochemical Disaster

When a petrochemical disaster occurs, such as a chemical spill or explosion, the rights of those affected become a critical issue, particularly for people with disabilities. Disasters of this nature can have severe short- and long-term health impacts, and individuals with disabilities often face additional barriers to accessing information, services, and relief efforts. Understanding your rights and how to advocate for them is essential in ensuring that your needs are met during and after a disaster.

### Your Rights After a Disaster

1. **Right to Accessible Information and Communication**
  - **Legal Framework:** Under the Americans with Disabilities Act (ADA), individuals with disabilities have the right to receive information in formats that are accessible to them. This includes emergency alerts, evacuation orders, and other critical communications that must be provided in formats such as large print, Braille, or through sign language interpreters, as necessary.
  - **Advocacy:** If you find that emergency information is not accessible, you have the right to request that local governments and emergency management agencies

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<sup>4</sup> [https://www.ready.gov/sites/default/files/2024-05/ready\\_supply-kit-checklist.pdf](https://www.ready.gov/sites/default/files/2024-05/ready_supply-kit-checklist.pdf)



provide information in a format that you can use. This can include real-time captioning, TTY (text telephone) for deaf individuals, or accessible websites.

## 2. Right to Equal Access to Emergency Services

- **Legal Framework:** The ADA and Section 504 of the Rehabilitation Act mandate that emergency shelters, medical services, and disaster recovery programs must be accessible to people with disabilities. This means shelters should accommodate mobility devices, service animals, and offer accessible transportation to those who need it.
- **Advocacy:** In the event that shelters or services are not accessible, individuals have the right to file [complaints with the Department of Justice](#) (DOJ) or their state's civil rights agency. It's important to document any barriers you face, as this documentation can be used in legal or administrative proceedings to secure accommodations.

## 3. Right to Health and Environmental Safety

- **Legal Framework:** The Clean Air Act and Safe Drinking Water Act, among other environmental laws, protect individuals from exposure to harmful substances. People with disabilities who are disproportionately affected by petrochemical disasters have the right to safe air and water.
- **Advocacy:** If you suspect that environmental safety regulations are not being enforced, you can file a complaint with the Environmental Protection Agency (EPA) or your state's environmental agency. Community-based environmental justice organizations can also offer support in documenting environmental hazards and advocating for stricter enforcement of regulations.

## Advocating for Your Rights After a Disaster

1. **Document Your Experience:** Keep detailed records of your experiences during and after the disaster. This includes noting inaccessible facilities, lack of accommodations, and any health effects you experience. This documentation is crucial when advocating for your rights, whether through legal action or public campaigns.
2. **Engage with Disability and Environmental Advocacy Organizations:** Disability rights groups can provide resources, support, and a platform for advocating for your rights. These organizations often have experience in dealing with similar situations and can help you navigate the complex process of securing your rights after a disaster.
3. **Know Your Legal Resources:** [Legal aid](#) organizations can provide assistance in filing complaints or lawsuits if your rights are violated. [The National Disability Rights Network \(NDRN\)](#) and local legal aid offices are valuable resources for individuals who need legal support in the aftermath of a disaster.
4. **Use Media and Public Campaigns:** Raising awareness about the specific challenges faced by people with disabilities during petrochemical disasters can be a powerful tool for advocacy. Consider working with local media or launching a social media campaign to highlight the need for inclusive disaster planning and response.

5. **Engage in Policy Advocacy:** Long-term change requires policy advocacy. Engage with lawmakers to push for stronger protections and inclusive disaster planning. This might involve testifying at public hearings, meeting with elected officials, or participating in campaigns to pass new legislation.

Petrochemical disasters pose significant risks, especially for individuals with disabilities. However, by understanding your rights and actively advocating for them, you can help ensure that your needs are met during and after a disaster. Inclusive disaster planning and accessible communication are not just ideal; they are essential lifelines that must be upheld to protect the most vulnerable members of our communities. Through documentation, legal action, and advocacy, individuals with disabilities can push for the necessary changes that ensure their safety and well-being in the face of environmental disasters.

## Guidance for Local Government

The cycle of disaster services includes preparedness, response, recovery, and mitigation. Local government and response partners, like the American Red Cross, must ensure throughout this cycle that they are meeting their obligations under the Americans with Disabilities Act (ADA), Section 504 of the Rehabilitation Act, and other laws protecting the civil rights and civil liberties of disabled people.

Local governments should always be transparent and open with their communities, and establish multiple feedback loops for community engagement. This is especially important with regard to the operations of local businesses and industries, especially those which may pose environmental and health risks to their communities.

There are many types of businesses which have impacts on the environment and public health. Most are required to comply with multiple regulations at the Federal, state and local level. Information on risks, hazards and hazardous materials should be shared with the public to every extent allowed by law, both by all levels of government and the business entities themselves.

### Preparing with the Community

Local emergency management agencies (EMA) should hold community preparedness real-time and tabletop exercises specific to petrochemical disasters. People with disabilities should be engaged in the planning and practice of these exercises, and any hotwashes<sup>5</sup> and after-action reviews, to ensure accurate, meaningful feedback on physical, programmatic, and communication access.

### Effective Communication

It is imperative that local governments be knowledgeable and open in all communication with their communities. Transparency is especially crucial when sharing information about possible risks and impacts from chemicals, chemical concentration, air- and water-borne contaminants, and what individuals can do to keep themselves safe and informed. Local governments should also recognize that individuals with disabilities or existing health issues are at greater risk of injury and harm, therefore communications should include early warnings and/or guidance for these specific groups.

Crisis communication plans should be developed early in the planning stages or as soon as possible, with input from a wide range of individuals and community-based organizations representing cross-disability, diverse races, ethnicities, and cultures, and socioeconomic

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<sup>5</sup> A **hotwash** is the immediate "after-action" discussions and evaluations of an agency's (or multiple agencies') performance following an exercise, training session, or major event, such as [Hurricane Katrina](#).<sup>[1]</sup>

backgrounds. This collaborative workgroup should also review and update communication plans on a regular basis.

People with disabilities and others with communication access needs must be able to receive and act upon information in the same way as anyone else. Every time information is disseminated to the community, it must use [plain language](#), be translated to multiple languages (based on community needs), and be made available in alternate formats, such as large-print, and icon-based communications. All digital documents must be compatible with screen readers.

All press conferences must include American Sign Language (ASL) interpreting, and captioning. When responding to a petrochemical disaster, press conferences should continue on a regular basis, to keep the community informed on the progress of the operation, and alerted to any additional risks.

Information sharing should happen in a variety of formats - online, phone calls, texting, and canvassing. It's important to knock on doors and consider that not everyone has access to phone and/or internet services.

If shelter-in-place orders are in effect, the community will expect to be given instructions on how to stay safe and limit exposure in their homes. Information sharing should continue until the crisis is resolved and the response has stabilized.

## **Ensuring Access to Mass Care Services**

Mass Care response activities may vary for petrochemical disasters, but are typically focused on residents sheltering in place to reduce exposure to toxic substances. As conditions stabilize, shelter-in-place orders are modified or canceled, and Mass Care responders may begin direct outreach to affected neighborhoods. This may include mobile and fixed distribution of emergency supplies, such as water and food, and should be done in collaboration with community-based organizations (CBO), including faith-based groups, cultural and social clubs, mutual aid societies, etc.

All points of distribution (POD) and other service delivery sites, whether outdoors or indoors, must be ADA compliant, with accessible parking, sidewalks and entrances, and clear, level paths of travel between stacks or sections of items, and/or work areas. PODs and other sites must be sufficiently staffed to allow for assisting individuals with lifting and loading items and prepared to allow for sitting if long lines are expected.

Community outreach must also include door-to-door distribution for people who can't go to PODs. Planners must provide multiple intake mechanisms for people to sign themselves up for door-to-door distribution, such as accessible online entry forms, and phone-based helplines.

All response and recovery programs should employ a "no wrong door" approach to their intake processes, so that disaster-affected households have access to all services for which they are eligible, no matter how they enter the system.

## **Inclusive Decontamination Guidance**

Disabled individuals, and any companion, service, and/or assistance animals, as well as any mobility equipment or assistive devices they may use, must be included in decontamination procedures. First responders must be ready to support disabled survivors without making assumptions about their quality of life or level of independence. Remember that they were living independently in the community at the time of the event, and support their right to return home when it is safe to do so.

Consider incorporating inclusive practices into planning, training, and exercising:

- Engage disability-led NGO partners to train first responders to understand disability rights, and their obligations under the Americans with Disabilities Act, the Rehabilitation Act, the Stafford Act, and the Post-Katrina Emergency Management Reform Act.
- Disability-led partners can also assist with developing inclusive drills and exercises, with disabled people rather than actors, to gain meaningful insight and feedback from real subject matter experts.
- Due to the risk involved, and the limitations of personal protective equipment (PPE) for sign language interpreters and language translators, use universal signage and image/tactile-based communication boards to support people who are deaf or hard-of-hearing, people with intellectual, developmental or cognitive disabilities, or people who communicate best in a language other than English.
- Use a tagging system to ensure that mobility equipment and assistive devices are properly labeled with their owner's name and contact information. Give the survivor a corresponding wristband with an item number(s), and make sure they match when items are returned.

## Guidance for Industry

Many petrochemical facilities are purposefully located close to coastal and inland waterways, which makes them susceptible to hurricane and flood risks—especially those near the Gulf Coast, the Atlantic and Pacific coasts, and the Mississippi River. Earthquake risk is also a concern in a large western portion of the United States, and in other regions with known faults.<sup>6</sup> Temperature inversions where cooler air in the upper atmosphere traps warmer air near the ground can cause considerable risk trapping air pollution near homes, schools and businesses in areas with hills, mountains and valleys such as the Appalachian region.<sup>7</sup>

Disasters can have a significant impact on the operation and safety of petrochemical plants. They can be especially devastating for facilities storing toxic chemicals and other hazardous materials. Accidental release of these substances can affect the environment and endanger the health and safety of area residents. Damage can be widespread and long lasting.<sup>8</sup>

Petrochemical plants have standard operating procedures for emergency preparedness. It is unclear, however, whether these effectively address the damage that might be caused by a hurricane, earthquake, flood, or fire. History shows us that this work must be done before disasters happen, rather than in response to them.<sup>9</sup> In disaster situations petrochemical facilities will often release excessive amounts of toxic pollution during rapid shutdown and start up procedures.<sup>10</sup>

This guidance is intended to provide basic strategies for petrochemical businesses (hereafter referred to as “the company”) to include people with disabilities in:

- regular and disaster-related communications
- disaster planning and preparedness, response, and recovery
- protecting their health and safety as area residents and employees of the company before, during, and after disasters

The company should always be transparent and open with their communities and workers, and establish multiple methods of engagement and feedback. This is especially important when disasters occur, and most crucial when toxic substances may put surrounding residents and the environment in danger. Information on specific risks and hazards should be shared with the public and company staff, to every extent allowed by law.

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<sup>6</sup> [How the Petrochemical Industry Can Enhance Extreme Weather Resilience](#)

<sup>7</sup> [What is an Inversion](#)

<sup>8</sup> [Natural Disaster Planning in the Petrochemical and Energy Sector](#)

<sup>9</sup> [Natural Disaster Planning in the Petrochemical and Energy Sector](#)

<sup>10</sup> [A billion-pound problem: How unchecked “excess emissions” ballooned in Texas](#)

## Effective Communication

People with disabilities and others with communication access needs must be able to receive and act upon information in the same way as anyone else. Every time printed or online information is disseminated to the community, it should use [plain language](#), and be available in:

- alternate printed and digital formats, including large-print, and icon-based communications
- digital formats that are compatible with screen readers, for people who are blind or have low-vision
- multiple language translations (based on community needs)

All press conferences should include American Sign Language (ASL) interpreting and captioning.

## Inclusive Disaster Planning

The company should have designated safety officers (SO) who are tasked with disaster planning. Ideally, the SO should convene a Disaster Planning Work Group (DPWG) which reflects a diverse cross-section of employees and community members, including people with disabilities.

Company representatives from a number of functions should participate in the DPWG, including:

- Communications Management
- Plant Management
- Risk Management

It is recommended that local government and community-based organizations (CBO) also participate, including:

- ADA Coordinators, who are responsible for ensuring compliance with the Americans with Disabilities Act, and other laws protecting the civil rights and of disabled people
- Centers for Independent Living, for primary subject matter expertise on the needs of disabled people
- Emergency managers, including Access and Functional Needs (AFN) Coordinators
- First responders, such as law enforcement, fire and rescue
- Public Information Officers (PIO)
- American Red Cross disaster operations and response leadership, including Mass Care and Client Care
- Local non profits who provide direct relief

Tasks of the DPWG should include, at minimum:

- Contributing to the company's crisis communication plans, to ensure effective communication access
- Developing and practicing inclusive facility evacuation plans. Engage with disabled employees to understand their needs in a disaster, which may include:
  - language access, such as ASL interpretation
  - assistive equipment for evacuation, such as an [evac chair](#) to quickly evacuate employees who use wheelchairs whose work areas are above the ground floor
- Yearly training for multiple employees to use assistive equipment and practicing as part of the overall facility evacuation plan

Petrochemical disasters present unique challenges, particularly for people with disabilities. By proactively integrating inclusive disaster planning and accessible communication into every aspect of preparedness, response, and recovery, companies and organizations can ensure the safety and well-being of all community members and employees. Prioritizing transparency and accessibility is not only a legal responsibility but a moral imperative that builds trust and strengthens resilience in the face of environmental disasters.



## Chemicals of Concern

Here's a list of some petrochemicals that are known for their toxicity, flammability, or other hazardous properties. Please note that this is not an exhaustive list.

**Acetone:** Highly flammable and can cause irritation. Found in nail polish remover and some cleaning products.

**Acrylonitrile:** Used in the production of plastics. It is a potential carcinogen and can cause respiratory issues.

**Ammonia:** A colorless gas used in fertilizers and industrial processes. Can cause respiratory distress, skin irritation, and is toxic to aquatic life.

**Arsenic:** Released during refining. Carcinogenic and can cause skin, lung, and bladder cancer.

**Asbestos:** Used in insulation. Causes lung cancer, asbestosis, and mesothelioma.

**Benzene:** Highly toxic and a known carcinogen. Found in many petroleum-based products, including gasoline.

**Butadiene:** Used in the production of synthetic rubber. It is a known carcinogen.

**Carbon Monoxide (CO):** Produced by incomplete fuel combustion. CO poisoning is life-threatening due to oxygen deprivation.

**Chloroform:** Once widely used but now known to be carcinogenic. Found in some cleaning products.

**Chlorine:** Used in petrochemical manufacturing, particularly plastics. Highly toxic when inhaled.

**Dioxins:** A group of toxic byproducts from industrial processes. Can cause cancer, reproductive, and developmental issues.

**Ethylene:** A colorless gas used for welding and cutting metals. It's a neurotoxin and can affect the respiratory system, causing suffocation.

**Ethylene Glycol:** Found in antifreeze and coolants. Highly toxic if ingested.

**Ethylene Oxide (EtO):** Used in plastics manufacturing and industrial sterilization. Both flammable and highly reactive. Known to cause cancer.

**Formaldehyde:** Used in the production of plastics and resins. It is a strong irritant and potential carcinogen.

**Hexane:** A solvent used in petrochemical processes. Prolonged exposure causes nerve damage.

**Hydrochloric Acid:** Used in various industrial processes. It is corrosive and can cause severe burns.

**Hydrogen Sulfide:** Extremely toxic and flammable. Found in natural gas and petroleum refining.

**Lead:** Though less used now, lead can still contaminate older facilities. Affects nearly all organs, especially the nervous system.

**Mercury:** Released in refining processes. Highly toxic, particularly harmful to the nervous system and developing fetuses.

**Methanol:** Highly flammable and toxic. Found in some solvents, antifreeze, and windshield washer fluid.

**Methyl Ethyl Ketone (MEK):** Highly flammable and can cause respiratory irritation. Found in some adhesives and paints.

**Monoethanolamine (MEA):** Used in carbon capture technology and can cause respiratory and blood pressure issues upon exposure.

**Nitrogen Oxides (NOx):** Produced from fuel combustion. Contributes to air pollution, acid rain, and respiratory problems.

**Ozone (O<sub>3</sub>):** A secondary pollutant that forms from NOx and VOCs under sunlight. Causes respiratory issues and contributes to smog.

**PAHs (Polycyclic Aromatic Hydrocarbons):** Formed from the incomplete burning of organic substances. Some are carcinogenic and can cause respiratory and cardiovascular issues.

**PFA/PFOA:** Used in water repellents and firefighting foams. Known for toxic effects, including liver, brain, and immune dysfunction.

**Phthalates:** Chemicals used to make plastics flexible. Can disrupt the reproductive system, particularly in children.

**Propylene:** A colorless gas with a faint petroleum odor, highly flammable. Can cause frostbite upon contact and asphyxiation by air displacement.

**Styrene:** Found in plastics and synthetic rubber. Prolonged exposure can affect the nervous system.

**Sulfur Dioxide (SO<sub>2</sub>):** A toxic gas from burning fossil fuels. Causes respiratory problems and aggravates asthma.

**Toluene:** Can cause respiratory and neurological issues. Found in paints, thinners, and adhesives.

**Vinyl Chloride:** Used in the production of PVC. It is a known human carcinogen.

**Xylene:** Similar to toluene, it can cause health issues with prolonged exposure. Found in paints, varnishes, and adhesives.