PREVENTING "DOUBLE DISASTERS"

How the U.S. Environmental Protection Agency can protect the public from hazardous chemical releases worsened by natural disasters

JULY 2021

A joint policy brief of the
Center for Progressive Reform, Earthjustice,
and the Union of Concerned Scientists

Center for Progressive Reform | CPR | EARTHJUSTICE | Union of Concerned Scientists

David Flores: Senior Policy Analyst, Center for Progressive Reform; Casey Kalman: Researcher, Union of Concerned Scientists; Michelle Mabson: Staff Scientist, Earthjustice; and Darya Minovi: Policy Analyst, Center for Progressive Reform, authored this policy brief.

The authors benefited from the insights and contributions of a number of practitioners and scholars,* including:

Rebecca Bratspies, CUNY School of Law and CPR Member Scholar
Allison Cain, Union of Concerned Scientists
Thomas Duffy, United Steelworkers
Gretchen Goldman, Union of Concerned Scientists
Stephanie Herron, Environmental Justice Health Alliance for Chemical Policy Reform
Rick Hind, Material Research
Adrienne Hollis, Union of Concerned Scientists
Jesse Marquez, Coalition For A Safe Environment
Paul Orum
Juan Parras, Texas Environmental Justice Advocacy Services
Steve Sallman, United Steelworkers
Sid Shapiro, Wake Forest University School of Law and CPR Member Scholar
John Paul Smith, United Steelworkers
Steve Taylor, Coming Clean
Jane Williams, California Communities Against Toxics
Robyn Winz, Earthjustice

*Organizational affiliations provided for identification purposes only

Center for Progressive Reform
www.progressivereform.org | @CPRBlog

Earthjustice
www.earthjustice.org | @Earthjustice

Union of Concerned Scientists
www.ucsusa.org | @ucsusa

Cover image source:
California Woolsey Fire, Erin Donalson, Canva Pro

INTRODUCTION

It's past time to address "double disasters" — hazardous chemical releases by industrial facilities that are worsened by inadequate action in the face of conditions of climate change and natural disasters. As the global climate crisis intensifies, coastal and inland communities are increasingly at risk of natural disasters. When industrial facilities in these communities fail to adequately prepare for extreme storms, wildfires, earthquakes, heat waves, floods, rising sea levels, and other natural disasters, hazardous chemicals stored onsite can ignite, explode, and there may be dangerous and even catastrophic releases that threaten the health and safety of workers and the public. This can lead to a cascading series of harms, including toxic chemical exposures, on top of the effects of the storm itself.

Officials of the U.S. Chemical Safety and Hazard Investigation Board (CSB), an independent federal agency, and other safety experts have highlighted the need for stronger action in response to these natural hazard-related technological (also known as "natech") disasters.[1] Members of the public are also calling for reform. Workers have cried out for action after being "locked in" at inadequately prepared chemical facilities during hurricanes.[2] Fenceline communities — people who live near major industrial sites — have also demanded government action to end the "second storm" of pollution.[3] This brief spotlights this urgent issue, proposes policy solutions, and calls on federal leaders to take bold and prompt action to solve this problem.

The U.S. Environmental Protection Agency (EPA) administers the Clean Air Act's Accidental Release Prevention program, which regulates industrial facilities that use, store, and/or manage highly hazardous chemicals like hydrogen fluoride and chlorine.[4] This program, commonly known as EPA's Risk Management Program (RMP), is responsible for preventing hazardous chemical incidents and protecting workers and communities from death, injury, toxic exposure, property damage, and other harms.[5] Sadly, it has a notorious history of failing to prevent serious chemical disasters; EPA has studied thousands of such incidents during the last decade, and more than 100 harmful incidents occur every year in the United States.[6]

The RMP regulates about 12,331 chemical facilities in the United States, such as chemical manufacturers, oil refineries, water treatment plants, industrial agricultural facilities, and pulp and paper mills. About a third of these facilities are exposed to risks of wildfire, storm surge, flooding, and sea level rise, which are increasing dramatically as the climate changes. That means almost 4,000 facilities — many of which are near residential communities — face a greater threat of a natural disaster. Yet EPA's regulatory program neither addresses climate change nor requires these facilities to take any specific actions to protect people from the

Natural hazard-induced technological "natech" disasters —

Disasters that arise from the coincident effects of a natural hazard, like a storm or earthquake, and the failure or disruption of technological infrastructure, such as chemical plant spills, releases, and explosions.

cascading effects of natural disaster-related chemical releases or the cumulative and compounding hazardous exposures that can result.

The Trump-Pence administration issued a rollback of the Obama EPA amendments known as the Chemical Disaster Rule, which would have addressed some critical gaps in the RMP.[7] Fortunately, the Biden-Harris administration is gathering information to review this program, although it is unclear what new action it might take.[8] The administration must issue a new rule that strengthens RMP regulations by adding protections from natech disasters, and it must do so with close involvement of affected workers, their representatives, and community members. The evidence for doing so is clear.

New rules must not only restore Obama-era regulations but also strengthen them. The 2017 Chemical Disaster Rule included important provisions that would prevent and reduce harm from climate-related disasters, but it did not go far enough.[9] Research shows that more extreme weather, floods, wildfires, and other climate impacts threaten communities near chemical facilities, and the people affected are disproportionately low-income and communities of color.[10] The Biden-Harris administration must require chemical companies to take specific actions to protect fenceline communities from these rising threats. Critical reforms are necessary to safeguard against chemical disasters, which are worsened by facilities' inadequate preparation for climate change and natural disasters. It is a matter of health, safety, equity, and justice.

This brief highlights the serious problems posed by natech disasters and proposes vital policy reforms EPA must implement now to bring relief to workers and communities in areas most vulnerable to natural and chemical disasters. Based on our findings, we urge EPA to require:

- Assessment of natech risks and implementation of prevention and mitigation measures, like backup power and safer equipment and systems.
- Advance community notification and natech emergency response planning.
- Involvement of workers and their representatives in natech preparedness and response practices.
- Monitoring and collection of toxic air emissions data in real time.
- Expanded RMP coverage to more facilities in areas prone to natural disasters.
- Prompt implementation and compliance design "built in" to new rules.

EPA should also take and support action to invest in community protection, enforcement, and infrastructure that are responsive to climate, equity, and justice.

ANALYSIS

Worsening impacts of climate change increase the risk and harm from fires, explosions, leaks and "fugitive" emissions, and catastrophic disasters at RMP-regulated facilities.[11] The impacts on workers' and communities' health and safety are grave and unjust, and strong government action is urgently needed to regulate facilities.

In a single 10-year period, more than half a million people were injured, killed, or forced to shelter in place or evacuate after a chemical release at an RMP facility.[12] Workers in industrial chemical facilities are hurt "first and worst" when an industrial incident occurs.[13] Nearly 200 million people live in "worst-case scenario zones" for chemical disasters. And although many communities have faced more than one chemical incident, EPA has not assessed the immediate or cumulative effect of hazardous exposures on first responders, workers, or community members.[14]

This is a serious environmental justice problem. Black, Latino, and low-income people are more likely to live in communities closest to RMP facilities. People of color comprise about a third (36%) of the national population but nearly half (47%) of those who live within one mile of RMP facilities.[15] Low-income and linguistically isolated people are also over-represented in these areas.[16] Furthermore, chemical facilities near communities of color are almost twice as likely to experience disasters as those in predominantly white neighborhoods.[17] Earlier studies have found that RMP facilities in areas prone to extreme weather and flooding are in communities that are also among the most socially vulnerable to disasters, nationally.[18]

Ongoing exposure to fugitive air emissions (e.g., uncontrolled emissions of vapors or gases, which may be due to evaporation or faulty equipment, leaks, or spills) contributes to higher rates of cancer and death in these communities, and chemical disasters compound these effects.[19] Yet EPA's RMP ignores the cumulative impacts of these disasters, compounded for people who live near multiple RMP facilities.[20] The rules must protect all people who live, work, and spend time in potential impact zones near RMP facilities, including homes, schools, hospitals, places of worship, and detention facilities, among others. All community members in these areas face harm from chemical releases, and affected areas may be subject to shelter-in-place or evacuation orders if RMP facilities fail to prevent toxic releases due to natural disasters.

Evidence and concern about disaster-related chemical releases have grown in the wake of Hurricane Katrina, a Category 3 storm that struck the Gulf Coast in 2005; Hurricane Harvey, a Category 4 storm that dumped nearly 50 inches of rain in parts of Texas in 2017; and severe storms in Texas in the winter of 2021 that led to excessive flaring (the controlled burning of

natural gases) and substantial chemical releases.[21] Nearly half of reported air pollution emissions in Texas during Hurricane Harvey were due, in part, to releases linked to the storm, and nearly three quarters (72%) of toxic emissions (some 1.5 million pounds) came from RMP facilities.[22] Facilities attributed excess emissions both to shutdowns and startups initiated in response to the storm as well as to releases linked to flooding, high winds, and storm surge.[23]

Scene from the Arkema chemical disaster.
Source: U.S. Chemical Safety and Hazard Investigation Board

In one notable example, an Arkema Inc. chemical plant in Crosby, Texas, a town near Houston, flooded, lost electrical power, and organic peroxides stored onsite ignited.[24] The fires spewed toxic black smoke into the surrounding residential community. Twenty-one emergency responders sought medical attention due to exposure to the toxic air emissions, and 205 people within 1.5 miles of the facility were evacuated from their homes.[25] The facility, located on a floodplain, had seen extensive flooding in the past, as well as previous incidents of fire and fugitive emissions.[26] Nevertheless, the Arkema plant did not have adequate preparation for severe flooding, loss of power, inundation and failure of backup generators, the combustion of unstable chemicals stored onsite, and toxic air emissions.[27]

In Brief

Global climate change is contributing to a growing risk of natural disasters within the United States, according to the Fourth National Climate Assessment, a government report that assesses and analyzes global climate change and its effects. The intensity and frequency of heavy precipitation events in most parts of the United States have increased over the last century and are expected to increase over the coming decades. Similarly, the frequency of the most intense tropical storms and hurricanes is projected to increase. In Western states, large wildfires have become increasingly frequent over the last 40 years and are projected to become even more frequent. Sea levels have risen an average of one foot in the last 100 years, with levels in the Gulf of Mexico and the Atlantic Ocean exceeding average measures. This has contributed to more frequent nuisance flooding and will continue to contribute to longer and more extensive flooding.

The Arkema incident is not the first — nor will it be the last — double disaster if our government fails to require chemical facilities to take precautions to prevent such catastrophes.[28] To understand these risks to public health and safety, the Union of Concerned Scientists analyzed geographic data from the National Oceanic and Atmospheric Administration, the U.S. Geological Survey, and the U.S. Fish and Wildlife Service to identify U.S. facilities at risk of wildfires, inland flooding, storm surge, and coastal flooding due to sea level rise.[29]

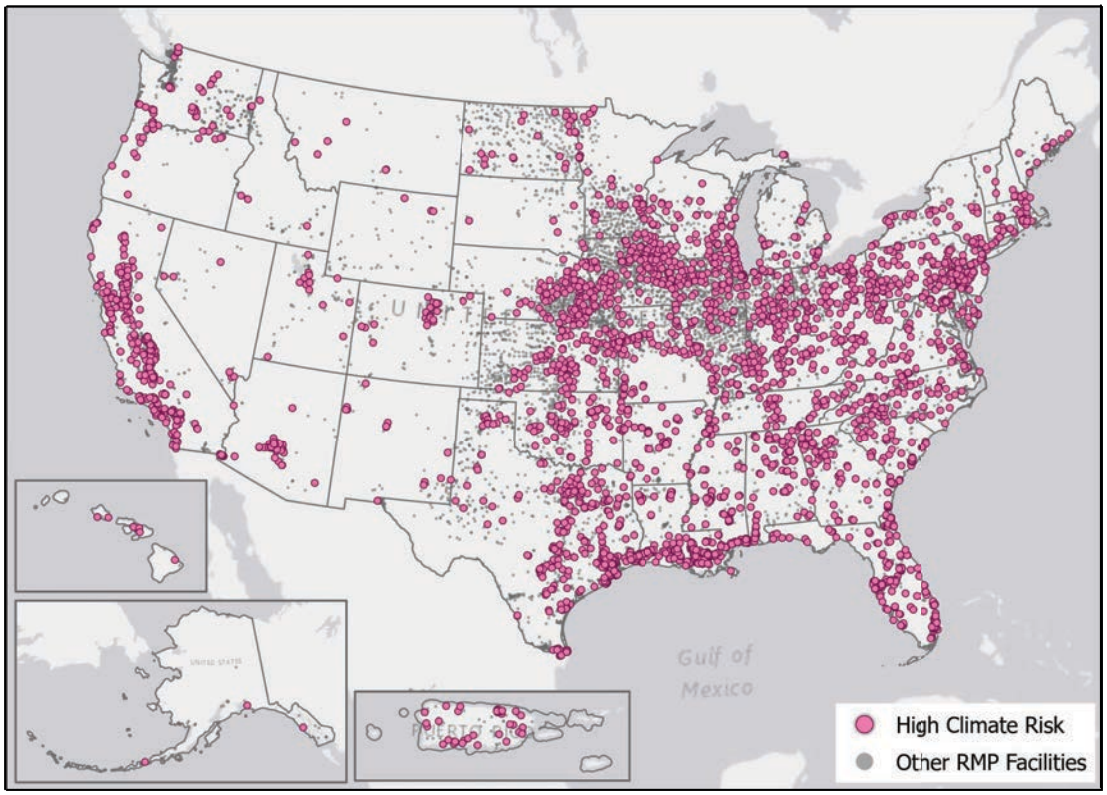
Our analysis found that of roughly 12,331 RMP facilities in U.S. states and territories, 3,856 (one third) face a growing risk of natural disasters due to climate change (Table 1, p. 7). This statistic likely underestimates the number of facilities in at-risk areas due to limitations of publicly available data. For example, our analysis shows twenty-eight percent of facilities are located in a 100- or 500-year flood zone. However, this finding is based on data from the Federal Emergency Management Agency's (FEMA) National Flood Hazard Layer database, which is limited by both quality (many designations are outdated) and geographic coverage (data are not available for all U.S. counties).[30]

CSB video simulation of the Arkema incident.
Source: U.S. Chemical Safety and Hazard Investigation Board

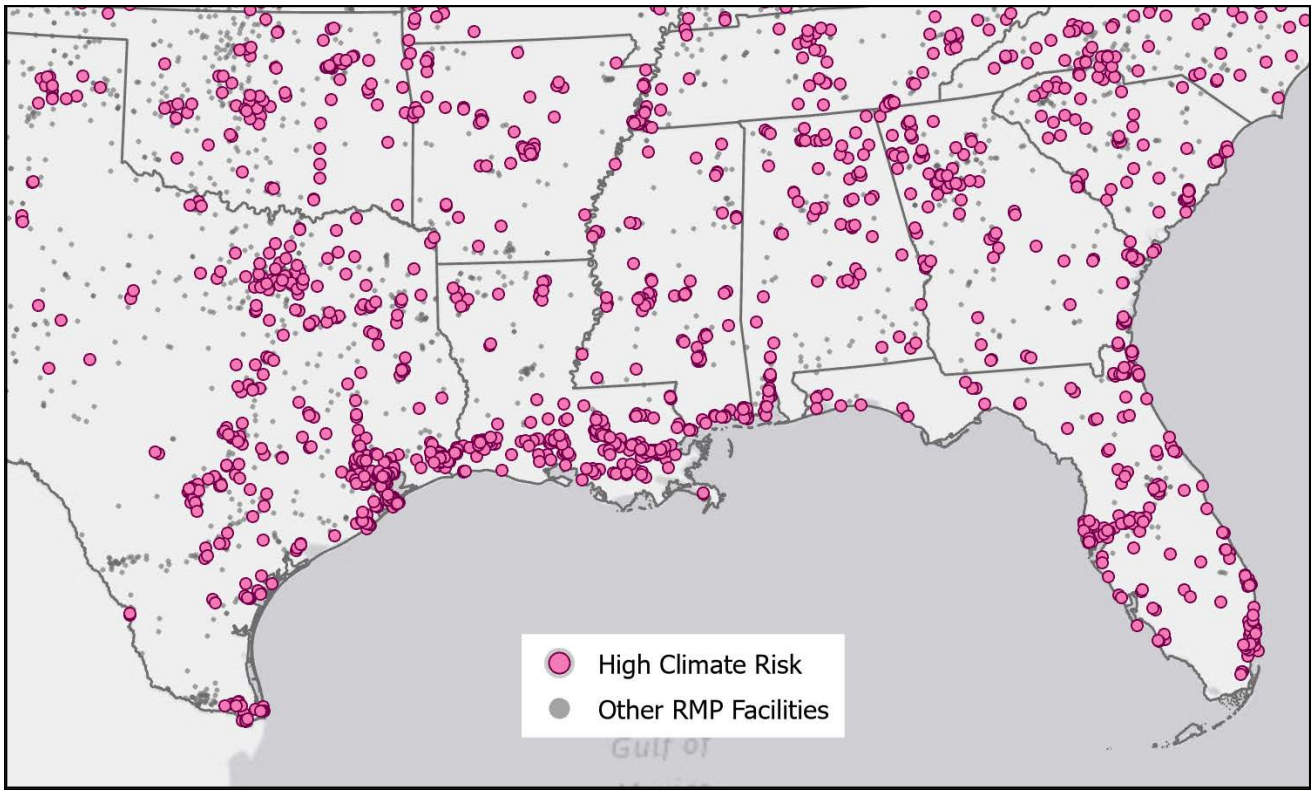
Inundated power generator at the Arkema facility following the chemical disaster.
Source: U.S. Chemical Safety and Hazard Investigation Board

Table 1. Number of RMP facilities at risk of climate-related natech events [31]

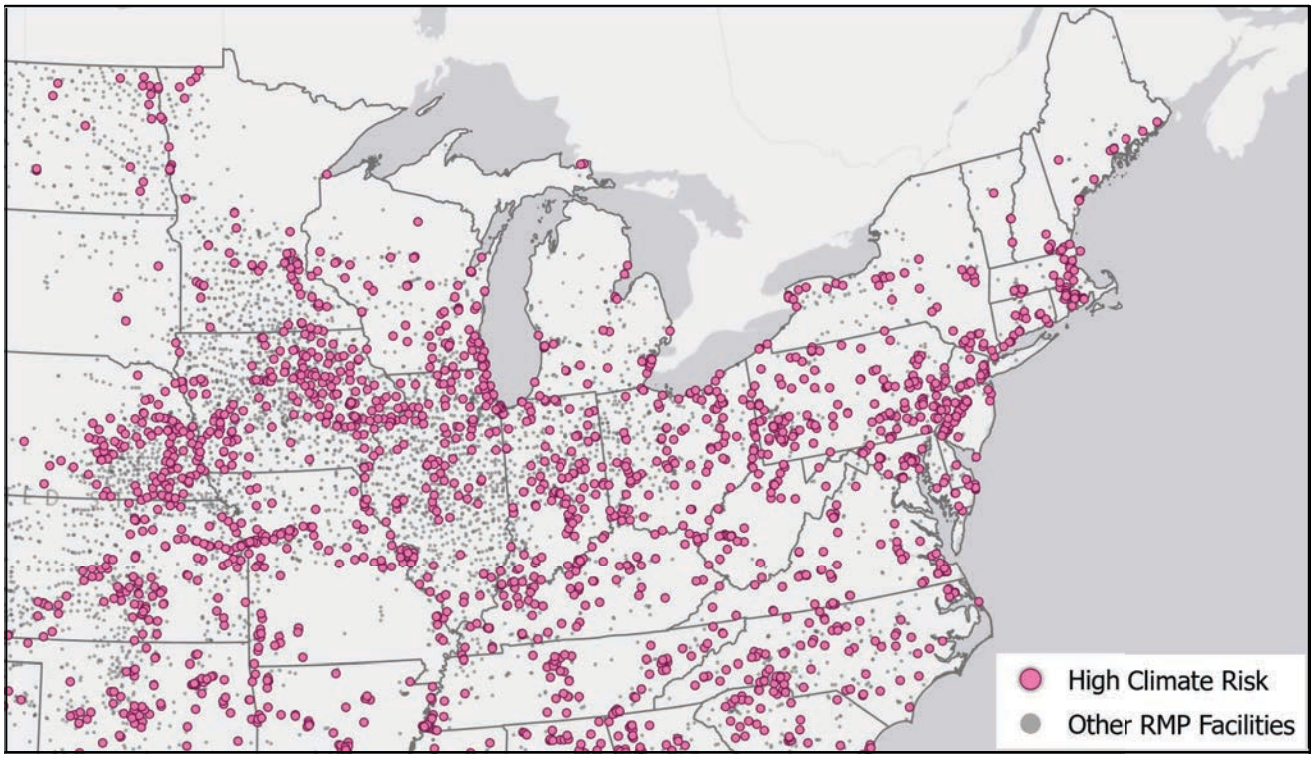
Climate risk	RMP facilities identified
Wildfire	88
Flooding	3,397
Hurricane storm surge	765
Coastal flooding	870
One or more climate risks, as above	3,856



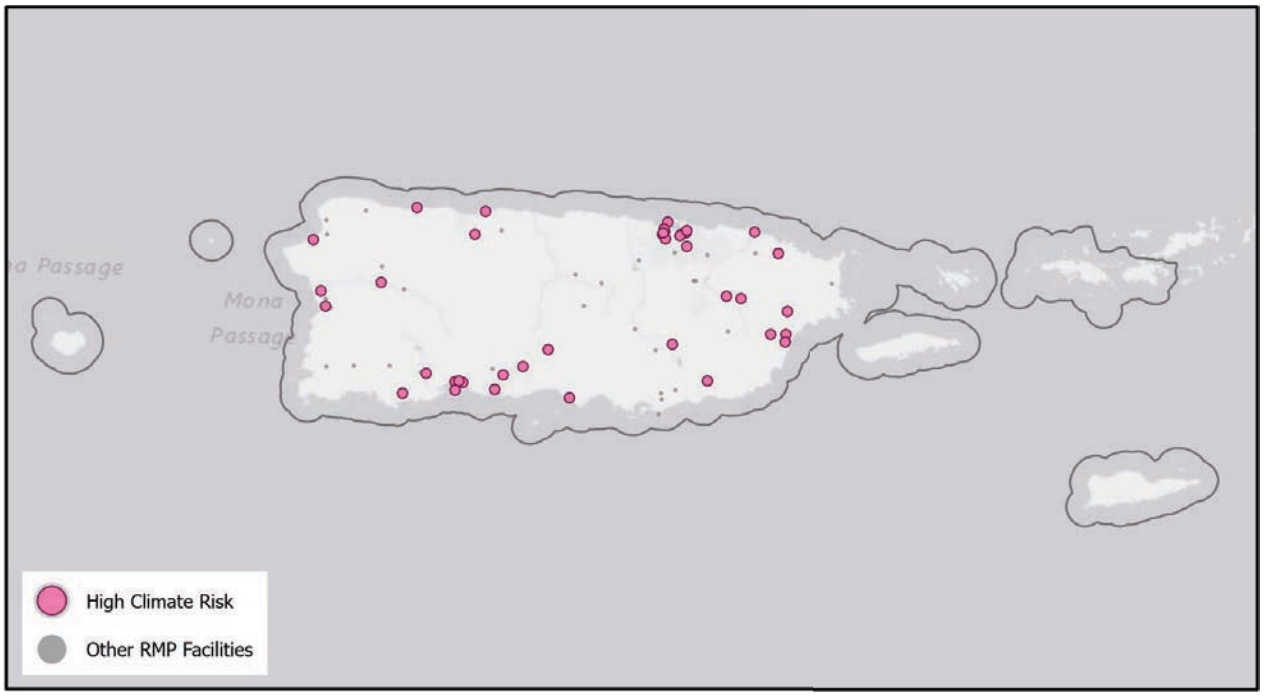
The Gulf Coast is among the nation's most vulnerable regions, with more than 2,500 facilities facing at least some elevated natural disaster risk. Of these, almost half are in areas designated at risk of wildfires, inland flooding, storm surge, and/or worsening coastal flooding. More than 300 facilities are located within five miles of the Gulf Coast, and, as of March 2021, 633 RMP incidents have been recorded within this zone.[32] This figure does not include the Arkema incident because the Texas plant is nearly 20 miles inland.



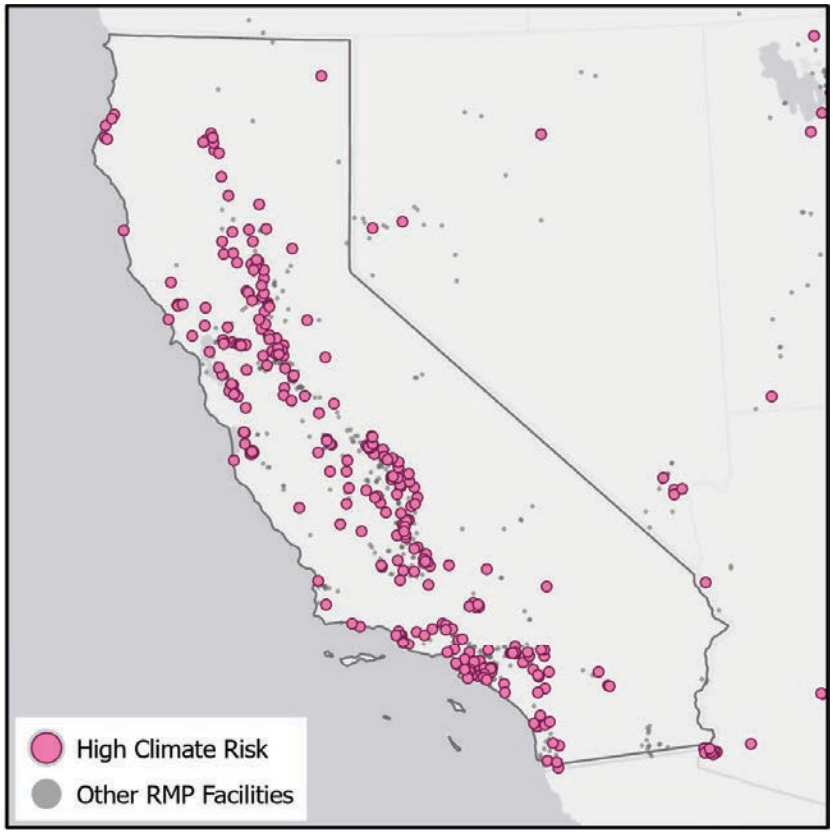
RMP facilities at risk of climate-related natech events on the Gulf Coast.



RMP facilities at risk of climate-related natech events in the Midwest and Northeast.



RMP facilities at risk of climate-related natech events in Puerto Rico.



RMP facilities at risk of climate-related natech events in California.

EFFORTS TO ASSESS AND ADDRESS NATECH THREATS

In the United States and abroad, governments have acknowledged the need to address climate-related or other natech chemical disasters. Some state and local governments have enacted laws and developed plans that begin to address natech disasters at RMP and other hazardous chemical facilities[33] or the more general climate impacts on facility siting and pollution permitting.[34] The United States has yet to take action at the federal level.

The European Union, by contrast, requires member states to address the risk of natech disasters.[35] Under legislation known as the Seveso III Directive, E.U. member states must require operators of relevant industrial installations to issue safety reports describing how natural causes might impact chemical accidents.[36] Germany has issued two Technical Rules for Installation Safety (TRAS) that support the implementation of the German Major Accidents Ordinance (MAO) and focus on reducing natech risks.[37] Under TRAS 310 rules, for example, operators of certain industrial installations must issue hazard source analyses that assess how precipitation and flooding impact major accidents involving hazardous substances.[38] They must also update safety reports based on "developments in what is known about environmental hazard sources and the influences upon them exerted by climate change."[39] The U.S. EPA should follow suit by leading our nation's effort to prevent double disasters and promulgating natech-specific rules under the RMP. Federal agency investigations of climate and natural disaster risks to hazardous chemical facilities provide a foundation for natech reforms to RMP rules. The Chemical Safety Board (CSB) report on the Arkema chemical disaster found that the facility's process hazard analysis and other safety systems and assessments did not adequately identify and account for flood and hurricane risks specific to the site.[40]

Aerial image from CSB of the Bio-Lab facility in Westlake, LA, in the aftermath of Hurricane Laura and the chemical fire and release. Source: U.S. Chemical Safety and Hazard Investigation Board

The CSB Arkema report also illustrates that a substantial number of RMP facilities have likely not adequately assessed and prepared for climate and natural disaster risks because federal regulations and guidance do not impose sufficient requirements to assure this.[41] It calls on the Center for Chemical Process Safety (CCPS), a professional engineering organization that sets voluntary industry standards, to create draft guidance. Since that time, both the CSB and CCPS have provided additional guidance and recommendations to identify and respond to these hazards, demonstrating the complexity of risks involved.[42] However, their findings highlight the lack of enforceable federal requirements for prevention, design, and response criteria and standards that are responsive to natural hazard risks.[43]

Similarly, the U.S. Government Accountability Office (GAO) has broadly recommended that EPA integrate information about climate and natural disaster threats into site risk assessments and risk response decision-making for facilities on its Superfund National Priorities List, which identifies top sites that have released or threatened to release hazardous substances, pollutants, or contaminants. Some 60% of these sites are exposed to flooding, storm surge, wildfire, and sea level rise, according to GAO.[44] Federal regulations for hazardous waste treatment, storage, and disposal facilities prohibit siting or impose other restrictions on facilities located within certain earthquake-and flood-prone areas.[45] More recently, EPA has adopted provisions in some Clean Water Act permitting that, for the first time, explicitly require consideration of extreme weather threats in the selection and design of pollution control measures.[46] But so far, EPA has failed to issue any similar regulations under the Clean Air Act RMP or take other steps to prevent chemical releases triggered by natural disasters.

RECOMMENDATIONS FOR REFORM

Climate- and natural disaster-responsive reforms to RMP must be prioritized to guard against natech chemical disasters. EPA should implement lessons and guidance from the CSB, for similar reasons as the GAO has advised for contaminated sites designated by EPA's Superfund program.[47] Reforms should address the entire program, from coverage expansion to prevention planning, practices, response, and enforcement. Chemical disaster planning and response requirements should be strengthened with rigorous operational procedures, such as backup power, publicly accessible real-time fenceline monitoring and data collection, and community notification systems to prevent and minimize risks and harms to workers and fenceline communities. Specifically, the EPA should:

1 Require facilities to assess natech risks and adopt chemical release prevention practices that can withstand the risk of climate- and natural disaster-related hazards.

Currently, RMP facilities are not required to assess or implement practices necessary to prevent or mitigate climate- and natural disaster-related hazards that increase the risk of harm from chemical disasters. A number of national and international publications document the need to quantify and assess risks associated with these events.[48] The Agency should reform RMP rules to specifically require process hazard analysis for these events and natech-focused hazard reductions, as well as third-party audits to identify specific practices, such as backup power generation, leak detection and repair, and inspection, maintenance, and repair of aging pipes, tank components, and other equipment.[49] The Agency should also require facilities to evaluate and use safer processes and chemicals (like alternatives to hydrofluoric acid),[50] new tank designs, and other systems tailored to particular facilities and hazards. EPA should also require facilities to undertake site-specific analyses and implement inherently safer technology and systems requirements wherever feasible (that are at least as strong as requirements for refineries in California);[51] conduct third-party audits that explicitly assess climate risks; and take measures to prevent chemical releases and harm worsened by climate and other natech risks.[52]

Compliance with the prescribed practices should be implemented through both the rules and incorporation of the RMP into the permitting process through Title V of the Clean Air Act and evaluation of other ways to ensure consideration and mitigation of disaster prevention in the air permitting process.[53] Strengthening RMP rules to support and provide for effective

participation by workers and their representatives is an essential way of ensuring implementation to protect public health and safety.

The EPA should also expressly require facilities to consider climate and natural disaster factors in review, planning, reporting, prevention, and response provisions that include: (a) release scenario and offsite consequence analyses, (b) accident history and incident investigations, (c) hazard review and process hazard analysis, and (d) emergency response coordination, programs, and exercises.[54] For example, EPA should consider requiring offsite consequence analysis parameters to incorporate climate and natural disaster factors.[55] Consultation and knowledge-sharing with workers, their representatives, and fenceline communities is critically important throughout both development of these reforms and their subsequent implementation by RMP facilities. Indeed, worker and community expertise, engagement, and access to information are paramount and essential to the practical effectiveness and success of resulting regulations and plans.

The agency should also adopt mitigation standards using the hierarchy of controls and provisions requiring specified and orderly emergency procedures for safer shutdown and restart of operations in anticipation of forecasted natural disasters to reduce releases and hazards during these procedures.[56]

And EPA should prohibit host and contractor employers from locking in workers, as has occurred at some facilities.[57] During Hurricane Harvey, for example, facilities that took measures to shut down operations before the storm appear to have released a smaller volume of chemicals than others.[58] After the hurricane, CSB issued a safety alert urging precautions during startup.[59] Illustrating the need for this action, releases at some facilities continued for days and even weeks afterward.[60]

During this year's extreme winter storms in Texas, EPA documented dozens of petrochemical facility shutdowns and concerns about air releases, to which millions of pounds of excess air pollution have been attributed.[61] Recently, EPA's enforcement division has also recognized the particular urgency of preventing chemical accidents through implementation of more rigorous procedural safeguards on restarting during nonroutine operations.[62] Restarting operations after extreme weather and other natural disasters should necessarily require enhanced maintenance and inspection procedures designed to detect and prevent malfunctions.[63]

In addition, decades of industrial process safety studies and successful local and state programs have proven that hazard mitigation using the hierarchy of controls is an essential step that protects workers, communities, and the environment from various types of incidents. From advance planning to repairing leaks, addressing aging facility infrastructure, and shifting to less hazardous chemicals, significant information is available in CSB reports on how facilities can shift to safer operations. EPA should also collect this information from facilities,[64] especially those at greater risk of climate-driven chemical disasters. To help prevent such disasters, EPA

should institute RMP reforms focused on hazard reduction, like the inherently safer technology requirements in California's petroleum refinery safety rules.[65]

2 Expand community-level emergency response planning and communications capacity to ensure plans work during natech incidents.

Communities near chemical facilities, as well as first responders, workers, and their representatives, must be given information about chemicals and hazards at facilities near their homes and workplaces and where an emergency response may be needed. EPA's failure to provide adequate and accessible information has already had severe public health consequences, especially in the context of natech incidents.[66] EPA must take steps now to prevent similar incidents in the future.

First responders and workers are key players in mitigating harm during a chemical release and need chemical hazard information to plan, prevent harm, and conduct emergency coordination exercises. CSB and the U.S. Fire Administration have outlined the need for strong emergency coordination and preparedness requirements,[67] and GAO has expressed concern for the safety of first responders who do not receive adequate chemical information.[68] RMP facilities must be required to report data to EPA that can be made accessible to workers, their representatives, and fenceline communities to reduce harm when preparing for and responding to a natech incident. This includes hazard reduction and elimination assessments and facility plan information.

Advance community notification systems that include RMP facility notification would help ensure people most in need of lifesaving information can get it before an incident occurs, especially communities at risk of double disasters. Reverse 911 text and call reporting systems, for example, should provide community members with phone numbers and website addresses that have critical information about nearby facilities and how to prepare for emergencies.

Language accessibility is a central concern, especially in communities where a significant population does not speak English as a first language.[69] Multilingual community alerts (including by text message) and assuring public information access for everyone in a potential impact zone should be required as part of emergency response communications.

Additionally, EPA should require RMP facilities to undertake — and facilitate the participation of first responders in — emergency response exercises (including field, tabletop, and community notification exercises) on clear, regular, and enforceable timetables. Facilities should also be required to make emergency response components of their RMP plans, including up-to-date information regarding all chemical hazards, publicly available and accessible online (such as through EPA's website). Such information should be easily understandable and accessible

(incorporating multilingual formats where appropriate) to communities near RMP facilities. Community members need more access to information about chemicals that are made, stored, and used at local facilities.

3 Formally engage workers and their representatives in facility preparedness and response planning.

RMP reforms should include increased involvement of workers and their representatives and participation with anti-retaliation protections in RMP plan development and training in incident prevention, response, and investigation, as has been successful under the California refinery rule framework.[70] Emergency exercises should also include information and procedures that are responsive to the particular risks of natural disasters and natech incidents for a given facility.

In consultation with the U.S. Occupational Safety and Health Administration, EPA should develop and require delivery of trainings and resources to workers at RMP facilities on climate and natural disaster risks and how they may impact hazardous chemical processes, onsite emergency responses, and worker health and safety.[71] Workers also need access to mechanisms to anonymously report safety hazards and near-miss incidents with anti-retaliation protections, requiring immediate response by RMP facilities to present and imminent threats, including those related to extreme weather and other natural disaster risks. A public record of these reports is also needed to ensure timely maintenance or other corrective action is taken to prevent incidents.

4 Require facilities to conduct real-time fenceline monitoring, share data with the public, and provide timely community alerts at hazardous facilities.

Hazardous chemical releases can be detected and reported in real time, and a few refineries and chemical plants have this type of fenceline monitoring system in place in compliance with consent decrees or local rules. But no federal regulations currently require facilities to collect and report real-time data on hazardous chemicals in nearby communities or act on this information to control harmful emissions.[72] EPA's own air monitoring network has, in fact, failed to detect major plant explosions and air emissions incidents.[73] Having real-time data and community text and cell phone alerts, with corrective action requirements following alarming reports, will help the facility, surrounding community, and the local, state, and federal governments detect and respond to chemical disasters.

EPA should require RMP facilities to install and maintain real-time or near real-time fenceline air monitors, including those that can collect data during or as soon as possible after natural

disasters. This process should be required quickly at the facilities with past incident records and the greatest hazards, such as those with multiple sources, like oil refinery or petrochemical plant complexes, and expanded to all facilities where this has potential to ensure early detection of a serious threat to public health. Sampling data and actions taken in response should be accessible to the public online in real time because community members have a right to know hazards to which they are exposed.[74] In the event of chemical release or safety threat, EPA should ensure there are prompt, multilingual community alerts using cell phone networks to first responders and affected communities.

5 Expand RMP coverage to more facilities at risk of natech incidents in areas prone to natural disasters.

The administration should redefine eligibility criteria to expand coverage to more facilities in at-risk areas. It is especially important to extend safety protections to more facilities and nearby communities to ensure that natech-focused protections are factored into the evaluation of permitting for facilities in areas particularly vulnerable to natural disasters and climate impacts. RMP eligibility criteria should be reformed and broadened, in part to ensure stronger public safeguards from chemical disasters in vulnerable areas.

For instance, facilities that are already subject to RMP requirements for one or more processes or chemicals should be covered for all processes across the facility to avoid cascading disasters like the incident at the Arkema chemical plant in Crosby, Texas, and the fatal plant explosions in West, Texas.[75] EPA should expand the universe of hazardous chemicals that trigger RMP requirements, including (and especially) flammable, explosive, and other reactive chemicals on EPA's "List of Lists," a consolidated roster of hazardous chemicals subject to reporting requirements of the Emergency Planning and Community Right To-Know Act, the Comprehensive Environmental Response, Compensation and Liability Act, and Section 112(r) of the Clean Air Act.[76] Doing so would mean that more, currently unregulated facilities in regions at risk of natural disasters must take additional precautions. The agency should also adopt additional RMP-coverage criteria that require additional protections at proposed facilities and covered processes that would be sited in areas vulnerable to climate and natural disaster risk.

6 Prioritize compliance-focused design and enforceability to address heightened risks due to natural disasters and climate change.

While adopting the regulatory reforms described above, the agency must build compliance mechanisms into new natech rules. These rules must be transparent and easily enforceable by federal and state enforcers, workers and their representatives, and the public.[77] And they must include prompt compliance deadlines as well as regulatory language that clearly defines facility and EPA obligations and requires compliance reporting to EPA in a publicly accessible form.

Deadlines for basic emergency response exercises in the current RMP are far in the future, and some regulations lack deadlines.[78] Communities and workers need strong natech protections with clear and expeditious deadlines in place — as hurricanes, wildfires, and other extreme weather continue to worsen.

This includes appropriate testing and assessment for worst-case failure scenarios of critical components and systems, testing and assessment of mitigation measures, inspections and reports, and replacement of components like corrosion-vulnerable pipes and equipment. These actions, which must take place before a dangerous incident occurs, are essential to improve the rules' enforceability. Revising regulations to ensure full RMP implementation as part of the Clean Air Act Title V permitting program will help improve compliance with the new rules by integrating the RMP into major source facilities' permits.[79]

7 Bolster regulatory action with broader investments in enforcement, climate, equity, and infrastructure spending and policymaking.

The Biden-Harris administration has made clear its intention to take a whole-of-government approach to climate change, social equity and justice, economic stimulus, and infrastructure.[80] Reforms to RMP rules and their enforcement should be paired with additional public sector investments to protect and support, in particular, fenceline communities and workers who are disproportionately harmed by disaster-related and chronic toxic exposures, evacuations, shelter-in-place incidents, injuries, and, in some instances, deaths. Communities need emergency protection equipment like air filters, personal protective equipment, and information on how they can protect themselves and seek help in the event of a chemical disaster. The administration should make technical assistance grants available to enable affected communities to engage in and improve RMP planning and implementation, much like EPA's technical assistance grants that support community participation in federal Superfund programming.[81]

The EPA should prioritize health and cumulative impact assessment and target regulatory enforcement for RMP facilities in areas vulnerable to natural disaster risks and near communities with environmental justice concerns. At the same time, it should prioritize funding and other resources for emergency response and recovery, transportation, housing, clean energy, and public health services in affected communities. Prioritization of inspections and RMP enforcement goes hand in hand with reform to ensure that communities experiencing the greatest harms receive the fastest relief. To the fullest extent of its authority, the agency should utilize enhanced administrative penalties, injunctive relief, and supplemental environmental projects that explicitly respond to failures and adequately account for and act to mitigate climate and natural disaster threats as new natech rules are implemented.

CONCLUSION

In its first six months, the Biden-Harris administration has made far-reaching commitments to address climate change, protect public health and worker safety, and advance environmental justice.[82] A major test will come as the agency decides what action to take on the RMP rule. Meanwhile, another hurricane season is starting in the Gulf of Mexico, and communities nationwide face more intense storms and the constant and rising threat of wildfires, earthquakes, floods, and extreme weather. For far too long, EPA has ignored this problem and failed to require industrial facilities to take needed precautions to prepare for these foreseeable threats. That approach is unjust and unacceptable, as the science and growing evidence of harm proves. Communities, workers, and their representatives are looking to our new federal leaders for action. As this problem worsens year after year, EPA must follow through on the administration's commitments by adding essential natech protections to its Risk Management Program — and finally bring these vital health and safety rules in line with what the circumstances and risks require.

These reforms are an urgent priority. They are needed to evaluate present and future risks from natural disasters and climate change and, more importantly, to ensure that RMP facilities take all possible precautions to mitigate risks and prevent harm to workers and fenceline communities. The need for reform is greater than ever, and the timing could not be more favorable. Voters overwhelmingly want this administration to take quick action to adopt and strengthen safeguards for climate, pollution, and worker safety — and to value the lives and health of people over corporate profits.[83] An all-of-government prioritization of racial and environmental justice, infrastructure, and climate resilience[84] lays a strong foundation for RMP reforms that contribute to a more just, equitable, and prosperous society, environment, and economy.

APPENDIX A:

Methodology for Geospatial Analysis

Methods

To identify the number of Risk Management Plan (RMP) facilities at risk of climate-related natech events, we overlaid the location of RMP facilities, drawn from the Homeland Infrastructure Foundation-Level (HIFLD) database (last updated April 1, 2018, downloaded July 2021 from https://hifld-geoplatform.opendata.arcgis.com), with geographic data representing the areas of the country at risk of climate-related disasters. For this analysis, we focused on wildfires, inland flooding, coastal flooding and storm surge.

For example, to identify the areas of the country at risk of wildfires, we used historical wildfire perimeters from the USGS Wildland Fire Decision Support System, as well as Burn Potential (BP) data from the USDA Forest Service. Due to the nature of the datasets, the historical wildfire perimeter data was used in its entirety without modification. The BP data was filtered to select for the areas of the U.S. with a particularly high burn potential. To do this, we selected only those areas with a burn potential greater than three standard deviations above the mean for the dataset. These two datasets — Burn Potential and historic wildfire perimeters — were then merged into a single layer to represent the areas of the country at risk of wildfires. The wildfire layer was then overlaid with RMP facility locations to identify those facilities located within — or within 200 meters of — areas at risk of wildfire. This additional 200-meter search radius was added to account for the fact that the RMP locations are stored as a single point (latitude/longitude) and not a polygon that would represent the full area of the RMP facility.

Similarly, we overlaid the RMP facilities with each of the data layers representing areas at risk of different climate-related natural disasters to identify facilities at risk of inland flooding, coastal flooding, and storm surge. Any modifications made to these datasets are noted in the table below. The list of 3,856 high climate risk facilities identified in this report is available by request to the Union of Concerned Scientists.

Limitations

While we believe we used the best available data for our analysis, it is important to address the limitations of the datasets currently available to the public. The National Flood Hazard Layer is not available for the entirety of the U.S. and is known to be outdated.[85] Because of these data

gaps, we can assume the number of RMP facilities located in 100- or 500-year flood zones is greater than stated here. We used probabilistic storm surge data for a Category 4 storm. Data for a Category 5 storm is not available for the entirety of the East and Gulf Coast; therefore, we can consider this an underestimate of the number of RMP sites at-risk of storm surge. Furthermore, the coastal flooding layer was developed by UCS using a modified bathtub model; more information on the limitations associated with this model can be found in the original report and appendix.[86]

Data Sources

Climate risk	Data Sources	Description
Wildfire	Wildland Fire Decision Support System, Historic Wildfire Perimeters (2012-2018)[87]	Perimeters of fires that occurred between 2012 and 2018
	Probabilistic Wildfire Risk from USDA Forest Service[88]	This data was generated using a geospatial Fire Simulation (FSim) developed by the USDA Forest Service Missoula Fire Sciences Laboratory (Finney et al. 2011). The model simulates the incidence and growth of wildfires under various hypothetical fire seasons in order to estimate Burn Potential (BP). When preparing this data for analysis, we selected for areas with a BP greater than or equal to three standard deviations above the mean. This was done to remove areas with a lesser burn potential and only include areas with a particularly high burn potential. For this reason, the numbers presented in the analysis are a conservative estimate of the number of RMP facilities at risk.
Flooding	FEMA National Flood Hazard Layer[89]	The National Flood Hazard Layer is a compilation of flood maps for the entire country. NFHL designations

		assign a letter to areas to help viewers understand their flood risk. For this analysis, we filtered for areas of the National Flood Hazard Layer labeled as A or V zones. These represent areas known as 500- or 100-year flood zones.
Storm Surge	NOAA Probabilistic Storm Surge Areas[90]	Probabilistic storm surge for a Category 4 storm for the East and Gulf Coast of the U.S. This data was generated by the National Oceanic and Atmospheric Administration using SLOSH storm surge modeling, which uses hypothetical storm scenarios to estimate the extent and severity of storm surge along the East and Gulf Coast of the U.S.
Coastal Flooding (2040)	UCS Modeled Coastal Flooding Layer (2040 High Scenario)[91]	Developed using a modified bathtub model for the year 2040 given estimated sea level rise under the high climate change scenario according to the 2017 National Climate Assessment. See UCS Report *A Toxic Relationship* for more information.[92]

APPENDIX B:

Relevant Research and Other Written Materials

Allyn West, Who's going to take responsibility for air pollution in Texas?, *The Texas Observer*, March 3, 2021, https://www.texasobserver.org/whos-going-to-take-responsibility-for-air-pollution-in-texas/.

Aman Azhar, During February's freeze in Texas, refineries and petrochemical plants released almost 4 million pounds of extra pollutants, *Inside Climate News*, March 15, 2021, https://insideclimatenews.org/news/15032021/texas-freeze-petrochemical-refineries-houston/.

Brett Wilkins, "No safe amount": Environmentalists sound alarm over Texas refineries' release of hundreds of thousands of pounds of pollutants during storm, *DeSmog*, February 23, 2021, https://www.desmogblog.com/2021/02/23/environmentalists-sound-alarm-over-texas-refineries-release-pollution.

Comment of Community In-Power & Development Ass'n, Texas Environmental Justice Advocacy Services, Union of Concerned Scientists, Air Alliance Houston, et al., U.S. EPA Accidental Release Prevention Requirements: Risk Management Programs Under the Clean Air Act, Proposed Rule, 83 Fed. Reg. 24,850 (May 30, 2018), Docket No. EPA-HQ-OEM-2015-0725. Available at https://earthjustice.org/sites/default/files/files/Comments%20%28final%29_08-23-2018.pdf.

Earthjustice, *A Disaster in the Making*, April 2018. Available at https://earthjustice.org/features/toxic-catastrophes-texas-national-chemical-disaster-rule.

Environmental Justice Health Alliance for Chemical Policy Reform, et al. *Who's in Danger: Race, Poverty, and Chemical Disasters*, May 2014. Available at https://ej4all.org/assets/media/documents/ej4all-Who'sInDangerReport.pdf.

Environmental Justice Health Alliance for Chemical Policy Reform, et al., *Life at the Fenceline: Understanding Cumulative Health Hazards in Environmental Justice Communities*, September 2018. Available at https://ej4all.org/life-at-the-fenceline.

Goldman, G, et al. *Community Impact: Chemical Safety, Harvey, and Delay of the EPA Chemical Disaster Rule*, October 2017, Union of Concerned Scientists. Available at http://www.ucsusa.org/HarveyRMP.

John Pardue, A burning chemical plant may be just the tip of Hurricane Laura's damage in this area of oil fields and industry, *Louisiana Illuminator*, September 4, 2020, https://lailluminator.com/2020/09/04/a-burning-chemical-plant-may-be-just-the-tip-of-hurricane-lauras-damage-in-this-area-of-oil-fields-and-industry/.

Laura Sanicola & Erwin Seba, Texas freeze led to release of tons of air pollutants as refineries shut, Reuters, February 21, 2021, https://www.reuters.com/article/usa-weather-texas-emissions-idUKL1N2KP03J.

Sara Sneath, Incoming U.S. Chemical Safety Board advisor says preparing for climate change a top priority, NPR WWNO, January 12, 2021, https://www.wwno.org/post/incoming-us-chemical-safety-board-advisor-says-preparing-climate-change-top-priority-0.

Sara Sneath, Louisiana chemical facilities are 'ticking time bombs' during hurricanes. Residents are left in the dark about the risks., *Southerly*, December 7, 2020, https://southerlymag.org/2020/12/07/louisiana-chemical-facilities-are-ticking-time-bombs-during-hurricanes-residents-are-left-in-the-dark-about-the-risks/.

Sara Sneath, The communities who need it most aren't receiving air quality information during disasters like Hurricane Laura, One Breath Partnership, October 21, 2020, https://onebreathhou.org/newsroom/2020/10/texas-louisiana-hurricane-laura-industrial-pollution-air-quality-information/?fbclid=IwAR0M7pYMX_mDEkzRtAApGjA1iuyNJ4c2fszIfSVouHRwW6VkNOzQzBwgXKc.

Sara Sneath & Mark Schleifstein, Chlorine, other chemicals detected near Hurricane Laura-damaged chemical plant, EPA says, *The New Orleans Times Picayune*, August 31, 2020, https://www.nola.com/news/environment/article_b9a1b9b6-ebb6-11ea-a03c-070bf59a81e7.html.

Union of Concerned Scientists, *A Toxic Relationship: Extreme Coastal Flooding and Superfund Sites*, July 2020. Available at https://www.ucsusa.org/sites/default/files/2020-07/a-toxic-relationship.pdf.

Valerie Yurk, Environmental Justice: Hurricane released cancer-causing chemicals into community, E&E News | *Greenwire*, April 5, 2021, https://www.eenews.net/stories/1063729223.

ENDNOTES

[1] U.S. Chemical Safety and Hazard Investigation Board, Investigation Report: Organic Peroxide Decomposition, Release, and Fire at Arkema Crosby Following Hurricane Harvey Flooding, No. 2017-08-I-TX (May 2018), https://www.csb.gov/file.aspx?DocumentId=6068 (discussing the internationally recognized term of art, "natech," referring to industrial or technological "secondary effects" associated with inadequate preparation or prevention of releases during or after natural hazards).

[2] See, e.g., Comment of United Steelworkers Union to EPA at 21-22 (Aug. 23, 2018) & Declaration of Ben Lilienfeld ¶¶ 8-22, https://www.regulations.gov/comment/EPA-HQ-OEM-2015-0725-1970 (attach. 4 & 6).

[3] L. Olsen, After Harvey, a 'second storm' of air pollution, state reports show, Houston Chron., Mar. 31, 2018, https://www.houstonchronicle.com/news/houston-texas/houston/article/After-Harvey-a-second-storm-of-air-12795260.php (quoting Juan Parras, Texas Environmental Justice Advocacy Services).

[4] 40 C.F.R. Part 68.

[5] 42 U.S.C. § 7412(r); id. § 7412(r)(7).

[6] See Comment submitted by Earthjustice on behalf of Air Alliance Houston et al. at 5, 88 & n.11 (Aug. 23, 2018), https://www.regulations.gov/comment/EPA-HQ-OEM-2015-0725-19699 (citing EPA, 2014-16 Accident Data Spreadsheet, https://www.regulations.gov/document?D=EPA-HQOEM-2015-0725-0909; EPA, 2004-13 Accident Data Spreadsheet, https://www.regulations.gov/document?D=EPA-HQ-OEM-2015-0725-0002).

[7] 84 Fed. Reg. 69,834 (Dec. 19, 2019); 82 Fed. Reg. 4594 (Jan. 13, 2017); Pres. Biden, E.O. No. 13,990 of Jan. 20, 2021, Protecting Public Health and the Environment and Restoring Science To Tackle the Climate Crisis, 86 Fed. Reg. 7037 (Jan. 25, 2021); Biden White House. Fact Sheet: List of Agency Actions for Review (Jan. 20, 2021), https://www.whitehouse.gov/briefing-room/statements-releases/2021/01/20/fact-sheet-list-of-agency-actions-for-review/.

[8] EPA, Notice of virtual public listening sessions, 86 Fed. Reg. 28,828 (May 28, 2021).

[9] See 82 Fed. Reg. 4594; EPA, 40 CFR Part 68 Regulatory Text Redline/Strikeout Changes for Final RMP Reconsideration Rule (Dec. 19, 2019) (showing deleted and weakened provisions from 2017 Rule, issued by Administrator Wheeler in 2019), https://www.regulations.gov/document/EPA-HQ-OEM-2015-0725-2093.

[10] Supra Note 1 (discussing the international term "natech" referring to industrial or technological "secondary effects" associated with inadequate preparation or prevention of releases during or after natural hazards).

[11] See Ctr. for Chem. Process Safety (CCPS), Am. Inst. of Chem. Engrs, CCPS Monograph: Assessment of and planning for natural hazards (2019), https://www.aiche.org/sites/default/files/html/536181/NaturalDisaster-CCPSmonograph.html; Necci et al. (2018). Understanding Natech risk due to storms: analysis, lessons learned, and recommendations. This paper uses the term "RMP facility" to mean any industrial site that must comply with the Risk Management Program rules. See 40 C.F.R. § 68.10(a) (applying the RMP regulations to an owner or operator of a stationary source that uses, stores, manufactures, handles, or otherwise processes more than a threshold quantity of a regulated substance in a process); id. § 68.3 (defining "process" and "covered process").

[12] EPA RMP Incident Data 2004-13, https://www.regulations.gov/document?D=EPA-HQ-OEM-2015-0725-0002; see also EPA, Regulatory Impact Analysis at 66-67 (Apr. 27, 2018), https://www.regulations.gov/document/EPA-HQ-OEM-2015-0725-0907(listing deaths and injuries).

[13] See, e.g., Comment of United Steelworkers Union to EPA at 2 (Aug. 23, 2018), https://www.regulations.gov/comment/EPA-HQ-OEM-2015-0725-1970 (attach. 6).

[14] See supra note 9; see also EPA Regulatory Impact Analysis at 83, 94 (Dec. 16, 2016), https://www.regulations.gov/document/EPA-HQ-OEM-2015-0725-0734; R. White, EJHA, Coming Clean et al., Life at the Fenceline: Understanding Cumulative Health Hazards in Environmental Justice Communities (Sept. 2018), Environmental Justice Health Alliance, Coming Clean, Campaign for Healthier Solutions, https://new.comingcleaninc.org/assets/media/documents/Life%20at%20the%20Fenceline%20-%20English%20-%20Public.pdf.

[15] EPA, Regulatory Impact Analysis at 89-90.

[16] Id.

[17] Center for Effective Government, Living in the Shadow of Danger at 2 (Jan. 2016), https://www.foreffectivegov.org/shadow-of-danger; R. White, EJHA, Coming Clean et al., Life at the Fenceline: Understanding Cumulative Health Hazards in Environmental Justice Communities (Sept. 2018), Environmental Justice Health Alliance, Coming Clean, Campaign for Healthier Solutions, https://new.comingcleaninc.org/assets/media/documents/Life%20at%20the%20Fenceline%20-%20English%20-%20Public.pdf.

[18] N Sachs and D Flores. Toxic Floodwaters: The Threat of Climate-Driven Chemical Disaster in Virginia's James River Watershed at 18 (Mar. 2019), Center for Progressive Reform, http://progressivereform.org/our-work/energy-environment/virginia-toxic-floodwaters/; e.g. Center for Disease Control and Prevention, Agency for Toxic Substances and Disease Registry, Social Vulnerability Index, available at https://www.atsdr.cdc.gov/placeandhealth/svi/index.html.

[19] Comment submitted by Earthjustice on behalf of Air Alliance Houston et al. at 21-29, Section I.F (Aug. 23, 2018), https://www.regulations.gov/comment/EPA-HQ-OEM-2015-0725-1969 ("Harms to Public Health and Safety Caused by Chemical Disasters"); see also R. White, EJHA, Coming Clean et al., Life at the Fenceline: Understanding Cumulative Health Hazards in Environmental Justice Communities at 2-5 (Sept. 2018), Environmental Justice Health Alliance, Coming Clean, Campaign for Healthier Solutions, https://new.comingcleaninc.org/assets/media/documents/Life%20at%20the%20Fenceline%20-%20English%20-%20Public.pdf.

[20] See, e.g., UCS & t.e.j.a.s, Double Jeopardy in Houston (Oct. 2016), https://www.ucsusa.org/sites/default/files/attach/2016/10/ucs-double-jeopardy-in-houston-full-report-2016.pdf; UCS& EJHA et al., Environmental Justice for Delaware: Mitigating Toxic Pollution in New Castle Communities (Oct. 17, 2017), https://www.ucsusa.org/resources/environmental-justice-delaware.

[21] See, e.g., UCS, Community Impact: Chemical Safety, Harvey, and the Delay of the Chemical Disaster Rule (Oct. 2017), http://www.ucsusa.org/HarveyRMP; Comment submitted by Earthjustice on behalf of Air Alliance Houston et al. at 16-21, Section I.E (Aug. 23, 2018), https://www.regulations.gov/comment/EPA-HQ-OEM-2015-0725-1969 ("The Domino Effect of Chemical Disasters Related to Chemical Facilities' Inadequate Preparation and Prevention Measures for Natural Disasters" (case study on Hurricane Harvey impacts)); EPA, On-Scene Coordinator, Winter Storms Uri and Viola (Winter Storm Reports Feb. 18, 2021 – Mar. 15, 2021) (https://response.epa.gov/site/site_profile.aspx?site_id=15082. The Coalition to Prevent Chemical Disasters has additional information on recent incidents at this link: https://preventchemicaldisasters.org/chemical-facility-incidents/; T. Slack et al. Natech or natural? An analysis of hazard perceptions, institutional trust, and future storm worry following Hurricane Harvey, Nat. Hazards 102, 1207-1224 (2020), https://doi.org/10.1007/s11069-020-03953-6.

[22] UCS, Community Impact: Chemical Safety, Harvey, and Delay of the EPA Chemical Disaster Rule at 7 (Oct. 17, 2017), http://www.ucsusa.org/HarveyRMP.

[23] Id.

[24] Id. at 4.

[25] Supra Note 1 at 54-60.

[26] Id.

[27] Id. at 67-86, 15.

[28] Indeed, chemical releases in the Gulf region attributed, in part, to tropical storms and inadequate startup, shutdown, and malfunction procedures are increasingly reported, including, for example, the chlorine gas release in August, 2020 at the Bio-Lab plant in Westlake, LA, which occurred following landfall of Hurricane Laura. https://www.csb.gov/bio-lab-chemical-fire-and-release-/; See also, U.S. Chemical Safety and Hazard Investigation Board, Safety Bulletin: After Katrina: Precautions Needed During Oil and Chemical Facility Startup, No. 2005-01-S (Sept. 2005). Available at https://www.csb.gov/after-katrina-special-precautions-needed-during-oil-and-chemical-facility-startup/.

[29] See Appendix A for a complete description of our methodology.

[30] See, T. Frank, Studies Sound Alarm on 'Badly Out-of-Date' FEMA Flood Maps, Scientific American, Feb. 27, 2020, https://www.scientificamerican.com/article/studies-sound-alarm-on-badly-out-of-date-fema-flood-maps/; see also, Association of State Floodplain Managers, Inc., Flood Mapping for the Nation: A Cost Analysis for Completing and Maintaining the Nation's NFIP Flood Map Inventory (Jan. 2020), https://asfpm-library.s3-us-west-2.amazonaws.com/FSC/MapNation/ASFPM_MaptheNation_Report_2020.pdf.

[31] See Appendix A for a complete description of our methodology.

[32] EPA's 2021 Non-OCA RMP Database. The data covers the period between 1992 and March 2021.

[33] See, e.g., California Accidental Release Prevention (CalARP) Program, Cal. Code Regs. tit. 19, §§ 2735-2785 (requiring certain owners or operators stationary sources with a regulated substance to develop hazard prevention programs that consider seismic events) (§§ 2745.7(q)(1), 2760.2(c)(8)); Richmond Municipal Code 8.16.035(2) (Fire Code) (acknowledging that "[f]ire following an earthquake has the potential of causing greater loss of life and damage than the earthquake itself" and that "[h]azardous materials, particularly toxic gases, could pose the greatest threat . . . should a significant seismic event occur"); Massachusetts Office of Technical Assistance and Technology, Chemical Safety and Climate Change Preparedness, available at https://www.mass.gov/chemical-safety-and-climate-change-preparedness; H.B. No. 2780 and S.B. No. 900, 87th Leg. (Tex 2021) (considering a bill requiring performance standards for aboveground storage tanks prone to "accidents, fires, explosions, hurricanes, [and] floods"); see also CalARP Program Siesmic Guidance Comm., Guidance for Cal. Accidental Release (CalARP) Program: Seismic Assessments (Jan. 2019), https://www.caloes.ca.gov/FireRescueSite/Documents/SGD%20LEPC%20I%20Approved%2008%2007%202019.pdf.

[34] New York State's Community Resiliency and Recovery Act of 2014, as amended, requires pollution permit applicants to demonstrate design consideration of climate risks, including to sea-level rise, storm surge, and flooding, among others, and the Act also requires state regulators to consider these risks in facility-siting regulations for regulated hazardous waste, petroleum, and hazardous substances. Available at https://www.dec.ny.gov/energy/102559.html.

[35] Seveso III Directive 2012/18/EU of the European Parliament and of the Council of 4 July 2012 on the control of major-accident hazards involving dangerous substances, amending and subsequently repealing Council Directive 96/82/EC, 2012 (L197/1).

[36] See id. at 15, 27 & art. 10.

[37] See TRAS 310: Vorkehrungen und Maßnahmen wegen der Gefahrenquellen Niederschläge und Hochwasser [Technical Rule on Installation Safety 310: Precautions and Measures against the Hazard Sources of Precipitation and Flooding Short Version], Dec. 15, 2011 (Ger.); TRAS 320: Vorkehrungen und Maßnahmen wegen der Gefahrenquellen Wind sowie Schnee- und Eislasten - Fassung [Technical Rule on Installation Safety 320: Precautions and Measures Against the Hazard Sources Wind, Snow Loads and Ice Loads], June 15, 2015 (Ger.).

[38] See TRAS 310, at 4.

[39] Id.

[40] U.S. Chemical Safety and Hazard Investigation Board, Investigation Report: Organic Peroxide Decomposition, Release, and Fire at Arkema Crosby Following Hurricane Harvey Flooding, No. 2017-08-I-TX (May 2018), https://www.csb.gov/file.aspx?DocumentId=6068.

[41] Id. at 14 ("Although Federal process safety regulations require companies to compile relevant process safety information, the regulations do not specifically identify flood insurance maps and related studies as required process safety information. The CSB investigation revealed that other companies also might be unaware of the potential for flood risks to create process safety hazards at their facilities if flood-related information is not typically compiled or assessed in required safety analyses.").

[42] CSB, 2020 Hurricane Season: Guidance for Chemical Plants During Extreme Weather Events (2020), https://www.csb.gov/assets/1/6/extreme_weather_-_final_w_links.pdf; Ctr. for Chem. Process Safety (CCPS), Am. Inst. of Chem. Engrs, CCPS Monograph: Assessment of and planning for natural hazards (2019), https://www.aiche.org/sites/default/files/html/536181/NaturalDisaster-CCPSmonograph.html.

[43] Supra Note 42.

[44] U.S. Government Accountability Office. Superfund: EPA Should Take Additional Actions to Manage Risks from Climate Change, GAO-20-73 (Oct. 18, 2019), https://www.gao.gov/products/gao-20-73.

[45] 40 CFR §§ 264.18, 257.3-1, 270.14(b)(11)(iv).

[46] United States Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) Multi-Sector General Permit (MSGP) for Stormwater Discharges Associated with Industrial Activity at Part 2.1.1.8, at 17-19, "Stormwater Control Measure Selection and Design Considerations," https://www.epa.gov/sites/production/files/2021-01/documents/2021_msgp_-_permit_parts_1-7.pdf.

[47] Supra Note 44.

[48] EPA Office of Inspector General, EPA Needs to Improve Its Emergency Planning to Better Address Air Quality Concerns During Future Disasters, Report No. 20-P-0062 (Dec. 16, 2019), https://www.epa.gov/office-inspector-general/report-epa-needs-improve-its-emergency-planning-better-address-air-quality; Cai and Marson (2021) A regional Natech risk assessment based on a Natech-prone facility network for dependent events; Advances and Gaps in Natech Quantitative Risk Analysis (2020); Risk analysis in Natech events: State of the art (2020); Asia-Pacific Regional Framework for NATECH (Natural Hazards Triggering Technological Disasters) Risk Management (2020); Natech Hazard and Risk Assessment (2017) – UNISDR; Implementation Guide for Man-Made and Technological Hazards (2014) – UNISDR.

[49] See, e.g., Hydrocarbon Publishing Co., Refinery Power Outage Mitigations (2014), https://www.hydrocarbonpublishing.com/ReportP/power.pdf; and CSB, List of Recommendations, available at https://www.csb.gov/recommendations/?F_RecipientId=4846.

[50] See, e.g., CSB Letter to EPA on Hydrofluoric Acid (Apr. 23, 2019), https://www.csb.gov/assets/1/6/letter_to_epa_4.23.2019.pdf; USW, A Risk Too Great: Hydrofluoric Acid in U.S. Refineries (Apr. 2013), https://www.usw.org/workplaces/oil/oil-reports/A-Risk-Too-Great.pdf; J. Morris, Regulatory Flaws, Repeated Violations Put Oil Refinery Workers At Risk, Ctr. for Pub. Integrity (Feb. 28, 2011), https://www.publicintegrity.org/2011/02/28/2111/regulatory-flaws-repeated-violationsput-oil-refinery-workers-risk.

[51] See, e.g., Cal. Code Regs. tit. 19, § 2762.13.

[52] Regulatory reforms to increase public disclosure of climate risks may also bolster action to mitigate and plan for climate-driven chemical disasters. See C. Carlson et al. Stormy Seas, Rising Risks: What Investors Should Know About Climate Change Impacts at Oil Refineries (Feb. 2015), Union of Concerned Scientists, https://www.ucsusa.org/resources/stormy-seas-rising-risks.

[53] 40 C.F.R. § 68.215; 42 U.S.C. § 7661c.

[54] National Institute for Occupational Safety and Health. Hierarchy of Controls, Centers for Disease Control and Prevention (Jan. 13, 2015), https://www.cdc.gov/niosh/topics/hierarchy/default.html.

[55] 40 CFR § 68.22.

[56] CSB, Safety Digest: CSB Investigations of Incidents during Startups and Shutdowns (2018), https://www.csb.gov/assets/1/17/csb_start_shut_02.pdf?16301; supra Note 54; CRC Press, Process Plants: A Handbook for Inherently Safer Design Second Edition; Kletz, Trevor and Amyotte, Paul; 2010; pp 15-17 ("…the phrase hierarchy of controls [is used] to describe [that]….there is a hierarchical ordering of controls to deal with hazards and ensuing risk. The hierarchy covers the spectrum from elimination (at the top of the hierarchy) through engineering and administrative (procedural) controls, to PPE (personal protective equipment) at the bottom of the hierarchy.").

[57] See, e.g., Comment of United Steelworkers Union to EPA at 21-22 (Aug. 23, 2018) & Declaration of Ben Lilienfeld ¶¶ 8-22, https://www.regulations.gov/comment/EPA-HQ-OEM-2015-0725-1970 (attach. 4 & 6).

[58] A. Phillips. Preparing for the Next Storm: Learning from the Man-Made Environmental Disasters that Followed Hurricane Harvey at 3 (Aug. 2018), Environmental Integrity Project, https://www.preventionweb.net/publications/view/60070.

[59] CSB, After Harvey: Precautions Needed During Oil and Chemical Facility Startup (2017), https://www.csb.gov/assets/1/20/csb_harvey2017_05.pdf.

[60] Supra Note 8 at 6-7.

[61] See, e.g., EPA Winter Storms Uri and Viola Report #6 February 22, 2021, https://response.epa.gov/sites/15082/files/Winter%20Storms%20Report%206%2002222021.pdf; see also A. Ahzar, "During February's Freeze in Texas, Refineries and Petrochemical Plants Released Almost 4 Million Pounds of Extra Pollutants," Inside Climate News, Mar. 15, 2021, https://insideclimatenews.org/news/15032021/texas-freeze-petrochemical-refineries-houston/.

[62] EPA, Enforcement Alert: Risk of Chemical Accidents During Process Startup, Office of Enforcement and Compliance Assistance (Feb. 2021), https://www.epa.gov/sites/production/files/2021-02/documents/ncistartupsafety-enforcementalert.pdf.

[63] CSB, Safety Alert. 2020 Hurricane Season: Guidance for Chemical Plants During Extreme Weather Events (2020), https://www.csb.gov/assets/1/6/extreme_weather_-_final_w_links.pdf.

[64] See, e.g., CSB Comment Letter to EPA at 6 (July 20, 2018), https://www.csb.gov/assets/1/6/csb_comments_epa_rmp_20180720.pdf; CSB Comment Letter to EPA at 4-5 (May 10, 2016), https://www.regulations.gov/comment/EPA-HQ-OEM-2015-0725-0428; CSB Comment Letter to EPA at 13-17 (Oct. 29, 2014), https://www.regulations.gov/comment/EPA-HQ-OEM-2014-0328-0689; see also e.g., CSB, Tesoro Refinery Investigation Report (May 2014), available at https://www.csb.gov/tesoro-refinery-fatal-explosion-and-fire/; CSB, Chevron Final Report at 17 ("Using inherently safer design concepts to eliminate the hazard . . . will prevent future similar failures in refineries." (emphasis added)); CSB, Interim Investigation Report: Chevron Richmond Refinery Fire at 45 (Aug. 2012), https://www.csb.gov/chevron-refinery-fire/ ("Chevron Interim Report") ("Chevron and other process plant's implementation of inherently safer systems to the greatest extent feasible would provide a higher degree of protection from incidents like the one that occurred on August 6, 2012."; EPA-HQ-OEM-2015-0725-0888, Attachment # 51: Mark N. Mauriello, Acting Comm'r, Dep't of Envtl. Prot., Inherently Safer Technologies Implementation Summary at 2 (Jan. 15, 2010).

[65] See, e.g., Cal. Code Regs. tit. 19, § 2762.13.

[66] See, e.g., CSB Arkema Report; see also CSB comments, supra Note 64.

[67] See CSB comments, supra Note 64 (summarizing recommendations); U.S. Fire Administration, InfoGram: Preparing for and responding to chemical threats (Nov. 16, 2017) ("Chemical threats are one of the most deadly faced by first responders. Your department should know the chemicals used by industries in your jurisdiction, the dangers they pose, the layout of the facilities and you should run regular drills and exercises to prepare for accidents, fires, spills or man-made threats.").

[68] GAO has also encouraged "bolster[ing] chemical information sharing between facilities and communities," and has stated its "'biggest concern from the safety perspective'" is whether "'first responders … have access to everything that is at [the] facility.'" R. Rainey, "As RMP Rollback Looms, GAO Raises Concerns Over Chemical Data Sharing," Inside EPA (June 13, 2018), https://insideepa.com/daily-news/rmp-rollback-looms-gao-raises-concerns-over-chemical-data-sharing (quoting Christopher Currie, director of the homeland security and justice team at GAO).

[69] Improving language accessibility to RMP information is in conformance with EPA's own policies. See EPA, Assisting People with Limited English Proficiency (Feb. 14, 2019), https://www.epa.gov/ogc/assisting-people-limited-english-proficiency for more.

[70] See https://cchealth.org/hazmat/calarp/calarp4.php; Cal. Code Regs. tit. 19, § 2762.

[71] Ctr. for Chem. Process Safety (CCPS), Am. Inst. of Chem. Engrs, CCPS Monograph: Assessment of and planning for natural hazards (2019), at 9-10, https://www.aiche.org/sites/default/files/html/536181/NaturalDisaster-CCPSmonograph.html.

[72] EPA's Refinery Sector Rule (issued in 2015) requires passive benzene sampling which is valuable but does not require real-time alerts or emergency reporting. 40 C.F.R. Part 63 subpart CC, 40 C.F.R. § 63.658. Local regulations for refineries in Los Angeles require open-path monitoring that has a higher detection limit but allows for real-time alerts. See S. Coast Air Qual. Mmgt. Dist. Rule 1180 (Dec. 2017); Rule 1180 Refinery Fenceline Air Monitoring Plan Guidelines (Dec. 2017), http://www.aqmd.gov/docs/default-source/rule-book/support-documents/1180/rule-1180-guidelines.pdf. Some EPA enforcement consent decrees also have required real-time fenceline monitoring and reporting at refineries and chemical plants. See, e.g., Shell Norco CD, EPA (2018) https://www.epa.gov/sites/production/files/2018-02/documents/shellchemicallp021218-cd.pdf; see also additional consent decrees at https://cfpub.epa.gov/enforcement/cases/index.cfm.

[73] T. McLaughlin, L. Kearney, and L. Sanicola, "Special Report: U.S. air monitors routinely miss pollution - even refinery explosions," Reuters, Dec. 1, 2020, https://www.reuters.com/article/usa-pollution-airmonitors-specialreport/u-s-air-monitors-routinely-miss-pollution-even-refinery-explosions-idUSKBN28B4RT.

[74] Interpretation and dissemination of real-time monitoring data collected at the fenceline of RMP facilities is within EPA's Clean Air Act authority under sections 112(r)(7)(A),(B), 113, and 114, 42 U.S.C. §§ 7412(r)(7)(A), (B), 7413, 7414, and is consistent with Section 222(b)(ii) of Executive Order 14008 (Jan. 27, 2021), requiring that "The Administrator of the Environmental Protection Agency shall, within existing appropriations and consistent with applicable law: [...] (ii) create a community notification program to monitor and provide real-time data to the public on current environmental pollution, including emissions, criteria pollutants, and toxins, in frontline and fenceline communities—places with the most significant exposure to such pollution."

[75] U.S. Chemical Safety and Hazard Investigation Board, Investigation Report: Organic Peroxide Decomposition, Release, and Fire at Arkema Crosby Following Hurricane Harvey Flooding, No. 2017-08-I-TX (May 2018), https://www.csb.gov/arkema-inc-chemical-plant-fire-/; U.S. Chemical Safety and Hazard Investigation Board, Investigation Report: Organic Peroxide Decomposition, Release, and Fire at Arkema Crosby Following Hurricane Harvey Flooding, No. 2017-08-I-TX (May 2018), https://www.csb.gov/file.aspx?DocumentId=6068; U.S. Chemical Safety and Hazard Investigation Board, Investigation Report: West Fertilizer Company Fire and Explosion, No. 2013-02-I-TX (Apr. 2013), https://www.csb.gov/west-fertilizer-explosion-and-fire-/.

[76] EPA, List of Lists: Consolidated List of Chemicals Subject to the Emergency Planning and Community Right To-Know Act (EPCRA), Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and Section 112(r) of the Clean Air Act, EPA 550-B-20-001 (Aug. 2020), Office of Land and Emergency Management, https://www.epa.gov/sites/production/files/2015-03/documents/list_of_lists.pdf.

[77] See, e.g., C. Giles, Next Generation Compliance: Environmental Regulation for the Modern Era – Part I: Rules with Compliance Built In, Harvard Envt'l & Energy Law Program (Jan. 27, 2020) (http://eelp.law.harvard.edu/wp-content/uploads/Cynthia-Giles-Part-1-FINAL.pdf (explaining that enforcement is important but can only reach so many facilities so "[w]e will only be able to protect the public from serious harms if we write environmental rules with compliance built in.").

[78] See, e.g., 40 C.F.R. §§ 68.10(a), 68.96 (allowing sources until 2023 to develop emergency response exercises, until 2024 to conduct an emergency notification exercise, until 2026 to conduct a tabletop exercise, and setting no deadline for emergency response field exercises).

[79] See 40 C.F.R. § 68.215; 42 U.S.C. § 7661c.

[80] See, e.g., President J. Biden, Exec. Order 13990: Protecting Public Health and The Environment and Restoring Science to Tackle the Climate Crisis (Jan. 20, 2021), https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/20/executive-order-protecting-public-health-and-environment-and-restoring-science-to-tackle-climate-crisis/; President J. Biden, Exec. Order 13985: Advancing Racial Equity and Support for Underserved Communities Through the Federal Government (Jan. 20, 2021), https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/20/executive-order-advancing-racial-equity-and-support-for-underserved-communities-through-the-federal-government/. See also https://www.whitehouse.gov/briefing-room/statements-releases/2021/01/27/fact-sheet-president-biden-takes-executive-actions-to-tackle-the-climate-crisis-at-home-and-abroad-create-jobs-and-restore-scientific-integrity-across-federal-government/.

[81] 40 CFR Part 35, Subpart M – Grants for Technical Assistance; for more, https://www.epa.gov/superfund/technical-assistance-grant-tag-program.

[82] Supra Note 80.

[83] J. Goodwin and E. Winter, Building a Progressive Regulatory Agenda: How a better cost-benefit analysis process can be used to tackle climate change (Jan. 2021), Center for Progressive Reform and Data for Progress, https://www.filesforprogress.org/memos/dfp-building-a-progressive-regulatory-agenda.pdf. J. Goodwin et al., Reclaiming Regulation: Making the Public's Values Heard in Regulatory Analysis (Feb. 2021), Center for Progressive Reform and Data for Progress, https://www.filesforprogress.org/memos/reclaiming-regulation.pdf.

[84] See Pres. Biden Exec. Orders, supra Note 80.

[85] Supra Note 30.

[86] J. Carter and C. Kalman, A Toxic Relationship: Extreme Coastal Flooding and Superfund Sites (July 28, 2020) Union of Concerned Scientists, https://www.ucsusa.org/resources/toxic-relationship.

[87] USGS, Wildland Fire Decision Support System, https://wfdss.usgs.gov/wfdss/wfdss_data_downloads.shtml.

[88] K. C. Short et al. Spatial datasets of probabilistic wildfire risk components for the United States (270m) (2nd Edition), 2020, Fort Collins, CO: Forest Service Research Data Archive. https://doi.org/10.2737/RDS-2016-0034-2. Available at https://www.fs.usda.gov/rds/archive/catalog/RDS-2016-0034-2.

[89] Federal Emergency Management Administration, National Flood Hazard Layer. Available at https://www.fema.gov/flood-maps/national-flood-hazard-layer.

[90] B.C. Zachry et al. 2015: A National View of Storm Surge Risk and Inundation. Weather, Climate, and Society, 7(2), 109–117. DOI: http://dx.doi.org/10.1175/WCAS–D–14–00049.1. Available at https://www.nhc.noaa.gov/nationalsurge/.

[91] Supra Note 87.

[92] Id.