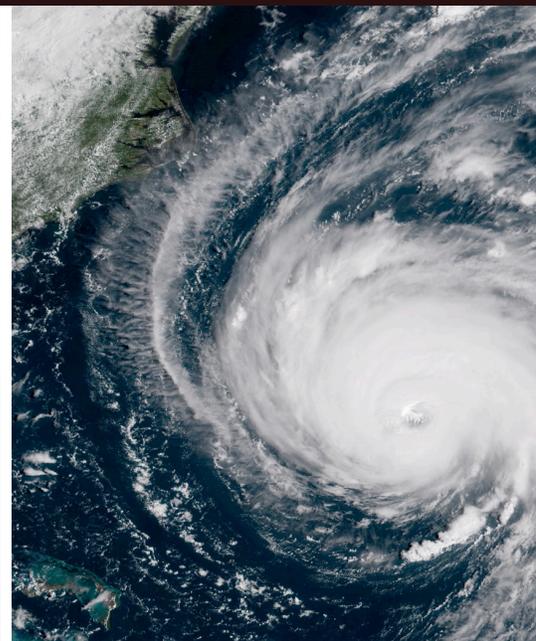




TOO MUCH TO LOSE: OFFSHORE DRILLING & HURRICANES IN THE SOUTHEAST



By Melissa Whaling,
Southern Environmental Law Center

SELC thanks Jenny Brennan and Dan Radmacher for their contributions to this paper, as well as the Gulf Restoration Network for their tireless work advocating for communities in the Gulf of Mexico and documenting the impacts of drilling.

For more information, please visit SouthernEnvironment.org, or contact:
Southern Environmental Law Center
601 West Rosemary Street, Suite 220
Chapel Hill, NC 27516
(919) 967-1450

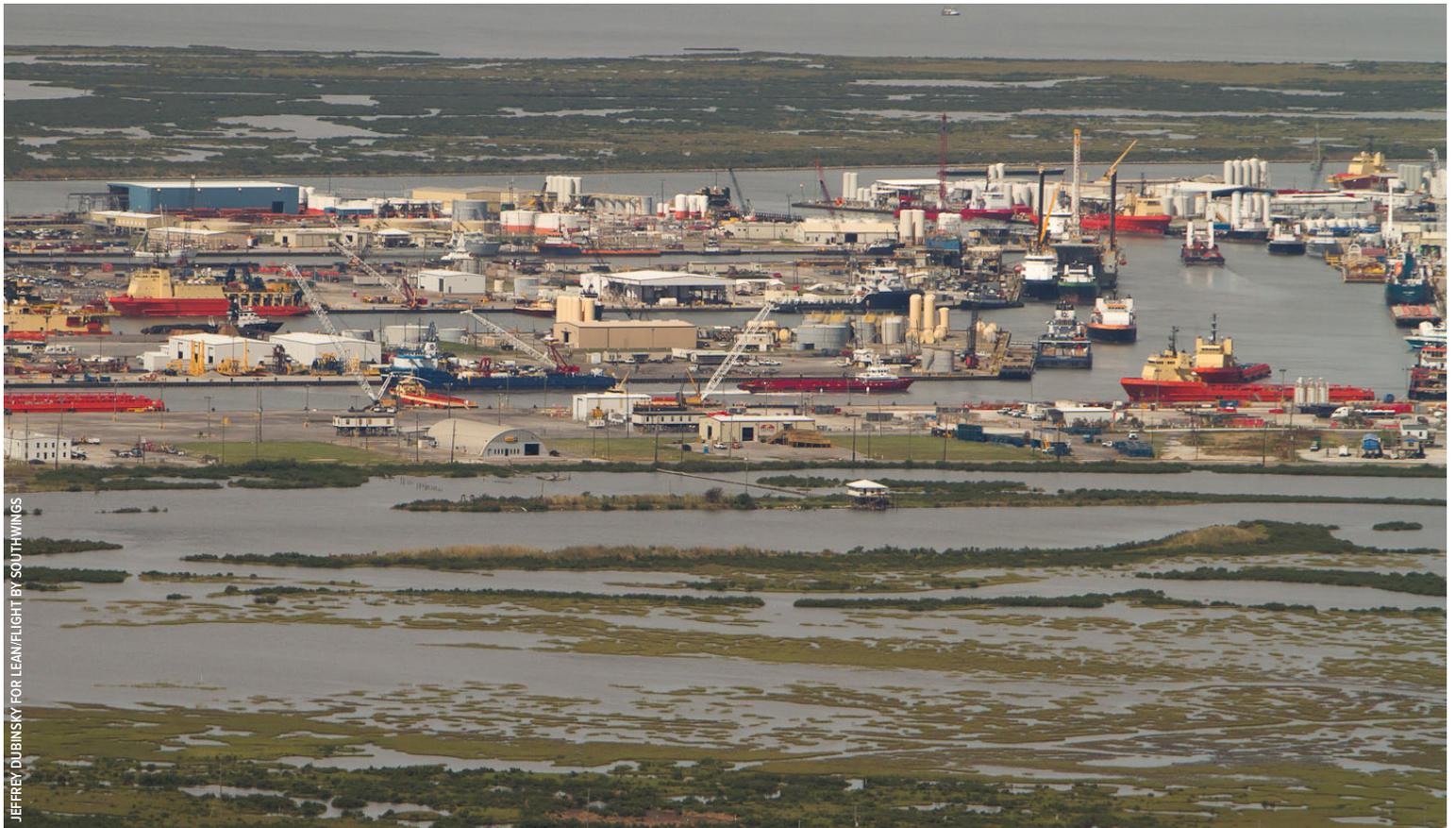
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JEFFREY DUBINSKY FOR LEANFLIGHT BY SOUTHWINGS

Drilling infrastructure in a marsh wetland.



SPENCER PLATIGETY

Bryce Hill, age 9, of Lockport, Louisiana looks on as workers clean up after an oil spill.

EXECUTIVE SUMMARY

Offshore oil and gas extraction involves much more than the distant deep sea oil rigs most people picture. Supply services and downstream processing—including refineries, storage tanks and distribution networks—create a far larger infrastructure footprint, onshore and off, than many realize. Much of this infrastructure—oil rigs, ports, waste disposal sites, refineries, pipelines, and storage sites—is vulnerable to damage during hurricanes from high winds, rough seas and flooding.

As the current administration proposes opening the entire Atlantic coast to offshore drilling for oil and gas, it is important to consider how associated infrastructure will become vulnerable to this threat. This report attempts to illuminate that vulnerability by examining incidents in the Gulf of Mexico, where offshore drilling has been well-established for decades—and where monstrous hurricanes hit regularly and devastating consequences have been felt.

Offshore, hurricane-force winds and waves bombard well platforms, rigs, and tankers. Onshore, catastrophic flooding and storm surge wrecks pipelines, refineries, and storage facilities. The consequences are ongoing. In this report, you'll read about the impact of Ivan, which damaged a cluster of wells that are still leaking tens of thousands of gallons of oil into the ocean every day. You'll read about the millions of gallons of crude oil spilled into the Gulf when Katrina and Rita struck Louisiana barely a month apart, and how Katrina resulted in the largest release of oil into a U.S. metropolitan area on record. You'll read about how Ike destroyed dozens of offshore oil platforms while its strong winds pushed the thousands of gallons of crude oil released onshore, contaminating residences in Texas and Louisiana. We'll describe the impact of Isaac on refineries and other production facilities in Louisiana. And we'll discuss the incredible flooding in Houston caused by Harvey and the pollution released as refineries braced for the impact.

The Southeast coast¹ is particularly prone to hurricane strikes, with some cities in the region experiencing a return period of 1-2 years for tropical storm strikes. Furthermore, data show that the Atlantic Ocean is increasingly experiencing more intense hurricanes as a result of climate change. We hope this report will help put focus on the dire risks of the decision by the federal government and the oil and gas industry to continue to pursue and promote offshore drilling, despite their own findings showcasing this impending threat. The U.S. Government Accountability Office (GAO) found in a recent assessment that our nation's energy infrastructure is becoming increasingly vulnerable to severe weather driven by climate change. Similarly, a study commissioned by the U.S. Department of Energy (DOE) found that extensive amounts of U.S. energy infrastructure are currently exposed to damage from storm surge. Further, they even warned against investing in new energy infrastructure in hurricane-prone areas. Even oil and gas industry representatives themselves have openly recognized this problem.

The experience of residents along the Gulf Coast should be an important lesson for the East Coast—and for the Trump administration and the oil and gas industry that appear to be intent on repeating the mistakes made there and further threatening a region already imperiled by hurricanes.



AN OVERVIEW OF DRILLING INFRASTRUCTURE

What is required for offshore drilling to occur?

Offshore drilling occurs in three phases: exploration, development, and production. Beyond these phases, supply services and downstream processing are also integral to the process of extracting and distributing offshore oil and gas. Offshore extraction begins with exploratory drilling to locate hydrocarbon deposits. Once a viable deposit is found, one or more production wells are installed. The resources generated at these wells are held temporarily in storage tanks, then transported onshore via pipeline or tanker, where they are processed for distribution in refineries. The fossil fuels are then sold to distribution networks such as power plants. These activities are supported by a fleet of vessels, helicopters, and trains throughout this process. The waste products generated from these processes are dealt with in a number of ways at waste disposal centers.

Given the long-standing industry presence in the Gulf, the current extent of drilling infrastructure required to support the oil and gas industry there is significant. Presently there are 4,000 active offshore drilling platforms and over 27,000 miles of subsea pipeline in the Gulf of Mexico.^{2,3} In Louisiana alone, more than 57,000 shallow-water wells have been drilled in just 10 of the state's coastal parishes since 1900.⁴ Onshore, more than 125,000 miles of pipeline zig-zag across Louisiana, enough to wrap around the Earth five times.⁵ As of 2014, there were almost 300 oil and natural gas refineries in the four Gulf States, about one per county in Texas alone.⁶ There are hundreds of storage facilities, ports, and transport terminals.

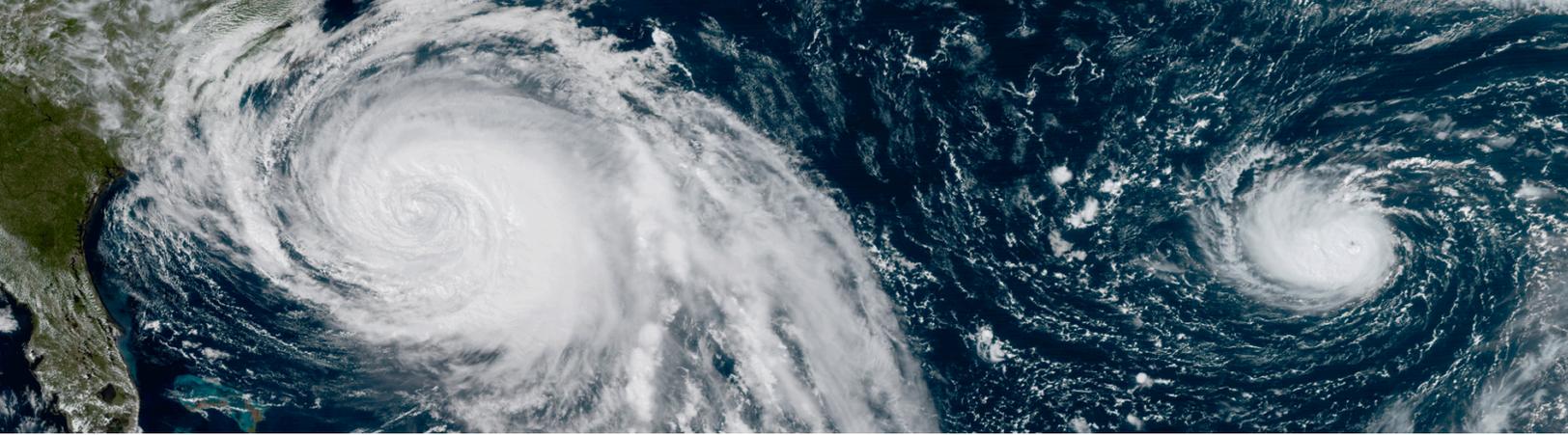
The government has concluded that in order to bring drilling to the Atlantic, the industry would need to either expand or develop the following facilities on land: ports, waste disposal sites, refineries, pipelines, and storage sites.⁷ Offshore, exploratory and production wells would need to be drilled, and transporting those energy

resources would require tankers, subsea pipelines, and storage equipment. However, predicting the specific areas where offshore drilling infrastructure would exist is extremely difficult given many uncertainties, such as how much oil and gas exists in the Atlantic outer continental shelf (OCS) and which areas would be leased. Based on the Trump administration's January proposal to open 90% of the country's offshore areas to oil and natural gas drilling, we can expect that infrastructure would be needed for both resources.⁸

What happens to infrastructure towards the end of its life cycle?

It is important to note that not all oil and gas infrastructure in the Gulf is currently in use. The infrastructure required for oil and gas development doesn't disappear after the end of its life cycle—it sticks around after oil companies move on. As a result, about 36,000 abandoned wells pepper the shallow waters of the Gulf of Mexico, many with residual oil still in them.⁹ In many cases, this infrastructure is now more than 40 years old, and has repeatedly broken and been repaired again.¹⁰ Also, by this point, ownership has been passed on to multiple subcontractors and subsidiaries of the original oil companies that built the infrastructure.¹¹

This issue can be attributed to systematic problems with how the oil industry is regulated. For example, the only requirement for purchasing an offshore oil lease is to be the highest bidder. Oil companies aren't required to prove they are fit to take care of the infrastructure for the entire life cycle of the drilling process—including safely closing a well.¹² Further, the current administration has delayed implementation of rules that would make decommissioning activities safer.¹³ This approach breeds a poor safety culture within the entire industry.



WHEN HURRICANES AND DRILLING MEET

This plethora of infrastructure in the Gulf becomes problematic when strong hurricanes strike. Damage to energy infrastructure from hurricanes is one of the leading causes of oil spills.¹⁴ A recent GAO assessment stated, “U.S. energy infrastructure is increasingly vulnerable to a range of climate change impacts—particularly ... in areas prone to severe weather.”¹⁵ Similarly, DOE experts recently found that an “extensive amount” of U.S. energy infrastructure is currently exposed to hurricane damage.¹⁶ They further emphasized the importance of “limiting investments in new critical infrastructure in areas currently exposed to [hurricanes].”¹⁷ Even oil and gas industry representatives predict that this threat could be significant enough to impact growth and reinvestment trajectories.¹⁸ This risk poses serious questions for what growth of energy infrastructure could mean for the Southeast coast.

What are the environmental impacts of oil spills?

In a natural environment untouched by humans, oil leaks are an ordinary occurrence. Anywhere there is an oil deposit underground, petroleum slowly seeps up through the seafloor. Organisms that live over these seeps have evolved to thrive in these conditions, even helping to break down the oil.¹⁹ The rest of ocean life, however, can suffer dramatically from leaking oil, especially given that human-caused oil spills release hundreds of times more oil than the environment can handle.

The ocean is full of air-breathing animals such as whales, dolphins, sea turtles, and seabirds that rely on clean surface waters for oxygen. The chemical components of oil are poisonous; thus when these animals come in contact with even small amounts of it at the surface, they can suffer lethal and sub-lethal conditions, such as lung disease,²⁰ skin lesions,²¹ and infertility.²² Oil also destroys the insulating ability of furry mammals like sea otters, and the water resistance of bird feathers, exposing these animals to the harsh elements of the marine environment.²³ Oil exposure can also devastate fish populations by causing widespread heart defects,²⁴ tissue damage,²⁵ and decreased swimming ability.²⁶ Plants and algae can’t photosynthesize in the presence of oil,²⁷ which also means corals can’t survive either.²⁸ Even a few molecules of oil can kill larvae of many species.²⁹ Filter feeders such as clams and oysters pull toxins out of the water as they feed, and these substances can pass up the food web as they are eaten by other species, including humans.³⁰

Oil spills can be detrimental to human health. Many compounds in fossil fuels are neurotoxins and carcinogens. Oil spill cleanup workers, fishermen, and residents that become exposed to oil can suffer respiratory, neurological, hearing, and vision problems—and even death.³¹ The long-lasting impacts from oil spills can be extremely traumatizing, leading to chronic anxiety, depression, and PTSD.³²

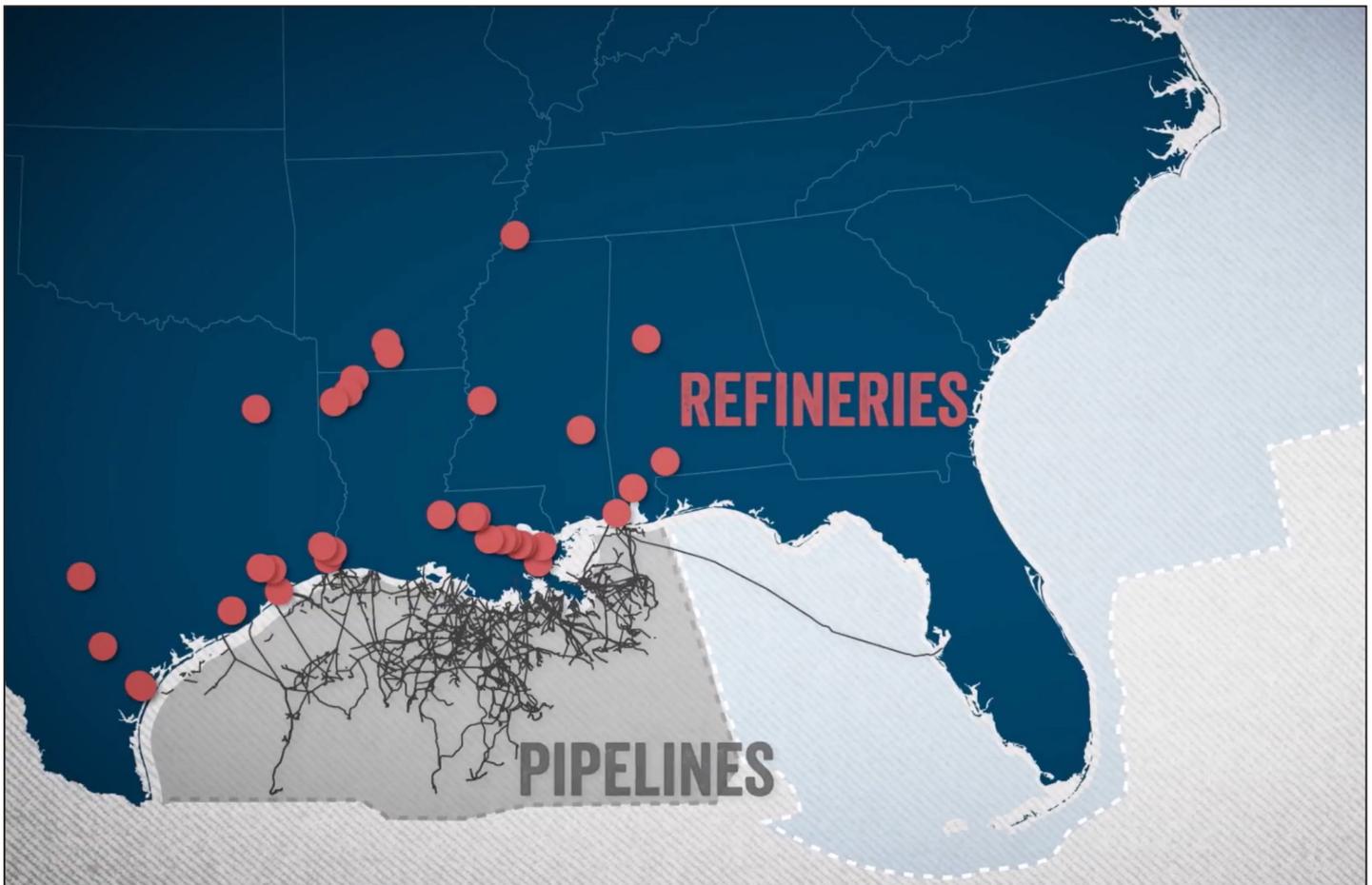




LESSONS FROM THE GULF

The Gulf of Mexico's history is wrought with horrifying examples of hurricanes damaging oil and gas infrastructure. Offshore rigs, wells, tankers, and subsea pipelines are continuously at the mercy of strong hurricane forces. Even more vulnerable to hurricane damage than offshore infrastructure is the onshore infrastructure associated with the transport and processing of oil and gas. Unlike hulking offshore rigs built to withstand natural wave energy and currents, coastal infrastructure in the Gulf of Mexico is weak and aging. As discussed previously, some

pipelines date back to the 1940s and are abandoned, receiving minimal maintenance. Consequently, this leftover infrastructure is now corroding, leaking, and sitting right in the path of future hurricanes. Further, refineries aren't flood-proof and are susceptible to extensive damage from storm surge, wind, and rain.³³ This section outlines several examples of the consequences that often result when hurricanes and oil and gas infrastructure meet.



Contrasting the presence of heavy oil and drilling infrastructure in the Gulf of Mexico compared to the absence in the Atlantic.

IVAN: CATEGORY 3 AT LANDFALL ALABAMA, SEPTEMBER, 16, 2004

Hurricane Ivan made landfall near Gulf Shores, Alabama, on the morning of September 16, 2004, with maximum sustained winds of over 130 miles per hour. As it approached land, Ivan triggered a massive mudslide on the Gulf seafloor, which damaged a cluster of 25 oil wells, tangled a network of pipelines connected to the wells, and toppled an entire drilling platform in its wake.³⁴ Some of this damage occurred near a wildlife refuge.³⁵ Thirteen years later, the wreckage is still down there, leaking oil into the Gulf only ten miles off Louisiana's coast.³⁶ The company responsible for the damaged infrastructure, Taylor Energy, went bankrupt plugging nine of the wells, and is suing for taxpayer money to clean up the rest.³⁷ The company argues that there's not much else that can be done, and the site will continue to leak for the next century.³⁸ According to recent court filings, the site leaks, on average, 10,000 to 30,000 gallons per day into the ocean, resulting in a persistent oil slick that covers miles of ocean surface.³⁹ In terms of volume over time, this is one of the most devastating oil spills to occur from a hurricane to date.



WATERKEEPER ALLIANCE

A sheen from the Taylor Energy oil spill seen from above. The spill, which began when Hurricane Ivan damaged a cluster of oil wells in the Gulf, is ongoing and leaks approximately 10,000-30,000 gallons of oil into the Gulf every day.

**KATRINA AND RITA: CATEGORY 3 AT LANDFALL
LOUISIANA, AUGUST 29, 2005 AND
SEPTEMBER 24, 2005**

Hurricanes Katrina and Rita struck an area central to the oil and gas industry, back-to-back, in the span of less than one month. They inflicted \$10 billion worth of damage to energy infrastructure alone.⁴⁰ Together, they destroyed 115 oil platforms,⁴¹ damaged 558 pipelines,⁴² and spilled nearly 11 million gallons of crude oil into the Gulf.⁴³ Before the *Deepwater Horizon* tragedy, it was considered the worst oil spill disaster since the 1989 Exxon Valdez oil spill in Alaska.⁴⁴ The two largest spills resulting from the storms occurred within 10 miles of each other, in the coastal parish of Plaquemines along the Mississippi River. The first—at Bass Enterprise’s storage site—dumped 3.78 million gallons of oil into the environment. The second—at Chevron’s Empire storage terminal—spilled 1.4 million gallons.⁴⁵ Another spill—the Murphy Oil Spill—was the largest release into a metropolitan area, with about a million gallons of oil spilling into the densely populated St. Bernard Parish, after Katrina’s storm surge dislodged and lifted a storage

tank holding petroleum products.⁴⁶ The spill affected about 10,000 homes in surrounding neighborhoods.⁴⁷

While some of the toppled offshore oil platforms were recovered, others disappeared in the wake of the two storms. Several months later, a storage tanker traveling from Houston to Tampa struck one of the sunken and displaced platforms hiding below the ocean surface, spilling nearly 2 million gallons of oil slurry into the Gulf.⁴⁸

The two hurricanes also triggered an unprecedented amount of hazardous-material releases from processing and storage facilities onshore. More than 200 onshore releases of hazardous chemicals, petroleum, or natural gas were reported.⁴⁹ Storm surge was responsible for the majority of petroleum releases and failure of storage tanks was the most common mechanism of release.⁵⁰ According to one report, many air pollutants were released during emergency shut downs in preparation for the hurricanes, and start-up procedures after the hurricanes, a common practice seen during emergency planning.⁵¹



Day 18 after Hurricane Katrina, contract workers use absorbent pads to collect crude oil in a canal near Port Sulphur, Louisiana.

**IKE: CATEGORY 2 AT LANDFALL
TEXAS, SEPTEMBER 13, 2008**

Hurricane Ike made landfall in Texas as the largest Atlantic hurricane on record in size. It destroyed dozens of offshore oil platforms, spilling more than half a million gallons of crude oil into the Gulf of Mexico—enough to fill an Olympic-sized swimming pool.⁵² The storm's strong winds and considerable surge pushed these pollutants onshore, contaminating residences along the coast.⁵³ Aerial photos show extensive oil slicks on floodwaters near Galveston, Texas, and across Southern Louisiana.⁵⁴ As the storm approached, nearby refineries and petrochemical plants burned off hundreds of pounds of toxic substances as part of emergency protocol.⁵⁵ Texas Governor Rick Perry temporarily suspended all environmental rules that would prohibit such releases, and in other cases, power failures sent even more chemicals straight into the atmosphere.⁵⁶

**ISAAC: CATEGORY 1 AT LANDFALL
LOUISIANA, AUGUST 28, 2012**

Hurricane Isaac made landfall in Louisiana twice, striking Plaquemines Parish on August 28, 2012, and then Port Fourchon the following day. Substantial amounts of pollution were released into the environment as a result of the hurricane, including 340,000 gallons of oil and related chemicals and 192 tons of toxic gases from various energy production facilities.⁵⁷ Many of these chemicals were recognized neurotoxins and known carcinogens. One refinery owned by Marathon Corporation dumped 12.6 million gallons of untreated stormwater runoff into Lake Maurepas.⁵⁸

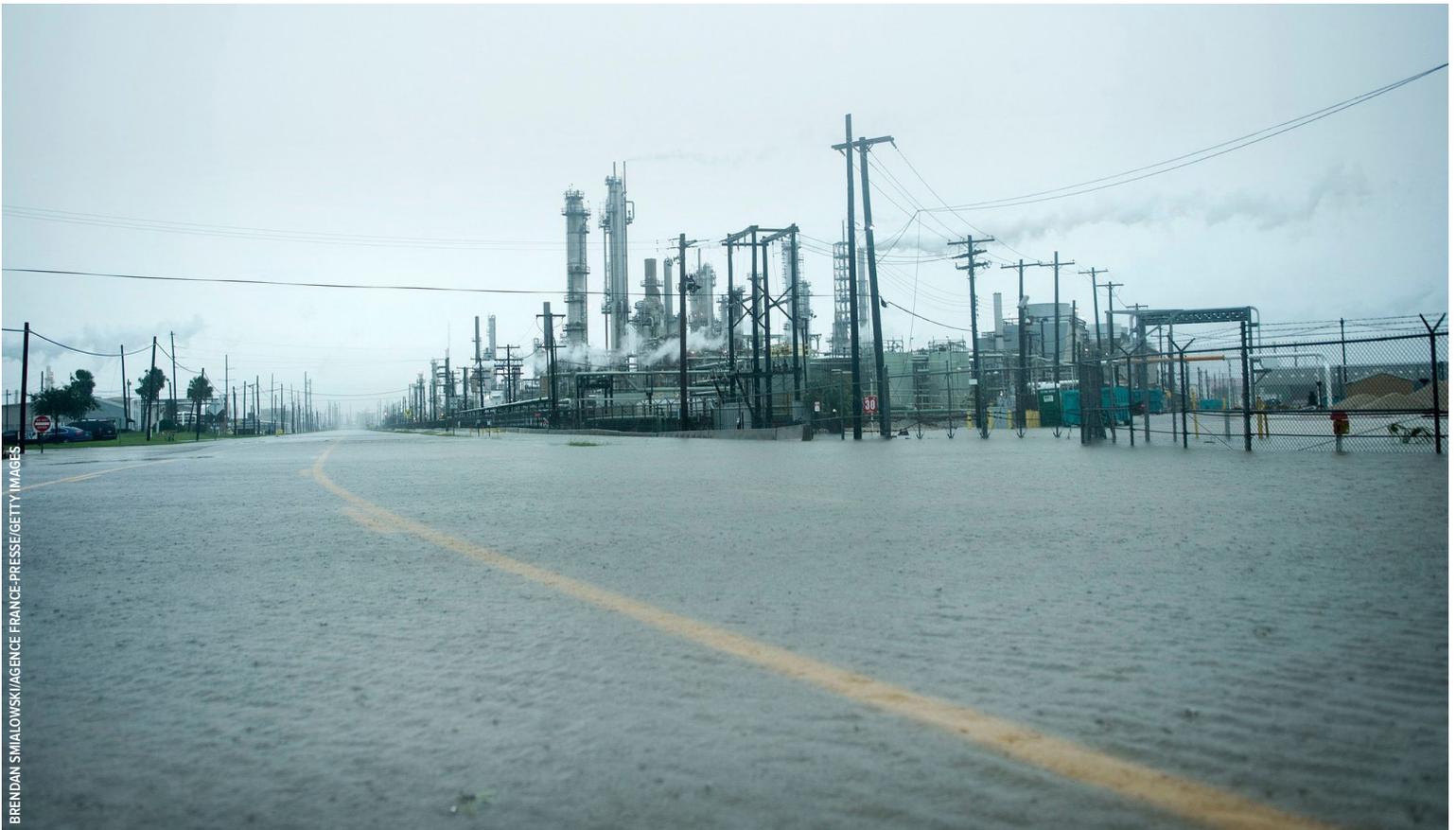
Although Hurricane Isaac was among the weakest hurricanes on record to hit Louisiana, and its rainfall and storm surge were by no means unprecedented, more than 100 pollution incidents from energy infrastructure were reported to the Coast Guard.⁵⁹ This highlighted the staggering lack of preparedness by oil and gas companies in the face of natural disaster potential. Levees built to contain contaminated water failed, allowing dangerous chemicals to enter surrounding wetlands and waterways, storm and wastewater storage capacity was insufficient, and irresponsibly placed tanker cars shifted during flooding.⁶⁰ Hurricane Isaac made it clear that oil and gas companies did not take the proper precautions necessary to safeguard their facilities.



Oil slicks caused by damage to oil drilling infrastructure off the coast of Louisiana after Hurricane Isaac.

**HARVEY: CATEGORY 4 AT LANDFALL
TEXAS, AUGUST 25, 2017**

Few can forget the overwhelming storm surge and biblical deluge Hurricane Harvey brought to Houston and the Gulf Coast of Texas. Houston is at the center of the nation's oil and gas industry and contains abundant oil and gas infrastructure. Production facilities, which are located adjacent to many socially vulnerable communities, were a large source of storm-induced pollution. The storm damaged 22 percent of all oil refineries in the area, leaking more than 2 million pounds of dangerous air pollutants into the communities and natural environment around Texas.^{61,62} Photos from the scene revealed large, jet-black plumes emitting from oil and gas waste disposal facilities.⁶³ Separately, dozens of facilities burned off excess natural gas products that had nowhere to go, because production downstream had stalled, emitting dangerous levels of nitrous oxides into the atmosphere.⁶⁴ Health problems associated with the pollution are still ongoing, and may persist for years to come.⁶⁵



Floodwaters rise at the Marathon oil refinery in Texas City, TX during Hurricane Harvey.

HURRICANE PATTERNS IN THE ATLANTIC

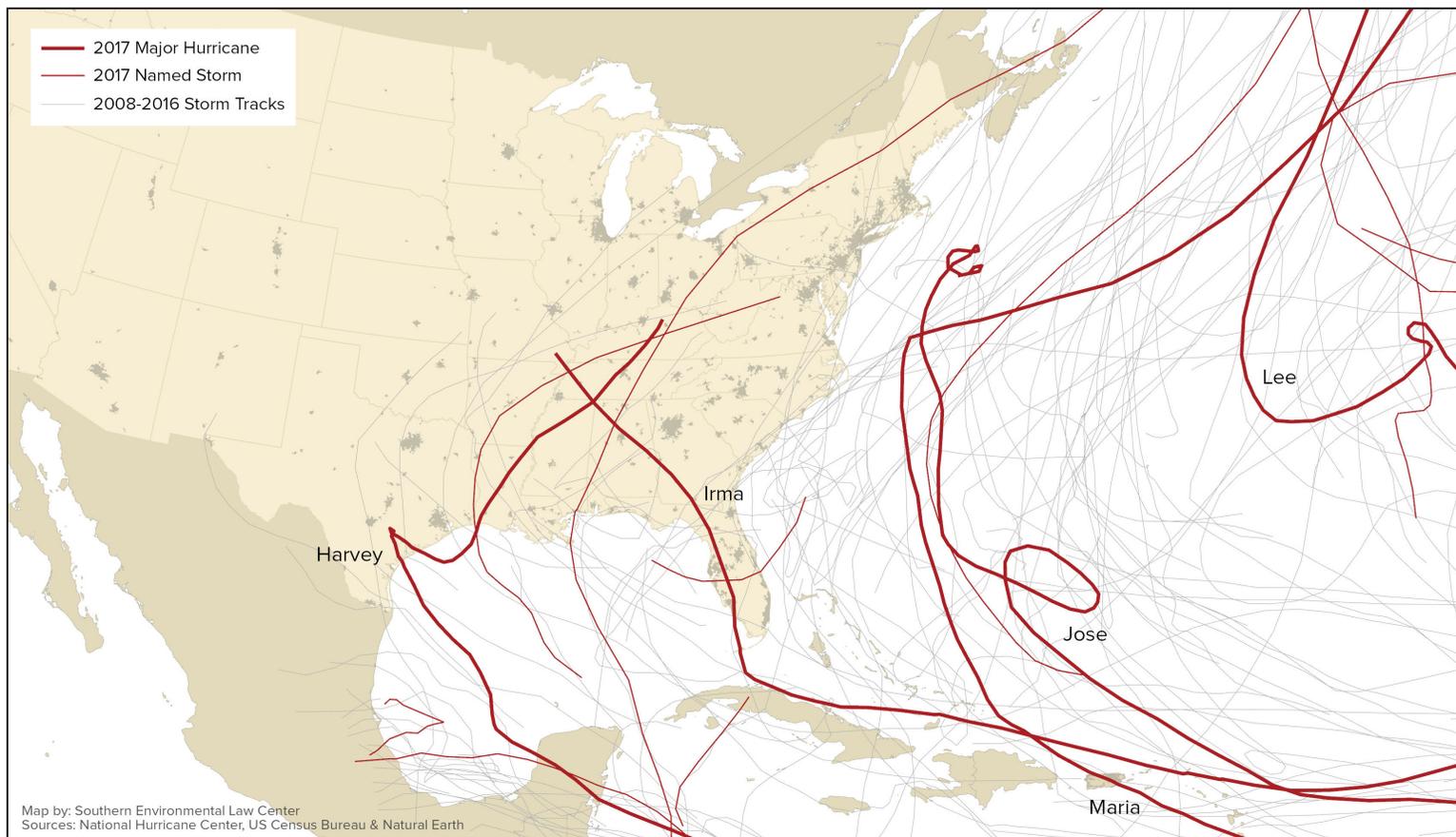
While hurricane season officially takes place from June 1 through November 30 each year, peak season in the Atlantic basin typically occurs from mid-August to mid-October.⁶⁶ The average season produces twelve named storms, of which six become hurricanes, and three become major hurricanes (Category 3 or higher).⁶⁷ North Carolina, South Carolina, and Georgia are among the five southeastern states historically hardest hit by storms in the nation.⁶⁸ Some cities are more vulnerable to storm strikes than others, due to their placement along the coast and regional currents. Eastern North Carolina, for example, is more exposed to hurricane strikes than other areas in the region.⁶⁹ The Outer Banks observes an average return period of seven years.⁷⁰

Twelve of the Atlantic's top 50 cities hit most frequently by tropical storms are located in the Southeast.⁷¹ Certain seasons are also more active than others, due to a range of environmental factors such as El Niño. Of course, even during less active seasons, it only takes one bad storm to inflict significant damage to a coastline.

The 2017 hurricane season in the Atlantic was

especially intense. The year began with an April storm for only the second time in history. Seventeen named storms subsequently formed, six of which became major hurricanes (Category 3 or higher), making 2017 the third most active hurricane season in history by that metric.⁷² While only eight Category 5 hurricanes have made landfall in the U.S. ever, two of those happened last year.⁷³ 2017 was also America's most expensive hurricane season on record, experiencing three of the top five costliest hurricanes in history.⁷⁴

When examining present-day observations, however, it is important to look beyond just the statistics of one particularly active season. Compared to historic trends, present day hurricane patterns are just as staggering. The Atlantic basin is seeing more major hurricanes (Category 3 or higher) today than it did before the 1980s.⁷⁵ Additionally, scientists have noticed that the zone in which hurricanes can survive and sustain maximum intensity is expanding poleward, and hurricane season itself has also become longer.⁷⁶



In an average year, about 12 named storms will form in the Atlantic. In 2017, 17 formed, and five of them—Harvey, Irma, Jose, Lee, Maria—became major hurricanes near the East Coast.



Atlantic Ocean fishing is a multi-billion dollar industry.

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END NOTES

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