

## SPORTS

## UH falls short in Lubbock

Texas Tech overcomes an early deficit to hand the Cougars their first loss in a 63-49 West Texas shootout. **PAGE C9**



## ZEST

## Not wasted on the way

Graham Nash talks about 50 years making music and why CSNY will never play together again. **PAGE G1**



## WEEK IN REVIEW

## Nation recalls 9/11

Americans remember 9/11 with somber tributes on the 17th anniversary of the attacks. **PAGE A24**

# HOUSTON CHRONICLE

Sunday, September 16, 2018 | HoustonChronicle.com and Chron.com | Vol. 117, No. 338 | \$4.00 ★★

Chance of storms: High 93, Low 75

## Women seek to regain power

Candidates hope to reverse 20-year slump in Texas

By **Andrea Zelinski**  
STAFF WRITER

AUSTIN — In 1990, women ruled Texas. Half of the state's biggest cities were run by female mayors. Straight-shooting Ann Richards commandeered the governor's office. And the number of women in the Legislature began to climb to an all-time high.

The nation took notice as women in charge in Houston, San Antonio and Dallas laid the groundwork for other female politicians, predicting that scores more would be catapulted into office.

"We all expected that to continue, and, surprisingly, that hasn't continued," said Congresswoman Kay Granger, who in 1991 was the first woman elected mayor in Fort Worth.

Today, only one woman serves in statewide office.

Just one major Texas city has a woman at the helm.

And the number of women sent to Washington, D.C., and Austin to represent Texans has hit a 15-year low.

That all could change in November. This year, 105 Texas women are in the final sprint for elected office. If successful, they could reclaim their largest share of political power since 2008, when 50 elected women served in state government and Congress.

Pundits have branded 2018 as the "year of the woman." Hot off the divisive 2016 presidential election, perhaps kindled by the #metoo movement's backlash against men who misuse their power, women across the country are opting to run for election in record numbers.

Here, they include MJ Hegar, a decorated Air Force pilot from Central Texas running for Congress

**Women continues on A16**

## ICE raid illuminates a fractured America



Marie D. De Jesús / Staff photographer

**Miguel Oliva, 63, was among those detained by immigration authorities on Aug. 28. He doesn't know if he'll be able to stay with his family in Texas and worries about his son, who has special needs.**

## After 159 workers are detained near Paris, residents find themselves on opposite sides of the immigration debate

By **Emily Foxhall**  
STAFF WRITER

PARIS — When he heard the helicopter, Juan Esquivel was halfway through his 6 a.m. shift at Load Trail, a northeast Texas trailer manufacturer. Maybe someone needed a medical evacuation, he thought.

But it was federal agents, swarming the property near the city of Paris that morning on Aug. 28. They rounded up 159 employees who they believed immigrated here illegally, including Esquivel, who is 39 and has lived in the United States for 23 years.

The event was big news in the area, where voters overwhelmingly supported President Donald Trump. Some found themselves grappling with the personal consequences of hard-line immigration policies on their neighbors. Others continued with life as usual, standing strong in their views that deportation is deserved for people who come here illegally.

The aftermath of the raid, which officials said was one of the largest workplace raids in the last decade,



**Immigration and Customs Enforcement raided Load Trail, which manufactures trailers in Sumner, near Paris.**

continues to reverberate here and in the nearby communities where many of the workers live, illustrating the stark divisions within the country's immigration policy and Trump's zero-tolerance enforce-

ment of the law.

The 147 men and 12 women detained are now enmeshed in immigration proceedings that may permanently alter their lives. As they wait, their suffering has been largely private, with some relatives afraid to leave their homes. Criminal charges are expected in the case against the company, founded by an immigrant. At least one person detained is already being deported.

Esquivel came to the United States from Mexico on a visa and never left. He made more money here than he believed he could back home. He returned after each shift to his wife and two daughters in a quaint nearby town called Honey Grove.

"We came to do one thing, and that's work," Esquivel said. "We were in Honey Grove. Nothing can go wrong."

At 10:27 that morning, Esquivel sent a text message in Spanish to his wife: *Immigration is here.*

She was at home making tostadas, expecting him to return that afternoon.

**Raid continues on A17**

## Deadly Florence pours on the rain

Hundreds rescued, thousands told to leave as rivers rise

By **Allen G. Breed**  
ASSOCIATED PRESS

NEW BERN, N.C. — The Marines, the Coast Guard, civilian crews and volunteers used helicopters, boats and heavy-duty vehicles Saturday to rescue hundreds of people trapped by Florence's shoreline onslaught, even as North Carolina braced for what could be the next stage of the disaster: widespread, catastrophic flooding inland.

The death toll from the hurricane-turned-tropical storm climbed to 11.

A day after blowing ashore with 90-mph winds, Florence practically parked itself over land all day long and poured on the rain. With rivers rising toward record levels, thousands of people were ordered to evacuate for fear the next few days could bring the most destructive round of flooding in North Carolina history.

More than 2 feet of rain had fallen in places, and the drenching went on and on, with forecasters saying there could be an additional 1½ feet by the end of the weekend.

"I cannot overstate it: Floodwaters are rising, and if you aren't watching for them, you are risking your life," Gov. Roy Cooper said.

As of 8 p.m., Florence was centered about 65 miles east-southeast of Columbia, the South Carolina capital, crawling west at 2 mph — not even as fast as a person walking. Its winds were down to 45 mph. But with half of the storm still out over the Atlantic, Florence continued to collect warm ocean water

**Florence continues on A38**

### In City | State

» Galveston "a better place" 10 years after Ike. **Page A3**

## How a molecule changed the Gulf Coast — and the world

Ethane flowing from shale fields is triggering a petrochemical boom that's reshaping markets

### First in a series

By **Jordan Blum**  
STAFF WRITER

SAN AUGUSTINE — Working in nearly 100-degree heat, sweating through mud-stained coveralls, four roustabouts wrestled with 30-

foot sections of pipe that would follow a drill bit plunging some 13,000 feet into the earth, then turning nearly 90 degrees to chew through another 10,000 feet.

Over the next few weeks, the well would be drilled, fracked and completed, freeing molecules of hydrogen and carbon that would

rush through fissures in the dense shale rock and flow through the well as natural gas. But accompanying the natural gas particles was another, more complex molecule, containing two atoms of carbon each attached to three atoms of hydrogen.

That molecule, described chemically as C2H6, is transforming the Gulf Coast economy and reshaping global markets, from E-

**Ethane continues on A12**



Elizabeth Conley / Staff photographer

**A contractor works at a drilling rig in the Haynesville shale in East Texas. The well is operated by XTO Energy, a subsidiary of Exxon Mobil.**

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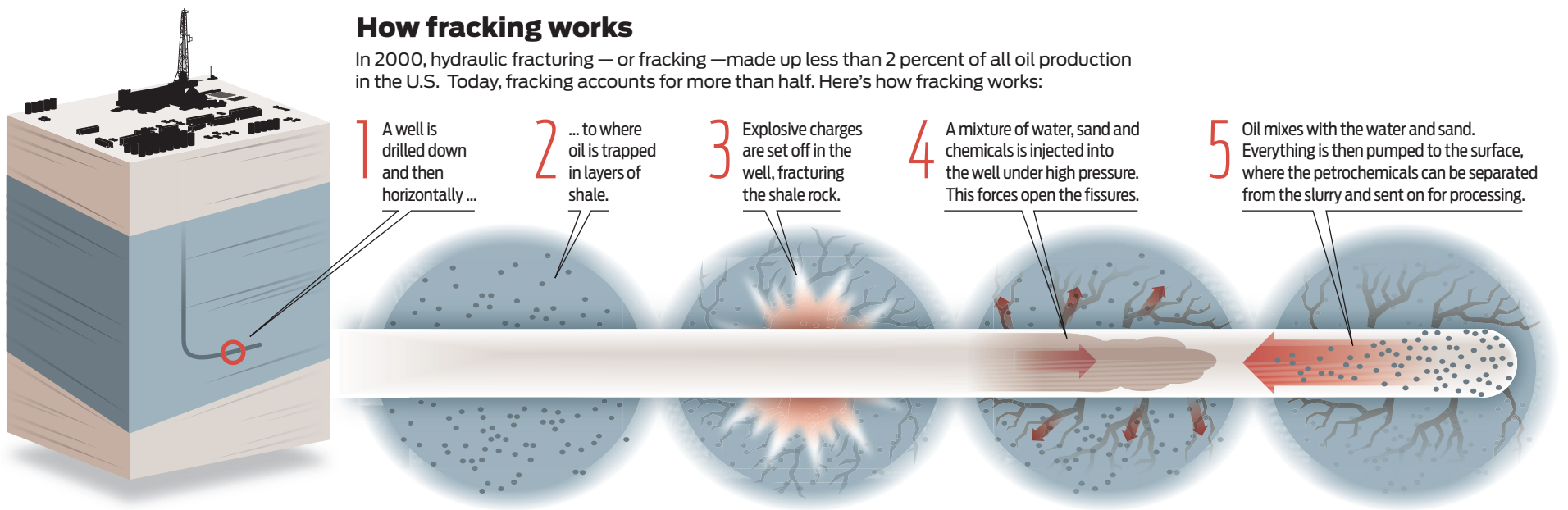
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**FROM THE COVER**

**How fracking works**

In 2000, hydraulic fracturing — or fracking — made up less than 2 percent of all oil production in the U.S. Today, fracking accounts for more than half. Here's how fracking works:



Sources: U.S. Energy Information Administration, Reuters, National Geographic, CNN, Ecotricity

Charles Appe/Houston Chronicle

**ETHANE**

From page A12

migrant and founder of The Woodlands. Mitchell, after striking it rich in oil, spent 35 years stubbornly focused on developing the Barnett Shale near Dallas, a play known once the “Wildcatters Graveyard.”

Mitchell, however, persisted, eventually combining hydraulic fracturing with horizontal drilling to unlock the complex shale rock. Mitchell didn't frack his first profitable well until 1998, but with that success, he sold his company four years later for more than \$3 billion to Devon Energy of Oklahoma City.

The shale boom was soon underway, producing oil and gas from Texas to North Dakota and the Northeast. It placed the United States among the world's biggest energy producers, roiling global markets and upending more than 40 years of geopolitics.

And along with oil and gas came large volumes of another petroleum product known as natural gas liquids.

Three primary components can come out of any successful well: crude oil, natural gas, which is essentially methane, and natural gas liquids, primarily ethane, butane and propane. Ethane is the most prevalent natural gas liquid, or NGL, and used solely as a feedstock for petrochemicals.

In oil-rich areas such as the Permian, the NGLs flow out of wells as liquids in the stream of crude. In shale plays containing

mostly natural gas, such as the Haynesville, ethane comes out as a gas, which is later separated from the methane.

At the fracking site, Tucker Energy Services of McAlester, Okla., led the operations for XTO. Workers, dragging heavy cables and chains, wore closed-channel headsets so they could hear each other, even from a few feet away, over the roar of the truck engines and other equipment.

Nick Cregan, a fracking field engineer with Tucker, was cooling off in the operations trailer as he prepared for the next fracking stage, the section of well that would get pounded by the high-pressure water, sand and chemical slurry.

Cregan travels here from his home in Oklahoma, nearly 300 miles away. He works two weeks on, one week off, spending too many nights in San Augustine hotel rooms while leaving his wife and four children behind. But the money is too good to pass up.

“It can be challenging and it's tough work,” Cregan said. “There's a lot of family time you miss out on. It's hardly ever in your backyard.”

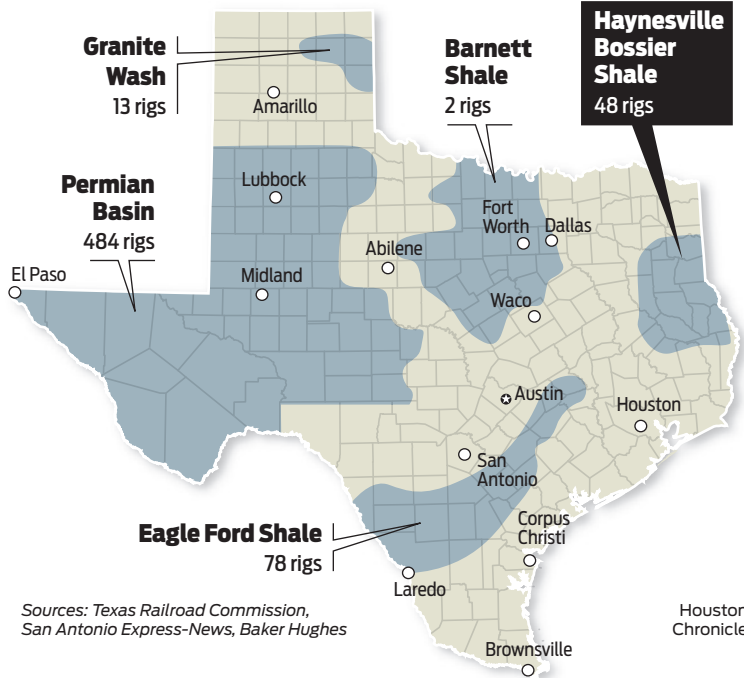
**Beginning with a bang**

Fracking begins with a bang — literally. Small explosive charges are lowered into the well, beginning at a depth of 200 feet, and detonated to create the initial fractures in the steel casing and shale rock. Next, the mixture of water, chemicals and sand are pumped into the well at a rate of 4,500 gal-

**Texas' major oil and gas basins**

As Texas goes, so does the nation when it comes to oil and gas production. And that's increasingly true with the emergence of shale as regions like West Texas' Permian Basin, South Texas' Eagle Ford shale and East Texas' Haynesville shale have boomed like never before in the past decade. And the Barnett shale, in particular, is where the modern horizontal drilling and hydraulic fracturing techniques were combined and popularized. Easily led by the Permian, Texas is currently home to more than half of the nation's active oil and gas drilling rigs.

ACTIVE DRILLING RIGS AS OF LAST WEEK



Sources: Texas Railroad Commission, San Antonio Express-News, Baker Hughes

Fracking crews targeted 52 stages, each a 130-foot section of the well.

The fracking proceeded with the efficiency of a factory. The sand went into a mixer where it was combined with water. Fracking chemicals were added to help lubricate the well and improve the flow of the slurry and the resulting production.

The pumping trucks then forced the mixture into the well and through perforations created by the explosions, shattering the shale rock and releasing the gas. “It's like an assembly line — the water, sand, pressure pumps and the well,” said Buddy Davis, the Tucker Energy Services manager overseeing the site.

The Fighting Camels well began producing two months later, the Eagles well three months after that. Some of the gas flowed into pipelines that fed into Exxon Mobil's English Bay pipeline system. Along the way, a processing facility separated the gas, essentially methane, from the natural gas liquids.

From there, the stream of natural gas liquids was piped to Mont Belvieu, about 35 miles east of Houston, where the ethane was separated from any other natural gas liquids. But it wasn't the final destination for these hydrocarbon molecules.

It's just the beginning of a transformation that is changing the flow of international commerce.

[jordan.blum@chron.com](mailto:jordan.blum@chron.com)  
[twitter.com/jdblum23](https://twitter.com/jdblum23)

lons a minute.

The sand, known in the industry as proppant, keeps the tiny fissures open; the chemicals help oil and gas to flow more easily from shale reservoirs.

The first wells fracked in the Haynesville shale consumed about

2 million gallons of water and 2 million pounds of sand. They were fracked in fewer than 10 sections, or stages.

The Fighting Camels well consumed 22 million gallons of water, most from privately owned ponds, and 16 million pounds of sand.

**FACULTY POSITION  
NATURAL GAS ENGINEERING**

The University of Oklahoma Mewbourne School of Petroleum & Geological Engineering is seeking faculty candidates with expertise or specialization in natural gas engineering.

A degree in petroleum or chemical engineering is required, with at least fifteen years industry experience. Expertise is sought in areas of natural gas engineering, with experience or ability to teach and develop graduate courses. Natural gas engineering could be in any area of natural gas from upstream to downstream - power generations, industrial and chemical application, transportation, storage, LNG, utilizations in petrochemical projects, financing and management. The successful candidate will be responsible for expanding the current online offering of Natural Gas Engineering and Management graduate degree, certificate programs and teach graduate level courses.

The school offers MS in Natural Gas Engineering and Management both on campus and online, and the online Natural Gas Technology Certificate. The school maintains an excellent relationship with industry and has very strong support from its Alumni.

Interested candidates should submit cover letter, resume, references, to <http://apply.interfolio.com/44156>. For additional questions contact Sonya Grant at [sdgrant@ou.edu](mailto:sdgrant@ou.edu).

The city of Norman, conveniently located near Oklahoma City, is a diverse and welcoming community. It is ranked as one of the Best Places to Live by Money Magazine, the third Most Affordable City in the U.S. by Kiplinger, and the Norman Public School system is recognized for producing the most National Merit finalists for the state. Norman offers all the amenities of big city living with the charm of a small town.



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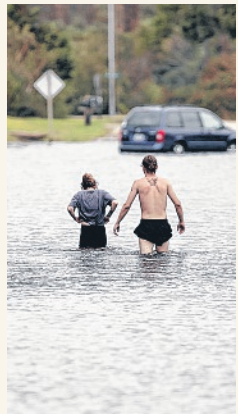
# HOUSTON CHRONICLE

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Partly cloudy: High 94, Low 76

## NATION Florence continues to wreak havoc

North Carolina confronts a spiraling statewide crisis as Tropical Depression Florence slowly ravages the region, flooding cities, endangering communities and requiring well more than 1,000 rescues. **PAGE A10**



Robert Willett / TNS

**Newport, N.C., residents wade through high waters on Sunday.**

## CITY | STATE Mormon church punishes former area bishop

The Church of Jesus Christ of Latter-day Saints has excommunicated Sugar Land's Sam Young, an ex-bishop and activist calling for the end of private meetings between bishops and teens where sexually explicit questions are asked. **PAGE A3**

## HEALTH Study: Aspirin doesn't benefit healthy seniors

A study of 19,000 people finds that seniors who took low-dose aspirin did not reduce their risks of cardiovascular disease, dementia or disability. **PAGE A10**

## NEWSMAKERS Can a Netflix film win Oscar for best picture?

"Roma" is receiving a lot of acclaim, but will Hollywood reward Netflix, which has a policy of avoiding theaters in favor of its own streaming service? **PAGE A2**

## STAR Millennials are killing off cultural norms

Various reports are painting millennials as a generation of cultural assassins, doing away with norms like the corporate dress code to icons like the Big Mac. **PAGE A2**



Getty Images

# A 'GAME CHANGER' FOR ALS PATIENTS?



Photos by Elizabeth Conley / Staff photographer

Sharon and Larry Bradley meet with Dr. Stanley Appel at the Houston Methodist ALS Clinic.

By **Todd Ackerman**  
 STAFF WRITER

Sharon Bradley got the jitters on the drive from Pearland to the hospital where her husband was scheduled to receive an experimental treatment never before tried on an ALS patient.

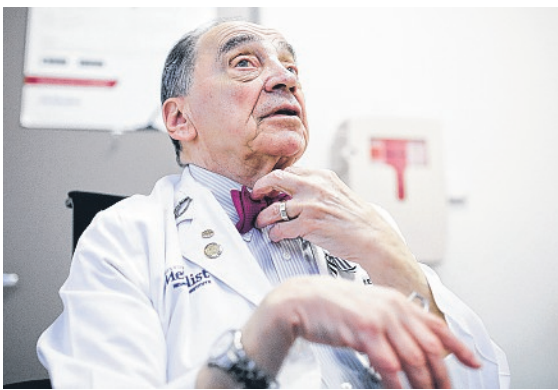
The couple hoped the immunotherapy would buy Larry time in his battle against amyotrophic lateral sclerosis, the terminal neurodegenerative disorder that traps patients in an increasingly paralyzed body. But they also knew something could go wrong in a new therapy tested only in mice, that it could hasten the disease's development rather than slow it.

One patient initially interested in the treatment got cold feet.

"Are you sure you're game?" Sharon asked.

"No matter what, we

Renowned doctor at Methodist is testing immunotherapy in hopes of slowing degenerative disorder



**Appel, a legendary figure in ALS research and care, is conducting a trial to see if infusions of immune cells will help his patients.**

don't have a lot of time," Larry, unperturbed, told his wife. "I want to try this for myself. But at the end of the day, if it doesn't make a difference for me, maybe it'll make a difference for someone else."

Researchers haven't had much luck devising treatment to make a difference in the lives of ALS patients, who on average die three to five years after diagnosis. Now Dr. Stanley Appel, a Houston Methodist Hospital doc-

tor who's considered a world leader in the field, is hoping he's unlocked an answer.

Appel's approach, funded by an Ice Bucket Challenge grant, involves injecting patients with their own immune cells, cells that had become dysfunctional in the body but were normalized and expanded in the laboratory after their removal. The idea is that again functioning properly in the body, the cells will help prevent the deterioration that characterizes ALS.

If clinical trials confirm the approach works, Appel thinks it might provide chronic treatment, much like insulin for diabetics.

ALS, also known as Lou Gehrig's disease, is one of medicine's most devastating disorders, an attack on nerve cells in **ALS continues on A6**

## High court bid in turmoil

After accuser comes forward, Dems urge delay in Kavanaugh vote

By **Sheryl Gay Stolberg**  
 NEW YORK TIMES

WASHINGTON — President Donald Trump's bid to confirm Judge Brett M. Kavanaugh to the Supreme Court was thrown into uncertainty on Sunday as a woman came forward with explosive allegations that Kavanaugh sexually assaulted her when they were teenagers more than three decades ago.

The woman, Christine Blasey Ford, 51, a research psychologist at Palo Alto University in Northern California, said in an interview with the Washington Post that during a high school party in the early 1980s, a drunken Kavanaugh pinned her on a bed, groped her and covered her mouth to keep her from screaming.

"I thought he might inadvertently kill me," the newspaper quoted her as saying. "He was trying to attack me and remove my clothing."

Kavanaugh has denied the accusations, and in a terse statement on Sunday, the White House stood by those denials. It signaled that it had no intention of pulling the nomination.

But Ford's decision to put her name behind accusations that began to circulate late last week — a choice made after weeks of reluctance — appeared to open a door to a delay in a Senate committee vote **Accuser continues on A9**

# To protect Gulf coral, disinfect before diving

Officials seek to prevent the spread of mysterious disease damaging reefs

By **Alex Stuckey**  
 STAFF WRITER

The dead husks of coral colonies first were spotted off the coast of Miami, Fla., in 2014. Their once-vibrant hues now the brownish color characteristic of dead

leaves.

At first, researchers weren't sure what they were seeing. But then, the disease began racing up and down the coastline with unprecedented speed, leaving millions of dead coral colonies in its wake.

It's been four years, but scientists still don't know what caused the disease or how to stop it. Concerned that it might be contagious, Texas officials now are asking divers to disinfect before splashing into the Gulf of Mexico, where 56 square miles of coral are federally protected from overfishing and harassment but not from a disease with no

**"There's a high concern it could be transmitted by divers on their equipment."**

G.P. Schmahl, Flower Garden Banks National Marine Sanctuary

name or known origin.

"There's a high concern that it could be transmitted by divers on their equipment," said G.P. Schmahl, superintendent of the Flower Garden Banks National Marine Sanctuary located about 100 miles off the coast of Galveston.

Though there haven't been any traces of the disease **Coral continues on A9**

# In petrochemical boom, 'all roads lead to Baytown'

Natural gas liquids from shale fields processed, transformed into plastics

**Second in a series**

By **Jordan Blum**  
 STAFF WRITER

MONT BELVIEU — They say geography is destiny, but in this small city east of Houston, the force shaping its history, economy and future is geology.

Mont Belvieu is built atop

a salt dome formed more than 100 million years ago from deposits likely left by an ancient inland sea that cut across the North American continent. For more than 60 years, energy companies have used it as a natural storage tank, carving out salt caverns some 3,000 feet deep to hold millions of barrels of petro-

leum products.

Today, those caverns are increasingly filled with ethane and other natural gas liquids that feed the plastics and chemical industries, making Mont Belvieu and its neighbor to the south, Baytown, the focal point of the Gulf Coast petrochemical boom. Here, where rice fields once stretched as far as the eye could see, Exxon Mobil alone has invested some \$6 billion to dramat- **Baytown continues on A8**



Elizabeth Conley / Staff photographer

**Exxon Mobil has expanded its complex in Baytown, where it can produce about 9 billion pounds of petrochemicals a year.**

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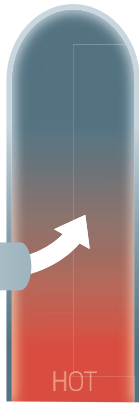


**FROM THE COVER**

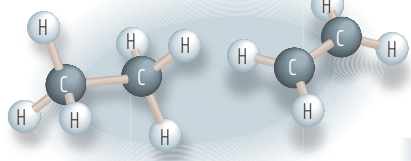
**From ethane gas to plastic pellets**

The ethane gas produced by shale fracking can be turned into the raw ingredients for making plastics via a process called cracking. Here's how that works:

**1** Ethane gas is fed into a furnace where it's heated to more than 1,500 degrees.



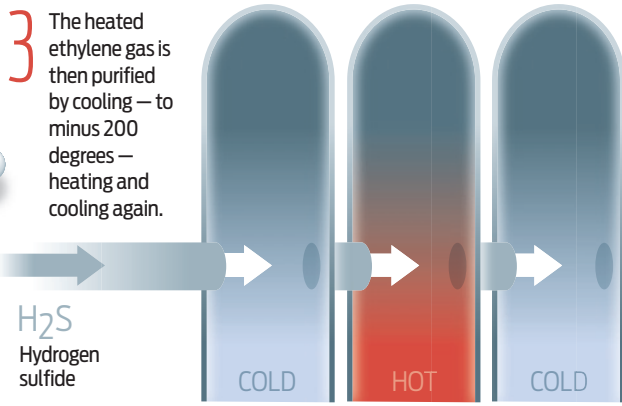
**2** The ethane is broken down into smaller molecules...



By products also created: **C<sub>3</sub>H<sub>6</sub>** Propylene, **CO<sub>2</sub>** Carbon dioxide

...and recombines into **ethylene**.

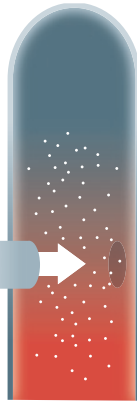
**3** The heated ethylene gas is then purified by cooling — to minus 200 degrees — heating and cooling again.



The result: **99.95 percent** pure ethylene.

This ethylene is piped back to Mont Belvieu. Some will go into storage but most will go through yet another process to turn it into **polyethylene**.

**4** Ethylene is fed into a chemical reactor where it is mixed with a catalyst made of silica, alumina and other chemicals.



The catalyst causes a chemical reaction that fuses trillions of molecules of ethylene into polyethylene.

**5** Polyethylene comes out of the reactor in the form of a fine powder, similar to laundry powder. This is sent to a purging tower where nitrogen and steam remove stray molecules.



**6** The powder is then poured into an extruder, where it is melted, compressed and then squeezed into dough-like strands. Each extruder can push out 200,000 pounds of polyethylene an hour.

**7** As the strands come through the extruder, they are sliced by a large spinning blade into semi-transparent pellets. The pellets are spun dry in a centerfuge and then loaded for shipping.

**8** Polyethylene pellets aimed at the domestic market are loaded into railroad cars. Each can hold up to 200,000 pounds of pellets.



Pellets for export are poured into 55-pound bags. Each bag can hold about a million pellets.



**BAYTOWN**

From page A1

ically expand its 36-year-old plastics plant as well as its sprawling refining and chemicals complex in Baytown.

At these plants, the ethane molecules that squeezed through fissures in shale rock, flowed up a Texas well and traveled more than 150 miles by pipeline will undergo chemical changes to transform them from once-overlooked byproducts of oil and gas drilling into one of most ubiquitous materials on earth. Hundreds of other pipelines stretching across Texas and beyond will carry millions more barrels of natural gas liquids from U.S. shale fields, converging near the salt dome under Mont Belvieu's Barbers Hill.

said Kim Haas, Exxon Mobil's operations manager, "and specifically the Baytown area."

**Hydrogen meets carbon**

Barbers Hill rises 85 feet above sea level, a mile-wide distortion in an otherwise flat landscape. First settled more than 175 years ago and named for an early rancher, Amos Barber, the area began attracting oilmen after another salt dome called Spindletop began gushing crude in 1901.

The first successful Barbers Hill oil well was drilled in 1916, and annual production peaked at more than 8 million barrels in 1931. About 25 years later, Barbers Hill got a second life when Warren Petroleum, a Tulsa company now part of Chevron, starting drilling caverns to store petroleum products.

The community, however, was jolted in 1985 by fires



Elizabeth Conley / Staff photographer

**Exxon Mobil employees in a control room for one of the massive ethane crackers in Baytown keep an eye on the process that transforms ethane into ethylene.**

on Barbers Hill that killed two Warren workers, forced the evacuation of Mont Belvieu's 2,000 residents, and led the city to

distribute letters to newcomers warning of the "serious danger and possible death" that came with living there. The population fell to about 1,300 by 1990.

But with improved safety, the recent petrochemical boom has revived the community, whose population has more than doubled since 2000 to about 6,000 residents. Today, Barbers Hill sits atop roughly 150 caverns potentially holding some 300 million barrels of petroleum products.

This is the next stop for the natural gas liquids produced by Exxon's subsidiary XTO Energy. Here, processing plants known as fractionators use varying pressures and temperatures to break the natural gas liquids into components, each with a slightly different combination of carbon and hydrogen, including butane (C<sub>4</sub>H<sub>10</sub>), propane (C<sub>3</sub>H<sub>8</sub>), pentane (C<sub>5</sub>H<sub>12</sub>) and, of course, ethane (C<sub>2</sub>H<sub>6</sub>).

The ethane is piped 10 miles to Exxon Mobil's Baytown complex, which is simultaneously one of the nation's oldest and most modern plants. The refinery was built nearly a century ago by one of Exxon Mobil's predecessor companies, Humble Oil. A chemical plant was added in 1979 and expanded in 1997.

Four year ago, Exxon Mobil launched another Baytown expansion, which, with the associated expansion of the sister

plant in Mont Belvieu, is the company's biggest U.S. industrial investment since Exxon and Mobil merged 20 years ago. The projects vastly increase Exxon Mobil's capacity to process ethane into ethylene, the basic chemical building block of most plastics, and then into the most common plastic, polyethylene.

At the peak of construction, nearly 6,000 people worked at the two sites. The expanded Baytown facility, which began operations in late July, can produce about 9 billion pounds of petrochemicals a year, including 3.3 billion additional pounds of ethylene.

The focus of the Baytown expansion was eight furnaces, each costing more than \$100 million and standing 23 stories tall — nearly the height of NRG Stadium. The furnaces, built in Thailand, are the heart of a plant known as a cracker, which gets its name from the process that uses extreme heat to crack ethane molecules in half and trigger chemical reactions that form ethylene.

Kevin Campbell keeps track of much of the process in his job as a hot ends coordinator, monitoring the operations and safety of the furnaces — the "hot end" of the cracking process. These control room jobs can easily pay \$70,000 a year.

Exxon Mobil runs four overlapping 12-hour shifts, the first beginning at 4 a.m.

Campbell, who works an early shift, sits in a control room, darkened to make it easier to see his console, where he's observing digital images and the constant flow of data to track furnace operations.

He and his colleagues compare the job to flying an airplane, mostly uneventful, but requiring strict oversight and cool, rapid decision-making when needed.

"Right now it's calm," Campbell said. "But it's not boring. It's very exciting."

**99.9 percent pure**

The ethane enters the Baytown plant as a gas, fed by pipeline into a furnace, where it's injected with steam and heated to more than 1,500 degrees Fahrenheit — hot enough to melt gold and silver.

In less than a half-second, the process breaks the ethane molecules, which contain two carbon and six hydrogen atoms, into two radicals each containing one atom of carbon and three of hydrogen. That frees the carbon and hydrogen atoms to recombine, forming ethylene, made of two atoms of carbon and four of hydrogen (C<sub>2</sub>H<sub>4</sub>), as well as byproducts such as propylene (C<sub>3</sub>H<sub>6</sub>), carbon dioxide (CO<sub>2</sub>) and hydrogen sulfide (H<sub>2</sub>S).

The heated gas then moves through a series of towers, where it is cooled, reheated, pressurized and cooled again — to minus-200 degrees — to remove byproducts and impurities. Finally, the ethylene is funneled through a 355-foot tower known as a splitter, where any remaining ethane is removed and recycled.

The result: 99.95 percent pure ethylene.

The ethylene is piped back to Mont Belvieu, where some will be stored in the salt caverns, but most will feed another process that will change the hydrocarbons liberated from Texas shale once again.

Where the Baytown complex used heat and pressure to crack ethane into ethylene, Exxon Mobil's Mont Belvieu plant relies on chemical reactions to fuse trillions of ethylene

*Baytown continues on A9*



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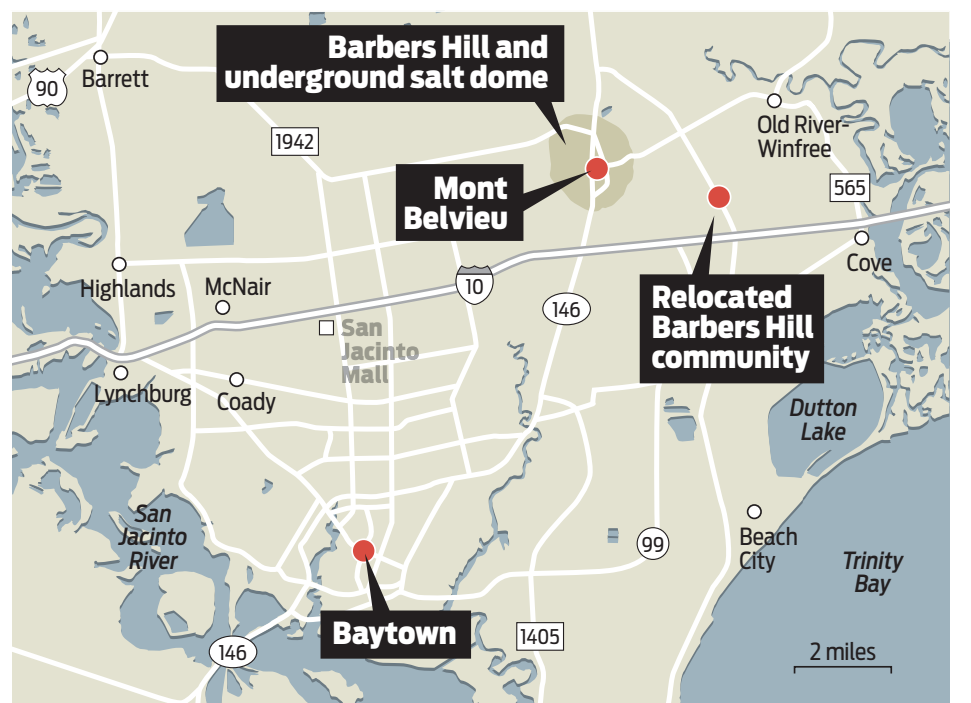
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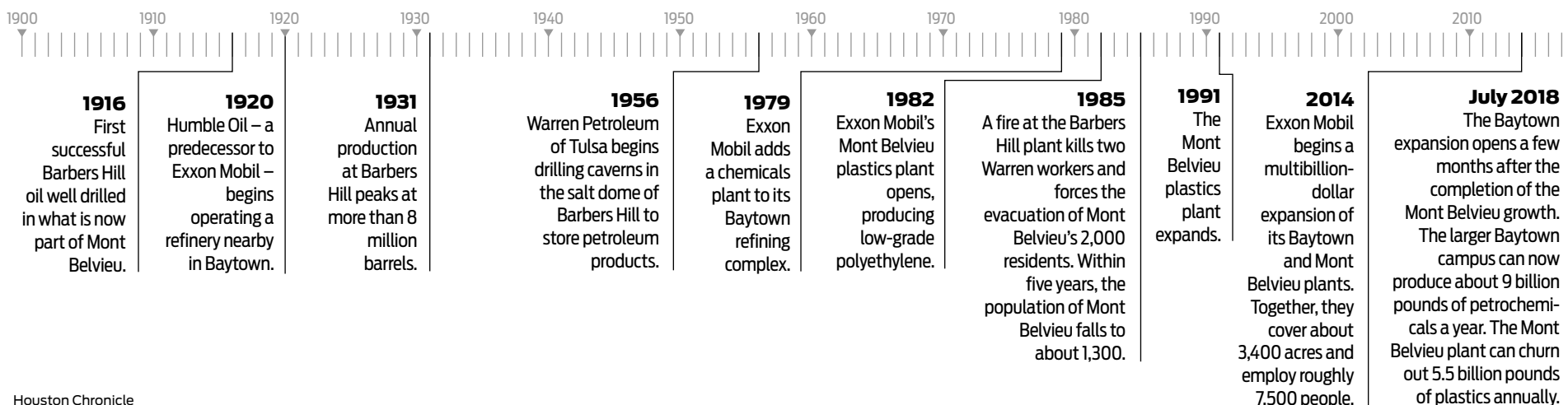




**FROM THE COVER**

**A brief, 102-year history of Barbers Hill and Baytown**

Mont Belvieu is now the natural gas liquids capital of the world thanks to its massive complex of underground storage and petrochemicals and plastics manufacturing. But it all started with efforts to drill oil in salt domes similar to the groundbreaking Spindletop discovery.



**BAYTOWN**

From page A8

molecules into polyethylene.

The process begins in a chemical reactor, a tall cylindrical tower that's fed ethylene by pipelines at least 10 inches in diameter. The reactor operates like a blender, mixing ethylene with a catalyst made from silica, alumina and proprietary materials that Exxon Mobil won't disclose.

The catalyst, a fine powder that feels like dust, sparks a chemical reaction that fuses the ethylene molecules together. By mixing different catalysts from specific materials, manufacturers can produce different grades of plastic with varying levels of strength and flexibility.

The Mont Belvieu plant opened in 1982, producing mainly low-grade, flexible polyethylene used in plastic wrap and food packaging, and expanded nine

years later to produce plastic for more rigid products, such as milk bottles. The most recent expansion, completed late last year, is dedicated to high-performance polyethylene that is light, flexible and strong.

Paul Fritsch is the plant manager. A chemical engineer by training, he has worked with Exxon for nearly three decades, overseeing expansions as far away as Singapore. He can touch almost any plastic in a supermarket and identify the type of polyethylene.

"When I go grocery shopping," he said, "I pick up the packaging and look to see if it's one of our customers."

**Made in America**

Polyethylene comes out of the chemical reactors as a powder, similar to laundry detergent. It's fed into a purging tower where nitrogen and steam remove any residual ethylene and hydrocarbons that didn't properly bond.

The powder is then transported to hoppers that funnel the material to an extruder, which melts the plastic, compresses it and pushes out dough-like strands of polyethylene, much like a pasta maker. Each extruder can churn out 200,000 pounds of polyethylene an hour.

As the strands come through the extruder, they are sliced by a large spinning blade into semi-translucent pellets. The pellets go into a centrifuge, where they are cooled by water, then spun dry, much as a salad spinner pulls moisture from lettuce leaves.

After quality testing, the plastic is loaded into as many as 35 railcars, each holding about 200,000 pounds of polyethylene pellets, and shipped throughout the country to customers who shape the polyethylene pellets into finished plastics products. About 40 percent of the polyethylene is made for the domestic market.

Polyethylene pellets marked for export are mechanically packaged in 55-pound bags, each holding about 1 million pellets. Every hour, the plant fills about 10,000 bags, which are loaded onto pallets, each holding 55 bags, and trucked to a 70-acre storage yard. As many as 100,000 pallets are kept for up to 45 days until they can be loaded into containers and shipped out of the Port of Houston.

"Our production is 24 hours a day," Fritsch explained, "but the Port of Houston isn't open 24-7."

With the expansions completed, Exxon Mobil's Mont Belvieu and Baytown campuses together cover about 3,400 acres, the equivalent of three Houston downtowns. The Mont Belvieu plant, which has doubled its polyethylene output to 5.5 billion pounds a year, is now the second-largest plastics plant in the world, after the Borogue complex in Abu Dhabi.

The Baytown and Mount Belvieu plants together employ 7,500 people, and Exxon Mobil estimates that the number doubles to 15,000 when counting contractors and jobs at local suppliers, restaurants and other businesses that support the plant. Exxon pays more than \$150 million a year in local taxes and fees.

The plants also have contributed to a surge in exports that has made Houston one of few regions in the country that exports more than it imports. That brings new money into the area – tens of billions of dollars that can be used to expand business, hire workers and increase wealth.

"We're going to have things that are made in America again and getting shipped overseas," Fritsch said. "That's what's exciting about shale gas. It's the explosion of industry again in the U.S."

*jordan.blum@chron.com*  
*twitter.com/jdblum23*

**ACCUSER**

From page A1



**Supreme Court nominee Brett Kavanaugh has flatly denied accusations of an assault decades ago.**

on the nomination scheduled for Thursday. The disclosure also injected a volatile #MeToo element into the confirmation debate, one that is playing out in the overwhelmingly male Republican-led Senate during a midterm election that has energized Democratic women.

One Republican on the Senate Judiciary Committee, Sen. Jeff Flake of Arizona, told Politico that he was "not comfortable voting yes" on the nomination until he learned more about Ford's account. A single Republican objection on the committee, which has 11 Republicans and 10 Democrats, could force a delay.

Another Republican on the panel, Sen. Lindsey Graham of South Carolina, said on Twitter that "if Ms. Ford wishes to provide information to the committee, I would gladly listen to what she has to say and compare that against all other information we have received about Judge Kavanaugh." But he said he hoped to keep the process on schedule.

Sen. Bob Corker, R-Tenn., made a similar statement to Politico.

Ford's account comes as Democrats are already raising questions about Kavanaugh's truthfulness during his confirmation hearings this month. They have accused him of dissembling on a range of issues from his time in the George W. Bush White House, including a breach of secret Democratic files on judicial nominations and discussions about detainee policy and torture.

**Interviews planned**

The new revelation prompted a hurried effort by Sen. Charles E. Grassley, R-Iowa, the Judiciary Committee chairman, to set up conference calls to allow Democratic and Republican aides to interview both Kavanaugh and Ford before Thursday's scheduled committee vote. A spokesman,

Garrett Ventry, said it was routine to hold such calls "when updates are made to nominees' background files."

Senate Republican leaders in the hours after the Post's story was published indicated that they intended to move forward with voting on him. Republicans planned to argue that unless corroborating information came to light, they had no way of verifying her story and saw no reason to delay the vote, according to a person involved in the discussions.

The decision about any delay in the vote could rest on the opinions of two Republican women: Sens. Lisa Murkowski of Alaska and Susan Collins of Maine. Both are publicly undecided about Kavanaugh.

Collins said in an interview Sunday night that she considered the allegations serious and that Ford needed to be personally interviewed to get a fuller account. But Collins, who could conceivably decide the outcome in the narrowly divided Senate, said Democrats had done a disservice to both Ford and Kavanaugh with their handling of the accusations.

"What is puzzling to me is the

Democrats, by not bringing this out earlier, after having had this information for more than six weeks, have managed to cast a cloud of doubt on both the professor and the judge," she said. "If they believed Professor Ford, why didn't they surface this information earlier so that he could be questioned about it? And if they didn't believe her and chose to withhold the information, why did they decide at the eleventh hour to release it? It is really not fair to either of them the way it is was handled."

**Trump urged not to tweet**

The White House, which has taken great pains to portray Kavanaugh as a champion of women, sought to bolster him by pointing to statements by women who have known him and testified to his character. Those included a letter from 65 women who said that they knew him in high school and that he had "always treated women with decency and respect."

Advisers to Trump were trying to avoid publicly assailing the accuser while hoping that the lack of contemporaneous corrobora-

tion for Ford's account would mean that Senate Republicans could move ahead without addressing it in detail.

More delicately, advisers were privately urging Trump, who has been accused of sexual harassment by more than a dozen women, not to speak out about the allegations against Kavanaugh on Twitter for fear that he would only inflame the situation.

Still, some of the president's allies on the right excoriated Ford – a registered Democrat – as a partisan.

But Democrats and their liberal allies rallied around her, praising her courage and deeming her allegations credible.

Sen. Dianne Feinstein of California, the top Democrat on the Judiciary Committee, called the accusations "extremely serious" and said they "bear heavily on Judge Kavanaugh's character." She urged critics of his accuser to stop "the attacks and stop shaming her."

Kavanaugh, in a statement released last week, said: "I categorically and unequivocally deny this allegation. I did not do this back in high school or at any time."

**CORAL**

From page A1

ease spotted in the sanctuary, its protectors are desperate to keep it that way: At a time when a quarter of coral reefs worldwide are considered damaged beyond repair, the sanctuary's three reef systems are, mostly, in good shape.

**Devastating disease**

It's not exactly unusual to find dead corals off the coast of Florida: Severe bleaching events have left the Florida Keys Reef Tract with less than 10 percent living coral along the sandy, shallow bottom.

But researchers soon realized this time was different – and they've spent the last four years trying to bring their knowledge up to a speed that matches the disease's rate of travel.

They haven't been successful thus far.

"It's a mystery," said Abigail Clark, who recently was hired to study the disease at the Elizabeth Moore International Center for Coral Reef Research & Restoration in Summerland Key, Fla. "We don't know what caused it, why it's spreading so fast or why it's affecting so many species."

In 2015, just a year after the disease first was discovered, it had attacked 55 linear miles of reef. It continued to spread from there. As of this year, the Florida

Department of Environmental Protection estimates the disease has spread 205 linear miles up and down the Florida Keys.

And it's killing almost everything it touches.

For the foreseeable future, Clark will be working to identify the pathogen responsible for the disease, using diseased coral tissue samples and water samples to pinpoint the cause or, at the very least, find species that are resistant to it.

The Moore center's claim to fame is their coral restoration work, in which they grow new coral in a lab from harvested fragments and plant them on the depleted Florida Keys reef. They've planted more than 35,000 coral thus far.

If Clark can find species of coral resistant to the disease, scientists can focus more on planting those species on the reef and, potentially, breeding those species with others for a more resilient hybrid.

But that work still is a while away. Scientists still are trying to figure out what type of disease it is: they think it's bacterial, she said, but they're not even 100 percent sure about that.

"We really don't know much," she added.

They do know, however, that it appears to only impact large boulder coral, which typically line the bottom of reefs and act as building blocks for the whole ecosystem. Re-

searchers have tried to infect branching coral – which, as their name suggests, have many branch-like offshoots from their base – without success, she said.

"That's a minor triumph," Clark said. "It won't get every coral colony, which is good."

But so far, it appears that 20 different species can and are contracting the disease – many of which are also found in the Flower Garden Banks.

**Potential source**

The about 3,000 divers that visit the Gulf of Mexico's sanctuary each year is an exciting number in economic terms but terrifying if the coral disease turns out to be contagious.

That's because the dive to Flower Gardens is not for

the inexperienced. At 70 to 115 miles off shore and 55 to 160 feet deep, divers need to know what they're doing and likely have done dives across the globe with their own diving equipment.

So, sanctuary officials are working with Fling Charters, the only recreational dive boat that travels specifically to Flower Gardens, to ensure that each divers' equipment is disinfected before they enter the Gulf, Schmahl said.

Sanctuary officials provided the dive company disinfectant six weeks ago, and Sharon Cain, the company's office manager, said they've been asking customers to dip their gear in the solution.

But they can't force them to do it until an official edict comes down from the National Oceanic and Atmo-

spheric Administration's National Marine Sanctuary Office, she said.

"If they don't want to do it, we have no recourse to make them do it," she added.

Responses to the request have been mixed. Some people have no problem sanitizing to help protect the reef, Cain said, but others are leery that the solution might harm their gear.

But they have to try to keep the coral disease out of the Gulf, Schmahl said.

"When it gets established on coral, over the course of a year or two, there is complete mortality," he said. "The least we can do is enhance awareness about it and try to prevent it from spreading."

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**EMMYS:** 'Mrs. Maisel', 'Game of Thrones' win **PAGE D1**

# HOUSTON CHRONICLE

Tuesday, September 18, 2018 | HoustonChronicle.com and Chron.com | Vol. 117, No. 340 | \$2.00 ★★

Chance of storms: High 93, Low 76

After an excruciating six months for Houston arts patrons, a refurbished museum reopens, keeping its 'sense of discovery'

## MENIL, VERSION 1.5



Michael Ciaglo / Staff photographer

"Middle Passage" by Frank Bowling sets the tone in the main foyer at the Menil Collection. The museum, which has been closed since February for renovations, is set to reopen to the public on Saturday. Museum regulars will find the changes "subtle," an official says.

**By Molly Glentzer**  
STAFF WRITER

Rebecca Rabinow fretted recently that when the Menil Collection reopens to the public after a six-month renovation, many visitors will wonder what took so much time.

Of course, that's the idea of the whirlwind update that has kept this Museum District hallmark

shuttered since late February. But during a recent tour, the venerated museum corridors looked like a Piet Mondrian painting, covered with a patchwork of brown Masonite and geometrically pleasing lines of blue painter's tape.

Underneath that protective covering, the museum's original pine floors looked as fresh as they did

**"If we did it right, you won't notice the effort. But things you don't notice take the most effort of all."**

*Rebecca Rabinow, director of the Menil*

the day Renzo Piano's landmark building opened 31 years ago. During the renovation, every wall has been rebuilt, new lighting and fire-suppression systems have been in-

stalled, bathrooms have been redone, and every gallery has been reconfigured.

"It has been a museum-wide, Herculean effort over the last six months,"

said Rabinow, director of the Menil. "If we did it right, you won't notice the effort. But things you don't notice take the most effort of all."

Following media and patrons' previews that begin Tuesday, the doors will reopen to the public on Saturday.

Check off another unveiling within the Houston **Menil continues on A8**

## Trump slaps tariffs on \$200B in Chinese goods

President's risky move aims to take advantage of Beijing's slowdown

**By Jim Tankersley and Keith Bradsher**  
NEW YORK TIMES

President Donald Trump, emboldened by the United States' economic strength and China's slowdown, escalated his

trade war Monday, saying the United States would impose tariffs on \$200 billion worth of Chinese goods as punishment over Beijing's trade practices.

The fresh round of tariffs comes on top of \$50 billion worth of Chinese

products taxed this year, meaning nearly half of all Chinese imports into the United States will soon face tariffs. The new wave is scheduled to go into effect Sept. 24, with tariffs starting at 10 percent before climbing to 25 percent by the end of the year. The timing will partially reduce the toll of price increases for holiday shop-

pers buying Chinese imports in the coming months.

The White House also said the United States was prepared to "immediately" place tariffs on another \$267 billion worth of imports "if China takes retaliatory action against our farmers or other industries."

The move is aimed at

pressuring China to change long-standing trade practices that Trump says are hurting U.S. businesses at a moment when the administration believes it has an advantage in the trade dispute. China's economy is slowing, with consumers holding back and infrastructure spending dropping sharply. **Tariffs continues on A10**

## Ethane's sweet trek from Houston to Vietnam and back

Byproduct of Texas shale gas turns region into world supplier of plastics

**Third in a series**

**By Jordan Blum**  
STAFF WRITER

Open a bag of frozen shrimp from Walmart. Toss the packaging in the trash.

Two routine tasks, but they represent final commercial destinations for ethane molecules freed from Texas shale, a journey that has taken them not only hundreds of miles to

Houston's massive petrochemical complex, but also around the world and back again in the carefully choreographed dance of global supply chains.

Each day, hundreds of trucks and rail cars move pellets of ethane-derived polyethylene from petrochemical plants, such as Exxon Mobil's in Mont Belvieu, to the Port of Houston. There, the pellets are loaded by the ton onto con-

tainer ships and bound for ports like Ho Chi Minh City in Vietnam, where the molecules of hydrogen and carbon will be transformed yet again — into plastic wrap, trash bags and packaging for farm-raised shrimp found in freezer sections of grocery stores in Houston and across the country.

Ultimately, the shipments of polyethylene, the world's most common plastic, will bring billions of dollars into the Houston economy and generate jobs for factory workers, longshore **Plastics continues on A6**



Michael Ciaglo / Houston Chronicle

A forklift moves resin exports at Katoen Natie's 2 million-square-foot logistics facility in Baytown, one of many stops in a journey through the global supply chain.

## Senate to hear judge, accuser

Public session on claims next week faces little GOP pushback

**By Kevin Diaz**  
WASHINGTON BUREAU

WASHINGTON — With public pressure mounting, Senate Republican leaders announced Monday that Supreme Court nominee Brett Kavanaugh and the woman who has accused him of sexually assaulting her 30 years ago will testify in a public hearing next week before the Senate Judiciary Committee.

The White House said Kavanaugh is eager to tell his side of the story.

"Judge Kavanaugh looks forward to a hearing where he can clear his name of this false allega-



**Judiciary Committee Chairman Charles Grassley**

tion," White House spokesman Raj Shah said. "He stands ready to testify tomorrow if the Senate is ready to hear him."

The hearing, scheduled for Monday, is shaping up to be a public spectacle akin to the 1991 confirmation hearings that featured Anita Hill, who accused future Justice Clarence Thomas of sexual harassment.

It was announced a day after Kavanaugh's accuser, Christine Blasey Ford, went public with her story — sending top GOP leaders scrambling to contain the fallout.

Texas Republicans John Cornyn and Ted Cruz, both influential figures on the Judiciary Committee, were among those calling for the allegations to be taken seriously.

**Judge continues on A10**

» Texas attorney general's aide shares a tweet mocking the accusation: **Page A5**

**NATION**  
**Carolina misery**  
Rescuers rush into beleaguered cities in the Carolinas as residents struggle with the aftermath of a storm that damaged tens of thousands of homes. **PAGE A7**

**BUSINESS**  
**Trip to the moon**  
Elon Musk reveals that Yusaku Maezawa, a Japanese billionaire, will be his first customer for a voyage around the moon on a SpaceX rocket. **PAGE B1**

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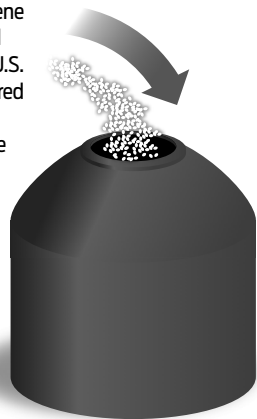


FROM THE COVER

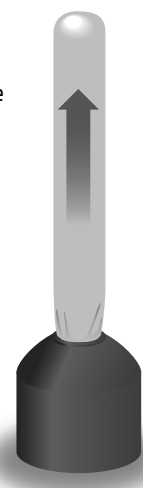
From plastic pellets to plastic bags

Polyethylene pellets are turned into plastic bags in a process called film extrusion or “the tubular film process.” In fact, it’s a lot like blowing bubbles ... and then squashing those bubbles.

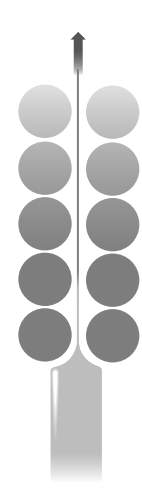
1 Pellets of polyethylene — shipped from the U.S. — are poured into huge vats where they are melted down.



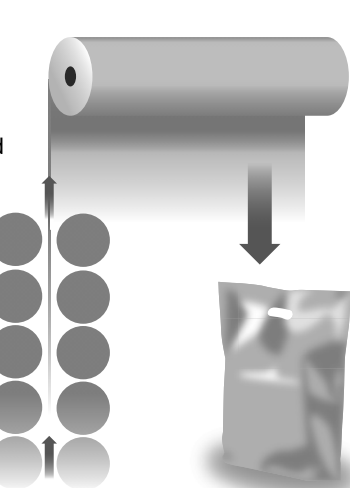
2 The molten polyethylene is then extruded by essentially blowing it into a thin cylinder balloon shape, several hundred feet long.



3 The walls of the cylinder of plastic are very thin — 2/10,000th of an inch thick. The cylinder cools and is passed through rollers that press it into sheet form.



4 The sheet is then collected onto a large roller.



5 Other devices cut sheets to size, crimp sheets into various shapes, punch holes for handles or melt edges together to form, say, plastic bags.

Sources: The Science Channel, Mechanical Engineering Online  
Jordan Blum and Charles Apple/Houston Chronicle

PLASTICS

From page A1

workers and truck drivers. Patrick Jankowski, chief economist at the Greater Houston Partnership, estimates the growth in U.S. plastics exports — dominated by the Gulf Coast and expected to double by 2030 — will have created some 10,000 local jobs in the region by early next decade.

“Nobody could have ever foreseen the U.S. becoming a major exporter of plastics,” said Neil Chapman, a senior vice president at Exxon Mobil. “It’s a byproduct of shale gas. That’s what’s truly amazing about this breakthrough.”

Industrial orchestra

Roughly three-fourths of the nation’s waterborne polyethylene exports leave from the Port of Houston, which is expected to move some 7 billion pounds of the plastic this year, up 35 percent from 2017. Each day, hundreds of 40-foot containers filled with plastics resins, primarily polyethylene pellets, are shipped from the port.

The container terminal seems a cacophony of noises — roaring trucks, whirring cranes and clanking containers. But each piece of equipment has specific notes to play in an industrial symphony that requires precision.

The newest cranes, which reach nearly 300 feet into the sky and cost \$11 million each, can load an average of 35 containers an hour, reaching across ships that are 22 containers or nearly 180 feet wide. Four cranes can load a ship, which typically carries about 2,500 containers, in about 18 hours.

Louis Alberti, a crane operator for the past 15 years, routinely lifts two 20-foot containers at a time in a maneuver called “twin picking.” He swings them up and over stacks of containers on the ship and tucks them into tight, secure positions, where they’ll stay for the weeklong ocean crossing.

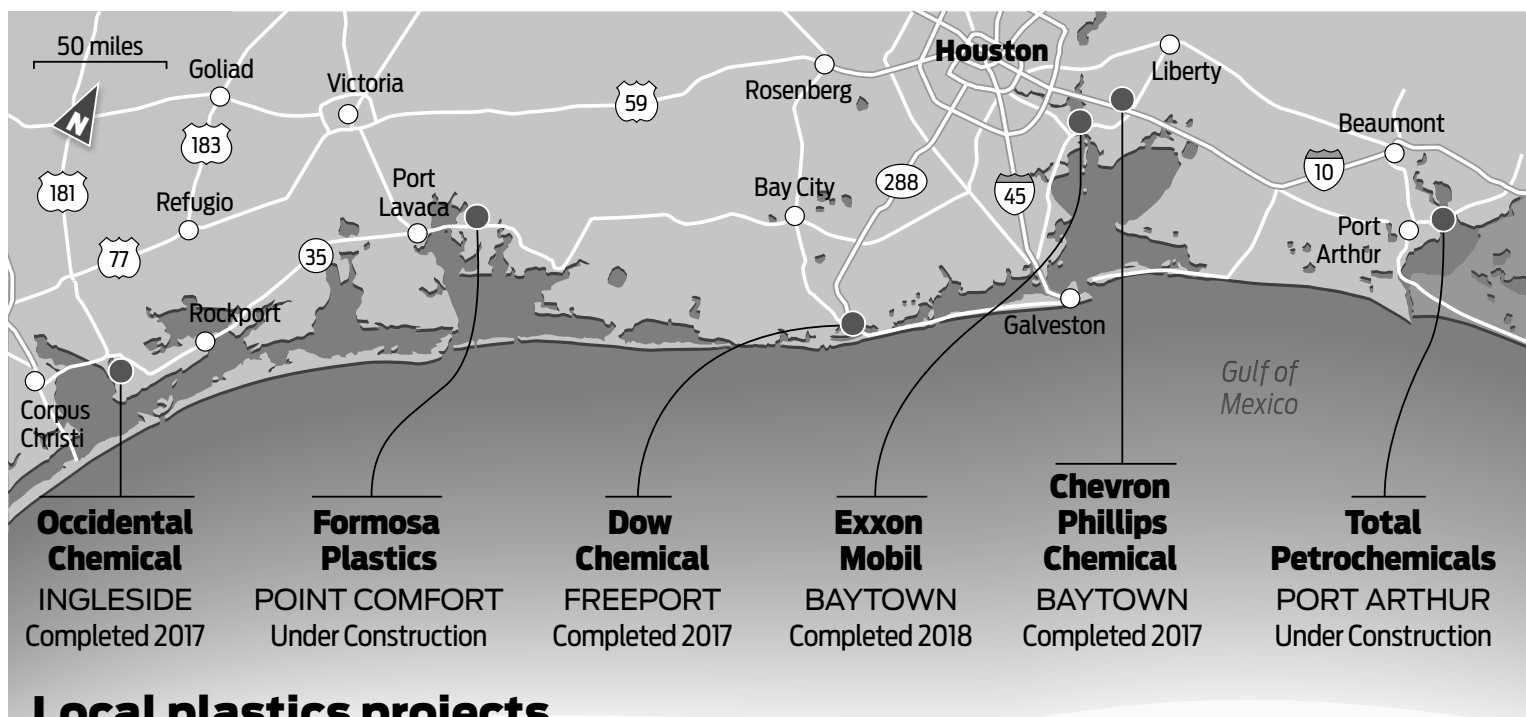
Alberti, 48, is among the workers benefiting from the boom in plastic exports, which has led to more hiring, more overtime, and extended hours at the port, which now operates until 11 p.m. Alberti’s 22-year-old son, Jimmy, recently got a longshore job at the port, while Alberti, a third-generation longshore worker, is racking up overtime.

With new night shifts that pay time-and-a-half, Alberti said he has doubled his annual earnings from roughly \$100,000 to \$200,000 by working 60 to 80 hours a week.

“It’s hard, but you have to work through it,” said Alberti, 48. “I can’t imagine having a 9-to-5 job. I’d probably be bored.”

Polyethylene accounts for about 15 percent of the cargo leaving the Port of Houston’s Bayport container terminal. After the ships are loaded, they will navigate what has become the nation’s busiest ship channel. Vessels routinely squeeze through the narrow waterway by aiming directly at an oncoming ship before getting pushed safely aside by the water pressure generated by the wakes. The pilots call it “Texas chicken.”

Within a few hours, the ships will reach the Gulf of Mexico, beginning a two- to three-week journey that will take them through



Local plastics projects

Major ethane cracker projects recently completed or under construction along the Texas Gulf Coast. Multiple other projects are still in the development stages.

Houston Chronicle



Houston Chronicle

the Panama Canal into the Pacific Ocean and on to Asia.

Next stop: Singapore

The Port of Singapore is the world’s biggest transshipment port — an intermediate stop where cargoes are unloaded, then reloaded onto the other ships that will take the containers to their ultimate destinations.

This is where Alex Dam makes his polyethylene connection. Dam is executive vice president of Thanh Phu Plastic Packaging, a Vietnamese company that makes packaging for brands such as the Chicken of the Sea, a unit of Thai Union International, and Huggies disposable diapers, made by Irving-based company Kimberly-Clark.

Just a few years ago, Dam said, his company was buying polyethylene pellets, also called resins, from Middle Eastern and Asian chemical-makers, which sold them more cheaply than U.S. companies. Then came the flood of ethane.

“The shale gas is changing a lot of the trend,” Dam said.

Exxon Mobil sells a premium resin to Thanh Phu Plastic Packaging, which typically orders 10 containers, or 250 tons, of polyethylene pellets at a time, shipped from Singapore to the port in Ho Chi Minh City. Dam’s plant is located about 15 miles from the port, in the southwestern part of the city.

The plant’s operations are run primarily by computers, which control a process known as “blown film” to turn polyethylene pellets into flexible plastic packaging. The tiny pellets are

fed by the thousands into a hopper, then funneled into a heated tube, where they are melted, compressed, formed into circles and inflated into spheres, much like glass blowing.

“We make it like a bubble,” Dam explained.

Rising middle class

The automated process forms the bubbles into different shapes and thicknesses by adding thin layers of polyethylene — so thin they are invisible to the human eye. The blown plastic is then cooled and run through rollers that flatten them into rows of film.

The number of layers in the packaging depends on the products they will protect. Plastic bags that hold seafood, for instance, are thicker and stronger so they won’t crack when frozen. Diaper packaging is thinner, more flexible and soft to the touch.

About 500 people work in the plant, about the same as 10 years ago. The critical difference is many of the jobs have shifted from assembly-line work to skilled positions requiring technical abilities, computer literacy and higher levels of education. Today, 1 in 5 of the plant’s employees are engineers, part of a rising middle class that is fueling a rapidly growing consumer economy in Asia.

The global middle class is forecast to more than double from 2 billion people in 2010 to more than 5 billion by 2030, with Asia accounting for 90 percent of the increase, according to the Brookings Institution, a Washington think tank. As middle classes grow in places like Vietnam, Chi-

na and India, the demand for electronics, cars, food and other consumer products, all with components or packaging made of plastic, is expected to follow.

Global polyethylene demand is growing about 4 percent a year, projected to hit 100 million metric tons — more than five times North American consumption — in 2018 and 120 million tons by 2023.

That trend is driving the billions of dollars in petrochemical investment along the Gulf Coast, with nearly all of it targeting foreign markets. For example, all of the polyethylene produced from Exxon Mobil’s \$6 billion expansion in Mont Belvieu and Baytown is headed overseas.

“This is a really dynamic market,” said Cindy Shulman, Exxon Mobil’s vice president of plastics and resins. “It’s growing because global living standards around the world continue to improve, and that’s a great thing.”

Price of progress

All this progress has not come without costs, some dear, to the environment. Fears are growing that the world is drowning in plastics; measured by weight, there could be more plastic in the ocean than fish by 2050, according to the Plastic Pollution Coalition, an environmental advocacy group.

About one-third of all plastics are used once and thrown away. Of the world’s roughly 6.5 billion metric tons of plastic waste, only 9 percent was recycled and 12 percent incinerated. The rest is sitting in landfills, oceans or other parts of the environment, where it will take more than 400 years for much of it to degrade.

If production and waste management trends continue, 12 billion metric tons of plastic waste — equivalent to the weight of 35,000 Empire State buildings — will be in landfills or the environment by midcentury, according to a study by the University of California at Santa Barbara and the University of Georgia. At least 8 million tons of plastic end up in the world’s oceans each year.

Neil Carman, clean air director of the Lone Star Chapter of the national advocacy group Sierra Club, said he worries more about the impact of drilling, fracking and petrochemical processes. Ex-

xon Mobil’s Baytown complex, for example, has a history of exceeding air pollution limits, which last year led to a federal court to impose \$20 million in penalties on Exxon Mobil. The company is appealing.

At well sites, emissions from diesel engines that power fracking fowl the air while disposal wells used to hold spent fracking water have been linked to an increase in earthquakes. The main component of natural gas, methane, is a powerful greenhouse gas that escapes during drilling and production, contributing to climate change.

“We’re still in the process of uncovering these enormous public health and environmental effects,” Carman said. “We’re not doing enough to assess these impacts and address them.”

Industry responds

Exxon Mobil and other petrochemical-makers are researching ways to increase the amount of recycled materials in their products while developing thinner, lighter plastics that use less material while maintaining their strength and flexibility.

Shulman said the thinner and stronger plastics allow companies to use 40 percent less packaging. That means less plastic is required for each product, reducing the amount that gets thrown out.

“It costs less to ship these products. They take up less room on the shelves,” she said. “They keep food fresh longer.”

Chicken of Sea’s frozen shrimp, protected in the packaging made in Vietnam, will end up on freezer shelves in stores such as Walmart, Target and Kroger, and ultimately on the plates of consumers in Houston and around the country. As families tuck into gumbos or seafood stews, they probably won’t give a second thought to packaging that brought the shrimp from farm to table, or the trash bag where the packaging will end up.

They are merely conveniences of modern life, conveniences made possible by a natural gas well called Eagles in East Texas and thousands of others like it in shale fields across America.

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RICE

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Mark Kantrowitz, a financial aid expert and publisher and vice president of research for Saving for College LLC, said Rice University is a part of a growing number of universities that are working to make college more affordable.

“The prospect of borrowing to pay for your college education if you’re a low-income student can have a chilling effect on whether you even apply,” Kantrowitz said. “Imagine being told that

you’re going to have to borrow more for your entire education than your parents earn in a year. There have been lots of efforts to try to encourage more college-capable, low-income students to pursue a college education.”

More than one child

Last year, the University of Michigan announced a similar plan, offering free tuition to in-state students with a family income up to \$65,000 a year. The median income in Michigan is nearly \$64,000 a year.

“Students who are scared away by the cost of college are

more likely going to consider going to college if they hear free tuition than if they hear no loans,” Kantrowitz said.

Leya Mohsin, a senior at Rice, applauded the financial plan. The policy studies and economics major said it’s not rare for student loans or the cost of college to come up in conversation with her friends.

“For a lot of my friends who are seniors, we also now have younger siblings who are studying to go to college,” said Mohsin, whose brother attends Emory University in Atlanta. “Something that none of us thought

about is the burden of having to pay for not just us, but parents who have to deal with multiple children who are in expensive universities at the same time.”

‘Extra layer’ of worry

Mohsin did not have to worry about taking out student loans because her parents were able to afford her \$46,600 annual tuition at Rice, but she knows that not all her classmates are as lucky. As part of the assistance plan, Rice will also allow students whose families have incomes up to \$200,000 not to be required to take out student

loans as part of their financial aid packages.

“When you’re 18 and starting college, you don’t realize the impact that student loans are going to have on your life as an adult after you graduate,” Mohsin said. “Being one of (the few in my group of friends) who doesn’t have to worry about that extra layer of having to pay off some of my debt every month is really a benefit to me, but I know it’s not something that a lot of students experience at the moment.”

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