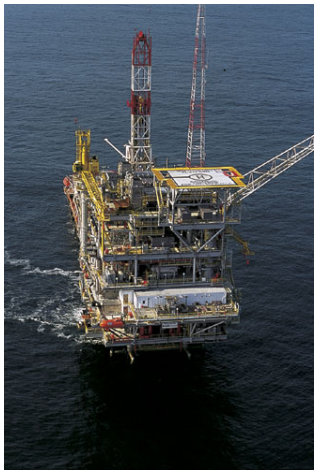
NATIONAL OCEAN INDUSTRIES ASSOCIATION

HURRICANES AND THE OFFSHORE OIL AND NATURAL GAS INDUSTRY



Every year, hurricanes of varying strength lay siege to America's coasts. The images of wind-battered buildings and flooded lands are well-known - 2004 and 2005 were particularly destructive seasons, as has been the 2017 season.

In 2005, the impact of Hurricanes Katrina and Rita on the vital energy infrastructure of the nation's Outer Continental Shelf was severe, destroying 113 offshore platforms, seriously damaging 52 more and shutting-in significant quantities of the nation's oil and natural gas production.

But did you know:

- There were over 4,000 platforms in the Gulf of Mexico in 2005, which means that more than 97 percent of the platforms survived these record-breaking storms?
- There were no deaths or injuries among the thousands of offshore workers because of stringent and effective safety regulations?
- There were no significant spills from any offshore facility and the minimal oil that did escape from damaged pipelines had no wildlife impacts?
- Most of the facilities damaged or destroyed by the storms were built prior to 1988 when more stringent construction specifications were mandated, while most built to meet the post-1988 requirements survived?
- The offshore industry continuously works to improve its safety and environmental record, as well as improve the time needed to bring shut-in production back to consumers?

More details follow on how the offshore industry contends with hurricane forces.

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Even the most damaged facilities are salvageable.

For example, Shell's Mars platform sustained serious damage during Hurricane Katrina (above), but dedicated and talented crews were able to repair the facility (below).

HURRICANE FACT: OFFSHORE PLATFORMS ARE DESIGNED TO SURVIVE DESTRUCTIVE STORMS

THE VAST MAJORITY OF OFFSHORE PLATFORMS AND RIGS ESCAPED SERIOUS DAMAGE DURING THE 2005 HURRICANE SEASON

- Though 113 platforms were destroyed by Hurricanes Katrina and Rita, there are over 4,000 platforms in the Gulf of Mexico at the time. This means that over 97 percent of the platforms survived these record-breaking storms.

- Platforms are designed to withstand both gale force winds and and severe wave activity. Offshore facilities built since 1988 are designed to withstand "100-year Storms," a designation that includes everything up to Category 5 events.

    - These standards are defined by regulations from the Bureau of Safety and Environmental Enforcement (BSEE), a principal regulatory agency for offshore oil and gas operations. The specific regulations can be found in the Federal Register at 30 CFR 250.900

    - To address wave threats, regulations stipulate that the platform deck must exceed the average height of hurricane-driven swells, generally estimated to reach 80 feet. Category 3, 4 and 5 storms all generate waves of approximately the same height.

    - To address wind threats, offshore facilities work in advance of evacuation to prevent any section or piece of equipment being knocked loose and damaging the rest of the platform.

- In recent storms, virtually all platforms seriously damaged or destroyed had been built before the 1988 design specifications were implemented.

    - In 2005, Hurricanes Katrina and Rita destroyed a total of 113 platforms, of which 108 were built to pre-1988 specifications.

    - These "end-of-life" facilities only represented 1.5 percent of total Gulf of Mexico production at the time.

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Thousands of offshore personnel are evacuated in advance of approaching hurricanes

HURRICANE FACT:

EMPLOYEE SAFETY ALWAYS TAKES PRIORITY

THE OFFSHORE ENERGY INDUSTRY HAS AN ENVIABLE RECORD OF PROTECTING THE LIVES OF ITS OFFSHORE WORKERS, AND COMPANIES PROVIDED CRITICAL SUPPORT DURING RECOVERY EFFORTS ONSHORE IN 2005.

- There are thousands of workers offshore at any given time. Despite the frequency and intensity of hurricanes in 2005, there were no injuries and no loss of life on offshore facilities. This safety record has been achieved consistently year after year.

- Prior to the arrival of a hurricane, offshore facilities evacuate all personnel.

    - Personnel secure the platform and leave in pre-determined stages. A standard hurricane preparation process includes:

        - Evacuation Phase 1 - Receive Storm Notification
            - Review operations forecast.
            - Communicate with air and marine transportation providers.
            - Perform safety system checks.

        - Evacuation Phase 2 - Complete Preparations
            - Secure all equipment.
            - Test communications systems that enable monitoring from shore.
            - Evacuate non-essential personnel.

        - Evacuation Phase 3 - Shut Down and Evacuation
            - Shut-in wells and subsurface safety valves
            - Close incoming and exit pipelines
            - Shut down operating systems
            - Transport remaining personnel to shore

- After Hurricane Harvey, as with Hurricanes Katrina and Rita, offshore companies stepped in to provide support services, emergency funds, housing and other assistance to their employees, and also donated millions to the Red Cross and similar organizations.

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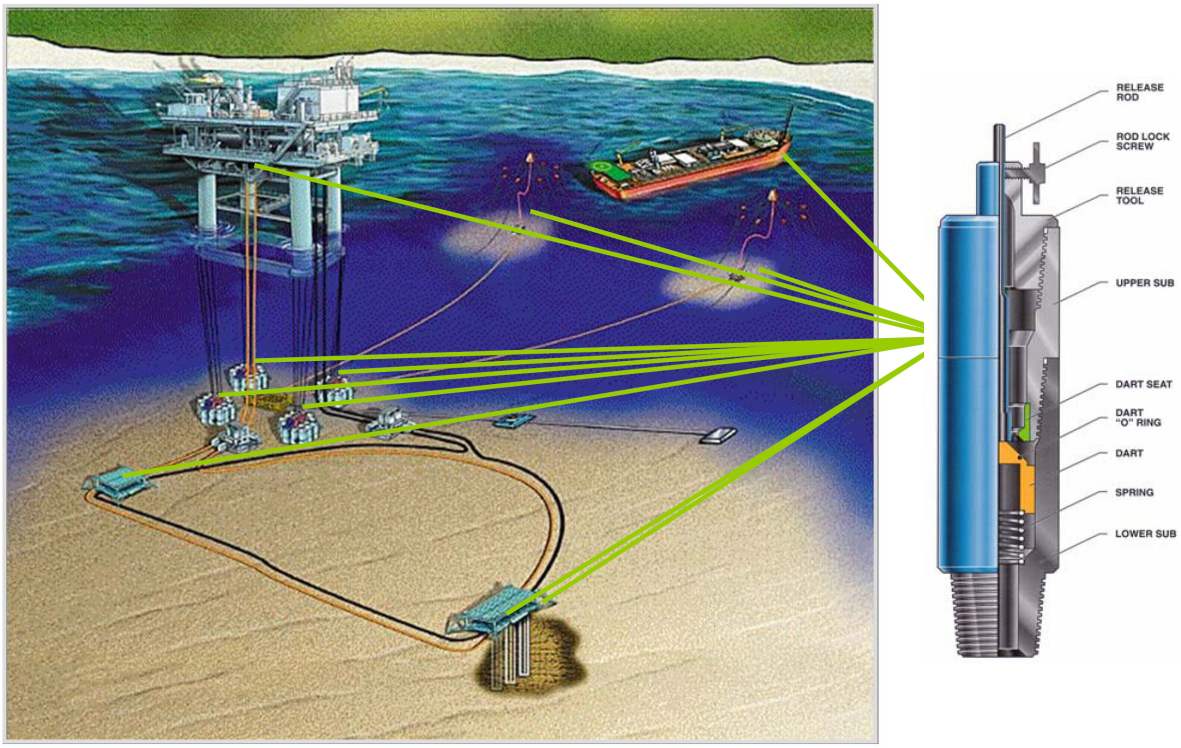
HURRICANE FACT: ENVIRONMENTAL SAFEGUARDS ARE BUILT IN TO THE OFFSHORE INFRASTRUCTURE

- All offshore platforms are equipped with safety valves that shut-in oil and natural gas in the event of storm damage. These valves lock closed at regular intervals so that oil or gas cannot flow if equipment is broken or separated. Every single safety valve held during the 2005 hurricane season.



Safety valves at all major junctures prevent oil and natural gas leaks when hurricanes cause damage

- During the 2005 hurricane season, there were no significant oil spills from offshore production facilities.
  - In a few isolated instances, small holding tanks on the platforms themselves were damaged or knocked overboard.
  - Most of the oil that ended up in the Gulf after Hurricanes Katrina and Rita came from damaged onshore facilities.

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Jack-up Rig

Drill Ship

Semi-submersible platform

BACKGROUND INFORMATION: A BRIEF INTRODUCTION TO OFFSHORE TECHNOLOGY

UNDERSTANDING THE TECHNOLOGY: RIGS VS. PLATFORMS

An **offshore drilling** rig is a facility housing equipment to drill for oil and natural gas from underground reservoirs. Sometimes a drilling rig is also used to complete (prepare for production) the well. The rig itself is not involved with the extraction of the oil, however. Its primary function is to make the hole in the ground so that the oil can be produced.

An **offshore oil platform** is a structure used to house workers and machinery needed to produce oil and natural gas in the ocean. Depending on the circumstances, the platform may be attached to the ocean floor or float. A typical platform may have many wellheads and access reservoirs using directional drilling both at different depths and at remote positions miles away from the platform. Platforms may also connect to many subsea wells on the seafloor miles away.

DRILLING PLATFORM TYPES:

- Jack-up rigs are towed to the drilling site, three or four 'legs' are lowered until they penetrate the ocean floor to the point of resistance. This allows the working platform to rest above the surface of the water, as opposed to a floating barge. However, jack-up rigs are suitable for shallower waters, as extending these legs down too deeply would be impractical. These rigs are typically safer to operate than drilling barges, as their working platform is elevated above the water level.

- Drill ships have a broadly conventional ship's hull, but also feature a large aperture, known as a "moon pool", through which drilling takes place. Drill ships use either anchors or dynamic positioning to maintain station. Drill ships can operate in more than 10,000 feet of water.

- Semi-submersible drilling platforms are supported primarily on large pontoon-like structures submerged below the sea surface. The operating decks are elevated perhaps 100 or more feet above the pontoons on large steel columns. This design has the advantage of submerging most of the area of components in contact with the sea and minimizing loading from waves and wind. Semi-submersibles are usually anchored with six to twelve anchors tethered by strong chains and wire cables, which are computer controlled to maintain stationkeeping.

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PRODUCTION PLATFORM TYPES:

- Fixed Platforms sit on legs anchored directly in the seabed, supporting a deck with space for drilling rigs, production facilities and crew quarters. Fixed platforms are economically feasible for installation in water depths up to about 1,700 feet (520 m).

- Compliant Towers consist of narrow, flexible towers and a piled foundation supporting a conventional deck for drilling and production operations. Compliant towers are designed to sustain significant lateral deflections and forces, and are typically used in water depths ranging from 1,500 and 3,000 feet (450 and 900 m).

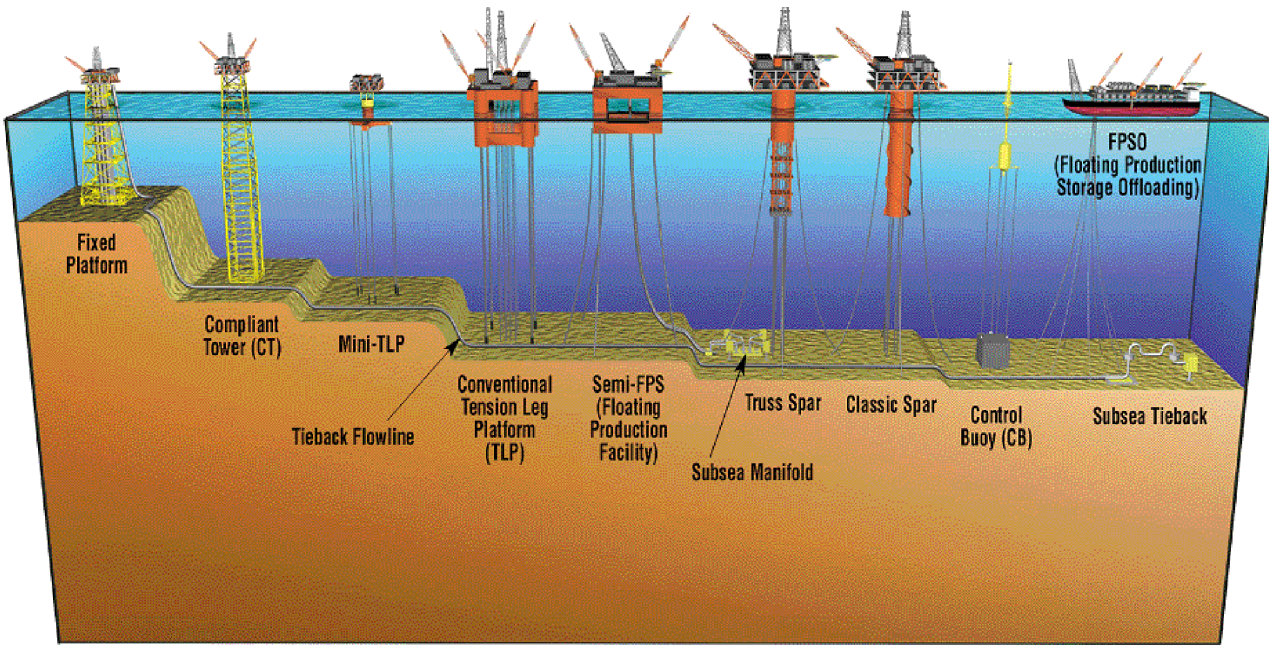
- Tension-Leg Platforms (TLPs) consist of floating rigs tethered to the seabed in a manner that eliminates most vertical movement of the structure. TLPs are used in water depths up to about 6,000 feet (2,000 m).

- Semi-Submersible Platforms have several "legs" which have sufficient buoyancy to cause the structure to float. Semi-submersibles can be moved and are generally anchored by mooring cables and anchors. Semi-submersibles are used in depths greater than 600 feet (200 m).

There are numerous types of offshore platforms. Most of the platforms destroyed by Hurricanes Katrina and Rita in 2005 were the older, fixed-leg type.

- Spar Platforms are moored to the seabed like the TLP, but use more conventional mooring lines. The Spar has more inherent stability than a TLP since it has a large counterweight at the bottom. It also has the ability, by use of chain-jacks attached to the risers, to move horizontally over the oil field.

- Floating production, storage and offloading systems (FPSOs) are large ships equipped with processing facilities and moored to a location for a long period.



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