



Introduction to Offshore Decommissioning

An Online Continuing Education Course for Engineers

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1. Introduction

Offshore oil and gas structures have been in existence since the 1920's and their associated technology has developed rapidly. Offshore structures have come from being simple derricks at the ends of wooden piers to massive structures weighing over 20,000 tons miles from shore. The complexity of decommissioning these massive structures has increased and the technology to remove them has fallen behind the ability to build and install these deep-water installations.

Decommissioning is the process which the operator of an offshore oil or gas installation and pipeline goes through in order to plan, gain approval for and implement the removal, disposal or re-use of an offshore installation when it is no longer needed for its current purpose.

It has several distinct stages:

1. Options are developed, assessed and selected and put through a detailed planning process that includes engineering and safety preparation.
2. The operator has to stop the production of oil or gas, plug the wells deep below the surface and make them safe.
3. All or part of the installation usually has to be removed from the site.
4. Those parts that are removed have to be disposed of or recycled.
5. Seabed surveys are carried out, as well as ongoing monitoring if any part of the platform / facility remains in place.

In summary, decommissioning is the process of deciding how best to shut down operations at the end of a field's life, closing the wells, cleaning up, making the installation safe, removing some or all of the facilities and reusing or disposing of them as appropriate.

For most of the history of the offshore oil and gas industry, facility decommissioning, sometimes called abandonment, has barely been a footnote in overall operations. Decommissioning is a permanent dismantlement of the licensed facility so that it is permanently incapable of its licensed use. This includes leaving downhole or subsurface



Figure 1: Decommissioning in operation

structures in a permanently safe and stable condition in accordance with requirements; the removal of associated equipment and structures; the removal of all produced liquids; and the removal and appropriate disposal of structural concrete.

The Outer Continental Shelf Lands Act (OCSLA) and implementing regulations establish decommissioning obligations to which an operator must commit when they sign an offshore lease under the OCSLA, including the requirement to apply for and obtain a permit for subsequent removal of platforms. Outer Continental Shelf (OCS) leases typically require the operator to remove seafloor obstructions, such as offshore platforms, within one year of lease termination, or prior to termination of the lease if either the operator or the Department of the Interior deems the structure unsafe, obsolete, or no longer useful for operations.

Formally, the OCS is governed by Title 43, Chapter 29 "Submerged Lands", Subchapter III "Outer Continental Shelf Lands", of the U.S. Code. The term "Outer Continental Shelf" refers to all submerged land, its subsoil and seabed that belong to the United States and are lying seaward and outside the states' jurisdiction, the latter defined as the "lands beneath navigable waters" in Title 43, Chapter 29, Subchapter I, Section 1301. The Outer Continental Shelf refers to the submerged land beginning 3 miles past the shoreline. OCSLA was enacted in order to govern incidents that occur on the subsoil and seabed of the Outer Continental Shelf and all artificial islands and installations permanently or temporarily attached to the seabed erected to exploit offshore oil and gas.

The United States OCS has been divided into four leasing regions:



- Gulf of Mexico OCS Region
- Atlantic OCS Region
- Pacific OCS Region
- Alaska OCS Region

Figure 2: Map of the Outer Continental Shelf

In the federally regulated Outer Continental Shelf (OCS), the Gulf of Mexico currently has about 4,000 structures associated with oil and gas production. The structures vary widely according to function and configuration. Since 1947, when offshore production started in the gulf, the industry has installed in OCS waters about 6,000 structures and removed about 2,000.

When the operating cost of a structure (maintenance, operating personnel, transportation, fuel, etc.) outstrips the income from the produced hydrocarbons, the structure becomes a liability instead of an asset. Decisions about when and how to decommission a structure involve issues of environmental protection, safety, cost, and strategic opportunity. Factors influencing the timing and manner of removal are complicated and depend on technical requirements and

costs as well as on preferences established by the contractor and the scheduling of the operation.

Decommissioning projects aim to render all wells safe and remove most, if not all, surface and seabed signs of production activity. Simple structures in shallow waters are removed relatively easily and inexpensively. Free-standing caissons, for example, are just big pipes in the ground that a lift vessel or stiff-leg in conjunction with a diving crew usually can cut, pull, and place on a cargo barge.

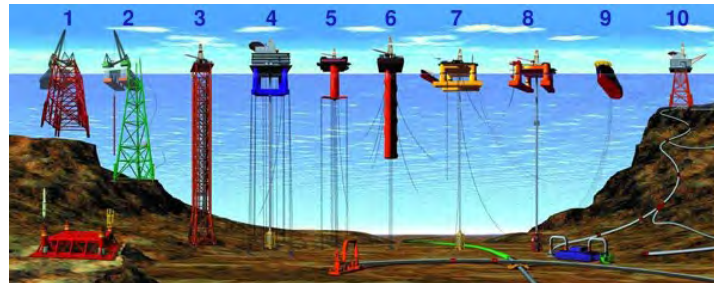


Figure 3: 1, 2) conventional fixed platforms; 3) compliant tower; 4, 5) vertically moored tension leg and mini-tension leg platform; 6) spar; 7,8) semi-submersibles; 9) floating production, storage, and offloading facility; 10) sub-sea completion and tie-back to host facility.

Conventional fixed platforms, compliant tower, sub-sea completion and tie-back to host facility, etc. on the other hand, are more complex structures that require greater planning and preparation to ensure worker health and safety, while also minimizing environmental impact and removal cost.

The removal process generally becomes more complicated and costly as the structure size, complexity, and water depth increases.

The Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) requires that within 1 year of the termination of a lease all wells be plugged and abandoned; all conductors, casing string, and piles be removed to a depth of 15 ft. below the mudline; and the site be returned to prelease conditions.

The OCSLA regulatory and lease requirements for decommissioning offshore platforms are designed to minimize the environmental and safety risks inherent in leaving unused structures in the ocean, and to reduce the potential for conflicts with other users of the Federal OCS (i.e., commercial fishing/aquaculture, military activities, transportation industry, other oil and gas/renewable energy operations, etc.).

Decommissioning an offshore platform generally entails:

- Plugging all wells supported by the platform and severing the well casings 15 feet below the mudline;
- Cleaning and removing all production and pipeline risers supported by the platform;
- Removing the platform from its foundation by severing all bottom-founded components at least 15 feet below the mudline;
- Disposing the platform in a scrap yard or fabrication yard, or placing the platform at an artificial reef site; and
- Performing site clearance verification at the platform location to ensure that no debris or potential obstructions to other users of the OCS remain.

OCSLA regulations administered by the Bureau of Safety and Environmental Enforcement (BSEE) require that operators obtain approval of the platform removal methodology prior to removal of the platform through an application process. To satisfy National Environmental Policy Act obligations, the Bureau of Ocean Energy Management (BOEM) prepares a site-specific environmental assessment for each removal application on behalf of BSEE. BSEE ensures the assessment is adequate and imposes any necessary protective mitigation measures as conditions of permit approval.

The terms ‘decommissioning’ and ‘abandonment’ are used interchangeably in connection to the process of removing and disposing redundant offshore installations. However, due to the sensitive nature of this issue since the Brent Spar incident, the industry has somehow jettisoned the term ‘abandonment’, which was formerly used to describe the process, in favor of ‘decommissioning’ for fear that the former conveys the wrong image of what is involved.



Figure 4: Parts of Brent Spar being brought ashore for disposal

The conflict over the removal and disposal of the 4,000-ton Brent Spar oil storage platform in the UK, that pitted one of the biggest company which wanted to sink the platform against environmental activists (Greenpeace), prompted the need to formulate suitable legal and regulatory framework on decommissioning as well as the compulsion to boost already existing ones at both international and national levels.

Decommissioning could be defined as a multidisciplinary process of deciding which one is the best way is to shut down production and operations for a facility once the field has reached its economic life. Its main objective is to deliver all property free from hazards for the environment

and to restore the area to the original conditions, as per the applicable regulations and company expectations.

Decommissioning and abandonment is a relevant issue in the petroleum industry because of the complex operations involved and the results after the decision has been made. Several factors could lead to abandoning wells and decommissioning platforms, among others hurricanes, production decline, economic limit, etc. The active weather in the Gulf of Mexico has a huge impact in the subject and requires a constant revision of the decommissioning and abandonment plans. Decommissioning and abandonment operations have a great impact in the revenue stream which is either lost or temporarily deferred depending on the situation. Every year 100-150 platforms are decommissioned and approximately 620 wells are abandoned in the Gulf of Mexico.

Any long-term strategy of an offshore oil and gas production company will likely include offshore platform decommissioning. After years of production, the wells eventually run dry. As during construction, cleanly and effectively removing an offshore platform is vital to maintaining the environment around it. However, decommissioning is not as simple as lifting the deck structure away and plugging a well hole. Many engineering and economic challenges await the business.

The regulatory paperwork and permitting process can pose an initial hurdle for the offshore industry. The U.S. decommissioning process is in part regulated by the Bureau of Safety and Environmental Enforcement (BSEE) and 30 CFR Part 250. The Bureau of Ocean Energy Management, Regulation, and Enforcement (BOEMRE) also have a say in the matter, controlling idle time and abandonment procedures. This process can at times be outside the expertise of in-house personnel, requiring help from a third party who understands the regulatory process and can navigate the permit paperwork.

Another major challenge of decommissioning is not as much about any particular removal step but more about the associated **planning and cost**. These two problems:

- ✓ many offshore structures “have **NOT** been designed with removal in mind”
- ✓ decommissioning cost can average about 1.2 times construction cost.

Incidentally, these two problems have some logical crossover.

It's easy to imagine if a structure is designed and constructed with decommissioning in mind, it will likely reduce the decommissioning costs later. Those designing and constructing new nuclear power plants exemplify the idea of including decommissioning considerations, supported by a wealth of research by the likes of the OECD Nuclear Energy Agency (PDF), Idaho National Laboratory (PDF), and the U.S. Department of Energy. Like those nuclear engineers,

offshore design engineers should consider designs that lead to a more rapid, environmentally-friendly decommissioning; this includes simplifying construction such that taking it apart will also be simple.

2. Legislation & Approvals

The obligation of the United States under international law for disposal of offshore platforms is governed by the U.N. Convention on Geneva Convention 1958 the Law of the Sea and the London Dumping Convention 1972.

Geneva Convention states:

“Any installations which are abandoned or disused must be entirely removed”.

As offshore oil and gas production moved into deeper water and more hostile environments during the 1960’s and 1970’s, it became apparent that absolute entire removal would become unreasonably burdensome. The huge deepwater platforms would be extremely costly and dangerous or impossible to totally remove. Requiring total removal also raised the question of harm to the environment.

The London Dumping Convention (known as the London Convention (LC)) was developed, at the recommendation of the United Nations, to protect the marine environment from hazards of dumping at sea. Much of the unregulated dumping that occurred before LC came into force in 1975 has largely been halted. The convention prohibits dumping in waters world-wide other than internal waters of a state.

Article III(i)(a) defines

“Any deliberate or negligent discharge from vessels, aircraft,

Any deliberate or negligent discharge from other man-made

However, Article III(ii) provides that the discharge of matter for a purpose other than the disposal of waste is not contrary to the aims of this convention if the discharge is necessary for a program in the Gulf of Mexico are possible.

International law on the removal of offshore platforms moved away from strict removal and toward cooperation. The international community first began to discuss this question, considering that the unimpeded commercial and military navigation led to a strict

