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Regulation of FPSO's in the Gulf of Mexico OCS

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Abstract

With the advances being made in deepwater technology, the United States Outer Continental Shelf (OCS) has embarked on a new era of development potential. The Gulf of Mexico (GOM) has reemerged as one of the principal offshore oil and gas basins in the world, a welcomed change after the slowdown during the late 1980's and early 1990's. With this move into deepwater comes a new set of challenges for both MMS and the oil and gas industry. The MMS has worked hard to keep pace with industry initiatives, technology developments, and the issues associated with deepwater activities. One aspect that we recognize needs further evaluation is floating production storage and offloading system (FPSO) operations in the Gulf of Mexico.

The MMS continues to gather information and has participated in discussions with the industry, both domestic and international, on FPSO technology. If an operator proposes the use of an FPSO to develop a Gulf of Mexico OCS discovery, MMS will evaluate the proposal using its established environmental and technical review procedures. A generic FPSO proposal or a specific FPSO-based project may require the preparation of an environmental impact statement (EIS) or similar document to identify and evaluate fully the significance of potential impacts associated with such a facility.

The purpose of this paper is to discuss the regulatory issues associated with FPSO operations in the GOM from three general perspectives: environmental, technical, and the conservation of natural resources.

Introduction

The past several years has been remarkable in terms of leasing activity and operations, particularly for the deepwater portion of the Gulf of Mexico OCS: record lease sales, drilling activities, and the application of new technologies that have pushed away some of the historical deepwater barriers. The MMS considers deepwater to begin where industry has to use different technology to develop and produce oil and gas from the OCS. In the Gulf of Mexico, this shift occurs where industry stops using fixed platforms and begins using other types of facilities to produce oil and gas, i.e., subsea facilities, floating production facilities, tension leg platforms, etc. As a rule of thumb, MMS adopted 1,000 feet as the marker for deepwater; that terminology will be used throughout this paper.

Over the last three years, there has been a surge in deepwater leasing in the GOM. Five recordbreaking or very large lease sales have been held. Another indicator of this surge in deepwater leasing is the relatively high number of rigs operating in the GOM: an average of nearly 200 rigs working and 150 rigs drilling since late 1996. The continued growth of deepwater activity levels is illustrated by the following statistics (April 1998):

— 29 rigs drilling in deepwater, the number steadily increasing from just 10 rigs in April 1994; several are in water greater than 4,000 feet, and one lies in more than 7,000 feet (Shell, MC 739 — 7,082 feet); 70 percent are mobile rigs;

— 24 deepwater fields are currently producing;

— 1997 estimated deepwater production: 25 percent of total Gulf of Mexico OCS oil, 7 percent of total gas as compared with 4.4 percent total oil and 0.6 percent total gas in 1990;

— approximately 17 percent of the total pipeline miles are associated with deepwater projects.

There have been 1,190 exploratory and development wells drilled to date in the deepwater areas of the GOM from both mobile and platform rigs. Deepwater drilling has been concentrated in the Green Canyon, Mississippi Canyon, Viosca Knoll, and Garden Banks areas; 90 percent of the deepwater wells have been drilled in these areas. Increased activities in the western GOM are expected beginning in 1998, particularly in the East Breaks, Garden Banks, Keathley Canyon, and Alaminos Canyon areas. The number of discoveries also continues to increase; many are remote from existing infrastructure.

FPSO's in U.S. Waters

The MMS's experience with FPSO-type vessels is limited to a single application in the Pacific Outer Continental Shelf Region – Exxon's offshore storage and treating (OS&T) vessel associated with the Santa Ynez unit development offshore California. The OS&T was located less than 10 miles offshore in the western end of the Santa Barbara Channel. After the first discovery of oil and gas in 1968, Exxon installed Platform Hondo (1976) in 850 feet of water. Oil, gas, and water pipelines, each approximately 8,000 feet in length, connected the platform to a single anchor leg mooring (Salm) in 490 feet of water. The OS&T vessel was permanently

connected to the Salm. Initial production from Hondo began in April 1981.

The OS&T was a converted 50,000 deadweight ton (dwt) oil tanker (previously the *Esso Newcastle*) — 743 ft length, 102 ft beam, and 50 ft draft. The OS&T's primary function was to serve as a floating separation, power generation, and storage facility. The vessel's six main cargo tanks could store 197,000 bbls of treated crude oil, 36,000 bbls of "offspec" product, and 18,000 bbls of produced and treated water. These tanks were located in the center of the vessel. Smaller tanks surrounded the cargo tanks. A cargo heat exchanger was used to circulate and heat the cargo tanks. Storage tanks were gas blanketed and vented to a vapor recovery system where vapors were compressed into the fuel system. Tank relief valves were piped to the vent system. A claus sulfur recovery unit operated on the OS&T.

Each day the OS&T could treat up to 40,000 bbls of oil, 25,000 bbls of water, and 40 million cubic feet of natural gas. It was also capable of producing eight long tons of sulfur per day. Its cargo transfer rate was 600,000 bbls per day. The oil was offloaded by the *Exxon Jamestown* (240,000-bbl capacity) to Los Angeles area refineries; approximately 35 trips per year were made.

FPSO Discussions

A workshop cosponsored by MMS and the industry consortium Deepstar was held in April 1997, with the purpose of educating the participants about the floating production technology in operation, and the proposal for use in the GOM.[1] The workshop was also designed to help identify the issues and concerns with FPSO operations as they relate to the Gulf of Mexico OCS. An equally important objective for MMS was to identify the sources of information available to help with the environmental reviews that are mandated by law for OCS activities. Presentations were given by industry experts, contractors, offloading/transport operators, MMS, and the U.S. Coast Guard (USCG). Discussions focused on the advantages and disadvantages of FPSO's, technology and scope of operations projected for the Gulf of Mexico, MMS requirements for use of FPSO's, USCG requirements for use of FPSO's, lightering and shuttle tanker operations, and the risks and hazards associated with tanker-supported FPSO's. Technical challenges for FPSO operations were described, along with some of the efforts underway to meet those challenges. The MMS role in the approval of offshore oil and gas operations is quite broad, leading to MMS involvement in all aspects of FPSO's.

Regulatory Issues

Since the time of the workshop, MMS has met with representatives of Gulf of Mexico OCS operating companies, FPSO companies, and tankering companies to gather technical information and discuss risks and concerns related to FPSO's in the Gulf of Mexico. In these meetings, MMS has explained that the burden of proof for demonstrating that FPSO operations can be performed in the Gulf of Mexico OCS in a safe and pollution-free manner resides with the operator. Since this would represent the first time OCS oil and gas production would be transported by tanker in the Gulf of Mexico, MMS will need to be assured that the use of such technology does not increase the general risk to the environment over other alternatives. The observations made by the MMS officials in this paper in no way definitively enumerate all aspects of MMS's regulatory approach to FPSO's. Indeed, the regulatory approach continues to evolve.

As with other deepwater initiatives, MMS has found itself needing to adapt some areas of the regulatory program and responsibilities to address the different issues and concerns related to FPSO's. The MMS has had a long-term and productive relationship with Deepstar, interacting primarily with their Regulatory Issues Committee to address issues before they become major concerns, and to share information about emerging technology. The open dialogue with Deepstar has been very beneficial making the concerns and needs of both MMS and industry mutually understood. Building on the success with Deepstar, similar lines of communication have been established with other segments of the offshore industry.

Environmental. As part of an overall deepwater strategy, MMS is preparing a deepwater environmental assessment (EA) on operations in the deepwater areas of the Gulf of Mexico OCS and from associated support activities and infrastructure. The MMS is using the EA process as a planning and management tool to ensure appropriate environmental review of deepwater operations. Objectives of the EA are to identify and evaluate the significance of potential impacts from operations in deepwater and to develop appropriate mitigation measures if needed. The EA will be completed in July 1998.

As no formal proposal for an FPSO-based development project has been submitted to the MMS, no decision has yet been made on what level of National Environmental Policy Act (NEPA) evaluation and documentation would be needed. It is likely that an EIS would be required for the first FPSO-based development project on the Gulf of Mexico OCS. The decision on whether to prepare an EIS is based on several considerations, including the potential for environmental impacts, the degree of uncertainty about the significance of potential impacts, and the level of concern or controversy associated with a proposed action. There are specific environmental issues and potential impacts related to FPSO's, as well as some broader programmatic concerns, that will likely trigger an EIS.

If an EIS is prepared by the MMS, the process would likely take about 2 years. Various industry representatives have expressed concern about the length of time involved if an EIS is required for a development project that uses an FPSO. According to some, such a delay negates the advantages of using the FPSO, specifically the reduction of the cycle time associated with a deepwater development project (time from discovery to first production). Regarding those concerns, the MMS believes that it may be wise for industry to begin the preparation of an environmental document. There are two options for initiating the environmental document. One option would be the formal submission of a site-specific, FPSO-based development operations coordination document (DOCD).

A second option would be the preparation by industry of a generic environmental document by a third-party contractor. In such a case, an operator or industry group would fund the preparation of the document and supply the technical information, and a typical FPSO operation expected in the GOM would be analyzed by the contractor. This environmental document would not formally be an EIS. (By law, MMS must remain responsible for the overall scope and findings of the EIS.) The advantages to

"contracting out" such a document are that the process could be initiated sooner and the process could be compressed into a shorter time (14-18 months). Any decision regarding the eventual use of an FPSO still resides with the MMS; the environmental document would provide the environmental information necessary for making an informed decision. In addition, subsequent environmental review of DOCD's for FPSO's could tier off this and would not as likely require a full blown EIS. The NEPA evaluations of subsequent FPSO-based projects would most likely be environmental assessments.

Conservation. As with all projects on the OCS, operators will be expected to conserve resources. The primary issues MMS sees with FPSO operations are flaring of associated gas and the early abandonment of producing zones. Gas disposition will be reviewed closely by MMS. Operators can expect that MMS will not allow extended flaring for any project, including an FPSO-based project. The MMS will consider and has approved some limited volumes and durations for flaring to allow for well testing, well unloading, and other infrequent, short-term efforts. Flaring oil field gas for up to 1 year may be permitted for economic reasons, with justification, if there is an approved plan of action to eliminate the flare. One example of such a situation might involve early production where a pipeline will ultimately be installed to transport the gas to market. Any economic analysis should include how the operator intends to address the gas disposition. The MMS is aware of gas reinjection as a disposition strategy. Reinjection would require further investigation, particularly regarding the potential for subsequent recovery once gas has been reinjected. Such proposals would likely be addressed on a case-by-case basis.

The MMS has established procedures to look at the conservation aspects of deepwater developments, both at the development (pre-production) stage and prior to zone abandonment. A Notice to Lessees and Operators (NTL)[2] describes the conservation review process and what information is required for GOM deepwater or subsea development projects.

Technical

The MMS initiated a Deepwater Operations Plan (DWOP) requirement in 1996 to address the growing complexities and issues evolving with deepwater development projects. Through MMS's active involvement with the Deepstar Regulatory Issues Committee, MMS and industry participants were able to evolve the DWOP concept jointly.

A DWOP is required for all deepwater development projects and all projects utilizing subsea production technology. Projects that use conventional fixed-leg platforms are exempt from the DWOP requirements. The DWOP addresses technology, safety systems, inspection, testing and maintenance practices, alternative compliance, and other subject areas. The DWOP is a proprietary document submitted to MMS in three parts: conceptual, preliminary, and final. Each part is described further as follows:

1) The conceptual part addresses the general design basis and philosophy used to develop the field. This part provides an early opportunity for MMS and the lessee to agree on a plan of development prior to major expenditures for engineering design. It should be submitted for approval after the operator has identified the concept(s) for development and prior to commencing with engineering design.

2) The preliminary part provides an opportunity for approval of the system and associated operations plan prior to major commitments and expenditures for hardware. It should be submitted for approval after the lessee has substantially completed system design and prior to commencing procurement and fabrication.

3)The final part updates information previously submitted in the preliminary or conceptual parts. This part shall be submitted for approval within 90 days following initial production.

The 3-part DWOP is intended to coincide with the operator's knowledge regarding the project. The DWOP is also intended to reduce the overall project planning and scheduling risk of the deepwater development project by eliminating the uncertainties associated with approving new technologies and alternative compliance measures. The DWOP approach has reduced the need for MMS to revise regulations constantly to keep pace with rapidly evolving deepwater technology.

A continuing dialogue with Deepstar and others has resulted in the revision of the first set of DWOP guidelines. Following an extensive review by MMS, a new NTL is planned to be issued in May 1998 to implement the revised DWOP guideline. The significant changes made include:

— improved readability;

— information requirements for floating production systems and nonconventional fixed facilities;

— increased flexibility by focusing DWOP information on a component basis; allowing unique technologies (new to the GOM) to be addressed without revising the guideline;

— requiring a conceptual part for every project that requires a DWOP; and

— waiving the preliminary part for certain shallow-water subsea developments.

The USCG role in regulating FPSO operations will be a key issue to delineate as we move forward with possible developments. There are jurisdictional overlaps between MMS and the USCG that we believe can be identified and coordinated to avoid duplication of effort. The Memorandum of Understanding between MMS and the USCG has integrated some of the initial thoughts of the two agencies regarding the delineation of responsibilities for all floating production systems, of which FPSO's is a subset. The USCG expertise in marine transportation and facilities will be valuable to the ensuing discussions. There have been concerns expressed regarding the need for a double hull for the FPSO, and the applicability of OPA regulations to FPSO operations. The USCG has indicated that double hulls would likely be required for a Gulf of Mexico FPSO.

The topic of FPSO classification by independent groups (classification societies) is also of interest to the MMS. The integration of offshore production facility design and tanker design philosophies is understood to be a challenge, and has resulted in some criticism by operators about FPSO system quality and project delays. It is unclear to MMS if the concerns raised to date were directed at specific projects (and shipyards), or if they are intended for the entire classification process. The MMS must be assured that the verification and classification process for FPSO operations is credible before an FPSO can operate in the Gulf of Mexico OCS.

The FPSO operations deviate from historical activities in the GOM by the number and variety of systems that interface with the production system (e.g., offtake to shuttle tankers interfacing with

production processing). The United Kingdon (UK) Health and Safety Executive (HSE) recently published a report titled "Close Proximity Study," which assesses the "risk of collision during close proximity operations involving shuttle tankers at offshore locations."[3] All aspects of the FPSO and shuttle tanker are addressed on a component basis (e.g., propulsion, surface export system, controls). The report includes a secondary objective of identifying mitigating measures to minimize the risks associated with collision. The report concludes that the "greatest single marine risk is that of collision between the Floating Storage Unit or FPSO and the offtake tanker."

The MMS is interested in how the various aspects of an FPSO-based project interrelate (i.e., production, processing, storage, offloading), and how stresses such as weather, process upsets, delays, etc., affect safety of the operation. Included in the HSE document are risk management, joint/simultaneous operations, delineation of responsibilities, emergency systems and procedures (includes risk reduction measures for shuttle tanker operations when in close proximity to the FPSO), communications, and interface operations and equipment. Before MMS can approve a project, the operator must be able to demonstrate to MMS that there are sufficient safeguards built into the production system to prevent the occurrence of significant incidents that impact safety or environmental concerns. Clearly defined operating procedures that describe the division of responsibility and accountability will be a factor in the acceptability of an FPSO development.

The MMS is aware of international efforts underway to develop guidelines for safe offtake from FPSO's, FSO's, and single-point mooring buoys, and for the associated shuttle tanker operations. We encourage operators considering the FPSO option for field development in the GOM to evaluate the international efforts underway, and integrate the results of these efforts as appropriate into the project planning and implementation.

A common theme for many deepwater development projects is the operator's desire to fast-track the process. In some instances, construction begins in parallel with design work, and time frames are compressed in an effort to reduce the cycle time, i.e., move up the date of first oil. The MMS is concerned about the move toward fast-track development, particularly in relation to the quality and safety of the systems developed for production on the OCS. Operators need to understand that there are environmental reviews and regulatory requirements that cannot be compromised as part of the fast-tracking effort. An early dialogue, as provided in the DWOP process, will continue to be a necessity for the sophisticated deepwater developments.

Conclusions

The MMS is committed to ensuring the safe and pollution-free exploration, development and production of the offshore mineral resources. As interest and activity continue to grow, especially in the deepwater areas of the GOM, it will become increasingly important for the industry and MMS to maintain an open dialogue about technological advances, regulatory needs and concerns, and operational safety. The MMS has been working to keep pace with advances in technology and with the issues that most affect safe and pollution-free exploration and development offshore. The issues involved with FPSO operations in the Gulf of Mexico OCS have been discussed jointly with operators, contractors, and others over the past two years. We have a better understanding of the FPSO systems, their capabilities, operability, and experiences in other areas of the world. The MMS continues to investigate the international efforts that are focusing on the interfaces between the production and nonproduction processes.

No one has proposed an FPSO as a development strategy for the GOM to date, although several operators have indicated that they are close to making a formal submittal. Once again, MMS has the environmental and regulatory regime in place to address such a proposal, and it will be the operator's responsibility to demonstrate to MMS that the FPSO can operate in the GOM in a safe and pollution-free manner.

References

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3. U.K. Health and Safety Executive, "Close Proximity Study," Offshore Technology Report OTO 97 055.