Lauren Segal
Paleogene Performance Unit Leader
Deepwater Developments, Gulf of Mexico

BP America Inc.
200 Westlake Park Boulevard
Houston, Texas 77079

office: (281) 366-2259
email: segallb@bp.com

February 22, 2008

Delivered by electronic submission and hand

Mr. Chris Oynes
Associate Director for Offshore Minerals Management
Minerals Management Service
Department of Interior
Washington, DC 20240

Subject: Technology Suspension

Dear Associate Director Oynes,

Please find attached written comments in relation to the MMS 'Technology Suspension' Federal Register Notice and Workshop held in New Orleans in January 2008.

We appreciate the opportunity to provide these comments on this matter and would be pleased to further discuss the particulars included in our submission. In that regard, please feel free to contact me at the number above or Mike Jennings, BP's Paleogene Resource Manager, on (281) 366-0919.

Meantime, we look forward to continuing to work with your organization on this and other matters of importance to the nation's energy supply.

Sincerely,

Lauren Segal

-TECHNOLOGY SUSPENSION-

BP EXPLORATION & PRODUCTION INC. ("BP") RESPONSE TO FEDERAL REGISTER NOTICE REQUEST REGARDING GRANTING TECHNOLOGY-BASED SUSPENSION OF OPERATIONS FOR DISCOVERIES IN THE GULF OF MEXICO PALEOGENE/LOWER TERTIARY TREND

Presented to the Minerals Management Service, the United States Department of the Interior, Herndon, Virginia

FEBRUARY 22, 2008

TABLE OF CONTENTS

PAGE

INTRODUCTION

BP Exploration & Production Inc. ("BP") submits this proposal in response to the Federal Register Notice, Vol. 72, No. 216, dated Thursday, November 8, 2007 and related request by the Minerals Management Service ("MMS") for comments concerning technology-based Suspension of Operations ("SOO") in connection with deep water Gulf of Mexico ("GOM") leases with proven discoveries of oil reserves in Paleogene era formations. Specifically, this proposal responds to the questions posed by the Federal Register Notice and addresses the methods by which MMS might exercise its existing statutory and regulatory authority to grant relief for such leases from the current lease maintenance requirements that apply after the expiration of the primary term.

BACKGROUND

Over the years, the Gulf of Mexico ("GOM") exploration and production industry faced many daunting and novel technological challenges as it moved into ever deeper waters. Many of these challenges were outside of existing industry capabilities when first encountered. In response, MMS provided critical regulatory flexibility that eventually played a major role in enabling industry to bring new oil and gas discoveries into production, benefiting not only industry and the United States government, but also, most importantly, the nation as a whole. Some of the most prolific fields in the history of the GOM were developed with the cooperation of the MMS in the face of such technological challenges. Many of the recent lower tertiary or "Paleogene" discoveries also face numerous daunting and novel technological challenges. Likewise, industry needs the MMS to provide regulatory flexibility to fully unlock the potential of the Paleogene in what could represent the next GOM opportunity for prolific domestic hydrocarbon production. In doing so, the MMS will be providing the critical element necessary to allow industry to answer the Paleogene technological challenges, helping to unlock the Paleogene trend in the most expeditious, efficient and safe manner possible, mutually benefiting industry and the MMS, and ultimately fulfilling the express purpose of the Outer Continental Shelf Lands Act.

In 2006, BP drilled the Kaskida discovery well in the Paleogene to a depth of more than 32,000 feet. The ultra-deep, high pressured, subsalt, Paleogene subsurface conditions that exist at Kaskida create technological challenges to production that industry has not faced in producing oil and gas from Miocene era formations (or even from prior Paleogene discoveries). Unlocking this significant Paleogene potential will require the enhancement of existing technologies, a substantial financial commitment in the billions of dollars, and the possible development of new technologies. The novelty of the Paleogene reservoir conditions means that "accelerated development" will have a different meaning for subsalt Paleogene plays than it has for the Miocene.

After extensive technical evaluation, including conducting the largest pre-stack depth migrated seismic survey to date in the GOM, and various commercial transactions to secure required acreage were completed, BP drilled its discovery well in Kaskida with less than two years remaining in the ten-year primary term of some of the leases in the unit. Under the current SOO regulations and policies of the Minerals Management Service ("MMS"), BP is required to conduct drilling activities every 180 days in order to maintain its lease rights. However, such a requirement would cause BP to drill unnecessary wells and, thereby, disrupt the most prudent

and efficient sequence of operations. If BP is required to divert resources in order to conduct new drilling operations every 180 days, commencement of first oil production will certainly be delayed. Moreover, because Paleogene wells will take many years to return BP's investment, and because of the need to invest in enhancement of existing technologies and possible development of new technologies to bring them to production, the inefficient use of resources to drill unnecessary wells could bring into question the commercial viability of developing Paleogene discoveries similar to Kaskida. Accordingly, the MMS should consider taking the necessary steps to avoid the drilling of unnecessary wells every 180 days. There is no question that the MMS has the authority to undertake such action. Moreover, there is ample precedent for the agency to adjust its lease maintenance rules to support industry investment in new sources of production. Furthermore, first oil will be achieved more expeditiously within a new play such as the Paleogene by granting a suspension to the current lease holder rather than allowing the lease to go back into the lease sale inventory and thereby effectively restarting the clock on enhancing and developing the technologies needed to unlock the play.

RESPONSES TO QUESTIONS POSED IN FEDERAL REGISTER NOTICE

BP's response to each of the questions posed in the Federal Register Notice is provided below. For a detailed explanation of each response please refer to the attached Appendix A.

a) The Paleogene Opportunity: Is the Technology SOO concept warranted?

Yes. The spectrum of Technological Challenges that industry must overcome include:

1) ***Seismic imaging*** – state of the art, expensive seismic technologies and processes, such as WATS seismic applications which can take up to four years to complete, are needed, despite limited industry capacity to deliver.
2) ***Technology gaps*** - exist in pressure containment systems and rig capabilities to broadly appraise and develop the Paleogene.
3) ***Drilling completions*** – pilot projects will be required to test new completions, which will require enhancement of existing equipment and possible development of new equipment that has yet to be designed and fabricated.
4) ***Well tests*** – Paleogene well tests can take over two years to plan and more than a year to execute.
5) ***Reservoir performance*** – low permeability and high viscosity of Paleogene reservoirs create challenges for both the rate of recovery and the volume of recovery. Improved enhanced recovery methods (secondary, tertiary waterflood, artificial lift, etc.) will need to be developed for the offshore environment.
6) ***Production systems*** – early production schemes might be required to determine whether a full field development is economic.

b) How could the MMS define Technological Challenge?

BP's view is that a lessee would need to clearly demonstrate that the project requirements are beyond traditional appraisal/development technologies and therefore call for regulatory flexibility.

To do this one (or more) of the technical challenges, which are more fully described in Appendix "A", must exist and can be categorized as quantitative and qualitative:

Quantitative Challenges could include high pressure, high temperature and/or extreme well depth.
Qualitative Challenges could include poor rock and fluid properties, rate/recovery uncertainties, and/or difficult seismic imaging conditions.

c) What other eligibility criteria should be considered?

A discovery during the primary lease term would be required. Following a discovery, the burden would be on the lessee to demonstrate eligibility through meeting at least one of the five Technological Challenges mentioned above.

d) What tangible/observable milestones would be required for technology development related to a lease?

The lessee should provide an activity schedule of investment and activity commitments that addresses the Technological Challenges. As is the case with any activity schedule, it would require MMS approval and periodic review for compliance with milestones. It would be updated on a specified timeframe and subject to MMS approval.

e) How long should a suspension last?

On a project level, the length of the suspension should be specified by the activity schedule. Periodic reviews will address progress toward overcoming the Technological Challenges. Suspension should be renewable/revisable based on results from the activities.

REGULATORY GROUNDS UPON WHICH THE MMS MAY GRANT A TECHNOLOGY-BASED SUSPENSION OF OPERATIONS

a) Legal Requirements for Lease Maintenance

Pursuant to its authority under Section 5 of the Outer Continental Shelf Lands Act, MMS has adopted regulations for lease maintenance requirements, including regulations "for the suspension or temporary prohibition of any operation or activity, including production, pursuant to any lease … at the request of the lessee, in the national interest, to facilitate proper development of a lease or to allow for the construction or negotiation for use of transportation facilities." 43 U.S.C. § 1334(a)(1). The basic rule, which is contained in 30 CFR 250.180, requires a lessee to conduct operations in the field every 180 days after the primary term to maintain its lease rights:

30 CFR 250.180 (a)(2) states "Your lease expires at the end of its primary term unless you are conducting operations on your lease (see 30 CFR part 256). For purposes of this section, *operations* means, drilling, well-reworking, or production in paying quantities.

The objective of the drilling or well-reworking must be to establish production in paying quantities…."

30 CFR 250.180(d) states "If you stop conducting operations on a lease that has continued beyond its primary term, your lease will expire unless you resume operations or receive an SOO [suspension of operations] or SOP [suspension of production] from the Regional Supervisor … before the end of the 180th day after you stop operations."

MMS's regulations recognize three types of exceptions to the 180-day requirement: a Suspension of Operations ("SOO"), a Suspension of Production ("SOP"), and a Lease Term Extension. *See* 30 CFR 250.168-177 (SOOs and SOPs) 250.180(e) (extensions).

b) MMS's Existing Authority

There is no question that the MMS has the existing legal authority to provide qualifying lessees the regulatory flexibility that is essential to develop Paleogene discoveries.

1) First, 30 CFR 250.180(e) authorizes the granting of an extension of the 180-day period "when operating conditions warrant," and where MMS determines that "the longer period is in the national interest, and it conserves resources, prevents waste, or protects correlative rights." The "operating conditions" that support extending the 180-day period have been described above in great detail. Further, the importance to the national interest of encouraging the investment of billions of dollars in private equity to develop the nation's resources is abundantly clear; moreover, it is mandated by the underlying purposes of the OCSLA, which are:

> (1) [to] establish policies and procedures for managing the oil and natural gas resources of the Outer Continental Shelf which are intended to result in expedited exploration and development of the Outer Continental Shelf in order to achieve national economic and energy policy goals, assure national security, reduce dependence on foreign sources, and maintain a favorable balance of payments in world trade;
>
> (2) [to] preserve, protect, and develop oil and natural gas resources in the Outer Continental Shelf in a manner which is consistent with the need (A) to make such resources available to meet the Nation's energy needs as rapidly as possible, (B) to balance orderly energy resource development with the protection of the human, marine, and coastal environments, (C) to insure the public a fair and equitable return on the resources of the Outer Continental Shelf, and (D) to preserve and maintain free enterprise competition;
>
> (3) [to] encourage development of new and improved technology for energy resource production which will eliminate or minimize risk of damage to the human, marine, and coastal environments. [emphasis added]

2) Similarly, MMS could grant an SOO to a qualifying lessee based on the following existing regulatory standard:

> The Regional Supervisor may grant an SOO when necessary to allow you time to begin drilling or other operations when you are prevented by reasons beyond your control, such as unexpected weather, unavoidable accidents, or drilling rig delays. 30 CFR 250.175(a).

Here, the indisputable reality is that many of the critical pieces of equipment that are necessary to develop and produce Paleogene era oil at discoveries like Kaskida will either have to be enhanced from existing technology or do not yet exist. This leads to circumstances that are currently "beyond [a lessee's] control"; but, circumstances that can be overcome by industry with MMS's cooperation.

3) In addition, granting a SOO for these reasons would be supported by 30 CFR 250.172(c), which authorizes MMS to grant an SOO "when necessary for the installation of safety or environmental protection equipment."

Fortunately, for all of these reasons, MMS's existing regulations could be utilized to grant a technology-based SOO.

BP proposes that the MMS publish an NTL that would authorize technology-based relief for qualifying lessees, based on the criteria set forth above. This NTL would set forth the agency's interpretation of 30 CFR 250.180(e), 250.175(a), and/or 30 CFR 250.172(c), which contains existing regulatory support for the type of relief being authorized. MMS could then determine whether it would be advisable to supplement such an NTL with a rulemaking.

4) BP believes that MMS can also look to a relevant precedent for the best approach to granting the necessary relief by looking no further than the model of regulatory flexibility it successfully employed in developing a new category of SOOs for ultra-deep shelf wells. *See* 30 CFR 250.175(b) & (c). In that case, MMS utilized a combination of NTLs and regulatory changes to create a special category of SOO that was designed to accommodate *both* industry's need to develop the requisite technologies *and* the nation's interest in maximizing the recovery of domestic hydrocarbons. The italicized statement from MMS's NTL No. 2004-G16 applies fully to leases containing Paleogene era oil reservoirs:

> Purpose and Need for NTL—This NTL provides guidance for operators to request SOO's for drilling ultra-deep wells affected by salt sheets and informs operators that a departure may be obtained to the requirements contained in 30 CFR 250.175(b)(2). *The ultra-deep frontier offers the potential for significant resources, but with accompanied high economic and technological risks. MMS recognizes the importance of expediting domestic exploration to address the critical national need. To that end, MMS sees that it is in the national interest to expedite exploration for new sources of hydrocarbons at these ultra-deep depths*. (Emphasis added.)

Following is a summary of MMS's development of its suspension program for ultra-deep shelf wells.

> *First*¸ on December 21, 2000 MMS issued NTL No. 2000-G22, which provided a specific interpretation of 30 CFR § 250.180(e), which pertains to lease extensions. Thus, in this initial step, MMS stayed away from the "SOP" and "SOO" categories. One critical requirement of this NTL was that drilling operations on a well had to have been commenced during the lease term.
>
> *Second*, on July 2, 2002 MMS promulgated a new regulation, 30 CFR § 250.175(b), to replace and expand on the policy contained in NTL No. 2000-G22. This regulation steered away from the "lease extension" category and framed the rule as providing for a specific type of SOO.
>
> *Third*¸ MMS issued NTL No. 2004-G16, effective August 19, 2004, to carve out an exception to one of the regulatory requirements contained in § 250.175(b). The italicized portion of the "Purpose and Need" section of this NTL (quoted above) demonstrates that MMS has previously adjusted its lease maintenance policies for the very same reasons that apply to the Paleogene:
>
> *Fourth*, on February 14, 2005 MMS issued its Notice of Proposed Rulemaking, proposing the promulgation of 30 CFR § 250.175(c), which would expressly authorize an SOO for ultra-deep wells that are not associated with a salt sheet. On December 16, 2005, MMS finalized its regulations, stating the following in the preamble:
>
> > Allowing a lessee additional time for this data analysis encourages companies to consider ultra-deep exploration. A successful development will generate more activity at lease sales and increase drilling on existing leases.
> >
> > MMS recognizes that a lessee knows the length of the lease term when it obtains a lease. When a lease expires, another lessee can acquire a new lease on the same tract. MMS considered these factors, and believes that the need to encourage drilling to significantly deeper depths warrants the final rule change. Successful wells benefit not only the companies that drilled the wells, but also the public by increasing domestic energy supplies. In addition, the drilling of successful wells will encourage other companies to acquire leases and pursue ultra-deep exploration in United States (U.S.) waters. 70 Fed. Reg. 74659 (Dec. 16, 2005).

Just as each of these steps was fully within MMS's statutory and regulatory authority, so too would MMS be authorized now to grant relief to qualifying lessees and to adopt Paleogene-specific rules. These same considerations support providing additional flexibility to those few operators who are willing to invest the considerable time and resources necessary for the pursuit of the vast resources of Paleogene era reservoirs.

BP proposes the MMS employ the criteria referenced in Section 1 above as the basis for granting either a lease term extension or an SOO to encourage industry to invest the billions of dollars that are necessary to develop Paleogene resources**.** Although MMS has the authority to grant such relief simply based on its existing regulations, it would be useful to industry for MMS to publish an NTL containing an interpretation of its existing regulations that would be used to grant lease term extensions or SOOs, as described above. Such an NTL would provide lessees with the type of criteria necessary to make the significant investment decisions required to develop Paleogene era reservoirs.

CONCLUSION

As the easily accessible reservoirs have depleted over time, the offshore oil and gas industry had to constantly reinvent itself. It has done so successfully many times, with the cooperation of MMS. In the early 1990s, 3-D seismic technology provided a much needed boost to offshore investment. Deepwater development followed soon thereafter, and deepwater oil and gas production increased six-fold during the period 1995-2004. The Paleogene offers the next big opportunity in the Gulf of Mexico, but it presents severe technological and commercial challenges. Few industry operators have the resources, capabilities and long-term view to undertake a challenge of the size and complexity present in subsalt, Paleogene discoveries. Among those operators that do have what it takes, BP has a proven track record of success and delivery in the deepwater Gulf of Mexico. It is strongly in the national interest for the government to facilitate industry's successful investment in Paleogene prospects such as Kaskida. This would include, at a minimum, providing industry with a flexible regulatory framework that will help drive the design and development of the enabling technologies required to unlock the potentially prolific Paleogene trend. The regulatory flexibility needed under the unique circumstances described above will not open Pandora's Box and lead to a flood of lessee's seeking to extend leases beyond their primary term. The criteria that must be present to qualify for the relief sought are unique, extreme, and applicable to limited areas in the GOM. Moreover, the regulatory flexibility, while undoubtedly of benefit to BP at Kaskida, will not result in a significant portion of BP's leases being extended beyond their primary term. The actual number of leases likely to be impacted by the proposed regulatory relief is a tiny percentage of BP's and industry's current inventory.

Finally, when considered in the context of the overarching purpose of the OCSLA, providing regulatory flexibility is the key that will encourage industry players like BP to commit the precious time and resources it will take to develop the technology and expertise necessary to unlock the potential of the Paleogene. Drilling wells that would not otherwise be drilled will only divert resources from the more valued use, prolonging the development of necessary technology and pushing first oil further and further into the future. As in the past, BP looks forward to a collaborative effort with the MMS to realize the goal of bringing the Paleogene into a producing reality.

APPENDIX "A"

BP America Inc. Written Submission to Minerals Management Service (MMS)
February 22, 2008

BP would like to thank MMS for holding the workshop on January 23, 2008 in New Orleans and is pleased to submit written comments. Our written comments support the presentation made by BP's Lauren Segal and Mike Jennings. This written submission is intended to address the questions posed in the MMS' Federal Register notice and to clarify or expand upon issues raised at the workshop.

The MMS is to be commended for holding the workshop and for encouraging the dialogue between government and industry on the critical technology challenges facing both in the Deepwater Gulf of Mexico (GoM).

The MMS and industry have a strong record of successful technological innovation and delivery that has been a key success factor for the deepwater GoM. BP has been actively exploring and developing in the GoM for decades and we are proud to be a participant in what is perhaps the most dynamic deepwater province in the world.

The Paleogene Opportunity: Is the TSOO concept warranted?
There have always been new challenges as we moved into deeper waters, deeper wells and poorer imaged prospects. Over time, when industry and government have faced challenges which are outside current capabilities, MMS has responded by providing needed regulatory flexibility. This flexibility in turn enabled industry to bring new oil and gas developments into production for the benefit of all interested parties.

Industry has delivered tremendous success to date, but the challenges are increasing and some of the most significant new challenges that we will face lie in the Lower Tertiary/Paleogene and Deep Gas trends. These novel technological challenges in these new trend areas could not have been contemplated when initial deepwater rules and regulations were drafted. In fact, these challenges were not contemplated when many of the currently held leases were acquired. This is because many of the leases in question were acquired for their Miocene prospectivity. Their Paleogene prospectivity was considered only when their Miocene potential was eliminated and new seismic technology to image the Paleogene became available (which in many cases was at or near the end of the primary lease term).

Compared to the Miocene, Paleogene formations have different rock characteristics and fluid properties, and they present an entirely different geologic setting. Lessons from prior GoM discoveries and developments will have limited value for the Paleogene. The unique reservoir characteristics that are typical of Paleogene formations will require industry to reinvent nearly every aspect of the process of appraisal and development that is necessary to bring these reserves to production. Furthermore, due to the extreme operating conditions

industry is encountering in recent discoveries, modifications to the existing regulatory framework are necessary to enable industry to unlock this new hydrocarbon potential.

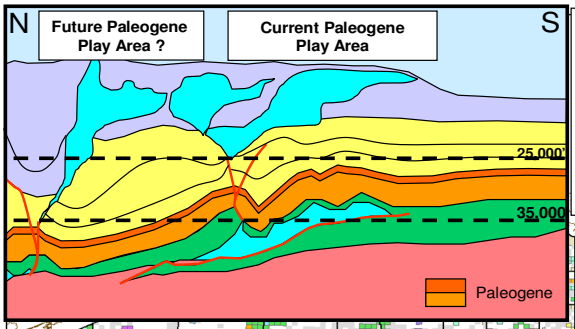
We believe the concepts MMS outlined in the Federal Register notice for the Workshop are consistent with past actions, including NTL's, LTL's, the expansions of continuous drilling requirements from 90 to 180 days and deep gas lease terms. Through these concepts and within existing authorities, BP believes that the MMS can create a mutually beneficial process that meets the energy needs of the nation by enabling industry to properly progress these "technologically challenged" discoveries through a reasonable schedule of activities that could lead to production.

The MMS' Federal Register notice was largely focused on high pressure and high temperature (HTHP) technology challenges. However, as was borne out in the discussion at the workshop, many believe the challenges facing industry are more complicated than HTHP. Specifically, the spectrum of challenges which the industry must overcome includes:

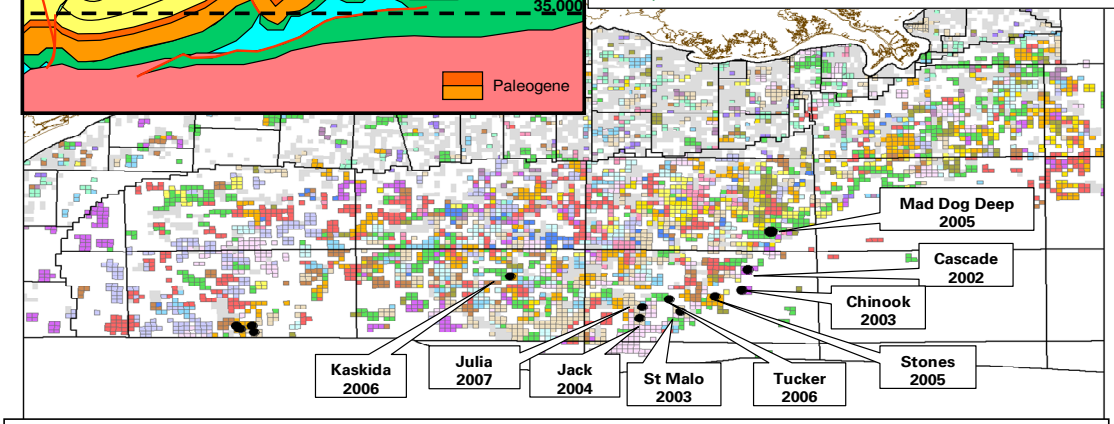
7) ***Seismic imaging*** – state of the art, expensive seismic technologies and processes, such as WATS seismic applications which can take up to four years to complete, are needed, despite limited industry capacity to deliver.
8) ***Technology gaps*** - exist in pressure containment systems and rig capabilities to broadly appraise and develop the Paleogene.
9) ***Drilling completions*** – pilot projects will be required to test new completions, which will require enhancement of existing equipment and possible development of new equipment that has yet to be designed and fabricated.
10) ***Well tests*** – Paleogene well tests can take over two years to plan and more than a year to execute.
11) ***Reservoir performance*** – low permeability and high viscosity of Paleogene reservoirs create challenges for both the rate of recovery and the volume of recovery. Improved enhanced recovery methods (secondary, tertiary waterflood, artificial lift, etc.) will need to be developed for the offshore environment.
12) ***Production systems*** – early production schemes might be required to determine whether a full field development is economic.

As the slide below indicates and the ensuing discussion amplifies, there is clearly a great deal of activity in the Paleogene.

MMS Questions: Is this Concept Warranted?
Paleogene: A Challenging Opportunity



- Most activity and discoveries are along the southern extent of the Paleogene Trend
- Moving to the North it will be potentially Deeper, hotter and higher pressure more difficult seismic imaging, more structurally complex



- Industry has invested in significant acreage positions
- Acreage is largely un-drilled but most of it likely to exceed currently challenged Pg conditions

The following outlines what we think makes the current Paleogene activity very significant. The first of the Paleogene or Lower Tertiary Discoveries in the eastern edge of the Central Planning Area occurred about 6-7 years ago with prospects like Cascade. This was followed by an impressive discovery track record – particularly along the edge of the salt. According to the consulting firm, Wood Mackenzie, discovery success has been very high with 19 wells drilled from 2000-2006 and ~1.8 billion barrels of reserves discovered. Recent discoveries, however, have proven that this trend may span some 15000 square miles as we move back under the salt canopy west and north into more complex imaging regimes.

However, despite the promising exploration success, all of these discoveries have introduced an entirely new set of technological challenges in moving through appraisal and into development. Unlike our Miocene successes, recovery and rate are much more challenged and poorly understood due to low permeability and viscous fluids. While industry has produced from rocks and fluid with similar characteristics, in other places around the world, industry has never done so at these reservoir pressures and well depths, in the harsh deepwater environment, and remote from infrastructure.

Even with the significant challenges facing industry, enthusiasm is running high for this new trend and its role as a potentially significant source of new supply in the GoM. For the nation, this trend could not have been better timed given the need for new domestic production. The challenge facing government and industry is how to convert this potential into producing barrels as quickly, efficiently and safely as possible.

How the MMS could define Technological Challenge

The discovery of hydrocarbons in the Paleogene (or Lower Tertiary) has created a set of conditions that are unique, not only to the GoM, but to the world. We are finding hydrocarbons resources at greater depths, at higher pressures & temperatures, in poorer imaging conditions, and with significant rock and fluid challenges.

These conditions create the need for new technologies and techniques in the realm of hardware, as well as upgrading of existing technologies. The conditions will require the use of limited new generation rigs, new development concepts and more subsea facilities. The nature of these reservoirs and the depths at which the target production intervals will be found both suggest that more rig days and hence more rig capacity will be needed to develop the Paleogene fields.

Unfortunately, there are currently no producing analogs for these conditions. These conditions also create a need for new approaches to appraisal as compared to conventional GoM appraisal. These discoveries will need an expanded set of appraisal activities: adding dynamic testing, advanced seismic imaging, and significant technology development for typical appraisal drilling.

How would MMS define "Technological Challenge"?
Emerging Technology Themes for the Paleogene

bp

Theme	Condition	Concerns and Gaps
Reservoir Depth & Pressure	>20k psi @ reservoir 15k psi @ seafloor >25-35k ft TVD	Completion technologies Intervention techniques
		Subsea Equipment & Dry tree riser & rig loads
Seismic Imaging	Subsalt	Advanced seismic techniques, limited capabilities, timeliness
Fluid & Rock Properties	Viscous fluids & low perm: Requires - High drawdown, downhole artificial lift, WF/EOR	Completion design & integrity, Zonal isolation, Artificial Lift integration, Injection pressures
Remoteness	Lack of export infrastructure	Crude Pipeline challenges, tankering, gas balance.
Temperature	<300° F @ Reservoir	Existing Technology
Water Depth	6,000 - 9000 ft.	Existing Technology

\+ No Existing Production Analogs

Key Focus Appraisal Areas:

- Static - Wells & Advanced Seismic
- Dynamic Flow Testing - Rate/Recovery
- Appraisal & Development Technology

The table above depicts BP's view of the emerging technology themes. The colors in the table are represented as follows:

- **Green** – Represents existing technology capabilities which are currently available within the GoM.
- **Yellow** – Some new concepts or upgrades of existing technologies will be needed.

- **Red** – Significant modification of existing technology and development of new technology will required.

Reservoir Depth and Pressure
This Lower Tertiary / Paleogene trend is generating some of the highest reservoir pressures and deepest wells the GoM has ever seen. This creates significant issues around rig capabilities – drilling, completion and intervention - and pushes the limits of current capabilities of pressure management. Therefore, the need for subsea equipment and risers to handle pressures greater than 15,000 psi is here now. This equipment does not currently exist and could take years to develop. Moreover, the equipment is not likely to be developed if the industry cannot be reasonably assured of the appropriate regulatory flexibility when faced with the combination of potentially significant discoveries and expiring lease terms; i.e. it will be very difficult for industry to commit the resources necessary to unlock the trend without the willingness of the MMS to utilize existing authorities to provide regulatory flexibility.

Seismic Imagery
The combination of the depth and the complex salt canopy makes imaging with conventional seismic techniques impossible in some areas. Consequently, advanced seismic techniques, such as Wide Azimuth Towed Streamers (WATS) are needed. Industry's currently capabilities simply in terms of boats and computing power for this technology are currently limited.

Rock and Fluid Properties
Rock & Fluid properties across the Paleogene trend also present a significant challenge due to the discovery of viscous fluids and less permeable rock than that found in the mature, shallower, younger basins like the Miocene. This is leading to significant issues around productivity and recovery. Possible solutions to these conditions include novel completion techniques, downhole artificial lift, and assisted recovery methodologies such as water flood enhanced oil recovery (EOR). These solutions generate concerns and gaps in completion design and integrity, integration of artificial lift, and injectivity requirements for EOR.

Remoteness
Remoteness and lack of export infrastructure is not a new challenge to the GoM, but the solutions may be. Because more viscous oil causes significant flow assurance issues in pipelines, FPSO's and shuttle tankering will become real options.

Temperature and Water Depth
While significant, we believe temperature and water depth challenges can be overcome within the capabilities of today's deepwater industry but could exceed current capabilities as the trend expands and we find areas in deeper water or deeper reservoirs.

The fact that there are no production analogs for these conditions means that there is no history with which to calibrate our rate and recovery prediction tools. Part of the appraisal process needs to be creating that history or calibration. This will take a commitment of considerable time and resources in the delivery of a multi-faceted activity set during the appraisal and development cycle of these prospects. This activity set will need to address the classic appraisal issue of acquiring static data in the form of better seismic and wells, but also the more challenging

dynamic data to address the productivity and recovery that these reservoirs may be able to deliver. Underpinning both of these planks of appraisal, and enabling us to more from appraisal into development, requires a significant technology development effort which can enable appraisal at these challenging pressure, depth and sub-salt conditions as well as progress commercial development concepts.

How would MMS define "Technological Challenge"?
Emerging Technology Themes for the Paleogene

Lessee must demonstrate that project requirements are beyond traditional appraisal /development.

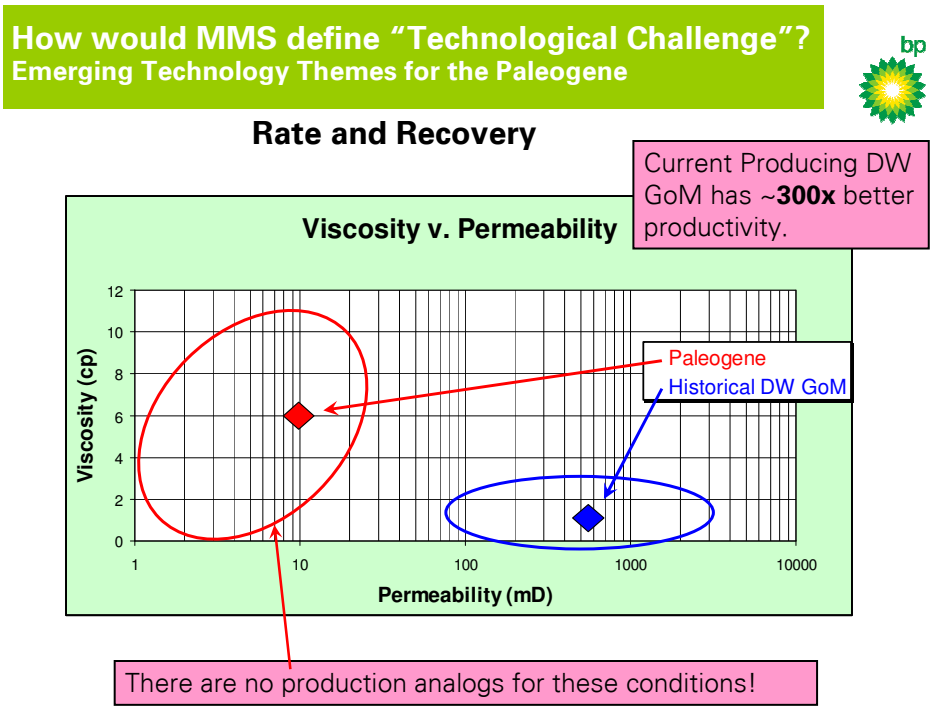
One or more of these 5 technical challenges creates the need for regulatory flexibility:

- Quantitative – Beyond current industry capability
  - HP – High Pressure > 15k psi @ seafloor or > 20k psi @ reservoir
  - HT – High Temperature > 350° F
  - Extreme Depth >25,000' subsea
- Qualitative
  - Rate/Recovery Challenges – Rock & Fluid Properties
  - Severe Seismic Imaging Challenges

BP's view is that the lessee must clearly demonstrate that the project requirements are beyond traditional appraisal / development technologies and therefore call for regulatory flexibility. To do this, one (or more) of the technical challenges must exist; for example, three could be quantitative and the other two are more qualitative

Quantitative Challenges could include high pressure, high temperature and/or extreme well depth.

Qualitative Challenges could include poor rock and fluid properties, rate/recovery uncertainties, and/or difficult seismic imaging conditions.



The Rate and Recovery Challenge is best seen by comparing permeability and viscosity to normal or historical GoM values. **Viscosity** is indicated on the Y-axis and **Permeability** on the X-axis (shown with a log scale to allow the data to group better graphically). The actual data from this plot has been removed, but it shows generally where the historical GoM sits and where this new trend sits.

On average, the Paleogene is about 1½ orders of magnitude worse in rock quality and 5-6 times worse in fluid quality. This creates significant productivity issues. Mobility (k/μ) is reduced 300x from the historical GoM. This is not just a rate issue. It is also a recovery issue, driven by a low energy system with a low mobility resource, which implies low and slow recoveries.

This does not mean the resources cannot be successfully recovered, but to do so, we must first understand what can be reasonably achieved with these reservoirs from a technology perspective. Since there are no analogs to help answer the questions, industry will have to create the calibration points to feed the evaluation by conducting appraisal activities.

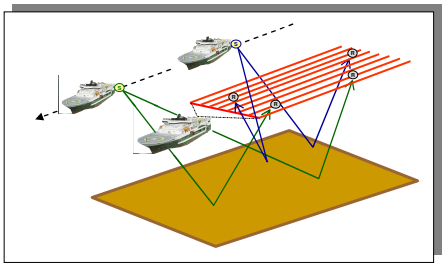
The Appraisal activities to do this include:

1) Gaining a good understanding of the static Reservoir Description (appraisal wells and seismic).
2) Dynamic Flow Testing**.**

How would MMS define "Technological Challenge"?
Emerging Technology Themes for the Paleogene

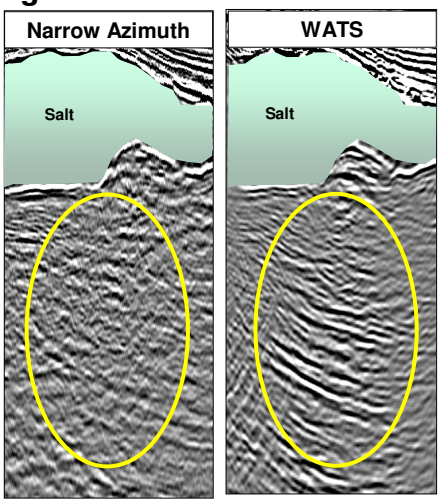
bp

Seismic Imaging



To address the challenging imaging issues, a Wide Azimuth Towed Streamer (WATS) survey takes ~ 4 years to plan, acquire, process and interpret.

BP CONFIDENTIAL



WATS Imaged parts of the Field previously hidden!

The second Qualitative Technology Challenge is Seismic Imaging. Many of the existing Paleogene discoveries are subsalt and BP believes that number will grow in the future. The combination of subsalt reservoirs and tremendous formation depth prevents conventional seismic from generating helpful images of the reservoir. The conventional narrow azimuth seismic image above on the left shows a virtually unappraisable field that would not be developed. The extent of the reservoir is undeterminable, making well planning nearly impossible.

With emerging advanced seismic techniques, a clearer image like the one on the right (WATS) is apparent, but these techniques are costly and take considerable time to plan, execute, process, and interpret (up to 4 years). Applying these techniques at the exploration level is not feasible due to the cost, time, and limited industry capability, but they can be applied during appraisal after a discovery is made.

With a usable image like the one on the right, appraisal wells can be placed more efficiently, dynamic testing results are more interpretable, and better development decisions can be made for the benefit of the industry and the nation.

Response to Remaining MMS questions

- **What other eligibility criteria should be considered?**
  - Discovery made prior to application

- **What would tangible/observable milestones be for technology development related to a lease?**
  - Detailed Activity Schedule of investment and activity commitments addressing the technological challenges
  - Approved by the MMS and updated regularly to demonstrate progress
  - Schedule milestones could include, but not limited to, the planning and execution of:

Milestones:

- Advanced seismic acquisition or processing
- Appraisal wells, sidetracks, deepenings, whole cores
- Dynamic well testing
- Technology development
  - Feasibility study
  - Preliminary engineering design
  - Detail engineering design
  - Prototype testing
  - Field trial
- Equipment commitments

The remaining questions are:

Eligibility Criteria - the first criteria should be a discovery during the primary term. Following a discovery, the burden should be on the lessee to demonstrate eligibility through meeting at least one of the Technological Challenges.

Milestones - the lessee should provide an activity schedule of investment and activity commitments that addresses the technological challenges. As is the case with any activity schedule, it would require MMS approval and periodic review for compliance with milestones. It would be updated on a specified timeframe.

Milestones could include:

1. Advanced seismic acquisition or processing
2. Appraisal wells, sidetracks, deepenings, whole cores
3. Well testing
4. Technology development
   - Feasibility study
   - Preliminary engineering design
   - Detail engineering design
   - Prototype testing
   - Field trial
5. Equipment commitments

How long should a suspension last?
On a project level, the length of the suspension should be specified by the Activity Schedule. Periodic reviews will address progress toward overcoming the Technological Challenges. Suspension should be renewable / revisable based on results from the activities.

Conclusion
The MMS and industry have a proven track record of collaboration in successfully meeting technology challenges in the GoM and can mutually benefit from the use of existing authorities when further challenges arise. We believe an orderly appraisal program enabled by a flexible regulatory framework that considers well testing, seismic imaging and technology development is the key to moving these technologically challenged, but potentially prolific, resources closer to development.

To enable success in these trends, a more flexible regulatory framework will:

- Decrease cycle time to first oil.
- Enable technology development that will help unlock the next generation of resource development for the government and industry.
- Enable the pursuit of proper activities on a prioritized schedule without having to make inefficient drilling and/or premature exit decisions.
- Allow for the most efficient allocation of scarce resources in service of technology development and production to enable earlier delivery of oil and gas and associated revenue streams.
- Ensure the activities undertaken are consistent with goals of resource conservation, protection of people and the environment, and avoiding the wastefulness of drilling unnecessary wells.

This will create a framework that allows for the appropriate and efficient allocation of resources to be aligned with the national interests of: enhancing US energy security, increasing US energy production, developing technology and creating jobs in the US, and creating value for the US government and the US taxpayer.