



RYDER SCOTT COMPANY
PETROLEUM CONSULTANTS

Houston

Denver

Calgary



2009 Ryder Scott Reserves Conference
“Evaluation Challenges in a Changing World”

“Undeveloped Locations-Key Considerations
for How Far and How Many”

Bob Wagner – Consultant/Sr. VP (Retired), Ryder Scott Company

DISCLAIMER



The information presented in today's presentations represents informed opinions about U.S. SEC reserves reporting regulations but does not purport to be identical to advice to be obtained from the SEC. As with any set of reserves definitions, the applicability of the guidance should be considered on a case by case basis.

- Change in SEC Regulations for Undeveloped Locations
- 2009 SEC Regulations and Guidance
- Considerations Under Other Sets of Regulations and Definitions
- Essential Elements to Demonstrate Reasonable Certainty, Reservoir Continuity and Economic Producibility
- Relevance of Prior SEC Interpretative Guidance and Litigation
- SEC Treatment for Horizontal Wells
- Q&A Session

UNDEVELOPED LOCATIONS WHAT CHANGED?



2009 Modernization of Oil and Gas Reporting

*“The most significant aspect of the proposed revision was the replacement of the existing **“certainty”** test for areas beyond one offsetting drilling unit from a productive well with a **“reasonable certainty”** test.”*

*“Currently, the definition of the term **“proved undeveloped reserves”** imposes a **“reasonable certainty”** standard for reserves in drilling units **immediately adjacent** to the drilling unit containing a producing well and a **“certainty”** standard for reserves in drilling units **beyond** the immediately adjacent drilling units.”*

RESERVES

HOW ARE THEY DEFINED?



“(26) Reserves”

*“Reserves are estimated remaining quantities of oil and gas and related substances anticipated to be **economically producible, as of a given date, by application of development projects to known accumulations.** In addition, there must exist, or there must be a **reasonable expectation** that there will exist, the **legal right** to produce or a revenue interest in the production, **installed means of delivering** oil and gas or related substances to market, and **all permits and financing** required to implement the project.”*

PROVED RESERVES HOW ARE THEY DEFINED?



“(22) Proved oil and gas reserves”

*“Proved oil and gas reserves are those quantities of oil and gas, which, by analysis of geoscience and engineering data, can be estimated with **reasonable certainty** to be **economically producible** - from a **given date forward**, from **known reservoirs**, and under **existing** economic conditions, operating methods, and government **regulations...**”*

PROVED RESERVES HOW ARE THEY DEFINED?

“(22) Proved oil and gas reserves” continued

“(i) The area of the reservoir considered as proved includes:

(A) The area identified by drilling and limited by fluid contacts, if any, and

*(B) **Adjacent** undrilled portions of the reservoir that can, with reasonable certainty, be judged to be **continuous** with it and to contain **economically producible** oil or gas on the basis of available geoscience and engineering data ...”*

PROVED RESERVES HOW ARE THEY DEFINED?



“(22) Proved oil and gas reserves” continued

*(ii) “In the absence of data on fluid contacts, proved quantities in a reservoir are **limited by** the lowest known hydrocarbons (LKH) as seen in a well penetration **unless** geoscience, engineering, or performance data and reliable technology establishes a lower contact with **reasonable certainty.**”*

UNDEVELOPED RESERVES HOW ARE THEY DEFINED?



“(31) Undeveloped oil and gas reserves”

*“Undeveloped oil and gas reserves are **reserves of any category** that are expected to be recovered from **new wells on undrilled acreage**, or from existing wells where a relatively major expenditure is required for recompletion.”*

UNDEVELOPED RESERVES HOW ARE THEY DEFINED?

“(31) Undeveloped oil and gas reserves” continued

- (i) *“Reserves on undrilled acreage shall be limited to those directly offsetting development spacing areas that are reasonably certain of production when drilled, unless evidence using reliable technology exists that establishes reasonable certainty of economic producibility at greater distances.”*

REASONABLE CERTAINTY HOW IS THAT DEFINED?



“(24) Reasonable certainty”

“If deterministic methods are used, reasonable certainty means a high degree of confidence that the quantities will be recovered. If probabilistic methods are used, there should be at least a 90% probability that the quantities actually recovered will equal or exceed the estimate.”

*“A high degree of confidence exists if the **quantity is much more likely to be achieved than not**, and, as changes due to increased availability of geoscience (geological, geophysical, and geochemical), engineering, and economic data are made to estimated ultimate recovery (EUR) with time, **reasonably certain EUR is much more likely to increase or remain constant than to decrease.**”*

PROVED UNDEVELOPED RESERVES HOW ARE THEY DEFINED?

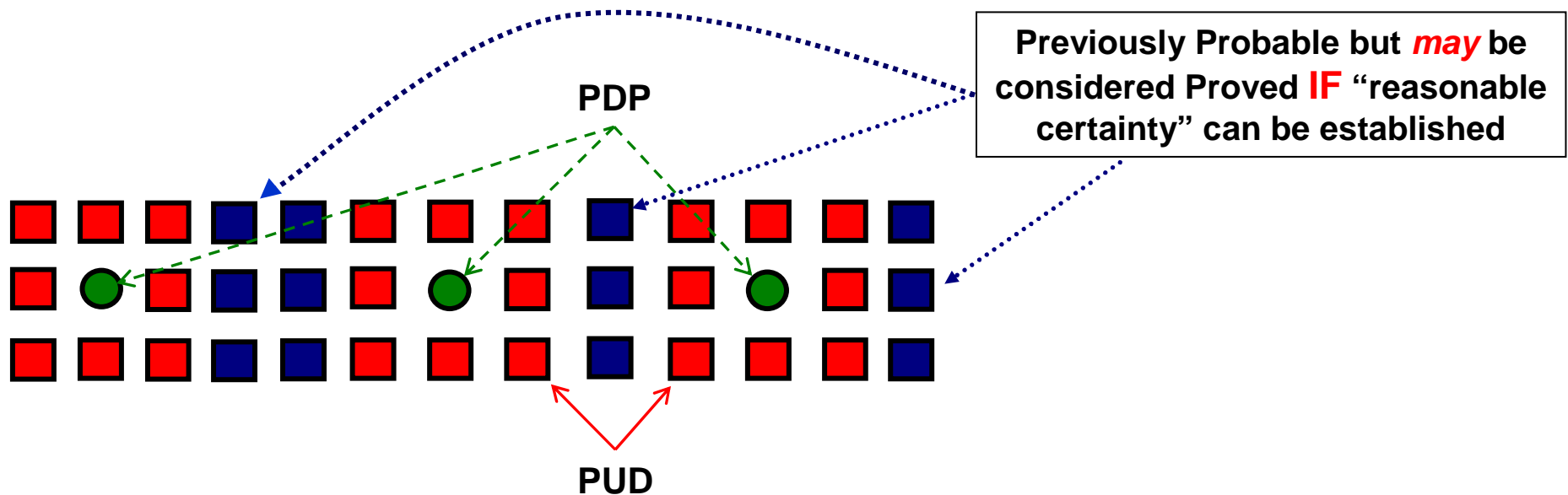


*“We also are adopting, as proposed, revisions that permit a company to **claim proved reserves beyond** those development spacing areas that are immediately adjacent to developed spacing areas if the company can **establish with reasonable certainty** that these reserves are economically producible.”*

UNDEVELOPED RESERVES HOW ARE THEY DEFINED?

Permit proved reserves **beyond** direct offset development locations that are immediately adjacent to existing well **IF** “reasonable certainty” can be established

- Replaced “certainty” with “reasonable certainty”
- Historically called the “one-offset rule”
- Incorporates “reliable technology” to help determine reasonable certainty



UNDEVELOPED RESERVES HOW ARE THEY DEFINED?



“(31) Undeveloped oil and gas reserves” continued

(ii) “Undrilled locations can be classified as having undeveloped reserves only if a development plan has been adopted ...”

MORE ON RESERVES and HOW ARE THEY DEFINED



“(26) Reserves” continued

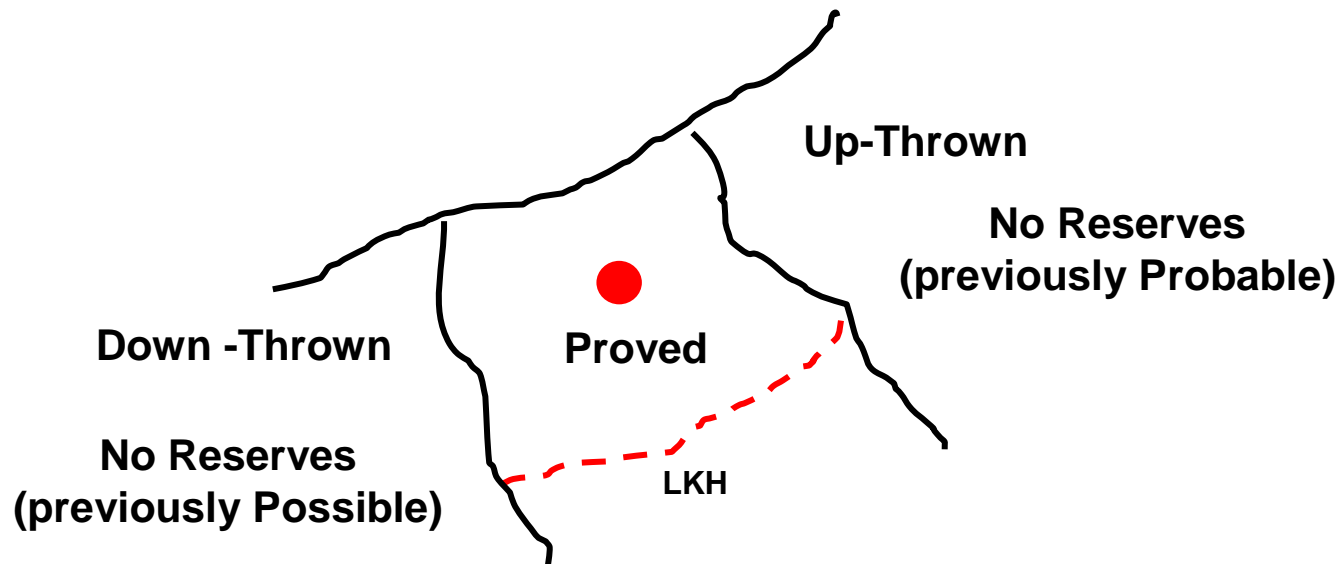
Note to paragraph (a)(26):

*Reserves **should not** be assigned to **adjacent reservoirs isolated by major, potentially sealing, faults** until those reservoirs are penetrated and evaluated as economically producible. Reserves **should not** be assigned to areas that are **clearly separated from a known accumulation by a non-productive reservoir** (i.e., absence of reservoir, structurally low reservoir, or negative test results). Such areas may contain prospective resources (i.e., potentially recoverable resources from undiscovered accumulations).*

UNDEVELOPED RESERVES HOW ARE THEY DEFINED?

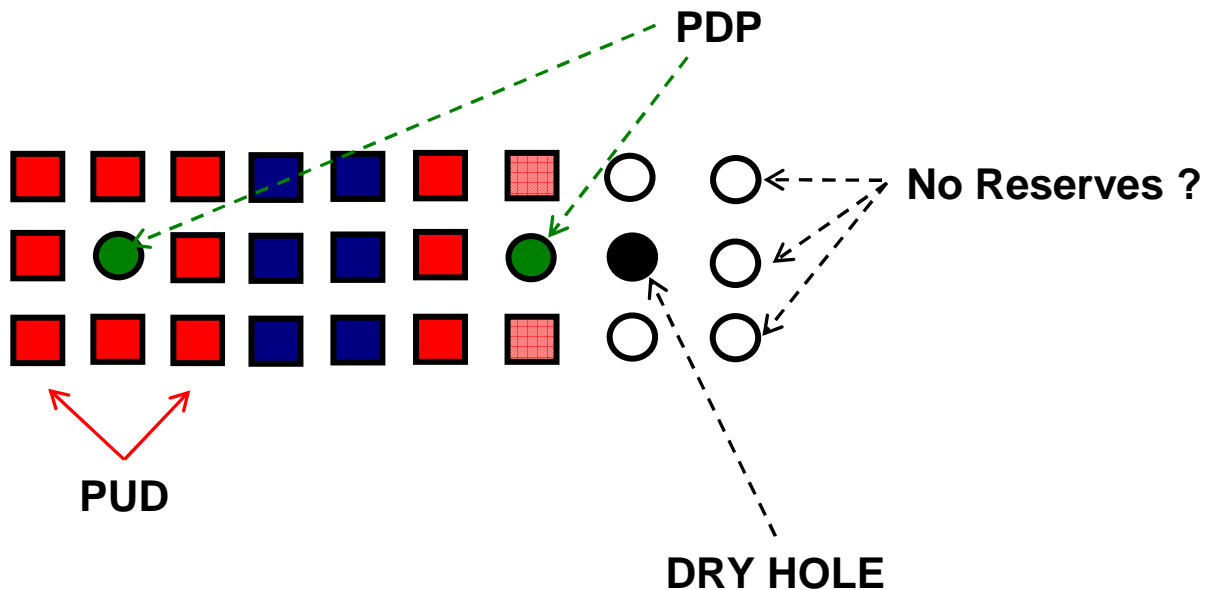
*“Reserves should **not** be assigned to adjacent reservoirs isolated by major, potentially sealing, faults until those reservoirs are penetrated...”*

- Different than 2007 SPE-PRMS (Table III) and may result in reduction of probable and possible reserves as previously booked using PRMS



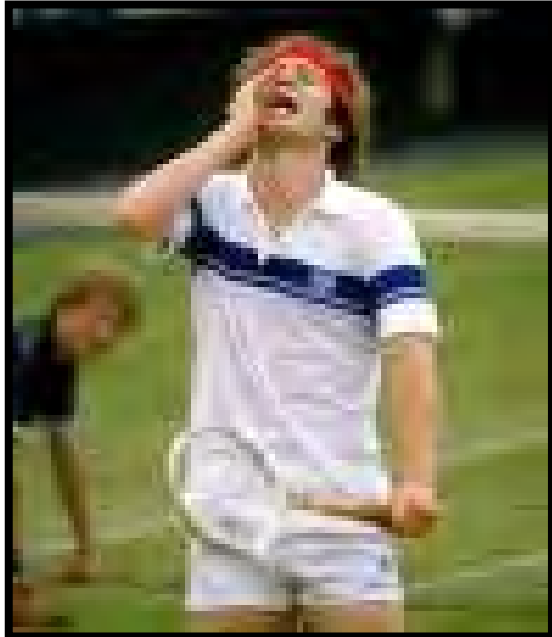
UNDEVELOPED RESERVES HOW ARE THEY DEFINED?

“Reserves should not be assigned to areas that are clearly separated from a known accumulation by a non-productive reservoir...”



“YOU CAN’T BE SERIOUS !”

**RYDER
SCOTT** 9



You mean I can’t assign probable or possible reserves to an adjacent fault block?

Or Identical Amplitude?

Under 2009 SEC Regulations, **NO** Unless you can show a compelling case that they might be in communication.

Maybe, with a compelling case under SPE-PRMS definitions (Table III)

CAN COGEH ADD ANY CLARITY?



5-24 Volume 1 - Reserves Definitions and Evaluation Practices and Procedures

“... factors to be considered in classifying reserves estimates associated with future drilling as proved, probable, or possible include:

- *whether the proposed location **directly offsets** existing wells...*
- *the expected degree of **geological continuity** within the reservoir unit containing the reserves,*
- *the likelihood that the **location will be drilled.**”*

DOES SPE-PRMS ADD ANY CLARITY?

“The area of the reservoir considered as Proved includes

*(1) the area delineated by drilling and defined by fluid contacts, if any, and
(2) **adjacent** undrilled portions of the reservoir that can reasonably
be judged as **continuous** with it and **commercially productive** on the
basis of available **geoscience and engineering data.**”*

*“In the absence of data on fluid contacts, Proved quantities in a reservoir
are limited by the lowest known hydrocarbon (**LKH**) as seen in a well
penetration **unless** otherwise indicated by definitive geoscience,
engineering, or performance data.”*

*“Such definitive information **may** include **pressure gradient analysis** and
seismic indicators. **Seismic data alone may not be sufficient** to define
fluid contacts for Proved reserves.”*

DOES SPE-PRMS ADD ANY CLARITY?



“Reserves in undeveloped locations may be classified as Proved provided that:”

- *“The locations are in undrilled areas of the reservoir that can be judged with reasonable certainty to be **commercially productive.**”*
- *“Interpretations of available geoscience and engineering data indicate with reasonable certainty that the objective formation is **laterally continuous** with drilled Proved locations.”*

WHAT MUST WE SHOW TO DEMONSTRATE REASONABLE CERTAINTY FOR A PROVED UNDEVELOPED LOCATION?



We need to **build, document**, and be able to **defend** a compelling case. As a minimum, this includes all of the following:

- Ownership
- Meet regulatory spacing criteria (if any) and
- Have all required permits and financing to implement the project
- Demonstrate “technically justified” drainage area
- Have a committed project to drill the location and
- Project is reasonably certain to commence within a reasonable time (5 years)
- Location must be structurally above LKH or
- Structurally above an observed water contact, or
- Structurally above an estimated water contact if determined with documented “reliable technology”

These are the **“EASY”** ones

**WHAT ELSE MUST WE SHOW TO DEMONSTRATE
REASONABLE CERTAINTY FOR A PROVED
UNDEVELOPED LOCATION?**

Now it gets tougher, we must document

- **Reservoir Continuity** and
- **Economic producibility**

For every location

WHAT CAN WE USE TO DEMONSTRATE RESERVOIR CONTINUITY?

- Log data from multiple wells in our field
- Subsurface correlations of productive intervals
- Seismic continuity of the productive interval tied to top of porosity as seen by well logs
- Consistency with our depositional model
- Consistency in our reservoir parameters
- Pressure measurements in different wells
- Partial depletion in an area without producing wells
- Fluid movement in recent wells or wells completed in another reservoir
- Consistent hydrocarbon content (CBM or Shales)
- Consistent fractures or cleats

WHAT ARE RESERVOIR CONTINUITY DEAL KILLERS?

- Poor subsurface correlations of productive intervals
- Highly laminated reservoirs
- Seismic tied to marker, not productive intervals
- Discontinuous or questionable seismic data
- Inability to tie seismic to reservoir quality in field or in analogous fields
- Highly variable reservoir thickness and parameters
- Highly variable hydrocarbon content (CBM or Shales)
- Highly variable fractures or cleats as demonstrated by production

WHAT ARE OTHER RESERVOIR CONTINUITY DEAL KILLERS?



- Potentially sealing faults
- Negative well or test information
- Limited data (too early in field life)
- The wrong type of data to support conclusions
- Consistency of the data
- Lack of analogies

WHAT RESERVOIR YARDSTICKS CONTROL OR DETERMINE ECONOMIC PRODUCIBILITY?



- Permeability
- Thickness
- Hydrocarbon content
- Porosity
- Fractures or cleats (CBM or Shales)
- Analogies
- Statistical interpretation of analog data

- We must demonstrate with “reasonable certainty” that our undeveloped locations are analogous to producing wells based on our data and “reliable technology”

WHAT DETERMINES THE CLASS OF RESERVES THAT MAY BE ASSIGNED?

- The quantity of the data
- The quality of the data
- The degree of certainty associated with the totality of the data will determine whether or not any reserves may be assigned to a location and what category is most appropriate
 - Proved,
 - Probable,
 - Possible, or a
 - Resource

**DOES PREVIOUS SEC INTERPRETIVE GUIDANCE,
or LITIGATION BETTER DEFINE WHAT IS REASONABLY
CERTAIN FOR UNDEVELOPED LOCATIONS?**



Interpretations and Guidance

SEC Division of Corporation Finance:

March 31, 2001

“If there is an indication of economic producibility by either formation test or production, the reserves in the legal and technically justified drainage area around the well projected down to a known fluid contact or the lowest known hydrocarbons, or LKH may be considered to be proved.”

“In order to attribute proved reserves to legal locations adjacent to such a well (i.e. offsets), there must be conclusive, unambiguous technical data which supports reasonable certainty of production of such volumes and sufficient legal acreage to economically justify the development without going below the shallower of the fluid contact or the LKH. In the absence of a fluid contact, no offsetting reservoir volume below the LKH from a well penetration shall be classified as proved”

DOES PREVIOUS SEC INTERPRETIVE GUIDANCE, or LITIGATION BETTER DEFINE WHAT IS REASONABLY CERTAIN FOR UNDEVELOPED LOCATIONS?



Interpretations and Guidance

SEC Division of Corporation Finance:

March 31, 2001

“Geologic and reservoir characteristic uncertainties such as those relating to permeability, reservoir continuity, sealing nature of faults, structure and other unknown characteristics may prevent reserves from being classified as proved.”

“Also, continuity of production requires more than the technical indication of favorable structure alone (e.g. seismic data) to meet the test for proved undeveloped reserves. Generally, proved undeveloped reserves can be claimed only for legal and technically justified drainage areas offsetting an existing productive well (but structurally no lower than LKH). If there are at least two wells in the same reservoir which are separated by more than one legal location and which show communication (reservoir continuity), proved undeveloped reserves could be claimed between the two wells, even though the location in question might be more than an offset well location away from any of the wells. In this illustration, seismic data could be used to help support this claim by showing reservoir continuity between the wells, but the required data would be the conclusive evidence of communication from production or pressure tests.”

**DOES PREVIOUS SEC INTERPRETIVE GUIDANCE,
or LITIGATION BETTER DEFINE WHAT IS REASONABLY
CERTAIN FOR UNDEVELOPED LOCATIONS?**



Interpretations and Guidance

SEC Division of Corporation Finance:

March 31, 2001

*“The SEC staff emphasizes that proved reserves **cannot be claimed more than one offset location away** from a productive well if there are no other wells in the reservoir, even though seismic data may exist.”*

**DOES PREVIOUS SEC INTERPRETIVE GUIDANCE,
or LITIGATION BETTER DEFINE WHAT IS REASONABLY
CERTAIN FOR UNDEVELOPED LOCATIONS?**



Interpretations and Guidance

SEC Division of Corporation Finance:

March 31, 2001

“However, seismic data is not an indicator of continuity of production and, therefore, can not be the sole indicator of additional proved reserves beyond the legal and technically justified drainage areas of wells that were drilled.”

“Continuity of production would have to be demonstrated by something other than seismic data.”

**DOES PREVIOUS SEC INTERPRETIVE GUIDANCE,
or LITIGATION BETTER DEFINE WHAT IS REASONABLY
CERTAIN FOR UNDEVELOPED LOCATIONS?**



**SECURITIES AND EXCHANGE COMMISSION,
Plaintiff, v. XYZ Corporation and individuals**

Filed 2008

"Plaintiff Securities and Exchange Commission alleges as follows:

The Guidance states that "continuity of production" cannot be based on seismic data alone and that "the required data would be the conclusive evidence of communication from production or pressure tests."

*With respect to **non-adjacent CBM PUDs**, XYZ did not have the required **conclusive evidence of communication** as referenced in the Guidance."*

**DOES PREVIOUS SEC INTERPRETIVE GUIDANCE,
or LITIGATION BETTER DEFINE WHAT IS REASONABLY
CERTAIN FOR UNDEVELOPED LOCATIONS?**



**SECURITIES AND EXCHANGE COMMISSION,
Plaintiff, v. XYZ Corporation and individuals**

Filed 2008

“In lieu of production or pressure tests, XYZ relied, improperly, on data from reservoir extent and or historical well statistics to support the non-adjacent PUDs overstatements resulted principally from:

(1) a failure to take account of negative drilling and production trends; and

(2) the reporting of proved reserves without sufficient geological and engineering data demonstrating with reasonable certainty that the reserves could be economically recovered.”

**WHAT MUST WE SHOW TO DEMONSTRATE
REASONABLE CERTAINTY BEYOND ONE
OFFSET LOCATION?**



The burden of proof to establish a compelling case to support the proved area still rests with the evaluator and should be determined by the totality of all of the available engineering and geoscience data including seismic data and appropriately documented analogs.

Each case must be evaluated and documented based on the available data for that case.

There is no cookbook answer to how far or how many.

ARE HORIZONTAL WELLS TREATED ANY DIFFERENTLY?

No, the same regulations apply

“Reserves on undrilled acreage shall be limited to those directly offsetting development spacing areas that are reasonably certain of production when drilled, unless evidence using reliable technology exists that establishes reasonable certainty of economic producibility at greater distances.”

EXCEPT, historically, the SEC has treated horizontal wells differently.

ARE HORIZONTAL WELLS TREATED ANY DIFFERENTLY?

For example, the SEC wrote to E&P XXX in a response letter dated July 9, 2007:

*"However, as previously discussed, you should **limit estimates of proved undeveloped reserves from future horizontal wells to two parallel offset wells** to a productive horizontal well. Please confirm that in the future you will limit proved undeveloped reserves from horizontal wells to these amounts **unless you have demonstrated productive continuity through pressure communication between wells more than an offset location away and on either side of a future horizontal well.**"*

"The current pressure communication test for horizontal wells is an insufficient exception. Because of the extremely low permeability of unconventional natural gas formations, these natural gas sources are not conducive to establishing pressure communication between wells"

**WHAT MUST WE SHOW TO DEMONSTRATE
REASONABLE CERTAINTY BEYOND ONE
OFFSET LOCATION?**



The bottom line is the same

The evaluator must build, document, and defend **ALL** undeveloped locations based on a combination of the totality of all of the available engineering and geoscience data including seismic data and appropriately documented analogs.

The data will determine how far and how many.

A good understanding of both the 2009 regulations and past interpretations by the SEC is critical to your success.

QUESTIONS?

Contact Info

bob_wagner@ryderscott.com