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A collage of images related to the oil and gas industry. It includes a 3D geological cross-section of rock layers, an offshore oil rig on the ocean, a document with a red circular seal, a group of business professionals in a meeting, a globe showing the Americas, and a man in a white shirt and red tie looking at a large, colorful geological map on a curved surface.

**Important Considerations with the  
Application of the SPEE Monograph  
3 and Reserves Bookings**

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*RSC Reserves Conference September 2012*

# Content

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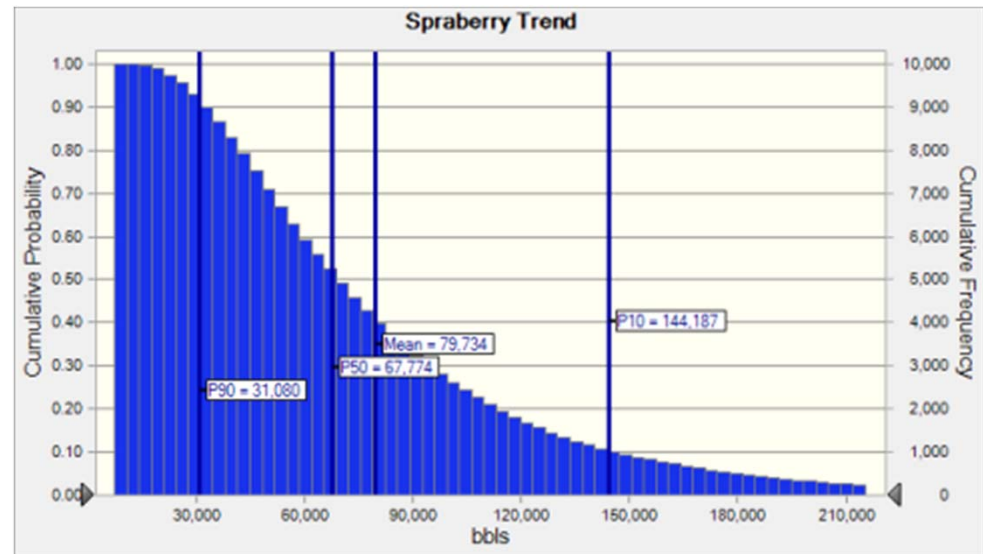
- Incremental projects
- PRMS, SEC and probabilistic aggregations
- Same well, different reserves?
- Year-on-year reserves rollover
- 5-year rule impact
- Acquisitions & Divestitures
- Project approvals, Final Investment Decisions, Staying Power and Gambler's Ruin
- Mean, P50, P<sup>^</sup> and Scale Consistency

# Example for Presentation Discussion



- After the SPEE Monograph 3 Spraberry Trend, Southwestern Martin County, Texas (pp. 45-46)

- P90 = 31 kbbls
- P50 = 68 kbbls
- P10 = 144 kbbls
- Mean = 80 kbbls
- P<sup>^</sup> = 74 kbbls



- Well level distribution
- Are these economic wells only or all wells?
- Should we be using a distribution of economic wells only and apply an economic COS factor?

- These examples will be discussed in terms of EUR & EUR per well. Nevertheless, the concepts apply to any variable (bbls/ft, peak rate, etc.) used to determine reserves following the SPEE recommended probabilistic analysis.

# Incremental Projects

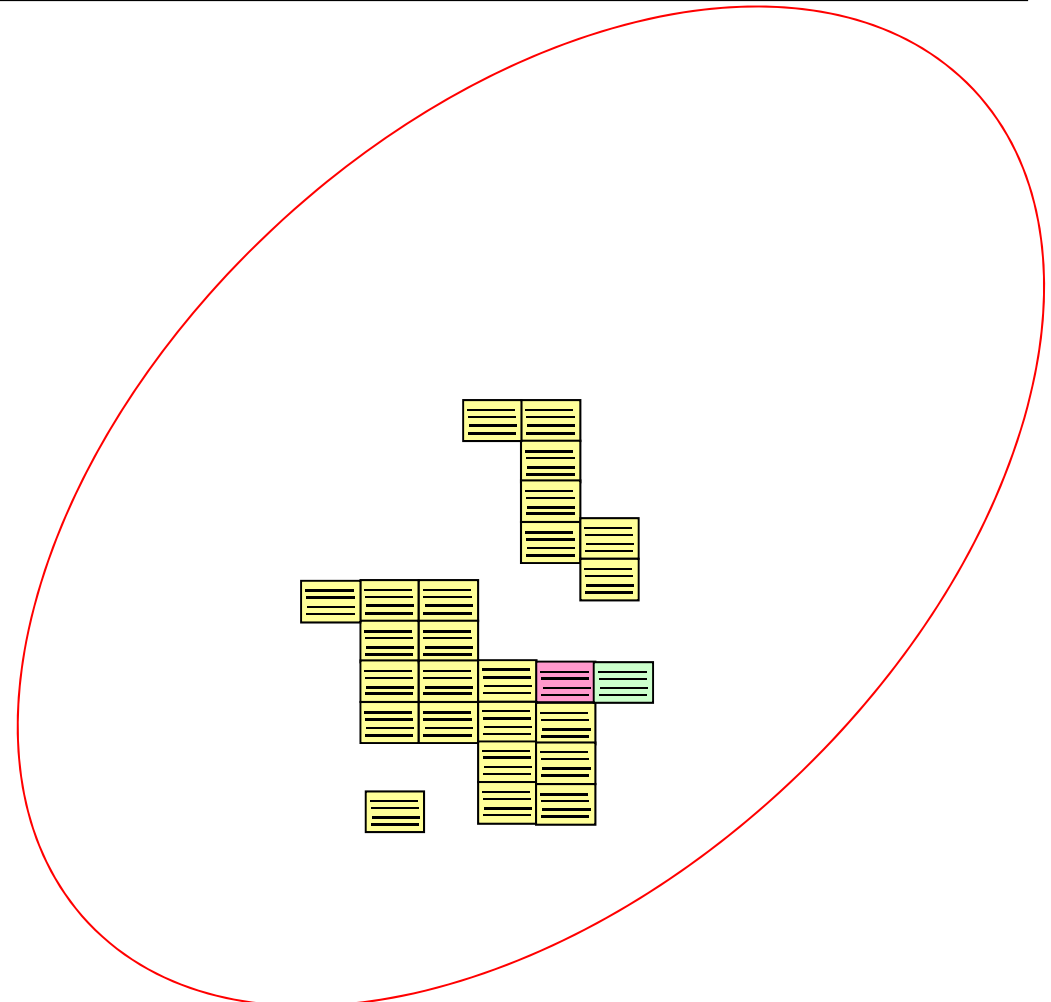


- SEC (Part 210 (22i)(B): “adjacent undrilled portions of the reservoir that can, with reasonable certainty, be judged to be continuous with it and to contain economically producible oil or gas.”
- SPEE Monograph 3:
  - “Offset well performance is not a reliable predictor of undeveloped location performance.”
  - “Consequently, predicting the performance of any particular well prior to completion is virtually impossible.”
- **Implication: reasonable certainty (P90) volumes for a single well or a small number of wells is generally far below expectations for PUD.**
- Apply probabilistic analysis to drilling portfolio – this entire program then becomes the minimum incremental project
  - Pre-drilling economics – OK, based on mean or proposed P<sup>^</sup>
  - Post-drilling economics – **may result in de-bookings**

- The SPEE Monograph 3 relies on probabilistic aggregation and portfolio effect to determine reasonable certainty
  - PRMS (Section 4.2.1): “The aggregation method utilized depends on the business purpose. It is recommended that for reporting purposes, assessment results should not incorporate statistical aggregation beyond the field, property, or project level.”
  - SEC(Part 210, Item 1202 (Disclosure of Reserves): “Regardless of whether the reserves were determined using deterministic or probabilistic methods, the reported reserves should be simple arithmetic sums of all estimates at the well, reservoir, property, field or project level within each reserve category.”
- Certain aspects of both, the PRMS and SEC definitions, appear to be in conflict with the aggregation process required in resource play estimations of reserves.
  - A firm opinion from the SEC on this matter is urgently required to avoid future problems of compliance.

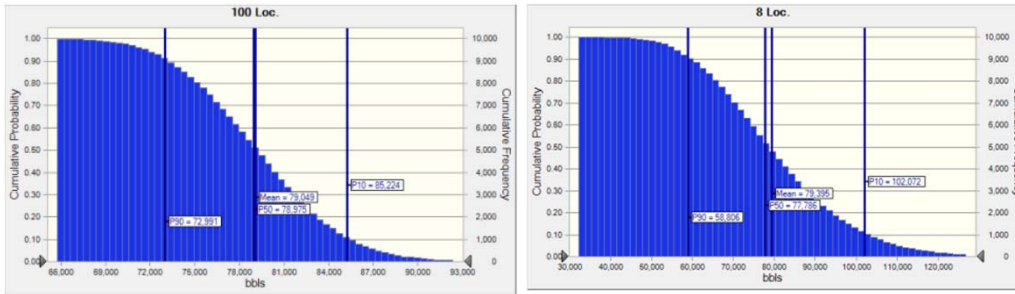
# Same Well, Different Reserves?

- “Wells exhibit a repeatable statistical distribution of estimated ultimate recoveries (EURs)”
- “A continuous hydrocarbon system exists that is regional in extent”
- **Problem: Acreage position may not be of regional extent and may vary from company to company**
- Implication: Same well(s) may be assigned different reserves based on the company’s acreage position.



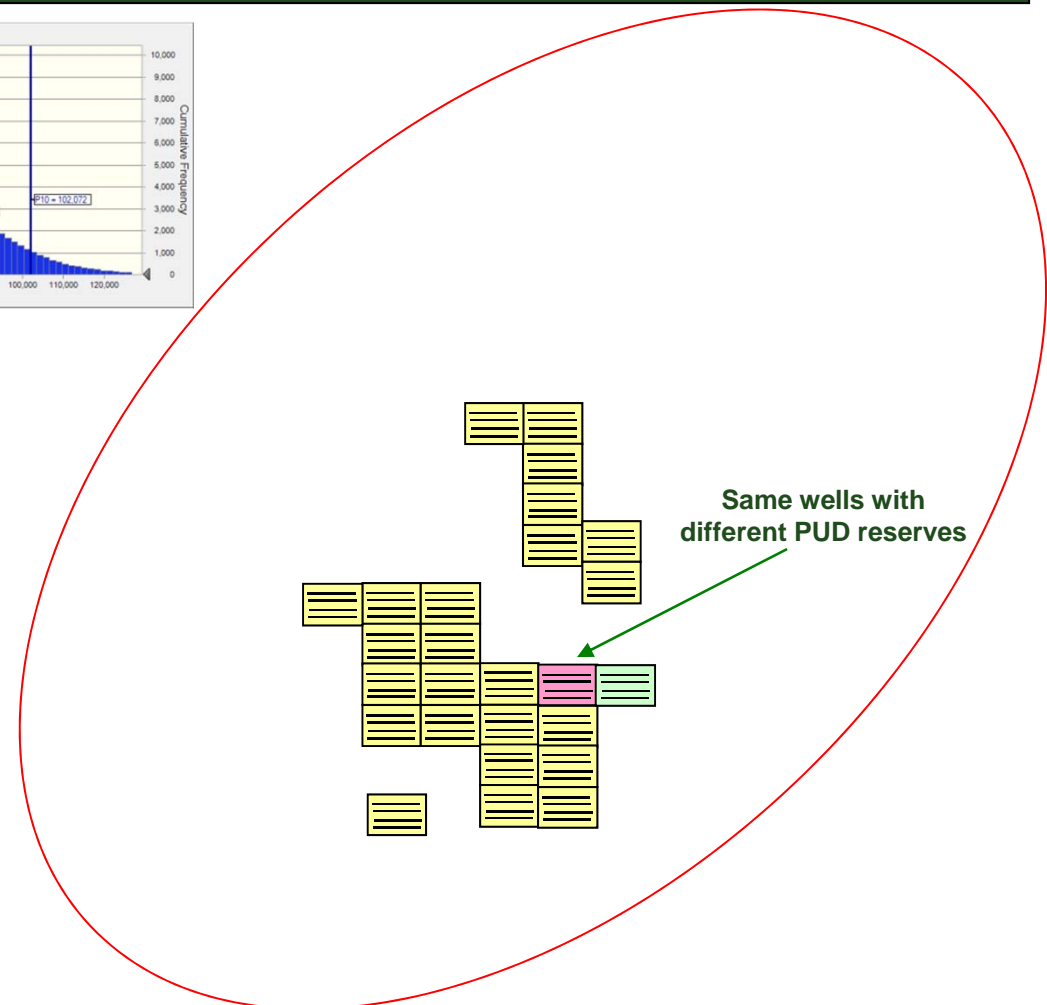
 Company A acreage – 100 locations  
 Company B acreage – 8 locations  
 Company A & B acreage – 4 locations

# Same Well, Different Reserves?



|           | Per Well (kbbbls) |    |     |
|-----------|-------------------|----|-----|
|           | 1P                | 2P | 3P  |
| Company A | 73                | 79 | 85  |
| Company B | 59                | 78 | 102 |

- Assign 1P reserves/well:
  - 73 kbbbls for Company A (notice close to P<sup>^</sup>)
  - 59 kbbbls for Company B
- Are we doing this?
- Are the SEC and financial markets ready for this?
- What about 3P – Higher for Company B?



Company A acreage – 100 locations  
 Company B acreage – 8 locations  
 Company A & B acreage – 4 locations

# Year-on-Year Reserves Rollover

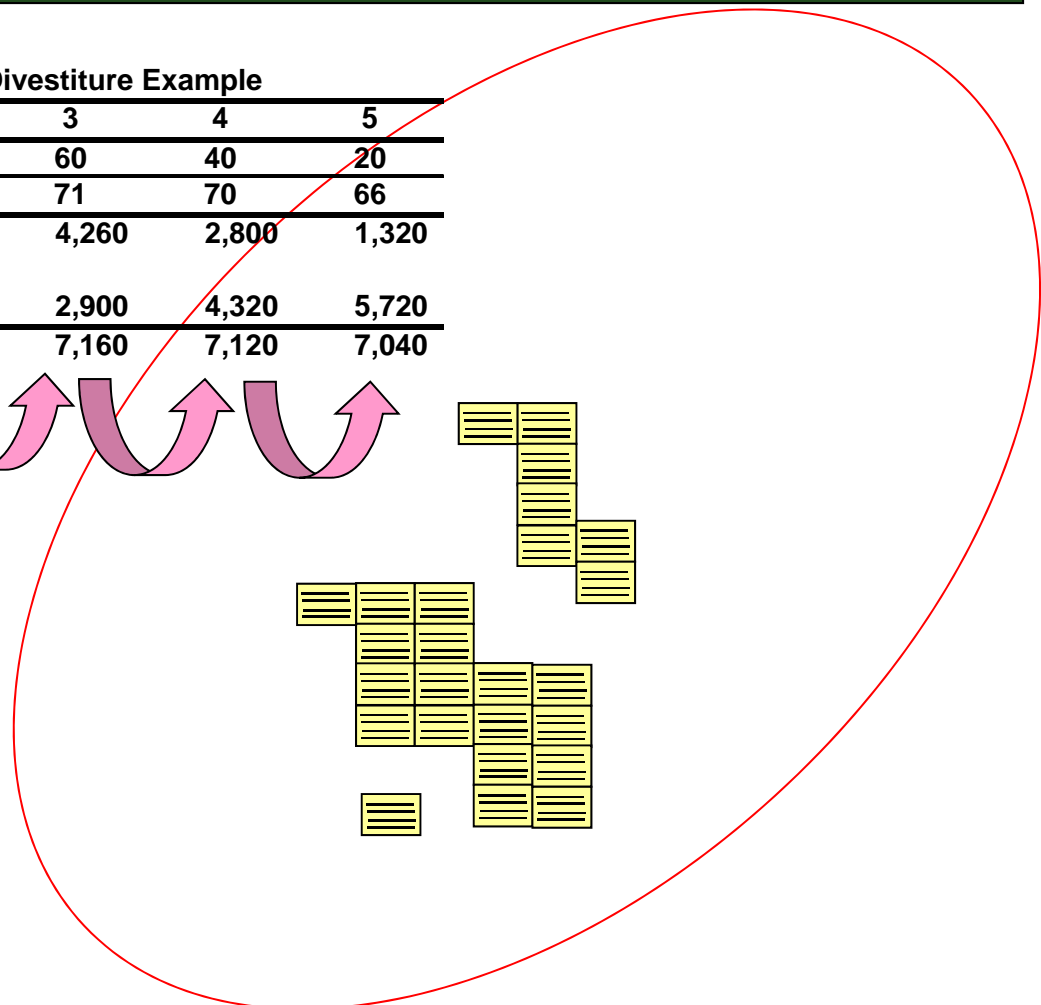


| Portfolio Divestiture Example |       |       |       |       |       |
|-------------------------------|-------|-------|-------|-------|-------|
| Drilling Year                 | 1     | 2     | 3     | 4     | 5     |
| PUDs Remaining                | 100   | 80    | 60    | 40    | 20    |
| EUR/well (kbbbls)             | 73    | 72    | 71    | 70    | 66    |
| Total PUD (kbbbls)            | 7,300 | 5,760 | 4,260 | 2,800 | 1,320 |

Converted to PVPD (kbbbls)  
EUR Subsequent Years (kbbbls)

|  |       |       |       |       |
|--|-------|-------|-------|-------|
|  | 1,460 | 2,900 | 4,320 | 5,720 |
|  | 7,220 | 7,160 | 7,120 | 7,040 |

- 100 PUDs
  - 5-year program
  - 20 wells per year
  - Should we retain the original EUR/well year-on-year?
  - Should we adjust the EUR/well year-on-year?



■ Company A acreage – 100 locations



# Year-on-Year Reserves Rollover



- We can retain the original EUR/well year-on-year only if we strictly book this original EUR/well for wells drilled over the period-  
**seldomly done**
- If we book reserves year-on-year based on the actual results of the wells we cannot use the original EUR/well-**commonly done**
  - We should then adjust the EUR/well based on the remaining portfolio-  
**seldomly done**
  - **Otherwise we would be “double-dipping” on the distribution (unless we perfectly achieve the original EUR/well year-on-year)**
- Example: We should not disclose better than expected drilling results in a particular year and then retain the original portfolio distribution for the remaining years. If distribution is still valid, one should expect lower than expected future years.
- Good news is that if done properly originally booked EUR should be preserved

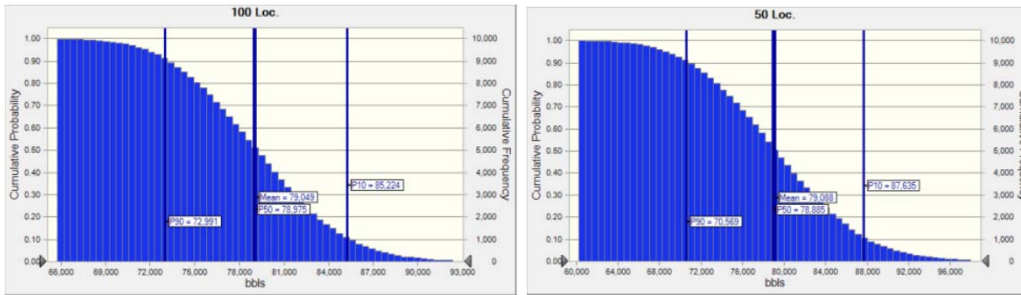
# Year-on-Year Reserves Rollover



- Audit Documentation

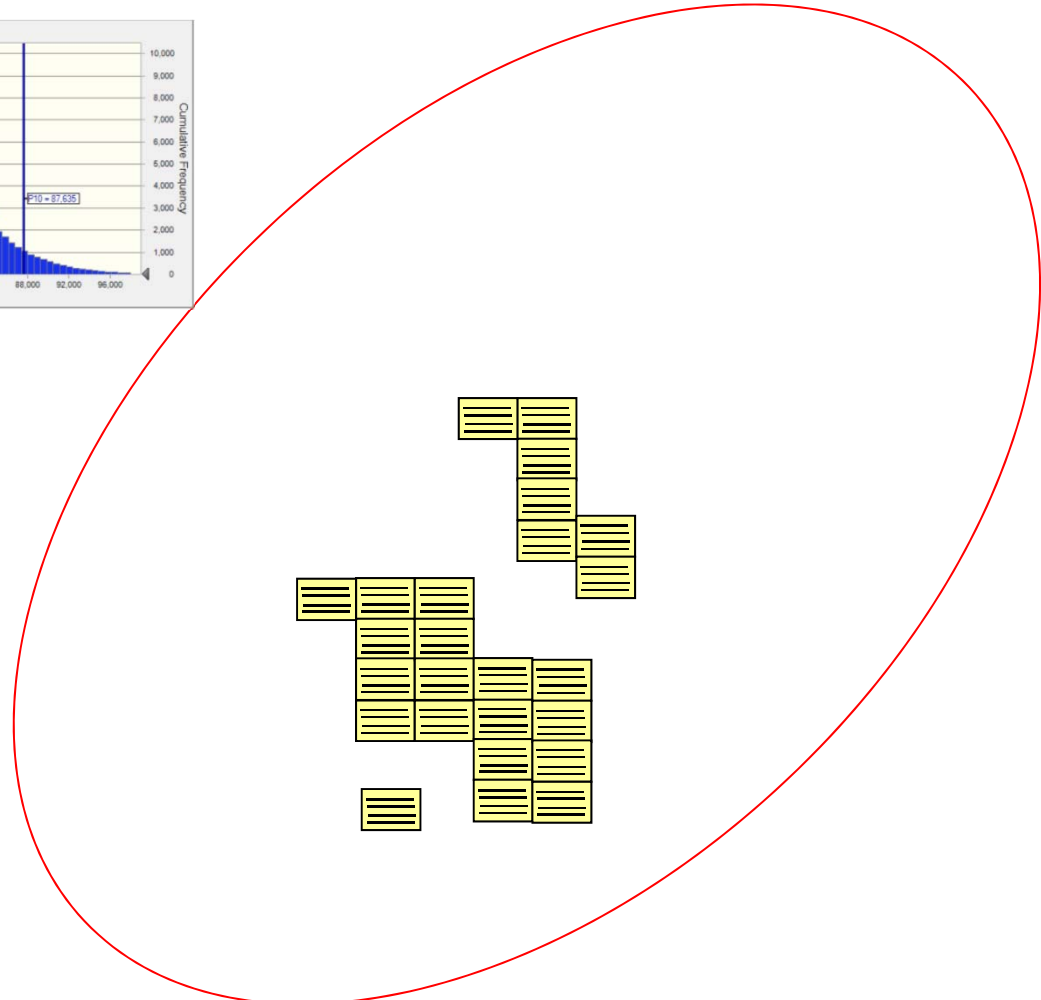
- When and how was the original program established.
- What well sample was used to determine the reserves of the original program (make sure this sample does not also include program wells).
- What wells have been drilled, what have been the results, what reserves have been booked?
- Maintain a comparison of the drilled well results/booked developed reserves against sample well distribution used to book undeveloped reserves.

# 5-Year Rule Impact



|                    | 5-Year Impact |       |
|--------------------|---------------|-------|
| No. of Wells       | 100           | 50    |
| EUR/well (kbbbls)  | 73            | 71    |
| Total PUD (kbbbls) | 7,300         | 3,530 |

- 100 PUDs
  - 100 wells \* 73 kbbbls/well
  - 1P = 7,300 kbbbls
- Only 50 PUDs will be drilled during the next five years.
- **We can not estimate our proved undeveloped reserves by simply multiplying**
  - 50 wells \* 73 kbbbls/well
  - 1P = 3,650 kbbbls
- We need to estimate the appropriate EUR/well for a 50-well program
  - 50 wells \* 71 kbbbls/well
  - 1P = 3,530 kbbbls



■ Company A acreage – 100 locations

# Acquisitions & Divestitures



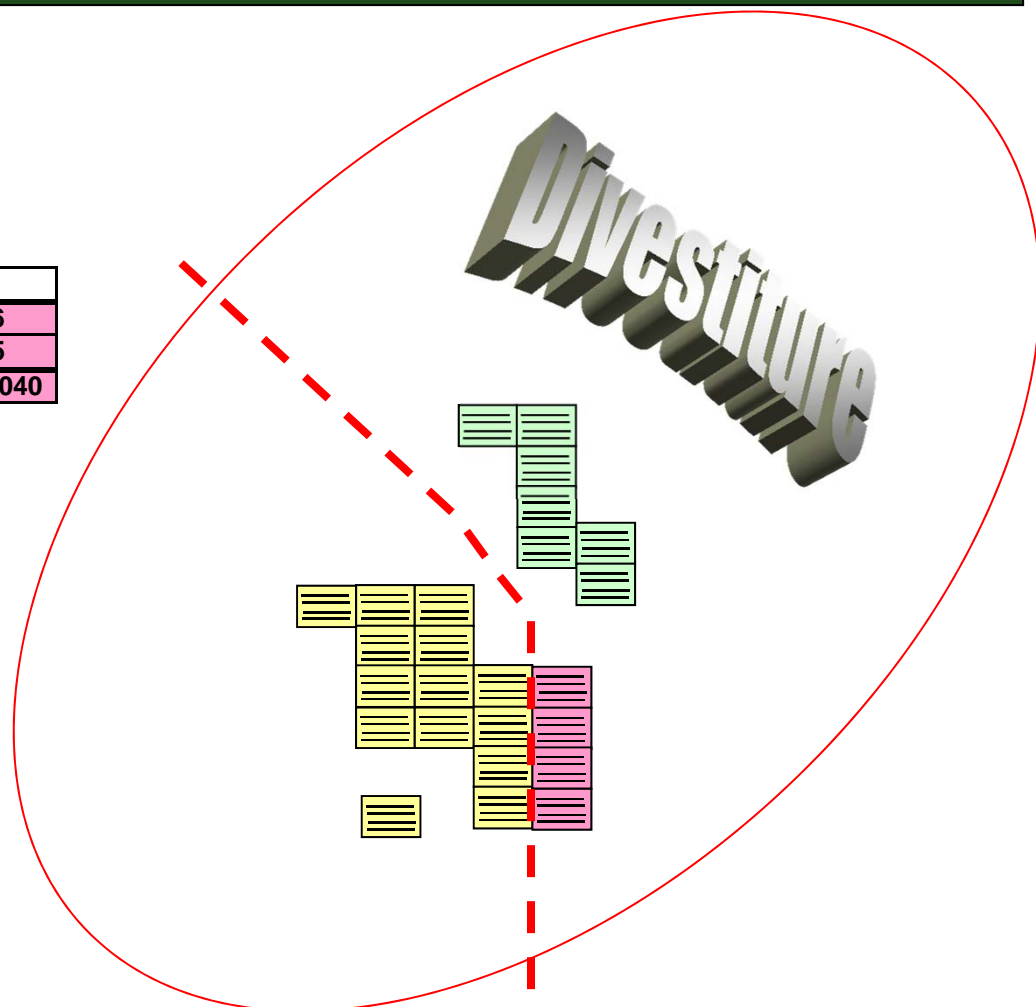
- Arithmetic sum not equal to the probabilistic aggregation of acreage/well portfolio
- Buyer/seller can not rely on a “traditional” reserves report to determine its reserves position before and after the sale
- Breaking up a portfolio changes the risk profile of the opportunity to both the seller and the buyer
  - In general, the sum of the pieces will be lower to both buyer & seller
    - Seller will “debook” more than what they sold
    - Buyer will “book” less than what they bought

# Acquisitions & Divestitures

- Original 1P position
  - 100 wells \* 73 kbbbls/well
  - 1P = 7,300 kbbbls

|                    | Portfolio Divestiture Example |       |       |       |
|--------------------|-------------------------------|-------|-------|-------|
| No. of Wells       | 100                           | 56    | 28    | 16    |
| EUR/well (kbbbls)  | 73                            | 71    | 68    | 65    |
| Total PUD (kbbbls) | 7,300                         | 3,976 | 1,904 | 1,040 |

- 1P position after portfolio breakdown is 6,900 kbbbls
  - Loss of 400 kbbbls strictly due to breakup of portfolio
- Are we doing this?
- Is the industry ready to take a hit in reserves bookings for breaking up portfolio opportunities?
- Are the SEC and financial markets ready for this?



- ■ ■ Initial Company A Portfolio – 100 locations
- Company A Divestiture 1 – 28 locations
- Company A Divestiture 2 – 16 locations

- Because the evaluation of resource play reserves involves the evaluation & aggregation of a portfolio, the company must demonstrate:
  - Project approval for the entire portfolio aggregated in the reserves estimations
  - Final investment decision & commitment to proceed with the entire program
    - Difficult if early results are disappointing
    - Can the results be explained within expected probabilistic outcome or are they a result of flawed analysis?

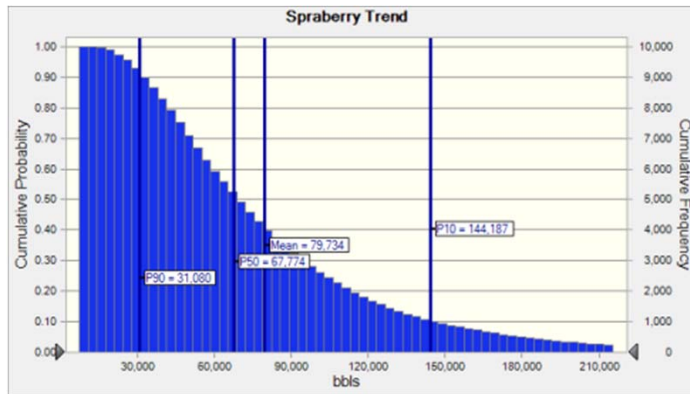
# Project Approvals, Final Investment Decisions, Staying Power and Gambler's Ruin



- A company's staying power with a project that may initially not yield expected resources:
  - Company A expects to heavily rely on the cash flow generated by the first few wells to pay back loans to drill these wells and finance the rest of the program – **Very Risky, may never achieve portfolio expectations**
  - Company B has enough financial resources for the entire program and management fortitude to stay with the program – Likely to achieve portfolio expectations assuming properly estimated
- Gambler's Ruin
  - Company A enters a resource play with  $\$n$  in cash and starts drilling where he wins with probability " $p$ " and loses with probability " $1-p$ ". The Company drills repeatedly, spending \$ (D&C) in each round. Company A leaves the play when total fortune reaches  $\$N$  or it runs out of money (**ruined**), whichever happens first. What is the probability that Company A is ruined?

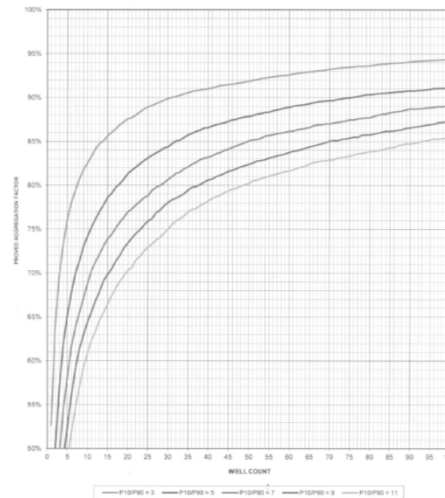
# Mean, P50, P^ and Scale Consistency

- Be aware that the distribution is originally generated for a well scale and then we are applying to portfolios of different characteristics
- SPEE introduces the concept of “Proved Aggregation Factor” for the number of wells to correct for these two issues



- Well level distribution for the Trend
- Select Mean or P^

X



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Proved Reserves Certificate





# Mean, P50, P<sup>^</sup> and Scale Consistency

- One can not be satisfied with this answer alone without knowing the details of:
  - Originally booked portfolio
  - Completed versus remaining opportunities
  - Distribution of results of completed versus remaining opportunities
  - Reserves booking practice
- Recommend to always generate a distribution of the average outcomes of remaining portfolio and compare to:
  - Compare P90 of this distribution with the proposed PUD/well
  - Compare P50 of this distribution with the proposed 2P/well
  - Compare P50 of this distribution with the proposed 3P/well



Thank you for your attention  
Questions?