



Difficulties in Probabilistic Aggregations and Recommended Practices to Solve Them

Probabilistic Subsurface Assessments
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Introduction



- Discussion from a reserve evaluation point of view.
- Different audiences have different tolerances for risk.
 - Do they participate in the entire portfolio being aggregated?
 - Lending institutions may not participate in the upside but are exposed to the downside.
- Is there a need to reconcile the SPE probabilistically derived proved reserves with reserves disclosed to SEC and others?

SPE Probabilistic Aggregation Methods

Ref.: Section 4.2.1



- All aggregations beyond the field, property or project level should use arithmetic summation.
- Tends to create a “portfolio effect”
- The aggregate Proved may be conservative and the aggregate 3P may be very optimistic.
- Petroleum quantities classified as Reserves, Contingent Resources and Prospective Resources should NOT be aggregated with each other without due consideration of the significant differences in the criteria associated with their classification.

Reserve Aggregations Considerations

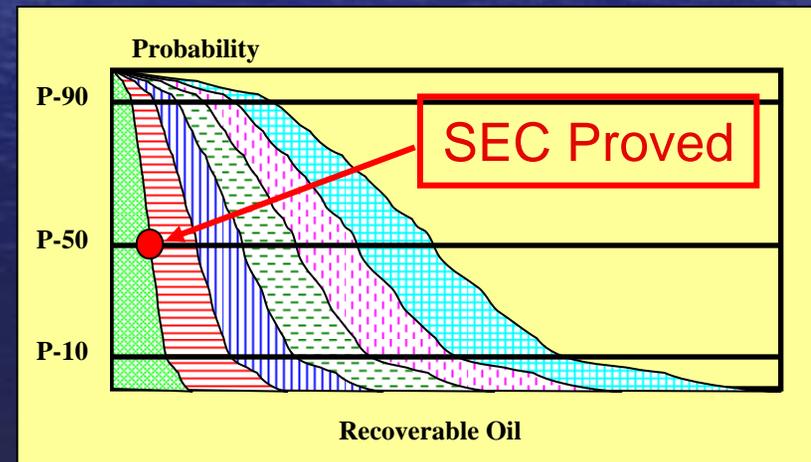
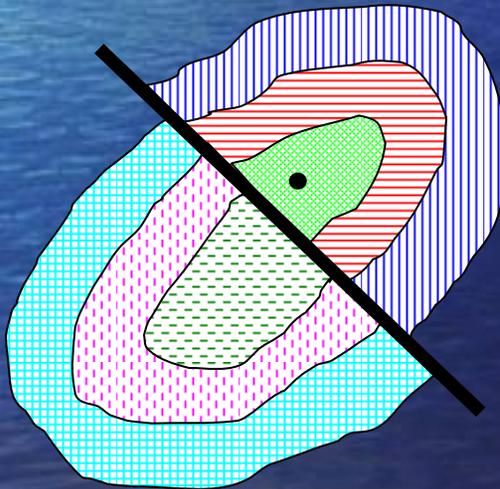


- Are the quantities being aggregated scale consistent?
 - If not, the aggregation results may not be valid.
- Are you aggregating properly risked distributions?
 - Has the degree of dependency been properly incorporated?
- How about project maturity and corporate decision process?
 - Can we really book reserves because we extracted P90, P50 and P10 numbers from a distribution.

Reserve Aggregations Considerations



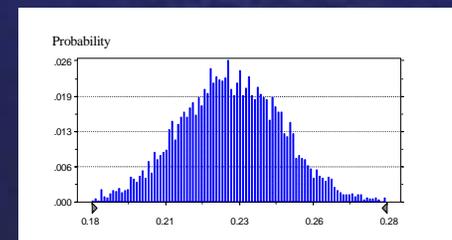
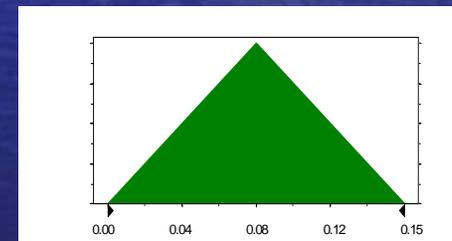
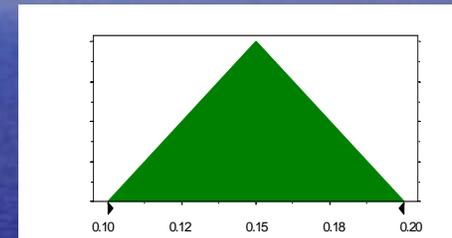
- Extracting P90, P50 and P10 may not be sufficient to classify reserves as proved, probable and possible.



Example of RF Aggregation



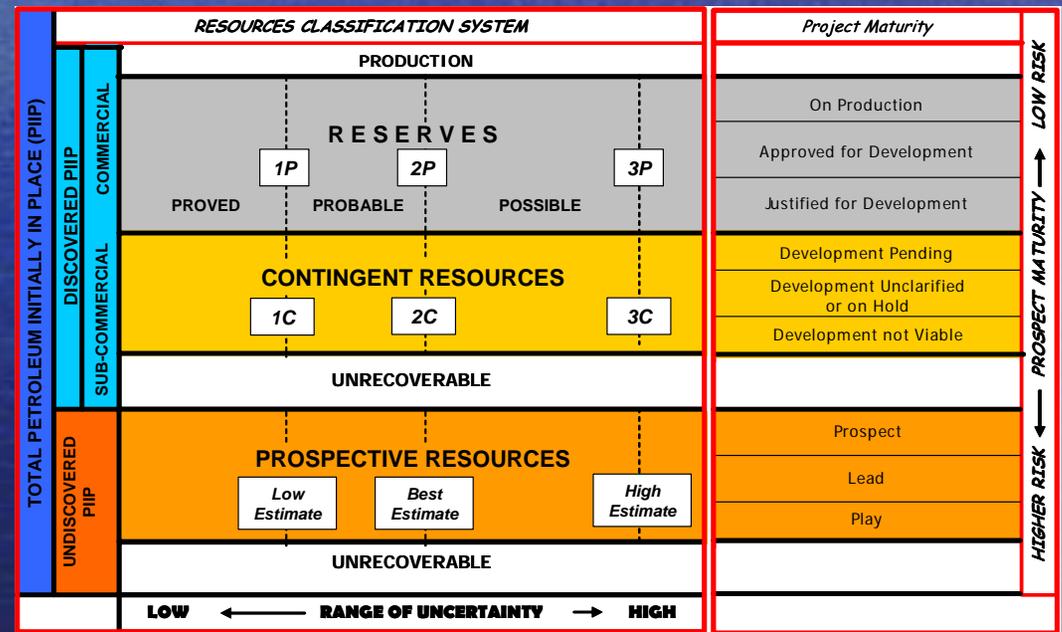
- Five fields on primary depletion.
- Primary RF: 10% to 20%
- Inc. Secondary RF: 0% to 15%
- Primary plus secondary RF:
 - P90: 20.5%
 - P50: 22.7%
 - P10: 24.9%



Reserve Aggregations Approach



- Start by mapping the decision process that may eventually lead to the development of the entire portfolio.
 - Decision gates, etc.
- Determine where each piece is within the Resources Classification System from a project maturity point of view.
- Ask yourself the question: Is one aggregation model sufficient or should I have multiple aggregations to distinguish between reserves and resources?

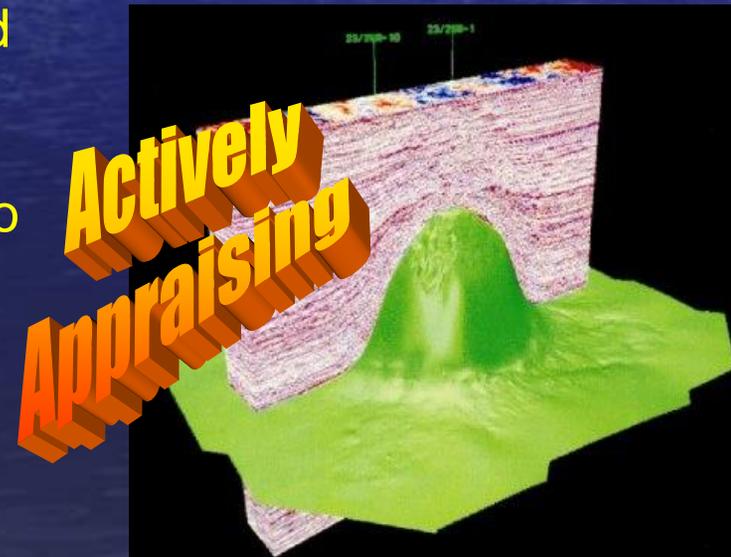
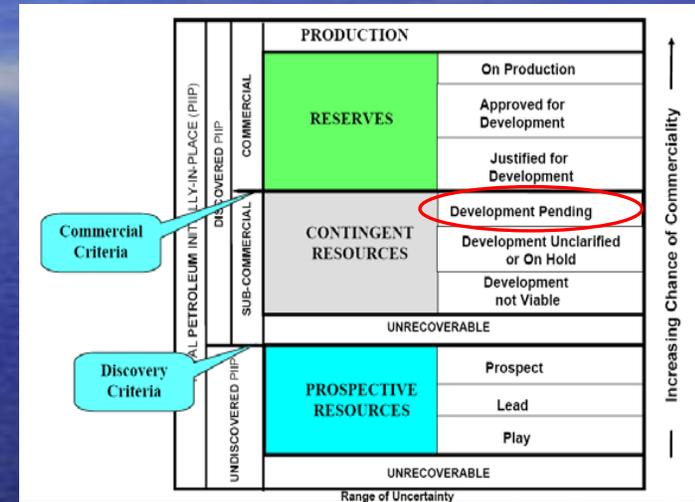


Let Project Maturity and Approval be your Guide



Ref.: Table 1

- Opportunity with enough hydrocarbons to justify ongoing activities to confirm commercial development in the foreseeable future
 - Reasonable potential for development subject to confirmation with ongoing data acquisition and investigations
 - Critical contingencies identified and reasonable expectations to resolve them
 - Disappointing appraisal may lead to downgrading to “On-hold” or “Not Viable”
 - Project decision gate is decision to move forward with appraisal and confirmation





Thank you for your attention.

Discussion