Managing risk and uncertainty of CO_2 storage – and associated liabilities

IEA – GCCSI Joint Liability Workshop

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DNV GL: Independent party providing assurance to stakeholders

- We classify, certify, verify and test against regulatory requirements, rules, standards and recommended practices
- We develop new standards and recommended practices
- We qualify new technologies and operational concepts
- We give expert advice to enhance sustainable business performance

Our purpose – and ambition for CCS

Safeguard life, property and the environment

- Be preferred **independent party**
  - Support projects with demonstration (and communication) of compliance with regulations/industry best practice
- Contribute to **trust and transparency**
  - Publish standards to support efficient and robust decision making processes
  - Guide development of harmonized regulatory frameworks for CCS
  - Credible verification of CCS projects and emissions reductions from CCS

Risk – Effect of uncertainty on project objectives

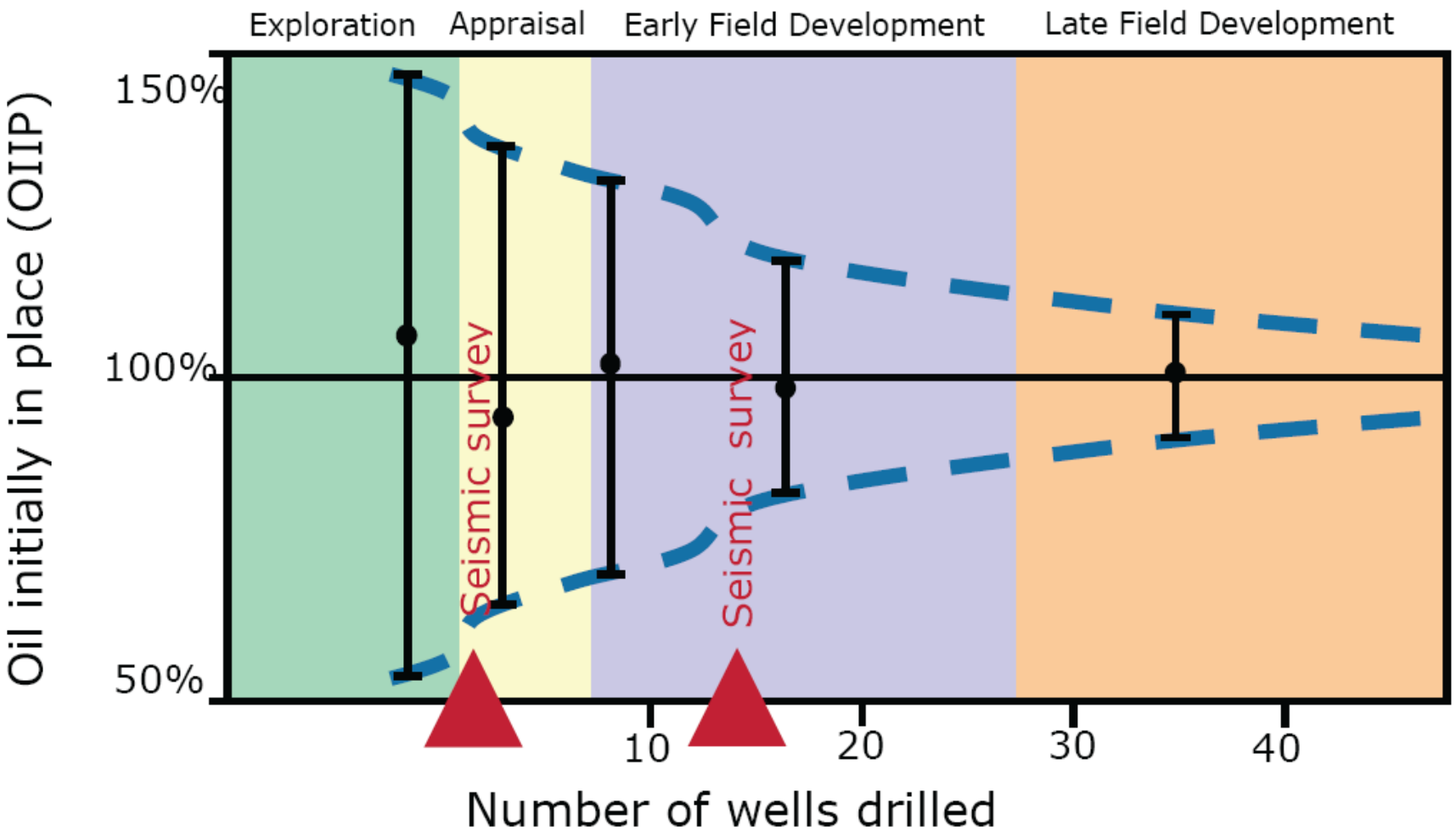
- Task: Set-up and manage a CCS project to the point of FID.
- Which uncertainties will keep you awake at night?

Key uncertainties for CCS project managers

- Long term CO_2 Price – ETS, Tax, Feed in tariffs, etc.
- Regulations – Clear, transparent and fair game
- Policies (and governments) – Is CCS a priority?
- Long-term liabilities and responsibilities
  - If or 'how and when' handover occurs

- Reputation:
  - Not doing anything (CCS)
  - Doing it in my backyard
  - #%&*ing up (and letting it hit the fan)
- Allegations – They did it!
  - Monitoring to detect leakage, seismicity
  - Monitoring and communication protocols to refute allegations

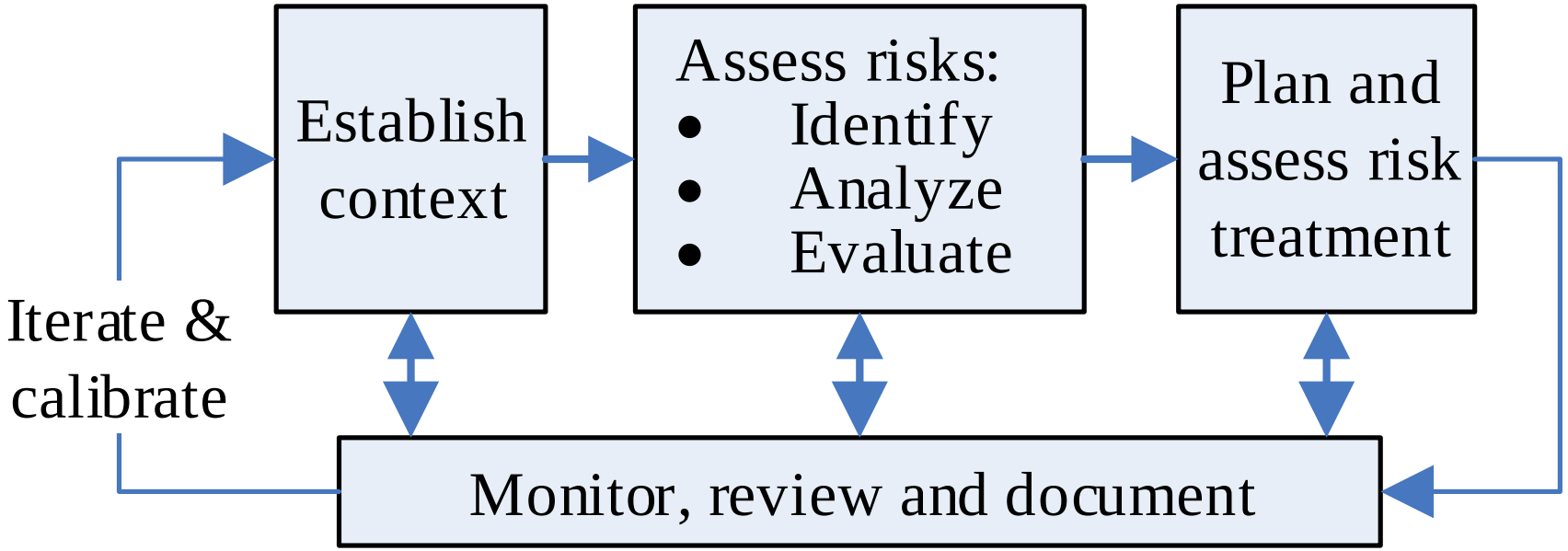
Managing uncertainty through project life



Courtesy of Phillip Ringrose, Statoil

Risk management – again, and again, and again …

- Managing risk is an iterative process of repeated assessments, analyses and data collection allowing project proponents to react to the expected and the unexpected.
- Risk is never zero, but should be managed within levels acceptable to all stakeholders.
- Residual risk prior to handover of liability (and responsibility), or simply walking away, may need to be close to zero based on a 'nothing more needs to be done' attitude.
- Still, some stakeholders may claim: We don't have enough evidence, what if, what if?



Reflections from Alberta PCSF study

- Post closure risk (5-50 after end of injection) should be informed by project experience – Not by other projects.
- Any liabilities post closure will be tied to potential for leakage (observed or not refuted).
- Quantification of leakage risk, in absence of any prior indications of leakage, is challenging: P<<<<1.
- Mitigation (to stop leak) and possible remediation cost are the big cost elements.

Concluding points

- There are risks and uncertainties in all projects.
- No two projects are identical – tailored approaches are needed.
- Unexpected circumstances are to be expected!
  - We will never know 'exactly' what the subsurface looks like, but managing subsurface uncertainties is part of the core business of O&G companies. It is how they earn their bucks.
- The level of risk we should be willing to accept (of doing CCS) should be weighed against the risk of not giving CCS a fair game.
- Burdenous requirements to long term post-injection monitoring, and the lack of an effective CO2 price are the two biggest obstacles to creating a stronger momentum for CCS deployment.

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