Risk and safety assessment
- Good practices for risk assessment for major projects

SBSTA technical workshop on CCS in the CDM, Abu Dhabi, 7–8 September 2011

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September 8th 2011
First briefly about DNV
Integrity at the core

- Independent self-owned foundation established in 1864
- The purpose is to Safeguard Life, Property, and the Environment
- 8500 competent professionals
Core competence

Industry:
- Energy sector – oil & gas, renewables, CCS
- Maritime sector – ships, mobile offshore units
- Identify, assess and manage risks during the complete life cycle of assets

Society:
- Technology development and knowledge sharing increase innovation and safety
- Joint industry projects are key to developing reliable guidelines and standards
- Joint industry projects allow industry players and authorities to join forces
- DNV’s in-depth knowledge and independent role facilitate this process
- 30-40 such joint industry projects launched each year
DNV’s core competence

identify
assess
manage

risk
Outline

- Risk management in the energy sector
  - Performance targets
  - Performance based regulations
  - Standards for HSE management

- How to transfer methodologies for risk and safety assessment to CCS
  - The development of CCS guidelines
  - CO2Qualstore guideline for qualification of CO2 storage sites

- DNV’s recommended approach for risk and safety assessment for CCS
  - Performance based regulations in combination with a risk bases assessment process
  - Site-specific and risk-based approach for managing geological storage of CO2
  - Assess the risks for each candidate site following the ISO31000 standard
Risk management in the energy sector

- Performance targets
- Performance based regulations
- Standards for HSE management
Risk management in the energy sector

- Risk management enables industry to realise the benefits of new technology in a safe and reliable manner.

- The energy industry has a long history of risk management - they control risks and perform risk assessments on a continual basis.

- Methods for risk management differ between industries and types of risk; general financial decisions or environmental, ecological, or public health risk.
Project Risk Management Types

Different risk management analysis techniques are applied for different purposes

"Set targets"
- Develop project
  - Explore
  - Appraise
  - Choose solution
  - Budgets & schedule

"Meet targets"
- Execute project
  - Manage against cost, time and quality
  - Manage interfaces
  - Decision gate reviews

"Realise benefits"
- Operate

- **Day-to-day Risk Management.** Risk management activities related to the day-to-day identification, assessment and control of risks. Reporting of HSE, exploration activities, well activities, operations.

- **Stage Gate Reviews.** Risk management activities related to the passing of stage gate reviews and permit applications
Performance based targets
- Performance based vs. prescriptive regimes

- Offshore operations in the North Sea (UK & Norway) are governed by a risk based regime focus on the prevention of major accidents AND the deployment of new, best available technology

- Such a regime relies on setting performance based targets

- These goals provide a more accurate and better framework than would be achieved by industry simply meeting a pre-determined set of detailed legislative requirements

- Offshore risk management relies on an extensive framework of standards and recommended practices…

**Performance targets:** “A targeted level of risk/uncertainty reduction achieved through implementation of a defined risk/uncertainty reducing measure, or range of such measures, i.e. = required terminal risk level + measures to prevent significant irregularities”
How to transfer methodologies for risk and safety assessment to CCS

- The development of CCS guidelines
- CO2Qualstore guideline for qualification of CO2 storage sites
CO2QUALSTORE: a key element in the CCS value chain

- DNV led Joint Industry Projects (JIPs):
  - CO2CAPTURE: Recommended Practice (RP) for Technology Qualification of CO2 Capture Technology;
  - CO2PIPETRANS (I): RP for design and operation of CO2 pipelines;
  - CO2QUALSTORE: guideline for selection and qualification of CO2 storage sites;
  - CO2WELLS: guideline for risk management of existing wells and re-qualification for CO2 injection;
  - CO2PIPETRANS (II): close the knowledge gaps that were identified in phase (I),

- JIPs carried out in collaboration with industry, regulators, international institutions and public enterprises assigned with responsibility for managing CCS
The CO2QUALSTORE guideline:

...mirrors best practices within the O&G industry, existing and emerging regulations, standards and directives relevant for geological storage of CO2, and learnings from existing CCS projects

- Defines a structured approach for CO₂ storage site selection;
- Provides a tool for managing CCS project development in a responsible way;
- Facilitates definition of criteria and procedures for issuing permits.
A risk-based qualification and management approach facilitates a discussion between regulators and project developers

- The CO2 QUALSTORE guideline describes a methodology for regulators to determine what is acceptable and un-acceptable levels of risk for geological storage sites.
- Risk assessments should be further refined as the site selection process progresses.
- The final risk assessment will form the basis of the monitoring and measurement program as well as shape the corrective measures strategy.
Applicability

Provides project developers with

- A transparent basis for decision-making to meet internal milestones and decision gates
- Guide to set performance targets that will enable the granting of relevant permits for individual sites
- Predictable operating conditions

Provides regulators/authorities with:

- Standardized guide to verify that sites have been selected and assessed as suitable for geological storage of CO$_2$
- Basis for development/implementation of national regulations aligned with industry best practice, directives and other national regulations
DNV’s recommended approach for risk and safety assessment for CCS

- Performance based regulations in combination with a risk based assessment process
- Site-specific and risk-based approach for managing geological storage of CO2
- Assess the risks for each candidate site following the ISO31000 standard
CCS in the CDM

DNV believes that the risks with CCS can be effectively managed within a CDM context by an adaptive risk-based approach.

Guidelines and regulatory frameworks have been developed.

Validation of geological storage is a feasible objective.
Safeguarding life, property and the environment

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ISO 31000 Framework for Risk Management

Principles (Clause 3)

- a) Creates value
- b) Integral part of organisational processes
- c) Part of decision making
- d) Explicitly addresses uncertainty
- e) Systematic, structured and timely
- f) Based on the best available information
- g) Tailored
- h) Takes human and cultural factors into account
- i) Transparent and inclusive
- j) Dynamic, iterative and responsive to change
- k) Facilitates continual improvement and enhancement of the organisation

Framework (Clause 4)

1. Mandate and commitment (4.2)
2. Design of framework for managing risk (4.3)
3. Implementing risk management (4.4)
4. Continual improvement of the framework (4.5)
5. Monitoring and review of the framework (4.6)

Process (Clause 5)

1. Establishing the context (5.3)
2. Risk assessment (5.4.2)
3. Risk identification (5.4.2)
4. Risk analysis (5.4.3)
5. Risk evaluation (5.4.4)
6. Risk treatment (5.5)
7. Monitoring and review (5.6)

Communication and consultation (5.2)