

Best Practices and Standards for Geologic Storage and Monitoring of CO₂

- Task Force delivered a report to the CSLF TG meeting in November 2013
- Agreement to continue given the required resources
- Only one country and person volunteered (Germany)
- One additional was willing to support but is not able to do prepare contributions
- Germany and Norway may be willing to prepare simple web site provided support by Secretariat
- CO2GEONET planning a project on European Best Practices , Guidelines etc
- ISO TC 265 (?)

- Request that the Task Force is officially disbanded

Best Practices and Standards for Geologic Storage and Monitoring of CO₂

- This web-site is intended for those who want a quick look at available standards, best practice manuals and guidelines to safe and efficient storage of CO₂. It is based on the CSL report **Reviewing Best Practices and Standards for Geologic Storage and Monitoring of CO₂, an Initial Compilation of Standards, Best Practices and Guidelines for CO₂ Storage and Monitoring** (http://www.cslforum.org/publications/documents/ReviewingBestPracticesStandards_2013Report.pdf)
- The web site is structured so that by clicking on the titles in the Content one is directed to one or more page with relevant documents. Each page contains title, link to the document and a brief description of the content.
- Please note that efforts are being made to keep the links updated.

Best Practices and Standards for Geologic Storage and Monitoring of CO₂

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Standards, general

- CSA: Z741-12 - Geological storage of carbon dioxide. For purchase:
- <http://shop.csa.ca/en/canada/design-for-the-environment/z741-12/inv/27034612012>
- This standard addresses:
 - Management systems
 - Site screening, selection and characterisation
 - Risk management Well infrastructure
 - Well infrastructure development
 - Monitoring and verification
 - Closure
 - The first edition CSA Z741, *Geological storage of carbon dioxide*. It was developed by the Technical Committee on Geological Storage of Carbon dioxide, which is a joint Canada – USA Technical Committee, with support from IPAC-CO2 Research Inc.

- DNV RP-J203: Geological Storage of Carbon Dioxide (DNV-RP-J203)
- http://www.dnv.com/news_events/news/2012/newcertificationframeworkforco2storage.asp
- This Recommended Practice (RP) is part of DNV's series of RPs. The main objective is to provide a systematic approach to the selection, qualification and management of geological CO₂ storage sites. It covers:
 - Storage screening and appraisal
 - Permitting
 - Context and requirements
 - Risk performance targets
 - Storage and closure permits
 - Risk management, assessment and treatment
 - Well qualification

Best Practices, Site screening, characterisation and selection

- DNV CO2QUAL: Guideline for selection and qualification of sites and projects for geological storage of CO₂
- http://www.dnv.com.au/binaries/CO2QUALSTORE_guideline_tcm162-412142.pdf
- A step by step guide to selecting a CO₂ storage site that covers
 - Pre-feasibility stages of developing a screening plan
 - Data acquisition
 - Capacity estimation
 - Modelling and simulation
 - Risk assessment
 - Regulation
 - Operation and closure (but majority of the BPM is on site selection and characterization).
- Covers the many different aspects that need to be considered and provides best practice for accomplishing each step often providing deliverables that could be expected. However, although it must be assumed that the best practices are based on lessons-learned; there are few direct case studies or examples that are mentioned as proof of the success of the best practices provided.

- NETL: Best practices for: Geologic storage formation classification: Understanding its importance and impacts on CCS opportunities in the United States
<http://www.netl.doe.gov/research/coal/carbon-storage/carbon-storage-infrastructure/best-practices>
- Written for the purpose of understanding and applying geology to a CCS project. Covers background on:
 - Geological terminology,
 - Rock types and how they fit into CCS and which are most suitable.
 - As well as more technical issues including different depositional environments and what each one means for CCS.
- This BPM covers only a very specific topic: understanding how geology affects a CCS project.

- NETL SS: Best practices for: Site screening, site selection, and initial characterization for storage of CO₂ in deep geologic formations
- <http://www.netl.doe.gov/research/coal/carbon-storage/carbon-storage-infrastructure/best-practices>
- Relates specifically to the needs of a generic CCS project covering all possible opportunities and what is necessary to select and characterize a site. Covers:
 - Identifying and developing all potential injection sites and requirements for each type (saline/depleted reservoir/coal)
 - Data analysis
 - Injection strategies
 - Model development and refinement
 - Capacity estimation and overall suitability analysis
 - Social and environmental considerations in developing and operating a site.
- A 110 page comprehensive discussion of ‘what you need to know with regard to storage. It addresses this from a fundamental standpoint covering basic scientific understanding and only occasionally inserting application examples. It does not cover simulation, risk and monitoring to a technical level as there are separate BPMs published to cover these.

Best Practices, Well construction and integrity

- DNV CO2WELLS: Guideline for the risk management of existing wells at CO₂ geological storage site
- http://www.dnv.com/industry/energy/segments/carbon_capture_storage/recommended_practice_guidelines/co2qualstore_co2wells/index.asp)
- Describes a transparent methodology to evaluate the integrity of wells, and risk-based procedure for re-qualification of wells for CO₂-injection. Content includes:
 - Well integrity risk
 - Risk assessment and risk criteria
 - Identification, analyses and evaluation of well risks
 - Communication
 - Qualification of existing wells
 - Assess performance of and qualification of wells
- The guideline provides a tool for independent validation and verification. Contributes to build confidence among regulators and stakeholders in risk informed approaches to selection and management of storage sites.

Best Practices, Monitoring and verification

- NETL: Best Practices for Monitoring, Verification, and Accounting of CO₂ Stored in Deep Geologic Formations – 2012 Update
- <http://www.netl.doe.gov/research/coal/carbon-storage/carbon-storage-infrastructure/best-practices>
- This BPM covers:
 - Overview of Existing MVA Technologies
 - Field Readiness of CO₂ Monitoring Tools
 - Applicability to Regulatory and Reservoir Management Needs Monitoring Plan
 - Monitoring of CO₂ in the Atmosphere
 - Near-Surface Monitoring Techniques
 - Subsurface Monitoring
 - MVA Data Integration and Analysis Technologies
 - Review of EPA Permitting Requirements

Guidelines

- European Commission:
- Guidance Document 1. CO₂ Storage Life Cycle Risk Management Framework
- http://ec.europa.eu/clima/policies/lowcarbon/ccs/implementation/docs/gd1_en.pdf
- Guidance Document 2. Characterisation of the Storage Complex, CO₂ Stream Composition, Monitoring and Corrective Measures
- http://ec.europa.eu/clima/policies/lowcarbon/ccs/implementation/docs/gd2_en.pdf)

- Two the four guidance documents Directive 2009/31/EC nos. 1 and 2 are relevant for this overview. The purpose of the Guidance Documents is to assist stakeholders to implement the Directive (so-called CCS Directive Guidance).
- Document 1 (GD1) addresses the overall framework for geological storage in the CCS Directive for the entire life cycle of geological CO₂ storage activities including
 - The phases
 - Main activities
 - Major regulatory milestones.
 - High-level approach to risk assessment and management

European Commission continued

- Guidance Document 2 (GD2) builds on GD1 provides guidance on:
 - Site selection;
 - Composition of the CO₂ stream;
 - Monitoring;
 - Corrective measures.
 - The Guidance documents are non- legally binding
- The European Commission has issued a directive, DIRECTIVE 2009/31/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009
- on the geological storage of carbon dioxide and amending. The directive has four guidance documents, on
 - Risk management
 - Characterization and monitoring
 - Transfer of responsibility
 - Financial security and mechanism