Guidelines for licensing CO_2 storage operations around the globe

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Abstract
In January 2008 the European Commission proposed a directive on the geological storage of CO_2 in the EU. Simultaneous to the development of the directive by the EC, the CO_2ReMoVe project, funded by FP6 and industry, wrote a Draft Contribution to Future Guidelines for licensing of CO_2 storage in saline reservoirs and depleted hydrocarbon reservoirs. This document contains detailed checklists for operators and authorities in each of the stages of a licencing procedure for a CO_2 storage operation. The draft guidelines will be updated as results from monitoring ongoing CO_2 storage operations become available. They may serve as a contribution to the regulation of CO_2 storage anywhere in the world, and may be also be of use in evaluating the EU directive in the future.

1. Introduction

The geological storage of CO_2 is considered an important option to curb CO_2 emissions and contributing to the achievement of Kyoto (and successor) targets in a world where economic stability will depend on fossil fuels for the next several decades. The first step towards Europe's goal of becoming a hydrogen economy requires the manufacture of hydrogen from fossil fuels. This can potentially be done cost-effectively on a large scale without significantly reduced GHG emissions, if the resultant CO_2 can be securely stored in geological formations.
Europe has invested large research efforts in CO_2 geological storage monitoring in a number of storage scenarios, gaining experience with industrial-scale projects (Sleipner, Weyburn), and smaller-scale pilot projects (Ketzin, K12B, Kaniov). Two new industrial-scale geological storage projects (In Salah and Snohvit) now provide the opportunity to build on this work. For CO_2 storage to qualify in Emission Trading Schemes, R&D efforts are required to develop a sound basis for monitoring and verification. This will provide the assurance of long-term storage security and establish consistent site certification guidelines for policy makers, regulators and industry.
CO_2ReMoVe is a consortium of industrial, research and service organizations with experience in CO_2 geological storage. The consortium proposes a range of monitoring techniques, applied over an integrated portfolio of storage sites that will develop the following:

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1) Methods for base-line site evaluation
2) Optimised suites of tools to monitor storage
3) New tools to predict and model long term storage behavior and risks
4) A rigorous risk assessment methodology for a variety of sites and time-scales
5) Guidelines for best practice for the industry, policy makers and regulators
This will encourage widespread application of CO_2 geological storage in Europe and neighboring countries. So far, project efforts have resulted in the document 'Draft Contribution to Future Guidelines for licensing CO_2 storage operations in saline reservoirs and depleted hydrocarbon fields'.

This article describes these guidelines for the acquisition and utilisation of a variety of geological and non-geological data. The guidelines start from eight phases in a licensing procedure that will be presented here. Next, the guidelines will be compared with the contents of the proposed EU directive on the geological storage of CO_2. The recently proposed EU directive on CO_2 storage does not make an explicit reference to the licensing phases, but basic elements of a licensing procedure are common to both documents; notably the importance of comprehensive and robust site selection.

While the Draft Contribution to Future Guidelines contains detailed checklists for operators and authorities in each of these stages, this paper will provide brief descriptions of each of the stages with reference is made to the stipulations in the proposed EU directive on CO_2 storage. The article will result in conclusions on the future of both the guidelines and the EU directive on geological storage.

2. Phases in a storage operation and licencing procedure

An overview of the key stages in a licensing procedure is given in Figure 1, with a brief summary of the activities associated with each phase. A CO_2 storage operation typically commences with a screening of candidate sites (Phase 1), an investigation of the selected site (Phase 2), including well drilling and testing (Phase 3), and the preparation of a site development plan (Phase 4). After these phases, the operator could be granted a site storage licence, or alternatively, licencelicence may walk away from a project at any time with no further obligations specific to the storage of CO_2 . After the issue of this licencelicence however, the licencelicencee will be obliged to follow the authorized site development plan for injection, storage, site closure and associated monitoring. This entails construction (Phase 5), the storage operation (Phase 6), and site closure (Phase 7). The last phase, post-closure (Phase 8), follows after liability for the site has been handed over to the relevant national authority.

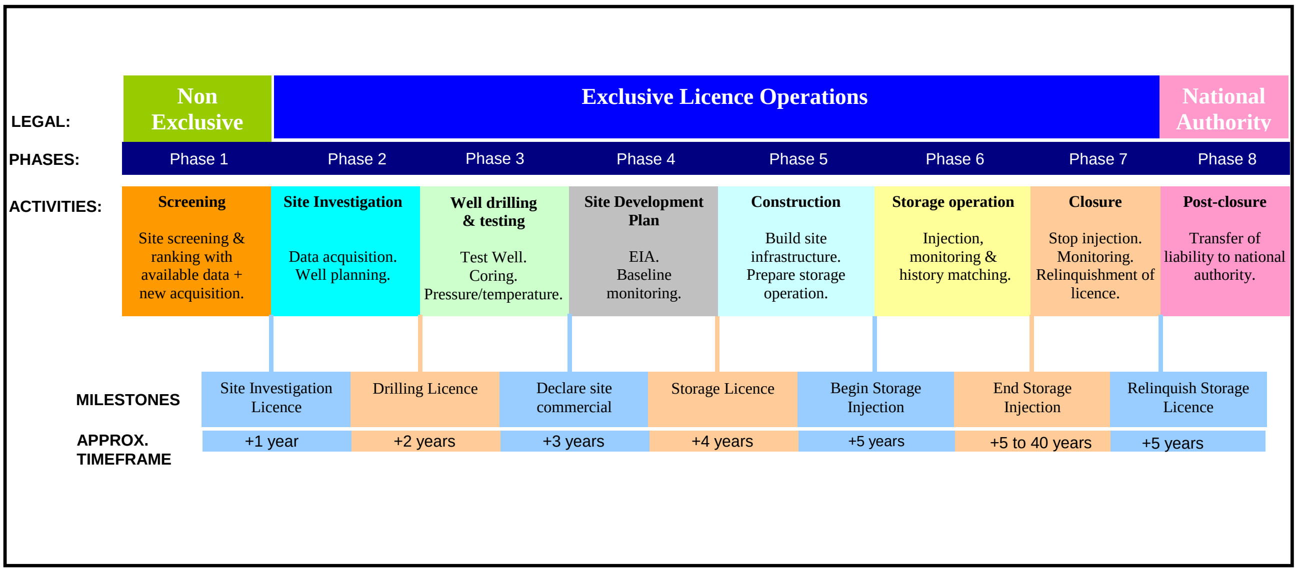

Figure 1 **Phases in the realization of a CO_2 storage operation**

For reasons of clarity the parties involved in a geological storage project are here assumed to be limited to a national regulator and a storage site operating company, or licencee. This simplification and does not take into account more complex regulatory structures or other stakeholders such as the general public or environmental NGO's. Furthermore, independent third parties may have a role as well. Their interference can be anticipated if:

- CCS is accepted into an emissions trading scheme, such as the EU-ETS; or
- a regulator requires third party assistance in the quality assessment of the licencee's activities

In the event that CCS is opted into an emissions trading scheme a third party would be required for validation and verification of emissions reductions. Here *validation* refers to the process of ensuring an accurate estimation of emission reductions prior to injection, and *verification* refers to the confirmation of the stated emission reductions for a given period of injection. Both processes would be performed according to anticipated guidelines for emissions accounting in the trading scheme.

Potential storage sites may be located in areas of where geological data availability is variable, largely depending on the degree of petroleum or geothermal exploration that has been carried out in the region, and some saline aquifer storage targets may have only sparse data. In such cases, drilling and well testing may need to be carried out earlier in the evaluation process than for locations in data rich areas. This implies that the duration of Phases 1-3 may vary significantly from site to site and that an iterative approach to data acquisition in these phases may be required at.

In contrast, considerable reservoir characterization data may exist for depleted oil and gas reservoirs, including those that are candidates for Enhanced Oil Recovery (EOR). Site investigation requirements for such sites would typically focus more on legacy issues such as the integrity of abandoned well bores than on new data acquisition.

Phase 1: Screening

The screening phase evaluates the practicality and potential of storing CO_2 in an appropriate region by identifying, assessing and comparing possible candidate storage sites. Proper screening is a first step to a well-considered site selection, and is therefore heavily emphasized in the recently proposed EU directive on CO_2 storage. The directive also specifies that Member States retain the right to determine the areas from which storage sites may be selected.

Screening is typically carried out by potential site operators who would not need to get their screening activities approved by a regulatory body at this stage in the process, as long as no new data are acquired. It is anticipated that existing datasets will be used to produce a ranked list of potential storage sites based on geological, economic and logistical considerations.

The screening phase will end with the application for an exclusive exploration licence. [Note that a grant for non-exclusive licence only may be a disincentive for costly seismic investigations in this phase]. Applications should be considered in the light of other licences in the same geological region since the injection at one location may affect the performance of other sites even if their licence areas do not overlap. The authorities may need to ask multiple operators to apply for a cooperative licence in this case or demonstrate that activity at one site will not infringe upon another site. Furthermore, it may be necessary for governments to prepare licensing rounds to manage any competition that may arise between operator companies to gain access to prime storage sites.

Potential operators of storage sites should compete on the basis of their qualifications and capacities, and the specific development plans they offer to the authorities. Potential operators may need to be pre-qualified to participate in licensing processes.

Phase 2: Site Investigation

Phase II involves further site investigation ahead of the drilling and well testing program in Phase III. The aim is to refine preliminary storage capacity estimates made in the screening phase and to provide the geological information necessary to show that, as far as can be discerned prior to drilling, the site will perform effectively and safely. In the event that more than one site is initially selected, it is envisaged that a single preferred site would be identified during this process. The main deliverable from this phase is the information to be included in the application for a drilling licence. This information should characterize the geology of the storage reservoir and overburden as accurately as possible and include a drilling program with targets and well completion and abandonment strategies.

A reasonable description of the reservoir, caprock integrity, stratigraphy, physical properties and geomechanical setting of the reservoir and overburden should be achievable during this phase. The key datasets for a robust characterization of reservoir and overburden will normally include 2D and/or 3D seismic surveys. 2D seismic can be used to constrain geological structures over a large area at low resolution between survey lines, whereas 3D seismic should be used to provide more detail over the predicted storage footprint and any anticipated containment risks. The data acquired during this phase should also form the basis for predictive flow modelling of the injected CO_2 in the storage reservoir. Such flow models would then form the basis for designing baseline monitoring surveys, an injection strategy and a monitoring programme..

Baseline monitoring will need to be initiated in good time prior to injection, though the exact timing (starting in Phase II, III or IV) will be the responsibility of the licencee. Baseline monitoring should include characterization of the following systems over timescales that take into account seasonal and annual variations:

- *Geosphere* – description of the geology above and beneath the storage reservoir based on e.g. seismic data and drilling, as well as the hydrogeological context, including groundwater flows to the surface in order to assess the potential displacement of reservoir fluids to the surface due to CO_2 injection.
- *Biosphere and local ecosystems* – identification and monitoring of target species, particularly in protected areas, and identification of potential migration pathways through which any groundwater systems or local terrestrial or marine ecosystems may be affected;
- *Background fluxes* - Measurement of background fluxes of CO_2 (and if appropriate CH_4) to avoid their inclusion in the estimate of annual emissions. Isotopic analysis of any background fluxes of CO_2 may be necessary, as this is likely to help distinguish them from the injected CO_2..

The characterization of the geosphere has been addressed in the proposed EU directive on CO_2 storage, as part of the site selection process. Characterization of biosphere and measurement of background fluxes are not explicitly mentioned in this directive, but would be part of the Environmental Impact Assessment (see Phase 4: Site development plan).

In large saline aquifers the long-term areal extent of a CO_2 plume over time may cover hundreds of square kilometers and the prediction of the exact location of this plume may be uncertain at this stage in the process. In such cases the need for a flexible, evolving baseline survey should be considered in order to avoid unnecessarily expensive baseline monitoring over areas that may not ultimately be affected by CO_2 migration issues. Such a survey would aim to characterize the geosphere, biosphere and background fluxes ahead of the migrating plume and prior to their being affected by the presence of injected CO_2.

The site investigation phase would end with the application for an exclusive drilling licence. This may represent an extension of the exploration licence, would typically be time limited (1 to 3 years) and include some minimum drilling obligations. After the completion of the drilling program the licencee must decide whether to proceed and commit himself to further drilling obligations or relinquish the area.

Phase 3: Drilling and well testing

The aim of well testing is to confirm and refine the site investigation from Phase II and provide key basic data for the predictive fluid flow modeling, estimates of storage capacity and preliminary injection programme design. Well logs, down hole fluid samples, well cuttings and core samples from test wells are anticipated to indicate the physical properties of the reservoir, caprock and overburden. This wide variety of data must be interpreted and resolved such that they form a consistent, integrated description of the underground. Particularly important properties are the porosity and permeability values, because these determine both static storage capacity and dynamic movement of the injected CO_2. Pressure and temperature information estimated for the reservoir or measured in wells can be used in the calculation of the density of the CO_2-rich phase.

The injectivity of the storage reservoir should be evaluated by injection testing. At this stage water or CO_2 may be used for injection, though the latter will have implications for the baseline monitoring and may need to be constrained to a maximum volume. It should be noted that the amount of information available from an injection test is dependant on its duration - tests of a few days reveal reservoir properties only close to the injection well. Care should be taken when drilling test wells to ensure that they can be used later in the operation of a storage site, or can be properly sealed to prevent leakage.

Note that the proposed EU directive on CO_2 storage does not contain any stipulations on drilling and well testing. Drilling has been regulated in the Borehole Directive (92/91/EEC).

After drilling and well testing the site may be declared commercial.

Phase 4: Site development plan

In Phase 4 the operation of the CO_2 injection site will be planned in detail and also its subsequent closure. This phase is carried out as a desktop exercise, although additional data should be acquired as needed. Baseline monitoring will also continue during this phase.

An Environmental Impact Assessment (EIA) will be carried out to establish the safety of the project. The EIA should draw on the results from Phases 1-3 to provide an assessment of the risks to health, safety and the local environment, as well as a plan to manage those risks that includes a monitoring programme for the operation and closure phases (6 and 7).

During this phase the operator needs to demonstrate that the proposed storage site can offer effective climate change mitigation by containing the stored CO_2 for a very long period, likely to be several thousand years in duration. Therefore, geological CO_2 storage requires specific monitoring of the geosphere and biosphere, which will be described in the monitoring program, in addition to standard practice regarding Health, Safety and Environmental (HSE) monitoring.

Following approval of the site development plan for the construction and operation of a storage site, the licencee will be granted a site storage licence. The proposed EU directive does not require that a storage licence be exclusive. Competing uses in the area such as hydrocarbons production or geothermal energy or other CO_2 storage operations should be considered by the authority before granting the licence. According to the EU

directive all applications should be reviewed by the Commission, who may take competing uses into account while preparing its recommendation.
After this point, the licencee would be bound to operate the storage site according to the approved plan and timeframe. Failure to do so would violate the licence terms and may provide a basis for financial compensation.

The proposed EU directive does not refer explicitly to a 'site development plan', but only to applications for CO_2 storage permits, which should contain a monitoring plan, a corrective measures plan, and a post-closure plan. The directive stipulates that proof of financial security shall be part of the permit application. In general, provisions in the proposed EU Directive on CO_2 storage relating to this phase place a strong emphasis on proper site selection and characterization. Properly selected storage sites will dramatically reduce the risk of leakage. Site selection will be reviewed thoroughly by the European Commission, and a non-binding recommendation on the storage permit applications will be given to the respective Member States.

Phase 5: Construction

Baseline monitoring will need to continue during the construction of surface facilities and the drilling of CO_2 injection wells in order to achieve the longest possible timeline for the baseline data.

Phase 6: Storage operation with injection of CO_2

During the storage operation, CO_2 will be transported from its source location(s) and injected into the storage reservoir according to the volumes and rates specified in the site development plan.

Two key aspects of this phase are the need to evaluate the degree to which the site is performing compared to predictive models through performance assessments and to evaluate the evolving containment risks through ongoing risk assessments. Performance and risk assessments will need to be carried out at regular intervals. The frequency will be site-specific, determined by discussion with the regulator (in the proposed EU Directive this is at least once a year). The results may require that operating parameters and limits stated in the original site development plan be adjusted to reflect updated understanding of the storage performance.

Various types of tool can be used to monitor the observed CO_2 plume, to history-match it against flow simulations, and to provide input to ongoing performance and risk assessments. The predictive models should be calibrated against the observations, and future predictions of plume behavior should be modified based on the calibrated history-matched models. The monitoring program (Box 1) will have been described in the site development plan (Phase 4).

Storage operation ends when the licencee ceases CO_2 storage operations for commercial or technical reasons with the approval of the authorities. Alternatively, should site performance deviate significantly from acceptable limits, the regulator may force cessation of injection.

Regulatory requirements of monitoring should not be prescriptive but should rather reflect site-specific conditions and objectives (Box 1).

Box 1 Elements of a monitoring program proposed by CO_2ReMoVe

The following may be monitored to enable history matching of flow modeling:

- *Injected CO_2;* the mass of injected CO_2, injection pressure, temperature and gas composition.
- *CO_2 inside the storage reservoir;* temperature and pressure data inside the reservoir, and time-lapse imaging of the migration of CO_2 within the storage reservoir.
- *CO_2 outside of the storage reservoir;* migration of CO_2 from the storage reservoir to other parts of the geosphere. Caprock integrity is an integral part of this monitoring target.
- *Surface fluxes of CO_2;* fugitive CO_2 that migrates from the geosphere to the biosphere may migrate further to the seabed or ground surface. Migration paths could include fault planes, "thief zones", wells (active or abandoned), groundwater and soil. Periodic investigations of the entire site, and any additional area below which monitoring and modelling suggests CO_2 is distributed, should be made to detect any unpredicted leaks.
- *Groundwater;* CO_2 contamination of potable groundwater reserves should be detected.
- *Well integrity;* abandoned wells in the vicinity of the CO_2 plume will need to be monitored for leakage.

The monitoring program should also contain descriptions of the following:

- *Timing of surveys during Storage Operation phase;* repeat time-lapse surveys will need to be performed in order to describe the evolution of the above measurements through time. The monitoring program will indicate the initial frequency of these surveys, and describe how this timing will respond to the results obtained and any unforeseen events .
- *Timing of surveys during Site Closure phase;* monitoring will be needed to demonstrate that the evolution of the CO_2 storage site is in agreement with earlier predictive models, and thus the long term fate of the CO_2 is well understood. Depending on the success of such history matching the frequency of monitoring surveys may be reduced.
- *Layout of surveys;* this should take into account land or marine use around the site, the geological nature of the reservoir and its depth, and the location of faults, wells and other surface infrastructure.
- *Permanent monitoring installations;* examples of permanent instrumentation in wells may include geophone arrays for seismic measurements, pressure and temperature sensors or fluid sampling systems. At the surface, pads for gravity surveys, or markers for other key surveys may be installed, so that specific future surveys, if needed, can be made at accurately located points to ensure better constrained comparisons with previous datasets. Such installations allow future generations to continue monitoring, although they should only be considered where their presence does not compromise the long-term integrity of the storage system.
- *Monitoring and modeling techniques;* the measurement technologies and predictive flow models to be used during storage operations together with a description of how monitoring techniques will be continuously reviewed to follow the most recent best practice.
- *Detection limits and uncertainty;* the sensitivity of the monitoring techniques to detecting CO_2 migration and leakage.

The specifications in the proposed EU storage directive (presented in Box 2) diverge slightly from the requirements suggested in Box 1. For instance, the directive does not contain any stipulations on the permanency of monitoring installations. It only suggests some groups of monitoring techniques suggested, including technologies that can detect presence location and migration subsurface, technologies that can provide information about plume behavior (3D simulation in 3D models), and technologies that can provide wide areal spread (across complete storage complex). Monitoring equipment is to be based on the best available technology at the time the monitoring plan is designed. Furthermore, the directive does not address uncertainties in the monitoring programme or detection limits. These issues are to be addressed in regulations on the accounting of CO_2 emissions from CCS operations participating in the EU Emissions Trading

Scheme. At present a CCS Annex to the 2007 EU-ETS Monitoring and Reporting Guidelines is being developed.

Box 2 Site characterization, static and dynamic modeling and contents of a monitoring plan according to the proposed EU Directive on CO_2 storage

Criteria for the characterization and assessment of storage sites, including a list of required data on characteristics of the complex (Annex I):

(a) *Reservoir geology and geophysics;*
(b) *Hydrogeology (in particular existence of potable ground water);*
(c) *Reservoir engineering (including volumetric calculations of pore volume for CO_2 injection and ultimate storage capacity, pressure and temperature conditions, pressure volume behaviour as a function of formation injectivity, cumulative injection rate and time);*
(d) *Geochemistry (dissolution rates, mineralisation rates);*
(e) *Geomechanics (permeability, fracture pressure);*
(f) *Seismicity (assessment of potential for induced earthquakes);*
(g) *Presence and condition of natural and man-made pathways which could provide leakage pathways;*

as well as data on the complex vicinity.

A static geological earth model will characterize the complex in terms of :

(a) *Geological structure of the physical trap;*
(b) *Geomechanical and geochemical properties of the reservoir;*
(c) *Presence of any faults or fractures and fault/fracture sealing;*
(d) *Overburden (caprock, seals, porous and permeable horizons);*
(e) *Areal and vertical extent of the storage formation;*
(f) *Pore space volume (including porosity distribution);*
(g) *Any other relevant characteristics.*

Dynamic modeling shall provide insight to:

(f) *Pressure volume behaviour vs. time of the storage formation;*
(g) *Areal and vertical extent of CO_2 vs. time;*
(h) *The nature of CO_2 flow in the reservoir including phase behaviour;*
(i) *CO_2 trapping mechanisms and rates (including spill points and lateral and vertical seals);*
(j) *Secondary containment systems in the overall storage complex;*
(k) *Storage capacity and pressure gradients in the storage site;*
(l) *The risk of fracturing the storage formation(s) and caprock;*
(m) *The risk of CO_2 entry into the caprock (e.g., due to exceedance of capillary entry pressure of the caprock or due to caprock degradation);*
(n) *The risk of leakage through abandoned or inadequately completed wells;*
(o) *The point when overspill may occur (in physical traps);*
(p) *The rate of migration (in open-ended reservoirs);*
(q) *Fracture sealing rates;*
(r) *Changes in formation(s) fluid chemistry and subsequent reactions (e.g. pH change, mineral formation, and inclusion of reactive modelling to assess affects);*
(s) *Displacement of incumbent formation fluids.*

The monitoring plan shall specify (Annex II):

(a) *Parameters monitored;*
(b) *Monitoring technology employed and justification for technology choice;*
(c) *Monitoring locations and spatial sampling rationale;*
(d) *Frequency of application and temporal sampling rationale."*

The parameters to be monitored are identified so as to fulfil the purposes of monitoring. However, the plan shall in any case include continuous or intermittent monitoring of the following items:

(e) *Fugitive emissions of CO_2 at the injection facility;*
(f) *CO_2 volumetric flow at injection wellheads;*
(g) *CO_2 pressure and temperature at injection wellheads (to determine mass flow);*
(h) *Chemical analysis of the injected material;*
(i) *Reservoir temperature pressure (to determine CO_2 phase behaviour and state).*

Phase 7: Site closure

The closure phase of a CO_2 storage project represents the period of time between ceasing to inject CO_2 and transferring liability for the site from the licencee to the relevant national authority. The closure phase will have been planned initially in the site development plan, with possible subsequent modification to reflect the evolving performance and risk assessments. Surface infrastructure associated with CO_2 storage will be removed and injection wells should be sealed as soon as possible unless they are to be used for monitoring purposes. Indeed, the proposed EU Directive stipulates that a corrective measures plan and a provisional post-closure plan should be part of the permit application.

During site closure, the operator will demonstrate that the total storage system is understood in a sufficiently detailed way such that future performance can be robustly assessed as satisfactory. Ongoing monitoring and history matching of predictive models will be required in order to provide evidence that the system is well understood and that the site may be closed. Until then, regular submission of performance and risk assessment reports to the regulator will continue.

The frequency of monitoring is likely to decrease with time during site closure as confidence in models increases. Clearly, if the system does not behave as predicted, such as if unexpected migration occurs or leaks develop, then the frequency and types of monitoring may increase. Thus, any residual risk can be minimized and liability can be transferred from the operator to the designated national authority.

The duration of the site closure phase could vary significantly depending on specific site characteristics and required tolerances in matching models and monitoring data. It will end with the relinquishment of the site storage licence and transfer of liability to the relevant national authority.

Phase 8: Post closure

The post closure phase will last an indefinite length of time, with responsibility for the storage site residing with the designated national authority. The primary safety issue of the post-closure phase is to avoid future subsurface activity that may disturb the CO_2 storage reservoir and compromise its sealing performance. Otherwise the site has already proven its “undisturbed” storage performance during the Closure phase and the national authority is in possession of the performance and risk assessment reports demonstrating long term safety of the site.

Safety in the post closure phase should not be based on a requirement for future monitoring, since this may be construed as placing an unethical burden on future generations to continue monitoring. Rather, the safety of the site should be based on its inherent qualities established during site selection and characterisation, and confirmed by monitoring during the operational and closure phases. Observations and data collected during the injection phase and dynamic modeling calibrated to this will likely supersede and make redundant some or much of the original site selection material. These qualities include the caprock integrity, wellbore abandonment techniques, sealing features such as faults and fractures and operational history (injection pressures, volumes, injection point etc.). Therefore, monitoring should not be needed in the post-closure period, only becoming necessary if unforeseen circumstances arise.

3. Draft CO_2ReMoVe guidelines and the proposed EU Directive on CO_2 storage

In this paper we discussed the various phases in a licensing procedure that have been described in the Draft Contribution to Future Guidelines elaborated by the CO_2ReMoVe partners. The recently proposed EU directive on CO_2 storage does not make an explicit reference to these stages, but crucial elements of a licensing procedure are included to both documents; in particular notably the importance of comprehensive and robust site selection.

The proposed EU directive is not fully comprehensive. For instance, the directive does not contain stipulations on the permanency of monitoring installations, reviews of monitoring technologies, uncertainties or detection limits. These issues are important in particular when it comes to quantifying the volume of potentially leaked CO_2. Quantification of fugitive emissions is fundamental if stored CO_2 is to have economic value in the EU (or any other) emissions trading scheme. Therefore, monitoring and reporting guidelines on accounting emissions from CCS operations are at present being developed by the European Commission.

A number of other issues that have been dealt with in the proposed EU directive are not addressed in the Draft Contribution to Future Guidelines. These include ways to guarantee a harmonized approach across countries to the evaluation of permit applications, the inspection of injection and storage operations, possible measures in case of leakage, CO_2 stream acceptance criteria, and third party access to CO_2 infrastructures. Future updates of the CO_2ReMoVe draft guidelines could deal with these issues. Currently, work is underway to improve guidance on acceptance criteria for impurities in CO_2 streams.

Although any guidance document on licensing CO_2 storage operations will need to be evaluated and updated frequently as new insights from field operations become available, the Draft Contribution to Future Guidelines for licensing CO_2 storage operations prepared by the CO_2ReMoVe partners offers a good start for licensing CO_2 storage operations. If it can help to assist legislators worldwide in elaborating effective and reasonable regulations for CO_2 storage operations, it will have met its purpose.