

## ANNEX II

### CRITERIA FOR ESTABLISHING AND UPDATING THE MONITORING PLAN REFERRED TO IN ARTICLE 13(2) AND FOR POST-CLOSURE MONITORING

#### 1. Establishing and updating the monitoring plan

The monitoring plan referred to in Article 13(2) shall be established according to the risk assessment analysis carried out in Step 3 of Annex I, and updated with the purpose of meeting the monitoring requirements laid out in Article 13(1) according to the following criteria:

##### 1.1. Establishing the plan

The monitoring plan shall provide details of the monitoring to be deployed at the main stages of the project, including baseline, operational and post-closure monitoring. The following shall be specified for each phase:

- (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<sub>2</sub> at the injection facility;
- (f) CO<sub>2</sub> volumetric flow at injection wellheads;
- (g) CO<sub>2</sub> pressure and temperature at injection wellheads (to determine mass flow);
- (h) chemical analysis of the injected material;
- (i) reservoir temperature and pressure (to determine CO<sub>2</sub> phase behaviour and state).

The choice of monitoring technology shall be based on best practice available at the time of design. The following options shall be considered and used as appropriate:

- (j) technologies that can detect the presence, location and migration paths of CO<sub>2</sub> in the subsurface and at surface;
- (k) technologies that provide information about pressure-volume behaviour and areal/vertical distribution of CO<sub>2</sub>-plume to refine numerical 3-D simulation to the 3-D-geological models of the storage formation established pursuant to Article 4 and Annex I;
- (l) technologies that can provide a wide areal spread in order to capture information on any previously undetected potential leakage pathways across the areal dimensions of the complete storage complex and beyond, in the event of significant irregularities or migration of CO<sub>2</sub> out of the storage complex.

##### 1.2. Updating the plan

The data collected from the monitoring shall be collated and interpreted. The observed results shall be compared with the behaviour predicted in dynamic simulation of the 3-D-pressure-

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volume and saturation behaviour undertaken in the context of the security characterisation pursuant to Article 4 and Annex I Step 3.

Where there is a significant deviation between the observed and the predicted behaviour, the 3-D model shall be recalibrated to reflect the observed behaviour. The recalibration shall be based on the data observations from the monitoring plan, and where necessary to provide confidence in the recalibration assumptions, additional data shall be obtained.

Steps 2 and 3 of Annex I shall be repeated using the recalibrated 3-D model(s) so as to generate new hazard scenarios and flux rates and to revise and update the risk assessment.

Where new CO<sub>2</sub> sources, pathways and flux rates or observed significant deviations from previous assessments are identified as a result of history matching and model recalibration, the monitoring plan shall be updated accordingly.

## 2. Post-closure monitoring

Post-closure monitoring shall be based on the information collected and modelled during the implementation of the monitoring plan referred to in Article 13(2) and above in point 1.2 of this Annex. It shall serve in particular to provide information required for the determination of Article 18(1).