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气候变化框架公约

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附属科学技术咨询机构
第三十五届会议
2011 年 11 月 28 日至 12 月 3 日，德班

临时议程项目 10 (a)
《京都议定书》之下的方法学问题
将捕获和在地质构造中储存二氧化碳
作为清洁发展机制项目活动

将捕获和在地质构造中储存二氧化碳列为清洁发展机制项目活动的方式和程序草案

秘书处的说明*

内容提要

本说明载有将捕获和在地质构造中储存二氧化碳列为清洁发展机制项目活动的方式和程序草案，本文是秘书处根据第 7/CMP.6 号决定第 6 段提出的请求编写的。草案参考了缔约方和获准参加的关在组织相关意见书以及 2011 年 9 月 7 日和 8 日在阿拉伯联合酋长国阿布扎比与技术和法律专家举行的技术研讨会的成果。草拟方式和程序草案的目标是为便利附属科学技术咨询机构第三十五届会议相关的讨论工作。

* 由于技术研讨会的时间安排以及需要对会议产生的信息进行广泛的分析，因此本文件逾期提交。

目录

一. 导言

A. 任务

1. 作为《京都议定书》缔约方会议的缔约方会议(议方会)第 7/CMP.6 号决定：

(a) 确定二氧化碳(CO_2)捕获和封存(捕存工作)在地质构造中有资格作为清洁发展机制(清发机制)下的项目活动，但是第 2/CMP.5 号决定第 29 段所确定的问题必须得到已圆满的处理和解决；[1]

(b) 请附属科学技术咨询机构(附属科咨机构)第三十五届会议审议捕存工作列为清发机制下项目活动的方式和程序，争取向议方会第七届会议提出一项拟议决定；

(c) 确定这些方式和程序要涉及特定的一系列问题；

(d) 请缔约方和获准参加的观察员组织向秘书处提交意见书，说明如何才能在方式和程序中处理这一系列问题，请秘书处根据这些意见书编写一份汇总报告(意见汇总报告)；[2]

(e) 请秘书处在科咨机构第三十四次会议之后但必须在第三十五届会议之前与技术和法律专家举办一次技术研讨会，审议上述意见书和意见汇总报告，并讨论如何才能在方式和程序中处理这一系列问题；

(f) 请秘书处在这些意见书和技术研讨会的基础上编写方式和程序草案，提请科咨机构第三十五届会议审议。

B. 本说明的范畴

2. 本说明列有上文第 1 (f)段提到的方式和程序草案。

3. 这些草拟的方式和程序是作为列在本说明的附件一之中的议方会决定草案以及列在本说明附件二之中的该决定附件草案提出的，并且如上文第 1 (f)段所述，提请科咨机构第三十五届会议审议。

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[1] 第 2/CMP.5 号决定第 29 段具体提到如下问题：非永久性，包括长期永久性；衡量、报告和核实；环境影响；项目活动界限；国际法；赔偿责任；意外不利结果的可能性；安全；以及因渗漏或泄漏造成的损害的保险与赔偿。

[2] FCCC/SBSTA/2011/INF.7 号文件。缔约国提交的意见书载于第 FCCC/SBSTA/2011/MISC.10 号文件。获准参加的观察员组织提交的意见书列于第 FCCC/SBSTA/2011/MISC.11 号文件，这些意见书的全文发表在《气候变化公约》的网站上(政府间组织提交的意见书可登录 http://unfccc.int/parties_observers/igo/submissions/items/3714.php 查阅，非政府组织提交的意见书可登录 http://unfccc.int/parties_observers/ngo/submissions/items/3689.php)查阅)。

C. 附属科学技术咨询机构可能采取的行动

4. 科咨机构不妨在审议将捕存工作列为清发机制下项目活动的方式和程序的情况下，注意到本说明所载资料，争取提出一项决定草案，请议方会第七届会议审议通过。

Annex I

[English only]

Draft decision on modalities and procedures for carbon dioxide capture and storage in geological formations as clean development mechanism project activities

Decision XX/CMP.7

Modalities and procedures for carbon dioxide capture and storage in geological formations as clean development mechanism project activities

The Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol,

Recalling the provisions of Articles 3 and 12 of the Kyoto Protocol,

Recalling decisions 3/CMP.1, 2/CMP.5 and 7/CMP.6,

1. *Adopts* the modalities and procedures for carbon dioxide capture and storage in geological formations as clean development mechanism project activities contained in the annex to this decision;

2. *Decides* to periodically review the modalities and procedures for carbon dioxide capture and storage in geological formations as clean development mechanism project activities and that the first review shall be carried out no later than five years after the adoption of this decision, on the basis of recommendations made by the Executive Board of the clean development mechanism and by the Subsidiary Body for Implementation, and drawing on technical advice from the Subsidiary Body for Scientific and Technological Advice, as needed;

3. *Agrees* to consider, at its eighth session, the eligibility of carbon dioxide capture and storage project activities which involve the transport of carbon dioxide from one country to another or which involve geological storage sites that are located in more than one country;

4. *Requests* the Subsidiary Body for Scientific and Technological Advice to consider provisions for the type of project activities referred to in paragraph 3 above, including a possible dispute resolution mechanism, with a view to forwarding a draft decision on this matter for consideration by the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol at its eighth session;

5. *Invites* Parties and admitted observer organizations to submit to the secretariat, by 5 March 2012, their views on this matter and requests the secretariat to compile the submissions into a miscellaneous document.

Annex II

[English only]

Draft annex to the decision on modalities and procedures for carbon dioxide capture and storage in geological formations as clean development mechanism project activities

ANNEX

Modalities and procedures for carbon dioxide capture and storage in geological formations as clean development mechanism project activities

A. Definitions

1. For the purpose of this annex, the definitions contained in the annex to decision 3/CMP.1 shall apply mutatis mutandis to carbon dioxide capture and storage project activities under the clean development mechanism (CDM). In addition, the following definitions shall apply:

(a) "Carbon dioxide capture and storage" (CCS) means the capture of carbon dioxide from anthropogenic sources of emissions and the injection of the captured carbon dioxide into a geological storage site for secure storage;

(b) A "geological storage site" means a paired geological formation, or a series of such formations, consisting of an injection formation of high porosity and permeability into which carbon dioxide can be injected, coupled with an overlying cap rock formation of low porosity and permeability which can prevent the upward movement of carbon dioxide from the injection formation;

(c) The "operational phase" means the period that begins when carbon dioxide injection commences and ends when carbon dioxide injection permanently ceases;

(d) The "closure phase" means the phase that follows the operational phase and is the period that begins when carbon dioxide injection permanently ceases and ends when the geological storage site has been closed;

(e) The "closure" of a geological storage site means the completion of:

(i) The removal of above-ground installations, such as, inter alia, injection facilities and pipelines;

(ii) The sealing of the geological storage site, including the appropriate plugging of wells relating to the geological storage site;

(f) The "post-closure phase" means the phase that follows the closure phase and is the period that begins when the geological storage site has been closed;

(g) "Seepage" means physical leakage of carbon dioxide from a geological storage site into the atmosphere, biosphere or hydrosphere;

(h) The "site development and management plan" is the documented description of how a geological storage site will be operated and managed;

(i) "History matching" means the process of comparing observed results from the monitoring of a geological storage site with the results of the predictive numerical modelling of the behaviour of carbon dioxide injected into the geological storage site, and the use of the observed results to calibrate and update numerical models and modelling results. It can involve multiple iterations;

(j) "Liability" means the legal responsibility arising from the CCS project activity or the relevant geological storage site to compensate or remedy any significant damages, including damage to the environment, such as ecosystem damage, other material damages or personal injury;

(k) A "transfer of liability" means the transfer of liability from the project participants to the host Party;

(l) "Remedial measures" means actions and measures intended to stop or control any unintended physical leakage or seepage of carbon dioxide, to restore the integrity of a defective geological storage site, or to restore long-term environmental quality significantly affected by a CCS project activity;

(m) A "net reversal of storage" of carbon dioxide means that:

(i) For a verification period during the crediting period, the accumulated verified reductions in anthropogenic emissions by sources of greenhouse gases (GHGs) that have occurred as a result of a registered CDM project activity are negative (i.e. the seepage from the geological storage site of the CCS project activity exceeds the remainder of the emission reductions achieved by the CCS project activity);

(ii) For a verification period after the end of the last crediting period, seepage has occurred from the geological storage site of the CCS project activity.

B. Role of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol

2. The provisions of section B of the modalities and procedures for a clean development mechanism, contained in the annex to decision 3/CMP.1 (hereinafter referred to as the CDM modalities and procedures), shall apply mutatis mutandis to CCS project activities under the CDM.

C. Executive Board

3. The provisions of section C of the CDM modalities and procedures shall apply mutatis mutandis to CCS project activities under the CDM, with the exception of the provisions of paragraph 5(e) on recommendations to the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP) relating to simplified modalities, procedures and definitions for small-scale project activities.

4. In addition, the Executive Board of the clean development mechanism (hereinafter referred to as the Executive Board) shall adopt relevant standards, procedures, guidelines and forms for CCS project activities, drawing on technical and legal expertise, including, inter alia, with regard to:

(a) A project design document for CCS project activities, taking into account appendix B to the annex to decision 3/CMP.1;

(b) The selection and characterization of geological storage sites, as specified in appendix B to this annex;

(c) The risk and safety assessment, as referred to in paragraph 10(c) below and specified in appendix B to this annex;

(d) The environmental and socio-economic impact assessments, as referred to in paragraph 10(d) below;

(e) Monitoring requirements, as specified in appendix B to this annex;

(f) Requirements for financial provision, as referred to in paragraph 10(g) below and specified in appendix B to this annex;

(g) The site development and management plan, as specified in appendix B to this annex.

D. Accreditation and designation of operational entities

5. The provisions of section D of the CDM modalities and procedures shall apply mutatis mutandis to CCS project activities under the CDM.

E. Designated operational entities

6. The provisions of section E of the CDM modalities and procedures shall apply mutatis mutandis to CCS project activities under the CDM.

F. Participation requirements

7. The provisions of section F of the CDM modalities and procedures shall apply mutatis mutandis to CCS project activities under the CDM. In addition, the provisions of paragraph 8 below shall apply to CCS project activities.

8. A Party not included in Annex I to the Convention may host a CCS project activity if it has established national laws or regulations which:

(a) Set licensing procedures that include provisions for the appropriate selection, characterization and development of geological storage sites, recognizing the project requirements for CCS project activities under the CDM set out in appendix B to this annex;

(b) Define means by which rights to store carbon dioxide in, and gain access to, subsurface pore space can be conferred to project participants;

(c) Provide for timely and effective redress for affected entities, individuals and communities for any significant damages, such as environmental damage, including damage to ecosystems, other material damages or personal injury caused by the project activity, including in the post-closure phase;

(d) Provide for timely and effective remedial measures to stop or control any unintended physical leakage or seepage of carbon dioxide, to restore the integrity of a defective geological storage site, and to restore long-term environmental quality significantly affected by a CCS project activity;

(e) Establish means for addressing liability arrangements for carbon dioxide geological storage sites, taking into account the provisions set out in paragraphs 20 to 23 of appendix B to this annex;

(f) For a host Party that accepts the obligation to address a net reversal of storage in the situation referred to in paragraph 26 below, establish measures to fulfil such an obligation.

G. Validation and registration

9. The provisions of section G of the CDM modalities and procedures shall apply mutatis mutandis to CCS project activities under the CDM, with the exception of paragraph 37(c). In addition, the provisions of paragraphs 10 to 13 below shall apply to CCS project activities.

10. In addition to the requirements contained in paragraph 37 of the CDM modalities and procedures, the designated operational entity shall also confirm that the following requirements are met:

(a) The participation requirements set out in paragraph 8 above are satisfied;

(b) The geological storage site has been characterized and selected in accordance with paragraphs 1 to 3 of appendix B to this annex and the conditions set out in paragraph 1 of appendix B to this annex are fulfilled;

(c) A comprehensive and thorough risk and safety assessment has been carried out, in accordance with international good practice and the provisions set out in paragraphs 4 to 7 of appendix B to this annex;

(d) Comprehensive and thorough environmental and socio-economic impact assessments have been carried out by (an) independent entity(ies), including with regard to transboundary impacts, drawing upon the risk and safety assessment referred to in paragraph 10(c) above. Such assessments shall include a detailed description of the planned monitoring and remedial measures to address any environmental and socio-economic impacts identified, and be compiled in accordance with procedures as required by the host Party;

(e) The results of the assessments referred to in paragraphs 10(c) and (d) above confirm the technical and environmental viability of the proposed CCS project activity;

(f) Provisions for liability have been agreed in accordance with national laws and regulations and the provisions set out in paragraphs 20 to 23 of appendix B to this annex;

(g) A financial provision has been put in place by the project participants in accordance with the requirements set out in paragraphs 16 to 19 of appendix B to this annex;

(h) The provisions in the project design document for monitoring, including the monitoring plan, are in accordance with this annex and appendix B to this annex;

(i) The project participants have provided a description and, where appropriate, analysis of the environmental conditions in the area of the geological storage site prior to any storage of carbon dioxide, including a description of:

(i) The climate, hydrology, aquifer and groundwater properties, such as acidity and dissolved gases;

(ii) The soils and soil gas properties, such as a carbon dioxide isotope analysis and carbon dioxide flux rate;

(iii) The ecosystems and the possible presence of rare or endangered or sensitive species and their habitats;

(j) The proposed project activity conforms to all other requirements for CCS project activities set out in the present decision and other relevant decisions adopted by the CMP or the Executive Board.

11. In addition to the requirements contained in paragraph 40 of the CDM modalities and procedures, the designated operational entity shall, prior to the submission of the validation report to the Executive Board, have received from the project participants written confirmation by the designated national authority of the host Party of the following:

(a) That the right to store carbon dioxide in, and gain access to, the proposed geological storage site has been conferred to the relevant project participants;

(b) That the host Party agrees to the financial provision described in the project design document;

(c) That the host Party accepts the allocation of liability as proposed in the project design document and the transfer of liability, in accordance with paragraph 23 of appendix B to this annex;

(d) Whether the host Party accepts the obligation to address a net reversal of storage in the situation referred to in paragraph 26 below.

12. The project boundary of a CCS project activity shall include all above-ground components, including, where applicable:

(a) The installation where the carbon dioxide is captured;

(b) Any treatment facilities;

(c) Transportation equipment and booster stations along a pipeline, or offloading facilities in the case of transportation by ship, rail or road tanker;

(d) Any reception facilities or holding tanks at the injection site;

(e) The injection facility;

(f) Subsurface components, including the geological storage site and all potential sources of seepage, as determined during the characterization and selection of the geological storage site, carried out in accordance with appendix B to this annex.

13. The project boundary shall also encompass the vertical and lateral limits of the carbon dioxide geological storage site that are expected when the carbon dioxide plume stabilizes over the long term during the closure phase and the post-closure phase.

H. Monitoring

14. The provisions of section H of the CDM modalities and procedures shall apply mutatis mutandis to CCS project activities under the CDM. In addition, the provisions for monitoring set out in appendix B to this annex shall apply to CCS project activities.

I. Verification and certification

15. The provisions of section I of the CDM modalities and procedures shall apply mutatis mutandis to CCS project activities under the CDM. In addition, the provisions of paragraph 16 below shall apply to CCS project activities.

16. In addition to the provisions contained in paragraph 62 of the CDM modalities and procedures, the designated operational entity contracted by the project participants to perform the verification shall:

(a) Determine whether monitoring was conducted in accordance with the monitoring plan and the provisions for monitoring set out in paragraphs 8 to 15 of appendix B to this annex;

(b) Determine whether the site development and management plan is being adhered to;

(c) Determine whether significant deviations were observed during history matching and whether, in such a case, a re-characterization of the geological storage site, an update of the risk and safety assessment, an update of the environmental and socio-economic impact assessments, a revision to the project boundary, and a revision to the monitoring plan have been conducted in accordance with the provisions set out in appendix B to this annex;

(d) Determine whether seepage occurred from the geological storage site of the CCS project activity during the verification period;

(e) In the case that such seepage occurred:

(i) Determine whether the remedial measures and plans described in the risk and safety assessment were implemented and effective;

(ii) Determine whether a net reversal of storage occurred as a result of the seepage;

(f) In the case that a net reversal of storage occurred, quantify the amount of the net reversal of storage that occurred as a result of the seepage;

(g) Determine whether there have been any unintentional transboundary effects;

(h) Where applicable, determine whether the geological storage site has been successfully closed.

17. The initial verification and certification of a CCS project activity may be undertaken at a time selected by the project participants. Subsequent verification and certification reports shall be submitted to the Executive Board not later than five years after the end of the previous verification period. Verification and certification shall continue beyond the end of the last crediting period of the proposed CCS project activity and shall only cease after the monitoring of the geological storage site has been terminated in accordance with the conditions for the termination of monitoring, as set out in paragraph 14 of appendix B to this annex.

J. Issuance of certified emission reductions

18. The provisions of paragraph 65 of the CDM modalities and procedures shall apply mutatis mutandis to CCS project activities under the CDM. In addition, the provisions in paragraphs 19 to 23 below shall apply to CCS project activities.

19. A certification report submitted for a verification period during the crediting period shall constitute a reuest to the Executive Board for issuance of certified emission reductions (CERs) equal to the verified reductions in anthropogenic emissions by sources of GHGs that have occurred as a result of the registered CCS project activity.

20. A certification report submitted for a verification period after the end of the last crediting period shall not constitute a request for issuance but shall provide, where applicable, information on the amount of any net reversal of storage that occurred during the verification period as a result of seepage from the geological storage site of a CCS project activity, in accordance with these modalities and procedures and any decisions of the Executive Board.

21. Upon submission of a certification report for a verification period during the crediting period and upon finalization of the consideration of the certification report by the

Executive Board, the CDM Registry Administrator, working under the authority of the Executive Board, shall, promptly, issue the specified quantity of CERs into the pending account of the Executive Board in the CDM registry, in accordance with appendix D to the annex to decision 3/CMP.1. Upon such issuance, the CDM Registry Administrator shall promptly:

(a) Forward the quantity of CERs corresponding to the share of proceeds to cover administrative expenses and to assist in meeting the costs of adaptation, respectively, in accordance with Article 12, paragraph 8, of the Kyoto Protocol, to the appropriate accounts in the CDM registry for the management of the share of proceeds;

(b) Forward [5] per cent of the CERs issued to a reserve account of the CDM registry, established for the CCS project activity for the purpose of accounting for any net reversal of storage, as referred to in paragraph 3(a) of appendix A to this annex;

(c) Forward the remaining CERs to the registry accounts of the Parties and project participants involved, in accordance with their request.

22. The last certification report, submitted after the monitoring of the geological storage site has been terminated in accordance with the conditions for the termination of monitoring, as set out in paragraph 14 of appendix B to this annex, may constitute a request to forward any remaining CERs in the reserve account established for the purpose of accounting for any net reversal of storage to the registry accounts of the Parties and project participants involved.

23. Upon submission of the last certification report, referred to in paragraph 22 above, and upon finalization of the consideration of the certification report by the Executive Board, the CDM Registry Administrator shall, promptly, forward any CERs remaining in the reserve account established for the purpose of accounting for any net reversal of storage to the registry accounts of the Parties and project participants involved, in accordance with their request.

K. Addressing the non-permanence of carbon dioxide capture and storage project activities under the clean development mechanism

24. Where a verification report determines that a net reversal of storage occurred during the verification period as a result of seepage from the geological storage site of a CCS project activity, the Executive Board shall:

(a) Notify the CDM Registry Administrator to cancel, up to the amount of the net reversal of storage, the CERs issued for the CCS project activity held in the CDM registry:

(i) Firstly, from the reserve account established for the purpose of accounting for any net reversal of storage, as referred to in paragraph 3(a) of appendix A to this annex;

(ii) Secondly, from the pending account;

(iii) Finally, from the holding accounts of the project participants, proportional to the amount of CERs for the CCS project activity held in each holding account;

(b) Determine any outstanding amount of the net reversal of storage for which no units were cancelled under paragraph 24(a) above and, where such an amount is outstanding, request the project participants to transfer, within 30 days after the notification, an amount of assigned amount units (AAUs), CERs, emission reductions units (ERUs) or removal units (RMUs) equivalent to the outstanding amount to a cancellation account of

the CDM registry established for this purpose, as referred to in paragraph 3(b) of appendix A to this annex, or a cancellation account of the national registry of any Party.

25. Where a verification report is not submitted within the time frame specified in paragraph 17 above, the Executive Board shall forthwith notify the project participants to provide the outstanding verification report. If the verification report is not received within six months after the receipt of the notification by the project participants, the Executive Board shall:

(a) Notify the CDM Registry Administrator to cancel all CERs that were issued for the CCS project activity and are being held in the CDM registry;

(b) Subsequently request the project participants to cancel, within one year after the notification, an amount of AAUs, CERs, ERUs or RMUs equivalent to the amount of CERs issued from the start of the CCS project activity:

(i) Minus any AAUs, CERs, ERUs or RMUs that were transferred to a cancellation account for the purpose of compensating for a net reversal of storage, prior to the notification of the CDM Registry Administrator referred to in paragraph 25(a) above;

(ii) Minus any CERs issued for the CCS project activity that were cancelled in accordance with paragraph 25(a) above.

26. If the project participants do not comply, fully or partially, with the requirements set out in paragraphs 24 or 25(b) above, the outstanding amount of units shall be transferred to a cancellation account of the national registry of a Party included in Annex I to the Convention (Annex I Party) or the CDM registry, within one year after notification by the Executive Board, by:

(a) The host Party, if the host Party has accepted the obligation to address a net reversal of storage in such situations in its letter of approval;

(b) The Annex I Parties which hold CERs issued for the CCS project activity in accounts of their national registries, if the host Party has not accepted the obligation to address a net reversal of storage in such situations in its letter of approval.

27. If the host Party has accepted the obligation to address a net reversal of storage in such situations in its letter of approval, the Executive Board shall determine the outstanding amount of units that must be cancelled and notify the host Party concerned of the requirement for cancellation. To meet this requirement, the host Party shall transfer an amount of AAUs, CERs, ERUs or RMUs equivalent to the outstanding amount to the cancellation account established for this purpose in the CDM registry or a cancellation account of the national registry of any Party.

28. If the host Party has not accepted the obligation to address a net reversal of storage in such situations in its letter of approval, the Executive Board shall:

(a) Determine the outstanding amount of units that must be cancelled;

(b) Request the international transaction log administrator to identify the quantity of CERs issued for the CCS project activity held in each national registry, distinguishing between units in holding accounts and other accounts, for the current and previous commitment periods;

(c) Immediately notify the international transaction log that, in accordance with these modalities and procedures, the CERs identified as being in holding accounts are ineligible for transfers other than for the purpose of the requirement detailed in paragraph 26 above. When the requirement for cancellation, as set out in paragraph 26 above, has

been satisfied, the CERs issued for the CCS project activity in holding accounts shall be again eligible for transfer;

(d) Determine the outstanding amount of units that must be cancelled by each Annex I Party proportionally, by dividing the amount identified in paragraph 28(b) above by the total outstanding amount;

(e) Notify each Annex I Party which holds CERs issued for the CCS project activity in accounts of its national registry of the requirement for cancellation, as determined in paragraph 28(d) above. To meet this requirement, the relevant Annex I Parties shall transfer an amount of AAUs, CERs, ERUs or RMUs equivalent to the outstanding amount to the cancellation account established for this purpose in the CDM registry or a cancellation account of their national registries.

Appendix A

Additional requirements for the clean development mechanism registry to address carbon dioxide capture and storage project activities under the clean development mechanism

1. The provisions of appendix D to the modalities and procedures for a clean development mechanism, contained in the annex to decision 3/CMP.1 (hereinafter referred to as the CDM modalities and procedures), shall apply mutatis mutandis to carbon dioxide capture and storage (CCS) project activities under the clean development mechanism (CDM). In addition, the provisions of this appendix shall apply to CCS project activities.

2. The CDM registry, established and maintained by the Executive Board of the CDM, shall be used to ensure the accurate accounting of the issuance, holding, transfer, acquisition and cancellation of certified emission reductions (CERs) from CCS project activities under the CDM.

3. In addition to the registry accounts specified in paragraph 3 of appendix D to the CDM modalities and procedures, the CDM registry shall have:

(a) A reserve account for each CCS project activity, where the CDM Registry Administrator holds CERs for the purpose of accounting for any net reversal of storage;

(b) A cancellation account to which CERs from CCS project activities are transferred to account for any net reversal of storage, in accordance with the provisions set out in the annex above.

4. Upon the request of the project participants, the CDM Registry Administrator shall, after the end of a commitment period, carry over any CERs held in a reserve account for a CCS project activity to the subsequent commitment period.

Appendix B

Additional requirements for carbon dioxide capture and storage project activities

1. Selection and characterization of the geological storage site

1. Geological storage sites shall only be used to store carbon dioxide as project activities under the clean development mechanism (CDM) if:

(a) All available evidence, such as data, analysis and history matching, indicates that the injected carbon dioxide will be completely and permanently stored such that, under proposed or actual conditions of use, no significant risk of seepage or risk to human health or the environment exists;

(b) The geological storage site is not located in international waters;

(c) The geological storage site is not suitable for other purposes, such as potable water supply;

(d) The use of the geological storage site location will not negatively affect the development of renewable energy sources.

2. For the purpose of determining whether the requirements set out in paragraph 1 above are met, the project participants shall take the following steps to characterize the proposed geological storage site:

(a) Step 1: data and information collection, compilation and evaluation. This step shall involve the collection of sufficient data and information to characterize the geological storage site and determine potential seepage pathways. The collected data and information shall be evaluated in order to make a preliminary assessment of the site's storage capacity and to assess the viability of monitoring. The data and information shall be evaluated for its quality and, where required, new data shall be collected;

(b) Step 2: characterization of the geological storage site architecture and surrounding domains. This step shall involve the assessment of known and inferred structures within the injection formation(s) and cap rock formation(s) that would act as barriers to, or facilitators of, the migration of injected carbon dioxide. This step shall involve the compilation of (a) numerical three-dimensional static earth model(s) of the geological storage site. The uncertainty associated with key parameters used to build the model shall be assessed. The model shall be used to determine, inter alia:

(i) The structure of the geological trap(s);

(ii) All relevant geological properties of the injection formation(s);

(iii) The cap rock formation(s) and overburden;

(iv) The fracture system;

(v) The areal and vertical extent of the geological storage site (e.g. the injection formation, the cap rock formation, overburden, secondary containment zones and surrounding domains);

(vi) The storage capacity in the injection formation(s);

(vii) The fluid distribution;

(viii) Other relevant characteristics;

(c) Step 3: characterization of dynamic behaviour, sensitivity characterization and risk assessment. This step shall involve an assessment of how the injected carbon dioxide can be expected to behave within the geological storage site architecture and surrounding domains, with a particular focus on the risk of seepage. This step shall utilize numerical dynamic modelling of the injected carbon dioxide using the static model developed in step 2 above to assess coupled processes (i.e. the interaction between each single process in the model), reactive processes (e.g. the interaction of injected carbon dioxide with in situ minerals in the numerical model) and short- and long-term simulations. Such numerical modelling shall be used to provide insight into the pressure and extent of carbon dioxide in the geological storage site over time, the risk of fracturing the cap rock formation(s) and the risk of seepage. Multiple simulations shall be conducted to identify the sensitivity of the assessments to assumptions made. The simulations carried out in this step shall form the basis for risk and safety assessments, detailed in paragraphs 4 to 7 below;

(d) Step 4: establishment of a site development and management plan. Drawing on steps 1–3 above, a site development and management plan shall be established. The plan shall address the proposed conditions of use for the geological storage site and include, inter alia, descriptions of:

(i) The preparation of the site;

(ii) Well construction, such as materials and techniques used, and the location, trajectory and depth of the well;

(iii) Injection rates and the maximum allowable near-wellbore pressure;

(iv) Operating and maintenance programmes and protocols;

(v) The timing and management of the closure phase of the proposed carbon dioxide capture and storage (CCS) project, including site closure and related activities.

3. A wide range of data and information shall be used in performing the characterization and selection of the geological storage site, including, inter alia:

(a) Geological information, such as descriptions of the overburden and cap rock formation(s) and injection formation(s), locations of mapped faults, locations of existing wells and wellbore trajectories, and information about regional tectonics, including the stress field and historical seismic activity;

(b) Geophysical information, such as the thickness and lateral extent of the cap rock formation(s), existence of faults, and reservoir heterogeneity. Sources of data include well logs, sonic logs and three-dimensional seismic surveys;

(c) Geomechanical information, such as the stress state and the rock fracture pressure within the injection formation(s) and the cap rock formation(s). Sources of data include borehole data, such as breakouts inferred from caliper and televiewer logs, minifrac results, information about anisotropy within the reservoir, and mud loss events;

(d) Geochemical information, such as information on rock and fluid properties. Rock properties include permeability, porosity and mineralogy, which are important in determining the injectivity of the injection formation and the cap rock formation containment capacity. Fluid properties, such as the brine salinity, should also be used to determine dissolution trapping rates;

(e) Hydrogeological information, such as aquifer characteristics and aquifer flow direction and rates within the geological storage site, the overburden and surrounding domains.

2. Risk and safety assessment

4. A comprehensive and thorough risk and safety assessment shall be carried out in order to assess the integrity of the geological storage site and potential impacts on human health and ecosystems in proximity to the proposed CCS project activity. The risk and safety assessment shall also be used to inform environmental and socio-economic impact assessments.

5. The risk and safety assessment shall consider the following:

(a) Specific risks associated with carbon dioxide containment failure resulting in physical leakage of carbon dioxide from above-ground installations and seepage from subsurface installations, and the potential effects on, inter alia:

(i) The contamination of underground sources of drinking water;

(ii) The chemical properties of seawater;

(iii) Human health and ecosystems (e.g. as a result of carbon dioxide accumulations at dangerous levels in non-turbulent air);

(b) The risk of continuous slow seepage or sudden mass release of carbon dioxide from a geological storage site. This type of event can arise due to, inter alia:

(i) Seepage along (an) injection well(s) or abandoned well(s);

(ii) Seepage along a fault or fracture;

(iii) Seepage through the cap rock formation.

6. The risk and safety assessment shall:

(a) Cover the full chain of carbon dioxide capture, transportation and storage, including surrounding environments;

(b) Provide assurance of safe operational integrity regarding the containment of carbon dioxide, based on site-specific information about the geological storage site, potential seepage pathways, and secondary effects of storing carbon dioxide in the geological storage site, such as brine migration;

(c) Be used to determine operational data for the application of the site development and management plan, such as to set the appropriate maximums of injection pressure that will not compromise the confining cap rock formation(s) and the overburden of the geological storage site;

(d) Take account of the effects of potential induced seismicity or other geological impacts, as well as any other potential consequences for the environment, including on local ecosystems, property and public health, and global environmental effects on the climate directly attributable to the CCS project activity, including effects due to seepage;

(e) Be used to help prioritize locations and approaches for enhanced monitoring activities;

(f) Provide a basis for remedial measures, including plans for responses that can stop or control any unintended physical leakage or seepage of carbon dioxide, restore the integrity of a defective geological storage site, and restore long-term environmental quality significantly affected by a CCS project activity. Such measures and plans shall accompany monitoring plans;

(g) Include a communication plan.

7. In order to assess the potential risks of carbon dioxide capture, transportation and storage in a geological storage site, the project participants shall take the following steps:

(a) Step 1: hazard characterization. This shall include an analysis of:

(i) Potential hazards resulting from the capture, transportation and injection of carbon dioxide;

(ii) Potential seepage pathways from the geological storage site;

(iii) The potential magnitude of seepage for identified potential seepage pathways;

(iv) Critical parameters affecting potential seepage, such as the maximums of injection formation pressure, injection rates and temperature;

(v) The sensitivity to various assumptions made during numerical modelling;

(vi) Any other factors which could pose a hazard to human health and the environment;

(b) Step 2: exposure assessment. This shall be based on the characteristics of surrounding populations and ecosystems, the potential fate and behaviour of any seeped carbon dioxide, and other factors;

(c) Step 3: effects assessment. This shall be based on the sensitivity of species, communities or habitats linked to potential seepage events identified during the hazard characterization, such as the effects of elevated carbon dioxide concentrations in the atmosphere, biosphere or hydrosphere and effects on seawater chemistry;

(d) Step 4: risk characterization. This shall comprise an assessment of the safety and integrity of the geological storage site in the short-, medium- and long-term, including an assessment of the risk of seepage under the proposed conditions of use set out in the site development and management plan.

3. Monitoring

8. Monitoring of CCS project activities under the CDM shall be undertaken to meet the following objectives:

(a) To provide assurance of the environmental integrity and safety of the geological storage site;

(b) To confirm that injected carbon dioxide is permanently stored within the geological storage site and within the project boundary;

(c) To ensure that good site management is taking place, taking account of the proposed conditions of use set out in the site development and management plan, established in accordance with paragraph 2(d) above;

(d) To detect any seepage or contamination, as well as to assess impacts on human health and the surrounding environment;

(e) To determine whether timely and appropriate remedial measures have been carried out in the event of seepage;

(f) To estimate the flux rate and total mass of carbon dioxide released into the atmosphere, biosphere or hydrosphere in the event of seepage being detected;

(g) To determine the reductions in anthropogenic emissions by sources of greenhouse gases (GHGs) that have occurred as a result of the registered CCS project activity.

9. In order to meet the objectives outlined in paragraph 8 above, the monitoring plan for the proposed CCS project activity shall, in addition to the requirements set out in paragraph 53 of the modalities and procedures for a CDM, contained in the annex to decision 3/CMP.1 (hereinafter referred to as the CDM modalities and procedures), during the operational phase, closure phase and post-closure phase:

(a) Reflect the principles and criteria of international good practice for the monitoring of geological storage sites and consider the range of technologies described in the relevant sections of the Intergovernmental Panel on Climate Change (IPCC) *2006 IPCC Guidelines for National Greenhouse Gas Inventories* and other good practice guidance;

(b) Transparently specify which parameters and information will be monitored and collected, and the location and frequency of application of different monitoring techniques during the operational phase, closure phase and post-closure phase;

(c) Provide for specific techniques and methods that can:

(i) Detect and measure the carbon dioxide stored in the geological storage site;

(ii) Detect potential seepage via pathways in the cap rock formation(s) and in the overburden and surrounding domains in the geological storage site;

(iii) Estimate the flux rate and total mass of carbon dioxide released into the atmosphere, biosphere or hydrosphere in the event of seepage being detected;

(iv) Assess the impacts of the detected seepage on human health and the surrounding environment;

(d) Include provisions for history matching, by using the monitoring results to calibrate and update the numerical models that were used to characterize the geological storage site;

(e) Provide for measurement of the carbon dioxide stream and composition, including impurities, at various points in the carbon dioxide capture, transportation and storage chain, including at the point(s) of injection into the geological storage site, at an appropriate frequency;

(f) Provide for measurement of the temperature and pressure at the top and bottom of the injection well(s) and observation well(s), at an appropriate frequency;

(g) Provide for the monitoring and measurement of various geological, geochemical and geomechanical parameters, such as fluid pressures, displaced fluid characteristics, fluxes and microseismicity, at an appropriate frequency;

(h) Provide for the monitoring and measurement of relevant parameters in the overburden and surrounding domains of the geological storage site, such as the monitoring of groundwater properties, soil gas measurements or measurements of the surface concentrations of carbon dioxide in the air, which shall be calibrated to detect signs of seepage, at an appropriate frequency;

(i) Provide for the detection of corrosion or degradation of the injection facilities;

(j) Provide for an assessment of the effectiveness of any remedial measures taken.

10. The project participants shall, for each verification period, carry out history matching and, where necessary, update the numerical models used to characterize the geological storage site by conducting new simulations using the monitored data and information. The numerical models shall be adjusted in the event of significant deviations between observed and predicted behaviour.

11. Where significant deviations are observed during history matching or when requesting a renewal of the crediting period, the project participants shall:

(a) Re-characterize the geological storage site, in accordance with paragraphs 1 to 3 above;

(b) Where appropriate, revise the project boundary;

(c) Update the risk and safety assessment, in accordance with paragraphs 4 to 7 above;

(d) Where appropriate, update the environmental and socio-economic impact assessments, referred to in paragraph 10(d) of the annex above;

(e) Revise the monitoring plan, in order to improve the accuracy and/or completeness of data and information, taking into account observed deviations determined during history matching, changes to the project boundary, changes to the risk and safety assessment, changes to the environmental and socio-economic impact assessments, new scientific knowledge and improvements in the best available technology;

(f) Update the site development and management plan, taking account of the results of the activities described in paragraph 11(a–e) above, where appropriate.

12. Where the information prepared in accordance with paragraph 11 above indicates that the geological storage site no longer meets the requirements set out in paragraph 1 above, the project participants shall cease the injection of carbon dioxide, apply remedial measures, if necessary, and enter the closure phase.

13. Any seepage that occurs during the crediting period(s) of a CCS project activity shall be accounted for as project or leakage emissions in the calculation of the monitored reductions in anthropogenic emissions by sources of GHGs that have occurred as a result of the registered CDM project activity. Any seepage that occurs after the end of the last crediting period shall be quantified and reported in monitoring reports.

14. The monitoring of the geological storage site shall:

(a) Begin with the start of the proposed CCS project activity;

(b) Be conducted at an appropriate frequency during and beyond the crediting period(s) of the proposed project activity;

(c) Not be terminated earlier than 20 years after the closure of the geological storage site;

(d) Only be terminated if no seepage has been observed at any time in the past 10 years and if the carbon dioxide plume in the subsurface has stabilized to a point where all available evidence from observations and modelling indicates that the stored carbon dioxide will be completely and permanently contained. This may be demonstrated through the following evidence:

(i) History matching confirms that there is agreement between the numerical modelling of the carbon dioxide plume distribution in the geological storage site and the monitored behaviour of the carbon dioxide plume;

(ii) Numerical modelling and observations confirm that no future seepage can be expected from the geological storage site.

15. The monitoring of the geological storage site shall be conducted by the entity or Party that is liable for the geological storage site, or by an entity that is under contractual arrangement with the liable entity or Party.

4. Requirements for financial provision

16. The project participants shall establish financial provision:

(a) To ensure that all obligations arising from the establishment and operation of the proposed CCS project activity will be met;

(b) To allow for the ongoing safe operation of the geological storage site;

(c) To address the risk of project participant insolvency;

(d) To offer a means of redress for affected communities and ecosystems in the event of seepage from a geological storage site of a CCS project activity;

(e) To enable the host Party to discharge its obligations arising in connection with transfer of liability in accordance with paragraph 11(c) of the annex above and paragraph 23 below.

17. The financial provision shall ensure that sufficient financial resources are available to cover:

(a) The cost of ongoing monitoring, at an appropriate frequency, of the geological storage site and verification and certification by a designated operational entity, from the end of the crediting period until at least 20 years after the closure of the geological storage site;

(b) In the event of seepage, the cost associated with the obligations set out in paragraphs 24 to 28 of the annex above;

(c) The cost of any remedial measures;

(d) Any other requirements determined by the host Party that are agreed at the time of the host Party approval and described in the project design document.

18. The type and level of the financial provision shall be described in the project design document and be established in accordance with any decisions of the Executive Board and relevant national laws and regulations in place in the host Party of the proposed CCS project activity.

19. The financial provision shall be transferable to a relevant authority of the host Party upon transfer of liability in accordance with paragraph 11(c) of the annex above and paragraph 23 below.

5. Liability

20. The project participants shall clearly document in the project design document how the liability obligations arising from the proposed CCS project activity or its geological storage site, as defined in paragraph 1(j) of the annex above, are allocated during the operational phase, closure phase and post-closure phase, in accordance with this decision.

21. Relevant provisions of national laws and regulations of the host Party, including those referred to in paragraph 8 of the annex above, shall apply to matters related to liability.

22. During the operational phase and the closure phase of the CCS project activity and until the transfer of liability to the host Party has been effected in accordance with paragraph 23 below, liability, as defined in paragraph 1(j) of the annex above, shall reside with the project participants.

23. The transfer of liability from the project participants to the host Party shall be effected once the host Party establishes that the following conditions have been met:

(a) The geological storage site has been closed;

(b) The minimum period for the closure phase, to be determined by the host Party, has elapsed;

(c) The transfer of any relevant financial provision from the project participants to the host Party has taken place;

(d) Any other conditions set out by the designated national authority in its letter of approval, as referred to in paragraph 11(b) of the annex above, and those set out in the relevant national laws and regulations have been complied with.