Recovery of anthropogenic CO_2 from large industrial GHG emission sources and its storage in an oil reservoir

Workshop on CDM Methodological Issues
in regard to CCS by METI

Le Palais des Congres de Paris, France

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MUFG Mitsubishi UFJ Securities

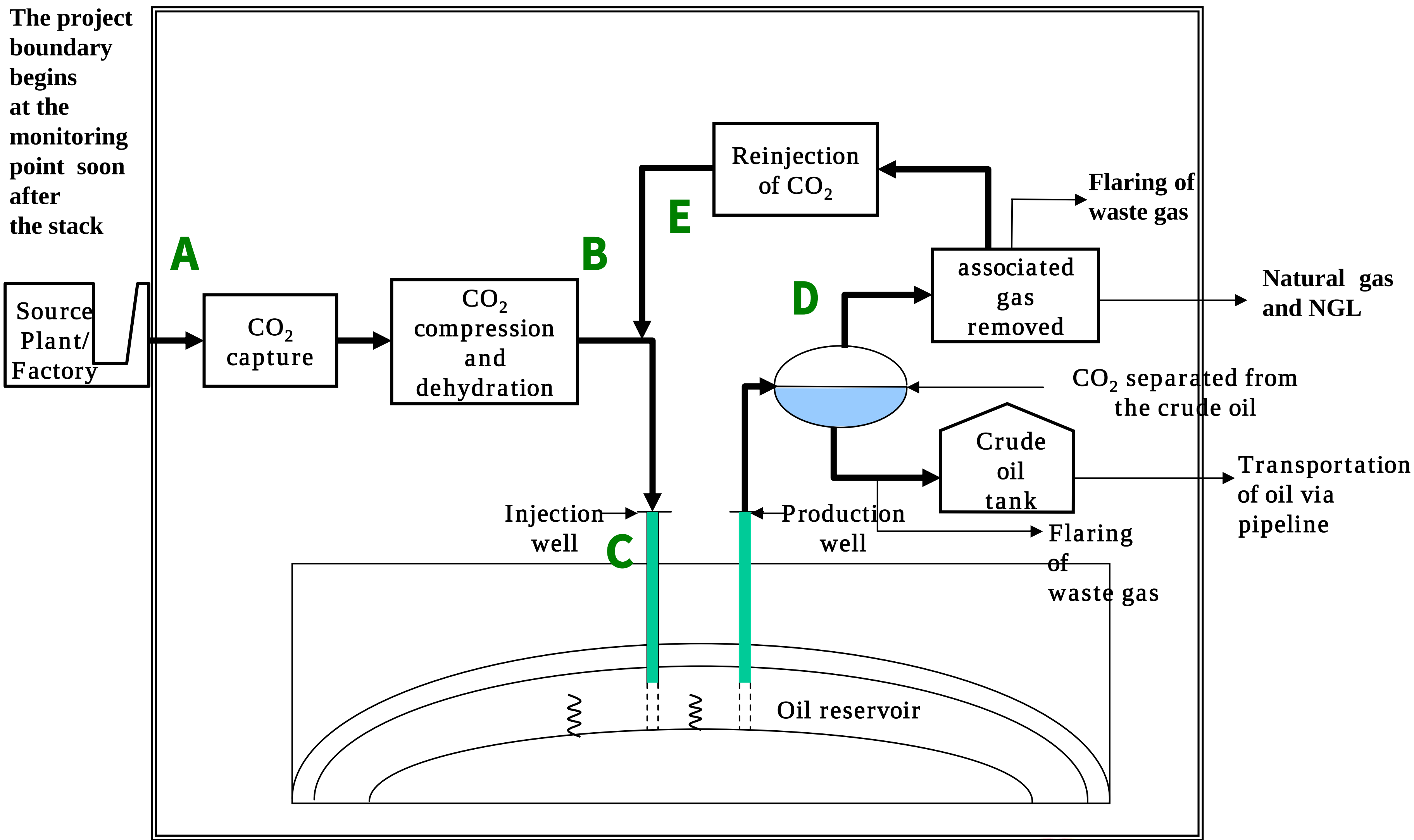
I SUMMARY

1. Activity

1) The methodology deals with projects for capture of anthropogenic CO_2 and its storage in an active or depleted oil reservoir.※

※Attempts are being made to disassociate the methodology from the term “EOR” (enhanced oil recovery), which in itself cannot be a CDM activity.

2. The Project And Its Boundary



3. The Framework of the Methodology

1) Strict applicability conditions

a) High integrity reservoirs only

b) Rules for careful management of injection operations

- Minimum injection depth
- Maximum injection pressure

3. The Framework of the Methodology - continued

2) These applicability conditions should ensure a high ratio of CO_2 retention.

3) Monitoring for confirmation

a) Adherence to the operational rules.

b) No fugitive emissions above a negligible level.

4. Fugitive Emissions

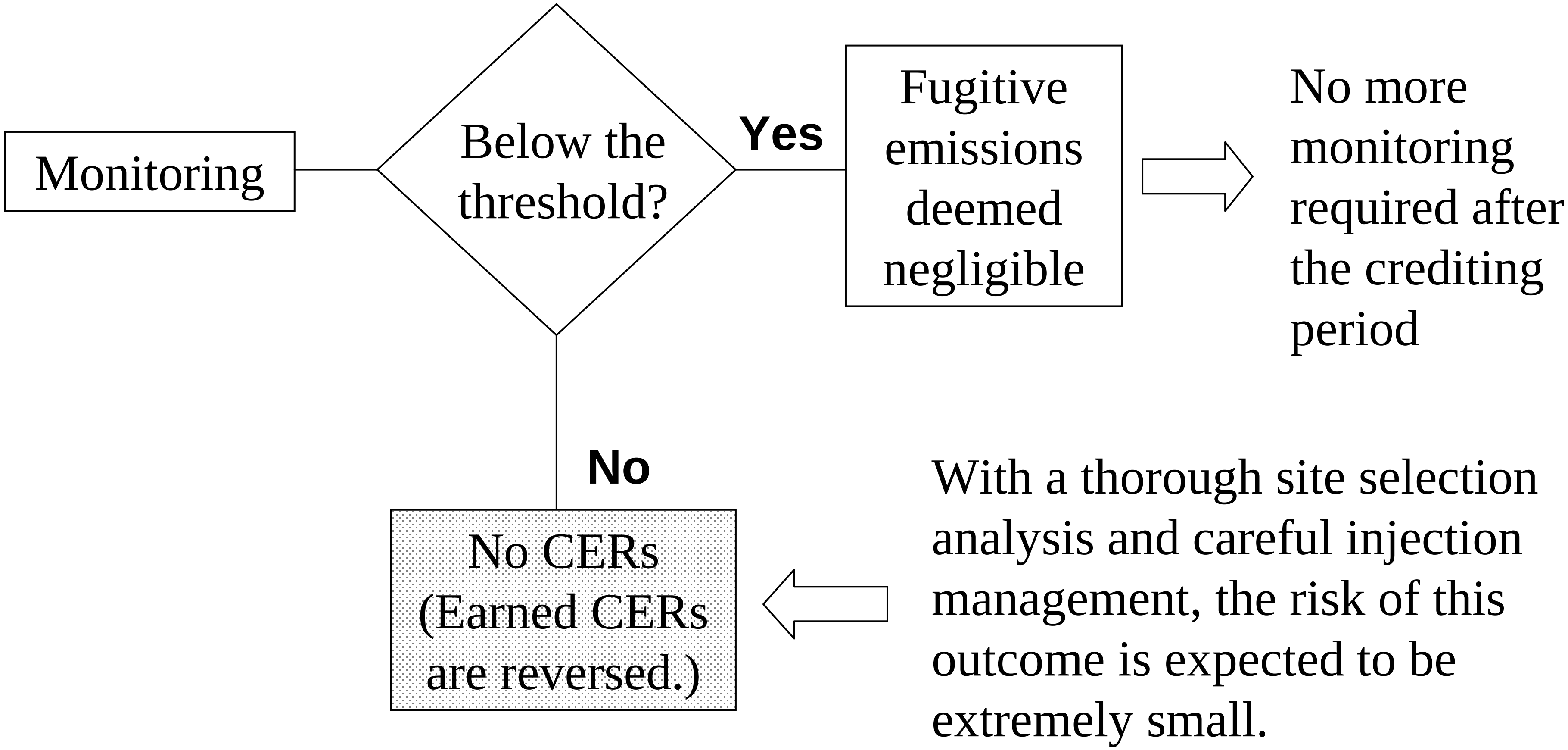
1) Ideally, the amount of fugitive emissions should be measured and deducted from the project's GHG mitigation contribution.

2) However, the precise determination of this value is difficult.

3) On the basis of the IPCC special report that the fraction of CO_2 retained in appropriately selected and managed geological reservoirs is likely to exceed 99% over 1,000 years, the following approach is proposed.

4. Fugitive Emissions - continued

3) The approach adopted by the MUS methodology is to set a threshold which will be applied in the following manner:



4. Fugitive Emissions - continued

4) The threshold selected is 0.7%/7 years (i.e. an average of 0.1% annually).

a) Seven years is based on the length of the crediting period as well as the monitoring interval that corresponds to it.

b) An annual average of 0.1% loss represents the level at which 90% of the sequestered CO_2 will remain after 100 years.

5. Project Boundary

1) The project boundary under the methodology does not include the power production process.

2) Electricity consumption for the project (for carbon capture, injection operation, etc.) is accounted for

- not as a reduction in power generation efficiency
- but as project energy consumption resulting in project emissions

5. Project Boundary

3) This approach has two advantages:

a) Insulate the project from efficiency volatility at the power station independent of the project.

b) Expand the applicability of the methodology to projects which source CO_2 from a facility other than power stations.

4) Other issues for the project boundary are dealt with in Adrian Stott's presentation

6. Goal of the Methodology

The methodology aims at striking a good balance between

- **environmental integrity** on the one hand

and

- **practicality** on the other

II DETAILS OF THE METHODOLOGY

1. CDM Methodologies

1) The CDM process requires that the GHG reduction contribution of a CDM activity is calculated in accordance with an approved methodology.

2) If no approved methodology is available for a project, a new methodology must be submitted.

1. CDM Methodologies - continued

3) The submission consists of three parts:

a) New Methodology : Baseline (NMB)

b) New Methodology : Monitoring (NMM)

c) An illustrative PDD

4) Once approved, the methodology can be used for any project that meets the applicability conditions.

2. Reservoir Data and Model(s)

1) Data/information to be submitted

a) The type of structure that makes up the reservoir

b) Forecasted storage capacity of the reservoir

c) The extent, nature and sealing ability of caprock (rock capping the reservoir)

d) Reservoir thickness

e) Physical properties of the reservoir, including overpressure and rock yield strengths

4. Reservoir Data and Model(s) - continued

f) Lithography and geological structure expected

g) Faulting in the storage area (If faulting is present, estimate the sealing properties of the faults.)

h) Information on tectonic and seismic stability of the area

i) Identification of any potable water aquifers that overlie the storage area

j) Confirmation that all abandoned wells or mines in the area that are likely to affect storage of CO_2 in the reservoir are adequately sealed

2. Reservoir Data and Model(s) - continued

2) Reservoir model(s)

a) A reservoir model(s) shall be produced to help predict how the reservoir will react to the injection.

b) The model(s) will be used to justify the assumption that not more than a negligible level of release is expected for the sequestered CO_2.

2. Reservoir Data and Model(s) - continued

3) The models are to incorporate the following elements, based on IEA recommendations (2003).

a) Main mechanisms which are likely to affect reservoir behaviour.

b) Location, depth and extent of potential injection disposal zones.

c) List all assumption in regards to permeability, porosity, tc., which were used in the model

d) Location and extent of other bottom or lateral bounding ormations.

e) Natural fluid flow rates and direction.

2. Reservoir Data and Model(s) - continued

f) The impact of any density driven flow.

g) Phase behaviour of fluids and any long-term mass transport phenomena.

h) Location of existing or abandoned wells or mines in the area that are likely to affect storage of CO_2 in the reservoir.

i) Identification of potential spill points.

j) Comment on the uncertainty of the model(s) and conduct sensitivity analysis to test whether it is robust to reasonable variation in the assumptions

3. Monitoring

1) Monitoring for adherence to operational rules

a) Actual well-head injection pressure to ensure that the maximum injection pressure is not exceeded (weekly)

b) Temperature and pressure of the reservoir (weekly)

c) Annular pressure (monthly)

d) Tubing pressure (monthly)

e) Map the location of sample points, location/number, etc. (First year and at the end of each crediting period)

f) Well abandonment carried out in strict compliance to regulations

3. Monitoring - continued

2) Monitoring for fugitive CO_2 emissions

a) Soil gas analysis or direct water analysis (first year and at the end of each crediting period)

b) Time lapse 3D seismic data for updating the reservoir model (end of each crediting period)

c) Vertical seismic profile of injection/production well (end of each crediting period)

d) Gas "bubble" using repeat 4D seismic surveys (end of each crediting period)

(Note) The crediting period is 7 years, with a maximum of two renewals (21 years in total).

III QUESTIONS FOR CCS EXPERTS

1. Site Selection

1) Are the data stipulated in the methodology (p.p. 17-18) sufficient to

   a) Determine the project boundary and

   b) Evaluate the reservoir integrity?

2) Will the data be available or obtainable without prohibitive costs?

3) Can the simulation prescribed in the methodology (p.p.19-21) be carried out with reasonable reliability?

2. Operational Rules

1) Should there be uniform standards for the salient features of operation (such as injection pressure and depth)?

2) Or, is it better to keep the standards flexible in accordance with the reservoir characteristics?

3) If uniform standards are preferred, what levels are appropriate?

3. Monitoring

1) Will the monitoring requirements enumerated in the methodology (p.21) be sufficient to detect fugitive emissions above the threshold?

2) Are the monitoring requirements technically feasible?

3) Can the monitoring requirements be fulfilled without prohibitive costs?

4. Permanence

1) Is the threshold of an annual average of 0.1% adequate?

2) In case a more conservative threshold (e.g. an annual average of 0.01%) is desirable for the sake of conservatism, are existing monitoring techniques capable of detecting fugitive emissions at such a low level?

4. Permanence - continued

3) If no significant loss of sequestered CO_2 is observed during the first 21 years, is it reasonable to assume that this situation will continue for a long time (e.g. 1,000 years) as long as the project is undertaken at a site where a sudden release is unlikely?

4) To deal with future uncertainty, will a conservative discount factor for retention be effective?

Leakage

1) What is the best way to confirm that abandoned wells are adequately sealed?

2) How much concern should there be about the deterioration of the sealing at the abandoned wells over a long period?

IV About Us

MUS Clean Energy Finance Committee

1) The Clean Energy Finance Committee of Mitsubishi UFJ Securities (MUS) specializes in CDM/JI consultancy.

2) MUS is one of the five institutions in the world which have successfully submitted more then one new CDM methodology.

MUS Clean Energy Finance Committee - continued

3) The Committee is a fully-fledged business unit despite its name. Twenty-two full-time professionals solely dedicated to CDM/JI consultancy.

4) The staff members are diverse in background and nationality, speaking twelve languages in total.

2. Full-time Professional Staff

Namec	Background	Based in
Junji Hatano (Chairman)	Former Deputy President, Tokyo-Mitsubishi Securities	Tokyo
Seiichiro Nishida (Deputy Chairman)	Former General Manager, Financial Institutions Div., Mitsubishi Securities	Tokyo
Mari Yoshitaka (Senior Consultant)	MS, School of Natural Resources and Environment, University of Michigan, USA	Tokyo
＜Consultants＞ (Alphabetical order)		
Arnaoudov, Vladislav	MA, Graduate School of Economics, Hitotsubashi University, Japan	Tokyo (Bulgarian and Russian-speaking)
Caguioa, C. Raymond	BS, Chemical Engineering, De La Salle University, Philippines	Manila
Hamaguchi, Kazuo	BA, Faculty of Law, Doshisha University	Tokyo
Hendrayani, Cynthia	BS, Chemical Engineering, The University of Sydney, Australia	Jakarta
Homma, Hitomi	MA, South East Asian Studies, University of Michigan, USA	Tokyo

(To be continued)

2. Full-time Professional Staff - continued

Name	Background	Based in
Hong, Soon Chan	MA, Economics, Seoul National University, Korea; MA, International Development, International University, Japan	Tokyo (Korean-speaking)
Hong, Shengtao	BA, Faculty of Law, Peking University, China; MA, Faculty of Law, Graduate School of Chinese-Academy of Social Science, China	Tokyo (Chinese-speaking)
Mendes，Mara	PhD, Environmental Engineering, University of Tokyo, Japan	Sao Paulo
Mizuno, Saya	BA, Philosophy, University of London, UK	Buenos Aires
Miyata,Takeshi	MS, Agricultural Environmental and Development Economics, The Ohio State University, USA	Tokyo
Nakade, Chisato	BS, Environmental Resources Engineering, Humboldt State University, USA; P.E., the state of California, USA	Tokyo
Nuibe, Atsuko	MA, International Relations, Boston University, USA	Tokyo
Okada, Kikuko	BA, Anthropology, University of California at Los Angeles, USA	Tokyo

(To be continued)

Full-time Professional Staff

Name	Background	Based in
Rodrigues, Fabiana	MSc, Marine Science and Technology, Tokyo University of Marine Science and Technology, Japan	Sao Paulo
Setterfield, Matthew	MA, (Cantab) History, University of Cambridge, Trinity Hall, UK; MA, ELT & Applied Linguistics, King's College, London, UK	Tokyo
Stott, Adrian	PhD, Marine Science and Technology, Tokyo University of Marine Science and Technology, Japan	Tokyo
Tochikawa, Kyoko	BS, Chemical Engineering, The University of Sydney, Australia	Hong Kong
Tsui, Coty	MSc, Environmental Engineering Science, The University of New South Wales, Australia	Hong Kong

For more information, please contact:

Junji Hatano (Tokyo)
(Email: hatano-junji@sc.mufg.jp)