A CDM METHODOLOGY
for
OIL RESERVOIR CCS ACTIVITY

Carbon Sequestration Leadership Forum

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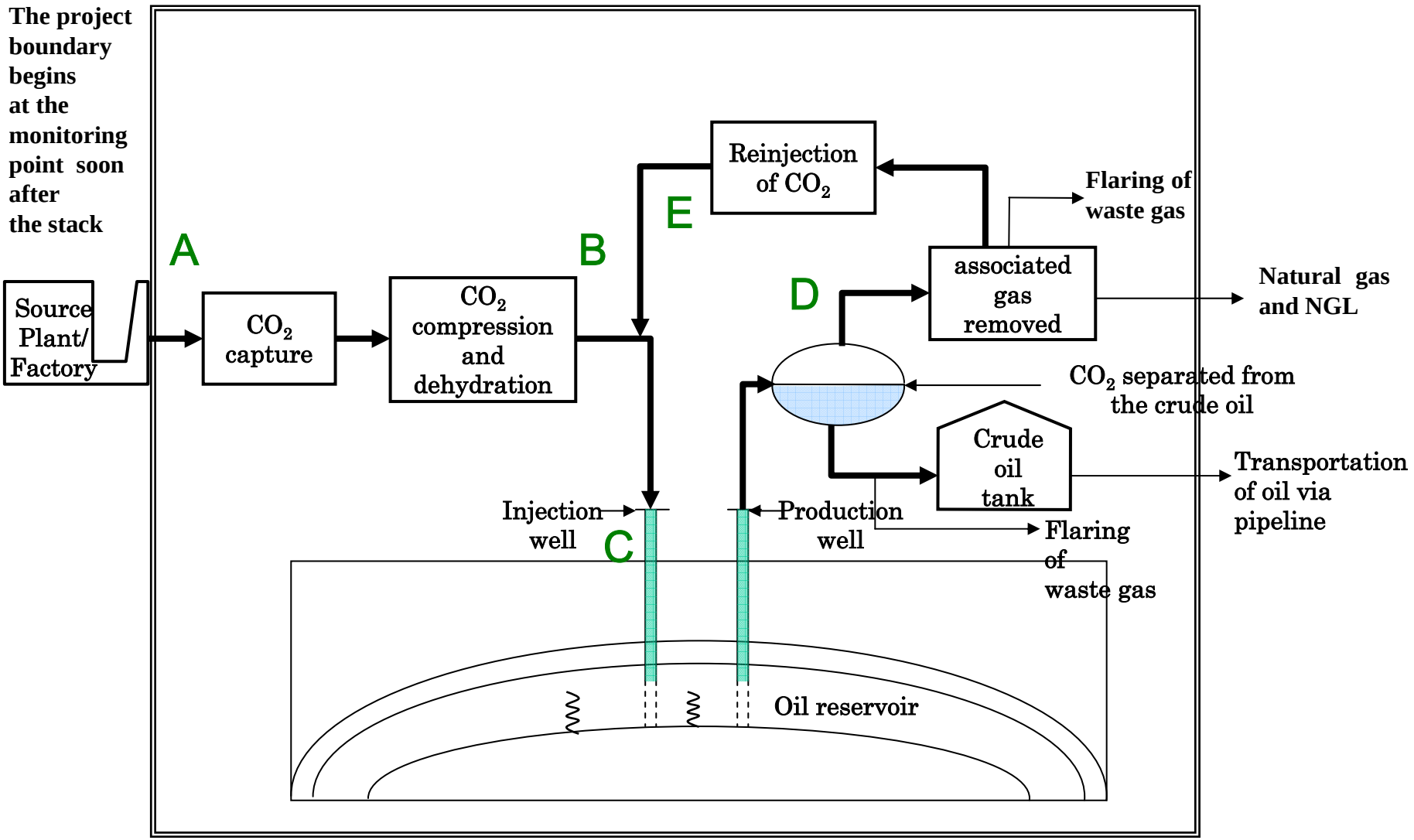
I SUMMARY

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

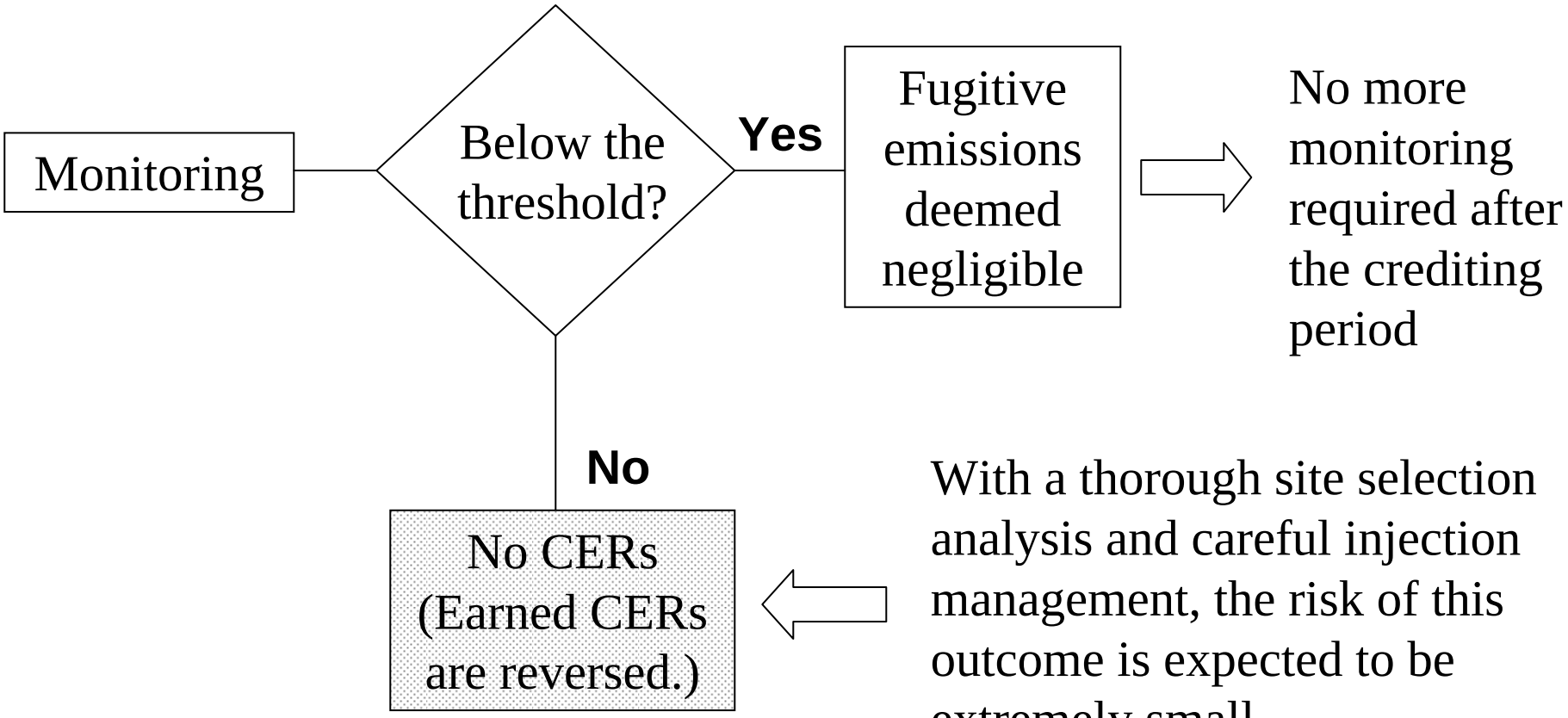
1) Ideally, the amount of fugitive emissions should be measured and deducted from the project's GHG mitigation contribution.

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

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



4. Fugitive Emissions - continued

5) 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. Goal of the Methodology

The methodology aims at striking a good balance between

- **environmental integrity** on the one hand

and

- **practicality** on the other

Questions and Comments

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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

2. 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, etc., which were used in the model

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

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 a 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).