Risk assessment and regulation of aquifer storage of carbon dioxide

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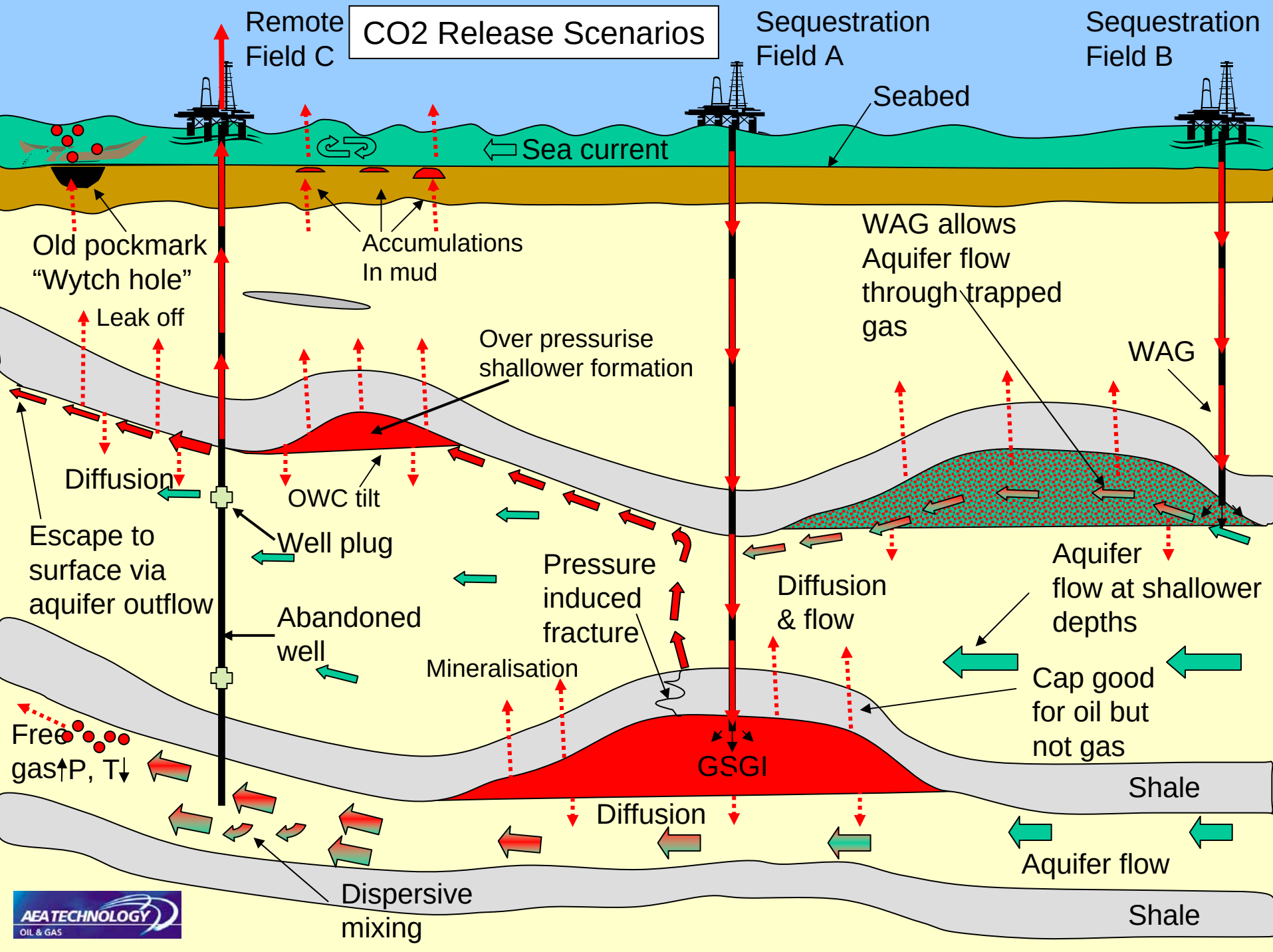
RITE


CO2 Release Scenarios
Remote Field C
Sequestration Field A
Sequestration Field B
Seabed
Sea current
Old pockmark "Wytch hole"
Accumulations In mud
Leak off
Over pressurise shallower formation
WAG allows Aquifer flow through trapped gas
WAG
Diffusion
OWC tilt
Well plug
Escape to surface via aquifer outflow
Abandoned well
Pressure induced fracture
Mineralisation
Diffusion & flow
Aquifer flow at shallower depths
Cap good for oil but not gas
Free gas↑P, T↓
GSGI
Shale
Diffusion
Aquifer flow
Dispersive mixing
Shale
AEA TECHNOLOGY
OIL & GAS

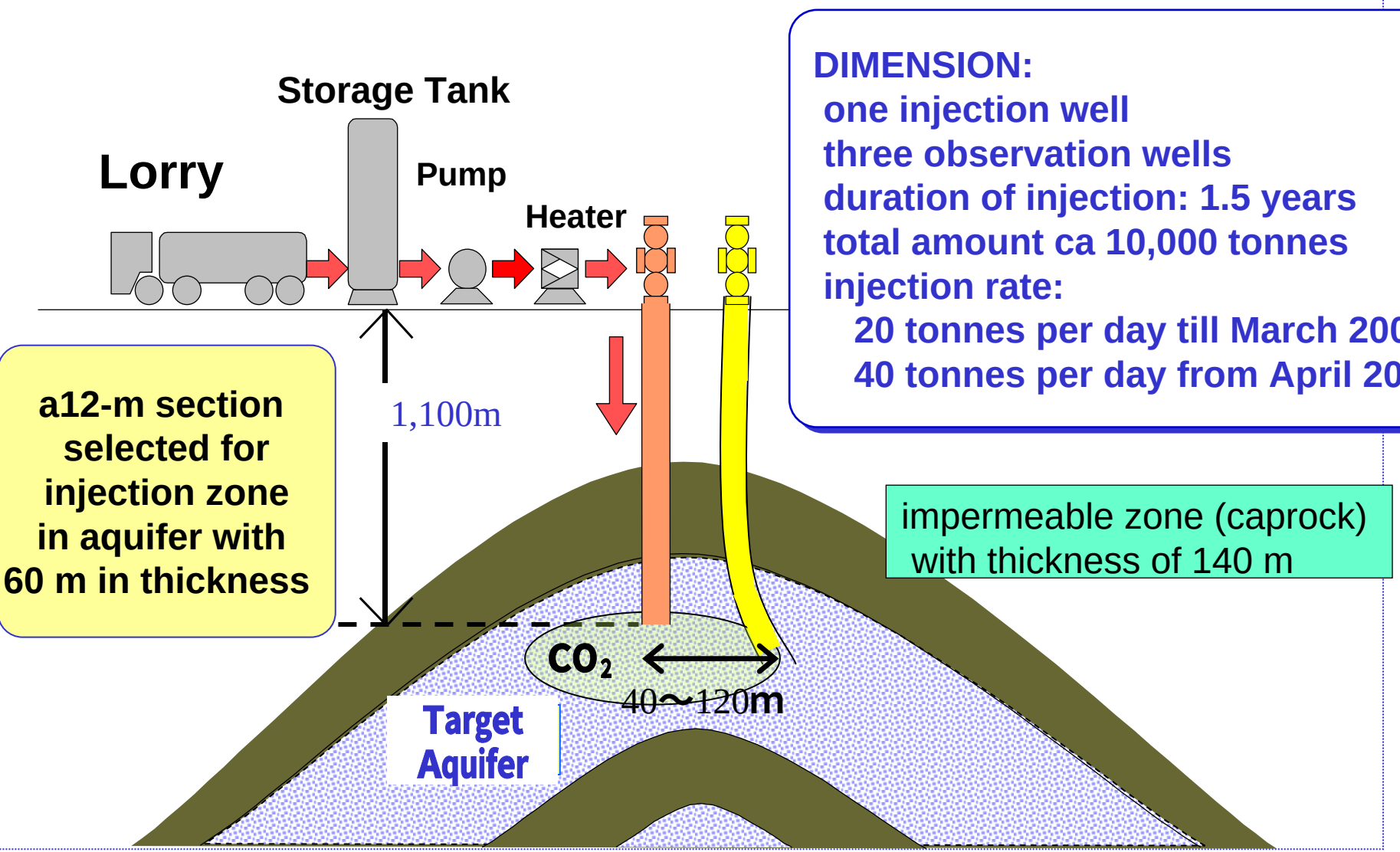
What has been done in the R&D projects for risk management ?

A release scenario was presented at “Risk Assessment Workshop” held in British Geological Survey in May 2002.

From outside Europe, RITE reported on the risk management at Nagaoka Project:

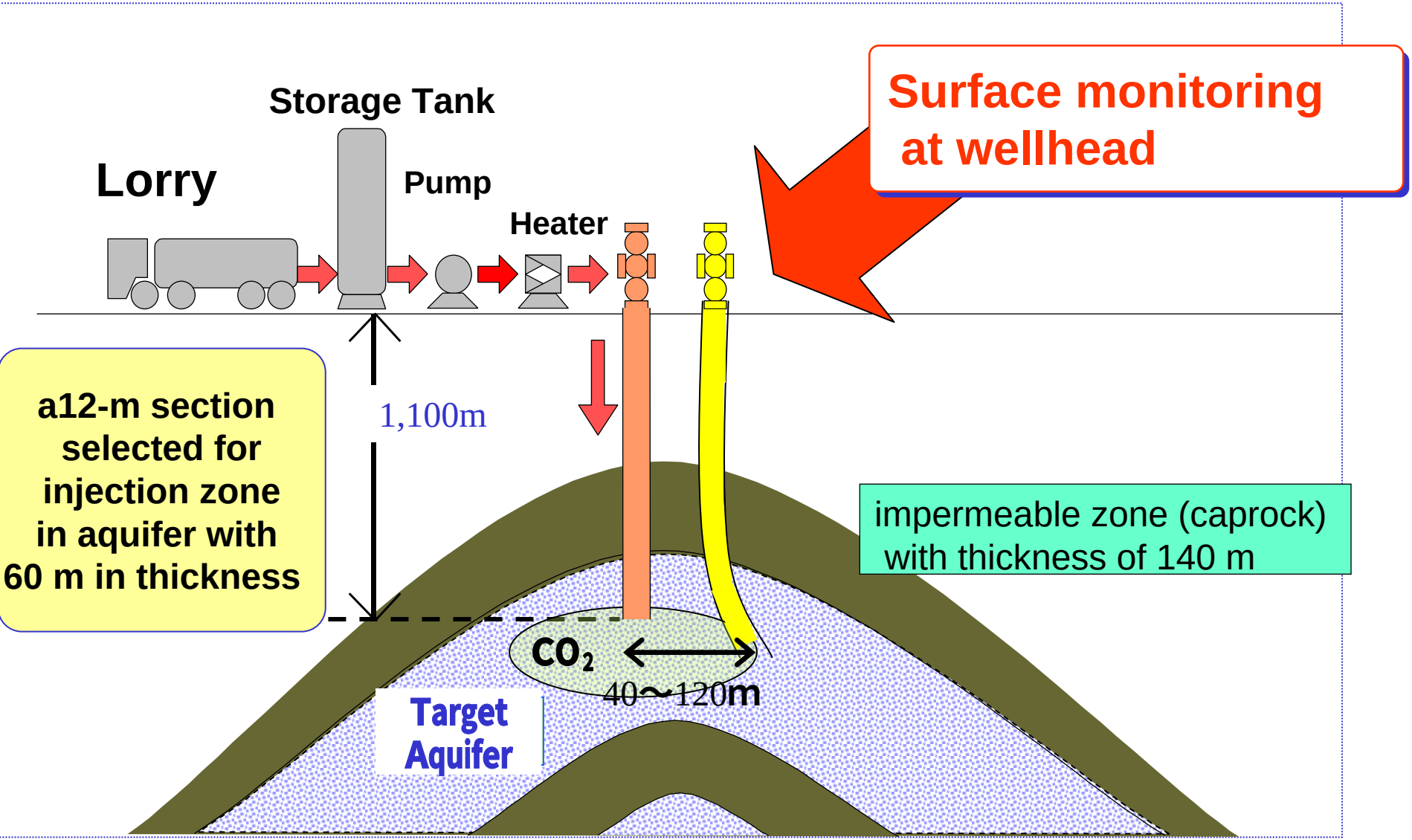
- monitoring on CO_2 concentration around wellhead
- monitoring for microseismicity
- caprock integrity evaluation using the actual core sample

Injection Test

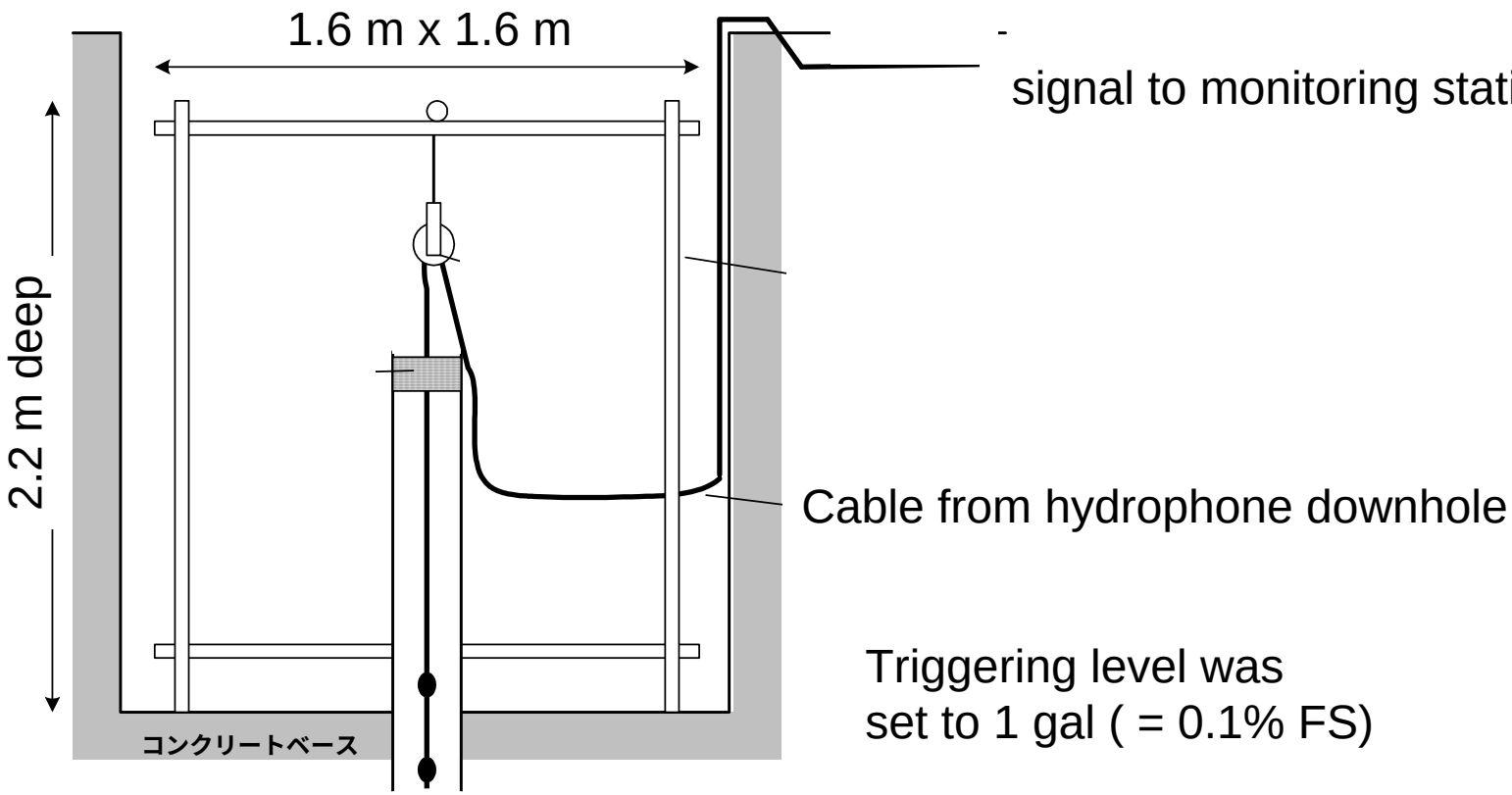


DIMENSION:
- one injection well
- three observation wells
- duration of injection: 1.5 years
- total amount ca 10,000 tonnes
- injection rate:
  - 20 tonnes per day till March 2004
  - 40 tonnes per day from April 2004

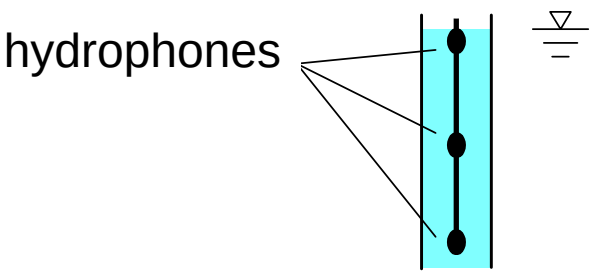
Injection Test



Real-time monitoring of microseismicity at Nagaoka test site



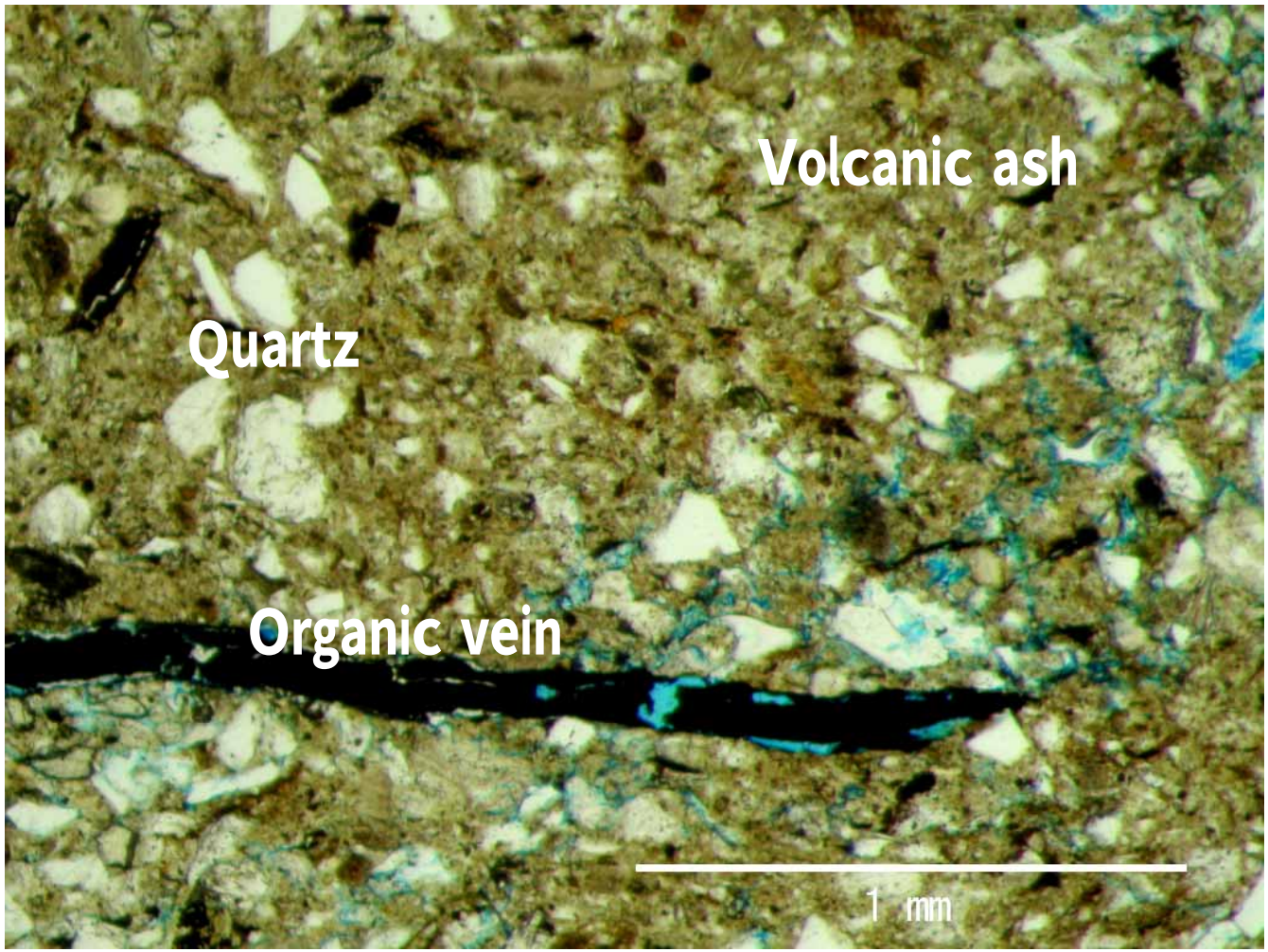
Triggering level was
set to 1 gal (= 0.1% FS)



water level in well : GL-120 m

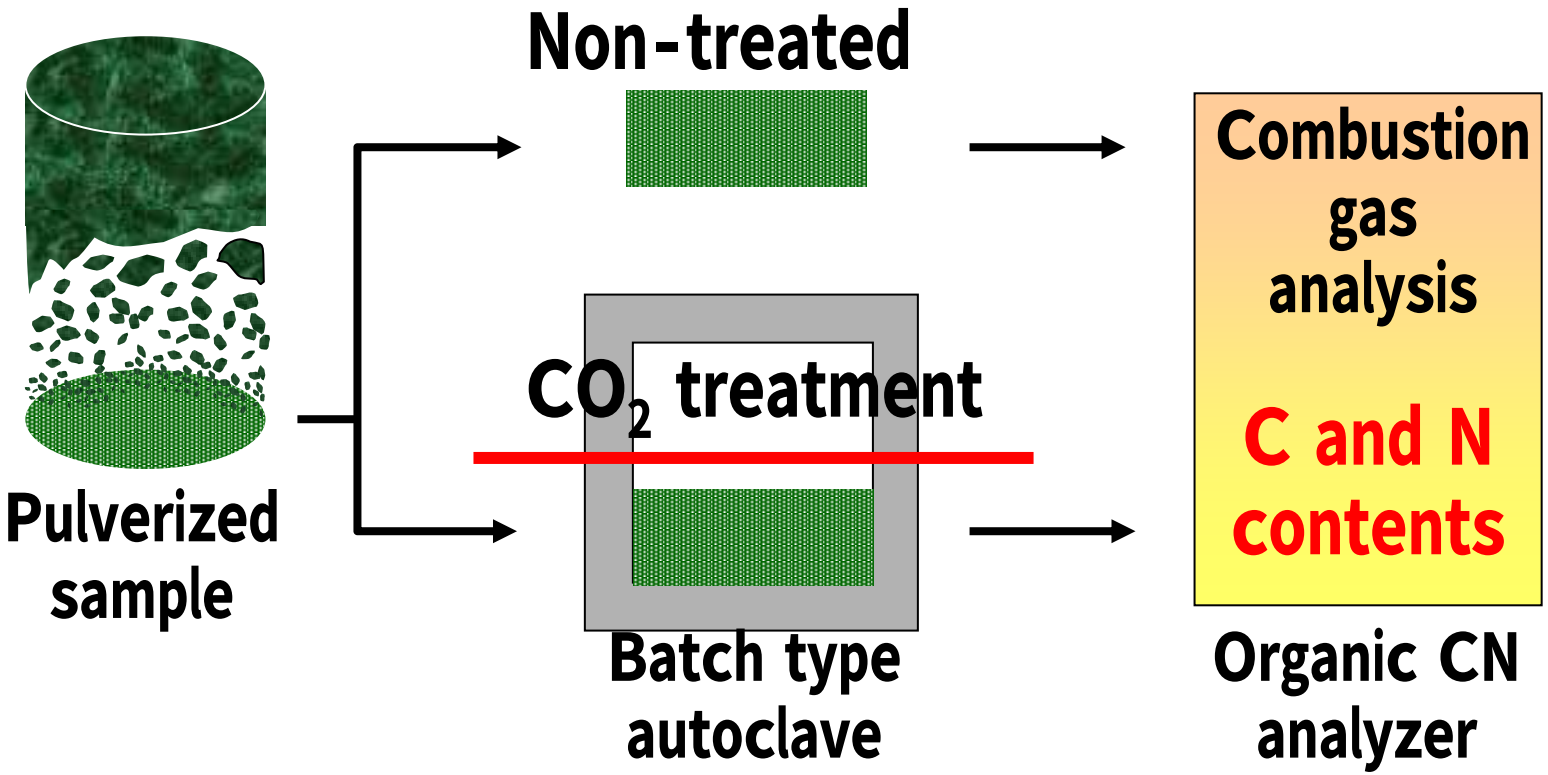
Core samples form target aquifer zone recovered from injection well

Microscopic image of siltstone sample



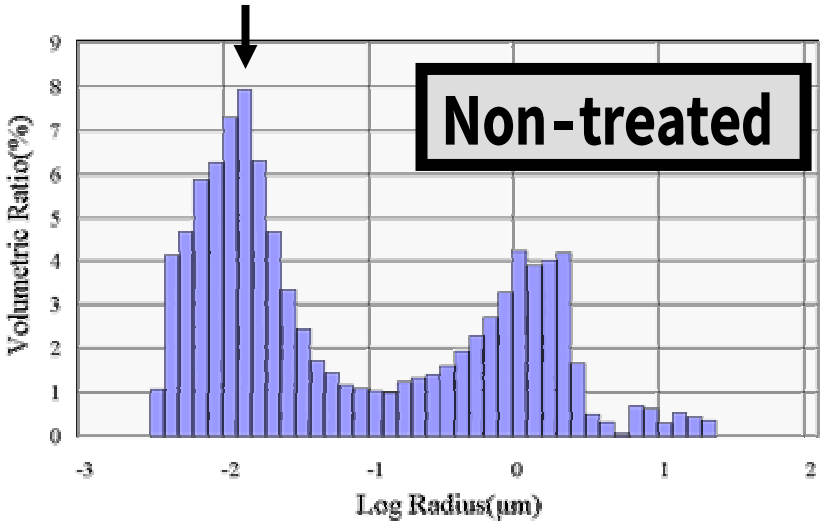
Siltstone as caprock of Nagaoka injection test site

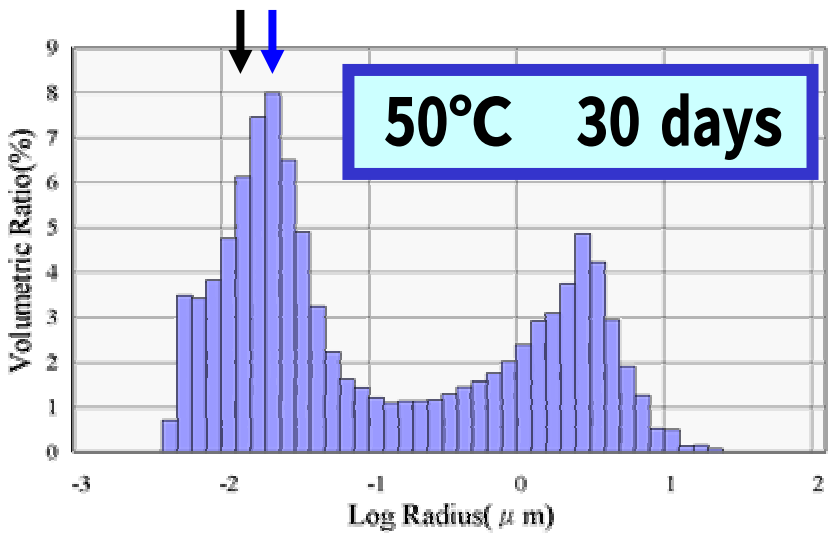
Supercritical CO_2 treatment on powder samples

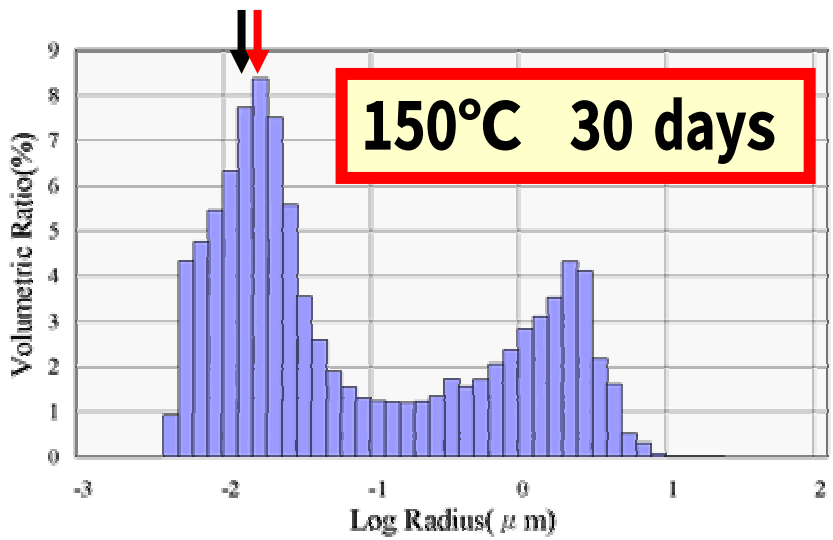


Pressure : 10 MPa
Temperature : 50, 100, 150°C
Treatment period : 10, 20, 30 days

Pore radius distributions







risk assessment & regulation
- risk communication -

International discussion on

the potential leakage onto sea-floor bottom and the consistency in the existing framework of marine pollution control

started in fall of 2004 and

finalized in fall 2007.

On 8 November 2007, CO_2-WAG was adopted in the London Protocol meeting.

What is the start point from now on, in the risk communication of CO_2 underground geological storage?

End points of the risk assessment

Time & space mode of migration of CO_2 to the surface environments and its effect are to be examined in terms of:

- human health
- economic damage (infrastructure…)
- ecosystem impact

To prevent ecosystem alteration is also the objectives of marine pollution control system including London Convention

The introduction of the permit system of offshore geological CO_2 injection to the London Convention Scheme is justified by the fact that CCS could mitigate the future acidification of marine acidification.

The important outcome was that “the mitigation/remediation measures in case that concerns on the potential leakage are emerged are included as a component of permit conditions”.