附件三

AGENDA

Date: Monday, 27th August 2007
Place: MIU site office, JAEA
Participants: JAEA) M Uchida, R Takeuchi, H Saegusa, H Onoe, T Ohyama
INER) Yin-Pang Ma, David Ching-Fang Shih, Fu-Lin Chang

13:30 – 13:35	Welcome address	JAEA (Uchida)
13:35 – 14:00	Overview of the MIU Project	JAEA (Uchida)
14:00 – 14:50	Facility Tour	JAEA (Uchida)
14:50 – 15:00	Break	
15:00 – 15:30	Hydrogeological model calibration using the result from crosshole hydraulic test	JAEA(Onoue/Saegusa)
15:30 – 16:00	GW pressure monitoring during shaft sinking	JAEA(Ohyama)
16:00 – 16:40	Current status of Taiwan's project for radioactive waste disposal	INER
16:40 – 17:10	Discussion	
17:10	Leave MIU	
17:32	Departure (Central Liner #18, Arrive Nagoya at 18:13)	

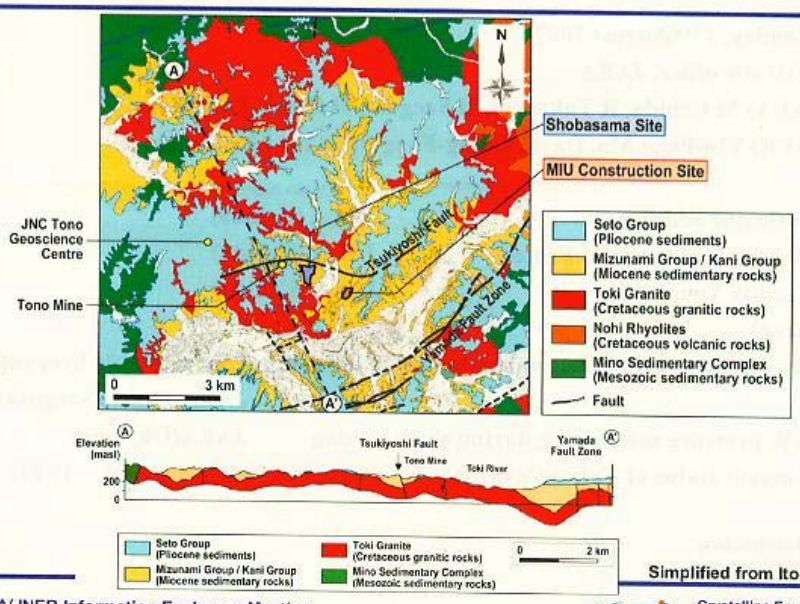
MIU Project: What is MIU?

Mizunami Underground Research Laboratory

- **Off site generic URL**, not site-specific URL
- **R&D site**, not potential site for waste disposal
- **Purpose-built**, not pre-existing excavation
- Crystalline basement with sedimentary overburden
  (↔ Horonobe URL, soft sedimentary rocks)
- Planned depth of ~1,000mbgl

Crystalline Environment Research Group
Tono Geoscience Research Unit
Geological Isolation R&D Directorate

Geological Map of the Tono Area



Simplified from Itoigawa (1980)

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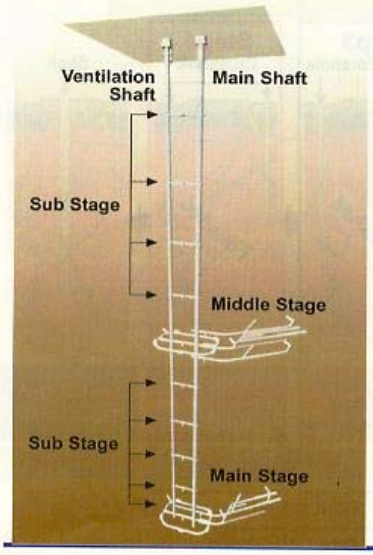
Tono Geoscience Research Unit
Geological Isolation R&D Directorate

Design of MIU



- **Specifications**
  - Access style: Shaft
  - Number of access shaft: 2 Shafts
  - Separation of access shafts: 40m
  - Shape of access shafts: Circular
  - Max depth of access shafts: 1,025mbgl
  - Inner diameter of Main Shaft: Ø6.5m
  - Inner diameter of Ventilation Shaft: Ø4.5m
  - Depth of Middle Stage: 500mbgl
  - Depth of Main Stage: 1,000mbgl
  - Interval of Sub Stages: 100m

*Plan is subject to change

Phase I Investigations

JAEA/ INER Information Exchange Meeting
JAEA Tono, 27 August 2007

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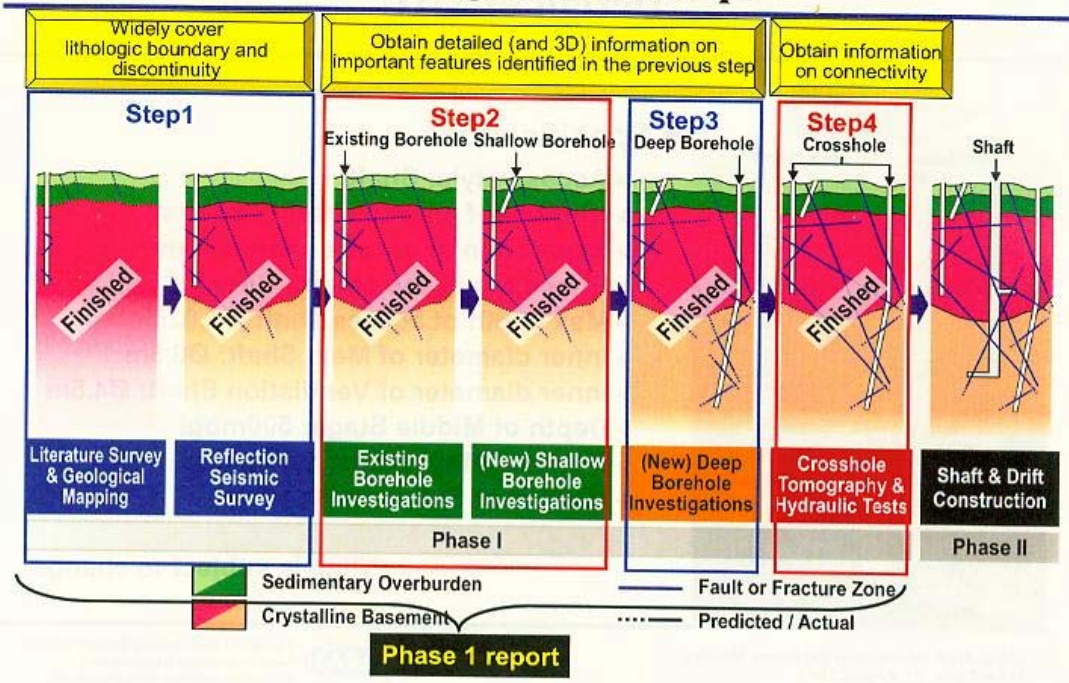
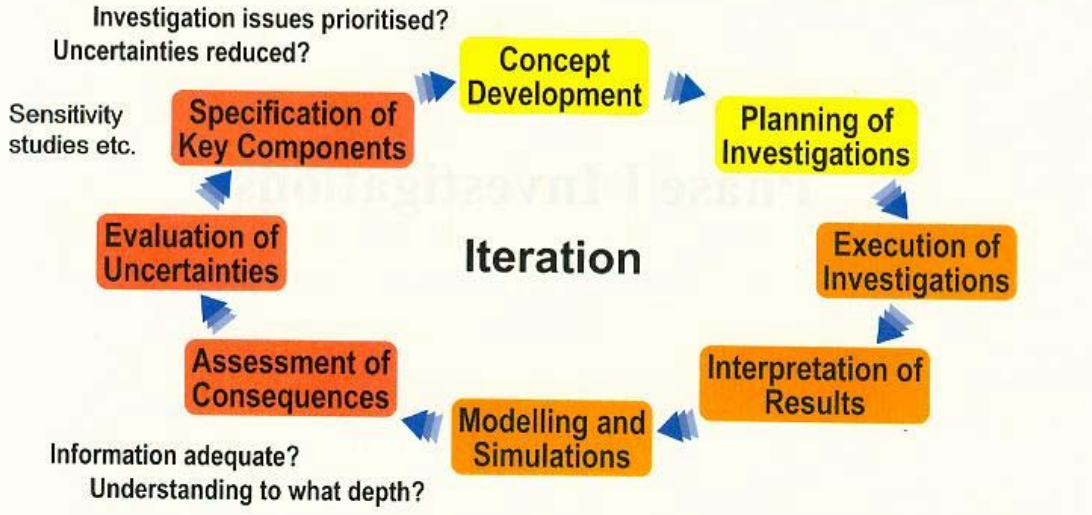
Tono Geoscience Research Unit
Geological Isolation R&D Directorate

Investigation Concept



Phase I: Investigation Approach



JAEA/ INER Information Exchange Meeting
JAEA Tono, 27 August 2007

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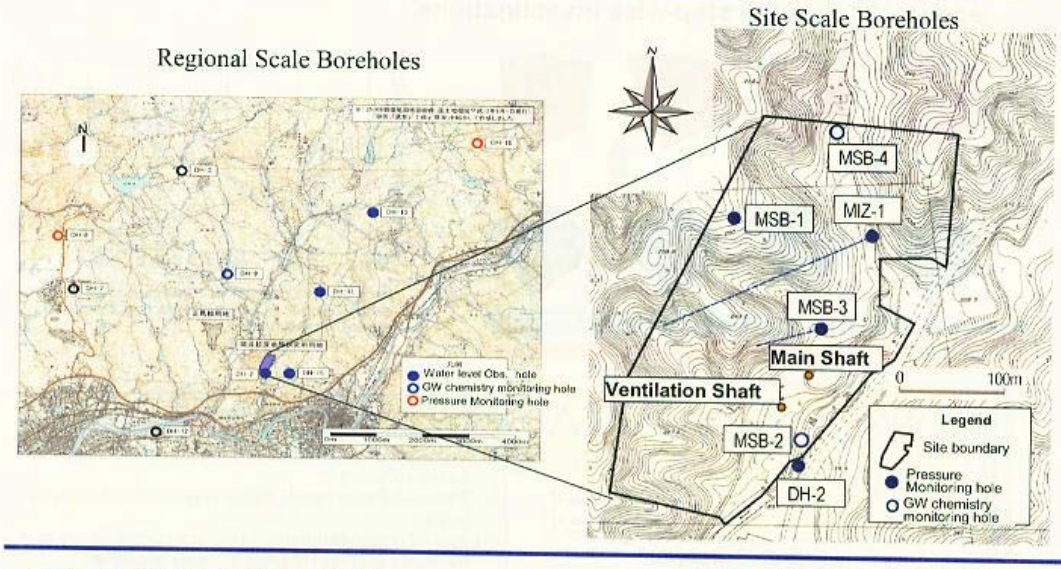
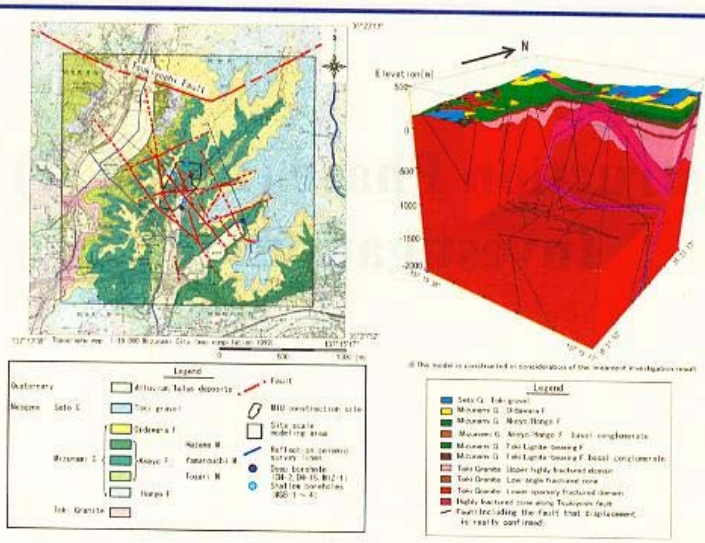
Tono Geoscience Research Unit
Geological Isolation R&D Directorate

Boreholes around MIU

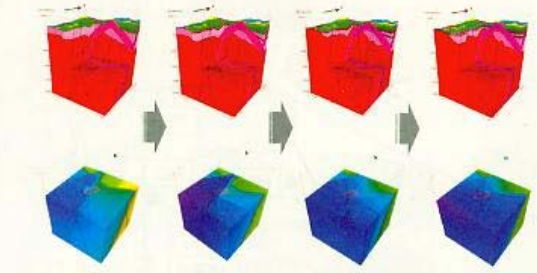


Phase I: Geological Model after Step 4



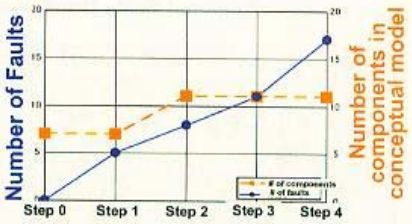
Evolution of the geology and hydrogeology model

- **Efficient site characterization was achieved by implementing "iterative approach" through step-wise investigations.**

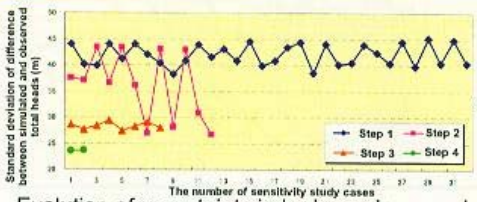


Degree of understanding

Uncertainty



Progressive change of "Number of Faults" and "Number of components in conceptual model" in each Step



Evolution of uncertainty in hydrogeology model

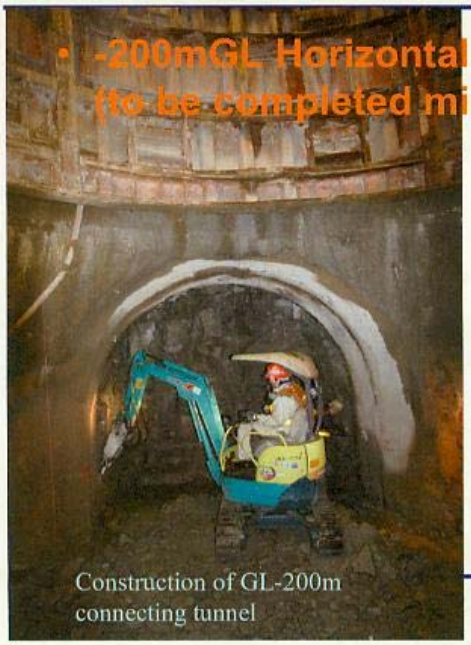
With progress of site investigations,
- The number of sensitivity study cases reduced
- Variation of total heads among sensitivity study cases reduced
- Simulated total heads better reproduced observed heads

⇒Level of understanding on hydraulic conductivity and hydraulic gradient is progressively improved

Construction Phase (Phase II) Investigations

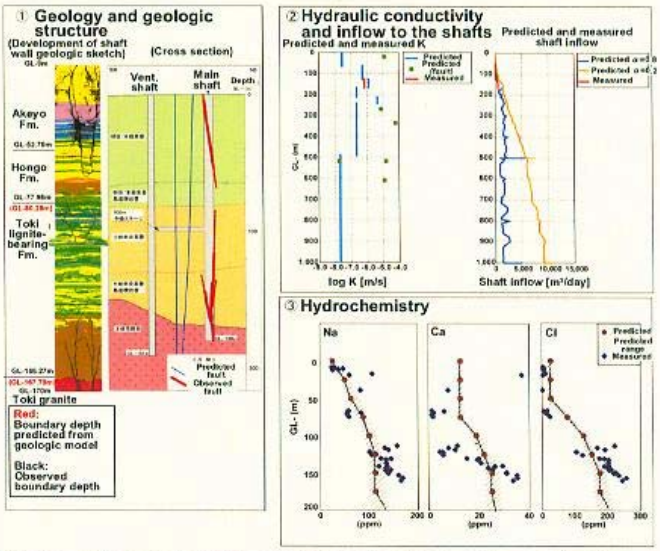
Current Status of MIU (Mizunami URL)

- -200mGL Horizontal Tunnel is under construction (to be completed middle September)

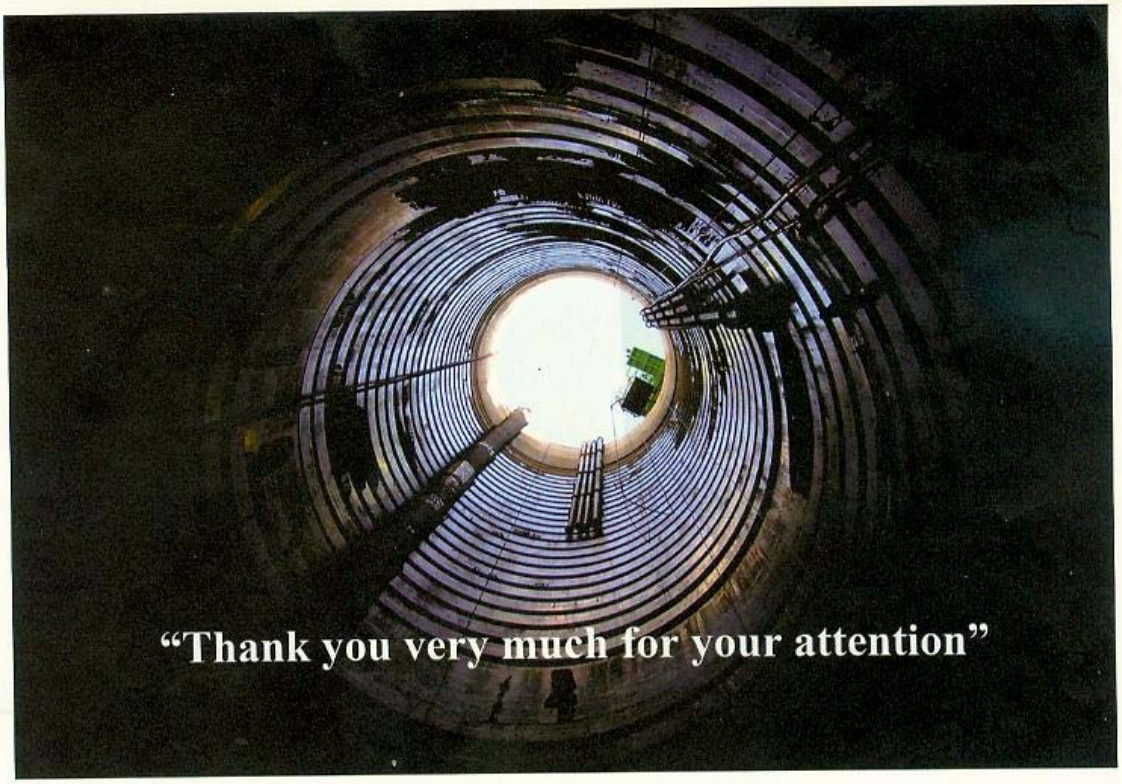


Study Plan during Phase II

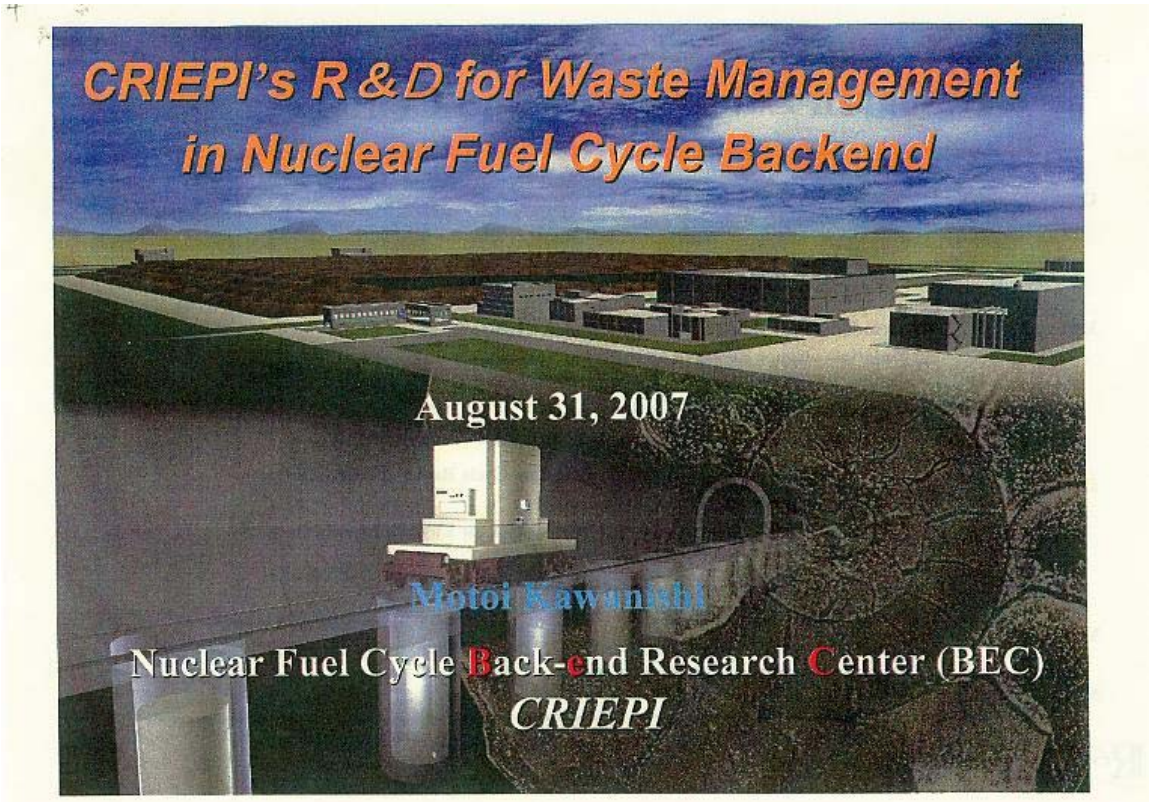
- Resolve remaining issues identified in Phase I
- Confirm prediction in Phase I of geosphere model and responses to shaft construction
- Continue iterative approach during Phase II and confirm "geosynthesis work flow"

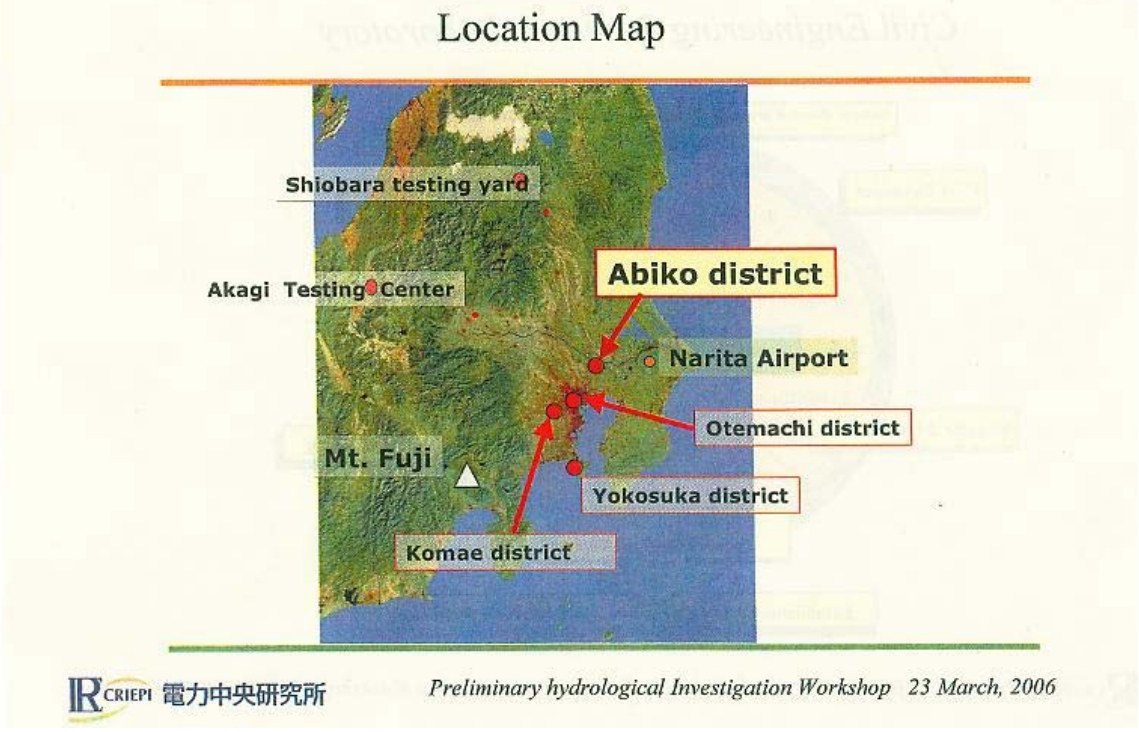


Confirmation of Phase I prediction by Phase II investigations - Examples -


“Thank you very much for your attention”

附件四


CRIEPI's R&D for Waste Management
in Nuclear Fuel Cycle Backend
August 31, 2007
Motoi Kawanishi
Nuclear Fuel Cycle Back-end Research Center (BEC)
CRIEPI


Location Map
Shiobara testing yard
Akagi Testing Center
Abiko district
Narita Airport
Otemachi district
Mt. Fuji
Yokosuka district
Komae district
CRIEPI 電力中央研究所
Preliminary hydrological Investigation Workshop 23 March, 2006

Research Laboratories and Centers

- **Otemachi district**
  - Head Office
  - Central CS Promotion Office
  - Socio-Economic Research Center
- **Komae district**
  - System Engineering Research Laboratory
  - Nuclear Technology Research Laboratory
    - Nuclear Information Center
    - Low Dose Radiation Research Center
  - Socio-Economic Research Center –Human Factors Research Center
  - Materials Science Research Laboratory(Komae Office)
  - Komae Operation & Service Center
  - Administrative Operations Center
- **Abiko district**
  - Civil Engineering Research Laboratory
    - Nuclear Fuel Cycle Backend Research Center
  - Environmental Science Research Laboratory
    - Solution Center for Environmental Issues
  - Abiko Operation & Service Center
- **Yokosuka district**
  - Electric Power Engineering Research Laboratory
  - Energy Engineering Research Laboratory
    - High Power Testing Laboratory
    - Shiobara Testing Yard
  - Materials Science Research Laboratory
  - Yokosuka Operation & Service Center
- **Akagi Testing Center**

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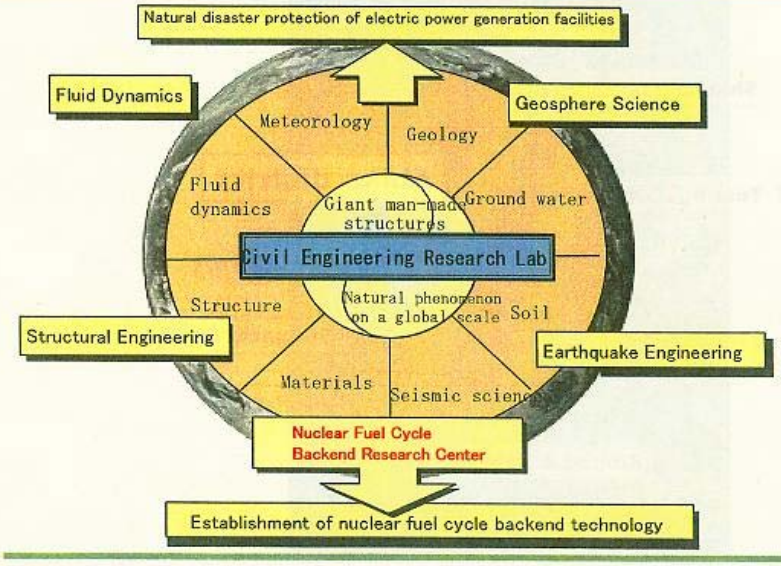
Civil Engineering Research Laboratory



R&D Projects in CRIEPI for Nuclear Fuel Cycle Back-End

- Transport/Storage Technology for Spent Nuclear Fuel etc.
- High-Level Radioactive Waste Disposal
- Low-Level Radioactive Waste Disposal
- Decommissioning Wastes
  (Recycle / Disposal)
- TRU Waste Disposal

Role of CRIEPI for R&D on Nuclear Fuel Cycle Back-End in Japan

- **Support for electric utilities, implementing bodies (JNFL,NUMO,RFS) to execution of projects**
- **Contribution to establishment of standard /guideline by government**
- **Contribution to establishment of technical standard/guideline by societies (AESJ, JASME,JSCE)**
- **Technical information dispatch to common people**

History of Radioactive Waste Management in Japan

LLW (by JNFL)

1992 start of operation for the 1st phase disposal facility(R1)
(for the Concentrated liquid Wastes)

2000 start of operation for the 2nd phase of disposal facility (R2)
(for the dry active wastes)

2013? Start of opening for the 3rd phase of disposal facility (R3)
(for the high β γ wastes)

HLW (by NUMO)

2000 A law relating to final disposal of "specified" radioactive waste

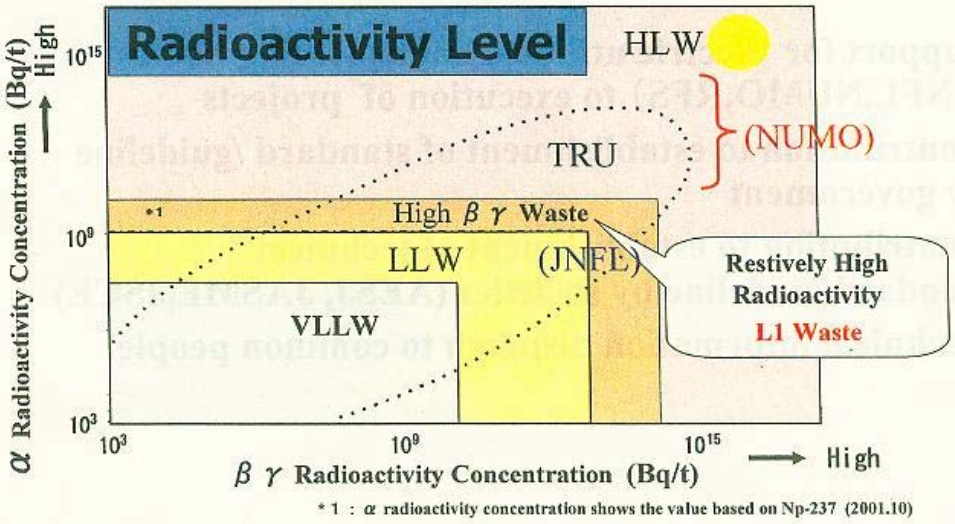
2000 NUMO (Nuclear Waste Management Organization of Japan) was established

~2027? Selection of the site for repository construction

2033~2037? start of operation

CRIEPI

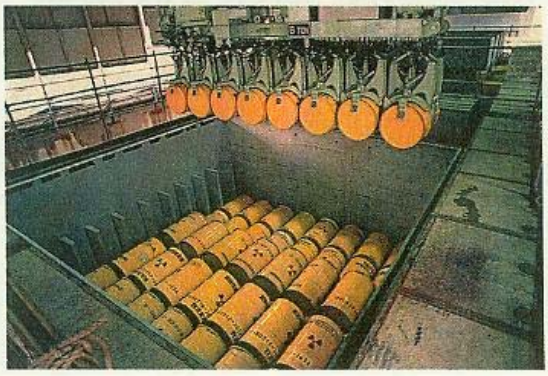
Rad Waste management in Japan



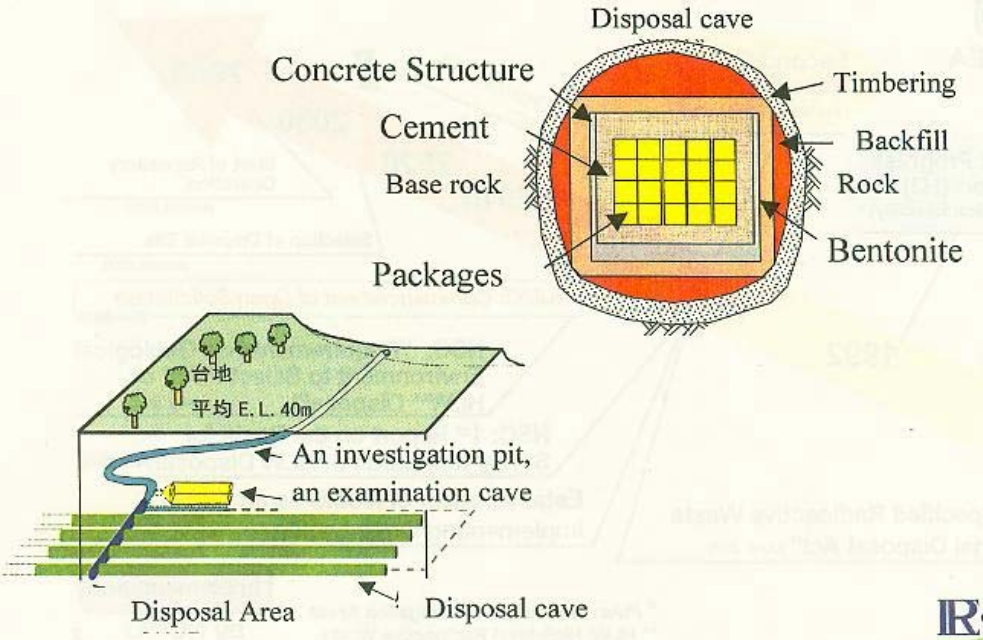
* 1 : α radioactivity concentration shows the value based on Np-237 (2001.10)

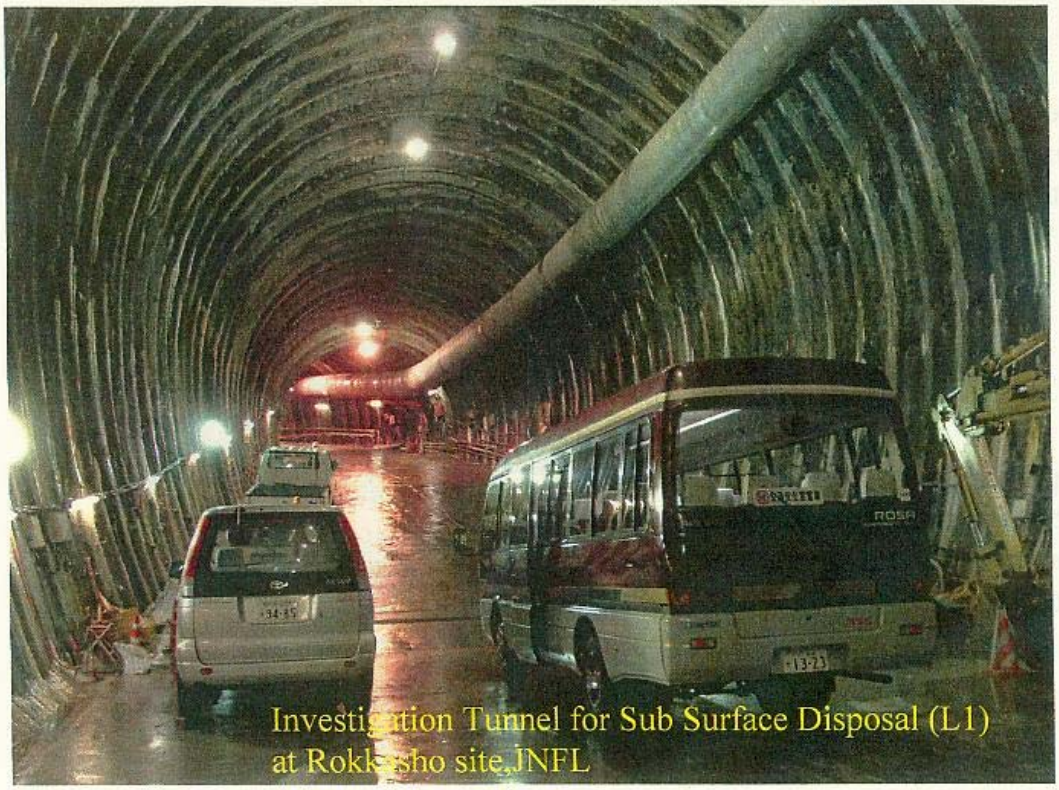
Complete view of LLW disposal facility at Rokkasyo site in Japan
(1st and 2nd phase by JNFL

Operating for setting of LLW drums into the concrete vault for shallow land disposal at Rokkasyo



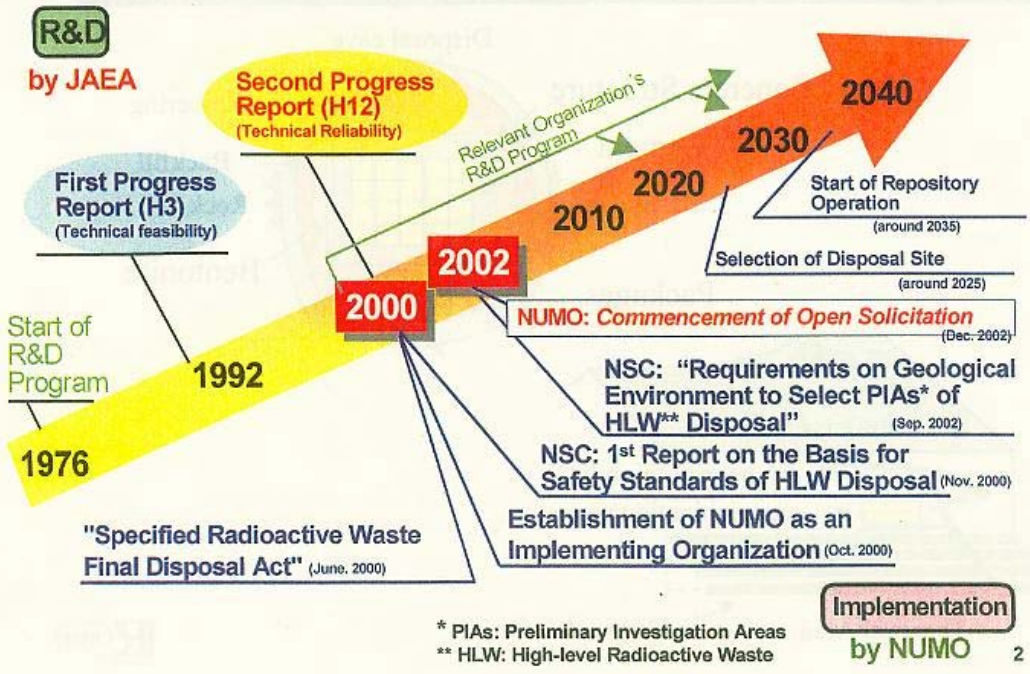
Present Design Concept Proposal for Sub-surface Disposal Facility



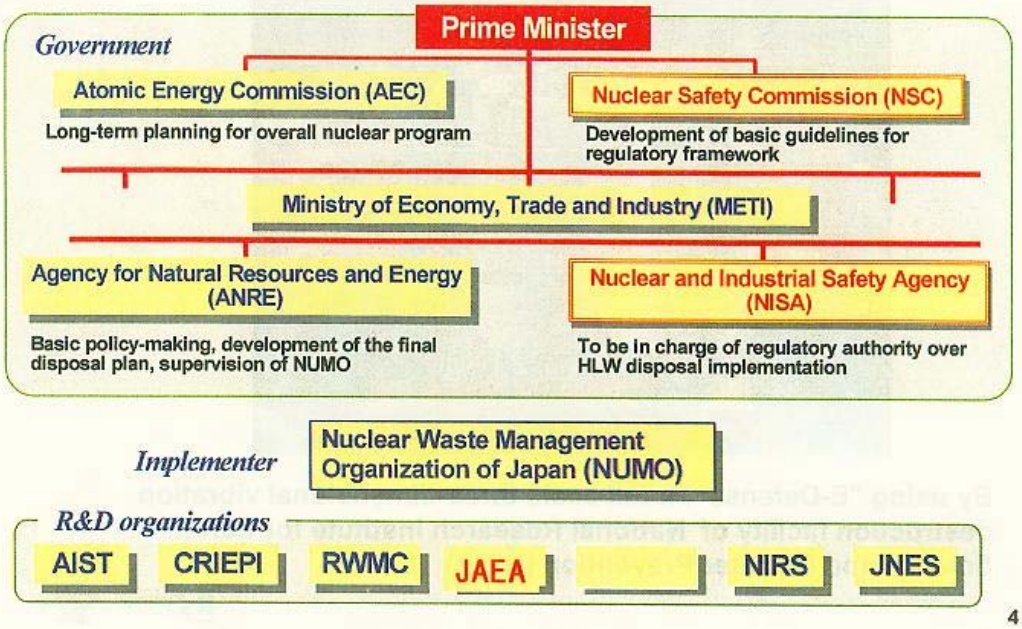


Investigation Tunnel for Sub Surface Disposal (L1)
at Rokkasho site,JNFL

Development of HLW Disposal Program



Government and Organizations: HLW Disposal Program



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R&D on SF Storage by CRIEPI

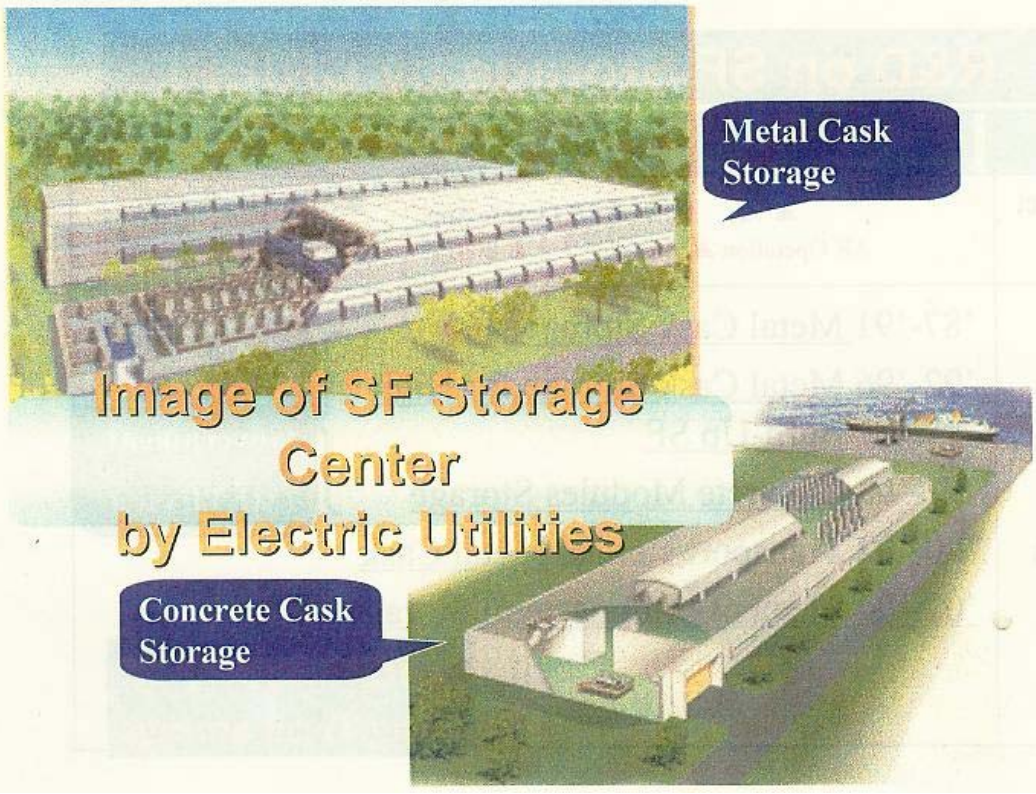
year	'87-'91,	'92-'96,	'97-2003	2004--------2010
Target	▲'92, AR Operation ▲' 95,	'97▲AR License App. ▲ 2001		▲AFR License App. AFR Operation ▲2010
Project Items	'87-'91 Metal Cask Storage '92-'96 Metal Cask Storage for High Burn-Up SF '97-'03 Concrete Modules Storage '00-'02 Transport/storage Metal Cask '02-'04 Element of Long-term Storage			

Contract from Government (METI, etc.)

Large Capacity & Long Term Storage

Full-Scale Mock Up Seismic Test on Concrete Cask for Spent Fuel Storage

By using "E-Defense": a full scale three-dimensional vibration destruction facility of National Research Institute for Earth Science and Disaster Prevention (NIED)



附件五

CRIEPI's R&D Programme for HLW management

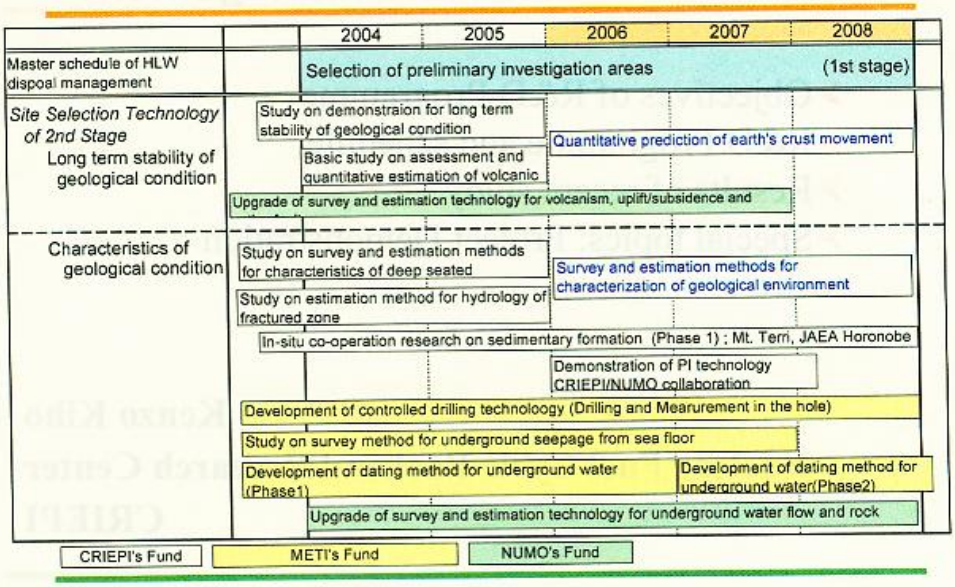
- Objectives of R&D Programme
- R&D Programme and schedule
- Results of recent study
- Special topics: Project Demonstration

Kenzo Kiho
Nuclear Fuel Cycle Backend Research Center
CRIEPI

Objectives

- To develop survey and estimation method for rational HLW management
  - Geological and hydrological conditions
  - Long term stability of geological condition
  - Performance Assessment
  - Facility design & safety assessment
- To support NUMO from technical aspect

CRIEPI's R&D for HLW management (Part1)



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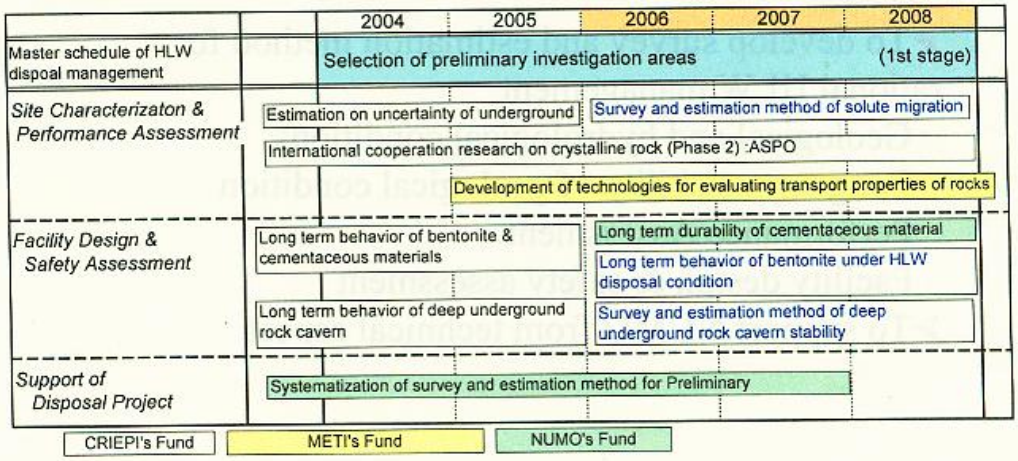
CRIEPI's R&D for HLW management (Part2)



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Research Results (Part 1)

Survey and Estimation technology for long term stability of geological condition

- Upgrade of survey and estimation method for uplift and subsidence
- Upgrade of survey and estimation method for fault activity
- Upgrade of survey and estimation method for volcanic activity

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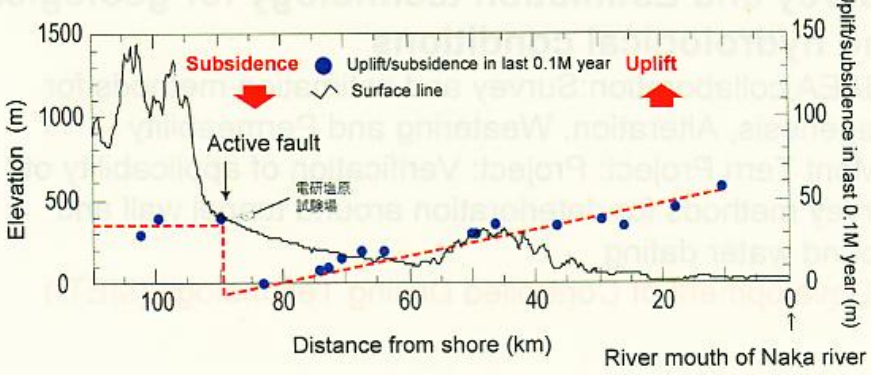
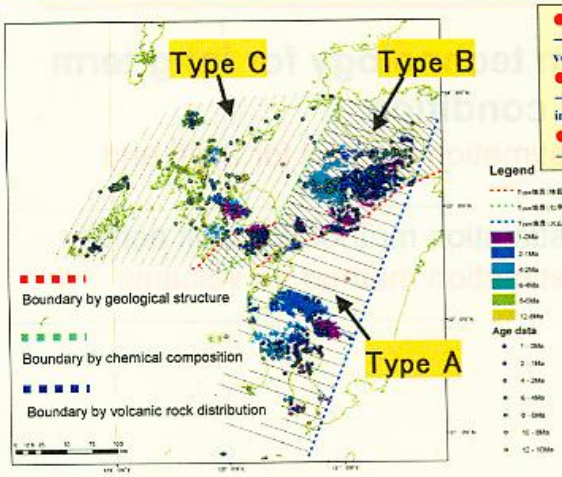
Long term stability of geological condition
Uplift and subsidence



Case study of uplift and subsidence along the Naka river in Tohoku area by contradistinction of altitude of terrace deposit.

Upgrade of survey technology and estimation method for volcanic activity (NUMO)



●TypeA : Activity along volcanic front
→Maldistribution of spacial distribution of volcanic activity + Low velocity anormary of seismic wave in Mantle
●TypeB: Activity along Beppu-Shimabara Lift Valley
→Low gravity anormary + Low velocity anormary of seismic wave in Crust
●TypeC : Activity at the Back Arc
→Relation with formation of basin preceding volcanic activity

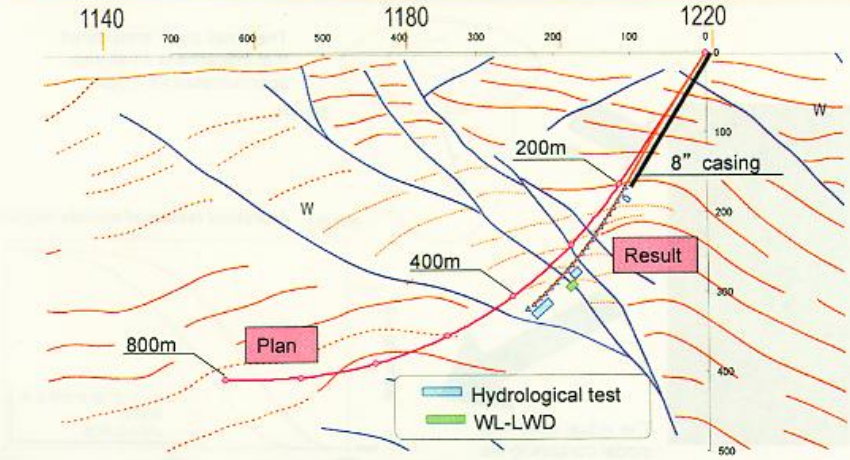
The volcanic activity in Kyushu area was divided into three types based on the geological, geochemical and lithological condition. This will make it possible to predict where the volcanic activity occur near feature in Kyushu area.

Research Results (Part 2)

Survey and Estimation technology for geological and hydrological conditions

- JAEA collaboration:Survey and estimation methods for Diagenesis, Alteration, Weatering and Permeability
- Mont Terri Project: Project: Verification of applicability of survey methods for deterioration around tunnel wall and ground water dating
- Development of Controlled Drilling Technology (METI)

Controlled Drilling Technology (Funded Research from METI)



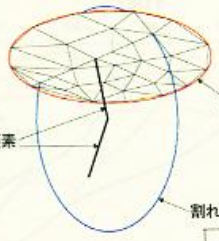
The controlled drilling technology was applied to the Omagari fault in Horonobe to the length of 400m, the fault was characterized by loggings and measurements.

Research Results (Part 3)

Performance assessment

- Fix of analytical code for solute migration which can treat a lot of cracks in the rockmass stocastically
- Verification of the applicability of ground water dating at the Great Basin area in Australia (METI)
- Adjustment between groundwater flow analysis and water chemistry (NUMO)

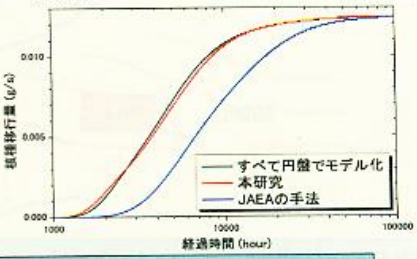
Analytical code for solute migration



The small crack considered that influence is small was approximated as a pipe

The virtual base rock model containing the crack of 2,000 sheets

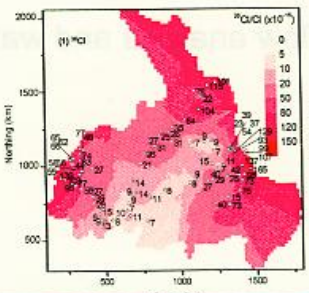
Analytical results of nuclide migration

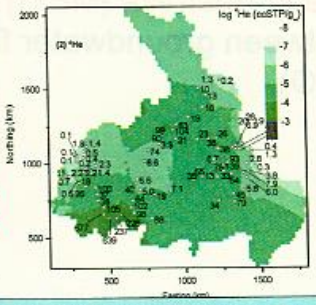


The estimation method which can analyze the nuclide migration through many cracks in the base rock with high precision by comparatively small calculation was developed.

Development of underground water dating (METI)

Groundwater dating method (Applied to the site)
Underground water flows from western and northeastern recharged zone to southern discharged zone, and there is tendency of increase in ^{4}He and decrease in ^{36}Cl.





Dating method for very old underground water (approx. 1my) was applied to the Great Basin Range in Australia and Horonobe site in Hokkaido, and the method was verified

Research Results (Part 4)

Facility design & safety assessment

- The Desolution procedure of cementaceous material was shown by the experiment.
- T-H-M Coupled Analysis for the artificial barrier.
- The evaluation of long-term subsidence of the overpack in the bentonite by centrifuge examination.
- Mechanical properties of soft sedimentary rock under the high temperature and high confining pressure.
- Mont Terri Project: Stress and deformation measurement of anistropic sedimentary rock.

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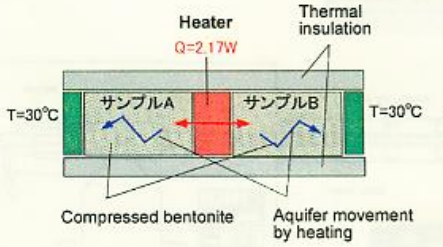
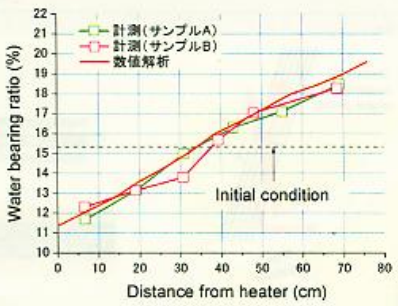
T-H-M Coupled Analysis for the artificial barrier (Aspo International Joint Research)

Heater Test of the compressed bentonite

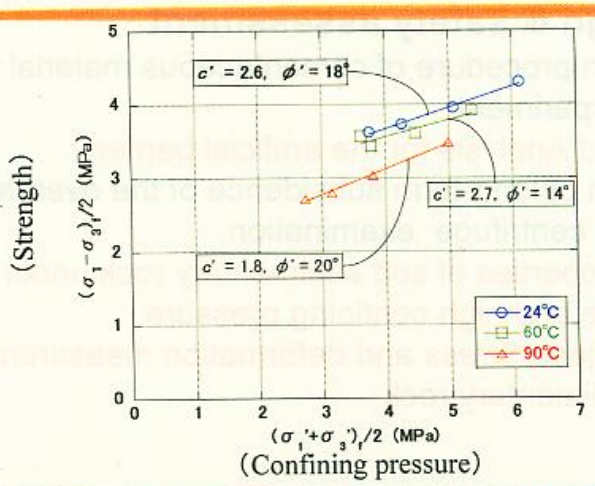


Distribution of the water bearing ratio after testing.



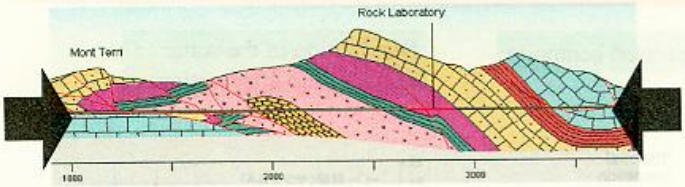
Analytical code predicting THM coupled behavior which will occur around the artificial barrier was developed. The code was applied to the bentonite heater test and confirmed it could predict accurately the aquifer movement in the bentoninte.

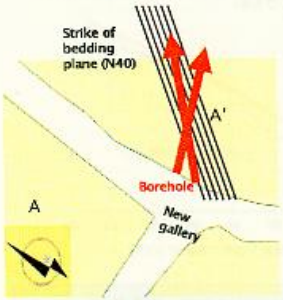
Study on mechanical properties of sedimentary soft rock

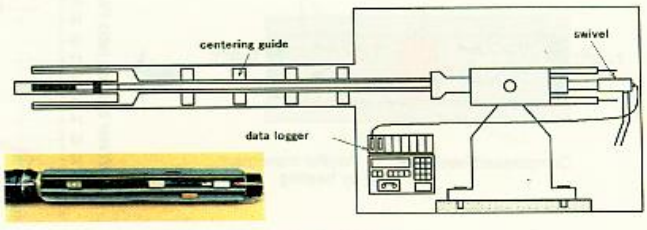


Mechanical properties of soft sedimentary rock under the high temperature and high confining pressure was solved. This data can be used for the numerical code for rock cavern stability.

AS Experiment: Mont Terri Project

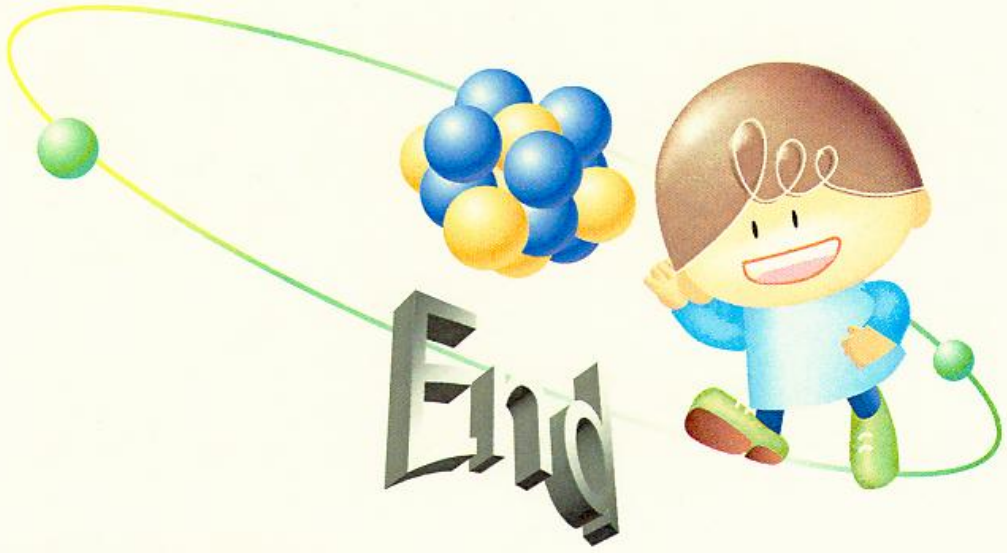






Overcoring

The stress measurement by using over coring was applied to the Mont Terri site whose mudstone has strong anisotropy, and the applicability was confirmed.



CRIEPI

附件六

Presentation to INER delegation

Impact Assessment near CO_2 injection points

August 31, 2007

Takashi Ohsumi
Central Research Institute of Electric Power Industry
(CRIEPI)

Topics

- Development of models to assess environmental impacts near the area (geology and ocean) of CO_2 injection

added information on:

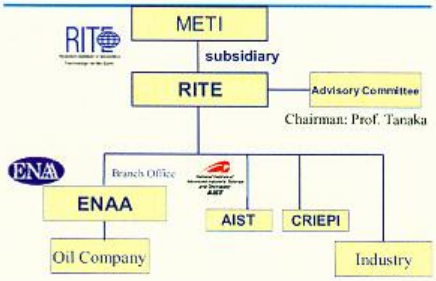
- site selection criteria
- local environmental assessment
- Earthquakes on July 16, 2007 and Oct. 23, 2004

Budgetary situation in "Ocean"

- News from Dr Murai on Thursday : METI decided that Ocean Sequestration R&D program should be reviewed in fall 2007.
- CRIEPI is communicating with the RITE program through
  - Dr Shitashima targeting at Dr Murai on natural analog study
  - Dr Nakashiki targeting at Dr Nishio of AIST on model study

please make further contact with Drs Shitashima and Nakashiki, if CRIEPI can help INER on RITE program

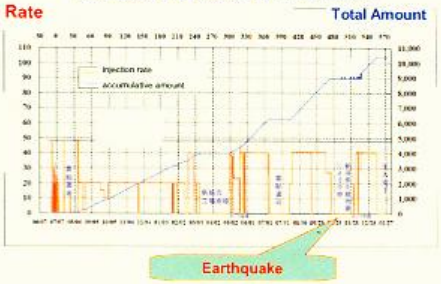
Project Scheme



Nagaoka Site

Injection operation

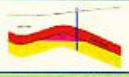
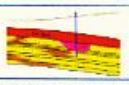
from July 7,2003 through January 11,2005



Outcomes of Nagaoka Project

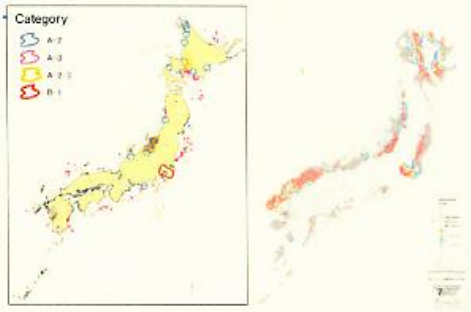
1 successful and meaningful continuous operation of CO_2 injection; 500days and 10 thousand tonnes
2 geophysical logging using observation wells revealed CO_2 migration and distribution
3 imaging by cross-hole seismic tomography
4 computer simulation of CO_2 migration prediction underground
5 experience of a big earthquake with M6.8. well integrity confirmed (20km distance to epicenter; depth of focus is 13 km)
6 pressure test to check for well and seal rock integrity before injection operation: up to 19.2 MPa (compare to the predicted injection pressure of 18.6 MPa) actual injection pressure of 12.6 MPa for injection rate of 40 tonnes per day

Re-evaluation for Aquifer Storage Potential in Japan

data source		Category A (Aquifer with Closure)	Category B * (Geological formation of stratigraphic trapping)
oil & gas field	data obtained during operation	A1: 3.5 Billion t-CO_2	B1: 27.5 Billion t-CO_2
Basic boring	public domain data by seismic and drillhole	A2: 5.2 Billion t-CO_2	
Basic survey	public domain data by seismic only	A3: 21.4 Billion t-CO_2	B2: 88.5 Billion t-CO_2
scheme			
sum		30.1 Billion t-CO_2	116.0 Billion t-CO_2
total		146.1 Billion t-CO_2	

Inland basins, such as Seto in land sea, Osaka Bay are excluded; based only on Public Domain Oil & Gas Exploring activity. *) deeper than 800m and shallower than 4,000m, located in waters shallower than 200m

Identification of potential storage sites



Recent Discussions on the London Convention and Protocol

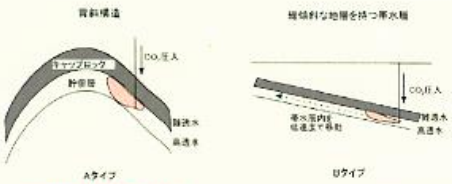
- On 10 February 2007, the amendment of London Protocol took into force, becoming able to allow CO_2 sequestration in sub-seabed geological formations.
- In the SG meeting in Spain, based on the framework of risk assessment of CO_2 sequestration in sub-seabed geological formations, the CO_2 specific Waste Assessment Guideline (CO_2-WAG)was completed.
- Japan finalized the domestic law adaptation to the amendment and the CO_2-WAG, and now is in the stage of drafting a detailed domestic guideline for application of permit.
- Japan will be the London Protocol country in mid-2007; London Protocol was ratified by National Diet in June.

Public comment on Site selection criteria

CRIEPI just submited the public comment to draft Guideline of impact assessment sissued by the Ministry of Environment:

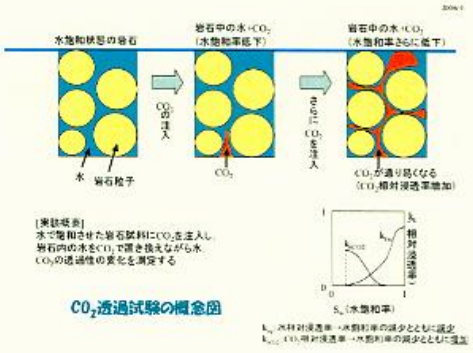
"Tectonically active locations is not automatically excluded for the site selection of CO_2 aquifer storage!"

open aquifer concept

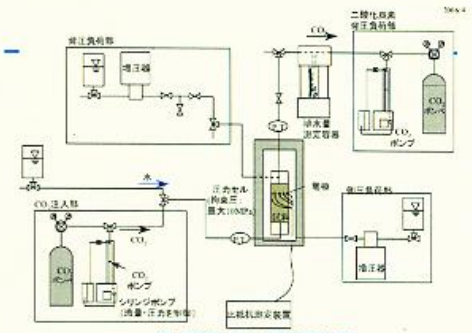


category A in RITE project

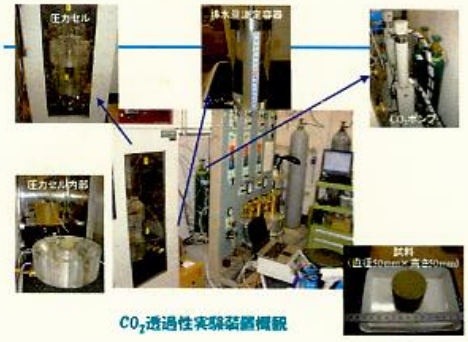
many cases in existing P/S



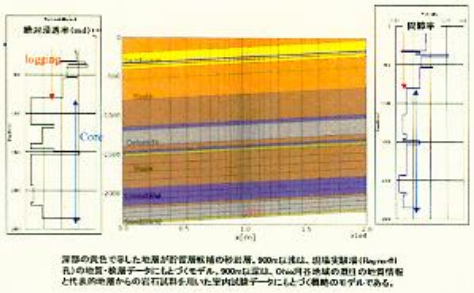
CO_2透過試験の概念図



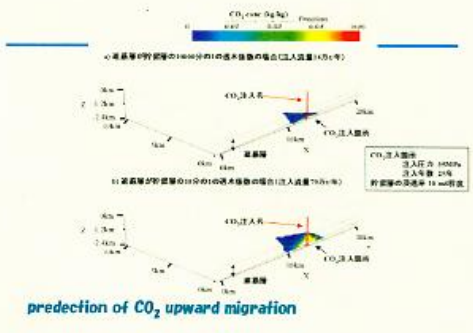
CO_2透過性室内実験装置概要



CO_2透過性実験装置概観



深部の黄色で示した地層が貯留層候補の砂岩層。900mは浅は、現場実験場(Rep-no.6孔)の地質・検層データにもとづくモデル、900m以深は、Otw河谷地域の既往の地質情報と代表的地層からの岩石試料を用いた室内試験データにもとづく概略のモデルである。
水理地質構造モデル(解析用推定図)



predection of CO_2 upward migration