# Introduction of the goals, format and expected output from this workshop

## Workshop on "Assessing the suitability of host rock"

Yokohama Minato-Mirai , Landmark Tower
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Kaname Miyahara
JAEA



## Aim

- Develop practical approaches to assess geological characteristics of suitable host rock influencing repository design, operational procedures or assurance of operational / post-closure safety

- Review and evaluate JAEA's progress to produce a detailed action plan for developing a comprehensive methodology for repository assessment based on descriptions of specific sites

# Premise

- Follow the stepwise siting approach based on the Final Disposal Act
  - Initiated by a call for volunteers

    LS PI DI
  - → PIAs → DIAs → A repository site
- Focus on crystalline and sedimentary host rocks (evaporites unlikely)
- Start from the H12 reference design and PA methodology - but bear in mind the NUMO concept catalogue!



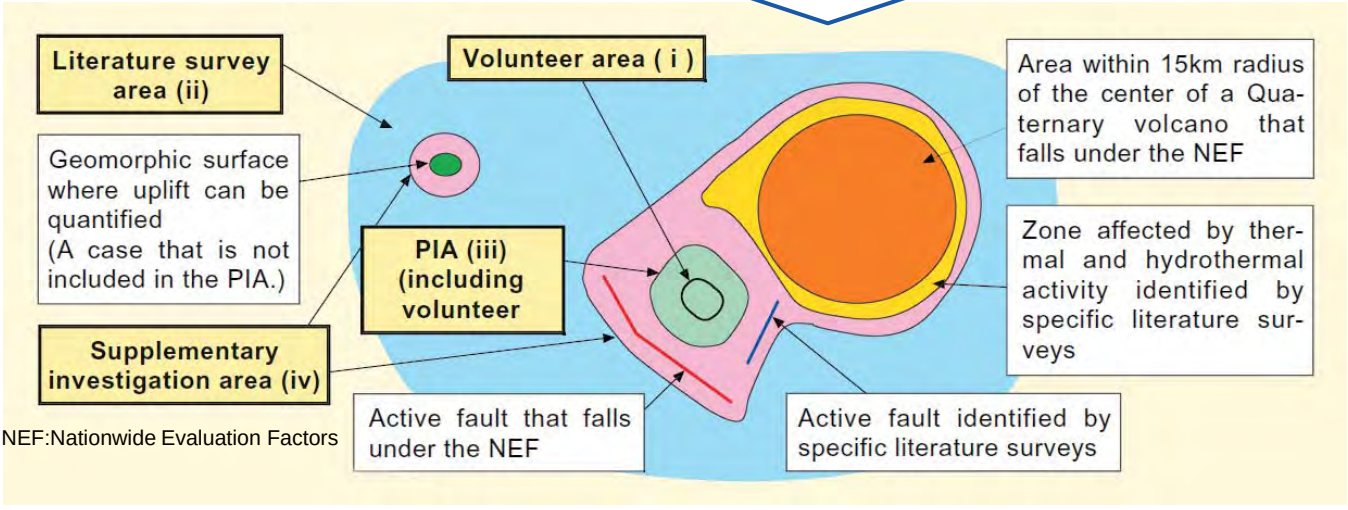
# Selection of PIAs

**Regions examined in terms of Evaluation Factors for Qualification (EFQ), which specify exclusion due to**

- ✓Earthquake, Fault activity
- ✓Igneous activity
- ✓Uplift / Erosion
- ✓Quaternary unconsolidated deposits
- ✓Mineral Resources

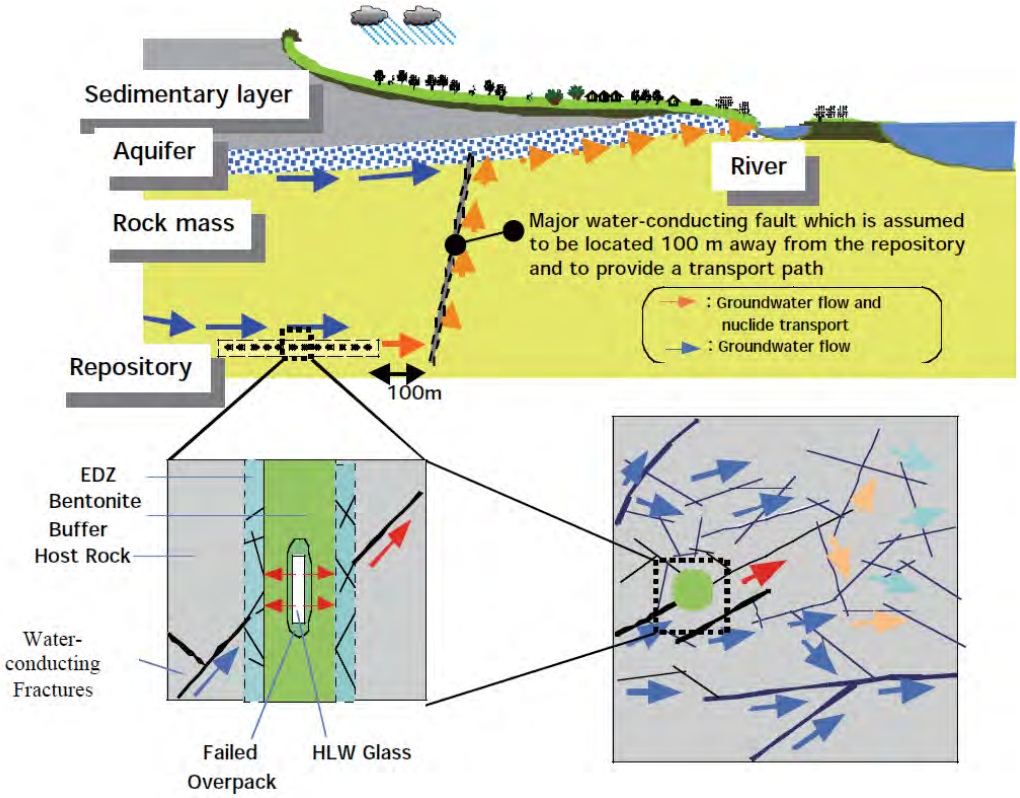
**Call for Volunteers**

- Exclusion criteria can be used to remove clearly unsuitable sites from further consideration
- But remaining options may not be as ideal for repository construction, operation and post-closure performance as those selected by a nomination process
- During a stepwise site selection process, options should be refined and compared in order to select the optimal combination of site and design for implementation




NEF:Nationwide Evaluation Factors

# H12 Reference PA Methodology

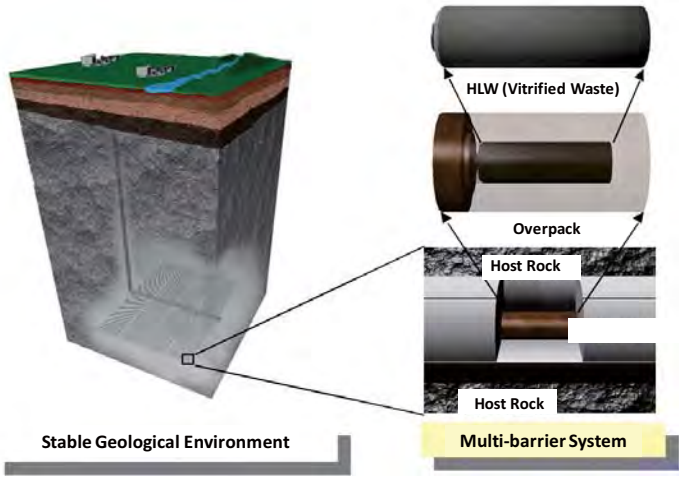


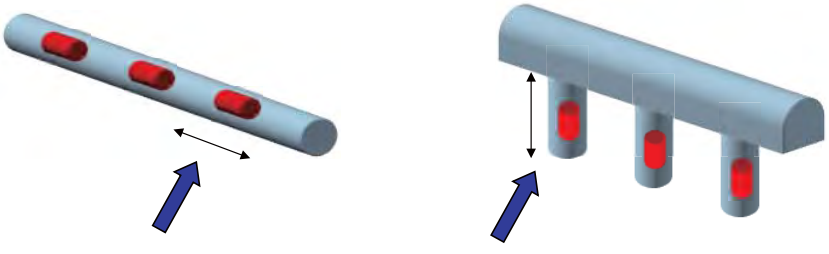



# H12 Reference Design

## Horizontal & Vertical Emplacement

- The water flux through EDZ per waste package is considered to be identical between horizontal and vertical emplacements
- In the case of horizontal emplacement, EDZ tends to be continuous pathway, and thus a large amount of nuclides flow into dominant pathways through EDZ
- In the case of vertical emplacement, fractures have less chance to hit the disposal pits



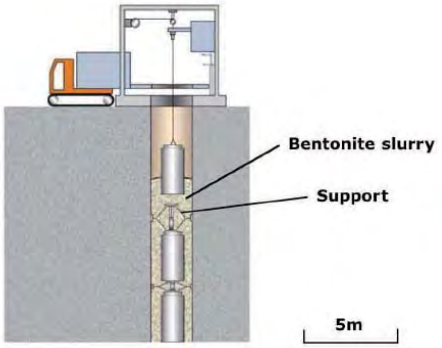
Water flux through EDZ

Water flux through EDZ

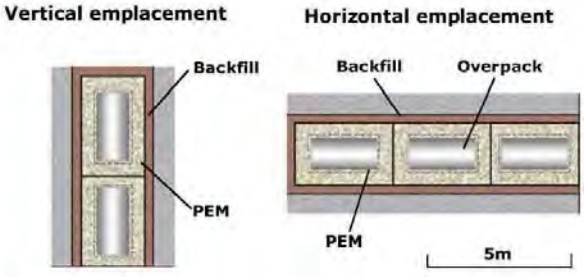
# NUMO concept catalogue (Examples)

## NUMO-TR-04-03

### Buffer emplacement options

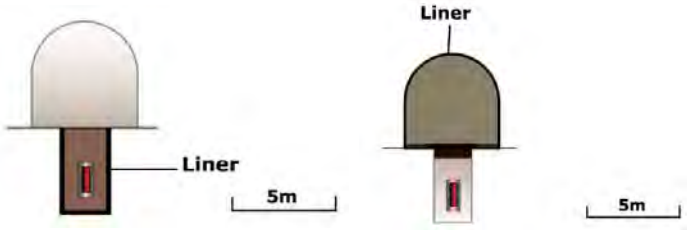



In-situ 'wet' emplacement for boreholes (bentonite slurry)

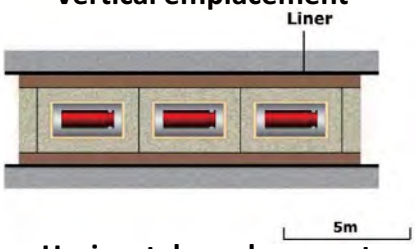



Prefabricated buffer

### Liner applications

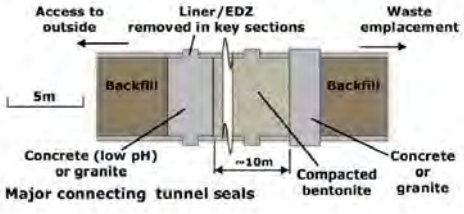



Vertical emplacement



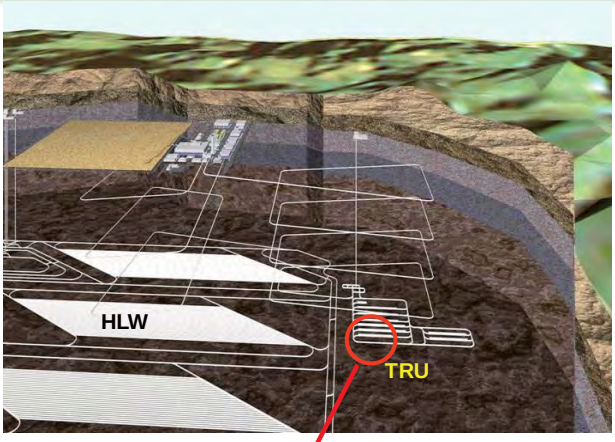

Horizontal emplacement

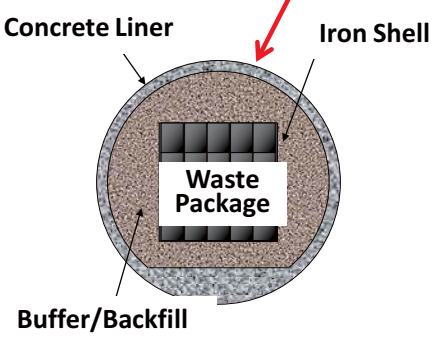
### Seals



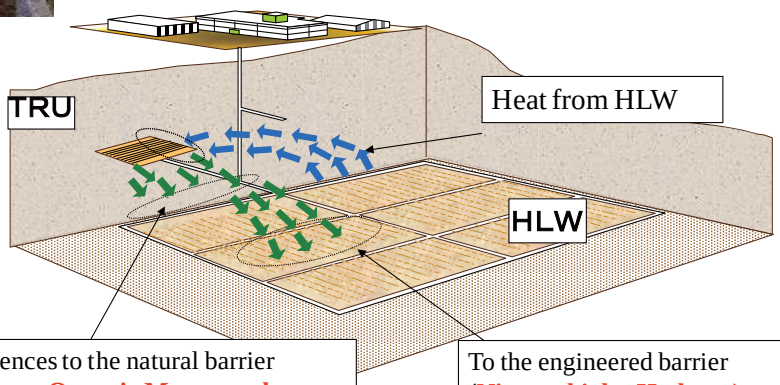



# TRU co-disposal




### Avoid Mutual influences



# Expected Output of Structured Brainstorming

- Develop host rock requirements related to engineering and long-term safety
- Classify the host rock characteristics to allow for stepwise identification of suitable rock volumes on the basis of practical measurement techniques
- Outline the process whereby feedback from requirement evaluation inputs to site characterization, design and modeling strategies

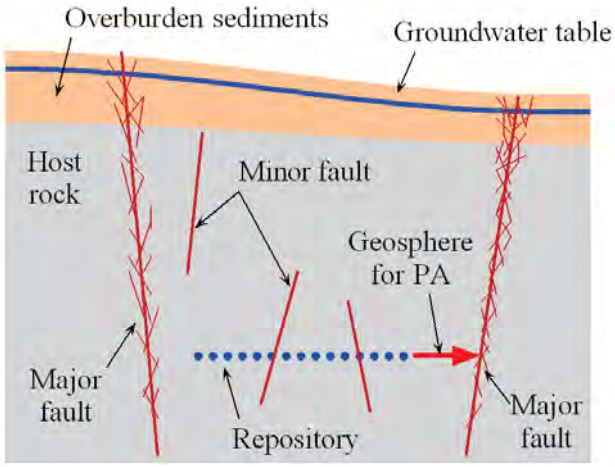


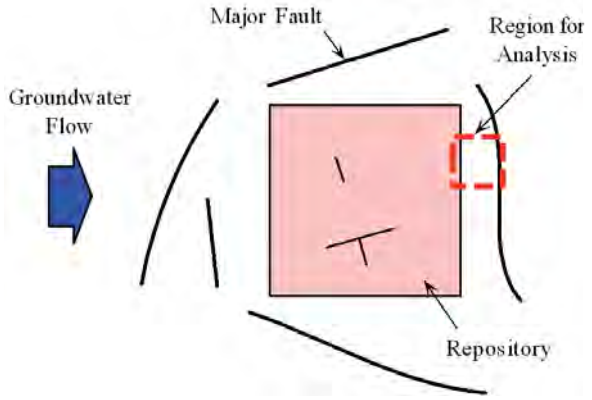
# Host Rock Requirements (Examples)

- **Repository design**
  - Minimum distances between canisters to control buffer temperature (buffer alteration)
- **Operational procedures**
  - Maximum permitted inflow to deposition tunnels and/or holes (buffer erosion, piping)
- **Operational safety**
  - A need to avoid large fractures in deposition tunnels and/or holes to ensure mechanical stability (spalling)
- **Post-closure safety**
  - Minimum distances from emplacement locations to large deformation zones (fast transport pathway)

# Identify possible repository horizons

- **Suitable depth**
  - geothermal gradient
  - rock strength and stress field
  - geochemistry
  - groundwater flow
- **Respect distance from major water-conducting faults（MWCF）**
  - prevent fast transport pathways

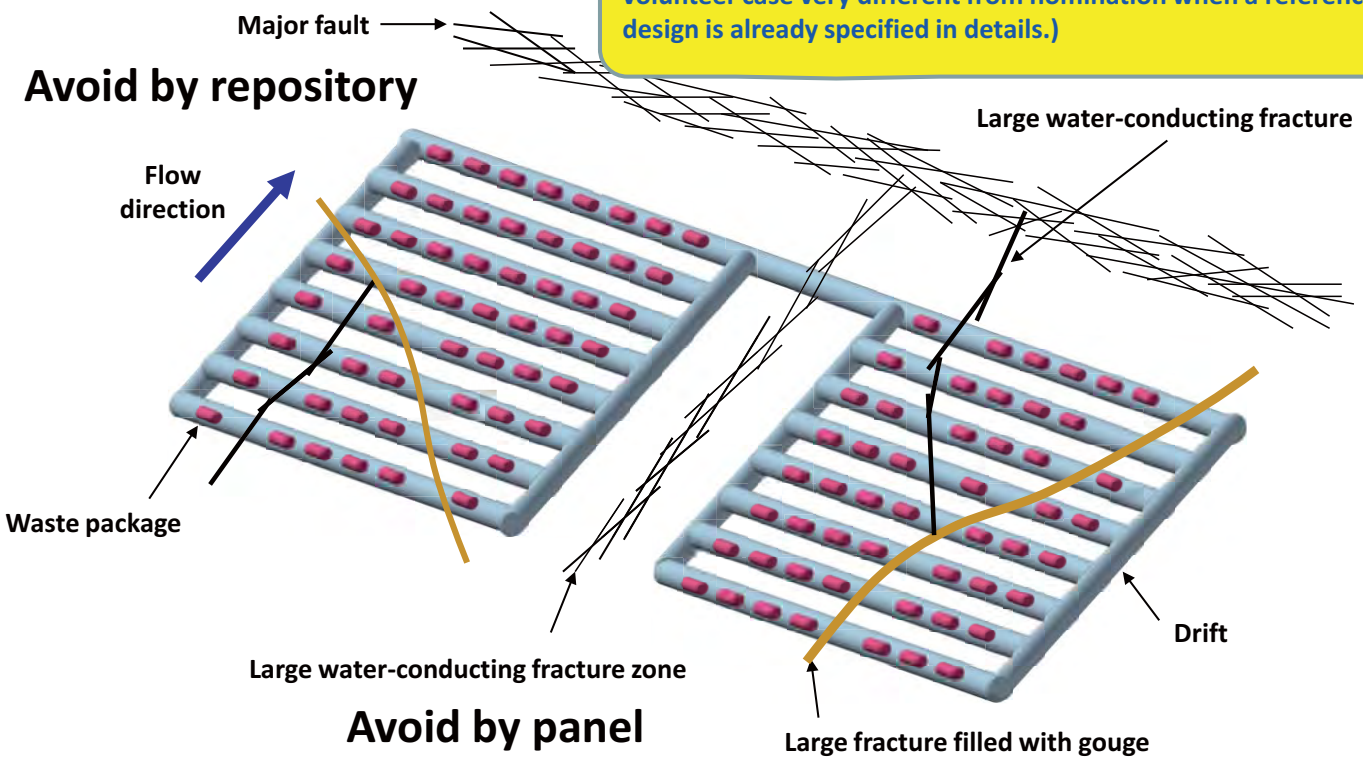





# Stepwise Identification of Suitable Rock Volumes

A stepwise iteration between site characterization team and designers/PA team is needed to establish hard constraints (NB volunteer case very different from nomination when a reference design is already specified in details.)

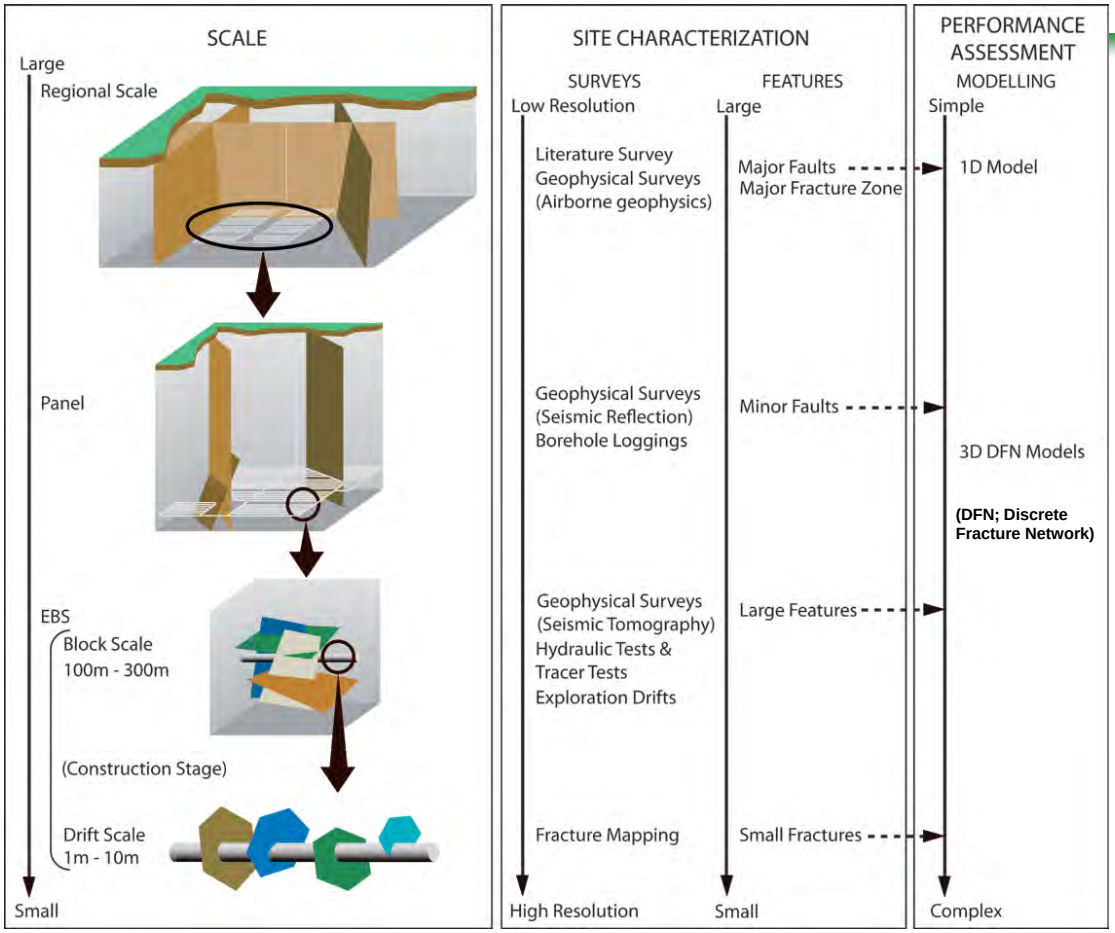


# Iterative Process

**Avoid by repository (Regional scale)**

**Avoid by panel (Panel scale)**

**Avoid by waste emplacement (EBS scale)**






# Feedback

- **Existing site understanding summarized in SDM will constrain or affect on the assessment of suitable host rock**

**→Ideally there should be an interface between SDM and conceptual designs with associated PA (NB "management cockpit" idea)**

- **H12 reference design or PA methodology poorly suited to the assessment of suitable host rock (idealized, feasible rather than practical)**

**→Rigorous representation of site characteristics in next generation of practical designs and realistic PA**

# Some perspectives to be discussed

- Identification of potential host rocks / emplacement horizons
- Definition of "Layout" determining features (LDF) at each scale
  - Regional
  - Panel
  - EBS
- Definition of design option determining features
  - HLW
  - TRU
- Characterisation of key site characteristics
  - (Literature survey)
  - Investigation in PIA (surface based investigation)
  - Investigation in DIA at surface based investigation phase
  - Investigation in DIA at mainly underground investigation phase
  - Repository construction
- Methods for iteration with PA and Design point
- Methods for comparing and ranking options
- Balancing flexibility with maintaining focus.



# Role Play (Group Discussion)

- **Implementer**

  Develop understanding required for next programme milestones in a time & cost-effective manner (avoiding disturbance to the site as much as possible)

  e.g. Define requirements based on practical measurements in a limited number of boreholes

- **Regulator**

  Assure safety in a robust manner

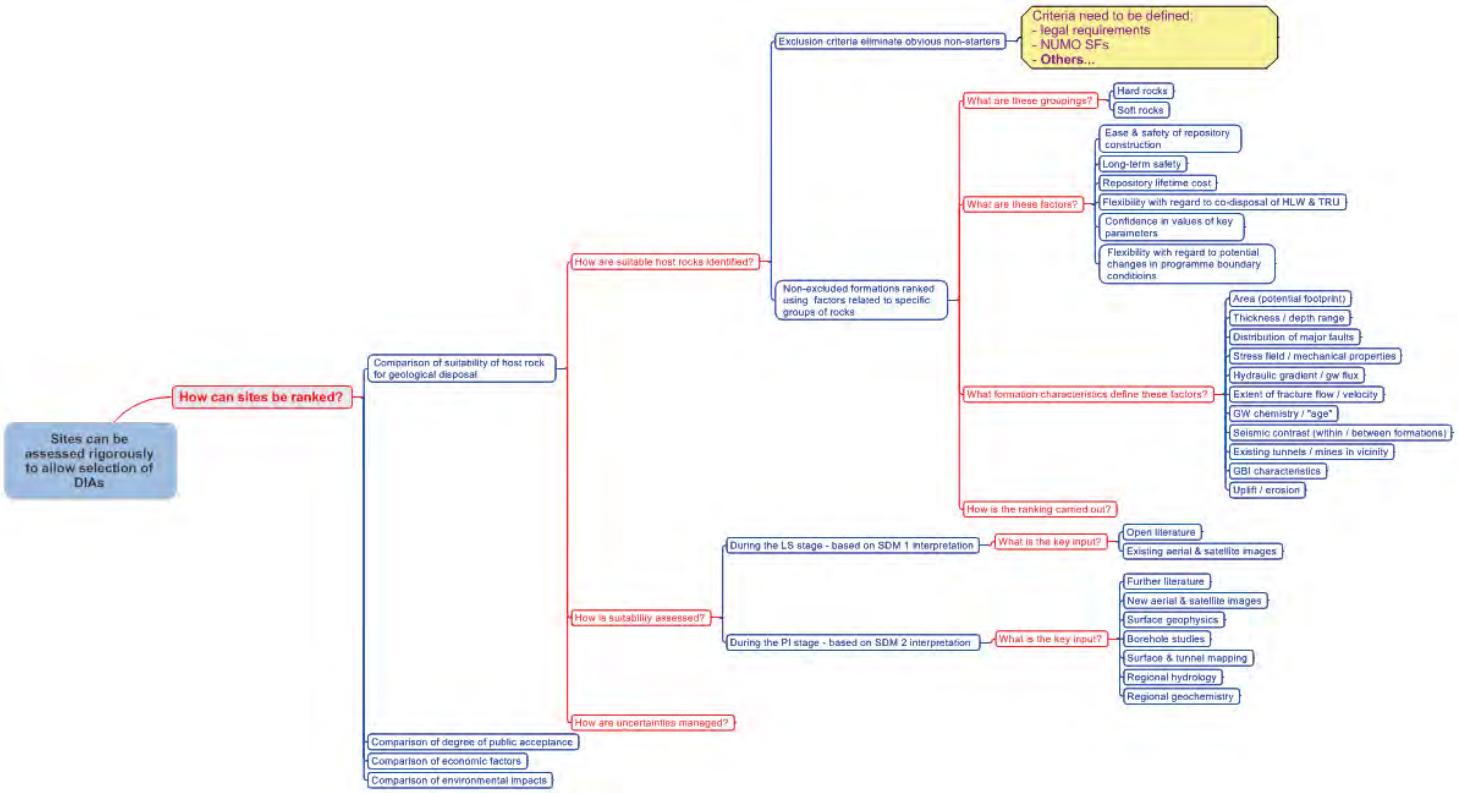
  e.g. Identify and quantify uncertainties and risks of future perturbations

- **Site investigator**

  Maximize efficiency, safety and practicality of the characterisation programme

  e.g. Assess hazards to staff and potential perturbations that could influence meeting set milestones

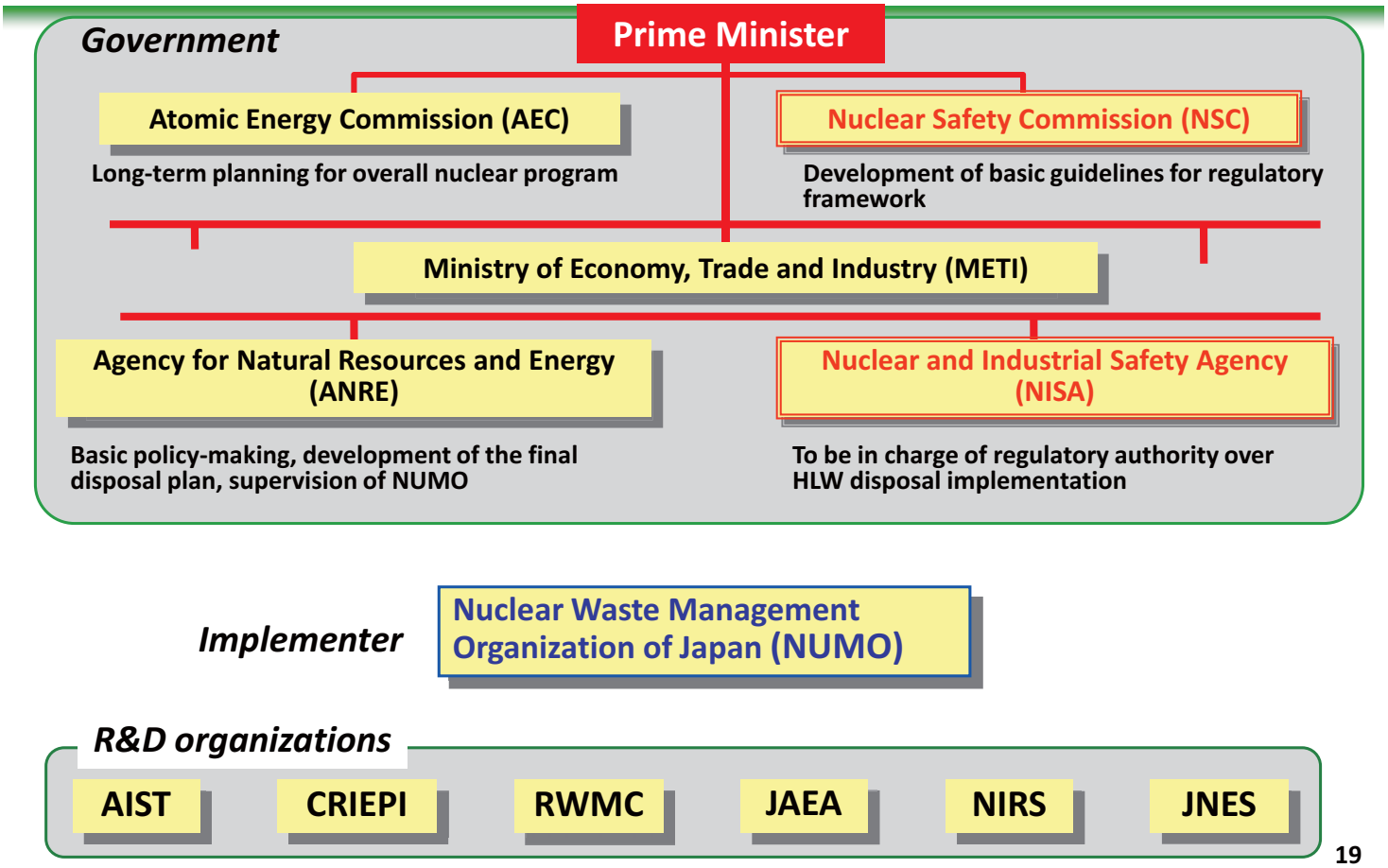
# Format (Argumentation Model)





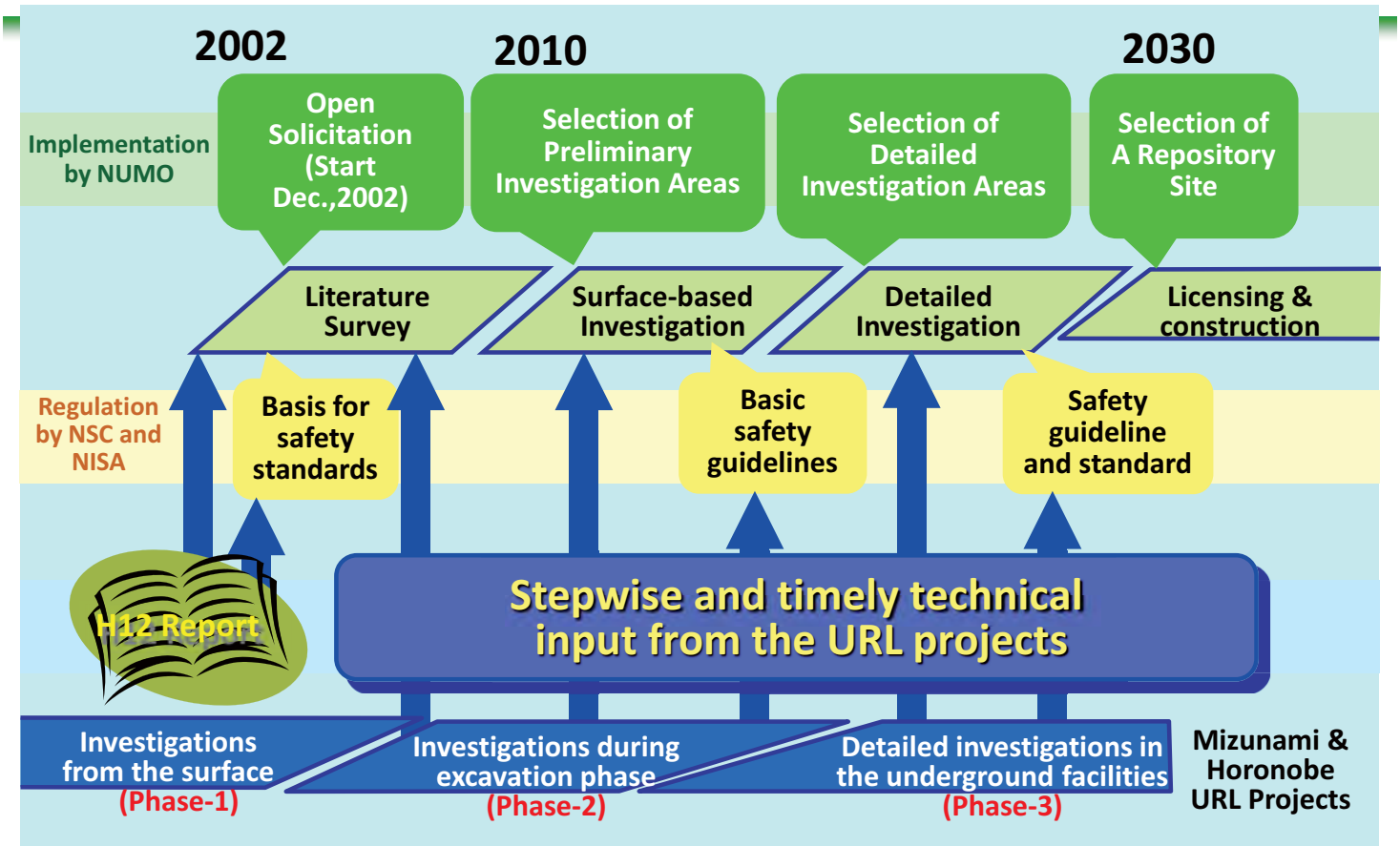

# Appendices

# Government and Organizations






# Stepwise Input from the URL Projects

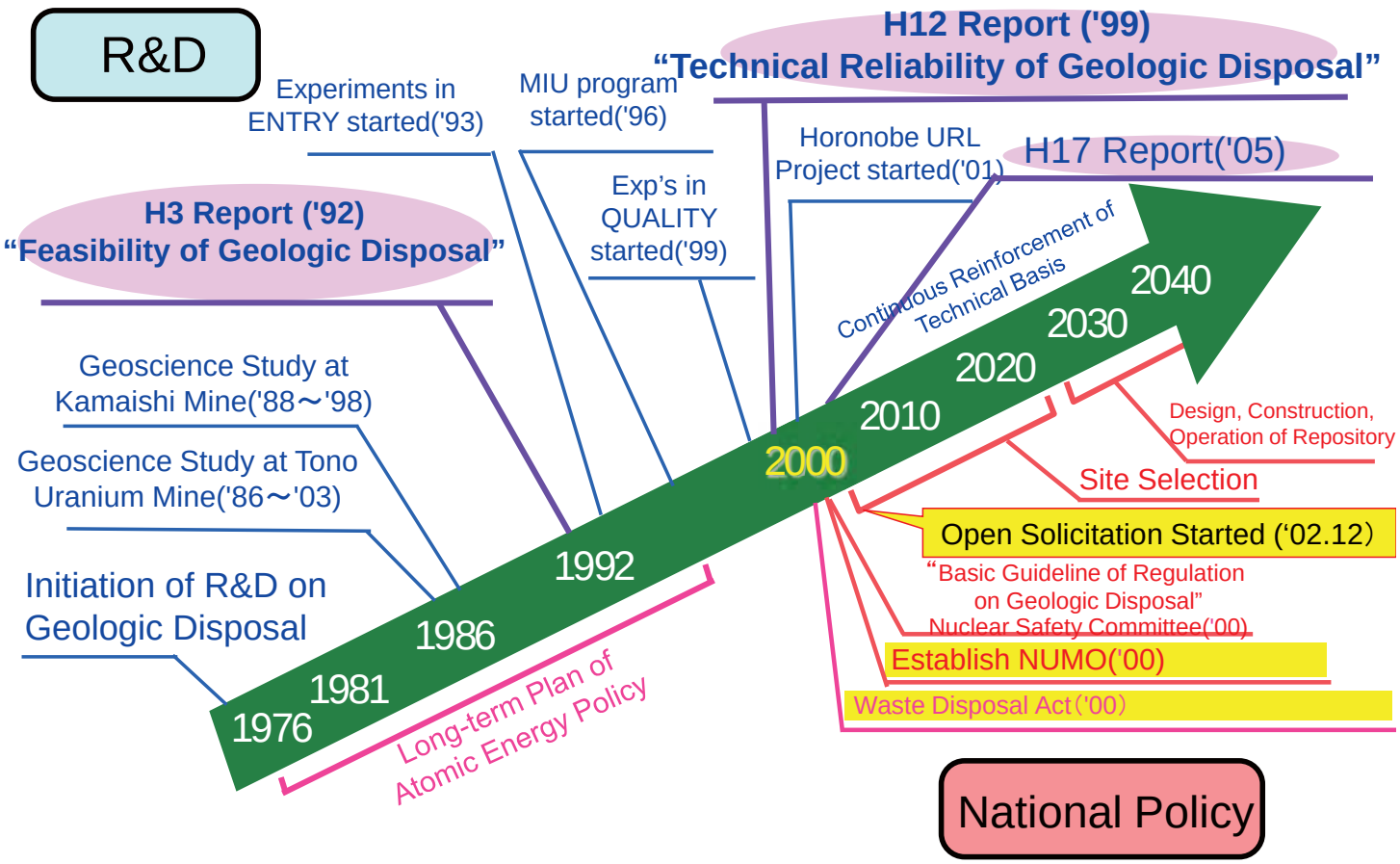


# ACRONYM

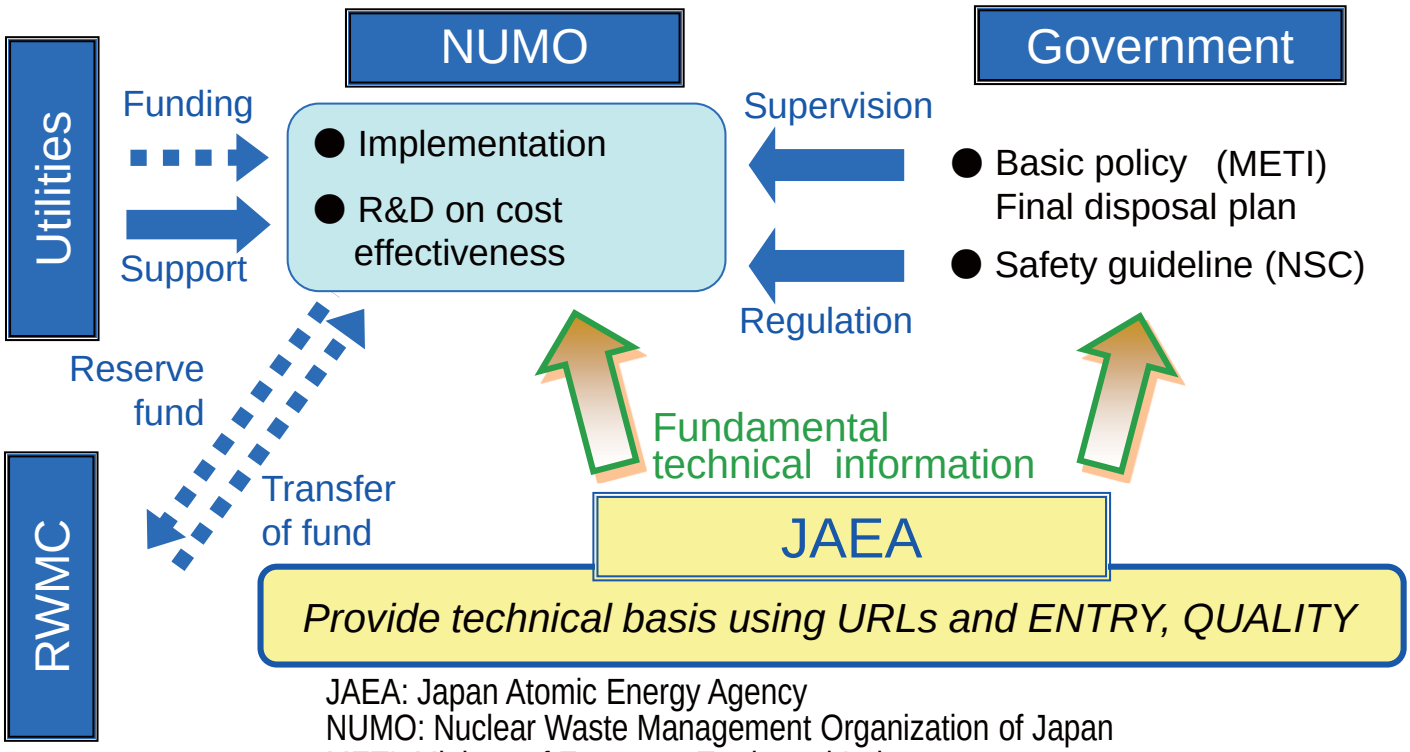
- LS; Literature Survey
- PI; Preliminary Investigation
- PIAs; Preliminary Investigation Areas
- DI; Detailed Investigation
- DIAs; Detailed Investigation Areas
- SDM; Site Descriptive Model
- PA; Performance Assessment
- EDZ; Excavated Disturbed Zone



# Schedule of Geologic Disposal in Japan

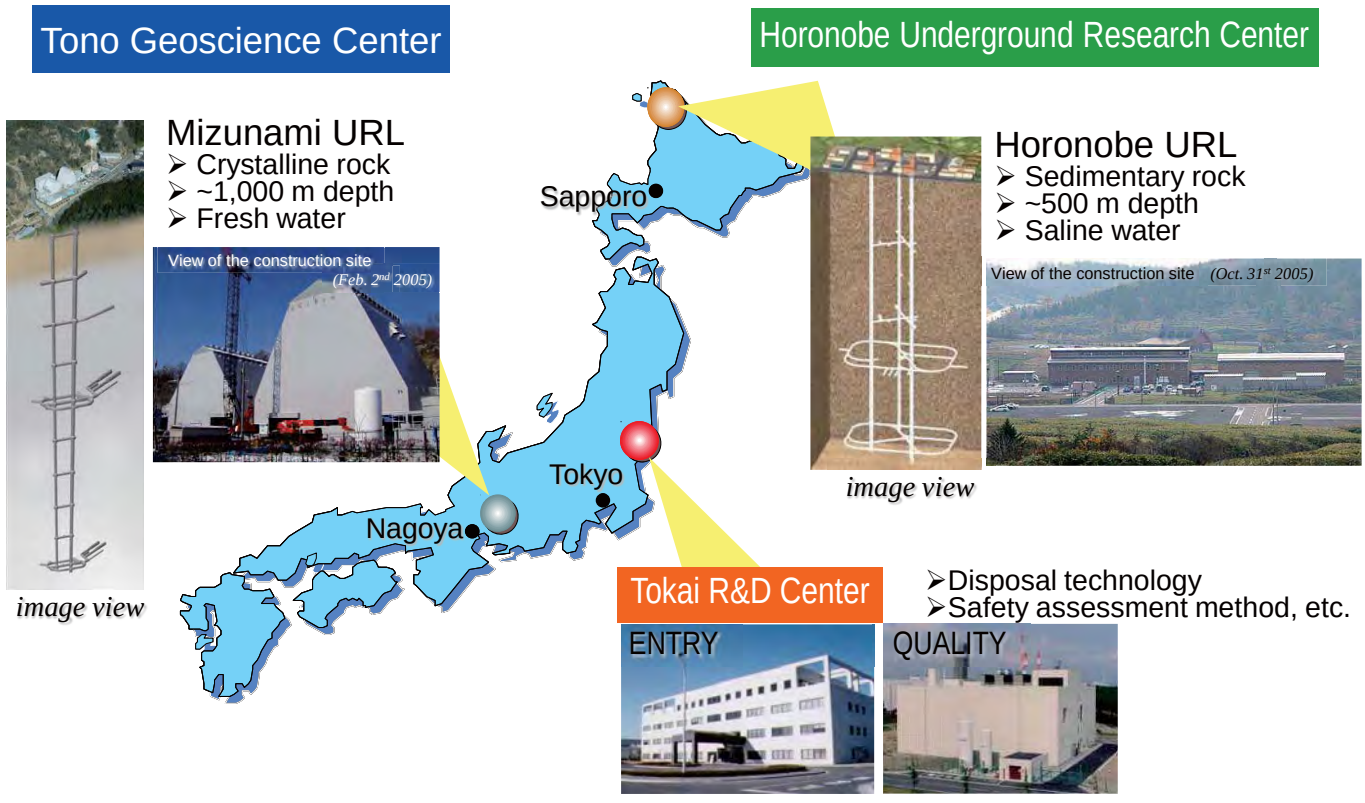


# Relevant Organizations of Geologic Disposal in Japan




JAEA: Japan Atomic Energy Agency
NUMO: Nuclear Waste Management Organization of Japan
METI: Ministry of Economy, Trade and Industry
NSC: Nuclear Safety Commission
RWMC: Radioactive Waste Management Funding and Research Center

# JAEA's R&D Facilities for HLW Disposal



# Main Goals of MIU Project

- To establish techniques for investigation, analysis and assessment of the deep geological environment
- To develop a range of engineering techniques for deep underground application