

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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JAEA

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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

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- 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!

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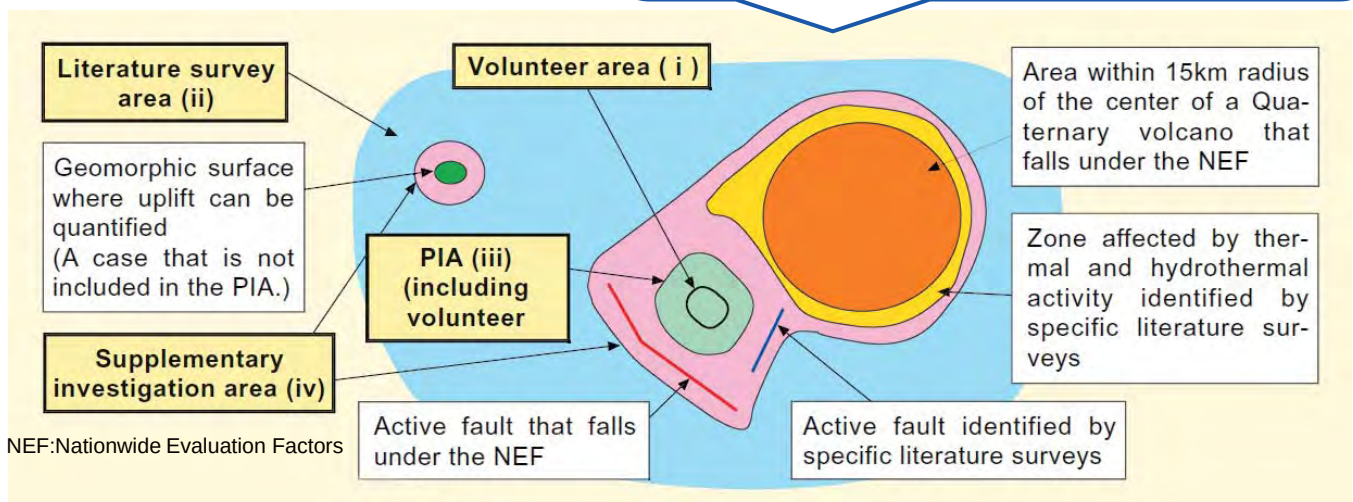
Selection of PIAs

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

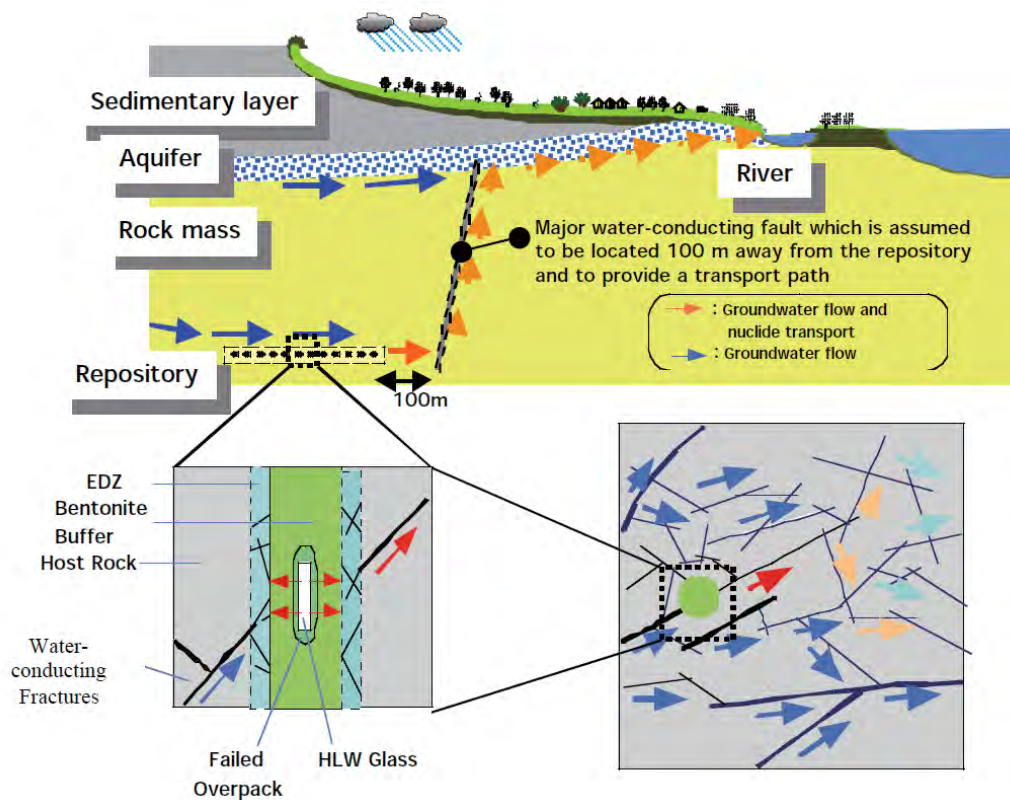
Call for Volunteers

- 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



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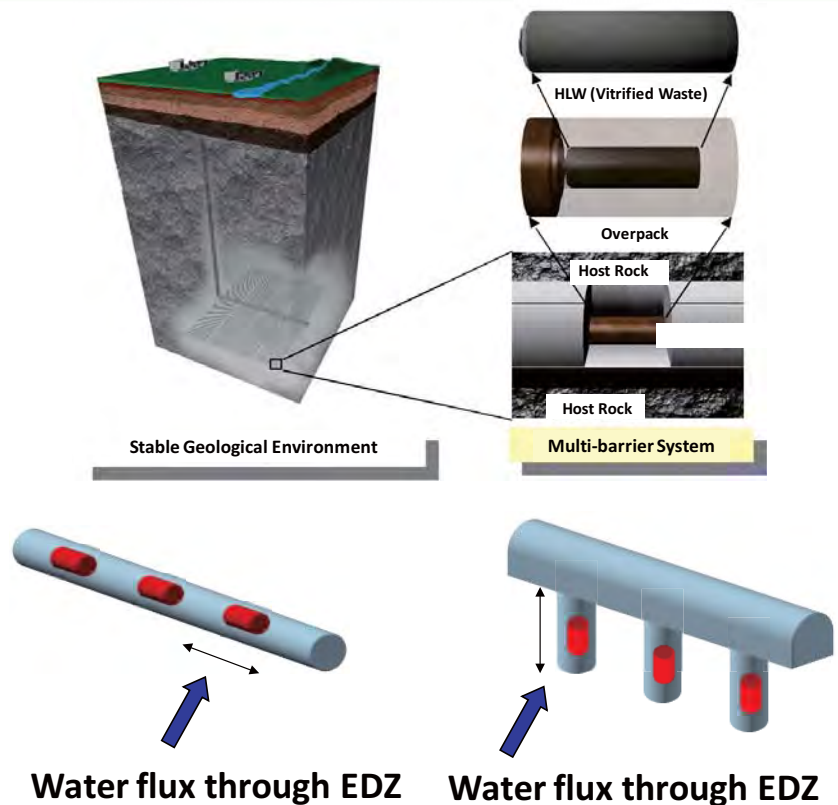
H12 Reference PA Methodology



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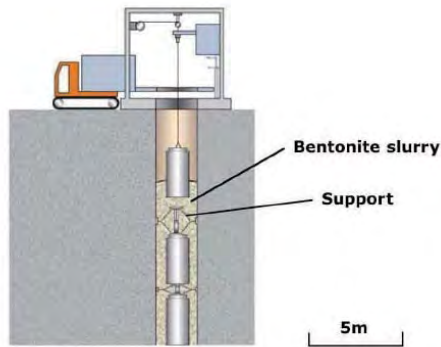
H12 Reference Design Horizontal & Vertical Emplacement

- 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



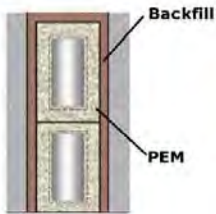
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Buffer emplacement options

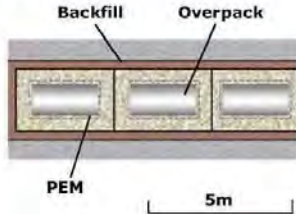


In-situ 'wet' emplacement for boreholes (bentonite slurry)

Vertical emplacement

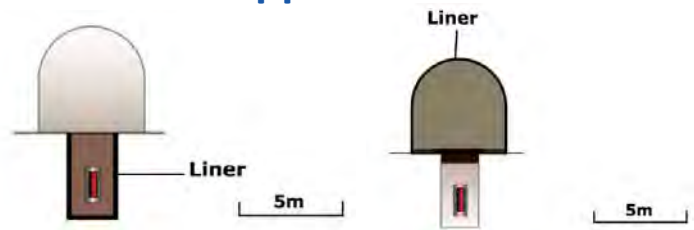


Horizontal emplacement

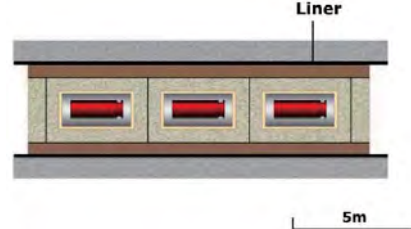


Prefabricated buffer

Liner applications

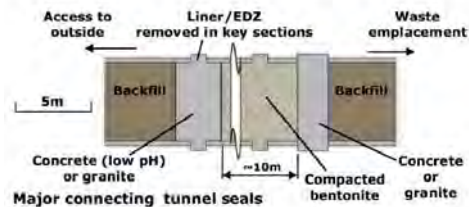


Vertical emplacement



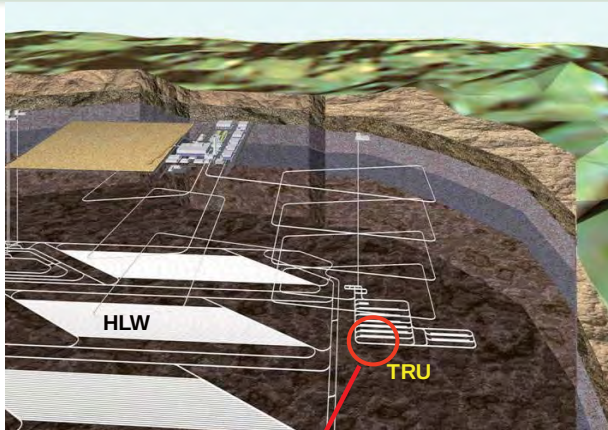
Horizontal emplacement

Seals

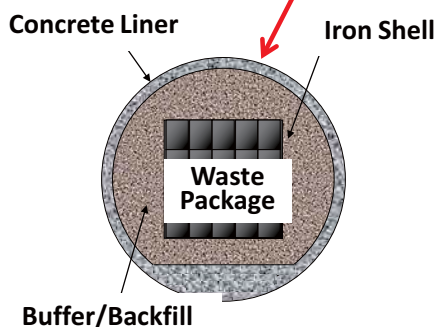
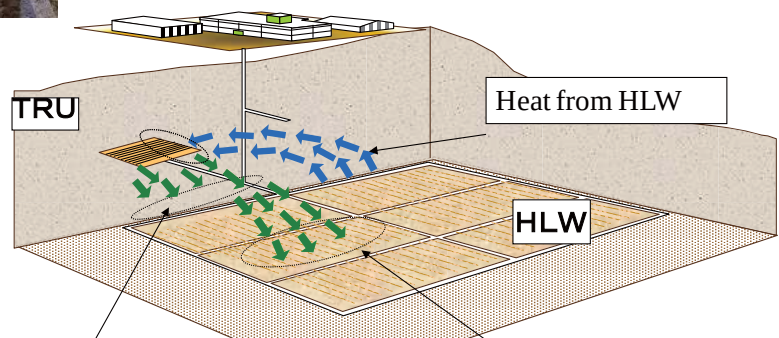


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TRU co-disposal



Avoid Mutual influences



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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

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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)

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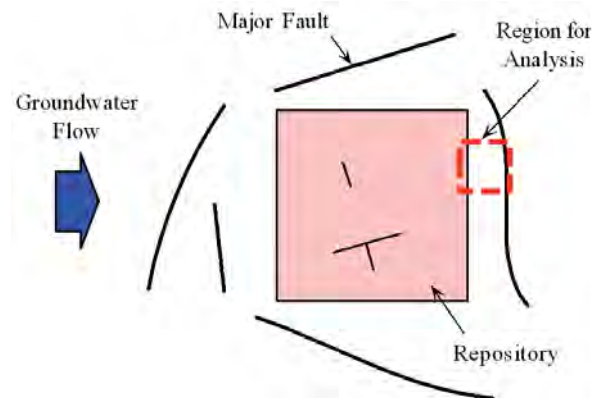
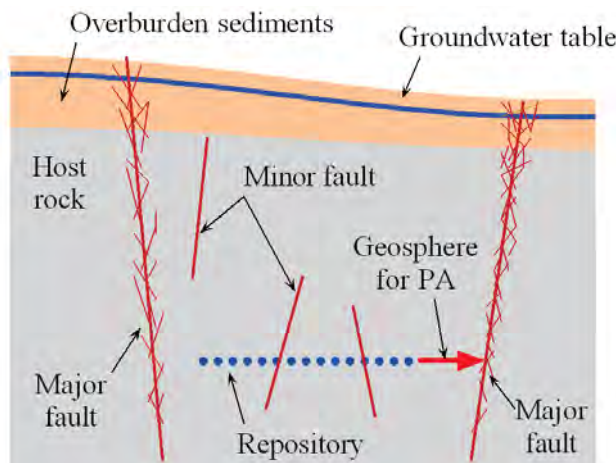
Identify possible repository horizons

➤ Suitable depth

- geothermal gradient
- rock strength and stress field
- geochemistry
- groundwater flow

➤ Respect distance from major water-conducting faults (MWCF)

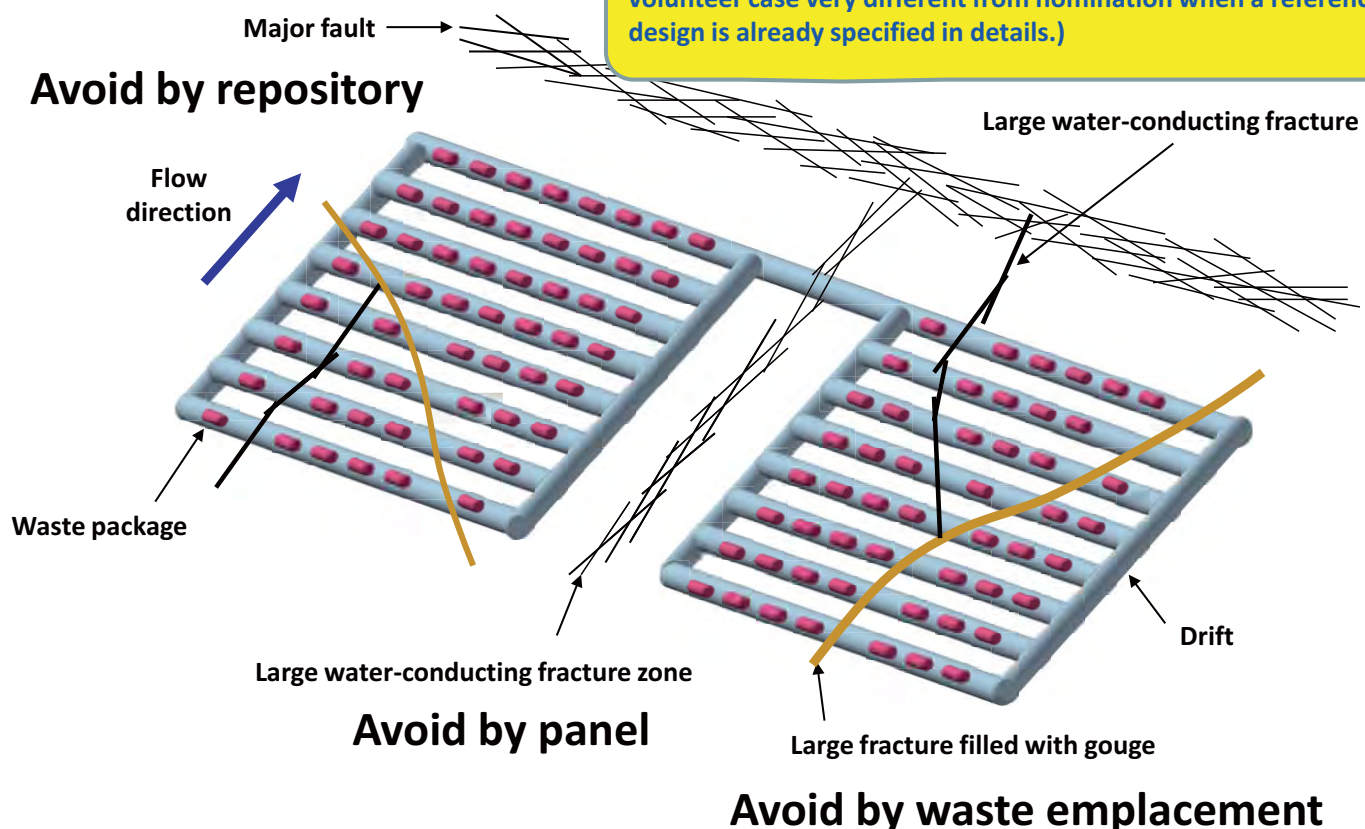
- prevent fast transport pathways



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Stepwise Identification of Suitable Rock Volumes

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



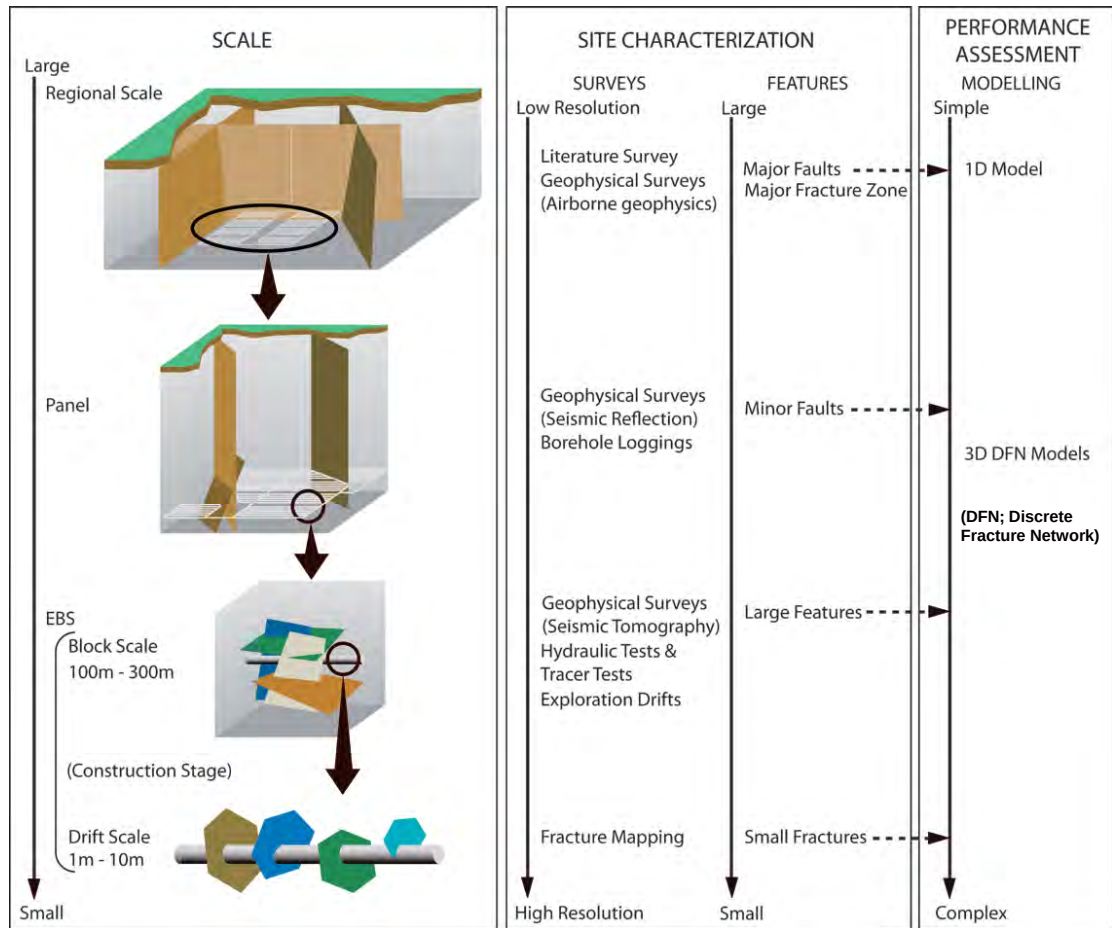
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Iterative Process

**Avoid by repository
(Regional scale)**

**Avoid by panel
(Panel scale)**

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



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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

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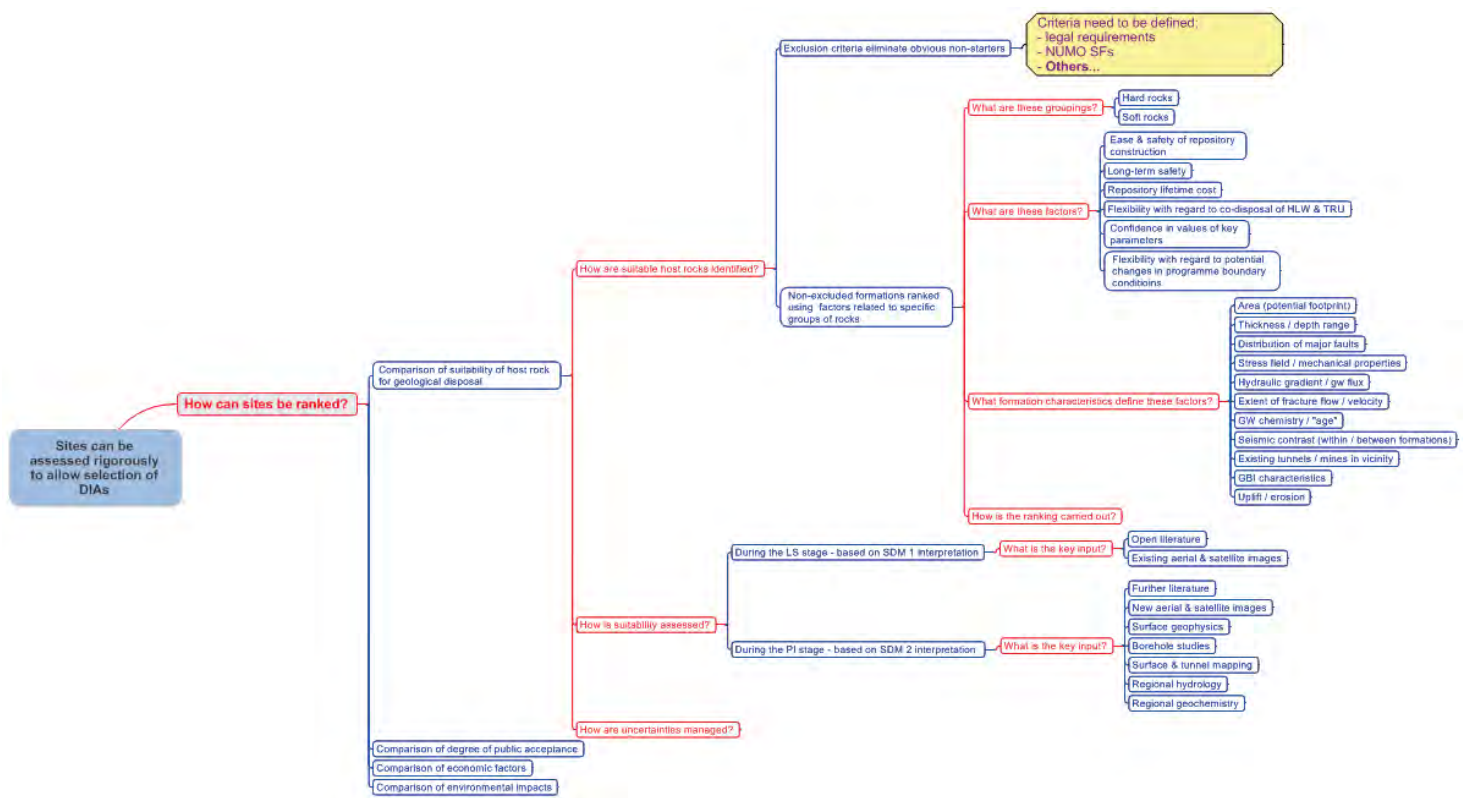
Some perspectives to be discussed

- 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.

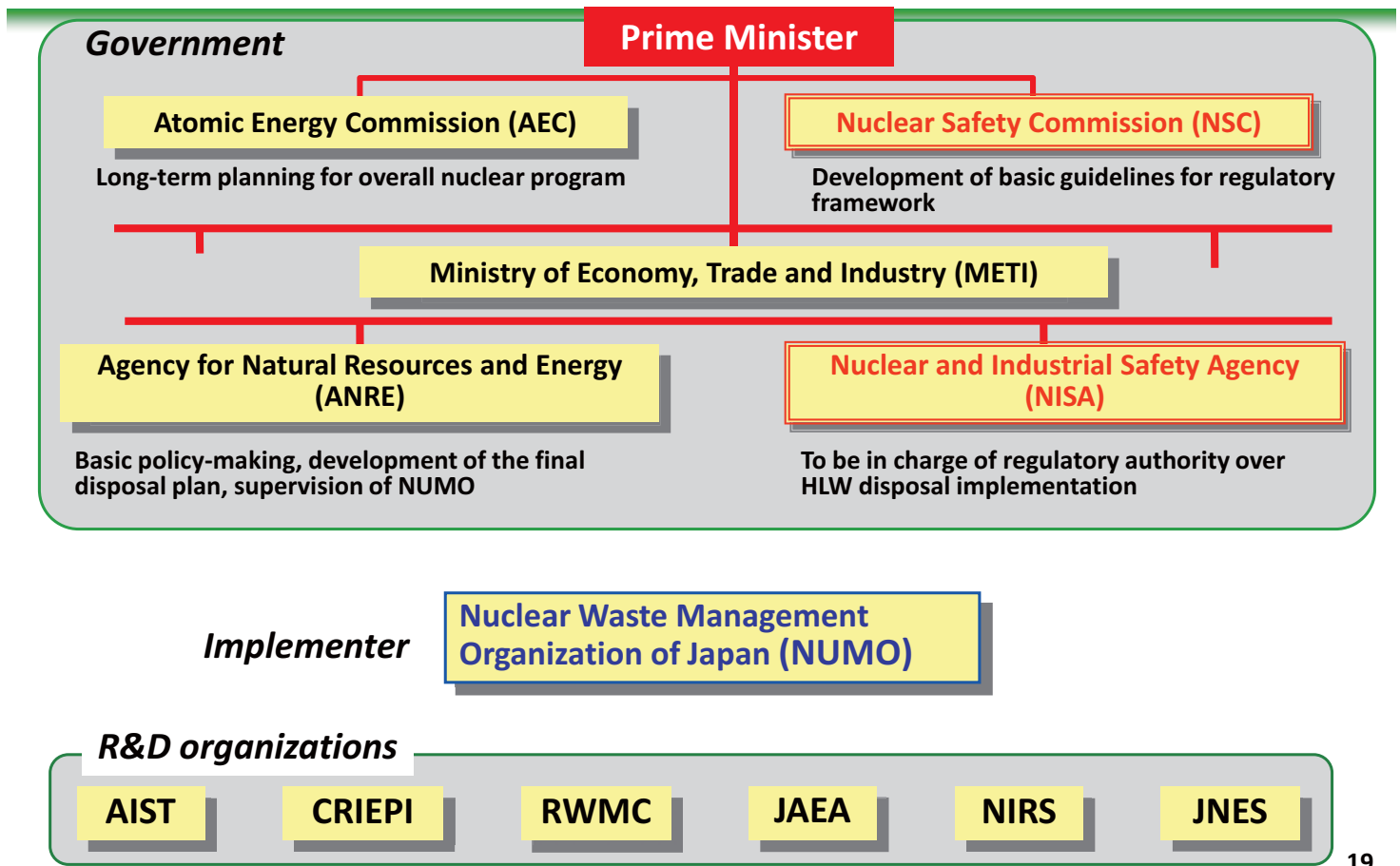
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Role Play (Group Discussion)

- **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

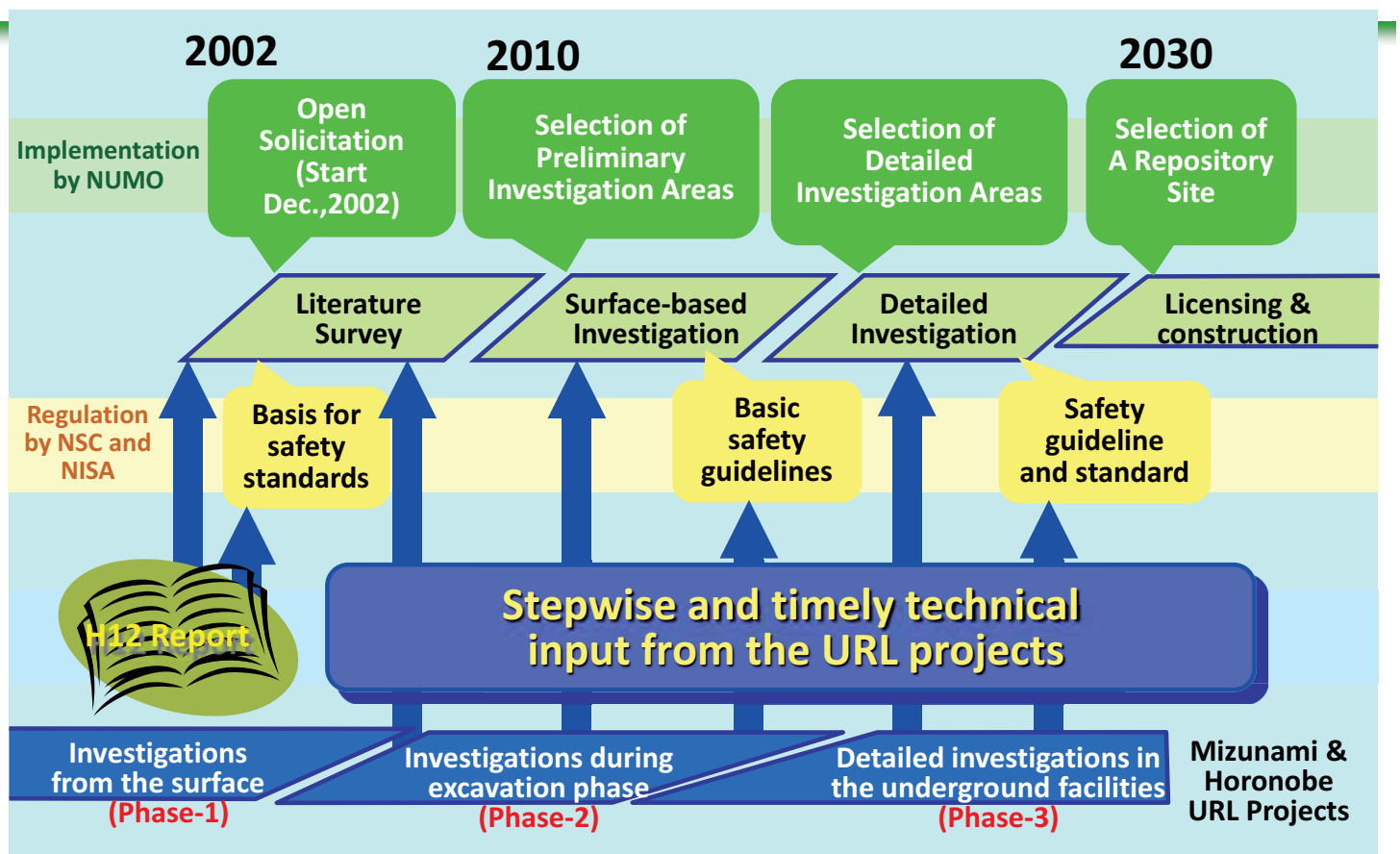


Appendices



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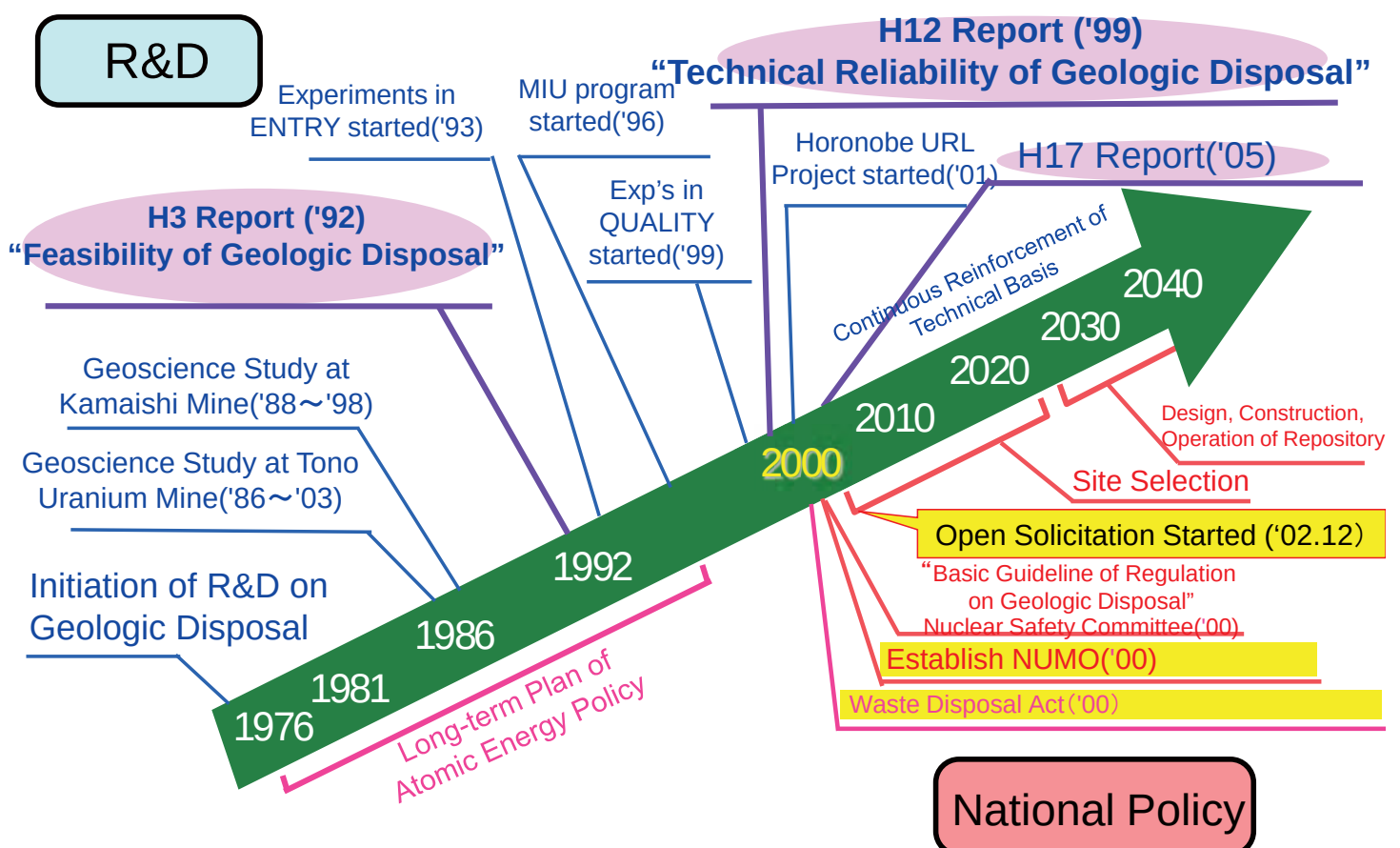
Stepwise Input from the URL Projects



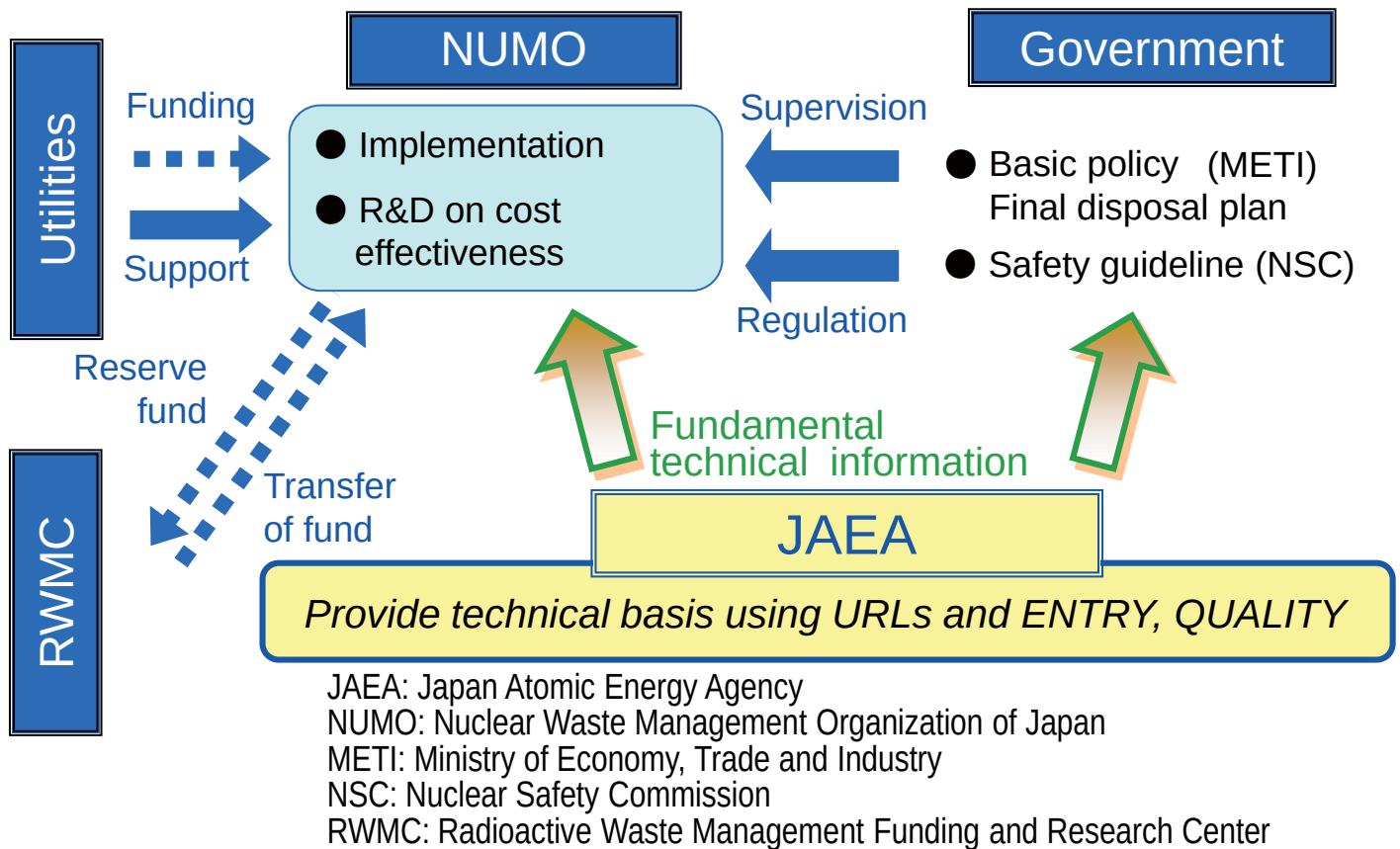
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- LS; Literature Survey
- PI; Preliminary Investigation
- PIAs; Preliminary Investigation Areas
- DI; Detailed Investigation
- DIAs; Detailed Investigation Areas
- SDM; Site Descriptive Model
- PA; Performance Assessment
- EDZ; Excavated Disturbed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

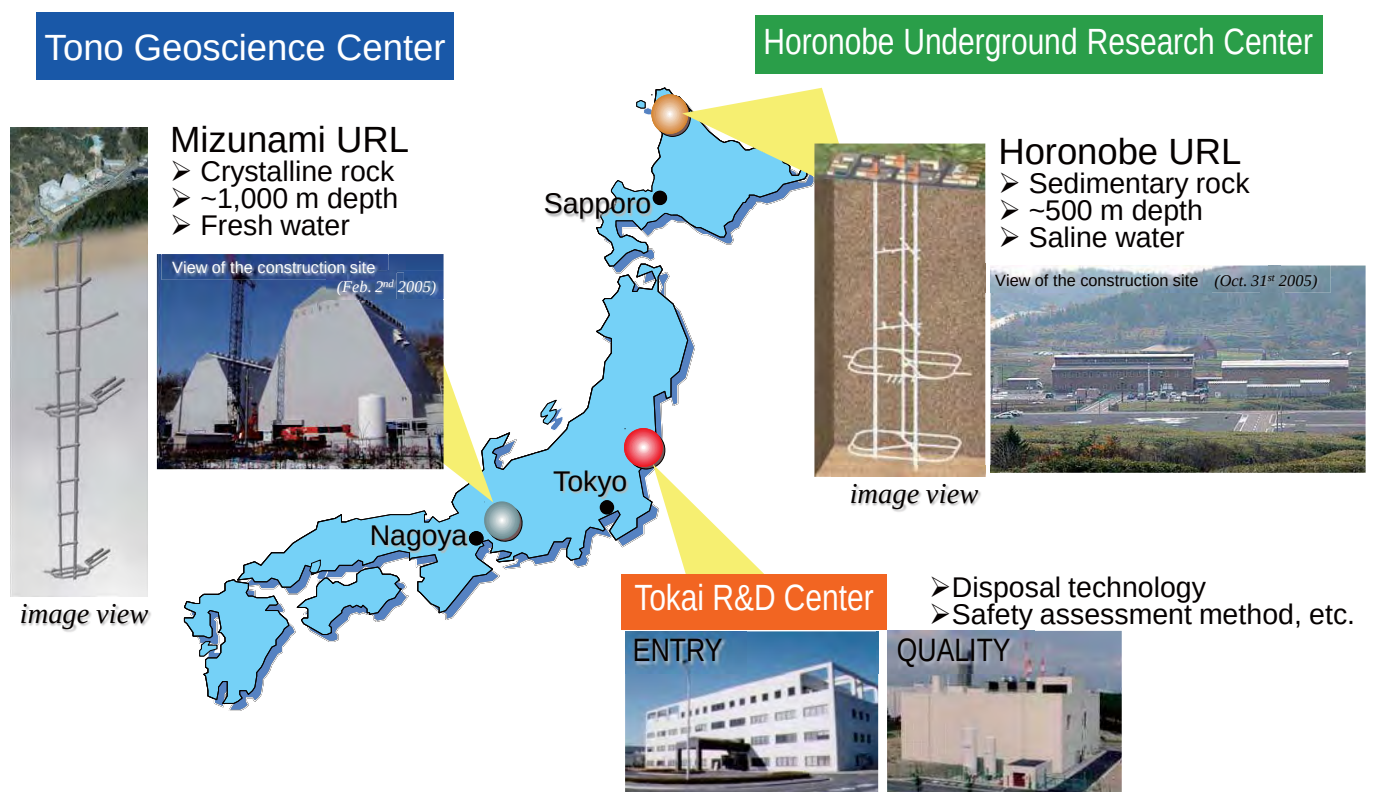
Schedule of Geologic Disposal in Japan



Relevant Organizations of Geologic Disposal in Japan



JAEC'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

