International Review Workshop on JAEA's URL projects

Relationship between JAEA's activities and requirements from Japanese implementer and regulator

18th June 2014

Japan Atomic Energy Agency

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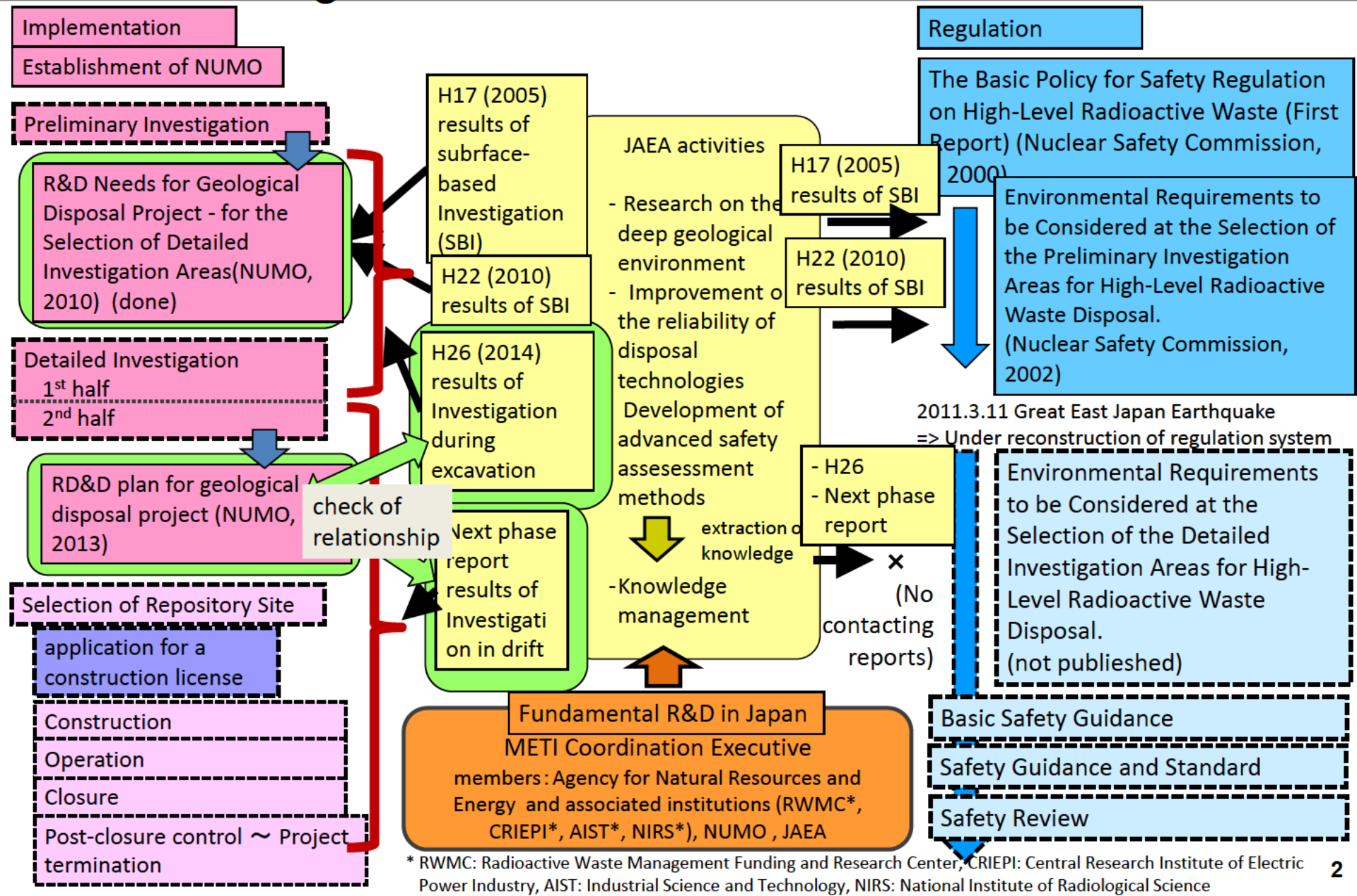
Contents

- Information the relationship among implementer, regulator and R&D in Japan
- Information of needs of Japanese implementer (NUMO) for R&D activities based on their latest report
  - Information on NUMO's expectations about developing technologies for R&D bodies
- Brief demo of JAEA KMS* (especially ISIS**)

* KMS : Knowledge Management System

** ISIS: Information Synthesis and Interpretation System, carried out under a contract with METI (Ministry of Economy, Trade and Industry) as a part of its R&D supporting programme for developing geological technology, FY 2007-2012

Relationship among implementation, regulation and JAEA's activities



* RWMC: Radioactive Waste Management Funding and Research Center, CRIEPI: Central Research Institute of Electric Power Industry, AIST: Industrial Science and Technology, NIRS: National Institute of Radiological Science

Information on NUMO’s expectations

- Intended document: “RD&D plan for geological disposal project (June 2013)”. (in Japanese)
- Relationship between contents of NUMO’s expectations for technologiy development by R&D bodies and “JAEA’s response to national programme requirements”
- Mainly investigations in the underground investigation facility in Detailed Investigation Stage (DI-2)

Developing Technologies expected by NUMO for research and development bodies[1)]

① Geological environment
- Development of comprehensive technologies for the investigation and evaluation of the deep geological environment by carrying out geoscientific basic research
- Advancement of technology for the investigation and evaluation of the deep geological environment

② Design and construction of engineered barrier
- Advancement of methodology on evaluation of long-term changes in the system performance, considering coupled behavior of engineering barrier
- Confirmation of design/construction technologies and performance of buffering material, backfilling material and plug, using research galleries of URL
- Establishment of conditions necessitating retrieval is required and development of retrieval technology according to the disposal options

③ Design of underground facility
- Specification of updating method of the facility design, depending on the progress of site investigation
- Establishment of basic criteria for emplacement of HLW and development methodology for evaluation of fractures
- Demonstration of grouting technology and performance, using the research gallery of URL

④ Safety assessment
- Modelling of phenomena and update of system performance assessment model

⑤ Safety design
- Knowledge of safety measure of excavation, operation and maintenance of under ground facilities
- Understanding and signing of knowledge of seismic movement characteristics by means of earthquake observation at the deep position

⑥ Monitoring
- Review of significance of monitoring at underground, consideration of parameter and measurement communication system
- Monitoring technologies from the surface during excavation
- Monitoring technologies about function of EBS and long-term safety after closure
- Monitoring technologies for institutional control and retrievability

● Transfer technologies and Knowledge

1) NUMO(2013): RD&D plan for geological disposal project (June 2013)

Relationship between NUMO's needs and "JAEA's response to national programme requirements" (1/3)

Next slides in detail

NUMO's Detailed needs

- Investigation /evaluation of the geological environment ○・・・ ○・・・ ○・・・
- Technologies for design, construction ○・・・ ○・・・ ○・・・
- Performance assessment ○・・・ ○・・・ ○・・・

Developing Technologies expected by NUMO [1] (excerpt)

Geological environment
- ○Development of comprehensive technologies
- ○Advancement of technology

Design and construction of engineered barrier
- ○Advancement of methodology on evaluation of long-term changes
- ○Confirmation of design/construction technologies
- ○development of retrieval technology

Design of underground facility
- ○Specification of updating method of the facility design
- ○Establishment of basic criteria for emplacement of HLW
- ○Demonstration of grouting technology and performance

Safety assessment
- ○Modelling of phenomena and update of system performance assessment model
- (data acquisition for process/phenomenon modeling)

Safety design
- ○Knowledge of safety measure
- ○Understanding and establishment of knowledge of seismic movement characteristics

Monitoring
- ○Review of significance of monitoring
- ○technologies from the surface during excavation
- ○technologies about function of EBS and long-term safety after closure
- ○technologies for institutional control and retrievability

Example of significance by foreign body [2] (excerpt)

- ○data for formulating criteria, demonstration
- ○ data for formulating criteria, demonstration
- ○ formulating criteria, scenario analysis
- ○ demonstration, formulating criteria
- ○scenario analysis, demonstration, formulating criteria
- ○demonstration
- ○formulating criteria
- ○demonstration, scenario analysis, formulating criteria
- ○demonstration, formulating criteria, scenario analysis
- (scenario analysis, formulating criteria)
- ○formulating criteria, demonstration
- ○formulating criteria, scenario analysis
- ○formulating criteria, demonstration, scenario analysis
- ○(same as above)
- ○(same as above)
- ○formulating criteria

JAEA's response to national programme requirements

【Horonobe】
- Near-field performance study
- Demonstration of repository design options
- Verification of the crustal-movement buffering capacity of sedimentary rocks

【Mizunami】
- Development of technology to control GW inflow into excavations
- Development of modelling methodology for heterogeneous fracture networks, and of Technology and methodology for analysis and evaluation of long-term changes of geological environment
- Development of long-term monitoring technology, and of Drift backfilling technology

Transfer technologies and Knowledge

⇒ use of JAEA KMS (a brief demo of ISIS)

1) NUMO (2013): RD&D plan for geological disposal project (June 2013)
2) SKB (2011) : Long-term safety for the final repository for spent nuclear fuel at Forsmark, SKB-TR-11-01.

Relationship between NUMO's needs and "JAEA's response to national programme requirements" (2/3) (Horonobe)

Developing Technologies expected by NUMO [1] (excerpt)*)	Example of significance by foreign body[2] (excerpt)**)
Geological environment ○Development of comprehensive technologies ○Advancement of technology	○ data for FC, D ○ data for FC, D
Design and construction of engineered barrier ○Advancement of methodology on evaluation of long-term changes ○Confirmation of design/construction technologies ○development of retrieval technology	○ FC, SA ○ D, FC ○ SA, D, FC
Design of underground facility ○Specification of updating method of the facility design ○Establishment of basic criteria for emplacement of HLW ○Demonstration of grouting technology and performance	○ D ○ FC ○ D, SA, FC
Safety assessment ○Modelling of phenomena and update of system performance assessment model (data acquisition for process/phenomenon modeling)	○ D. FC, SC (SA, FC)
Safety design ○Knowledge of safety measure ○Understanding and establishment of knowledge of seismic movement characteristics	○ FC, D ○ FC, SA
Monitoring ○Review of significance of monitoring ○technologies from the surface during excavation ○technologies about function of EBS and long-term safety after closure ○technologies for institutional control and retrievability	○ FC, D, SA ○ FC, D, SA ○ FC, D, SA ○FC

JAEA's response to national programme requirements (see the presentation materials of "Current status of next phase plans (MIU/Horonobe)")

【Horonobe】
- Near-field performance study
- Demonstration of repository design options
- Verification of the crustal-movement buffering capacity of sedimentary rocks

【legend】
*) : as to code number, see slide #4
**) FC: formulating criteria
D: demonstration
SA: scenario analysis

1) NUMO (2013): RD&D plan for geological disposal project (June 2013).
2) SKB (2011) : Long-term safety for the final repository for spent nuclear fuel at Forsmark, SKB-TR-11-01.

Relationship between NUMO's needs and "JAEA's response to national programme requirements" (3/3) (Mizunami)

Developing Technologies expected by NUMO [1] (excerpt)*)	Example of significance by foreign body[2] (excerpt)**)
Geological environment ○Development of comprehensive technologies ○Advancement of technology	○ data for FC,D ○ data for FC, D
Design and construction of engineered barrier ○Advancement of methodology on evaluation of long-term changes ○Confirmation of design/construction technologies ○development of retrieval technology	○ FC, SA ○ D, FC ○ SA, D, FC
Design of underground facility ○Specification of updating method of the facility design ○Establishment of basic criteria for emplacement of HLW ○Demonstration of grouting technology and performance	○ D ○ FC ○ D, SA, FC
Safety assessment ○Modelling of phenomena and update of system performance assessment model (data acquisition for process/phenomenon modeling)	○ D. FC, SC (SA, FC)
Safety design ○Knowledge of safety measure ○Understanding and establishment of knowledge of seismic movement characteristics	○ FC, D ○ FC, SA
Monitoring ○Review of significance of monitoring ○technologies from the surface during excavation ○technologies about function of EBS and long-term safety after closure ○technologies for institutional control and retrievability	○ FC, D, SA ○ FC, D, SA ○ FC, D, SA ○FC

JAEA's response to national programme requirements (see the presentation materials of "Current status of next phase plans (MIU/Horonobe)")

【Mizunami】
- Development of technology to control GW inflow into excavations
- Development of modelling methodology for heterogeneous fracture networks, and of Technology and methodology for analysis and evaluation of long-term changes of geological environment
- Development of long-term monitoring technology, and of Drift backfilling technology

【legend】
*) : as to code number, see slide #4
**) FC: formulating criteria, D: demonstration
SA: scenario analysis
——: implementation in Mizunami
- - - -: implementation in terms of investigation of geological environment

1) NUMO (2013): RD&D plan for geological disposal project (June 2013).
2) SKB (2011) : Long-term safety for the final repository for spent nuclear fuel at Forsmark, SKB-TR-11-01.

URL and regulator

OECD/NEA(2001):

- Participation in a URL programme can allow a regulator to develop and/or improve the dialogue with the implementer and public on a later repository project.
- A URL programme, in particular one in a generic URL at the earlier stages of repository development, has an important role in the regulatory context, in that it supplies information that is of direct relevance to the regulatory authorities in their assessment of the general feasibility of the proposed disposal concept.
- A URL can also provide a vehicle for a regulator to develop and test its own models for use in evaluating a repository.
- The data provided by a URL programme may allow a regulator to perform an independent safety assessment for a repository, to identify key areas in which to focus for an actual safety assessment submitted by an implementing agency.
- This type of exercise can provide valuable experience and training for the personnel who will be performing the regulatory assessment of a repository.

IAEA(2001):

- Numerous generic URLs have proved the usefulness ....., and for regulatory authorities to develop their own experimental expertise

- **OECD/NEA(2001):The Role of Underground Laboratories in Nuclear Waste Disposal Programmes, OECD/NEA, Paris**
- **IAEA(2001):The use of scientific and technical results from underground research laboratory investigations for geological disposal of radioactive waste, IAEA-TECDOC-1243, IAEA, Vienna**

Conclusion

- It is possible to relate “JAEA’s response to national programme requirements” with needs of implementer.
- It is useful for regulator to develop their own experimental expertise.