

# Current Status of Program for Geological Disposal of high-level radioactive waste (HLW) in Japan<sup>1</sup>

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In Japan, the Government started R&D programs on deep geological disposal of HLW separated from spent fuel during reprocessing, in parallel with the starting of the construction of Tokai Reprocessing plant in 1976.

In 2000, receiving a report from JAEA that concluded the feasibility of deep geological disposal of HLW in Japan, the Act on Specified Radioactive Waste Final Disposal was enacted, and thereby the Ministry of Economy, Trade and Industry (METI) authorized the HLW producers to establish Nuclear Waste Management Organization of Japan (NUMO), which is an organization to plan and implement the geological disposal of HLW and promote R&D activities for geological disposal in cooperation with R&D institutions, in parallel with the Final Disposal Fund that manage the fee for final disposal collected from all electric customers to make sure all costs of NUMO's activities will be secured.

In accordance with the Act, NUMO adopted a stepwise process for determining the site for repository, which consists of literature survey, preliminary investigation and detailed investigation, and at each step of which process opinions of the concerned local communities should be respected.

Since its launch, while promoting R&D of deep geological disposal in cooperation with R&D institutions at home and abroad, NUMO hold seminars and symposiums to inform the public on the importance and safety of

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geological repositories in cooperation with METI on a nationwide scale and in 2002, announced to all municipalities in Japan open solicitation for accepting the literature survey.

In 2007 Toyo town in Kochi prefecture officially expressed its participation in the literature survey. A strong opposition campaign spread in the municipality of which population was about 3000, however, and an ensuing mayoral election resulted in the defeat of the incumbent who promoted the project. The town then withdrew its submission.

After this event, METI started to explore the way to induce municipalities to consider the acceptance of literature survey but could not come to concrete conclusions before the occurrence of Great East Japan Earthquake and a major nuclear accident at Fukushima Daiichi in March 2011.

The accident at Fukushima Daiichi caused public disbelief in the Government and amplified public concerns about the safety of geological disposal. In this social environment, the Science Council of Japan (SCJ) published their opinion in response to the Japan Atomic Energy Commission's request for opinion on the effective approaches of public outreach with a view to promoting the final disposal of high-level radioactive waste, which request had been sent to SCJ before the Accident.

SCJ's opinion was that

1. Social consensus on the nuclear energy policy should be pursued before talking about geological disposal of HLW;
2. The limitation of scientific and technological capability should be recognized and scientific autonomy for scientific deliberation should be secured;
3. A policy framework should be rebuilt centered on temporary storage and total volume control of the waste;
4. Socially acceptable procedures should be pursued, formulating policies based on the principle of fair burden-sharing;
5. Multi-step procedures should be pursued to build consensus by

establishing venues for discussion and

6. Need for long-term tenacious efforts to solve the problems should be recognized.

Deliberating this opinion of SCJ, JAEC recommended the Government;

1. To clarify the amount and nature of HLW in association with nuclear fuel cycle policies to be pursued in the post-Fukushima accident era, noting that one repository under planning will be sufficient for several decades of nuclear power generation;
2. To review the safety of geological disposal of HLW based on the latest knowledge of science and technology and geology in particular, and share the result with the public as well as learned societies;
3. To make it clear that its efforts to realize final disposal of HLW be promoted step-by step, assuring reversibility and retrievability so that the course of action can be modified based on the result of consensus with the public and risk assessments to be emerged in the future;
4. To take initiative in sharing information and exchanging opinions with the public through regular meeting with citizens and municipalities.

In April 2014, the government adopted the new Basic Energy Plan that outlined Japan's energy policy for achieving stable, economic and environmentally friendly energy supplies. In the plan, nuclear power was considered as a key base-load power source and the nuclear fuel cycle program was to be promoted as in the past in order to make an effective use of resources and reduce the volume and hazard level of HLW to be disposed of in geologic repositories.

Then it said that the geological disposal of HLW and used fuel, if necessary, is the issue the current generation who has benefitted from nuclear power generation should address and the action to realize the disposal should not be postponed by the extended storage of HLW.

As the majority of the public now have a feeling of antipathy to nuclear power, it insisted that nuclear community should sincerely communicate with the public about their resolve of never betraying the nation's right to be safe from

nuclear accidents by making full use of lessons learned from the accident at Fukushima, and the process to select a site for geological repository should be achieved stepwise through incessant consultation with the public, while securing reversibility of the process and retrievability of waste and placing the first priority on the safety at any time.

Furthermore, it said that the government will establish a venue for deliberation with the public on the safety and necessity of deep geological repository, inviting the participation of a diverse range of residents in the municipalities that are interested in the disposal project, and will encourage municipalities to accept the geological investigation of the area, explaining that the Government would cooperate with them to explore the way for sustainable development of the municipalities from the viewpoint of equity of benefit, respecting the action of the municipalities to accept the geological investigation of the area for the benefit of the nation.

At the same time, the Government established a group of expert in geology and asked the group to review the availability of geological environment desirable for the location of geological repository in Japan from the viewpoint of thermal, mechanical, hydrological and chemical characteristics, taking into consideration of knowledge in geology accumulated by NUMO and other research organizations since 2000. The group concluded that A) areas having preferable geological characteristics would be widely distributed in Japan; B) some type of natural events should be avoided in the site determination process due to their impact on the physical isolation and confinement functions of geological disposal systems and C) research on various earth science phenomena related to these impacts should be promoted continuously.

In these years, the NUMO has been active in the public outreach activities, holding seminar and symposium on the importance and safety of geological disposal on a nationwide scale, utilizing such tools as Geo Mirai PR vehicle, an 8-ton truck carrying models and panels describing information about geological disposal.

NUMO has been also active in the systematic promotion of technology R&D in cooperation with various research organizations, including JAEA which operates underground research laboratories at Horonobe and Mizunami; awarding R&D contracts to companies with relevant expertise, participating in the various international collaborative activities promoted by the IAEA and the NEA and promoting R&Ds in cooperation with overseas GD implementers and research institutes.

Current R&D topics are 1) science and engineering for the investigation and evaluation of the geological environment; 2) development of engineering measures; 3) post-closure safety assessment methodology; 4) safety assurance during project implementation; 5) waste form and inventory; 6) development of monitoring technology and confidence building of the safety of geological disposal.

Last but not least, NUMO decided recently, in accordance with such decision of government, to innovate its organizational structure so as to be able to pursue joint understanding on the importance of site surveys for geologic repositories with plural municipalities in parallel, as well as nationwide dialog activities to bring about a social environment to pay respect to municipalities that are interested in siting the repository. It also decided, as a unique implementer of deep geologic disposal, to compile a generic deep geologic disposal safety case report next year that should present essential information about the safety of geological disposal in Japan.

In summary, though no municipalities have successfully volunteered for site survey yet, Japanese government recently decided to improve the process by showing suitable areas for the repositories to the public with a view to encouraging municipalities to consider the acceptance of the survey and explaining that Government would cooperate with them to explore the way for their sustainable development, respecting their intent to contribute to the nation.

Therefore NUMO will strengthen, following the safety-oriented, stepwise procedure for the realization of geological repositories, the activity to

communicate in a transparent, impartial, authentic and open manner with stakeholders, keeping its knowledge and skills in relevant fields up-to-date through the promotion of relevant R&D activities in cooperation with experts at home and abroad.