Renewing Approaches to Geological Disposal of High-Level Radioactive Waste(HLW)
(Statement)

December 18, 2012
Japan Atomic Energy Commission

1. Approaches to the disposal of HLW in Japan

In Japan, the Special Committee on Disposal of High-Level Radioactive Waste (Special Committee) of the Japan Atomic Energy Commission (JAEC) made recommendations about the high-level radioactive waste (HLW) disposal system after two years of investigation and national debate, and published a report entitled "Basic Concept of HLW Disposal" in May 1998, including the following suggestions: i) the present generation must establish a waste disposal system, and we must not leave anything that would impose a burden on later generations, ii) geological disposal is the most practical technique currently available, but the mechanism and system of disposal should be socially acceptable; with risk management in mind and assuming potential unexpected events in future, iii) certain issues cannot be solved by discussions among experts, but their technological requirements should be discussed from a social acceptance perspective, iv) it is important that people outside the host area should regard disposal operation as their own problem in the first place to ensure social and economic equity between the host area and others, and that measures for coexistence of disposal operation and the host community should contribute to the long-term, self-sustaining development of these areas, rather than a temporary benefit, and v) at a national level, the ability to check each phase of the disposal operation is critical, and a mechanism and system for inspection at each phase as well as fair, independent third party reviews should be established.

The government, upon receiving this report, presented a bill called the Designated Radioactive Waste Final Disposal Act to the Diet for streamlining the required system based on the recommendations of the report, which was enacted in 2000. The Nuclear Waste Management Organization of Japan (NUMO) was approved by this law, whereupon the government decided on the basic policies and final disposal program. Based on these arrangements, the NUMO, R&D bodies and related administrative agencies started working to implement the geological disposal of HLW.

In order to meet the requirement defined in the supplementary resolution when the above act was enacted, namely that "the Nuclear Safety Commission shall commit itself to ensure safety", the Nuclear Safety Commission (NSC) provided the Basic Concept for Safety Regulations

Concerning the Disposal of High-level Radioactive Waste (1st report) and the Environmental Requirements in the Summary Survey Area Selection Process for the Disposal of HLW, as a neutral, professional third party organization independent of the regulatory authorities, acknowledging that new knowledge must be used flexibly for a safe and secure geological disposal program. It also acknowledged the importance of gaining public trust by ensuring both the guaranteed long-term safety and transparency of the process.

In the Framework for Nuclear Energy Policy determined in 2005, JAEC stated that "NUMO shall reinforce its joint R&D projects with R&D organizations, in particular, with the Japan Atomic Energy Agency (JAEA) that promotes the scientific study of deep geological repositories, basic research and development for enhancing the reliability of geological disposal technology and safety assessment methods, and R&D for safety regulations, to extend knowledge critical for the ultimate disposal program carried out by NUMO and the national safety regulation bodies. JAEC also recommended the government to streamline the system relating to safety regulations in accordance with the progress of relevant research and development activities.

To that end, NSC started investigating the institutional requirements relating to safety regulations for the disposal of HLW and environmental requirements for selecting detailed survey areas in the Specific Radioactive Waste Disposal Safety Investigative Committee in 2006.

Although some progress has been made in certain individual programs as seen in these examples, no local governments have applied to the public invitation for bibliographic survey point offered by NUMO since 2002. To salvage this, JAEC called on related administrative agencies to find the best way of determining the survey point in 2010 based on the recommendations from the conference for evaluating the policy in this field, while sending request titled "Issues concerning HLW Disposal" to the Science Council of Japan (SCJ) in September 7, 2010 to deliberate recommendations for activities to disclose literature and information on the disposal of HLW to the public.

2. Recommendations by SCJ

SCJ established the Investigative Committee for the Disposal of HLW, consisting of experts of social science, seismology and various other academic fields, as commissioners to discuss recommendations, and sent "Issues concerning HLW Disposal (Reply)" back to JAEC on September 11, 2012.

The Reply from SCJ pointed out that seeking a consensus on an individual issue of selecting the final HLW disposal site before reaching a consensus on broader policies concerning nuclear power generation was procedurally inverted and thus inappropriate. Moreover, it suggested the requirements for a fundamental review of policies concerning HLW disposal, restructuring of the policy framework focusing on identifying the limits of scientific and technical viability, ensuring scientific autonomy, temporal storage and total volume control, and streamlining of procedures for determining reasonable policies in terms of fair burden sharing, and making multistage agreements by providing a venue for discussion. It recommended continuing tenacious negotiations from a long-term perspective to solve the problem.

JAEC requested feedback on the content of the Reply from experts who had contributed to discussions, assessment and criticism of HLW disposal approaches, and underwent a comprehensive examination on the Reply, taking consideration of the Innovative Strategy for Energy and the Environment. It also deemed the Reply as analyzing the problem from a totally new perspective, beyond the scope of the JAEC' request, and made its recommendations based on this analysis, which made concerned parties aware of the fact that they disregarded of priority of what should be done first.

Although the Reply pointed out the inverted and inappropriate order of procedures of an agreement on the individual issue of selecting the final HLW disposal site, preceding complete agreement on broader policies for nuclear generation, this is not necessarily agreeable for us considering the three-stage Round-table Conference on Nuclear Energy Policy and Diet deliberations for determining the base legislation, let alone the efforts made by the Special Committee. However, the suggestion reminded us that the public would not remember the progress of the situation for long, and the parties concerned should have continued to share information on how the things got this way. This was the premise of agreement on individual issues with the public, which was, however, neglected.

After the HLW disposal policy was designed and the operation shifted to the siting stage, nuclear-related organizations and academic societies discussed procedures ensuring safety by paying sufficient attention to the uncertainties about the safety of geological disposal over an extra-long period, such as "reversibility" to allow the reverse order of operation steps from the closure of the disposal site and " retrievability" as one of the practical reversibility measures, and the policy of risk management for disposal. However, the parties concerned seem to have focused on public understanding of the obligations of the present generation for HLW disposal

while in dialogue with citizens, and overlooked citizens' rights in every aspect of the operation to select a viable disposal technique out of a number of theoretically possible techniques. Efforts to establish comprehensive communication with citizens, including academic society, should have been made considering citizens and experts skeptical of geological disposal, but were seemingly neglected. That is why JAEC thought that the Reply strongly suggested skepticism in the academic society.

JAEC recommended NUMO the revision of the Reliability on Technology for Geological Disposal of HLW in Japan, a report issued in 1999 by the research and development organization, taking into consideration of knowledge significantly reinforced after the Great Hanshin-Awaji Earthquake and progress made in science and technology on geological disposal in Japan and overseas. In the Request, JAEC asked JSC to address the announced report on the revision, but the Reply did not cover this topic, probably reflecting skepticism of academia on their approach of revision.

The final disposal operation extends over a century, including the survey, construction, operation, closure and various other processes, and the area that hosts the final disposal facilities should be maintained for mutual benefit over an extended period. JAEC recommended that the government and NUMO should provide documents that specify support to be supplied to hosting area so that any potential host areas can discuss their future based on them, and in this regard, reminded them that this involves regional development, not only of the hosting municipality but also the surrounding communities and related cities and prefectures. In response, the requested materials were provided, but since the final HLW disposal is a comprehensive national program, all administrative agencies should have been involved to present their wisdom in relevant processes of its preparation. Unfortunately this did not transpire.

Despite the nationwide public offering for candidates to host the final disposal facilities, no municipalities have yet applied. The government should have asked the Association of Prefectural Governors for cooperation in siting, and ensured its participation in the discussion on the siting scheme, including the regional development initiative, or at least requested comments on the result of the discussion, but none of them happened.

In the meantime, the government increased the amount of subsidy to a municipality that accept bibliographic survey to ¥1 billion per year from FY 2007, assuming a considerable burden will be imposed on its administrative machinery when it publicizes its intention. Before addressing

the subsidies, however, the government should have considered the heavy burden imposed on local government head on, and streamlined the system allowing the governor of the related local government to remit the process of discussions from various perspectives while accepting advices from the government, operator and suitable advisers under the third party presenter. JAEC thought that the Reply addressed the subsidies to clarify its accusation against government failure to remain aware of the importance of concluding the social agreement calmly and positively and striving concertedly to realize it.

3. Efforts to be made from now on

Out of regret at the above turn of events, JAEC ultimately concluded that the government should plan and promote the HLW disposal program while reflecting the recommendations in the report from the Special Committee ;namely, i) the obligation of the present generation, ii) the present scientific knowledge and countermeasures for unexpected events, iii) technological requirements and social acceptability, iv) socioeconomic equity between the hosting area and others, and v) the regulatory function of the government), analyzing the root cause of insufficient efforts for employing the latest scientific knowledge and sharing recognition with the public, reviewing basic government policy and governance of the operator with humility, and reflecting the lessons learned from the Reply. JAEC summarized what should be noted, and published the draft statements and sought public comment. This document is the finalized statement incorporating such public comments.

(1) Clarify the amount and nature of HLW for disposal in association with nuclear energy and fuel cycle policies.

The Reply suggested the concept of "total volume control," and one of the reasons for this may be SCJ's perceptions of insufficient efforts to share recognition with the public concerning the amount, nature and disposal of HLW produced from nuclear generation. Around 1,000 pieces of vitrified HLW are produced from spent fuel each year when operating a 30 GWe reactor, and when the reactor is operated for 40 years, around 40,000 pieces of vitrified HLW are produced. A trial design of disposal facilities was conducted to estimate the cost of disposal, whereupon little deviation was found in the unit cost of disposal per piece of vitrified HLW if vitrification of this amount or more is available at the disposal facilities. To continue nuclear power generation at the current level, disposal facilities of this scale or larger must be built every 30 years, based on which, electricity consumers were asked to pay the cost of disposal, and a suitable disposal site was sought. Cement solidification of TRU waste with a long half-life was subsequently added for geological disposal. The amount of TRU waste produced per unit generation of electricity

is considerable but the heat density is small, also meaning minimal impact of additional disposal on facilities is small and the scale of the facilities need not be changed. Including these facts, however, information and details of the mechanism of disposal are not always shared with the public.

Another reason for the proposal of "total volume control" may be insufficient discussions concerning relations between nuclear policies, especially fuel cycle policies, and waste disposal. Concerns at the fuel cycle include not only the effective use of resources, but waste disposal-related operations, e.g. to reduce the volume and toxicity of waste. Criticism at government for its failure to integrate discussions on waste disposal and nuclear power generation in previous nuclear and fuel cycle policies, expressed as "the mansion without lavatories," is another reason for recommending "total volume control."

According to the cabinet decision on future energy and environment policies, the government is to maintain existing policies for reprocessing of spent fuel. It should streamline the operation for finding the site for disposal of HLW, however, promoting the risk management for various uncertainties related with such questions as "how much radioactive waste is disposed of and in what form, within what scale of disposal facilities and in what fuel cycle" in future, based on the new knowledge revealed according to a step-by-step investigation on the progress of construction and operation, and potential changes in the technological specifications or operation of the disposal operator. And it should present options to the public, explaining the pros and cons of such options convincingly and carefully. These provisions should be periodically revised using new information and therefore these tasks should be continued routinely.

Minimizing waste from nuclear energy operation is one of the basic principles for waste management, which should be continually striven for. This helps extend the period before construction of the next disposal facilities is required, rather than reducing the scale of facilities. Accordingly, the amount of waste reduced per unit generation, costs and risks incurred to achieve it should be discussed in detail, and the result reflected in efforts to streamline the operation.

(2) Apply the latest earth science knowledge to a viability study of geological disposal, and share the result with the public.

JAEC considered geological disposal a reasonable option, provided risk management is included in the HLW disposal operation for applying the scientific knowledge obtained in

R&D in line with progress achieved in science, while recognizing limits of knowledge, and the operation is advanced with step-by-step and flexible decision-making while reversibility is ensured. Accordingly, the government should regularly confirm the validity of selection, including risk management according to the latest knowledge at the time, and share the result with the public. In particular, the operation concerning geological disposal lasts for an extended period, and as time passes from the beginning of operation, science and technology will progress while generations change and the sense of value is also likely to change. Periodical evaluation of the validity of the selected option and related tasks, based on the latest knowledge, and sharing of judgment with the public are the two key aspects for promoting geological disposal. JAEC called on NUMO to publicize the 2010 Report, but its response could not be considered appropriate.

The government should restructure the system to facilitate these efforts, recognizing the recent suggestion that the first thing to start is an effort to share the meaning of "safety", including precautionary principles, handling of uncertainty, and activities to support it with the public. The government should also fully take on board another suggestion that the accident at Fukushima Dai-ichi Nuclear Power Plant of TEPCO, following the Great East Japan Earthquake and subsequent tsunami, exacerbated public mistrust, not only of government, utilities and experts but also of science and technology. It should carefully examine the mechanism by which this report of NUMO may be shared with the public. It may be essential, for example, to finalize it including advice and evaluation from third party organizations as detailed in paragraph (4).

(3) Improve the operation according to the discussions on the need and significance of interim storage

The Reply recommended that "the HLW should not be directly sent to the final repository" but for solving problems, "put in the temporal storage for a certain period with the stringent safety in mind and in the retrievable form for ensuring the time for discussing and making decision for the subsequent long-term disposal, not directly subject to final disposal," and the way of final disposal should not be determined in advance, while putting HLW in the deep underground temporal storage for several tens to hundreds of years.

The present plan intended for geological disposal includes the "storage" of spent fuel or vitrified waste at certain storage facilities. This plan was accepted because post-storage handling is clearly indicated. Furthermore, SC emphasized the importance of a step-by-step approach considering reversibility and retrievability to allow flexible

modification and changes in the disposal scheme, based on the latest scientific and technological insight, including emerging new knowledge concerning safety. This is with the intention of flexibly achieving "technical evolution" to establish safe geological disposal, given further progress in science and technology and pending agreement by stakeholders to close the disposal facilities

As implied in the above paragraph, the government was supposed to choose a discreet step-by-step approach, but the Reply recommended the idea of "temporal storage," strongly suggesting that the intention of the government may not necessarily have been clear. We should take this seriously. The government should improve its efforts based on these recommendations, including a review of work to date from the new risk management perspective that requests all concerned to prepare for rare but possible devastating events, considering the lessons learned from the accident at Fukushima Dai-ichi Nuclear Power Plant of TEPCO.

(4) Provide a system of sharing disposal techniques and the site selection process with the public.

Public opinion on HLW disposal may be diversified, and the parties concerned should take public involvement for granted when making decisions. It is important to provide a system that can reflect as many opinions as possible in the decision-making.

This is recognized in various countries that established an organization independent of the government or operator to achieve the goal. For example, CoRWM in the U.K., the Advisory Council in Canada's NWMO, and KASAM in Sweden have been established and are functioning to date. These organizations comprise members with waste management expertise and experience and insight for difficult joint activities with citizens concerning public policies. Their actions include frequently reviewing the activities of the organization, ensuring the latest scientific knowledge is applied to decision-making, and engaging in detailed consideration about any uncertainties of scientific knowledge, with well-considered and balanced employment of public opinion and interest in the region, and for these purposes, advising the parties concerned on qualified, transparent and sound operation, or presenting their comments to the relevant ministers on these matters. Specifically, they organize regular hearings on related information to share it with the public, manage knowledge as an organization, and periodically evaluate R&D and siting by the operator, all of which are reported to the relevant ministers. Continuing these efforts may lead to "scientific autonomy" and "information sharing with the public."

Certainly, although councils and organizations believed to be on the citizens' side exist in Japan, they can hardly be considered as means to ensure the appropriateness of the operator engaged in geological disposal. The responsible ministers should inspect the decisions made by them while listening to the opinions of scholars and citizens, with the aim of analyzing the root cause of inability of these organizations functioning as their counterparts overseas, and convincingly establish an independent and functionally effective third party organization to provide suitable advice to the government and related parties in time.

(5) The government leads policy restructuring.

The government should start restructuring the whole operation and reviewing the "Basic Policy" of HLW disposal, including re-examining the laws and institutions, by taking into account "innovative strategies for energy and the environment" and the existence of uncertainties in the future of nuclear operations, based on strict recognition that the government entities should collaborate to target definite progress. It should also emphasize government involvement in restructuring by asking the Association of Prefectural Governors to cooperate in siting and designing the system to involve local governments in the selection of the disposal site.

To promote such comprehensive and systematic approaches effectively, it is important; i) to establish not only candidate selection criteria but also an environment and system for mutual interaction between the operator and local governments that make it possible for them to establish joint projects for sustained development in the region, ii) to review, at the same time, supervision by government and operational management of the operator should to clarify any unsuccessful efforts to plan and promote the operation according to the indications in the report of the Special Committee, iii) to establish a third party organization, as stated in paragraph (4), that reviews the work of the operator and propose improvements to the operator and government in time, and iv) to improve efforts of both the operator and the government based on their opinion.