Topics Fukushima 17 January 2013 No. 11

Topics Fukushima introduces JAEA's activities related to Fukushima.

Japan Atomic Energy Agency (JAEA) Reporting Conference #1
Our Efforts – In Light of the Nuclear Accident

"As a group of experts, what should we do?"

–Learning from the nuclear accident

Atsuyuki Suzuki, President

At the JAEA's Reporting Conference held in Tokyo on November 28, 2012, Atsuyuki Suzuki, President of JAEA, made the following remarks on the JAEA's responsibility as a group of experts, and the resolve it must have:

"In simple terms, I believe the cause of the accident at the Fukushima Daiichi Nuclear Power Station was the lack of 'learning and incorporation of the latest scientific findings,' which is, of course, a fundamental rule of safety. As described by Takeo Doi in his book *The Anatomy of Dependence*, Japanese society has a structure of dependence, and this resulted in the problem of 'asymmetrical information' and the horrible accident which should never have occurred. I feel that this problem of asymmetrical information is the root of the false sense of confidence that 'a core meltdown will never occur' and the myth of safety relating to the 'infallibility of regulation.' Going forward, we will need to address this problem head-on. In other words, based on the assumption of scientific uncertainty, we must strive for more robust defense in depth, and, at the same time, take measures to ensure complete transparency in our accountability relating to such an effort for safety. As a group of experts, JAEA must rebuild its knowledge and experience to achieve that goal, and make diligent efforts at self-improvement."

President Suzuki continued, touching on the need for experiential knowledge, imagination and integration capabilities:

"The first thing we need to do is to overcome the disaster. On site, the key issues are analysis of the accident, dismantling the reactors, and managing wastes. Experiential knowledge is essential to perform the accident progression simulation, the decommissioning work and the environmental management. Off site, the key issues are dose assessment, decontamination work, and prediction of

environmental dynamics. There is a need for verification, assessment simulation and communication, and we must use our imaginations in ways such as sharing ideas with local people affected by the disaster. By organically integrating the resources within our organization and aligning the thinking of our staff, JAEA promotes synergistic action, and projects tremendous power as an organization. Exhibiting these integration capabilities is our mission, as a group of experts in a country which has allowed an accident to happen."

As specific examples of such integrative effects, President Suzuki discussed a number of efforts made by JAEA and their results.

"Examples of our work include: studies of the metabolism of radioactive materials by microorganisms and plants in forests, primarily by the Advanced Science Research Center; elucidation and analysis of the cesium adsorption mechanism, through collaborative work by the Center for Computation Science and e-Systems, the Headquarters of Fukushima Partnership Operations and the Quantum Beam Science Directorate; examination of the effects of seawater injection on fuel cladding tube corrosion and analysis of fuel debris, as a joint project by the Nuclear Science and Engineering Directorate and the Fukushima Special Team for Technology Development; evaluation of the infiltration behavior of cesium into concrete by the Oarai Research and Development Center in collaboration with the Tokai Research and Development Center; evaluation of radiation resistance of robot arms and other equipment and development of simple radioactivity measurement methods by the Takasaki Advanced Radiation Research Institute and the Kansai Photon Science Institute; development of heat-resistant, flexible radiation shielding resin material and high-precision analysis using accelerator mass spectrometers, by a joint team of the Naka Fusion Institute and the Aomori Research and Development Center; and research on models of migration through the environment, taking into account factors such as differences in land use (e.g., forests), through a collaboration between the Geological Isolation Research and Development Directorate and facilities in Tono, Horonobe and Ningyo-toge."

President Suzuki also mentioned the importance of making efforts as an organization to communicate with the public.

"When all is said and done, our actions in the local area, on the site, are the most important, and we researchers and engineers must take the initiative and share any worries or doubts the people of Fukushima Prefecture have. It is crucial to adopt a stance of "coexistence" where we become part of their inner circle. As one type of dialog for achieving that, we have held many townhall meetings in Fukushima Prefecture. We will need to continue such activities in the future, and at that time, we should strive to impart information in a visual, easy-to-understand form, and actively disseminate information which is highly reliable and transparent – by, for example, using animation to show the changes in the air dose. We have also signed new collaborative agreements with Fukushima University and the Fukushima National College of Technology. Considering that it will take many

years to truly end this accident, I believe it is essential to contribute to the development of human resources in the local area through agreements like these ones.

In recent years, the concept of resilience has garnered attention in the general field of disaster recovery, in addition to the field of nuclear power. The word is used to indicate recovery capability, and refers to a problem solving approach which not only uses the resources and knowledge possessed by individuals, but also combines this with the diverse connections, knowledge and experience of people. My guess is that the importance of fostering recovery capability is better understood by stressing such human interaction. Therefore it is essential to build good relationships with the outside, and adopt a stance of humbly learning."

With the above problem awareness, the President concluded by expressing the following ideas as his personal opinions.

"However, in addition to such human interaction, we also need to foster recovery capability through technological innovation. That is, previously science and technology have been developed as techniques for alleviating resource constraints, i.e., by increasing the amount of resources, but going forward, there will be a particular need to develop technology which can cope with factors such as social and environmental constraints, including safety and security, and technology itself will need to evolve toward a self-sufficient environmentally-friendly society. The private sector is ordinarily the driver of technological innovation, but in a field such as nuclear power, where there is a large public element, public institutions like JAEA play an important role. Since the era of the ancient Greeks, the basic virtues necessary for public life have been thought to be ‘justice, courage, prudence and moderation.’ We believe these virtues must be instilled into the JAEA, and that our core areas of "safety, cycle, fusion, and quanta" must be reassessed from the standpoint of recovery science. I believe that this will enable R&D on science and technology for creating a system to achieve harmonious relationship between society and the environment.

The fields of science and technology are highly specialized, and thus there is always the problem of ‘asymmetrical information.’ This is unavoidable. To realize nuclear power based on a ‘science of recoverability,’ the system of harmony between society and the environment must have a structural mechanism whereby the new scientific findings, which are the lessons of the Fukushima Daiichi accident, are properly reflected in technology. At the same time, we must improve transparency in how we move forward with R&D on science and technology, and thereby achieve a type of harmonious correlation between science/technology and society wherein the ability to explain our activities to society is automatically promoted. This is not a cultural theory or spiritualism which relies on the ideas of individuals. It is an attempt to structure a "science of recoverability" in organizations or society as a more robust mechanism or system, and in that way realize a future where global society can be made truly affluent not just through resources but also through technology. Nuclear power can be – indeed must be – such a technology. That is our mission."

Report on R&D activities

Yoichi Ito, Executive Director

Next, Executive Director Yoichi Ito provided a general overview of Japan Atomic Energy Agency (JAEA)’s R&D activities. The following summarizes his remarks concerning response to the accident at the Tokyo Electric Power Company (TEPCO)’s Fukushima Daiichi Nuclear Power Station.

◇

On March 11, 2011, when the nuclear accident occurred, JAEA established the Nuclear Emergency Response Headquarters. In May, the Headquarters of Fukushima Partnership Operations was established, and in June, the Fukushima Office was opened in Fukushima City. In November, the headquarters was reorganized, named the Headquarters of Fukushima Partnership Operations, and under the management of the headquarters were placed the Fukushima Environmental Safety Center, the Department of Partnership Operations for Plant Restoration, and the Department for Planning and Management of Partnership Operations. Since the nuclear accident, JAEA has been providing emergency support as the designated public institution, and through the end of March 2012, a total of over 45,000 JAEA staff had been involved in disaster response.

At present, activities to deal with the nuclear accident are positioned as a key task in the medium-term plan for achieving the JAEA's medium term goals, and the heart of those activities is R&D on decommissioning of the TEPCO’s Fukushima Daiichi Nuclear Power Plants, and measures to clean up environmental contamination due to the nuclear accident.

JAEA plays a central role in the government's R&D framework for tasks such as decommissioning.

Currently, there are Working Teams and Task Forces in the Research and Development Promotion Headquarters under the Government and TEPCO's Med-to-Long Term Countermeasure Meeting, and 19 individual R&D projects have been designated by these groups. JAEA is involved in 12 of these projects. More specifically, the projects concern: remote decontamination in buildings, treatment technology for melt-solidified fuel (referred to below as "debris"), assessment of soundness of the primary containment vessel (PCV) and reactor pressure vessel (RPV), measures for material accountancy related to debris, debris criticality control, analysis of actual debris properties (scheduled to start in 2016), accident progression analysis, determination of the characteristics of debris model specimens, long-term soundness of fuel assemblies, technology for dealing with damaged fuel (scheduled to start in 2013), examination of treatment/disposal of wastes, and

stabilization of wastes resulting from contaminated water treatment.

In R&D on treatment/disposal of debris, the model specimens were made based on research on severe accidents, such as the accident at the Three Mile Island Nuclear Power Plant in the US, and their physical and chemical characteristics are being evaluated/tested. Existing treatment/disposal technologies are being examined for potential applicability to long-term storage or treatment/disposal after damaged fuel has been removed.

In R&D on the treatment/disposal of radioactive wastes which result from dealing with the nuclear accident, the properties of zeolite as secondary waste produced due to treatment of contaminated water, as well as issues such as production of hydrogen by waste and corrosion of containers, are being evaluated, and based on the results measures for long-term storage exceeding 20 years are being examined.

In terms of remote technology, the nuclear accident robot owned by the JAEA has been modified and improved, already supplied to TEPCO, and is being used to measure radiation inside Unit 2 reactor of the TEPCO's Fukushima Daiichi Nuclear Power Station. In the area of remote sensing technology, technologies for in-reactor laser monitoring and internal observation/processing are being developed.

In R&D for decommissioning, the long-term soundness of fuel assemblies is being assessed through approaches such as basic testing involving durability evaluation of zircaloy cladding tubes, technology for quick analysis of the nuclides contained in contaminated water is being developed, and R&D on ascertaining/analyzing the situation inside the reactor is being conducted using methods such as evaluating thermal-hydraulic behavior at the time of the accident.

In responding to the nuclear accident, we are making an organization-wide effort in collaboration with local governments and relevant agencies, while making the most of the personnel and facilities of JAEA.