Contribution from Nuclear Engineering

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Introduction

Base on the insufficient actions as a nuclear energy scientist, I will try to consider required contribution.（*）

Preparation for the probable accident, activities during and after accident were sufficient? What should we do from now on?

<u>Objectives of the Atomic Energy Society (AESJ) of Japan</u>

AESJ is an organization aiming to contribute towards the development of atomic energy by seeking academic and technological advances pertaining to the peaceful use of atomic energy and through communications with cooperation facilitated among the members as well as with relevant academic organizations, both within and outside Japan.

（Number of members: about 7,000)

（*：This lecture is based on a personal thought, not representing AESJ.

Activity Policies and Society Operation of AESJ

Activity Policies of AESJ　（As of December 19, 2007)

【Philosophy and vision of AESJ】

・Continuously contribute towards the welfare of humankind as well as sustain the development thereof, through the peaceful use of atomic energy.

・Evolve into an academic organization that comprises of members with a high standard of ethics and whose presence is felt.

・Offer a place for fair, just, and transparent debates in order to become the most reliable source of technical information pertaining to atomic energy for citizens and regional communities.

【Services provided by AESJ】

・Promote the formulation of standards.

・Disseminate appropriate knowledge in a rapid manner whenever a problem occurs.

・Proactively contribute by offering recommendations for government policies pertaining to atomic energy.

・Strive to facilitate the coexistence of atomic energy with citizens and regional communities through the activities described in the previous section.

【Support for the activities of members of AESJ】

・Activities intended to sustain and improve the safety and reliability of atomic energy facilities.

・Activities intended to sustain and improve specialized capabilities.

Code of Ethics of AESJ

Code of Ethics of AESJ (Revision approved on Nov.11, 2005)

【Preamble】

We the members of the Atomic Energy Society of Japan (AESJ) amply recognize that nuclear technology brings tremendous benefits to humans but also raises the possibility of catastrophe. Based on that premise of recognition, with pride and a sense of mission of being directly engaged in the peaceful use of atomic energy, we energetically pursue human welfare and sustainable development while conserving global and local environments through the use of atomic energy.

Whenever we conduct atomic energy research, development, utilization, and education, under the principle of information disclosure, we the members of the AESJ make constant efforts to enhance our knowledge and skills, to keep pride and responsibility in our work, to keep a spirit of self restraint, to maintain a harmonious relationship with society, to comply with laws and regulations, and to secure nuclear safety.

In order to implement these ideals, we the members of the AESJ have established herein fundamental canons of attitude and conduct.

Roles of the Academic Society (AESJ)

Facing Fukushima Daiichi NPP accident, following items were decided as important roles (As of April 2010)

1. Collecting, Analyzing and Evaluating Information about the Accident
2. Extracting Reflection and Lessons Learned
3. Dispatching Proposals and Drawing Road Map
4. Dispatching of Easy-to-Understand Information to the General Public
5. Cooperation with the Related Academic Societies
6. Dispatching and Exchanging Information to the Overseas Colleagues

Insufficient Activities before and during Accident

【Before Accident】
・Preparation for external events
（Height of Tsunami, measures against flooding for building, etc.）
・Preparation for Station Black Out
・Determination of Safety Target, Safety Regulation, Safety Design
・Preparation for Severe Accident Management
・Probability of Hydrogen Explosion
・R&D for Safety
【During Accident】
・Actions of Severe Accident Management
・Dispatching of Information
（technological explanation, radiation safety, evacuation zone, INES level, communication between local government and emergency headquarters, etc.）
・Emergency safety management
・Collaboration for disaster termination

Activities after Accident: Sufficient?

- Understanding of Accident Progress, Information Dispatching
- Analysis of Direct and Indirect Causes and Reflection of Them
  （Technological, Social）
- Proposal for New Regulation System
- Proposal of Re-constructing Safety Engineering
- Explanation of Radiation Effect and Social Understanding
- Contribution to Decontamination
- Collaboration with Reactor Decommissioning

- Recognition of Insufficient Actions for Risk Assessment, Environmental Effect and Economical Features of Nuclear Energy

Actions after Accident

After accident, many academic societies and R&D institutions tried to collect information and conducted various actions from there positions.

Contribution to accident termination

- Technological analysis of accident ⇒Proposal of Safety Measures
- Technological support to accident termination
- Support of worker's safety management

Contribution to environment remediation

- Contamination monitoring, mapping
- Decontamination, waste disposal
- Proposal of decontamination plan

Radiation effect, radiation management

- Dispatching of correct information about radiation effect
- Human resources development for radiation control
- Support of public health

- Apply accumulated knowledge to real activities
- Reflect to safety standard and disaster prevention plans

Examples of Activities after Accident

Atomic Energy Society of Japan (see also next page)

- Foundation of Committee of Nuclear Safety Investigation
  Technical analysis subcommittee, Radiation effect subcommittee, Clean-up subcommittee
- Collaboration with the related academic societies, proposal to the government
- Dispatching and exchanging Information to the overseas colleagues

Japan Atomic Energy Agency（JAEA）

- Foundation of integrated office “Special Project Team"
  Technology evaluation and R&D of Mid-and long-term measures, Building long term cooling system, recovery of accumulated water, environment effect evaluation, radiation control etc.
- Technical support of radioactive waste and fuel management
- Technical support of remote control
- Educating radiation control staff

National Institute of Radiological Sciences

- Internal dose evaluation
- Telephone consulting about radiation medicine
- Support of radiation contamination to body
- Support of injured persons, preceding investigation of public

AESJ Activities after Accident (1/2)

- Announcement of basic position (March 18)
- Explanation to public by accident explanation team (Team 110)
- Information dispatching by HP

  Internal exposure, accident progress, radiation effect, introduction of related links, interview in Japan reporter club, etc.
- Press release: radiation effect, lesson learned, decontamination catalogue, etc.
- Opening Q&A Desk in HP (QandA@aesj.or.jp)
- Information dispatching to foreign countries by English HP
- Cooperation with the related academic societies
- Dispatching and exchanging information to the overseas colleagues
- Presentation in international conferences
- Foundation of Committee of Nuclear Safety Investigation (April 8)

  Technical analysis subcommittee: evaluation of accident progress, analysis of core and plant, extraction of lessen learned, and recommendation of actions

  Radiation effect subcommittee: radiation level, contamination mapping, radiation effect

  Clean-up subcommittee: environmental remediation, decontamination, decommissioning R&D

AESJ Activities after Accident (2/2)

- Standard committee, Tsunami PSA WG in risk sub-committee
- Presentation of AESJ activities to Japanese AEC (March 17)
- Donation of survey meters to local governments near the cite
- Urgent Symposium on Fukushima Daiichi Accident, March 21, Tokyo
- Special Symposium on Fukushima Daiichi Accident, Sep. 19, Kokura
- Many Presentations at AESJ Fall Meeting, Sep. 19-22, partly opened to public
- Science Council of Japan, Atomic Energy Symposium 2011, Oct. 2011
- International Symposium on Nuclear Safety －Toward the Future, with Lessons Learned from the Accident at Fukushima Dai-ichi Nuclear Power Plant, Oct. 31-Nov. 1, Tokyo
- Information dispatching on radiation effect and decontamination with Fukushima Prefecture etc

  Fukushima Prefecture decontamination advisor

  Safety Forum: Decontamination Promotion, Co-organized by AESJ and Fukushima Prefecture, (Nov. 27, and more three times until February)

  Support of “Decontamination Information Plaza”

Role and Responsibility of Scientist….

Why was new knowledge not reflected to safety regulation?

Examples of non-reflection
- ✓ International standards were not adopted after Chernobyl accident
- ✓ Severe accident management was not considered
- ✓ Enough measures against tsunami was not adopted although it was pointed out

Process of reflecting new knowledge to safety standard has not been prepared.
There has been a high resistance to change the safety standard after it was considered safe.

Why could we not propose accumulated knowledge to the authorities at the accident?

It was difficult to understand the situation at the accidents because of complicated information.
Could we respond correctly to the general public, who wanted true information for good behavior?
Should we have behaved more independently?

There has been no system to advice to the authorities from academic side.
Academic society became commentators, and could not conduct emergency management.
There has been no system to supply accumulated knowledge.
Many scientists dispatched irresponsible information, causing confusion

- ☐ How could we supply smoothly accumulated knowledge to an appropriate organization? Scientists should play a central role in this process.
- ☐ Scientists should be responsible for the content of information.

What should we do from now on?

To make process to reflect knowledge obtained by researches to safety standards and safety measures.

To make process for proposing information at an emergency

- Information collaboration between academic society and the authorities.

To strengthen the statement power of academic society in the social environment.

- The academic power in Japan is smaller than those in ANS, NAS?

Nuclear energy scientists should give information on features, meaning and safety measures of nuclear power in making new energy policy.

R&Ds of nuclear energy system with safer and more public acceptance, nuclear fuel cycle, radioactive waste management, environment remediation and decommissioning.

Reference

Lessons Learned from the Accident at the Fukushima Daiichi Nuclear Power Plant

May 9th, 2011

Technical Analysis Subcommittee
Committee for Nuclear Safety Investigation
Atomic Energy Society of Japan
(QandA_gb@aesj.or.jp)

Summary of Important Lessons

a. Estimated tsunami was too small.
b. Safety System and Components were damaged because of seawater flooding, resulting in severe accidents.
c. Long-term station blackout caused the accidents progression.
d. Reactor parameter monitoring was difficult without electricity.
e. Seawater cooling system was vulnerable to tsunami.
f. Accident Management (AM) for long-term station blackout may be insufficient.
g. Hydrogen explosion at outside the containment vessel (CV) was not considered.
h. Enclosure of radioactive materials at spent fuel pool is difficult if reactor building was damaged.
i. Insufficient safety design for external event.
j. Japanese safety regulation system is insufficient.
k. Public feels that the information disclosure is not enough.
l. AM activities prevent significant deterioration of the accidents.
m. Seismic Design for the earthquake was considered effective in many cases.

Summary of Strongly Recommended Actions

1. Hardware preparation to protect the safety System, Structure and Components (SSC) from tsunami.
2. Preparation for variety of power sources, such as air-cooled gas turbine system.
3. Consideration and preparation for variety of cooling systems in addition to seawater cooling system.
4. Assume that severe accidents do surely occur. Adequate consideration for severe accident management (AM). Hardware preparation for the AM such as multiple wiring for power source. Training and education of AM.
5. AM for preventing hydrogen explosion. AM for spent fuel pool.
6. Improvement of severe accident researches and human resources development.
7. Drastic revision of the safety regulation including legal system and organizational reconstruction.
8. Establishment of quantitative risk analysis. Introduction of risk concept into the entire safety regulation.
9. Reassessment of public information disclosure and information sharing.
10. Realistic disaster prevention practice based on the recognition that severe accidents do surely occur.
11. Detailed evaluation for the seismic design, coordination design, AM, plant behaviors for the present Fukushima-Daiichi Accident. Then, improve the Nuclear safety considering wide range of countermeasures.

Special Symposium on Fukushima Daiichi NPP Accident

Crisis at Nuclear Power Plant

- Indirect Causes of the Accident and its Countermeasures -

September 19, 2011

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Indirect Causes of the Fukushima Dai-ichi Nuclear Accident （1）

1）Structural Strength and Hardware-Centric Approach to Ensure “Materials” Reliability ：

Since the adoption of nuclear energy for its peaceful use, too much enphasis has been place on the quality of materials and hardware, both on safety measures and on quality issues.

2）Lack of Communication Between Ministry and Agencies to Ensure “Nuclear Safety”：

Public administration of regulation and research, lack of communication between ministry and agencies led to inadequate amount of attention on “Reactor Safety (Nuclear Safety),” which is the fundamental aspect safety regulation for commercial LWR.

3）Missing the “Nuclear Safety” Enhancement Bigger Picture for the Sake of Trivial Quality Issues：

From the viewpoints from the reactor safety, minor accidents and troubles have been shed light on to become social issues, and those troubles have been treated as the political issues by the press and local authorities. This may have prevented the discussion for fundamental nuclear safety issues.

－Loss of Patience in the society would also be the important cause.

4）Common Goal Lost Due to Conflicts Between Regulators and Licensees ：

Regulators and licensees share the common goal of nuclear safety enhancement. Yet, the their conflicts have led to delayed disclosure of information, and safety enhancement became even harder.

5）One Dimensional Safety Criterion – “Complete Safety” Dogma and the Resultant Overconfidence ：

Japanese nuclear installations are internationally renowned for the low frequency of unplanned scrams, which possibly Is where the safety dogma all started. There was an disinclination for Risk Assessment.

Indirect Causes of the Fukushima Dai-ichi Nuclear Accident （2）

6）Change-Resistant Culture Waving Off Technological Innovation ：

There is a deep-seated perception in Japanese culture that, once decided, things stay the way they are, as if the rock-ribbed law never allow any changes. Thus, response for revision is delayed due to the change-resistant culture.

7）Claimed Rights, Unfulfilled Responsibility ：

Most resolutions take place at committee meeting and deliberation council, which would obscure the responsibility/responsible party of assigned tasks.

8）Regulation in the Absence of Experts ：

World's advanced nations place the highest priority on the ensured nuclear safety by securing competent human resources. In Japan, the mechanism for recruiting, fostering, and sustaining experts, for sustainable regulatory system, does not exist. We need to develop this mechanism.

Manufacturing of equipments/hardware and nonstructural design in Japanese nuclear installations are internationally renowned for its technological advantage.

However, the "soft" aspect, such as building consensus and communication with the public, are far below that of advanced nations. We are behind in the global "Nuclear Safety" field. The largest cause, possibly, may be our ignorance to never went furthest to understand the fundamental principle behind "Nuclear Safety."