

Progress and Updates of Regulatory Challenges and Safety Issues in Korea during Three Years after Fukushima Accident

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1. Introduction

Before the public fear on radiation risk caused by neighboring country's severe accident disappeared, a series of nuclear safety issues last 3 years made a few reactors shut down and the public trust much lower than before. Because of these scandals such as cover-ups, forged certificated items, corruption of manager of licensee and so on, many efforts made during three year after Fukushima accident on improving the nuclear safety were invalidated and even regulators as well as operators have been sharply criticized for its responsibility and transparency. This paper shares information on the progress and updates achieved in Korea so far in connection with the safety issues caused during last 3 years and actions taken by the regulatory body.

2. Progress and Updates of Regulatory Challenges and Safety Issues

2.1 Post-Fukushima Action Plan and Complementary Measures

Regarding the assessment of safety vulnerabilities of nuclear power plants, the nuclear safety committee was convened on Mar. 21, 2011, to assess safety of Korean nuclear power plants in operation focusing on whether (a) designs and equipment were proper to prevent accidents; (b) power supply systems and cooling systems were ready to prevent an event from developing into a severe one; (c) accident management system were good enough to manage severe accidents, and lastly, (d) emergency response systems were in place. The result of the inspection confirmed that nuclear power plants in operation were designed and operated considering the current design basis earthquake and tsunami. However, the team recommended 50 safety improvements and licensee submitted implementation plans for the items by 2015.

36 of 50 action items have been implemented by KHNP so far and 22 of 36 items were reviewed and 14 items under review. The remaining 14 of 50 action items are still being addressed by KHNP and additional action items were drawn after reviewing foreign experiences.

In March, 2014, Nuclear Safety and Security Commission (NSSC) decided to identify the

complementary measures of Post-Fukushima Actions as follows; examine extreme events to be considered, secure safety functions with dedicated mitigation features, support emergency response activities with guidelines and organization, and reflect the experiences from international and domestic actions. The complementary measures will be applied for all operating and new plants in several years.

Occurrence of Earthquake	Installing an Automatic Seismic Trip System (by 2013)
Occurrence of Coastal Flooding	Extension of Sea Wall of Kori NPPs (by 2012)
Station Blackout	Stand-by Unit of a Movable Generating Vehicle (by 2014)
Loss of Cooling of Coolant and SFP	Ensuring Countermeasures When Loss of the Cooling Function of SFP Occurs (by 2012)
Hydrogen Explosion	Installing Passive Hydrogen Removal Equipment (by 2013)
Containment Over-Pressurization	Installing Containment Building Filtered Ventilation or Depressurization Systems (by 2015)
Release of Radioactive Substance	Securing Additional Radiological Protection Equipment for Residents (by 2012)

Fig.1. Fukushima Response

2.2 IRRS and Follow-up Mission

An international team of sixteen senior safety experts met representatives of the Nuclear Regulatory Bureau of the Korean Ministry for Education, Science and Technology (MEST), the Korean Institute for Nuclear Safety (KINS) and other organizations contributing to nuclear safety from 10 to 22 July 2011, in order to conduct an Integrated Regulatory Review Service (IRRS) Mission. The mission took place at the headquarters of KINS in Daejeon. The IRRS mission also included the following Regulatory Policy Issues for discussion: response to the Fukushima accident; independence of the regulatory body; transparency and openness; continued operation; and aging management of nuclear power plants. The IRRS Review Team identified 15 good practices, made 22 recommendations and suggestions that indicate where improvements are necessary or desirable to continue enhancing the effectiveness of regulatory functions in line with the IAEA Safety Standards. Peer Review provided effective opportunity for improving nuclear safety and was useful to learn the good practices and to find out the weak points.

Follow-up mission scheduled for Dec. 8~19, 2014 will be carried out with the review of new areas such as fuel cycle facilities, waste management facilities, radiation source applications, transport activities, control of medical exposure, and occupational radiation protection. The scope of the follow-up mission was finalized through the preparatory meeting from 8~10 July 2014. The Follow-up mission will include major changes in the regulatory framework made after the IRRS mission in July 2011.

2.3 Reform of Regulatory Body

In order to improve the effective independence of the regulatory body, the Korean government decided to establish the Nuclear Safety and Security Commission (NSSC) as an independent regulatory body completely separated from MEST. KINS remains as a regulatory expert organization reporting to the NSSC and MEST's role will be restricted to promoting the utilization of nuclear energy. NSSC was established on Oct. 26, 2011 directly under the Jurisdiction of President, which is responsible as a whole for safety, security and non-proliferation.

New government decided to move the governmental position of NSSC under the control of Prime Minister, and an amendment of Government Organization Act including the act on establishing and operating NSSC was passed in March, which still guarantees sufficient independence from other government organizations. The amendment of the act on establishing and operating NSSC includes that the NSSC consists of 9 commissioners including a chairperson of the vice-minister level. Only chairperson and one commissioner are standing, and chairperson shall be appointed by the president at the recommendation of the Prime Minister. Half of eight commissioners shall be appointed by the President at the recommendation of the Chairperson and the other four commissioners shall be appointed by the president at the recommendation of the National Assembly.

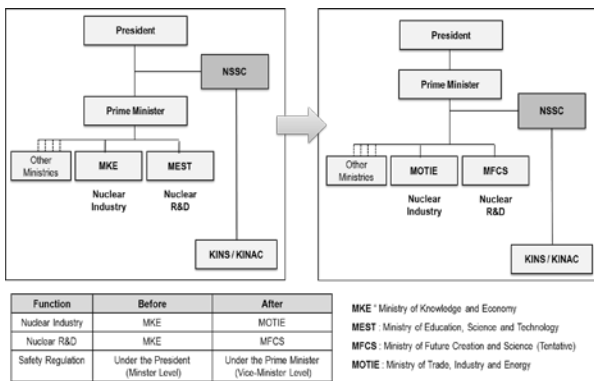


Fig.2. Reform of Regulatory Body

2.4 Augmented Stress Test for Continued Operation of Old Reactor

Last December, Korea has elected the new president for the coming five years. She promised to set up the responsible management system which puts the top priority to ensure the safe operation of nuclear power plant and build up the public trust as the national agenda. It is the first time that the nuclear safety policy is stated in the national agenda, which expresses the importance of ensuring the nuclear safety as the prerequisite of promoting nuclear energy.

To ensure the safe operation of nuclear power plant, the strict safety assessment on whether the life extension of old reactors such as Kori unit 1 and Wolsong unit 1 would be permitted or not will be performed through the "Stress Test" on the basis of a comprehensive and transparent safety assessment to implement the "Priority to Safety" policy. As regard to her pledge on nuclear policy, the first challenge will be the stress test of old reactors and the regulatory body needs to prepare the procedure and technical guidelines. Currently, the stepwise approach is prepared consisting safety assessment undertaken by the licensee and independently reviews by regulatory body and experts. Technical scope for test is classified as six parts including; the extreme natural events such as earthquake and tsunami challenging the plant safety function and leading to a severe accident, consequences of loss of safety function by extreme event, severe accident management and emergency preparedness.



Participation of Experts recommended by Local Community
 To Ensure Transparency

Fig.3. Framework of Stress Test

2.5 Unapproved Items with Forged Certificates

It was revealed that 5 units (Yonggwang units 3, 4, 5, 6 & Ulchin unit 3) had been equipped with more than 5,000 falsely-certified items. Most of them were non-critical to the safe operation used in supplementary equipment. The government shut down two units (Yonggwang units 5&6) manually which almost all the unapproved parts were used in. Safety commission launched a "Special Investigation Team" to

independently review common grade items dedication for all operating nuclear power units, to check the existence of additional one and to verify overall effectiveness of licensee's purchasing system. NSSC announced the comprehensive countermeasures on overall licensee's quality management system considering the audit system in manufacturing process and subcontractor registration.

Investigation into the authenticity of the QVDs issued by domestic institutes for the 21 reactors in operation and 5 under construction, was completed in 2013 and corrective actions are underway. In case of the QVDs issued by foreign institutes, investigation has been in progress since Feb. 2014. Regarding this issues, the Nuclear Safety Act has been revised mainly to reflect the needs to prevent and respond to more effectively to forged certificates.

2.6 Revision of the Nuclear Safety Act

Licensee shall comprehensively assess the safety of the reactor facility every 10 years from the date of operating license issuance by the PSR(Periodic Safety Review). If the licensee wishes to continue the operation of nuclear reactor beyond the expiration of the design life, each of the following shall be additionally included assessment of the life of major device in consideration of the period of continued operation and assessment of change in radiation environmental impact after operating license. The assessment has been carried out as an individual assessment of the 11 items, however, in 2014 11 assessment items was extended to 14 items including design, implementation of PSA, risk analysis and safety culture thru the revision of Nuclear Safety Act. Regarding the safety culture, a new policy was set to supervise safety culture of licensee. The national plan for nuclear safety defined the "Promoting the strong nuclear safety culture of utility" as the mid-term task to establish safety management system of utility and to foster the safety culture of licensee. According to this plan, pilot inspection program was started in the late 2013 and research project for infrastructure for regulatory oversight of safety culture is ongoing.

Emergency planning zones should be defined in accordance with the IAEA Requirements (GS-R-2). The revision of the Act on Physical Protection and Radiological Emergency for the designation of emergency planning zone in accordance with the IAEA requirements was completed in May 2014. Emergency planning zone was divided into the Precautionary Action Zone (PAZ: 3~5 km) and the Urgent Protective action Planning Zone (UPZ: 20 ~ 30 km). The relevant revisions of the Enforcement Decree and Regulations are underway and is expected to be finished by November 2014.

3. Conclusions

Korea has improved the effectiveness of safety regulation up to now and still has been making efforts on further enhancing nuclear safety. The outcomes of these efforts have resulted in a high level of safety in Korean NPPs. However, now we are faced with the new challenges such as decreasing the public anxiety or suspicion on nuclear safety caused by the arguments on lack of licensee's safety culture such as cover-ups, forged certificated items, and corruption of manager. Additionally, public criticism of the regulatory activities demands more clear regulatory guides and transparent process. Under this situation more than we have done so far, NSSC and KINS will continue to make every effort for the improvement of the quality of regulatory activities and effectiveness of regulatory decision making process.

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