

## **Future Challenges in Nuclear Renaissance: A Regulatory Perspective**

Young Sung Choi, Kwang Sik Choi and Kyu-Hyun Han  
*Korea Institute of Nuclear Safety*  
*cys@kins.re.kr*

### **1. Introduction**

Clear signs of increasing interest in the nuclear power option in national energy mix are being observed worldwide. Construction of Olkiluoto 3 is underway in Finland and France announced the construction of Flamanville 3 and its policy of developing Gen-4 reactors and replacing current operating Gen-3 reactors by 2050. In US, energy Policy Act of 2005 gives rise to expectation of new construction and Bush administration initiated Global Nuclear Energy Partnership (GNEP) with the aim of expanded use of nuclear energy worldwide. UK has expressed the intention of maintaining nuclear option in its national energy policy through several policy papers. Continuous nuclear program is promoted in Japan, Korea and Russia. China and India have ambitious plan of constructing large amount of NPPs.

The expanded use of nuclear energy in the future, however, should require appropriate plans and much effort for ensuring safety and security with both global and national contexts.

This paper reviews future challenges to nuclear safety and security and presents some perspectives for ensuring safe and secure use of nuclear energy.

### **2. Outlook for the future**

#### *2.1 Ageing of Nuclear Plants*

Many new Nuclear Power Plants (NPPs) will be constructed during next decades, however, current 438 operating reactors over the world will continue to operate and most of them will have been in operation for more than 30 years. Ageing implies degradation in structure, system and components and it requires changes in operating and maintaining the plants along with technology development, advanced knowledge and experiences. Ageing management will also be further emphasized to cope with safety and security challenges.

#### *2.2 Synergy between Safety and Security*

Global citizens took concerns and worries on the possibility of terrorists attack to nuclear facilities after the attacks in September 11, 2001. Since then, security has become very important with conventional nuclear safety issues. Terrorists attack and sabotage should be carefully handled and more attention should be paid to the interfaces between security and safety. They should not be handled separately as the failure of security

system can cause safety barriers failures and it might result in conventional nuclear accident scenarios. In that regard, safety and security are handled closely by the IAEA. That point was emphasized in several occasions: at the 'international conference on effective nuclear regulatory systems: facing safety and security challenges' organized by IAEA and held in Moscow February 2006; at the INSAG's recent 'Annual Assessment Letter to the IAEA Director General' dated at August 2007 to describe Recommendations and Opinions on Current and Emerging Nuclear Safety Issues.

#### *2.3 Comparison of Old and New Reactors*

The comparison of safety and security level between aged reactors and new ones such as Gen-3+ and Gen-4 systems would be increasingly the controversial issues. Operating NPPs have already licenses to operate for given periods and there is limitation in upgrading safety and security to the level of new ones. Hence, regulatory criteria between permitting continued operation and forcing shutdown of old reactors would be asked by domestic and international stakeholders. This issue is also related to safety goal and total risk management of nuclear facilities. It would not be easy for society to accept the significant increase of risk by the construction of many new reactors. Then it would be needed to persuade them that the total risk will be still within acceptable limit by the substantially low risk of new reactors and reducing risk level of existing reactors.

#### *2.4 Changing Environmental Conditions*

As the global climate changes, many countries are experiencing unusual weather such as local heavy rain and snow, fierce heat and cold, and super typhoon/hurricane. Some countries have to stand ready for the sea-level rise. Continuous attention must be paid to the influences of changing environmental conditions on NPP safety. Safety reassessments of NPPs built with old design criteria need to be conducted against new analysis results on weather, earthquake and tsunami. In addition, emergency preparedness and security measures in old NPPs must be enhanced in commensurate with new ones.

#### *2.5 Requirements for New Regulatory Approaches*

More efforts should be made for reducing human errors, managing organizational factors, strengthening

management leadership and fostering safety culture, where many areas for improvement are left and both licensees and regulators need to develop and adopt new approaches for the areas. International agencies need to play more active role in improving operational experience feedback. Discussion on regulatory goal of ensuring nuclear safety is underway. Regulatory goal is considered to provide the public or stakeholders with satisfaction or ease with safety. Public confidence is therefore needed to achieve the regulatory goal and enhancing transparency or openness is needed as it is one element of public confidence. Public demands on nuclear safety have been growing and regulatory approach also has evolved to meet them. Transparency in regulatory process and public communication becomes more important in regulatory activities and stakeholders' participation and interaction are also increasing. However, transparency may conflicts with confidentiality. Holistic approach for safety should be considered. It is also needed to assure nuclear safety in accordance with global standards. The concept of integrated safety assessment of NPP is presently discussed by senior regulators. If it is developed and widely accepted, safety confirmation of NPPs and comparison among them might be realized. Then, global safety standards would be discussed in terms of best practices beyond international harmonization. Maintaining, and in some cases developing competence are becoming an important issue. Risk informed performance based operation and regulation would be also continuing challenges.

#### *2.6 Role and Responsibility of Regulators*

During next decades, regulators should think over their roles and responsibilities. They should determine whether to end with just assurance of nuclear facilities' being operated within an acceptable level of safety, or to extend to achieving the public's satisfaction with safety and their feeling of freedom from nuclear risk. They should deliberate their role and responsibility in assuring safety. The scope and way of regulatory activities will be affected by the result of the deliberation. Regulatory body should assume its responsibility for nuclear safety keeping in mind the principle that prime responsibility for safety rests with licensees.

#### *2.7 Global Approach and International Cooperation*

To secure a robust basis for assuring safety and security, global approach would be required considering the trans-boundary nature of nuclear hazards. At the international level, the collective action problem is compounded by the gap between externalities that are becoming more and more international in reach, and the fact that the main policy-making unit remains the nation state. The concept of Global public goods (GPG) has been suggested by UNDP that provides strong basis for

international or global approach. International cooperation and pressure for safety that may be initiated by regulators' leadership would be effective.

### **3. Conclusion**

To predict or imagine the future challenges to nuclear safety and security and take preventive measures in time is regulator's top priority mission. It is no use blaming utility or imposing stringent regulatory requirement after a serious event actually happens. Regulators need to be conservative enough because the public is observing the regulatory process especially for controversial issues such as life extension and power uprates. Regulator's duty is considered to remove the concern and worry about the safety and security of nuclear installations. Regulators need to be always calm, especially in the wake of nuclear renaissance. Regulators mission or objective is to protect public health and safety and also to assure that nuclear installations are operated in the acceptable safety level. Wisdom of every expert in every area, collective intelligence is needed and the consilience, unity of knowledge, should be emphasized and implemented to accomplish regulatory mission.

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