MANAGEMENT OF TECHNICAL KNOWLEDGE IN STRENGTHENING THE GLOBAL NUCLEAR SAFETY REGIME

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Abstract

The management of technical knowledge is becoming one of the key issues and challenges in strengthening global nuclear safety. The success of the industry depends on how to optimize knowledge acquisition, transfer and deployment. In this presentation, joint conduct of large-scale R&D work, assurance of free flow of safety-related knowledge from developed to developing nations, and potential imposition of a trade agreement between nuclear exporting and importing nations are discussed. The introduction of a "***Global Nuclear Safety Treaty***" could be an excellent mechanism for achieving effective knowledge management and eventually enforcing a global safety regime.

Key words: nuclear safety, global nuclear safety regime, knowledge management

Preamble

As we all well aware, nuclear energy has contributed greatly to human welfare. It has generated electricity economically, and facilitated the stable long-term supply of energy in the world. And most important of all, it has contributed tremendously to mitigating the global warming problem.

The sustained record of operational safety has always been the most important factor in maintaining the use of nuclear energy as one of the best electricity options. Safety has been, and will continue to be, of paramount importance in the future sustainable development of nuclear energy.

Nuclear safety is not an issue of one nation, but rather that of a large region or of the whole world. We have experienced the results of global impact from the local breach of nuclear safety. The accidents of TMI-2 and Chernobyl are typical examples. One of the most important lessons that we have learned from these accidents is the fact that we could have avoided these unfortunate accidents if we had established a better mechanism of enforcing the global safety regime beforehand. Hence, constructing a good global safety regime, and strengthening it by establishing a strong implementation system is a very important issue left to us.

The definition of "technical knowledge" is basically information plus experience. The technical knowledge is an important resource and asset, which requires a focused effort of management to optimize its acquisition, transfer and deployment. In particular, it is essential to develop the well-organized management of safety-related knowledge (information plus experience) in nuclear power technology. In order to establish a robust global safety regime, we have to make sure of its proper management for reliability and availability at the right time.

To optimize the acquisition of technical knowledge, in this presentation, the joint conduct of large-scale R&D work is proposed. To optimize the transfer and deployment of the technical knowledge, the global sharing of the knowledge, i.e. the assurance of free flow of safety-related information and experience from developed to developing nations, is discussed. And the potential safety implications involved in the worldwide trade of nuclear power plants

among nations are reviewed, especially trading from developed and developing nations. The mechanism for imposing a strong trade agreement between nuclear exporting and importing nations is looked into to ensure global safety.

Joint Performance of R&D

There is no doubt in my mind as a nuclear professional that we have already developed a very robust and solid technology, and most of us have strong confidence and satisfaction in the present level of its safety. Actually in recent times, nuclear power plants continue to show strong safety performance records worldwide.

Nuclear safety, however, is not an issue that can ever be regarded as “resolved.” As INSAG Chairman Richard Meserve wrote in a recent letter to the Director General of IAEA: "Nothing is more corrosive to continued safety performance than a belief that the safety challenge has been 'solved' and that attention can be focused on other matters." It is essential that we preserve the technical competence for safe operation of existing facilities. There is also a growing concern for the nuclear community: how to preserve the knowledge base for advanced reactors such as fast reactors and high temperature gas cooled reactors, which may be used in the future under the programs of the GEN IV International Forum (GIF) initiated by U.S., and the International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO) by the IAEA. This means that we should keep performing R&D work to adequately maintain the safety of existing nuclear power plants as well as to adopt in a timely fashion advanced concepts of nuclear technology for the future.

Most R&D work in nuclear power plant technology requires a large amount of capital investment. And duplicative R&D work is in progress individually in various nations without proper collaboration and integration, which can be considered very inefficient. In R&D schemes, without doubt, most work should have been already performed in some advanced nations or could be easily accomplished through close international cooperation at the minimum cost. International cooperation could start with sharing in expenses among nations in future large R&D projects.

For the purpose of good international cooperation, an international body could be formed to disseminate the results of R&D work with proper review among related nations so that the

duplicative work could be minimized and the expenses could be appropriately shared. Through this body, we could also arrange joint R&D programs. In my opinion, a joint R&D program is also beneficial in gaining public confidence, by showing combined efforts in pursuing the safety at the international level.

Global Share of Knowledge

The global safety regime also requires the optimization in the transfer and deployment of applicable technical knowledge. It becomes very important to develop a good system of sharing technical knowledge among nations: safety-related information and experience, especially up-to-date R&D results and operational experience. We have to develop measures to better identify the nature and scope of the topic, to understand what we do to resolve it, and to determine what co-operative international actions might be appropriate.

Most safety-related R&D work has been performed by a few well-known nuclear vendors in developed nations, and the generated results are considered the proprietary knowledge which is increasingly under their sole controls. By any means, they are not subject to free transfer and deployment of information to other interested parties, even though this might contain the essential knowledge which may prevent the severe breach of safety in global sense. There always exists a case that the vendor's commercialism conflicts against securing global safety.

To ensure that the world nuclear community has the opportunity to share the knowledge needed for global safety enhancement, we have to develop a mechanism of imposing certain obligations to such knowledge generators, for the proper dissemination of information. It is especially required to establish the easy flow of new safety-related R&D information from developed to developing nations. The share of safety-related operating experience among nations is another issue, which has been frequently discussed in various international meetings and conferences. An international organization such as the IAEA should orchestrate its activities in collecting, analyzing and disseminating the gathered operating experience in a timely fashion. Another good example is the Asian Nuclear Safety Network (ANSN) that is already doing the same for transfer and deployment of safety-related information and experience in the Asia-Pacific region. It is envisaged that ANSN serves as a good model for other regional networks for sharing nuclear safety-related knowledge.

Enforcement of the Global Nuclear Safety Regime

Currently, there exist many nations that would like to introduce new nuclear power plants. It is highly likely that there will be a surge of new construction, mostly in the developing nations of Asia and Africa, since it is an attractive option for generating electricity for them. At the same time, nuclear vendors are very bullish in promoting the sale of nuclear power plants that can be built at economically attractive costs. All of these developments suggest that the world trade of nuclear power plants will grow significantly in the coming decades. It will most probably happen through the sale from developed to developing nations.

The international trade should, however, proceed with appropriate attention to nuclear safety. There is a strong international interest in ensuring that plants are engineered and designed, constructed, and operated with close attention to safety. We need internationally consolidated efforts in accomplishing the desired level of global safety. In particular, the establishment of proper national and international infrastructures for maintaining the safe operation is essential in the years following the construction of a nuclear power plant. Even a small nuclear accident in a nation could have big global impacts on public acceptance.

Increased harmonization in national regulatory approaches is required to ensure high quality, independent oversight for nuclear activities. Four months ago in Moscow, there was an International Conference on Effective Nuclear Regulatory Systems - the first effort to bring together all senior regulators with oversight in nuclear safety and security. The conference made a number of recommendations, including: wider participation by all nations in international conventions and other instruments; and renewed emphasis on international cooperation in developing a comprehensive body of international safety standards and security guidance. Also, there was increased emphasis on the value of international instruments - both binding and non-binding - as part of the global nuclear safety regime. Increased emphasis is also being given to the IAEA´s role in the implementation and enhancement of these instruments.

There should also exist a system of assuring nuclear safety between exporting and importing nations. In my opinion, the system should be formulated in such a way that the exporting nation first holds the full responsibility of its safe construction and operation until a proper safety regulating infrastructure is established in the importing nation. In this way, certain

obligations could be developed for the regulators of both exporting and importing nations to work together to ensure that adequate global safety is maintained. The joint responsibility of exporting and importing nations should be sought wherever nuclear trading is exercised. Indeed, there is a strong need for building or strengthening inter-governmental regulatory capacities. The program of multinational design approval that Dr. Diaz, Chairman of USNRC, suggested might be one way of helping the world nuclear trade system to achieve a certain level of safety even though the detailed scheme of its implementation should be further explored in the future.

Reformation of the Convention on Nuclear Safety

The Convention on Nuclear Safety (CNS) has been formulated for each government to agree to accept the intergovernmental commitment to a top level of nuclear global safety. The problem of CNS, however, has been that its sole enforcement mechanism is for each nation just to submit a periodic report. The report is then reviewed and discussed at the review meeting which holds only to a triennial schedule. The time interval between two successive review meetings is considered too long to be reasonable for making proper responses in time. We have to develop a mechanism of properly reviewing safety-implicated matters and exploring the appropriate corrective actions on a continuing basis, rather than triennial basis. Striving for a global safety regime must be a continuing venture. The submission of periodic reports, and a triennial review process as for the present CNS mechanism will never serve the purpose of accomplishing a global safety regime.

It is strongly recommended that CNS must act as a more comprehensive binding agreement in observing global nuclear safety. I think we have to develop a fundamental treaty (maybe named the "***Global Nuclear Safety Treaty***") beforehand, and have all the nations which are interested in selling and buying nuclear power systems join the treaty, with a strong enforcement mechanism for achieving a global safety regime. I think CNS should be reformulated as such a "***Global Safety Agreement***," which would be the major guideline for having every exporting and importing nation comply with the criteria set forth in the Treaty, and IAEA should work hard to enforce the mechanism. The mechanism of sharing technical knowledge should also be included and laid out in detail in the proposed Agreement as one of major principles of achieving the global safety regime.

Summary and Conclusion

The sustainable development of nuclear energy requires the drastic improvement of its world-wide, well-balanced safety, which could be achieved by establishing a proper global safety regime. It could be strengthened through the effective management of safety-related technical knowledge. The future of its management mainly lies on how to optimize the acquisition, transfer and deployment of knowledge, and maintain the knowledge base. Specific cases were introduced in this presentation in this regard: joint acquisition of the knowledge, and global sharing of the knowledge. And, finally, the enforcement mechanism of the knowledge management has been recommended.

Through this presentation, I have proposed to develop a system of: performing joint R&D with large-scale investment; assuring the free flow of safety-related knowledge from developed to developing nations; and imposing a strong trade agreement between nuclear exporting and importing nations to ensure the safe operation and construction. It is recommended to reform CNS as a more enforcing and binding international agreement in keeping the global safety regime.

In conclusion, we will encounter challenges in the sustainable development of nuclear power technology in the future. The effective management of its technical knowledge will become one of the challenges to further strengthen nuclear safety. With wisdom and effort, we can overcome this safety challenge. The IAEA has always had the responsibility of maintaining high levels of nuclear safety through close international nuclear cooperation. These important roles of the IAEA have always been well recognized and should continue to be emphasized more than ever in order to strengthen the global safety regime in a timely fashion.