Chapter 9

Perspectives on Nuclear Safety, Security, Safeguards and Non-proliferation

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Global nonproliferation and nuclear security and safety situation remains facing challenges—The global situation on nuclear non-proliferation, nuclear security, and nuclear safety presently remains facing considerable uncertainties. The Korean Peninsula nuclear issue, although achieved some progress over the year 2018, still in the jeopardy of increasing tension escalations in the wake of the Hanoi Summit ending up without further agreements. The recent tests of the DPRK's short-range missiles have provided more uncertainties for the future of the Korean Peninsula situation. Meanwhile, the Iran nuclear issue is confronting severe challenges. The Trump administration's withdrawal from JCPOA, as well as its revival of sanctions against Iran, has inevitably triggered an increasingly intense confrontation between Iran and the United States, fueling regional tensions and conflicts risks. Nuclear proliferation risks have been increasing featuring as some country has accumulated a large amount of sensitive nuclear materials in the operation process of nuclear power industries which could serve for proliferation purposes. Some emerging technologies are contributing to the proliferation risks growth by facilitating wide-spreading nuclear weapon design knowledge and lowering nuclear devices design and production thresholds. More broadly, the global development of nuclear power industries would inevitably be coupled with the risks of proliferation due to the dual-use nature that nuclear technologies possess.

Chinese approach to address challenges of nuclear proliferation, safety and security—China is facing an extremely complicated situation both in domestic and abroad. The Korean Peninsula nuclear issue is in the vicinity of Chinese territory, which could deliver a considerable impact on Chinese national security. There has been a considerable amount of sensitive materials in China's neighboring counties, leaving China facing potential proliferation threats. Chinese nuclear power industries

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have been undergoing rapid developments with about 11 nuclear power plants under-construction simultaneously, ranking the global top. The facilities would be possibly become the targets of nuclear terrorism, resulting in emerging nuclear security challenges.

Addressing the complicated threats and challenges of nuclear security, safety and proliferation requires strategic thinking and concrete measures. The Chinese ancient culture has provided the general guidance for managing the complicated risks of proliferation, safety, and security, which could be dated back to the philosophy of Confucius and Laozi about 2500 years ago. There is a Chinese character that could be used to convey this idea, which is 和, whose primary meaning is harmony. Chinese ancient philosophers raised great ideas featuring compatibility between peoples and between people and nature. For personal relations, this idea highlights no impose on others; For relational between people and environment, it highlights the integration between the two and the compliance with natural patterns.

To address the imminent domestic threats and challenges, China has adopted a Rational, Coordinated and Balanced Nuclear Safety Strategy, which highlights equal emphasis on development and safety, and develop the nuclear industry in a context of guaranteed safety, equal emphasis on rights and obligations, and promote international nuclear safety on the basis of respect for the rights and interests of all countries, equal emphasis on independent efforts and coordination, and seek universal nuclear safety with a mutually beneficial approach and equal emphasis on symptoms and root causes.

China has attached great importance to the building of legal framework consisting of the laws on nuclear safety, under which administrative regulations and departmental rules dovetail with the law, the provisions of laws and regulations and technical standards complement each other. In June 2003, the Law of the People's Republic of China on the Prevention and Control of Radioactive Pollution was promulgated; in September 2017, the Nuclear Safety Law of the People's Republic of China was issued. By June 2019, China had enacted nine administrative regulations such as the Regulations on the Supervision and Administration of Civil Nuclear Facilities, the Regulations on the Supervision and Administration of Civil Nuclear Safety Equipment, the Regulations on Nuclear Material Control, and the Regulations on Emergency Management of Nuclear Accidents at Nuclear Power Plants. It had issued over 30 sets of departmental rules and 100 sets of safety guidelines, and formulated over 1000 national and industry standards related to nuclear safety.

Milestones of China's Building of Legal Structure on Nuclear Non-proliferation and Nuclear Safety and Security

Governance capabilities, under the legal guidance, are essential to ensure the enforcement of the strategies as well as the legal instruments. China has constructed a three-pronged regulatory system consisting of headquarters, regional offices and technical support organizations and developed a whole set of regulative regimes which includes comprehensive review and license management, whole-process surveillance and law enforcement, round-the-clock radiation environment monitoring, improved nuclear and radiation emergency response and professional teams.

China's increasing embrace of global nuclear governance marks another Chinese effort to enhance its capabilities to confront nuclear proliferation, safety, and security challenges. China joined the Zangger Committee in 1997 and The Nuclear Supplier Group in 2004 respectively and signed with the IAEA the safeguard protocol in 1998. China in 2008 decided to ratify the amendment of Convention on Physical Protection of Nuclear Materials.

Milestones of China's Participation in Global Governance on Nuclear non-proliferation and Nuclear Safety and Security

Chinese nuclear scientists community has launched a variety of research programs on nuclear non-proliferation, nuclear safety, and security and has been conducting dialogues and communication broadly with international colleagues in the area. Chinese scientists in organizations such as China National Nuclear Cooperation, China Institute of Atomic Energy and China Academy of Engineering Physics have done nuclear material composition analysis through destruction analysis technologies such as X-ray fluorescence analyze and mass spectrometry, uranium enrichment,

and plutonium isotope composition through non-destruction analysis technologies such as gamma spectrometry. Chinese scientists employ numerical modeling and Monte Carlo method to simulate nuclear reactors' operation and developed sensitive material detection and vehicle monitoring, which contributes to addressing nuclear material smuggling challenges.

The creation of China-the United States Center on Excellence has marked one of the great highlights in China's cooperation and collaboration with partners worldwide. During the Washington Nuclear Security Summit in April 2010, the former President Hu Jintao reached an agreement with then President Obama on the joint establishment of a Center on Excellence (COE) on Nuclear Security in China. The COE started operation in 2015 and has become a nuclear security exchange and training center boasting the enormous scale, the most comprehensive equipment, the most robust technical capabilities.

Through the systemic approaches, China has maintained a good nuclear safety record for a long time—it ranks among the highest of all countries in terms of nuclear power safety operation indicators. In 2000, 2004, 2010 and 2016, the International Atomic Energy Agency conducted four comprehensive reviews of China's nuclear and radiation safety regulation, giving full recognition to China's good practices and experiences. In the comprehensive ranking of similar units of the World Association of Nuclear Operators (WANO) in recent years, operating units in China have performed above the world median for more than 80 percent of the indicators, and have reached the world's advanced level for more than 70 percent of the indicators.

Suggestions for further enhancing global efforts of promoting nuclear-nonproliferation, safety and security—Nuclear proliferation and security and safety challenges are posing a shared threat to human community. Chinese President Xi Jinping stated in UN Geneva Office in 2017 that “Nuclear weapons, the Sword of Damocles that hangs over mankind, should be completely prohibited and thoroughly destroyed over time to make the world free of nuclear weapons”. It is of great necessity that the international community should take joint measures to address the complicated situations concerning nuclear non-proliferation, nuclear safety, and security.

The Korean Peninsula nuclear issue remains one of the most severe items in international security agenda, which involves complicated domains such as security, politics as well as nuclear technologies. Furthermore, the possible denuclearization process would confront challenges such as declaration, dismantlement, disablements. The Chinese government has consistently advocated solving the complicated situation featuring the addressing symptoms and roots of nuclear proliferation, which means the security concerns and denuclearization demands should be addressed simultaneously. The dialogue and negotiation in this regard would be the most desirable approach. Moreover, given that the denuclearization process could be time-consuming, creative thinking is necessary to ensure the future possible denuclearization process could proceed smoothly. Deals on capabilities frozen, facilities disablements, weapons dismantlement could be reached respectively and separately.

The security mechanism building would be proceeded accordingly, possibly including confidence building measures such as exercise halt, exchange military posture information, and legally binding instruments such as peace treaty.

Given the indispensable role of sensitive nuclear materials in nuclear proliferation, strengthening nuclear sensitive material control would contribute significantly to reduce proliferation risks. The data from International Panel on Fissile Materials demonstrates that the global HEU inventory remains over 1000 tons with potential proliferation, nuclear security, and safety risks despite the significant improvements having been achieved in the reduction of HEU globally over Nuclear Security Summits, leaving considerable rooms to desire for further global efforts. The focus of efforts should be further orientated to reduce HEU usage with the highlight to promote the conversion of research reactors from fueling HEU to LEU. Plutonium would be the other focus of nuclear material control efforts. Spent fuel should be subject to international safeguards wherever possible and greater efforts remain in need of enhancing monitoring and detecting possible clandestine reprocessing facilities. Based on current researches and capabilities, Kr-85 remains the most reliable reprocessing indicator, and ariel random sampling is of more feasibilities than other means given that the required high-density network of fixed monitoring stations in the vast region would be prohibitively costly due to the Kr-85 background.

More theoretically, emerging technologies are dual-edged swords that could impact negatively on international security if proper management is absent. Global scientists community in this regard would be obligated to take enhanced approaches to take preemptive measures of risk management such as assessing proliferation as well as safety and security risks, promoting national legalization as well as participating in international cooperation.

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