

Enhancing Nuclear Security Culture in China

---Next Steps for Strengthening China's Nuclear Security

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Current Practices of China's Physical Protection

- Widely applied the modern PPS; the concept of defense in depth and detection balance;
- Based on DBT including outsider and insider adversaries
- Switching from the traditional “guns, gates, guards” approach to an effective mixed approach, combining personnel with modern techniques;
- Facilities required to conduct in-depth vulnerability assessments;
- Applying the graded protection measures, according to the relative attractiveness, the nature of nuclear materials and facilities, and potential consequences;
- Emergency plan to response: unauthorized removal of NM, sabotage of nuclear facilities .

Cat. I nuclear facilities	Physical protection
<p>---Facilities containing category I nuclear materials</p> <p>---100 MW(th) reactors or larger</p> <p>---Spent fuel pools with 10^{17} Bq Cs-137 radioactivity or larger</p> <p>--- Spent fuel reprocessing facilities</p> <p>--- High-level liquid nuclear waste storage and processing facilities</p>	<p>---24 hour armed policemen at individual and vehicle access to the three areas</p> <p>--Alarm and monitoring system at all access entrances</p> <p>---Permits or badges held by authorized personnel and vehicles to enter three areas</p> <p>--Strict control of non-site personnel and vehicles to access; full time escort with site personnel after entering the protected and vital areas</p> <p>--A “two man and double-lock” rule for the vital area</p> <p>---Radioactive material detection systems installed at access to the protected and vital areas</p> <p>---Emergency power backup system</p> <p>---A system control center to manage physical protection system</p>

China's nuclear security: Challenges

- ❑ No unified national-level DBT standard; could not cover 911-type attack.
- ❑ No realistic tests of security performance (force-on-force exercise)
- ❑ Major regulations and rules issued 20 years ago
 - "Regulations for Control of Nuclear Materials of the People's Republic of China" (1987)
 - "Rules for Implementation of the Regulations on Nuclear Materials Control of the People's" (1990)
- ❑ Ineffective MC&A system for bulk processing facilities (e.g. reprocessing plant)
- ❑ Nuclear security culture issues

Nuclear security culture is imperative

---To ensure that nuclear security systems are actually implemented effectively, the development of an effective security culture is imperative.

“The fundamental principles of nuclear security include embedding a nuclear security culture throughout the organizations involved. By the coherent implementation of a nuclear security culture, staff remain vigilant of the need to maintain a high level of security.”

--Nuclear Security: Global Directions for the Future (Proc. Int. Conf. London, 2005), IAEA, Vienna (2005) 262.

Nuclear security culture is imperative (Con't)

--Nuclear security culture is defined as:

The assembly of characteristics, attitudes and behavior of individuals, organizations and institutions which serves as a means to support and enhance nuclear security.

--"An appropriate nuclear security culture aims to ensure that the implementation of nuclear security measures receives the attention warranted by their significance."

(IAEA : Nuclear Security Culture—Implementing Guide, 2008)

GOAL: EFFECTIVE NUCLEAR SECURITY

Management systems are well developed and prioritize security

- (a) Visible security policy;
- (b) Clear roles and responsibilities;
- (c) Performance measurement;
- (d) Work environment;
- (e) Training and qualification;
- (f) Work management;
- (g) Information security;
- (h) Operation and maintenance;
- (i) Continual determination of staff trustworthiness;
- (j) Quality assurance;
- (k) Change management;
- (l) Feedback process;
- (m) Contingency plans and drills;
- (n) Self-assessment;
- (o) Interface with the regulator;
- (p) Coordination with off-site organizations;
- (q) Record keeping.

Behaviour fosters more effective nuclear security

Leadership behaviour

- (a) Expectations;
- (b) Use of authority;
- (c) Decision making;
- (d) Management oversight;
- (e) Involvement of staff;
- (f) Effective communications;
- (g) Improving performance;
- (h) Motivation.

Personnel behaviour

- (a) Professional conduct;
- (b) Personal accountability;
- (c) Adherence to procedures;
- (d) Teamwork and cooperation;
- (e) Vigilance.

PRINCIPLES FOR GUIDING DECISIONS AND BEHAVIOUR

- (a) Motivation;
- (b) Leadership;
- (c) Commitment and responsibility;
- (d) Professionalism and competence;
- (e) Learning and improvement.

BELIEFS AND ATTITUDES

- (a) Credible threat exists;
- (b) Nuclear security is important.

Characteristics of nuclear security culture, (IAEA, NSC, 2008)

Nuclear security culture is imperative (Con't)

BELIEFS AND ATTITUDES

- (a) Credible threat exists;
- (b) Nuclear security is important.

---One key element of an effective nuclear security culture is that relevant individuals hold a deeply rooted belief that nuclear security is important and that insider and outsider threats are credible.

---"These beliefs form the foundation of nuclear security culture and are vitally important because they affect behaviour that ultimately influences the effectiveness of nuclear security to achieve objectives relating, for example, to nuclear non-proliferation and counter-terrorism." (IAEA, NSC)

NSC in China: Challenges

- However, many Chinese professionals in the nuclear field still doubt that the nuclear terrorism threat is realistic in China.**
- Complacency within its nuclear industry: believe that China already has strict nuclear security systems that have worked well and “free of accident” over the past 50 years.**
- Some managers doubt whether it is worth the money and time to establish and maintain a stronger security system.**

Assessment on the risk of nuclear terrorism threat in China

Some Chinese nuclear experts doubt that the nuclear terrorism threat is realistic in China. They argue:

- **Theft, seizure, and the explosion of nuclear weapons within China--implausible**

---Because China's arsenal is very limited, tightly monitored and guarded by heavy armed forces.

- **Theft of nuclear material and making a bomb--extremely low**

---They argue: the technologies necessary for manufacturing, delivering and detonating a weapon are very difficult for Chinese terrorists to obtain.

---China has established a strict regime of security and accountability of its nuclear materials.

China has very limited stockpiles of warheads, Pu and HEU

---1.8 t Pu and 16 t HEU

---about less than half of the material in about 200 warheads.

---about 10 t materials distributed in several sites (less than 10), strict control by military

--- the warheads not only 3 G, also advanced PPS: real time video monitoring, infrared secure system, a computerized warheads accounting system, temperature and humidity controls, fingerprinting and other control, advanced communication, etc.

■ Sabotage of nuclear facilities -- plausible

---As the number of nuclear power plants is rapidly increasing--poses a challenge to China's nuclear security.

---the Fukushima accident may increase the interest of terrorists in targeting the NPP

China's nuclear energy development

- 50s defense nuclear—1979 focus switched to civilian nuclear power----mid 80s decided to develop NPP
- currently, operating 20 reactors of 16GWe; 31 reactors (34 GWe) under construction
- official Plan: 40 GWe installed capacity by 2015; 58 Gwe installed + 30 Gwe under construction by 2020; more expected in coming decades.
- a multi-purpose reprocessing pilot plant (50 tHM/yr) at Jiuquan complex: started construction in 1997---Dec.2010 hot test.
- a demo reprocessing plant (200tHM/yr) proposed, operation in 2020?
- a commercial reprocessing plant (800tHM/yr) planed in commission in 2025? (negotiating with Areva).
- 25 MWe China Experimental Fast Reactor (CEFR), near Beijing, commission in July 2010. First loading 240 kg (64.4% HEU), later MOX.
- a pilot MOX fuel fabrication (0.5t/a) building;---A commercial MOX fuel fabrication plant planned in commission by 2025?
- larger commercial FBRs to be commissioning 2030-2035? Not feasible before 2050?

Chinese assessment on sabotage of power reactors

Based on the design features of power reactors and the likely characteristics of a terrorist attack, Chinese experts identified five potential modes of attack against a nuclear power plant:

- 1) **attacks against the reactor building with the goal of causing a large-scale release of radioactive materials--would lead to serious consequences including social and psychological disruption;**
- 2) **thefts of nuclear materials for future terrorist acts, including passive, explosive (i.e. dirty bomb) or atmospheric dispersal of the materials to incite public panic;**
- 3) **attacks against secondary facilities that would disrupt reactor operations, causing a shutdown with economic and psychological effects;**
- 4) **attacks against conventional facilities at nuclear power plants that would result in economic and psychological effects;**
- 5) **attacks against plant workers, leading to a collapse in reactor operations and/or plant command structures, and inflicting a psychological setback.**

Chinese assessment on sabotage of power reactors (cont'd)

They concluded:

the first mode--the only mode that could result in the severe consequence of a radioactive release. The impact of the others would be limited to social and psychological disruption

However, the above conclusions are incomplete:

--As the Fukushima accident demonstrated, the destruction of off-site power supplies and on-site diesel generators could also lead to a major radioactive release even while the reactor building remained intact.

--Destroying the reactor's connection to the ultimate heat sink would be another possible out-of-building strategy.

--Post-Fukushima reviews have concluded that assets outside the protected area of the reactor also need to be protected to avoid major releases.

Chinese assessment on the risk of nuclear terrorism threat (cont'd)

- **“dirty bomb”—the most realistic threat**
 - relatively easy to make using radioactive sources
 - such sources are distributed widely across China.
 - there exist many orphan and spare radioactive sources.
 - the control and management systems for radioactive sources are weaker than those for nuclear materials

Rethinking the nuclear terrorism threat in China

■ Insider threat

---the possibility of insider theft of nuclear materials in China cannot be ruled out, especially as China increasingly grows into a market-oriented society and contends increasingly with corruption.

---recently, several senior officials of the National Energy Administration (responsible for nuclear power development) under investigation for corruption

■ Outsider threat

---in particular, the terrorist forces of “East Turkestan,” which the Chinese government believes have long been recipients of training, financial assistance, and support from international terrorist groups including Al Qaeda.

---recently, Xinjiang terror activities within and outside the region is increasing .

Rethinking the nuclear terrorism threat in China (cont'd)

■ Smuggling concerns

---China has borders with Central Asia and Pakistan---a high level of international terrorist activity and cause for higher levels of concern since the risk of nuclear smuggling and proliferation is believed higher.

---these regions are also the locations where the Eastern Turkistan Islamic Movement has a solid presence.

■ A security incident elsewhere would affect China

---a security incident on the scale of Chernobyl, wherever it could potentially occur, would be a global catastrophe and would result in severe consequences that doom prospects for large-scale nuclear growth everywhere, foremost within China, which is the most rapidly growing nuclear power sector in the world.

Measures for enhancing NSC in China

❑ Updating nuclear security legal framework

- Requirement of NSC as licensee management responsibility.
- Review and upgrade requirements for a national-level DBT.
- The minimum DBT standard should include protection against: 1) *a* modest group of well-armed and well-trained outsiders; 2) a well-placed insider; and 3) both outsiders and an insider working together, using a broad range of possible tactics.
- Updating its old 1987 Regulations and 1990 Rules and issue the new strict and clear Regulations and Rules based on least the minimum DBT standard.
- To incorporate the latest IAEA guidelines regarding nuclear security into its national laws, e.g. INFCIRC/225/Rev.5, conducting realistic “force-on-force” exercises.
- Having a nuclear security regulatory body that has adequate legal authority, technical and managerial competence, and financial and human resources to ensure it can carry out its responsibilities and functions effectively, efficiently, and independently.

Measures for enhancing NSC in China (Con't)

❑ Clarifying the responsibilities of organizations

- Regulators and operators etc have a clear a nuclear security policy: declares a sound commitment to quality of performance in all nuclear security activities, and makes it clear that security has a high priority
- Ensuring that an adequate nuclear security culture is in place and maintained by the use of appropriate management systems/ structures, including requirements of security expectations and standards, etc.
- Making arrangements for regular review of nuclear security practice and systems, including lessons learned from internal & external reviews, security exercise , changes in the threat level.
- Establishing expeditious means to communicate security related information; Sharing intelligence knowledge and data among relevant organizations.

Measures for enhancing NSC in China (Con't)

❑ Leadership commitment

- Leader and managers ensuring that people understand that: *A credible threat exists; Nuclear security is important.*
- Establishing a formal decision making mechanism well understood, including : individuals involved are able to contribute their knowledge and ideas.
- At all levels of an organization, managers must ensure that training is conducted to develop skills and provide tools to promote and implement security culture.
- Motivating staff members via rewards and recognition; encouraging vigilance, questioning attitudes and personal accountability.
- Encouraging personnel to report any event that could affect nuclear security.
- Seeking continual improvement in nuclear security culture; working to prevent complacency from compromising overall security objectives, e.g. corrective actions response to experience, conducting self-assessments, performance testing, etc.

Measures for enhancing NSC in China (con't)

❑ Role of personnel

- All personnel are accountable for their behaviour and motivated to ensure nuclear security; conducting in a manner that recognizes the circumstances and potential consequences of their behaviour.
- Conduct regular training programs at its nuclear facilities -- not only to improve the guards' and security personnel's professional skills, but also to impress upon them that nuclear security is important and must be taken seriously.
- Each staff member should not only scrupulously abide by the existing nuclear security regime, but also actively and continuously find further ways to improve it.
- Avoiding divulging any information that has the potential to undermine security.
- Strengthening teamwork and cooperation among all personnel involved in security. All staffs understand how their particular roles and interfaces contribute to maintaining security.

Measures for enhancing NSC in China (con't)

□ **Strengthening international cooperation**

--Continuing US-China cooperation in the civilian sector; extending cooperation to the military sector, e.g.:

--Moving forward with cooperation on security culture including implementing targeted programs to assess and improve security culture at each key site.

--Using the new CAEA Center of Excellence to provide training and exchanges of best practices for domestic guards and security personnel and those from other countries in the Asia-Pacific region.

-- Strengthening cooperation with the IAEA, e.g. host IPPAS mission: allow teams of international experts to periodically evaluate their security procedures

Measures for enhancing NSC in China

□ **Strengthening international cooperation (con't)**

--Sharing nuclear security best practices with others, e.g. through exchanges facilitated by WINS.

--Joining the new initiative on Strengthening Nuclear Security Implementation as other 35 countries pledged at the 2014 Nuclear Security Summit

-- to incorporate the IAEA principles and guidelines regarding nuclear security into its national laws;

--host IPPAS mission

More could be read:

Hui Zhang and Tuosheng Zhang, *Securing China's Nuclear Future*. Cambridge, Mass.: Report for Project on Managing the Atom, Belfer Center for Science and International Affairs, Harvard Kennedy School, March 14, 2014.

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Hui Zhang, "Why China Should Observe the Nuclear Security Summit Pledge." *Bulletin of the Atomic Scientists*, April 21, 2014.

Hui Zhang, "How Beijing Can Help Prevent Nuclear Terrorism." *Bulletin of the Atomic Scientists*, March 10, 2014.