Nuclear Terrorism: a Potential Threat to China

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Introduction

Nuclear terrorism has become one of the most urgent threats to international serenity. The 2012 Nuclear Security Summit stated that nuclear terrorism is 'one of the most challenging threats to international security'. Currently, along with the spread of nuclear technologies, the risk of terrorist groups acquiring nuclear material and triggering a nuclear incident is growing. The US government has often declared its determination to tackle nuclear terrorism; exemplified by their efforts alongside the international community to secure Soviet-era nuclear materials and weapons that were at risk from theft, loss, or accident after the fall of the Soviet Union.

The role of the fast-globalising and rapidly-increasing nuclear industry in reducing the risk of nuclear terrorism and improving international nuclear security can be viewed as a two-edged sword. On one hand, the improvement of nuclear technologies could enhance the nuclear security level in some regions. On the other hand, this rapid growth could increase the total quantities and dispersion of nuclear material;increasing the problems in securing these materials against loss or misuse.

There are three types of nuclear terrorism that arouse wide concern. One is the detonation of a nuclear weapon or improvised nuclear device (IND). The second is radioactive contamination by a diffuser, such as a dirty bomb, or environmental poisoning. The third is the sabotage of nuclear facilities, to diffuse radiation.

Different types of nuclear terrorism inflict different damages. When a nuclear weapon detonates, 50% of its total energy is released as blast, 35% is released as heat, 5% is released as initial radiation, and the remaining 10% becomes residual nuclear radiation.[1] The physical damaged caused by the explosion of a dirty bomb would be relatively small. The most lethal element of such an attack would be the health problem caused by the resulting radioactive contamination. This is also the case for a sabotaged nuclear facility, which would disperse radiation. Fortunately, most nuclear reactors are purposely located in areas with low population densities, as the consequences of a radioactive leak are considered before their locations are chosen. But some research reactors, especially those used in universities, are located in the center of cities. Aside from the casualties and physical damage caused by acts of nuclear terrorism, the economic and social disruption caused by such attacks would also be devastating.

Type of nuclear terrorism	Blast and heat damage	Radiation damage	Location
Nuclear weapon	Huge	Huge	City or Harbor
Crude nuclear bomb	Large	Large	City or Harbor
Dirty Bomb	No larger than conventional bomb	Relatively small	City
SabotagedCommercial facility	Bomb-limited	Large	Rural area
Sabotaged Research reactor	Bomb-limited	Relatively small	City

Table 1: The consequences of different types of nuclear terrorism

The risk of nuclear terrorism in China

China has always attached importance to, and been supportive of, international efforts in the arms control and disarmament field, putting forward many reasonable and feasible proposals in this regard in a serious effort to promote the international arms control and disarmament process. In tandem, China has made efforts to make their nuclear

stockpile more safe and secure.[2] Substantial additional efforts have been made to prevent and combat nuclear terrorism, including: further strengthening physical protection of nuclear materials and nuclear installations, improving export control mechanisms, drafting emergency response plans to deal with nuclear terrorism and accidents, strengthening the control and management of nuclear materials, and so on.[3] China also faces the potential risk of nuclear terrorism. Firstly, extremists exist in China, some of whom might try to achieve their interests through terrorist activities. Secondly, while China has strict control over the development of its nuclear industry, increasing numbers of nuclear facilities will also amplify the difficulties in securing them all. Thirdly, the quantities and dispersion of global nuclear weapons and nuclear material stockpiles creates a risk of international nuclear terrorism.[4] Fourthly, China's extensive borders and large-scale import and export trade - from food and light industry to raw materials and heavy industry - create a number of busy ports, exacerbating the risk of nuclear terrorism.

Chinese terrorist groups

As stated above, China is facing various terrorist threats, and has already been a victim of terrorism.[5] Several organisations are regarded as terrorist organisations by China's Ministry of Public Security. These include the Eastern Turkestan Islamic Movement (ETIM), the East Turkestan Liberation Organisation (ETLO), the World Uyghur Congress, and the East Turkistan Information Center.[6] They have carried out several terrorist attacks in China,and may potentially use violence again – either alone or in collusion. If these groups were to include employees or contractors of nuclear facilities, the risks of nuclear terrorism would increase. Among these groups, ETIM is one of the most harmful, having claimed responsibility for over 200 acts from 1990-2001.[7] The group has a close relationship with al-Qaeda, and receives funding and training in Afghanistan.[8] Recently, some of these terrorist groups became involved in the Syrian crisis. An article highlighted that, '[t]heir aim is not only troop training, but also seeking for the acceptation and support from other terrorist groups, so as to get help in the future.'[9] Furthermore, the increasing capabilities of criminal groups exacerbates the threat of nuclear terrorism in China. These groups have been involved in a number of incidents that have caused great casualities to China over the last thirteen years – some of which are listed in Table 2. Incomplete statistics show that in the past decade, more than ten crimes utlised explosives or homemade grenades. As the force of the terrorist group grows, so too does the risk of nuclear terrorism.

Date	Event	Location	Perpetrators	Weapons	Casualties
20/04/2013	Ethnic clashes	Bachu,Kashgar, Xinjiang	25	Knives, explosives	15 deaths
29/06/2012	Hijacking	Hotan - Urumqi	6	Aluminium crutches, explosive[1]	-
28/02/2012	Attack	Kargilik, Xinjiang	9	Knives, axes	16 deaths 18 injured
30/07/2011 31/07/2011	Attacks	Kashgar, Xinjiang	2 5	Explosives, guns, knives	18 deaths 40 injured
18/07/2011	Attack	Hotan, Xinjiang	18	Molotov cocktails, knives, grenades	5 deaths 6 injured
19/08/2010	Bombing	Aksu, Xinjiang	6	Explosives	7 deaths 14 injured
12/08/2010	Attack	Yamanya, Xinjiang	9	Knives, spears	3 deaths

[1] The terrorists pretended as the disabled to avoid the security check. The explosive is hidden in the artificial limb, the aluminum crutches is used as stick.

27/08/2010					1 injured
10/08/2010	Attack	Kuqa County, Xinjiang	15	Homemade explosives	5 deaths save 13 hostages
04/08/2010	Attack	Kashgar, Xinjiang,	2	Grenades, knives	17 deaths 15 injured
05/01/2007	Raid	Pamirs Plateau, Xinjiang	35	Grenades, guns, explosives	1 injured
03/04/2002	Bombing	Chengdu, Sichuan	2	Explosives	Many injured, 1 seriously
16/03/2001	Bombings	Shijiazhuang, Hebei	1	Explosives	108 deaths 38 injured

Table 2: **Violent incidents, some involving criminal gangs, in China over the past thirteen years**

Risks to nuclear facilities

To keep up with growing energy demands, the Chinese government has set up aggressive plans for improving its future nuclear capacity, significantly increasing the responsibility to enhance nuclear security. Currently, the two most pressing issues relate to the quantities and dispersal of nuclear materials. Firstly, the amount of nuclear material is large. Many countries around the globe hold weapons-usable high-enriched uranium or plutonium. The international nuclear material stockpile poses a risk for all countries, not just for those that own said nuclear material. Therefore all countries should together make an effort to secure the material. These materials are not only used for weapons, but also exist in research reactors and experimental reactors. It is possible for terrorists to find some weakness in the safeguards for widely used weapon usable materials, which increases the chances that terrorists might obtain nuclear material. Secondly, these materials are dispersed all around the world, with some countries accounting for more than ninety percent of the world's stockpile, while others have 10 tons of highly enriched uranium and 10 tons of separated plutonium in total - which is less than one percent and two percent of the world's stockpiles, respectively.[10] Despite their lower stockpiles of nuclear material, these smaller countries face a similar threat of nuclear terrorism to that of larger countries. Under the NPT regime, nuclear weapon states are obliged to help non-nuclear weapon states with the civil uses of nuclear energy. While nuclear weapon states have made many contributions to help smaller countries manage their nuclear material stockpiles, there is still a long way to go to before the international nuclear stockpile is secure.

Risks from radioactive sources

Aside from nuclear materials, radioactive sources are another target for a potential terrorist, and it is the control of these sources that is China's most immediate challenge. According to surveys made in 2002 by the State Bureau of Environmental Protection, the Ministry of Public Health, and the Ministry of Public Security, China possesses at least 63,720 radioactive sources. These include isotopes used for irradiation devices, in radiotherapy equipment, and in industrial detection devices. Survey results indicate that in 2002, there were more than 8,300 users of radioactive sources in China, including hospitals, industries, agriculture, research, and education departments, and there were approximately 13,000 spent radioactive sources awaiting disposal.[11]

Radioactive source control should focus on all elements of their use, including source production, import and export trade, markets, utilization, storage, transportation, disposal, and so on. In China, the number of source production companies is relatively small, so high emphasis should be placed upon import control. Strict import and export management systems and a registration system on radioactive sources could increase the management of radioactive

sources, therefore strengthening their security.

Nuclear security requires international cooperation

Some problems need to be solved by international cooperation, communication, and consensus-building. The globalisation process provides more room for terrorists, with many terrorist groups becoming internationally active, complicating the fight against terrorism. Furthermore, the globalisation process can facilitate the development of terrorist expertise and capabilities, as they gain access to many materials or instruments through international trade. Globalisation also presents terrorists with an opportunity to collude with other terrorists, governments, or military officers.

Currently, although there is no international consensus on the legal definition of terrorism, different governments or inter-governmental organisations designated their list of terrorist organisations. Those lists have significant impacts on the groups' activities.[12] The numbers of terrorism organisation designated by a country or organisation are shown in table 3. In the framework of international cooperation, China endeavors to improve nuclear security by restraining its nuclear weapon numbers, stopping the production of weapons-usable nuclear materials, strengthening the effort to secure nuclear material and radioactive sources, developing advanced nuclear security technologies, and fostering nuclear security culture.

Country or Organisation	Australia	Canada	European Union	United Kingdom	United States	India	Russia	China	Turkey
Number of designated terrorist groups	18	44	27	59	54	33	19	4	11

Table 3: Number of designated terrorist groups

Understanding the risks and responsibilities

The risks of terrorism and the risks to nuclear materials are different for each country. As international society becomes globalised, a nuclear or radiological terrorist attack on one nation would affect many others. Three types of international nuclear terrorism risks exist; the risk of attack on domestic nuclear facilities, the act of nuclear material being stolen and the risk of stolen nuclear material from foreign countries being used in an attack. Countries would face different risks depending on how the pathways of nuclear terrorism have been linked.

To understand these risks, one can look at the number of terrorist attacks within each country from 2000 to 2008 to judge the risk of being attacked, and use the number of commercial nuclear power reactors to describe the difficulties in protecting their nuclear material. These two descriptions are combined in figure 4 to give a rough image of the risk nuclear terrorism presents in a number of states.[13] It can be found that for different countries, the risk of being attacked and the risk of sites with nuclear material is inconsistent. Especially, in Europe, some countries suffered more terrorist attacks despite having fewer nuclear power plants, . Given these discrepancies, it is tdifficult to know where exactly to best focus security efforts in order to address certain nuclear risks.

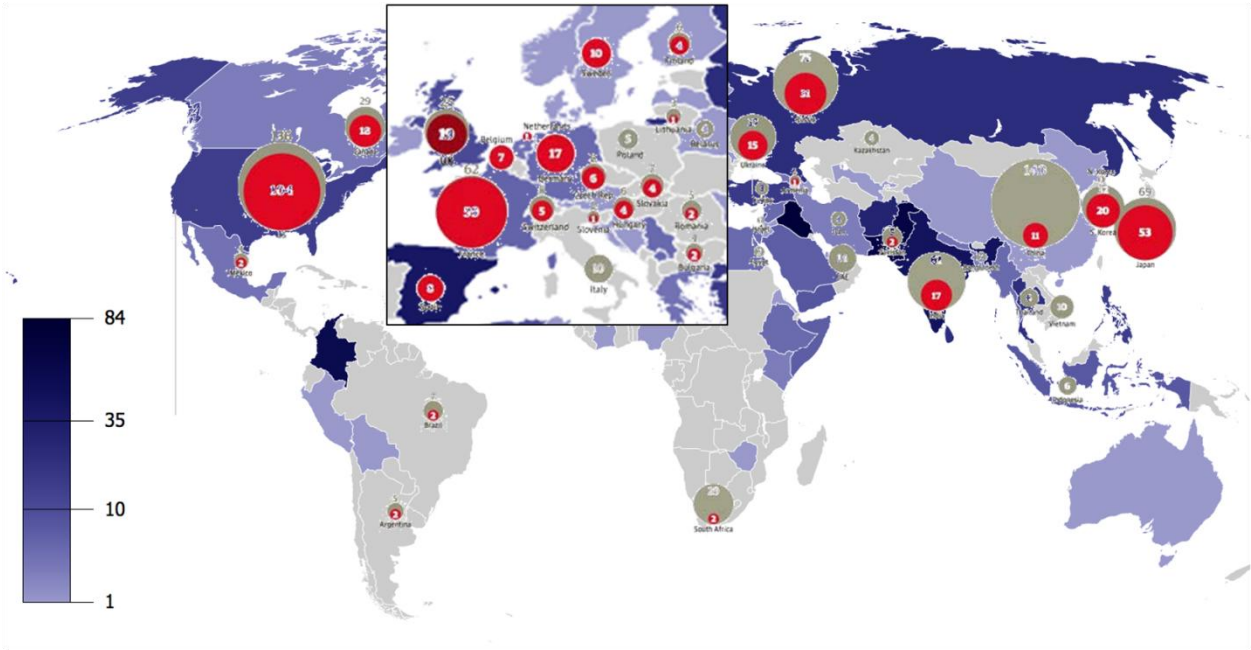

Figure 4: Number of nuclear attacks and nuclear power reactors[2]
Outer circle = planned nuclear reactors, Inner circle = active nuclear reactors, Shade = # of attacks

Countering nuclear terrorism requires joint forces

It would be very difficult for one nation to prevent nuclear terrorism alone. If stolen or built abroad, a nuclear bomb might be delivered to other countries. The length of the border, the diversity of means of transport, the vast scale of legitimate traffic across national borders could all work in favour of a potential nuclear terrorist.[14] As the risk of radioactive material and illicit nuclear material transport becomes evident to the government and public, radiation monitoring at borders crossings are attracting more investment. These detection systems are gradually becoming more widespread, particularly being used to monitor ports. Thanks to the development in radiation detection technologies and its utilization in nuclear security inspection, the sensitivity of radiation monitors is improving. However, while there has been progress in implementing a border inspection system, the risk of nuclear material crossing the border remains high.[15] Factors such as the shielding, the distance and duration of exposure – not just the sensitivity of a detector – all affect the likelihood of detection. Due to the relative low intensity of neutron emission from most nuclear materials, and the effects of shielding, the number of material-origin neutrons is typically insignificant compared with background levels, making reliable detection challenging.[16]

In 2002, the International Atomic Energy Agency (IAEA) established a technical document on the detection of radioactive materials at borders. This document suggested that states undertake a series of measures to combat the illicit trafficking and inadvertent movement of radioactive materials.[17] The document recommends that neutron detectors be placed where there is a need to detect illicit trafficking in nuclear material. With different usage scenarios, the instruments for detecting radioactive materials at borders can be divided into three categories: pocket-type, hand-held, and fixed; installed or automatic instruments. Their sensitivities, false alarm rates and operational availabilities of each category are also recommended in the document.

[2] Is figure is combined and modified with the figure on the number of terrorism attacks between 2000 and 2008 from http://filipspagnoli.wordpress.com/2008/12/16/human-rights-maps-36-worst-terrorist-attacks/ and the figure on the number of nuclear power plants from http://www.guardian.co.uk/environment/datablog/2009/aug/14/nuclear-power-world. The data are up to 2009.

According to this document, a fixed neutron detector should be sensitive enough to detect the existence of 0.01 micro-grams of Californium-252 from a distance of two metres, within 5 seconds. The false alarm rates should be lower than 1 in 10000. While 0.01 micro-grams is a very small quantity of nuclear material, Californium-252 is highly active and emits a large number of neutrons. In comparison, a significant quantity of nuclear material would produce far fewer neutrons. It is possible to calculate the probability of detecting various quantities of nuclear materials if such a recommended fixed detector is used (see table 4). It can be found that the chances of detecting a significant quantity of uranium (be it weapons-grade or natural) is as low as 0.01 percent. The chances of detecting weapons-grade plutonium are only slightly higher – but still lower than one per cent.

Nuclear Material	Counting material	SQ (kg)	Neutron yield (/g/s)	Metal Mass (kg)	Total Neutron (/s)	Detected rate	Oxide Mass (kg)	Total Neutron (/s)	Detection probability
WGU	^{235}U	25	0.001	26	0.028	3.1×10^{-4}	30	0.031	3.1×10^{-4}
HEU	^{235}U	75	0.011	375	4.1	1.0×10^{-4}	425	4.1	1.0×10^{-4}
NU	^{235}U	75	0.014	1×10^{4}	140	1.0×10^{-4}	1.2×10^{4}	140	1.0×10^{-4}
WGPu	Pu	8	60	8	480	0.0024	9.1	530	0.0031
RGPu	Pu	8	193	8	1.5×10^{3}	0.0701	9.1	1.7×10^{3}	0.099

Table 4: **The detection probabilities of different significant quantity of nuclear material**

Conclusion

China faces various terrorist threats, and has recently seen a number of domestic attacks using bombs, gasoline-filled bottles and other weapons. The increased capability of criminal groups makes nuclear terrorism a realistic threat to China as they could resort to nuclear means. As such, China is strengthening the security of its nuclear material in an attempt to prevent nuclear terrorism The threat of nuclear terrorism is not unique to China – it also threatens broader international security. This threat cannot be met by any one country. The international community needs to build a deeper understanding of the problem and find a cooperative solution to the threat of nuclear terrorism.

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About the UK Project on Nuclear Issues (UK PONI)

UK PONI was established in 2010 as a cross-generational forum dedicated to fostering dialogue and building expertise amongst emerging nuclear scholars.

The issues surrounding nuclear weapons and nuclear energy are complex and multifaceted, requiring a broad understanding of everything from technical intricacies to developments in International security. Changes to the shape, size and function of the world's nuclear arsenals, have the potential to profoundly affect global dynamics. Developments in civilian nuclear energy will similarly influence the form and direction of international non-proliferation efforts. These trends will ensure that nuclear issues continue to be at the top of the defence and security policy agenda. Yet despite the continuing importance of nuclear issues, there is little evidence that sufficient expertise is being grown to sustain those with expertise in the field.

Aiming to redress this, UK PONI was established as a cross-generational forum allowing young nuclear scholars to engage with established experts on a wide variety of contemporary issues. As part of the US PONI network founded by the Center for Strategic and International Studies (CSIS) nine years ago, UK PONI aims to promote the study of nuclear issues with a European focus. Accordingly, UK PONI holds an annual conference, as well as small events throughout the year. It also sponsors young delegates to attend conferences elsewhere, and aims to facilitate a global network of emerging nuclear specialists.

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