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Opportunities and Challenges in Developing Nuclear Security in Africa

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Abstract

Those involved in nuclear security recognize that regions of significant instability in Africa have an impact on the safety and security of the continent's nuclear material and un-enriched uranium; however, some countries outside of continental Africa have taken counterproductive approaches to this issue. Despite challenges, the nuclear security community continues to develop and apply appropriate levels of nuclear security where needed. The community also takes every opportunity to make significant contributions to the global discourse on nuclear security culture.

Keywords: nuclear security culture, cultural beliefs, need, propaganda of the deed

I. Introduction

In order to license a nuclear facility, only licensees and regulatory authorities are required to address nuclear safety of the facility—such as the methods used to safeguard nuclear material; however, there is now a greater need for more thorough reviews.

Terrorist threats have evolved from local attacks on regimes, such as the attacks by the Irish Republican Army (IRA) on British military targets in Northern Ireland and the mainland of the United Kingdom, to global acts of war that cause large-scale loss of life, such as the attacks in New York, Mumbai, and the most recent attacks in Paris and Beirut. Terrorists are no longer trying to change the regime within a country, but are now seeking a new world order. They want to redraw geopolitical boundaries to create new states ruled and regulated on a different set of principles—principles based upon theocratic beliefs rather than political systems. A growing global terrorist network that is internationally connected and well-funded is developing as a new threat.

The international security community believes that more significant attempts will be made to acquire and use weapons of mass destruction (WMD). George Tenet, former Director of the CIA, said, "It's not

a question of if terrorists will detonate an atomic bomb somewhere in the U.S. but merely a question of when." This is a chilling comment made by someone who is more informed than most.

II. Terrorism in Africa

Globalization of terror is particularly concerning for Africa, a continent becoming progressively less stable. There are a number of religiously motivated terrorist groups operating in Africa, including Boko Haram in northern Nigeria, Al-Shabaab in Somalia, Ansar Dine in Mali, and Al-Qaeda in the Islamic Magreb in North Africa and the Middle East. These are just 4 of the 13 different terrorist organizations listed by the US Department of State[1]. All of these organizations are willing and able to attack across international borders in order to achieve their goals. Recently, some of these organizations have declared a desire to link with the Islamic State of Iraq and the Levant (ISIL), which is a cause for concern.

III. Propaganda of the Deed

How does this affect nuclear security and development in Africa? Terrorist organizations promote their causes through broadcasts, or so-called "Propaganda of the Deed"[2]. The internet and social media have allowed them to more easily spread this propaganda; however, in order for these terrorist organizations to be heard above the general "noise" found on the internet, they have had to create increasingly more graphic, violent, and disturbing content to get the attention of the media and to shock the general population. The religiously motivated terrorist organizations based in Africa and the Middle East punish prisoners who are imprisoned for apostasy or being of the wrong sect by treating them as slaves and performing punishments described in the Qur'an, such as crucifixions and beheadings. The organizations then video the graphic acts and release them online. A certain audience, however small, will be receptive to these messages.

Displays of violence in terrorist propaganda have become more frequent over the last decade. The bombing of the embassies in Kenya and Tanzania, 9/11 in the US, 7/7 in London, the Madrid train bombings, the numerous attacks in the Middle East, the beheading of Steven Sotloff, and the recent attacks in Lebanon and Paris exemplify the desire to target civilians rather than a particular government. Terrorists are moving away from defined targets and towards more random targets, looking to kill and maim even more people.

IV. Nuclear Threat

The need to "elevate the horror" continues to grow as terrorists seek more airtime on the international news networks in a world where the bars have been raised for what is considered shocking. The media is designed to attract the attention of audiences with increasingly shorter attention spans.

One or more of these terrorist organizations will inevitably use weapons of mass destruction (WMD) to further their ideals—and it wouldn't be the first time. In 1995, Aum Shinrikyo, a Japanese cult still considered a terrorist organization by the US Department of State, carried out an attack on various sections of Tokyo's mass transit system using sarin gas, killing twelve people and injuring around 6,000[3]. There are also reports of Al-Qaeda's attempts to acquire nuclear weapons from sympathizers in Pakistan[4]. These are in addition to those incidents reported to the International Atomic Energy Agency's (IAEA) Incident and Trafficking Database (ITDB), which doesn't necessarily include all incidents that occur each year[5].

V. Africa

In order to better understand the need to establish and maintain nuclear security in Africa, we must take a look at what nuclear material exists—or can be reasonably estimated to exist—on the continent. We must also consider any vulnerability that might lead to an attack on a nuclear or radiological facility.

A. Highly Enriched Uranium

Only a select few know the exact quantities of highly enriched uranium (HEU), but some estimates can be made based on information in the public domain. In the early 1990s, South Africa declared that it had made six-and-a-half atomic weapons of the "gun type." They were subsequently dismantled under the supervision of the IAEA. Each of the weapons contained 55kg of HEU, suggesting that about 400kg of HEU were produced by the enrichment plants at Valindaba[6]. These numbers align with the figures calculated by the IAEA's Safeguards team that oversaw the dismantlement and decommissioning of the facilities[7]. Additionally, the U.S. provided South Africa with a number of kilos of HEU to fuel the Safari-1 research reactor that was built as a part of the "Atoms for Peace" projects in the 1960s. However, the South African Nuclear Energy Corporation (Necsa) returned about 6.3 kg of spent fuel to the U.S. in 2011[8].

Much of the HEU held by Necsa in South Africa has been down-blended to low-enriched uranium (LEU); the Safari-1 reactor can now run on LEU, and LEU targets are being used for the production of ⁹⁹Mo, which is used to make the ⁹⁹Tc generators used for medical imaging. Current estimates suggest that 219 kg of HEU are still held in vaults at Necsa[9]. As of 2011, there were two research reactors in Africa that were fueled by HEU. They are: the Nigeria Miniature Neutron Source Reactor, named Nigeria Research Reactor-1 (NIRR-1) at the Ahmadu Bello University, Zaria, Nigeria and the Ghana Research Reactor (GHARR-1) in Accra, Ghana[10].

Country	Facility Name	Type	Thermal Power (kW)
Algeria	Nur	Pool	1000
Algeria	Es-Salam	Heavy water	15 000
*Democratic Rep. of the Congo	* TRICO II	TRIGA Mark II	1000
Egypt	ETRR-1	Tank WWR	2000
Egypt	ETRR-2	Pool	22 000
Ghana	GHARR-1	MNSR	30
Libya	IRT-1	Pool, IRT	10 000
Morocco	MA-R1	TRIGA Mark II	2000
Nigeria	NIRR-1	MNSR	30
South Africa	SAFARI-1	Tank in pool	20 000

Figure 1. Research reactor in Africa (International Atomic Energy Agency, 2011)

* Currently on extended shutdown status.

B. High level Waste and Spent Fuel

While there are not many public resources that provide information about the amount of HEU, information on high level waste and spent fuel is available online[11].

Storage	USED FUEL ASSEMBLIES
Unit 1	1009
Unit 2	996
Dry storage	112
Total	2005

Figure 2. Used fuel assemblies in storage at Koeberg Nuclear Power Plant[11]

Storage	SPENT FUEL ELEMENTS
Wet storage	175
Dry storage	867
Total	1042

Figure 3. Inventories of used fuel at the Necsá Pelindaba Site

Information regarding the other previously mentioned research reactors is not as readily available, but it is presumably in proportion to the figures given for Safari-1 in Table 3.

C. Uranium Mining and Milling

Natural uranium—because it has yet to be enriched—is very low on the list of priorities when it comes to implementing nuclear security systems, but the author believes that Africa will be brought into focus by a drive to secure the feedstock for the nuclear fuel cycle. Africa has extensive uranium deposits, and there are always explorations for more. As of right now, mining and explorations are taking place in Algeria, Botswana, Central African Republic, Democratic Republic of Congo, Gabon, Guinea, Equatorial Guinea, Malawi, Mali, Mauritania, Morocco, Namibia, Niger, Nigeria, Tanzania, South Africa, Zambia, and Zimbabwe[12].

Clearly, there are large quantities of nuclear material and natural uranium in continental Africa, some of which are close to regions of unrest. To many observers from outside of Africa, this poses a significant nuclear security threat.

VI. Material in Transit

It is possible that terrorists might target Africa, and it is also possible that Africa will become the source of nuclear—or radiological—material used in terrorist attacks. Therefore, the international security community should consider the vulnerability of transport systems across Africa. The Port of Durban, which moves 83,000 containers monthly through the container terminal and employs 6,000 people, is the biggest single transit point for material and the largest container in the Southern Hemisphere, moving more than 31 million tons annually[13]. Further north, there is significant transport of uranium across the continent from mines in Malawi to the port in Walvis Bay, Namibia. There is also the movement of uranium mined in Namibia to Walvis Bay. Additionally, as more new mining concessions are operated, there will be movement of natural uranium from places like Tanzania. The international security community should consider that a multitude of sealed radioactive sources are moved about the continent on a daily basis.

VII. The Message and the Messenger

The issue of nuclear security is inevitably a political one, as a national government is ultimately responsible for nuclear security within the borders of its country. A lack of cultural understanding can affect the message being sent from one country to another.

In a classic example, the U.S. government attempted to seize the stockpile of HEU currently held by the South African Government at Necsa. Prior to both the Seoul and Hague Nuclear Security Summits, President Obama wrote to the South African President urging South Africa to relinquish its stock of HEU. In turn, the U.S. would supply South Africa with a similar amount of LEU. At first glance, this is not an unreasonable offer; however, the South Africa government took offense to the attitude of U.S. officials who were quoted in an article published by both the *Washington Post* and the Center for Public Integrity in March 2015[9].

In the article, many "experts" give opinions on the break in at Pelindaba, the main site of Necsa. These opinions were formed from 10,000km away and with very little understanding of South African culture and the prevailing social inequalities that exist within the country. A comment made by Professor Bunn, a White House security official in the Clinton and Bush administrations, demonstrates his lack of understanding of the crime situation in South Africa. He said, "Nobody breaks through a 10,000-volt security fence to steal someone's cellphone." The assumption "to be disproved," he added, "was that they were after the weapons uranium." But, in fact, criminals bypass 10,000 volt electric fences and disable alarm systems daily all across the country, and it is often to steal cell phones and other disposable electronic items.

Relationships can deteriorate when an individual like Professor Bunn, who is supposedly well-informed and who has advised many administrations, makes statements that are so obviously wrong in the eyes of local observers. *The Washington Post* article led to a significant cooling of relations between the U.S. and South Africa, with a number of important projects being put on hold. Only recently have things begun to return to normal.

While the break-in at the Pelindaba nuclear facility should be considered a nuclear security incident, it should in no way be considered an attempt to steal nuclear material. The attackers were poorly prepared individuals who were lightly armed and scared off by one unarmed man. They were criminals who were looking to make an easy score—not the sophisticated criminal masterminds or terrorists trying to steal HEU. Had they been terrorists looking to steal HEU, they would have been armed with assault weapons; reports in the *South African Mail and Guardian* suggest that a Kalashnikov AK 47 can be purchased for about \$200[14]. Had the burglars had insider information as they claimed, they would not have gone anywhere near the Emergency Control Center and Fire Station—because the HEU is stored elsewhere on the Necsa site.

Unfortunately, some use the Pelindaba break-in as evidence that South Africa and other African countries are incapable of securing their stock of HEU, which has led to an attitude of "We know best, and you should be doing what we tell you." For a sovereign state run by politicians who are not well-versed in international politics, this attitude is guaranteed to cause negative feelings towards those making such statements. The U.S. could have achieved more in the management of the HEU stockpiles at Necsa had a more conciliatory approach been taken.

VIII. The Need for Nuclear Security

Clearly, there is a need to advance nuclear security in Africa, and, fortunately, many people from countries across the continent recognize this need. A number of successful initiatives have raised

awareness for the need to advance nuclear security, helped many organizations to develop necessary skills in nuclear security, and ensured that the people with these skills are able to teach others. The next few paragraphs will make mention of a number of different ways in which the knowledge and information necessary to develop better nuclear security skills have been shared between the people who need to understand and apply the information.

A. Professional Development Courses (PDCs)

King's College London, the University of the Witwatersrand, and the International Nuclear Security Education Network (INSEN), an organization supported by the IAEA, teamed up to develop the King's College PDC concept into an international educational outreach program that has had a significant impact in a number of countries—including a number of African countries, such as Nigeria, Ghana, South Africa, Morocco, and Egypt. It has also made an impact in Indonesia, Jordan, Ukraine, Bulgaria, and Pakistan. Participants in both the original PDCs held in London and the initiative created by King's, Wits, and INSEN have returned home and either replicated the PDC concept in their own countries or took their new knowledge and incorporated it into other educational programs within their institutes.

B. World Institute for Nuclear Security (WINS)

The World Institute for Nuclear Security (WINS) academy provides online education to a large number of students, many of whom hail from Africa. Their program consists of an introductory module, followed by a number of other modules aimed at developing nuclear security skills in a particular field or level of management. A number of bursaries are available to pay for the education. WINS also publishes useful “Best Practice Guides” that are updated on a regular basis and available to the public[15].

C. International Atomic Energy Agency (IAEA)

In addition to supporting many other efforts, the Division of Nuclear Security at the IAEA actively trains individuals in various aspects of nuclear security and continues to offer a number of programs. Perhaps the most important program is the ICTP-IAEA International School on Nuclear Security, which is held annually at the International Centre for Theoretical Physics (ICTP) in Trieste, Italy. The school accepts about 60 young professionals who are new to the field of nuclear security and nuclear forensics and helps develop their skills. In addition to the educational benefits, the school offers a second-to-none opportunity to network with colleagues from different countries. African students are well represented at the school.

D. Institute for Nuclear Materials Management (INMM)

While not an educational or training organization per se, the Institute for Nuclear Materials Management (INMM) actively promotes the development of regional and national chapters of the organization. This allows interested individuals to form and develop relationships with people within their own fields of interest and to share knowledge pertinent to their interests.

IX. Nuclear Security Culture

Newer members of this global family can help by contributing to nuclear security culture and its regional application. For a long time, the nuclear security community has considered the US/Western European system of nuclear security, where junior members of an organization are encouraged to challenge their elders and/or senior members of staff when they recognize a security breach, to be the “right approach.” How can matters such as this be addressed in a region of the world where cultural traditions demand a different approach? One might very well find that, as the use of nuclear technology expands around the

globe, the Eurocentric model of nuclear security will become less popular and other methods of practice will need to be developed to be used in specific regions.

X. Conclusions and Discussion

There are many complex challenges of establishing effective nuclear security in Africa, and they will likely become more complex as more African countries, such as Kenya, Egypt, and Nigeria, show a serious interest in "going nuclear." However, a broad spectrum of individuals in regulatory, industrial, and academic worlds throughout Africa have taken up these challenges and are beginning to make very real and significant contributions to the search for solutions to a number of important problems that the expanding international nuclear family needs to address.

African nuclear security experts and others who better understand the prevailing regional cultures and how they affect nuclear security culture have a significant contribution to make to the development and application of nuclear security culture. Indeed, this seems to be a fertile area for some interesting research.

There are a number of dedicated individuals who fully understand the very real issues associated with the protection of nuclear and radiological material in Africa and the consequences should this material ever be lost. They are actively developing their own skills and the skills of others to ensure that they are not a risk to the world, but rather are used for the betterment of mankind.

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