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VULNERABILITY OF WATER INFRASTRUCTURE TO TERRORISM

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ABSTRACT

Terrorists groups like Al-Shabaab and Al-Qaeda have the knowledge and the capability to strike anywhere in Kenya and with Kenya Defence Forces (KDF) incursion into Somalia in mid-October 2011, the citizens in Moyale, Garrisa, Nairobi and Mombasa have been attacked and lifes' lost. This confirms that Al-Shabaab and Al-Qaeda have been motivated by Kenya Defence Forces (KDF) now under the African Union Mission for Somalia (AMISOM) incursion into Somalia and they will continue to attack Kenya as a way of retaliation. The importance of water and its infrastructure to humanity makes it a soft target for Al-Shabaab and Al-Qaeda terrorist. The hypothesis that Al-Shabaab and Al-Qaeda terrorists will strike at water systems is real. Water infrastructure can be targeted directly or water can be contaminated through the introduction of poison or disease causing agents. This makes water unusable and destroying purification and supply infrastructure. The risk of terrorists attack against this critical infrastructure can result in communal disruptions, disarray, and even overreaction on the part of governments and the public from any attack, may be high. We argue that Kenya Water Infrastructure is vulnerable for Al-Shabaab and Al-Qaeda terrorist attack. In summary, the article looks at concepts of terrorism, the dangers of attack on Water sources, the Kenya government preparedness and recommendations.

Keywords: Water Infrastructure, Water sources, Terrorism

INTRODUCTION

Water has always played, and continues to play, a central role in human societies. Water is a source of life and prosperity. It is an input to almost all production, in agriculture, industry, energy, transport, by healthy people in healthy ecosystems. Water is also a cause of suffering and devastation. It can be a force for destruction, catastrophically through drought, flood, landslides and epidemic, as well as progressively through erosion, inundation, desertification, contamination and disease (World Meteorological Department, 2002).

This destructive aspect of water, as a consequence of its extraordinary power, mobility, indispensability and unpredictability, is arguably unique. Achieving basic water security, harnessing the productive potential of water and limiting its destructive impacts, has been a constant struggle since the origins of human society (UNEP and GOK, 2000). Many of the earliest civilizations, and particularly those on the floodplains of the world's great rivers, succeeded by harnessing water, thus increasing production and reducing the risk of destruction (Mango, 2003). As then so today, water resources development and management remain at the heart of the struggle for growth, sustainable development and poverty reduction. This has been the case in all industrial countries, most of which invested early and heavily in water infrastructure. It remains the case in many developing countries today, where

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investments in water development and management remain an urgent priority (Emerton & Bos, 2004).

In Kenya the challenge of managing their water legacy is almost without precedent. Yet, if these challenges are not met, we believe that sustainable growth and poverty eradication cannot be achieved. Throughout history, water has also been a source of dispute and even conflict between uses and between users at both local and larger scales. As water becomes ever more scarce relative to demand, there are emerging fears of trans boundary waters becoming a source of conflict, constraining growth; conversely, there is also emerging experience of cooperation on trans boundary waters, supporting regional integration as a driver of growth (Republic of Kenya, 2004).

Water is a critical infrastructure that includes ground and surface water sources and mainly reserved in dams and reservoirs. The water is used for home consumptions and needs, industrial and agriculture. Water is a fundamental resource for human and economic welfare and Kenya society depends on complex, interconnected water infrastructure to provide reliable safe water supplies and to remove and treat wastewater (Republic of Kenya, 1999). This infrastructure is vital for human welfare and economic development and it is vulnerable to intentional disruption from terrorism.

According to Gleick (2004) water has been used as a military and political target for over 2,500 years. Water resources and systems are attractive targets because there is no substitute for water. Whether its lack is due to natural scarcity, a physical supply interruption or contamination, a community of any size that lacks sufficient fresh water will suffer greatly. Furthermore, a community does not have to lack water to suffer. Too much water at the wrong time can also lead to death and great damage like in Budalangi and Ahero (Achoka and Maiyo, 2008).

The chance that Al-Shabaab and Al-Qaeda terrorists will strike at water systems is real but not given a high priority by the government and the different water management boards. Water infrastructure can be targeted directly or water can be contaminated through the intentional introduction of poison or disease-causing agents (Kroll, 2006). The damage is done by hurting people, rendering water unusable, or destroying purification and supply infrastructure. Some important water facilities, such as dams, reservoirs and pipelines, are easily accessible to the public at various points. Pipelines are often exposed for long distances. Water and wastewater treatment plants dot our urban and rural landscape. What is less clear, however, is how significant such threats are today, compared with other targets that may be subject to terrorist attack, or how effective such attacks would actually be (Lines, 2002).

Analysis and historical evidence suggest that massive casualties from attacking water systems are difficult to produce, although there may be some significant exceptions. At the same time, the risk of societal disruptions, disarray, and even overreaction on the part of governments and the public from any attack, may be high (Ginsberg *et al,* 2005).

METHODOLOGY

The research employed quantitative and qualitative research methods. Because of the nature of the research topic, the research was formed through the analysis of secondary data and in this respect, extensive library research was done, where journals, internet, newspapers, books, and reports were consulted and studied. According to Bryman (2004) secondary analysis is analysis of data by researchers who will probably not have been involved in the collection of

data and in addition, is concerned with analyzing already collected data within another study (Sarantakos, 2005).

Secondary analysis allows for the examination of existing data yet can produce new and more detailed information, including the emergence of conclusions that differ to those in the original report (*Ibid,* 297).

The advantages of secondary analysis are that it is high quality data (Bryman, 2001) an additional strength of secondary analysis is quick and easy access to materials as documentary research is largely free of the restrictions and difficulties faced in primary data research, the researchers do not encounter rejection, non-response, bias, or any other respondent-based problems (Sarantakos, 2005).

People in the security and water sector were interviewed and provided primary data. A total of ninety seven (97) people of which sixty seven (67) were security personnel, 47 were from the government agencies and 20 from private security firms' and 30 from water sector people were interviewed.

Terrorism and Water Infrastructure

French Republic coined the term 'terror' as a measure to counter-revolutionaries against the weak government in 1795 and as a policy to protect itself (Sinclair, 2003) and the Bolsheviks used it to legitimize their actions against enemies of the state (Halliday, 2001). Terrorism is a subfield of peace and Conflict Studies that analyses the interactions between states and other actors in their engagement with each other over legitimacy (Onkware *et al,* 2010).

The United Nations General Assembly's Declaration on Measures to Eliminate International Terrorism, set out in its resolution 49/60, stated that terrorism includes "criminal acts intended or calculated to provoke a state of terror in the general public, a group of persons or particular persons for political purposes" and that such acts "are in any circumstances unjustifiable, whatever the considerations of a political, philosophical, ideological, racial, ethnic, religious or other nature that may be invoked to justify them" (UN, 1994).The Federal Bureau of Investigation (FBI) defines terrorism as "the unlawful use of force or violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives"(Emerton & Bos, 2004).

Terrorism is one of the most disputed terms and has no comprehensive definition (Martin, 2006 & Schmid, 2004).Terrorism refer to the deliberate killing of civilians, or to the doing of extensive damage to their property, with the intention of spreading fear through a population and communicating a political message to a third party, usually a government (Waltzer, 2002). Challenges of defining "terrorism", especially in the context of water systems, is provided by (Gleick, 2006). This elusiveness reflects the fact that the meaning of the term terrorism remains contested. It can be used in relation to violence by states against their subjects, sometimes referred to as 'enforcement terrorism' or 'terrorism from above' (Bloom, 2005).

It can be used more broadly to describe violent actions in a civil war or other conflict. It can also describe isolated acts of violence separate from a situation of war, intended to cause terror rather than contribute to a broader conflict. By extension, this type of terrorism can refer to acts of violence carried out internationally, in a third country apart from the location of its political cause (Mwakio, 2011).

"Terrorism means premeditated, politically motivated violence perpetrated against non-combatant targets by sub-national groups or clandestine agents, usually intended to influence

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an audience." The definitions focus on motive the "furtherance of political or social objectives". Such motives include religious, cultural, economic or psychological factors. Increasingly important, however, is the question of targets (Kroll, 2006).

In traditional discussions about terrorism, targets are usually governments, political figures, objects of economic or social significance, or random civilians. But the motives and targets can include environmental and ecological resources such as water and built water systems. The social and cultural value and importance of water systems also make them attractive targets. By calling attention to the inability of governments to protect vital symbols of civilization, terrorists can raise doubts about controlling authorities (Gleick, 2006). "The relatively high efficiency of terrorism derives from its symbolic nature. If the terrorist comprehends that he is seeking a demonstration effect, he will attack targets with a maximum symbolic value." There are few natural resources with more symbolic power than water (Thornton, 1964).

Precedence of Water Terrorism

As an example of the economic and human chaos even moderate disruption or contamination might cause, an outbreak of Cryptosporidium in Milwaukee in 1993 killed over a hundred people, affected the health of over 400,000 more (MacKenzie et al., 1994) and cost millions in lost wages and productivity. That outbreak, completely unrelated to terrorism, gives some sense of the vulnerability of modern water systems to similar undetected, intentionally caused, contamination events (Smith, 1994).

Water resources have been used as a target and tool of war and terrorism (Gleick, 1993, 2004). Water resources or systems can be used as delivery vehicles to cause violence to a human population. Water supplies can be poisoned; dams can be destroyed to harm downstream populations. The recorded history of attacks on water systems goes back 4,500 years ago, when Urlama, King of Lagash from 2450 to 2400 BC, diverted water from this region to boundary canals, drying up boundary ditches to deprive the neighboring city state of Umma of water. His son II later cut off the water supply to Girsu, a city in Umma (Ginsberg et al, 2005).

In an early example of biowarfare (or bioterrorism, depending on one's understanding of "states" and "governments" at the time) Solon of Athens besieged Cirrha around 600 BC for a wrong done to the temple of Apollo and put the poison hellebore roots (or rye ergot – reports differ) into the local water supply. This reportedly caused the Cirrhaeans to become violently ill and facilitated the subsequent capture of the city (Eitzen & Takafuji, 1997).

In the 1840s and 1850s, groups attacked small dams and reservoirs in the eastern and central USA because of concerns about threats to health and to local water supplies. Between 1907 and 1913, farmers in the Owens Valley of California repeatedly dynamited the aqueduct system being built to divert their water to the growing city of Los Angeles (Reisner, 1993).

The first reported attack of the Palestinian National Liberation Movement, Al-Fatah, was in 1965 on the diversion pumps of the Israeli national water carrier (Naff & Matson, 1984). In 2001, Palestinians attacked and vandalized water pipes leading to the Israeli settlement of Yitzhar to try to force the Israelis out of the settlement. Around the same time, Palestinians accused Israel of destroying a water cistern, blocking water tanker deliveries and attacking materials for a wastewater treatment project (Israel Line, 2001a,b; ENS, 2001). Rivers and water supply infrastructure such as reservoirs can be especially vulnerable to this type of terrorism, since they are publicly accessible in many places (Smith, 1994).

In July 1999, engineers discovered an unexploded bomb in a water reservoir near Pretoria, South Africa. The bomb, which had malfunctioned, would have been powerful enough to deprive farmers, a nearby military base and a hydrological research facility of water (Pretoria Dispatch Online, 1999). In 2000, a simulated terrorist attack on the Lake Nacimiento Dam caused some local panic in central California until the media was belatedly notified that the situation was merely a disaster preparedness drill (Gaura, 2000).

Motives for such attacks can be economic as well as political. In July 2000, workers at the Cellatex chemical plant in northern France dumped 5000 liters of sulfuric acid into a tributary of the Meuse River when they were denied workers' benefits. Whether they were trying to kill wildlife, people, both or neither is unclear, but a French analyst pointed out that this was the first time "the environment and public health were made hostage in order to exert pressure, an unheard-of situation until now" (Christian Science Monitor, 2000).

More recently, a series of events in India, Pakistan, the Persian Gulf and the Middle East have reaffirmed the attractiveness of water and water systems as targets for terrorists in a wide range of unrelated conflicts and disputes. The major water pipeline to Baghdad was attacked in 2003 (Waterman, 2003). The same year, Al-Qaida threatened US water systems in a call published in a Saudi Arabian magazine: "Al-Qaida does not 'rule out the poisoning of drinking water in American and Western cities'" (Associated Press, 2003; Waterman, 2003). In 2004, twelve Indian security forces were killed by an explosive device planted in an underground water pipe during a "counter-insurgency operation in Khanabal area in Anantnag district" (TNN, 2004).

Vulnerability of Water Infrastructure to Terrorist Attack

The most traditional form of water-related terrorism involves physical attacks on water infrastructure specifically water-supply dams and pipelines. One such attack might target a large hydroelectric dam on a major river or a major water supply system for a city (Lines, 2002).Terrorists equipped with a relatively small conventional explosive might not be able to cause serious structural damage to a massive dam, which is, after all, usually a giant block of rock, earth or concrete. But the adverse consequences of a major dam failure make the risk worth both assessing and reducing. A major dam failure can kill thousands of people and even more modest damage might interrupt power generation or affect some other important water system operation. Some natural disasters involving water infrastructure offer insights into the risks of water-related terrorism (Ginsberg *et al*, 2005).

In 1975, the Banqiao and Shimantan dams on tributaries of the Huang He (Yellow) River in China failed in sequence, contributing to the subsequent destruction of dozens of lower dams and the deaths of 85,000 people. The famous Johnston Flood of 1889 killed more than 2,200 people when the collapse of a poorly built dam sent a massive wall of water through the poor steel town of Johnston, Pennsylvania. At least 400 people died in California in 1928 when the Saint Francis dam failed in San Francisquito Canyon (Yi, 1998).

Worldwide, millions of people live in the floodplains below large dams and reservoirs. In addition to the potential loss of life, there are also secondary impacts including water quality problems, loss of freshwater supply and hydroelectric power, damage to property and commercial fisheries, and recreation losses (Waterman, 2003). Water systems have particularly vulnerable points, such as single large pipelines, pumping plants or treatment systems. The bombing of the major water pipeline entering Baghdad in 2003 highlights such vulnerabilities (Tierney & Worth, 2003).

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Responding To the Threat of Water-Related Terrorism

No easy estimate of the true risk of water-related terrorism is possible. The fact that there are numerous examples of actual and planned attacks on water systems in the past suggests that the risk is real. What is more challenging is evaluating both the probability of future attacks and their consequences – the separate components of calculating risk (Gaura, 2000).

In the absence of any definitive assessment of risk, however, it is vital to both understand vulnerabilities and to put in place measures to reduce those vulnerabilities and ultimately the overall risk. This can be done by reducing the probability of water-related terrorism, the consequences of an attack should one occur, or both. Addressing the probability requires a wide range of actions, from reducing the fundamental motivation for terrorist attacks to limiting the vulnerability of water resources and systems through selective and focused efforts of protection and detection (Hoover, 1941).

Addressing the consequences of attacks requires putting in place an array of responses suitable for different kinds of events. This can include responses like rapid repair teams to fix infrastructure, the development of redundant delivery and treatment systems, and preparing the health system promptly to detect and treat water-related illnesses (Kroll, 2006).

CONCLUSIONS

There is a long history of water-related violence and conflicts, including what must be categorized as environmental terrorism targeting water resources and infrastructure. The threat of future attacks is real, and the plans for responding to such attacks appear to be inadequate. The actual risks of serious human health consequences are highly clear, given the simple nature of our developing water systems, the inadequate protections in place to identify and eliminate biological and chemical contaminants and the attractiveness and vulnerability of other targets.

These protections must be strengthened in areas where clear risk assessments indicate high vulnerability, especially where critical infrastructure is exposed or where rapid monitoring can provide time for effective response. It is vital that sensitive water systems be protected through a combination of improved physical barriers, more extensive real-time chemical and biological monitoring and treatment and the development of smart and integrated response strategies at all levels.

Among the best defenses against terrorist threats to water systems are public confidence in water management systems, rapid and effective water quality monitoring, and strong and effective information dissemination.

New tools for communicating with water users may be valuable in countering the threat of water-related terrorism and ensuring public confidence and calm. Such tools will also have value during natural disasters and accidents. It is equally important, however, that the risks not be exaggerated, so that limited financial resources can be spent efficiently and effectively, and so that the public is not made fearful of risks that are low or manageable. The best approaches will require careful assessment of both the probability and the consequences of attacks. By evaluating both, it will be easier to identify vulnerabilities and put in place appropriate and measured responses to those vulnerabilities.

RECOMMENDATIONS

Based on a review of water Infrastructure management in Kenya, the following recommendations focus on ways that could improve upon current practices, and thus

strengthen the role that water Infrastructure management plays in protecting the long-term security of drinking water supplies.

The Protection of Drinking Water Sources Should Be Recognized As a Permanent and Integral Part of a Long-Term, Secure Water Supply Strategy

Source protection represents the first layer in a multiple defense system for ensuring that clean water is available to all water users. Source protection is especially vital to water users, such as rural residents and businesses, whose geographic location and low water usage afford those few alternative drinking water supply options and may limit the economic viability of employing end of- pipe treatment measures. Source protection programs are consistent with practices being adopted by water supply agencies in other international jurisdictions.

Denying Physical Access

Perhaps the most fundamental action that can be taken to protect water systems is to limit or deny physical access to vulnerable points. Sometimes this may be as easy as locking gates or buildings, or reducing public access to sensitive locations. Reduced access to some dams and pumping plants and blocked off some roads close to water reservoirs. Many water agencies have stationed guards at "critical sites" (Center for Defense Information, 2002).

Among the recommendations for reducing the physical risk to infrastructure are:

1. Facilities (treatment plants, reservoirs, dams, storage facilities, pumping plants, intake facilities and control systems) should be identified and inventoried. Physical access to those most critical to operations, or most vulnerable to attack, should be controlled.
2. Access to water distribution maps and facility plans should be controlled when there is a clear security risk.
3. Lighting, surveillance cameras and motion detectors should be installed in appropriate places.
4. On-site water treatment chemicals should be kept in secure facilities and they should be inventoried on a regular basis. This approach is not possible, given the vast exposed length of pipelines or aqueducts, or the public uses of lakes, reservoirs, rivers and land. As a result, limiting physical access is an important, but not sufficient approach.

Detection and Protection Challenges

Unlike more traditional weapons used by terrorists, water-related threats pose some special challenges in the areas of detection and response. Attack on a water system may be done surreptitiously through the introduction of a chemical or biological agent. In this case, unless immediate publicity is an objective of the attack, the first evidence may be increased incidences of sickness and death. Identifying the nature of the illness, the source of the contamination and then identifying and quantifying the specific threat could take a substantial amount of time. Security measures such as more extensive monitoring of pipelines, water supplies or more guards at power plants – will be expensive and mean higher costs for consumers. Nevertheless, it seems clear that some such measures will be required.

Early Warning Systems (EWS)

"Early warning" monitoring systems can help to identify contamination events early enough to permit an effective response. It must be easy to install and operate, provide continuous monitoring and result in rapid notification of an event. Continuous monitoring reduces the likelihood that contamination events will be missed. The development of standard monitoring

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systems would reduce cost, permit sharing among users and facilitate repair and replacement (Foran & Brosnan, 2000). New and developing technologies are being developed rapidly to detect pathogens in real time, both in source water and water distribution systems (US EPA, 2005).

Public and Governmental Responses

It is extremely unlikely that physical barriers, early warning systems and other preventative measures will be adequate to prevent all attacks. It is also possible that threats alone will trigger reactions. A threat to a drinking water system, whether real or a hoax, may cause as much of a problem as an actual terrorist act. As a result, it is vital to develop tools and advanced plans to respond to both real and threatened events.

Responses may include public advisories, temporary shutdown of the system, identification and use of alternative water supplies, chemical and biological treatment and disinfection, additional data gathering or monitoring, epidemiologic studies, health interventions or some combination of these actions. Responses to actual events will depend on the nature of the attack, the population affected and characteristics of the water system itself.

A key component to the success of any response will be the advance preparation of a process or plan that provides guidelines for all appropriate stakeholders, including water users, emergency responders and law enforcement agencies, water utility staff and community leaders and local media. Such a plan should be considered part of comprehensive emergency planning for a variety of threats to public health, both waterborne and non-waterborne.

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