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Dass, Rueben Ananthan Santhana

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Jihadists' Use and Pursuit of Weapons of Mass Destruction: A Comparative Study of Al-Qaeda and Islamic State's Chemical, Biological, Radiological and Nuclear (CBRN) Weapons Programs

This article compares and contrasts the Chemical, Biological, Radiological and Nuclear (CBRN) weapons programs of Al-Qaeda and Islamic State through the framework of organizational structure, typology, ideology and CBRN incidents (selected case studies). A three-step CBRN model explaining the use of CBRN weapons by both groups is proposed. This model suggests that the use of CBRN weapons is predicated on three factors: leadership at the strategic level; acquisition of material at the operational level and technical capabilities at the tactical level. It is found that the failure of both groups in developing and carrying out large-scale CBRN attacks boils down primarily to the lack of technical capabilities and the difficulties associated with acquisition of materials. It is argued that the future CBRN threat landscape will likely be dominated by the threat of small-scale, localized attacks using crude chemical or biological agents by lone actors or autonomous cells as opposed to larger-scale centrally directed attacks.

Keywords: Al-Qaeda; Islamic State; CBRN; weapons of mass destruction

Word Count: 11, 557 words

Author Name: Rueben Ananthan Santhana Dass

Affiliation: International Centre for Political Violence and Terrorism Research, a constituent unit in the S. Rajaratnam School of International Studies, Nanyang Technological University, Singapore

Correspondence: isrdass@ntu.edu.sg

Introduction

Al-Qaeda and Islamic State (IS) have been two of the biggest and deadliest terrorist groups active in the Islamist-Jihadist milieu over the last decades. Both of them have had a long history of attempting to acquire, develop and use chemical, biological, radiological and nuclear (CBRN) weapons.

CBRN weapons are often described as Weapons of Mass Destruction (WMD). Whilst there are a number of differing definitions for WMD, for the purposes of this article, the definition proposed by the United Nations in 1948 and that has now been enshrined in international law will be used:

“[WMD are] . . . atomic explosive weapons, radioactive material weapons, lethal chemical and biological weapons, and any weapons developed in the future which have characteristics comparable in destructive effect to those of the atomic bomb or other weapons mentioned above.”¹

There have been a number of studies in the past that look at the CBRN/WMD programs of both groups in detail individually. For example, Mowatt-Larssen provides a comprehensive background into Al-Qaeda’s WMD program, providing a detailed timeline of Al-Qaeda’s WMD activities from its inception in 1988 up until 2003.² Salama and Hansell provide a background into the history of Al-Qaeda’s WMD program, its evolution, the internal debate surrounding the use of WMD and a comprehensive analysis of Al-Qaeda’s WMD production instructions and capabilities as disseminated in their literature and online websites.³ Salama and Forest provide an understanding of the motivations for the use of WMD by Al-Qaeda and the role of WMD in Al-Qaeda’s target selection calculus and a possible threat evaluation for the group’s use of WMD.⁴

Similarly, Dean, Cruickshank and Lister's book provides an in-depth view of Al-Qaeda's CBRN program from the lens of an individual who was actively part of the program⁵ and Lia provides a detailed analysis of the program in terms of its typology and ideological motivations from the perspective of Al-Qaeda strategist and WMD expert, Abu Musab al-Suri.⁶

Similarly, for IS, there have been a number of studies focusing primarily on its chemical weapons activity rather than the actual programs itself. Separately, Binder et. al. and Strack provide a detailed description of IS chemical activity in Syria and Iraq over the period of 2006-2007 and 2014-2015.⁷ Middle East researcher Kyle Orton provides an analysis of the evolution of the leadership of IS's chemical weapons program through the time of Abu Musab al-Zarqawi till present.⁸

There has been, however, a dearth of literature comparing the CBRN programs of both groups. Therefore, this paper aims to plug the gap in the literature by providing a comparative study of the CBRN/WMD programs of Al-Qaeda and IS. The main aim of this article is to provide a deeper understanding of the CBRN programs undertaken by the two groups by comparing and contrasting the programs and to provide a threat analysis into the future CBRN threat posed by the two groups. This paper also proposes a three-step CBRN model that attempts to explain the defining factors that might lead terrorist groups such as Al-Qaeda and IS to use CBRN weapons. This would be important in understanding CBRN use by terrorist groups for policy makers and counter-terrorism practitioners alike.

The CBRN programs of Al-Qaeda and IS will be studied through a framework that uses the following variables as points of comparison:

- Organizational structure of the program i.e. relationship of the program with the central leadership of the group and its decision-making apparatus;
- Typology and structure of the program i.e. type of agents that were researched, structure and type of training involved;
- Ideology; and
- CBRN incidents (selected case studies).

The paper is divided into three parts: part one covers Al-Qaeda's CBRN program using the framework described above, part two covers IS' in the same way, and part three is a comparative analysis of the two and looks forwards to provide a threat analysis and policy recommendations.

Part 1: Al-Qaeda's CBRN Program

Organizational Structure

Terrorism expert Bruce Hoffman categorizes Al-Qaeda into four different dimensions:⁹

- Al-Qaeda Central (AQC) comprising remnants of the pre-9/11 Al-Qaeda organization
 - This comprises key figures of the central leadership and shura council such as Osama Bin Laden (OBL), Ayman al-Zawahiri, Khalid Sheikh Muhammad and Muhammad Atef.
- Al-Qaeda Affiliates and Associates comprising formally established insurgent or terrorist groups who have benefited from training and assistance from OBL and AQC
 - Examples are Al-Qaeda in the Arabian Peninsula (AQAP), Al-Qaeda in the Islamic Maghreb (AQIM), Al-Qaeda in Iraq (AQI) and Jemaah Islamiyah (JI).
- Al-Qaeda Locals comprising individuals/groups who have had some previous links to Al-Qaeda and who are now disconnected to the group

- Those who may have had some jihadi experience in places such as Chechnya, Algeria and Bosnia and have had some previous form of connection with Al-Qaeda in the form of training or contacts
- Al-Qaeda Network
 - Home-grown radicals who have no direct link to Al-Qaeda but who may be inspired to carry out attack in its name

Al-Qaeda Central adopted a command-cadre or hierarchical organizational structure.¹⁰ This was characterized by clear lines of authority, functional specialization and centralized decision-making with separate departments for particular tasks and training taking place for operatives at all levels.¹¹ The organizational structure of AQC is shown below

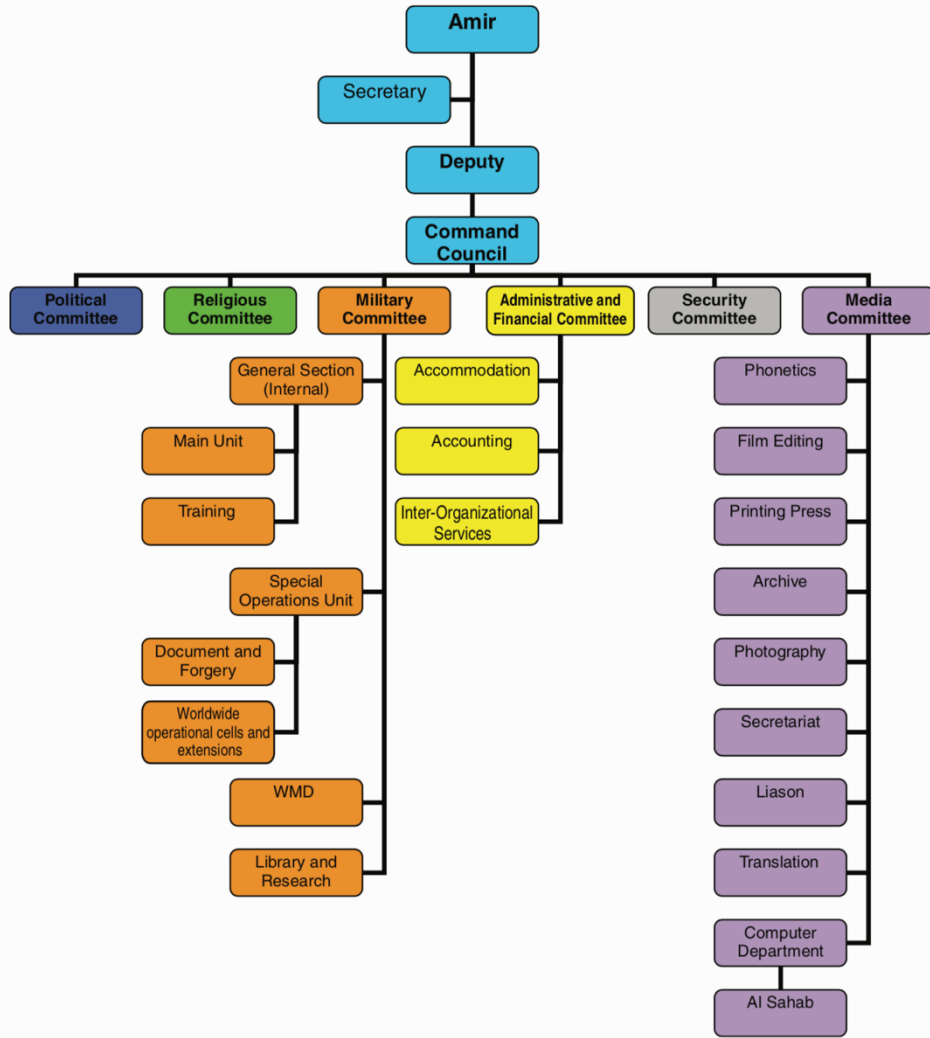


Figure 1: Al-Qaeda Central Organizational Structure¹²

The WMD sub-unit also known as the Nuclear Weapons Unit was part of the Military Committee.¹³ It was responsible for all aspects of unconventional warfare that Al-Qaeda undertook which included its CBRN/WMD program.¹⁴

Typology

Al-Qaeda’s CBRN program can be divided into three categories: Nuclear/Radiological; Anthrax; and Crude Toxins and Poisons. The central leadership had direct control over the

Nuclear/Radiological and Anthrax programs with both of them being placed under the purview of OBL and then Al-Qaeda Deputy Leader, Dr. Ayman al-Zawahiri respectively. The Crude Toxins and Poisons program was given more autonomy at the operational levels with the central leadership holding control at the strategic level. The camps running these programs were scattered around Afghanistan and the choice of agents and weapons to be developed were up to the leaders of the camps with the central leadership coming in only at later stages of the plot for approval.¹⁵ As noted by a US government official who stated, “Al-Qaeda’s WMD efforts weren’t part of a single program but rather multiple compartmentalized projects involving multiple scientists in multiple locations”.¹⁶ The figure below summarizes Al-Qaeda’s CBRN program structure

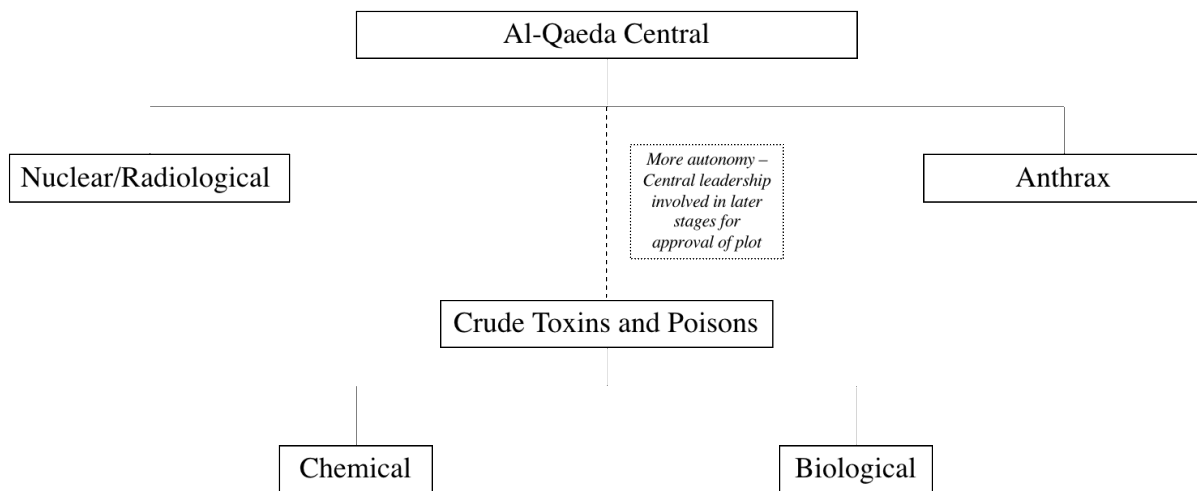


Figure 2: Al-Qaeda CBRN Program Structure. Chart developed by the author

Al-Qaeda’s nuclear procurement efforts were placed under the direct purview of OBL and the central leadership and began in late 1993-early 1994 when the group tried to purchase uranium for the construction of an improvised nuclear device (IND) through OBL’s contacts in Sudan.¹⁷ OBL had selected his aide and co-founder of Al-Qaeda, Mahmoud Mamdouh Salim as a

‘point man’ on nuclear matters.¹⁸ Salim had engaged in efforts to procure nuclear material for Al-Qaeda which was to be used to develop nuclear weapons.¹⁹ He was arrested in Germany in 1998 while attempting to buy enriched uranium.²⁰

OBL had also used two Al-Qaeda operatives, Muhammad Bayazid (known as Abu Rida al-Suri), a physicist and Mubarak al-Duri, an agronomist, both graduates from the University of Arizona to manage his business interests in Sudan and set up businesses that would act as dual use front companies for developing nuclear and biological weapons.²¹ Testimony from Al-Qaeda founding member Jamal al-Fadl revealed that Muhammad Bayazid and former Sudanese Prime Minister, Saleh Mabruk were involved in a transaction to help Al-Qaeda acquire uranium from South Africa which cost \$ 1.5 million.²² However, the outcome of the deal remains to be unknown.²³ Al-Qaeda had also engaged in efforts to purchase a complete nuclear weapon in the form of a suitcase bomb from Russia and other Central Asian states.²⁴ OBL had also engaged in efforts to obtain low-grade radioactive material for use in a radiological dispersal device (RDD) or ‘dirty bomb’.²⁶ However, there was no evidence that Al-Qaeda ever succeeded in these efforts.

In 2001, Pakistani humanitarian non-governmental organization (NGO) Umma Tameer e Nau (UTN), which was founded by Pakistani nuclear scientists had offered their assistance to develop biological, chemical and nuclear weapons for Al-Qaeda.²⁸ The Central Intelligence Agency (CIA) had alerted the Pakistani government as to the links and the Pakistanis thereafter interrogated the individuals involved. Investigations by Pakistani intelligence led to no conclusive findings as the parties involved had denied all allegations and the intelligence services were alleged to have treated them deferentially, often times looking up to them as men of science who had contributed to the nation.²⁹

Between 2002 – 2003, it was believed that senior Al-Qaeda leadership involving Saudi Al-Qaeda chief Abu Bakr, high ranking Al-Qaeda Shura Council Members, Saif al-Adel and Abdel Aziz al-Masri (who was referred to as Al-Qaeda’s Nuclear Chief by Khalid Sheikh Muhammad), were negotiating the purchase of three Russian nuclear devices, the outcome of which remains to be unknown.

Al-Qaeda’s nuclear/radiological program never went beyond the stage of material procurement. Although OBL had mentioned that Al-Qaeda had a nuclear device on at least two occasions and there have been numerous allegations of Al-Qaeda acquiring nuclear weapons, considerable speculation and doubt has surrounded Al-Qaeda’s actual nuclear capabilities with no proof ever offered that Al-Qaeda actually obtained nuclear weapons.³⁰ Bergen notes that while Al-Qaeda had acquired nuclear material, they were not suitable for making nuclear weapons.³¹ This was corroborated by the testimony of a Pakistani nuclear scientist named Sultan Bashiruddin Mahmood who had met with OBL, Zawahiri and other top Al-Qaeda leaders in an attempt to help the group construct a nuclear weapon. He stated that the nuclear material that Al-Qaeda had was suitable for use in a dirty bomb but could not produce a nuclear explosion.³²

Some analysts believe that Al-Qaeda had conjured up and exaggerated its nuclear capabilities in a psychological warfare campaign against the West. Aimen Dean, a former senior member of Al-Qaeda’s WMD program who eventually became an MI5 agent, stated that he believed Al-Qaeda was never close to acquiring a nuclear device and its claims of possessing a nuclear device was part of a “misinformation campaign by Al-Qaeda to keep the Americans guessing and embroil the CIA in a wild goose chase.”³³ Dean also states that Al-Qaeda had deliberately decided to plant a rumor that it had obtained several nuclear warheads as part of this misinformation/psychological warfare campaign against the Americans.³⁴

Another program that was under the direct control of the central leadership was Al-Qaeda's strategic biological weapons program which included anthrax development. The program was under the purview of Dr. Ayman al-Zawahiri who took personal control over it after the merger of his group, Egyptian Islamic Jihad (EIJ) with Al-Qaeda in 1998. The merger signified a turning point in Al-Qaeda's WMD efforts and was crucial in bringing WMD to the forefront in Al-Qaeda's leadership priorities.³⁵ This may be attributed to Zawahiri's scientific educational background in medicine, which together with OBL's strategic, global goals was responsible in giving renewed importance to WMD development.³⁶ Zawahiri had taken direct charge over a number of Al-Qaeda's WMD development programs (elaborated later) and steered the group toward the idea that WMD may be used to attack US infrastructure and economic establishments.³⁷

Al-Qaeda's anthrax program was initiated in 1999 and can be divided into two phases. The first phase was undertaken by a Pakistani microbiologist by the name of Abdur Rauf Ahmed who worked as a researcher at the Pakistani Council of Scientific and Industrial Research (PCISR).³⁸ Ahmed had used his professional affiliation with the PCISR to establish networks and gain information and resources for the possible acquisition of pathogenic anthrax by attending international conferences and visiting laboratories developing anthrax in different parts of the world.³⁹ However, Ahmed failed in his efforts to acquire anthrax and went only as far as providing a crude design for a biological lab.⁴⁰

The second phase of the program was initiated the following year when Zawahiri engaged the services of Malaysian Armed Forces medical corps officer, Yazid Sufaat to help Al-Qaeda develop anthrax.⁴¹ Sufaat had a degree in biochemistry and medical laboratory technology from the California State University.⁴² He had been a member of JI and had been introduced to

Zawahiri personally by top ranking JI member, Nurjaman Riduan Isamuddin (Hambali) who had links to Zawahiri.⁴³ Sufaat continued work to produce anthrax at the laboratory in Kandahar. Before he could develop a pathogenic strain of anthrax, the program fell into disarray when the US-led coalition forces intervened in Afghanistan in October 2001.⁴⁴ Sufaat was forced to abandon the project and moved back to Bogor, Indonesia.⁴⁵ There, he tried to revive the anthrax program with the help of Hambali's relative who was attached to a microbiology institute in Indonesia.⁴⁶ The individual had refused to cooperate with him and Sufaat was arrested shortly after thereafter.⁴⁷ The entire anthrax program had been managed at the highest level of Al-Qaeda with strict compartmentalization from other activities.⁴⁸

Al-Qaeda's quest for chemical weapons began in the early 1990s in Sudan. OBL had allegedly sought the help of then leader of the National Islamic Front (NIF), Hasan al-Turabi to obtain nerve agents to be used against US military personnel in Saudi Arabia and was planning to collaborate with the NIF to manufacture chemical weapons in Sudan and was purported to have provided financial support to a number of pharmaceutical factories which were believed to have been producing chemical weapons.⁴⁹ However, no evidence of chemical weapons were found in Sudan.⁵⁰

Al-Qaeda's crude toxins and poisons program was initiated in 1999 and was codenamed al-Zabadi (curdled milk in Arabic). It is believed to have been led by Zawahiri and then-Al-Qaeda military chief, Muhammad Atef. Zawahiri noted in an email correspondence to Atef that they (Al-Qaeda) had become aware of the destructive capabilities of biological weapons by the enemy (US) after the US had repeatedly expressed concerns that biological weapons could be produced easily and at little cost.⁵¹ It should be noted that toxins are a unique sub-group of biological weapons.

Former CIA director, George Tenet suggests that the group had become interested in WMD after the 1995 Tokyo subway attacks by the Japanese cult group, Aum Shinrikyo using the nerve agent, sarin.⁵² A budget of \$ 2,000 to \$ 4,000 was set aside for the program.⁵³ It involved the research and development of crude toxins and poisons which were chemical and biological in nature. They hired Egyptian chemical engineer and former member of EIJ, Midhat Mursi al-Sayyid (Abu Khabab) to lead the project.⁵⁴

al-Zabadi was an umbrella project that comprised various training camps in Afghanistan providing training to recruits in chemical and biological weapons and conducting research in the development of these agents. Some of the camps involved were known as Khalden, Darunta, al-Farook, Khost, Jihad Wal and Mes Aynak.⁵⁵ The difference between al-Zabadi and the nuclear/radiological and anthrax programs was the fact that the camps were given a higher degree of autonomy to decide the type of agents and weapons they were to develop, the training provided and plots to be carried out. These were outside the direct supervision of the central leadership and left up to the leaders of the camps. The central leadership came in only at the later stages of the plotting and were consulted to provide approval.

Little is publicly known about the camps other than Darunta. Darunta was led by Abu Khabab. It was a small establishment with only 4-5 trainees a single time.⁵⁶ The agents that were developed there were nicotine, botulinum toxin, scorpion venom and poison gases such as hydrogen cyanide, chlorine, cyanogen chloride, phosphene and phosgene.⁵⁷ Live tests were carried out on animals such as rabbits and dogs. The camp was most famously known for the development of a crude hydrogen cyanide dispersal device known as the *al-mubtakkar al-farid* (The New Invention).⁵⁸

It is suspected that other WMD camps were of a similar nature: small, decentralized and providing training to a select number of recruits. Apart from its research and development efforts, AQ had also acquired unspecified chemical agents from the black market and had dabbled in attempts at producing mustard gas, sarin and VX nerve agent.⁵⁹ In October 2006, Abu Hamza al-Muhajir, leader of Al-Qaeda in Iraq (AQI) had released an audio recording calling on all those who have expertise and qualifications in chemistry, physics, electronics, communications and particularly nuclear scientists to join AQI and the front of jihad.⁶⁰ He further notes that American military bases are an ideal location to test out biological and nuclear weapons.⁶¹ This points toward the fact that Al-Qaeda had an interest in attracting foreign talent with expertise to boost their CBRN capabilities.

Ideology

The transition of Al-Qaeda's ideological justifications can be divided into three phases: self-defense, deterrence and finally retribution.⁶² OBL had made six statements with respect to WMD between 1998 and 2002, his most famous being a fatwa issued in December 1998 which states that

*“Acquiring weapons for the defense of Muslims (including WMD) is a religious duty... It would be a sin for Muslims not to try and possess weapons that would prevent the infidels from inflicting harm on Muslims.”*⁶³

Two of the statements clearly mentioned the possession of WMD as a deterrent and three of the statements mention the legitimacy of the use of WMD as a just retribution against the West for the killing of Muslims.⁶⁴ For example, in November 2001, OBL had stated that “We (Al-Qaeda) have the weapons (referring to WMD) as a deterrent.”⁶⁵ A year later, OBL stated

that “Just as you kill, you are killed. Just as you bombard, you are bombarded”⁶⁶ which highlights the theme of retribution.

Al-Qaeda had wanted to acquire WMD not to be used as a first strike option but as a deterrent against US military might and to counterbalance American and Israeli WMD arsenals.⁶⁷ Al-Qaeda’s reasoning behind its WMD efforts have been rational as opposed to apocalyptic.⁶⁸ They had believed that WMD would enable them to obtain strategic parity with the West and enhance their capabilities.⁶⁹ This is corresponded by prominent Al-Qaeda strategist and poisons expert, Abu Musab al-Suri, in a statement in 1999, who said that

*“The difference in armament and number between Muslims and their enemies, between the oppressed and the strong, has never been larger... One (renascent Islamic forces) has to threaten with them (WMD) and deter the enemy exactly like they have been doing.”*⁷⁰

al-Suri had advocated for the formation of a ‘Strategic Operations Unit’ within Al-Qaeda which would have knowledge and operational abilities in acquiring and using weapons of mass destruction, in times when there is a need for retaliation, or for the strategic settlement of the conflict with America”.⁷¹ Post 9/11 and US intervention in Afghanistan, the ideological themes of revenge, identity and destruction of the enemy became more prominent and WMD was thought to be an instrument that could fulfill those aims.⁷² al-Suri himself had stated that strategic operations involving WMD may be the last option to destroy America.⁷³

The turning point in terms of the ideological justification of the use of WMD came with the proclamation of a fatwa titled “A Treatise of the Legal Status of Using Weapons of Mass Destruction Against Infidels” in May 2003 by Saudi cleric, Sheikh Nasir ibn Hamid al-Fahd. al-Fahd had stated that the use of WMD on the West is permissible purely on the principle of

reciprocity, in retribution for the destruction that the West has caused on the Muslims, i.e. “striking her (America) is permissible merely on the rule of treating as one has been treated” and if they (jihadis) establish that there is no better way to repel the infidels.⁷⁴ This fatwa removed any religious constraints with regards to WMD employment by portraying a narrative that the sanctity of the ideological goals of the use of WMD justified any means of its use.⁷⁵ The theme of retribution is also highlighted in a July 2002 statement by Al-Qaeda spokesman Sulayman Abu Ghayth who stated that “...it is our right to fight them with chemical and biological weapons, so as to afflict the fatal maladies that have afflicted the Muslims because of the [Americans’] chemical and biological weapons.⁷⁶ In Issue 8 of al-Qaeda’s Inspire magazine, the famous ideologue, Anwar al-Awlaki stated that the use of chemical and biological weapons against the enemies of Islam is encouraged due to its great effects on them and provides a long list of theological justifications which claim that the disbelievers must be fought by any means available which includes the use of these weapons.⁷⁷

It should be noted that there was a great deal of debate with AQ leadership vis-à-vis the use of WMD, with one group in support of the use and another opposing it.⁷⁸ Some were more in favour of the use of one type of weapon over another. For example, Abu Khabab supported the use of chemical weapons but saw the development and use of nuclear and biological weapons as a ‘waste of time’.⁷⁹ Individuals like al-Suri were very much in support of the use of WMD but OBL and Zawahiri (to a certain extent), who were supportive of the developments of these weapons, were more cautious when it came to the actual deployment of the weapons. This may have been due to the blowback that might have arisen in terms of reaction due to the use of these weapons from the Al-Qaeda leadership that opposed such use, the Muslim community to whom al-Qaeda largely depended upon for support and the countries in which these weapons were

deployed. Al-Qaeda leadership had also to balance their decisions with regards to WMD deployment as deterrents against the West but through calculated and rational decisions to remain legitimate amongst their support base.⁸⁰

CBRN Incidents

The figure below shows the breakdown of CBRN/WMD incidents involving AQ by agent type

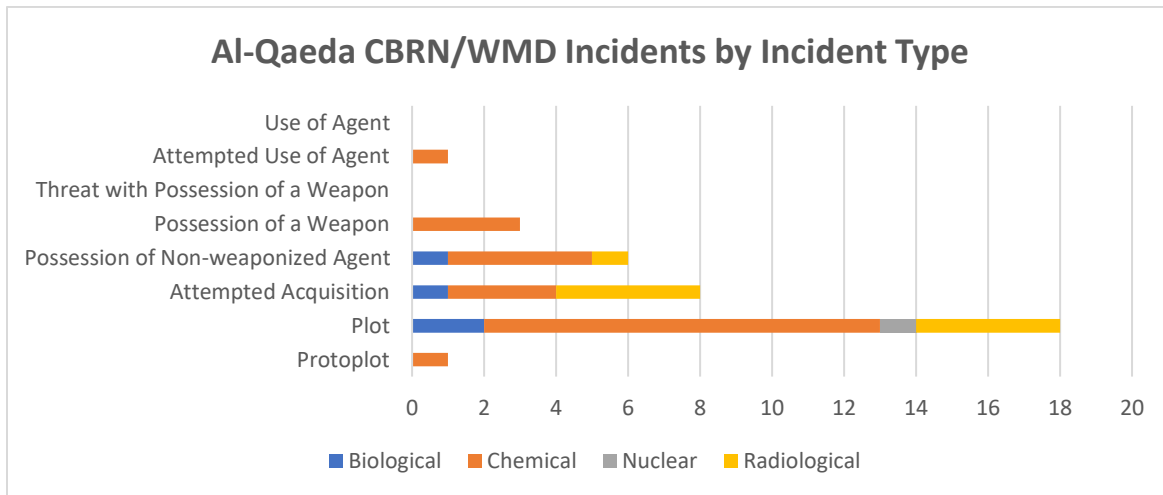


Figure 3: AQ CBRN/WMD Incidents by Incident Type⁸¹

Data from the University of Maryland shows that there were a total of 48 CBRN incidents between the period of 1990-2017. As the above figure shows, there has been no use of a CBRN agent in an attack successfully thus far by the group. The type of incident that seems to be most frequent is ‘plots’ involving CBRN agents with chemical agents topping the list.

There are two types of CBRN plot categories with regards to AQ: plots with involvement of the central leadership and plots by autonomous cells without involvement of the central leadership. In the first category, cases in point would be the 2003 New York and 2004 Bahrain *mubtakkar* plots. Both plots involved the deployment of the Al-Qaeda hydrogen cyanide gas

prototype device developed at the Darunta camp under the Crude Toxins and Poisons program and were conceptualized by cells linked to Al-Qaeda Affiliate groups in the region. However, there was no direct involvement of the central leadership with regards to the actual plot, innovation and development of the device. The central leadership held control only at the strategic level and came in only at the last stage of the plot i.e. to provide approval. In other words, the planning was decentralized but the decision-making was centralized. This is corroborated with the organizational structure of Al-Qaeda's WMD program as shown in Figure 2, where the central leadership held control at the strategic level and had given a certain degree of autonomy to the Crude Toxins and Poisons program at the operational and tactical level. Had Al-Qaeda been involved in a plot involving anthrax or nuclear material, a more substantial involvement of Al-Qaeda's central leadership might have been expected.

The 2003 New York plot was conceptualized by Head of Al-Qaeda Saudi branch, Yusuf al-Ayeri. The cell involved had sought the approval of Zawahiri who had called off the plot at the last minute upon consultation AQ's Shura Council.⁸² Zawahiri infamously said that they had 'something better in mind'.⁸³ Similarly, the Bahrain plot was conceptualized by Bahraini Al-Qaeda member, Yasser Kamal. Preparations had been carried out autonomously except for the latter stages where the central leadership was involved in providing the funds and final approval through the then Head of External Operations, Hamza al-Rabia.⁸⁴ The plot was thwarted by the Bahraini security services in collaboration with American intelligence.⁸⁵

Another example is the case of Jose Padilla. Padilla was an American citizen and Muslim convert, who had received training in Al-Qaeda-affiliated al-Farouq training camp.⁸⁶ Padilla and an accomplice had conceived of an operation to detonate a 'dirty bomb' that they had learnt to make on the internet.⁸⁷ He had approached Al-Qaeda logistics head, Abu Zubaydah with the

plan, who directed them to Khalid Sheikh Mohammed (KSM), who was member of AQC and head of Al-Qaeda operations unit.⁸⁸ KSM eventually turned the plan down stating that the idea was “a little too complicated”.⁸⁹ This highlights again, the involvement of the central leadership in CBRN/WMD plots and in particular their centralized control over the decision to launch such attacks at the strategic level.

The second category involves plots that were conceptualized by autonomous cells with the little to no involvement of the central leadership. A case in point is the 2005 Dudley nicotine poison plot in the UK. It involved a small cell of (it is believed) three people who intended to extract nicotine poison from cigarettes using an Al-Qaeda recipe and smear the door handles of luxury cars.⁹⁰ It is unclear whether the senior leadership of Al-Qaeda was aware of this plot.⁹¹ The leader of the cell, a British national by the name of Hamayun Tariq, eventually joined IS and served as a sniper and explosives expert.⁹²

Part 2: Islamic State’s CBRN Program

Organizational Structure

Islamic State (IS)’s CBRN program can be divided into three phases: phase one during the Abu Musab al-Zarqawi (founder and leader of AQI) period (1999-2006), phase two during the post Zarqawi period (2006-2008) and phase three (2014 onwards). IS’ WMD program was initiated during phase one by Zarqawi himself when he left to start his training camp in Herat, Afghanistan in 1999. The program initiated by Zarqawi was modelled very closely to Al-Qaeda’s crude toxins and poisons program. This is most likely because Zarqawi had shared a very close relationship with Darunta camp leader, Abu Khabab and had spent time training under him.

Zarqawi was described as “fascinated by experiments with gases and toxins” during his time at Darunta.⁹⁶

There was also a significant transfer of knowledge from Abu Khabab’s training camp in Darunta to Zarqawi’s camp in Herat. Zarqawi had continued his research and development into unconventional weapons in Khurmala, Afghanistan after the fall of the Taliban. Dean et. al. note that “A direct line can be drawn between Darunta experiments and the Islamic State’s current capacity to unleash chemical terror.”⁹⁷

It is believed that IS’ CBRN program was centralized and kept under the purview of the central leadership during phases one and two. This can be seen from its leadership structure. Most of the individuals that led the program in phases one and two came from Zarqawi’s inner circle. The program went dormant after the leadership of Abu Abdullah al-Muhajir, between phases two and three in the period of 2008-2014. This may have been due to the fact that IS (which was then Islamic State in Iraq (ISI)) was in an overall period of weakness due a number of reasons such as the death of Zarqawi, lack of resources, lack of support from the Sunnis who had rebelled against them with the *Sahwa* movement and decapitation operations that eliminated the leadership.⁹⁸ The dormancy of the chemical program also explains the lack of activity, particularly chemical attacks/bombings that IS had been actively perpetrating previously.

Post 2014, the status of the program vis-à-vis the central leadership was unclear. Owing to the fact that much of the chemical weapons research and development centers were scattered, it is believed that the program was more decentralized. Warrick notes that the the IS chemical weapons program was “ambitious and amateurish; one that was often mismanaged and disorganized, but malevolent in its intention.”⁹⁹

The group had elected technical experts from the former Saddam establishment, which included chemists, biologists and weapons experts, who were initially not members of IS to develop chemical weapons for the group. An example would be Suleiman Daoud al-Afari, a former geologist who worked for the Iraq's Department of Industries and Minerals.¹⁰⁰ He had not been a member of IS previously. When IS took over Mosul, they had offered him a position to supervise the development of chemical weapons and Afari accepted the task as he didn't want to lose his job.¹⁰¹ In his own words,

*"I was afraid that I would lose my job. Government jobs are hard to get, and it was important to hang on to it...They (IS) had become the government and we now worked for them... We wanted to work so we could get paid."*¹⁰²

Afari had initially worked under Salih al-Sabawi, an engineer who had worked in Saddam's chemical weapons program before joining AQI under Zarqawi in 2005.¹⁰³

IS' Chemical Weapons/WMD program may possibly have been carried out by a 'special operations unit' known as the *Jaysh al-Khalifa* or *Jaysh Dabiq*.¹⁰⁴ This may have been the entity responsible for all chemical weapons deployment by IS in Syria and Iraq.¹⁰⁵ However, it is unclear where this unit fits within the larger organizational structure of IS. It is likely that it may have been a specialized entity within the military council.

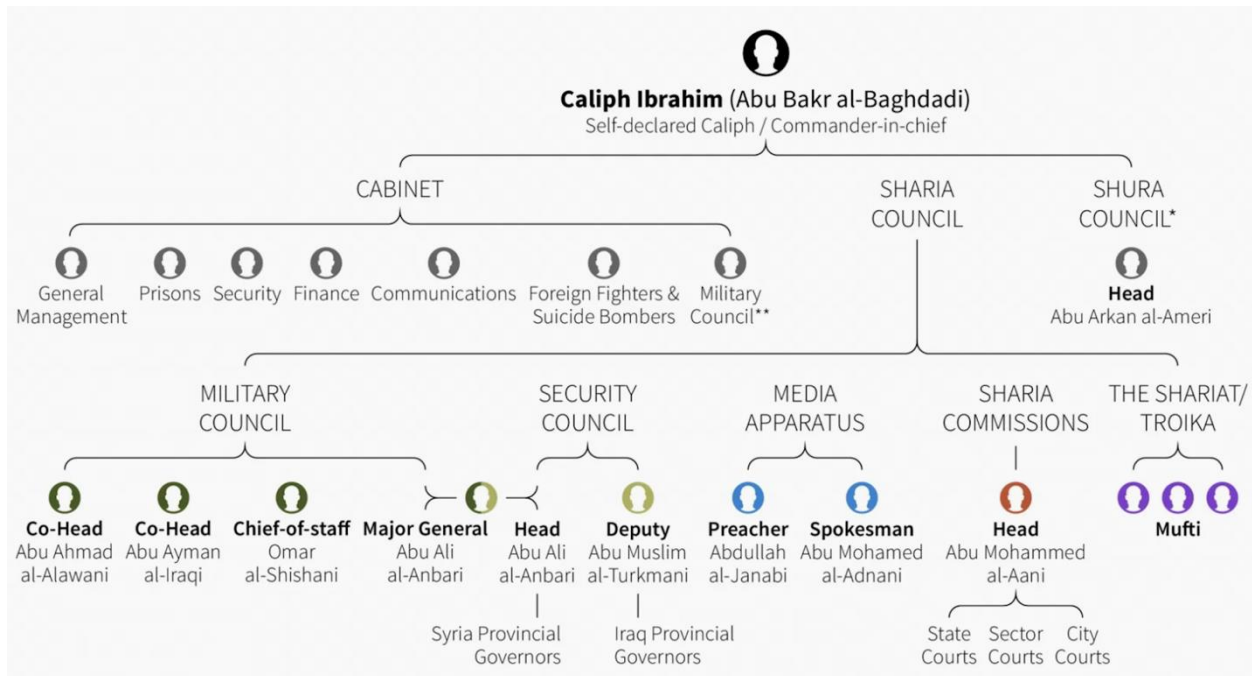


Figure 4: IS Organizational Structure¹⁰⁶

The chart below shows the leadership history of IS’ chemical weapons program:

Mustafa Ramadan Darwish (Abu Muhammad al-Lubnani)

- Elected in late 2003
- Former Deputy of Zarqawi in AQI
- Killed in 2005

Abu Abdullah al-Ani (Ammar al-Ani)

- Was Mustafa Ramadan Darwish's Deputy
- Engineer by qualification
- Worked at Iraqi regime laboratories
- Suspected to be member of IS Shura Council
- Date of death unknown

Saad al-Hiyali (Abu Ghazwan al-Hiyali)

- Engineer by qualification
- Former official at Iraqi Defence Ministry under Ali Hassan al-Majid (Chemical Ali)
- In charge of training engineers and recruiting specialists
- Killed 6 Nov 2008

Abu Muhammad al-Muhajir

Program goes dormant

Abu Saad al-Masri

- Physicist and Engineer
- Had Masters degree in Nuclear Science
- Killed between mid 2014-Jan 2015

Salih al-Sabawi (Abu Malik al-Iraqi)

- Operative working for Saddam's WMD program in Muthanna
- Joined IS in 2005
- Killed 24 Jan 2015

Unclear what happened after. One of two possibilities

Taha al-Dulayni

Sleiman Daoud al-Afari

Sleiman Daoud al-Afari

- Chemical engineer by profession
- Worked for the Iraqi Department of Minerals
- Coerced by IS to take control of the chemical weapons program
- Overlooked the chlorine and sulphur mustard production
- Arrested in Feb 2016

Abu Shaima

- Could be Taha al-Dulayni
- Iraqi Doctor at Baghdad University during Saddam's regime

Figure 5: IS Chemical Weapons Program Leadership History¹⁰⁷

Typology

Unlike Al-Qaeda, IS' CBRN program dealt primarily with chemical weapons. IS had utilized two classes of chemical agents: weaponized Toxic Industrial Chemicals (TICs) such as chlorine, phosphine, vinyltrichlorosilane (a compound used in the production of plastic and rubber products); and chemical warfare/blister agents such as sulphur mustard (more commonly known as mustard gas).¹⁰⁸ There is no evidence that IS had an indigenous nuclear program apart from the fact that it was suspected the group might have had possession of 'low grade' uranium when it seized the University of Mosul in 2014.¹⁰⁹ Despite further claims that the group could acquire nuclear weapons from Pakistan in similar fashion to Al-Qaeda before them, there was no evidence that IS acquired any nuclear or radiological capabilities.¹¹⁰ Similarly, there was no evidence that IS had an indigenous biological weapons program like AQ apart from the discovery of a ricin production manual from an IS hideout in Idlib, Syria.¹¹¹

During the first phase, there was significant evidence of experiments with poison gases such as hydrogen cyanide.¹¹² The facility in Khurmali was believed to have been developing cyanide and ricin.¹¹³ There was also a Zarqawi-linked lab based in Fallujah that was discovered in 2004 which was suspected to have been developing the Al-Qaeda prototype improvised chemical dispersion device called the *mubtakkar* and other improvised explosive devices (IEDs).¹¹⁴

IS had carried out a series of chemical vehicle borne improvised explosive device (VBIED) attacks involving chlorine between October 2006 and June 2007.¹¹⁵ The chlorine used in this phase was not developed by IS but was instead obtained by confiscating and hijacking

imported chlorine shipments meant for water purification.¹¹⁶ The attacks were carried out using crude delivery mechanisms i.e. vehicles.

IS' main technological achievement came in phase three during the 2015-2017 period where it was successful in developing sulphur-mustard gas and it achieved the capabilities to combine it with delivery systems such as projectiles and improvised rockets.¹¹⁸ It has to be noted that the sulphur-mustard developed by the group was more simplistic in its recipe and lacked the enhancers and stabilizers that military-grade sulphur-mustard usually contain.¹¹⁹ This made it the first terrorist group to have developed a chemical warfare agent combined with a projectile delivery system.¹²⁰

Exact details of the programs and the number of individuals involved are relatively unclear. Media reports suggest small-scale laboratories were scattered throughout IS controlled areas in Syria and Iraq. The main facilities were located in IS-controlled areas in Syria within the Euphrates River Valley, between Mayadin, Syria and the town of al-Qaim, just across the Iraqi border.¹²¹ In Iraq, it was reported that IS carried out research and development into chemical weapons at three locations in Mosul: Mosul University, Tal Afar laboratory and Qayyarah laboratory.¹²² A Washington Post report suggests that the chemical weapons program involved “university laboratories and manufacturing facilities and a cadre of scientists”.¹²³ Warrick notes that a hospital in the city of Hit, along the Euphrates river was also used by the group as a professional lab for chemical weapons production.¹²⁴

Apart from attracting technical experts and scientists from Saddam's former establishment, intelligence reports stated that IS managed to attract individuals from abroad including Southeast Asia and Chechnya.¹²⁵ One report suggested that “lots of nuclear physicists and engineers, especially from Russia joined them (IS)”.¹²⁶ It also stated that IS had benefited

from the research and expertise provided via tele-communication of a 36 year old PhD student in medicinal chemistry and drug design based in India.¹²⁷ He had shared his research on chemical and biological weapons and academic papers with IS scientists based in Mosul via web forums.¹²⁸

In February 2016, IS launched a Telegram recruitment channel called ‘Islamic State Scientists and Engineers’ targeted at individuals who had pledged their allegiance to IS and who had degrees in engineering, physics, aeronautics and biology.¹²⁹ The stated intent of the channel was to:

- *“collect as much caliphate scientist & engineers as possible from around the world & introduce them to each other*
- *use them to create a powerful worldwide industrial network to support the military industry in the Islamic State*
- *support the scientific education in the caliphate*
- *exploit some channel members’ situation to do research for the military benefit of the caliphate.”*¹³⁰

This indicates IS’ intent in developing these weapons and their manipulation of latest technologies and social media in recruiting individuals with the necessary expertise for the job.

It is believed that sometime in 2016, under the leadership of Abu Shaima, IS had moved all its chemical laboratories in Mosul into the densely populated residential neighborhoods in order to avoid attacks and air strikes.¹³¹ These were not only in lower income, agricultural neighborhoods but also in upper-class neighborhoods which were majority Christian in population.¹³² Experiments were carried out on live animals such as dogs and rabbits (similar to

Al-Qaeda) and reports even suggested experiments to test chemical weapons were carried out on IS prisoners in a secret prison in the al-Andalus region.¹³³ As compared to Al-Qaeda's programs which were situated in scarcely populated areas like the desert, this indicates the first time a group had carried out active development on chemical agents in densely populated areas such as residential neighborhoods and carried live tests on humans.

It also has to be noted that these laboratories were carrying out research for development of weapons that were specifically to be used in the battlefield. Unlike Al-Qaeda, recruits were not specifically trained to carry out terrorist attacks using CBRN agents¹³⁴ and there has been no clear evidence that research was being done by IS in developing improvised devices similar to the *mubtakkar* tailored specifically for terrorist attacks in the post-Zarqawi period. Thus, the primary aim of IS chemical weapons program points toward battlefield use rather than use in terror attacks during this period.

Ideology

There has been an absence of official statements and literature with regards to the use of WMD by IS. This is in stark contrast to Al-Qaeda who had released a number of statements, fatwas and documents with regards to the use of WMD. One of the few written 'theological' justifications for the use of WMD is found in a jihadist manual called the *Fiqh al-Dima* (Jurisprudence of Blood), written by IS and former Al-Qaeda in Iraq/Al-Qaeda ideologue, Abu Abdullah al-Muhajir.¹³⁵ In a chapter dedicated to the use of WMD, he states

“The central aim for which we strive – and we do so with all available strength – is the acquisition of weapons, weapons of mass destruction, for there is no escaping the

obligation to defend against these defiant perverters of faith and end the aggression of the malodorous filth against Islam and its people."¹³⁶

al-Muhajir's statement echoes OBL's statement who stated that the acquisition of WMD was a 'religious duty' for the defense of Muslims highlighting the similar narrative used by both groups and may also owe to the fact that al-Muhajir had served as an ideologue for Al-Qaeda prior to joining AQI under Zarqawi.

The relative dearth of literature and propaganda output by IS vis-à-vis its use of chemical weapons (and WMD in general) as compared to its regular media celebrations of other battlefield achievements and advancements in technological use such as the employment of drones may point to the fact that the leadership did not unambiguously support the use of chemical weapons.¹³⁷ There may also be the possibility that the chemical weapons project may have been low priority and a pet project of a limited number of actors within the organization.¹³⁸ This is not unlikely as it may be compared to IS' foreign terrorist operations planning unit, *al-Amn al-Kharji*, whose operatives conduct attack creation and logistics largely according to their own cognizance, provided they respected the IS leaders' strategic objectives.¹³⁹

There has been evidence of IS operatives using the fatwa provided by Sheikh Nasir ibn Hamid al-Fahd in May 2003 as possible justification. This was the same fatwa that was used by Al-Qaeda. The recycling of al-Fahd's fatwa by IS could have been due to the fact that al-Fahd had defected to IS in 2015 from al-Qaeda.¹⁴⁰ For example, in 2014, a laptop belonging to Tunisian Chemistry and Physics student Mohamed S. who was believed to be a member of IS contained a 19 page document on how to develop biological weapons and weaponize the bubonic

plague from infected animals.¹⁴¹ The laptop also contained Sheikh Nasir al-Fahd’s 26 page fatwa legitimizing the use of WMD.¹⁴²

CBRN Incidents

The figure below shows the breakdown of the IS CBRN/WMD incidents:

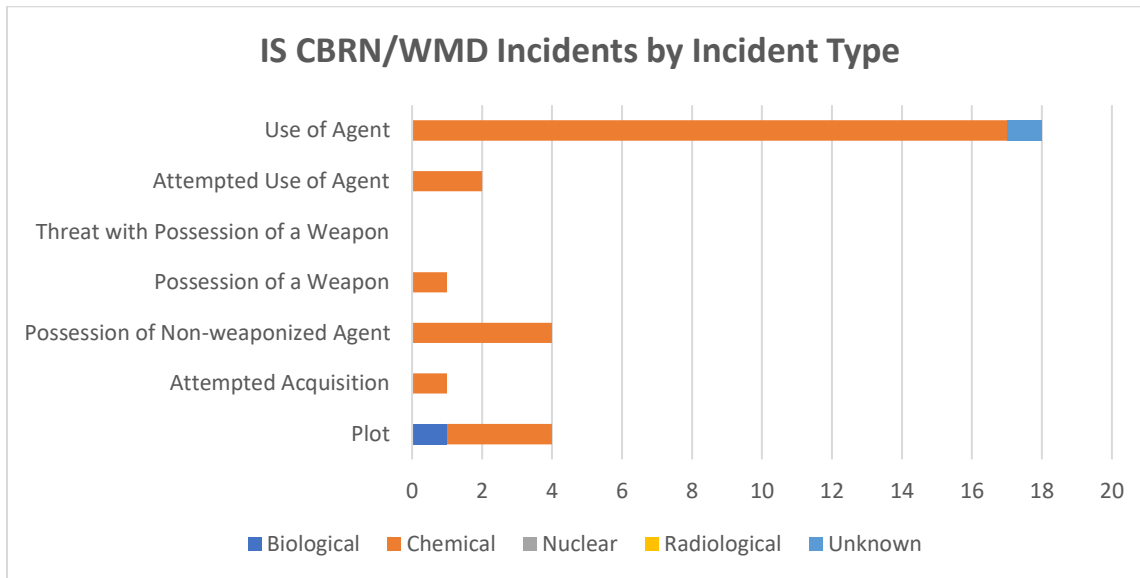


Figure 6: IS CBRN/WMD Incidents by Incident Type¹⁴³

The above figure shows that IS’ WMD incidents primarily involved chemical weapons. IS’ WMD incidents can be divided into the following categories: centralized attacks; battlefield chemical attacks; plots carried out by lone wolf/autonomous cells that were directed (‘remote controlled’) by individuals in Syria and Iraq; and ones that are solely inspired and had no involvement of any insider members.

The first group of incidents dates back to Zarqawi’s leadership and IS’ predecessor movement, AQI. These incidents were believed to have been largely under the purview of the central leadership of Zarqawi and his predecessors. The biggest WMD plot under Zarqawi was in

April 2004 when Zarqawi's network planned a VBIED attack against General Intelligence Directorate (GID) in Amman. The plot involved three large trucks to be used as VBIEDs with close to 20 tons of mixed industrial chemicals as the chemical component of the explosives.¹⁴⁴ The chemicals were aimed at producing a massive explosion with a 'toxic cloud' and severe mass casualties.¹⁴⁵ The plot was thwarted by Jordanian authorities.

After Zarqawi's death, AQI had continued his legacy by carrying out a spate of chemical VBIED attacks between October 2006 and June 2007. These attacks were focused in the regions of Ramadi in Anbar province and Baghdad and was believed to have been aimed at the Sunni uprisings in those regions.¹⁴⁸

The second category of incidents is IS' use of chemical weapons in the battlefield in the period between 2014-2017. Evidence suggests that the incidents were carried out under a larger degree of autonomy as attacks were carried out simultaneously across the Caliphate in Syria and Iraq pointing to the "existence of multiple operational units with the required expertise."¹⁴⁹ These incidents can be divided into three phases. The first phase occurred between June 2014 – June 2015 where IS carried out chemical bomb attacks using crude delivery mechanisms, i.e. by adding canisters of chemicals to the roadside or as VBIEDs.¹⁵⁰ The second phase occurred between July 2015 – January 2017 where IS achieved the enhanced capability of combining the production of sulphur mustard agent with delivery means via projectiles or rockets.¹⁵¹ The third phase was between the period of January 2017 – July 2017 right until the abandonment of the chemical weapons program following the fall of Mosul.¹⁵³ In total, IS carried out 48 chemical attacks in Iraq and 28 in Syria.¹⁵⁴ Of these, 28 used chlorine, 17 used sulphur mustard and 31 were unspecified.¹⁵⁵

It is believed that these phases of the chemical weapons program specifically for employment on the battlefield were aimed more at affecting the morale of the opposing forces and as a means of psychological warfare rather than physical destruction. This is corroborated by Suleiman Daoud al-Afari, former head of IS' chemical weapons program from 2015-2016, who stated that the program was primarily to defend the Islamic State's territory and as psychological weapons to terrorize its opponents.¹⁵⁶ In his own words, "It was more about creating horror, and affecting the psychology and the morale of troops fighting them. I don't believe the quality of the weapons was ever at such a dangerous level."¹⁵⁷

The third category of WMD incidents are incidents involving lone wolves/autonomous cells being directed by IS members within Syria and Iraq. A number of plots can be used as a means of a case study.

In 2017, an IS-linked cell in Sydney attempted to use an improvised chemical dispersion device to disseminate toxic hydrogen sulfide gas in crowded closed places in Sydney such as the public transport system.¹⁶⁰ The plot was part of a larger IS 'remote-controlled' operation that involved plans to blow up an Etihad Airways flight from Sydney to Abu Dhabi and plans to detonate homemade explosives.¹⁶¹ The plot involved four individuals, brothers Tarek Khayat, Khaled Khayat and Mahmoud Khayat and IS drone expert, Basil Hassan, also known as 'The Controller'. Tarek and Basil were based in Syria while Khaled and Mahmoud were based in Sydney. Khaled and Mahmoud received active instructions via Telegram from Tarek and Basil, as to how to construct the chemical dispersion device and how to concoct hydrogen sulfide gas in their homes. Excerpts from the court proceedings revealed the following:

48. On 6 May 2017 Khaled received instructions by Telegram on his Alcatel phone as to how to prepare a chemical compound and disperse it, as a gas, in a lethal concentration.

49. *From time to time, Khaled took photographs of the constituent elements in various forms which he sent to the Controller (believed to be Basil Hassan) or Tarek...Khaled received a video file by Telegram on his Alcatel phone showing how to make the gas from the precursor compound*

...

83. *On 23 July 2017 the Controller sent a message to Khaled telling him that he would send “details”, which I infer pertained to the poisonous gas plot. From 24 July 2017 there was a long series of messages between the Controller and Khaled about the preparation and testing of poisonous gas. In one such message the Controller instructed Khaled to conduct a trial that week. The Controller gave Khaled further information about the amounts of the poisonous gas which would need to be made in order to achieve the lethal concentration in a confined space. Khaled transcribed the formula and calculations onto a piece of paper which he kept in his wallet. The piece of paper was obtained following the search of his person after his arrest... Had the gas been produced in accordance with the instructions, it would have been lethal within a space of the proportions specified.¹⁶²*

One of the main distinctive characteristics of this plot is its attempt to develop a chemical weapon by ‘remote-control’ i.e. providing instructions and logistical support via long-distance tele-communication.¹⁶³

In 2018, German police foiled a biological terror plot involving Tunisian national Sief Allah. Sief had planned to carry out a possible biological attack in Cologne using ricin, a biological agent found in castor beans. Investigators had found that he had already produced 84.3

milligrams of ricin by the time he was arrested and that he had probably obtained material that could have been used in an improvised explosive device.¹⁶⁴ German authorities also revealed that Sief had been in contact with IS operatives based in either North Africa or Syria since the fall of 2017.¹⁶⁵ He had received instructions via Telegram from at least two IS linked individuals, one of them had given him advice on ricin production whilst the other had supplied him with instructions on how to build an explosive device.¹⁶⁶

The fourth category of incidents are ones that are carried out by autonomous cells who are inspired rather than directed. In 2015, Indonesian police foiled an attempt to detonate a chlorine bomb in a shopping mall in Jakarta.¹⁶⁷ It was believed that an IS cell comprising of a number of Indonesian fighters who had returned from fighting in Syria with IS were behind the plot.¹⁶⁸ The device was discovered after it had failed to go off properly.¹⁶⁹ This shows a clear exportation of knowledge from the battlefield in Syria to other countries by autonomous cells who are inspired by the groups' ideology and modus operandi.

Another case study is the 2016 Anthrax plot in Kenya. This involved an IS cell of four members which included Mohammed Abdi Ali, a medical intern at the Wote District Hospital in southeastern Kenya, his wife, Nuseiba Mohamed Haji, a medical student at Mubende Hospital in Uganda and two other medical interns, who were planning to unleash a large-scale biological attack in Kenya using Anthrax.¹⁷⁰ This plot highlights the danger of the insider threat, threats involving individuals who are 'inside' an establishment with access to technical materials, information and resources that may be used in a terrorist attack and lone wolves with some level of technical expertise as all four involved in the cell had medical/biological knowledge as students.

In 2019, an Indonesian based cell linked to pro-IS group, Jemaah Ansharut Daulah (JAD) planned to carry out suicide attacks using abrin, a biological agent found in rosary pea seeds in Cirebon, West Java.¹⁷¹ Abrin is highly lethal and it is believed that only 0.7 micrograms is sufficient to kill a 100 people.¹⁷² The cell had planned to add to the lethality of conventional explosives by the addition of abrin. It is believed that the cell had not received instructions from any IS member overseas and the preparations for the attack were carried out by their own accord as Indonesian police recovered books and material associated with microbiology and chemistry.¹⁷³ This highlights the fact that the CBRN threat is not only significant in the West but also in Southeast Asia.

Most of IS biological weapons incidents fall under the latter two categories of directed ('remote-controlled') and 'inspired' attacks. These categories of incidents have little to no involvement of the central leadership as stated by a former IS member in a written testimony,

“My matter will not be about the lone wolf operations that have happened in the European states and elsewhere, for I have an extended discussion about it first, and second the Dawla (Islamic State) has not had any preoccupation or hand in them, therefore we do not hold the Dawla responsible for their mistakes if they happened because they are carried out on the basis of skills of individuals and in general the Dawla does not know of them except after they are publicized in the media.”¹⁷⁴

Part 3: Analysis and Policy Recommendations

This paper investigates the CBRN programs of both Al-Qaeda and IS using the framework of organizational structure, typology, ideology and CBRN incidents. The table below highlights the key aspects of the points of comparison of both groups.

	Al-Qaeda	IS
Type of Programs	<p>Nuclear: Active procurement of nuclear material</p> <p>Biological: Anthrax</p> <p>Crude Toxins and Poisons: Variety of chemical and biological related agents</p>	<p>Chemical: Development and weaponization of sulphur mustard</p> <p>No evidence of biological weapons or nuclear weapons programs</p>
Organizational structure	<p>Nuclear procurement and anthrax program was under the central leadership.</p> <p>Chemical and other biological weapons program was under central leadership but allowed more autonomy.</p>	<p>Zarqawi followed the AQ model, running camps dealing with chemical and biological weapons in Herat and Khurmal. P</p> <p>Post-Zarqawi, the status of the chemical weapons program is believed to be under central leadership until its dormancy in 2008.</p> <p>In the post-2014 period the program was believed to have been decentralized</p>
Agents researched	<p>Apart from the Anthrax program, other programs depended very much on the leader of the camps</p>	<p>During the Zarqawi era, agents researched were poison gases such as hydrogen cyanide and cyanogen chloride and biological agents such as ricin</p> <p>Post-Zarqawi, it is believed to be focused on chemical agents such as chlorine and sulphur mustard</p>
Size of program	<p>Very small and specialized.</p> <p>Eg. Darunta camp only allowed 4-5 people at a time.</p>	<p>Unknown</p>
Ideology	<p>Surrounded around the concepts of <i>self-defence</i>, <i>deterrence</i> and <i>retribution</i>.</p>	<p>Similarities between AQ in that it mentions <i>self-defence</i></p>
Use of agent	<p>Agents developed specifically for terror attacks in other countries. Trainees were also trained to carry out WMD attacks outside Afghanistan, primarily non-Muslim countries</p>	<p>Agents developed predominantly for battlefield use.</p> <p>No evidence of development for terror attacks</p>

Incident type	<p>Two types:</p> <ul style="list-style-type: none"> Decentralized planning; Centralized decision-making Independent lone actor/autonomous cell 	<p>Four types:</p> <ul style="list-style-type: none"> Centralized attacks Battlefield attacks Directed ('Remote-controlled') lone actor/autonomous cell Independent lone actor/autonomous cell
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Table 1: AQ-IS Comparative Summary. Table created by the author

The figure below shows a comparison between AQ and IS' CBRN/WMD incident types:

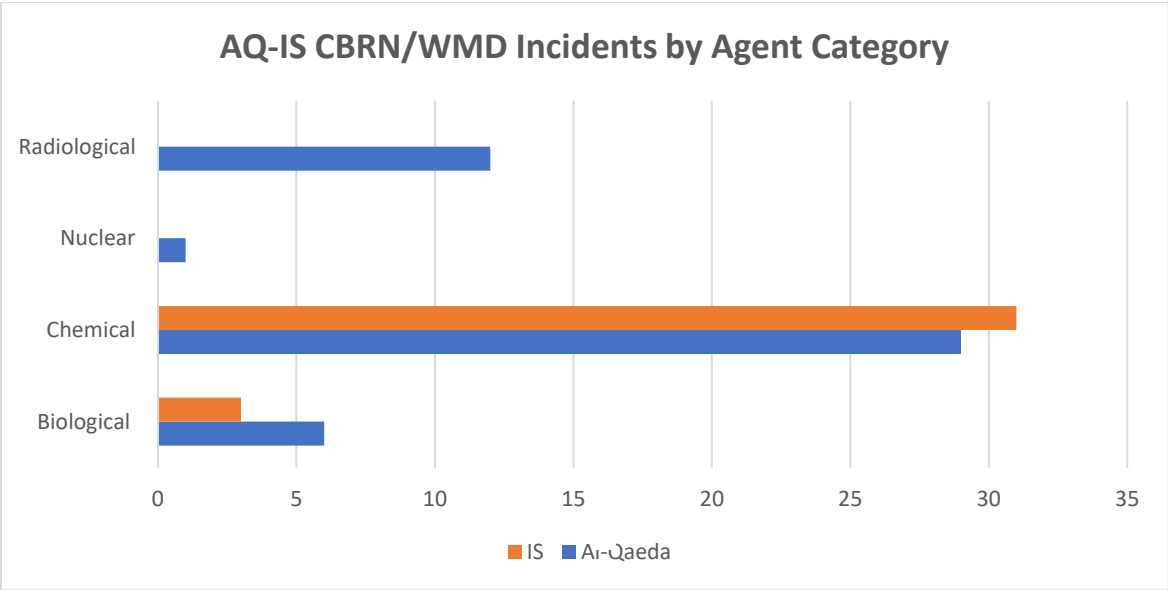


Figure 7: AQ-IS CBRN/WMD Incidents by Agent Category¹⁷⁵

Chemical weapons have seemed to be the most popular weapon category among both groups particularly that of IS (reasons explained below). The number of chemical weapon incidents involving IS are higher than that of AQ. This may owe to the fact of the groups use of chemical VBIEDs during phase two (October 2006 – June 2007) and chemical weapons on the battlefield during phase three (2015 – 2017). There has been no recorded IS incident involving nuclear or radiological weapons. As for AQ, if both radiological and nuclear incidents are

considered together, the high number likely owes to OBL initial efforts and deep interest in nuclear/radiological weapons in the early 90s.

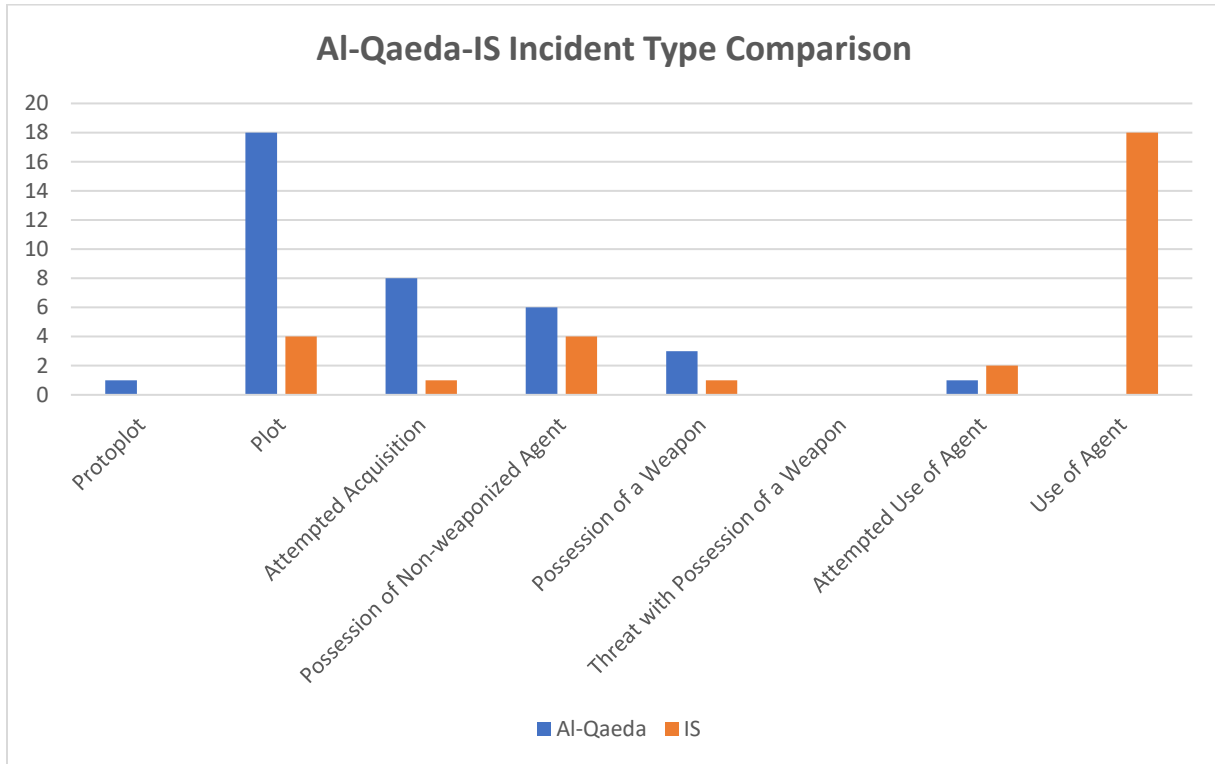


Figure 8: AQ-IS Comparison of CBRN/WMD Incident Type¹⁷⁶

As seen from above, IS has been one of the few groups who have successfully carried out the use of a CBRN agent, i.e. owing to its use in VBIEDs and the development of sulphur mustard gas combined with missile delivery systems for use on the battlefield. Whilst AQ has had a high number of plots, it has not successfully been able to use a CBRN agent in an attack.

Three-step CBRN Model

The three-step CBRN model can be used to model the use of CBRN weapons by AQ and IS (and other terrorist groups):

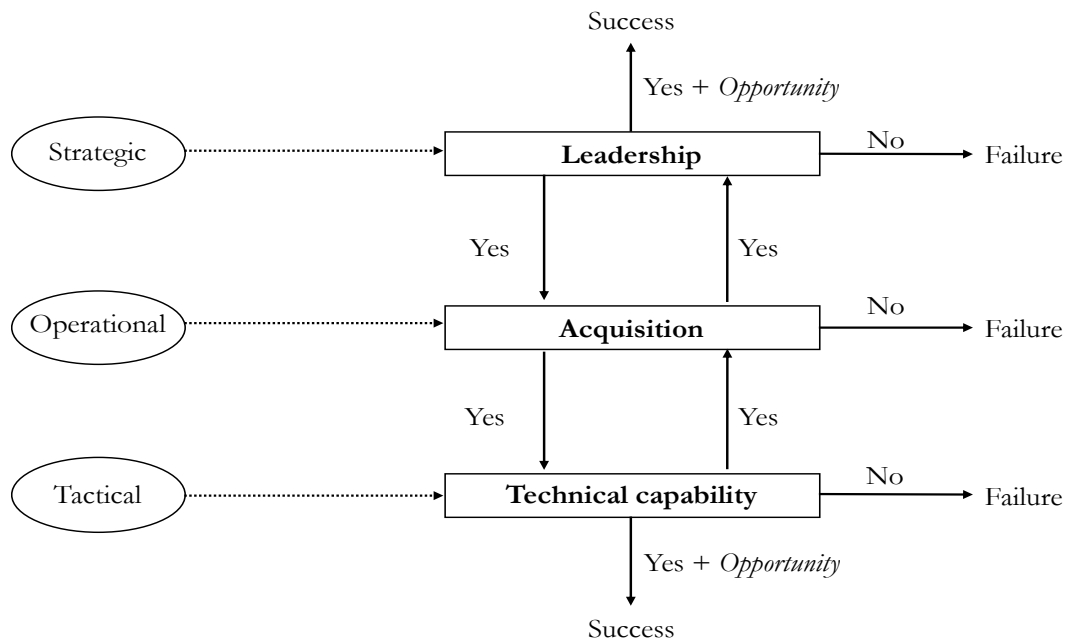


Figure 9: Three-step CBRN Model. Chart created by the author

The use of CBRN weapons by terrorist groups is dependent upon three primary factors: leadership at the strategic level; acquisition of material (includes precursors, agents, other material involved in the construction of a weapon) at the operational level; and technical capability for development and deployment at the tactical level. Upon convergence of the three factors, the success of a mission/weapon deployment is ultimately contingent upon the opportunity that arises to use the weapon. Groups would need to clear all three steps (in no particular order: may be top-down, bottom-up or from the center) and capitalize on an opportunity to enable a successful deployment of a CBRN weapon. Failure to pass through any step would result in the failure (no-use) of a CBRN weapon. In the case of lone wolf attacks, the leadership step may be by-passed leaving the individual/cell with only two steps, i.e. the operational and tactical steps.

In terms of leadership, Earl notes that the pursuit of WMD is “not only strategic but is deep-rooted and based upon the leadership and the leader’s vision of the organisation” and is often “fuelled by the leaders’ megalomaniac tendencies and their charismatic leadership.”¹⁷⁷ As for the case of Al-Qaeda, we see that bin Laden was primarily interested in the acquisition of CBRN weapons, in particular nuclear and chemical weapons since the early 1990s. This is seen in his multiple efforts to acquire nuclear material and his efforts to obtain and develop nerve agents and chemical weapons in Sudan. However, despite bin Laden’s interest in WMD, he was equally wary of using it in a large scale attack given the fact that it tarnish the group’s image and draw a certain level of criticism from its followers.¹⁷⁸ Bergen notes that “bin Laden himself was quite wary about their (WMD) use, not on moral grounds, but because he was concerned about how it would play in the media and with ordinary Muslims.”¹⁷⁹

When Zawahiri took over Al-Qaeda’s CBRN program, we see the initiation of Al-Qaeda’s strategic biological weapons program consisting of the Anthrax program and its crude toxins and poisons program, al-Zabadi which were under his purview. His interest in biological weapons may have been due to his own background as a medical doctor. Zawahiri was seen as a someone who was more open to the use of WMD as compared to OBL who took a more conservative stance.¹⁸⁰

As for AQI, under Zarqawi, we see a clear transfer of knowledge and expertise from Abu Khabab’s camps to Zarqawi’s Herat and Khormal camps. Zarqawi had pursued the development of crude toxins and poisons which were predominantly chemical in nature due to his personal interests in these weapons while training under Abu Khabab. This highlights the importance of leadership in driving the direction of a terrorist groups CBRN activity.

In the period post-Zarqawi, we see that IS had showed a primary interest in chemical weapons as compared to other forms. This may have been a concomitance of Zarqawi's influence and the ease of acquisition of chemical agents over others. Sources claim that IS had also obtained chemical agents from existing Syrian stockpiles developed by the Assad regime¹⁸¹ and from looting (the case of chlorine as mentioned previously). Dual-use chemicals with commercial applications are much more widely available as compared to chemical weapons.¹⁸² Chemical agents are also much more readily available and weaponized as compared to biological, radiological and nuclear agents (in the order mentioned).

It has to be noted that the role of ideology is encompassed within the leadership as the leaders also act as religious ideologues for these groups. As evidenced from the above discussions on ideology, there has been little ideological barriers with regards to the use of CBRN agents by these groups. Both groups have made numerous statements justifying and advocating the use of these weapons and there has been a recycling of AQ fatwas on WMD by IS. Thus, the use or non-use of CBRN agents is dependent more upon 'strategic constraints' rather than ideology, as ideology never really imposed barriers on their use of CBRN agents.¹⁸³ 'Strategic constraints' constitutes the doctrines of the group and constituency factors, i.e. blowback from the groups' supporters due to the use of such weapons.¹⁸⁴

The failure of Al-Qaeda and (to a certain extent) IS to have carried out plots of a larger scale using CBRN weapons comes down to the lack of technical capability. Al-Qaeda had attempted to develop CBRN weapons time and again but failed to produce lethal weapons due to the lack of resources, skill, conditions and knowledge. Whilst IS was the first terrorist group to have developed a chemical warfare agent (sulphur mustard) and used in successfully on the

battlefield, the agents that were developed were of low quality and its use never had a substantial physical impact on their opponents.

As shown in the three-step model, the success of CBRN employment lies not only in a group’s aspirations and decision-making, but for the most part on the availability of material, accessibility and achievability of the weaponization which requires technical skill and knowledge.¹⁸⁵ This is also noted by Gutkin who states, “it is the coming together of all the factors: the will, the expertise and the material.”¹⁸⁶

Threat Analysis and Implications for Policy – What is the significance of all this?

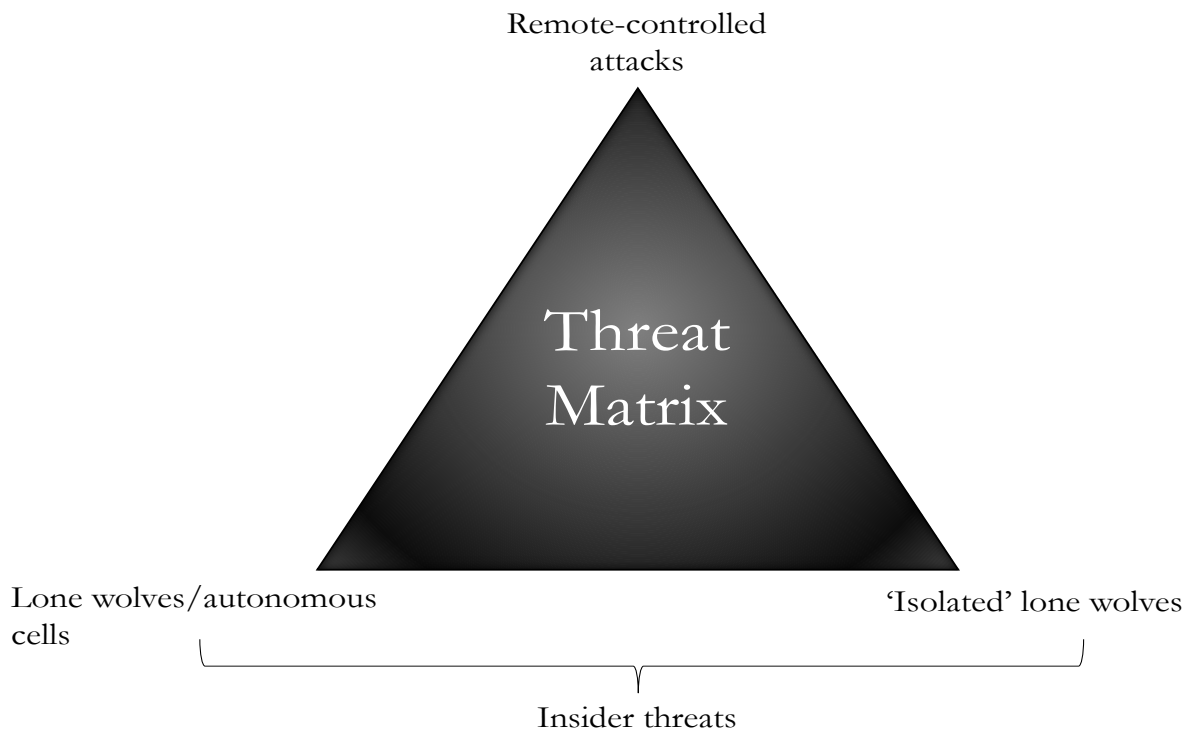


Figure 10: CBRN Threat Matrix¹⁸⁷

The CBRN/WMD threat posed by both AQ and IS in the present context looking at recent trends is three-pronged and comes primarily from the use of low-scale, improvised chemical or

biological devices involving crude agents. The main threat groups are lone actors/autonomous cells who are ‘remote-controlled’ by individuals with technical know-how (Sydney 2017, Cologne 2018), who may or may not have direct links to the groups; lone actors/autonomous cells who have the technical capability and knowledge (Kenya 2016, Indonesia 2015 & 2019) and ‘isolated’ lone wolves.¹⁸⁹ The latter two categories may comprise of insider threats, i.e. those within research or other related institutions who may have access to agents, precursor materials and equipment.¹⁹⁰ The recent trends of general terror attacks (not involving CBRN) in Europe (Paris and Nice) have also shown a similar trend indicating a shift from large-scale, centrally directed, synchronized attacks to smaller scale ‘pin-prick’ attacks that are carried out by lone wolves who are ‘isolated’ and self-radicalized rather than belonging to larger networks.¹⁹¹ An inspired and capable, ‘isolated’ lone wolf may well resort to the use of a crude CBRN weapon instead of the usual knife or firearm in the future.

The shift to small-scale, lone wolf attacks from large-scale, centrally directed attacks may be due to the fact that both Al-Qaeda and IS have suffered tremendous losses as a result of loss of territory and counter-terrorism operations targeted at them. Al-Qaeda and its affiliates have fallen victim to a number of counter-terrorism operations that have successfully eliminated their leaders. For example, leader of Al-Qaeda in the Arabian Peninsula (AQAP), Qassim al-Rimi, leader of Al-Qaeda in the Islamic Maghreb (AQIM), Abdelmalek Droukdel and senior Al-Qaeda leader Abu Muhsin al-Masri, believed to be Al-Qaeda Central’s second in command were all killed in counter-terrorism operations in 2020.¹⁹² These operations have decimated their leadership and greatly degraded its capabilities.¹⁹³ As a result, Al-Qaeda “no longer boasts the same ability to plot and execute the kinds of spectacular transnational terrorist attacks that it carried out in the years leading up to 9/11”.¹⁹⁴

Having said that, with the recent takeover of Afghanistan by the Taliban, the latter is likely to provide a safe haven to Al-Qaeda. The Taliban is still reported to be closely aligned with Al-Qaeda and show no indication of breaking ties with the group.¹⁹⁵ This might lead to a reinstatement of Al-Qaeda training camps in the country. However, whether this training camps may involve any form of CBRN activity as before is dependent upon the leadership of the group.

It has to be noted that there is also considerable speculation surrounding the status of Al-Qaeda leader Zawahiri with some reports suggesting that he was dead while others suggest he is in hiding but in grave health.¹⁹⁶ The next most suitable candidate for Al-Qaeda's top spot is former military leader Saif al-Adl who is believed to be in Iran. If a leadership change is imminent, Al-Qaeda's future CBRN endeavors is very much dependent on the new leader's interests and how far CBRN is up on his list. It is noted earlier that much of AQ (and IS) CBRN activity is leadership dependent. Most of AQ's biological and chemical weapons activity was driven by Zawahiri after he had merged his EIJ group with Al-Qaeda in 1998 and had become OBL's deputy. Given the current situation in Afghanistan, the group will be wary of renewed CBRN activity as they will be aware of potential Western retaliation following such actions and its consequences.

Like Al-Qaeda, IS has loss a significant amount of territory and leadership after the fall of its physical caliphate in 2019. The killing of its leader, Abu Bakr al-Baghdadi in October 2019 has left the group at the helm of Abu Ibrahim al-Quraishi, a lesser known figure who has yet to come into the jihadi limelight. Whilst IS continues to perpetrate small-scale localized attacks and assassinations in Iraq, Syria and Africa, there has been no evidence of the use of CBRN agents. Conventional IEDs are still the weapon of choice and like Al-Qaeda, there is no evidence of a resurgence of chemical or biological development activity.

In terms of agents involved, the most likely threat would come from crude chemical or biological agents which are most readily available particularly plant based agents such as ricin. This is mainly due to the ease of acquisition and manipulation of precursor materials. Most chemical agents and plant based toxins are available commercially as compared to nuclear/radiological material and other biological agents such as contagious viruses and certain types of bacteria such as anthrax which are extremely difficult to acquire and manipulate/weaponize. Data from the Profiles of Incidents involving CBRN and Non-State Actors (POICN) database have also found ricin to be the most popular bio-agent among terror groups.¹⁹⁸ This may be due to the fact that ricin can be easily procured (from castor oil beans) and is an agent of low complexity, requiring minimal knowledge and equipment to manufacture.¹⁹⁹

Whilst the weaponization and delivery of chemical agents and plant based toxins are a challenging affair, it is again easier as compared to nuclear/radiological and other biological agents. For example, ricin production does not require advanced technical knowledge and can be produced with regular kitchen equipment.²⁰⁰ Thus, governments must be prepared and ensure that they have sufficient stockpiles of anti-dotes in the event of an attack involving any of these toxins or poisons.

It is highly unlikely that groups such as AQ and IS will be able to carry out nuclear attacks. These groups do not have the technical and logistical capability to enrich nuclear material and develop nuclear weapons. State actors have spent large sums of money and resources and have still failed. Non-state actors who have limited amounts of resources stand an even slimmer chance of success.

Furthermore, procurement of nuclear agents is not an easy task either. In the event either group is able to procure any nuclear or radiological material, the most they could go is to detonate a radiological dispersion device (RDD), which is a device that comprises standard explosives with the addition of radiological material as additives. However, RDDs are likely to cause more physical harm from the conventional explosive component than the radiological component.

Thus far, both groups and lone actors associated with the groups have failed to carry out substantial WMD attacks (except for IS chemical weapon use on the battlefield) due to a lack of technical capability and the sheer difficulty of weaponizing these agents. Despite putting in substantial effort and hiring foreign individuals with some level of technical expertise (in the case of its anthrax program), Al-Qaeda failed to carry out any CBRN attack. In the case of IS, although they succeeded in producing and weaponizing sulphur mustard, the sulphur mustard produced was of low quality and failed to create substantial physical impact.²⁰¹ The use of chemical weapons by IS was more for defensive purposes and the impact has been more psychological than physical.²⁰²

Therefore, threat of use of these agents is most likely to be in the form of small scale, localized attacks which may result in a bigger psychological as opposed to a physical impact. This is again because of the fact that chemical and biological agents are very difficult to weaponize and deliver in a form that would cause mass casualties. Apart from the efficiency of the weapon, external meteorological factors such as humidity, temperature and wind speed also play a role in the lethality of the weapon. Biological agents such as ricin have to be injected into the bloodstream for it to be lethal making it more suitable for targeted assassinations as compared to mass casualty attacks.

The COVID-19 pandemic highlights the dangers posed by the uncontrollable spread of a novel biological agent. This may rekindle the interests of terrorist groups to continue the pursuit of and use of biological and chemical agents. It is highly doubtful that they possess the capability to create a novel biological agent, but they certainly would have the capabilities of carrying out small-scale, localized attacks involving chemical agents and poisons. Propaganda output by both Al-Qaeda and IS have shown that they continue to show an interest in chemical and biological attacks.

In a recent article in a pro-Al-Qaeda magazine called 'Wolves of Manhattan', Al-Qaeda had urged its 'wolves of Islam' to capitalize on the pandemic by handing out poisoned masks to passersby at streets and stations as a means to 'kill the Crusaders'.²⁰⁵ IS has recently released two posters, believed to have been made by its sympathizers, relating to chemical and biological terrorism on pro-IS media platforms which show that they remain interested in carrying out chemical and biological attacks. The former stated "The biggest invasion of chemical weapons and poisons in the abode of infidelity. God willing."²⁰⁶ The latter stated "Put your trust on Allah and ask him for support in spreading poison in their gatherings and their food."²⁰⁷ This is proof of the groups' interest in primitive use of these weapons.

In the realm of counter-terrorism operations, the threat of lone actors and autonomous cells as shown in the threat matrix above presents a far greater challenge than centrally-directed, large scale operations. Apart from standard counter-terrorism operating procedure involving surveillance of persons of interest, social media and online monitoring, intelligence agencies must look out for suspicious purchases of precursor materials and agents that could be used to develop CBRN weapons, both online and offline. For example, individuals purchasing large

quantities of castor oil beans (which could potentially be used to develop ricin poison) or other agents should raise alarm bells straight away.

Intelligence agencies and security services should also increasingly be aware of the threat of insiders in research institutions who may have easier access to resources than others. Cases in point include Pakistani microbiologist Ahmed Rauf who was involved AQ's anthrax program and the IS Kenya cell who plotted the anthrax attack in 2016. Scientific and technological developments such as Synthetic Biology (SynBio) have reduced the difficulty threshold of developing dangerous biological agents which may be capitalized on by terrorists.²⁰⁹ Thus, governments and academic institutions must work together to ensure the regulation of research and academic space particularly those involving high-risk areas and prevent any form of technology from being misused.

At the strategic level, referring back to the three-step model, effective counter-terrorism operations to mitigate the threat must target the three deciding factors: leadership, acquisition of material and technical capabilities. As has been done previously, operations targeted at key members of the groups' CBRN program is likely to remove the leadership and technical capabilities of the group and thus, will have adverse effects on the groups' propensity to develop and use CBRN weapons. At the operational level, interdiction of the groups abilities to acquire precursors and materials relating to weapons will further prevent groups from attaining CBRN capabilities. This may be done by safeguarding CBRN stockpiles particularly in conflict zones and ensuring tight control for the international transfer and safeguarding of precursors that may be used in the development of weapons. The tight regulations and safeguarding associated with nuclear material is one of the reasons why both groups have failed to obtain any nuclear material thus far.

Conclusion

Al-Qaeda and IS have actively pursued the procurement, development and use of CBRN weapons. This article provides a comparative analysis of the CBRN weapons programs and efforts of both groups in procuring and developing these weapons. The individual characteristics, differences and similarities of both groups' CBRN programs are highlighted. Al-Qaeda was involved in nuclear, anthrax and crude toxins and poisons programs. While the nuclear and anthrax programs were under the direct purview of the central leadership, the crude toxins and poisons program was given higher autonomy. IS was primarily involved in chemical weapons development for use in the battlefield.

A three-step CBRN model for the use of these weapons by Al-Qaeda and IS is proposed. The model highlights that the use of CBRN weapons by both groups depends on three factors: leadership at the strategic level, acquisition of material at the operational level and technical capabilities at the tactical level. Once a group passes through the three steps, the success of a mission involving CBRN weapons is contingent upon the opportunity that arises.

Both Al-Qaeda and IS have failed to carry out a successful attack using a CBRN agent thus far owing primarily to the challenges associated with the technical deficiency of weaponizing them and the difficulty of acquiring agents. Whilst it is unlikely that both groups have the capabilities to carry out large scale CBRN attacks, the most significant threat stems from lone wolves/autonomous cells that are remote-controlled; those that may have some level of technical knowledge and capability; and those that are 'isolated', inspired and have no links to larger networks.

The main threat is likely to come in the form of small scale, localized attacks that may have a larger psychological as compared to a physical impact. The most likely agent to be used in descending order is chemical, biological, radiological and finally nuclear. Whilst most CBRN agents are substantially difficult to weaponize and be delivered at an efficiency that would cause mass casualties, chemical and biological agents are slightly easier as compared to the rest and are easier to acquire.

Thus, the CBRN threat must be taken seriously. Governments must remain vigilant and prepared at all times. Effective counter-terrorism operations, intelligence sharing, inter-governmental cooperation and more holistic, ‘softer’ measures such as awareness and education are vital in mitigating the threat of not only CBRN terrorism but terrorism as a whole.

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