

Eliminating Syria's Chemical Weapons

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**ELIMINATING SYRIA'S
CHEMICAL WEAPONS**

By

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Executive Summary

How does the Department of Defense address the challenge of eliminating a nation's weapons of mass destruction (WMD) program, in particular, one that exists in an adversarial nation? This is not a new question, but one that has been debated for more than a decade, despite significant experience in cooperative threat reduction (CTR) and chemical demilitarization programs. The process by which the United States government took on the challenge of disposing of Syria's chemical weapons in 2013-2014 offers a prime example to discuss the challenges and demands of such a military capability. The purpose of this monograph is to provide a background on Syria's chemical weapons program and the east Ghouta attacks, to review the development of a U.S.-led chemical disposal program that began prior to Syria's declaration of its chemical weapons program, and to determine what lessons one can derive from this experience.

In the early hours of August 21, 2013, Syrian military forces attacked the Ghouta suburb of Damascus with sarin nerve agent, targeting 11 neighborhoods that were controlled by opposition forces. This was not the first time that Syrian forces were suspected of using chemical warfare agents against civilian population centers. This would not be the last time. This attack stood out due to the large scale of civilian casualties caused by chemical munitions – estimated to be more than 1,400 killed, including more than 400 children,¹ and at least 3,600 showing symptoms of nerve agent exposure.² At the time of the attack, Syria was not a signatory to the Chemical Weapons Convention, although it had signed onto the 1925 Geneva Protocol in 1968. While the Syrian government's use of chemical weapons was contained within its own borders during a civil conflict, President Barack Obama saw this as a breach of international norms and announced that he was going to attempt to compel the Syrian government to stop its chemical weapons use through targeted military strikes.³

These military strikes did not take place due to the Syrian government's admitting that it had a chemical weapons program and that it would accede to the Chemical Weapons Convention, eliminating its stockpile of chemical weapons, precursors, and associated production facilities in accordance to a joint U.S.-Russian framework. The schedule for eliminating the Syrian program was considerably accelerated as compared to other chemical disposal programs (notably the recent Libyan chemical weapons disposal effort), given international concerns about both the Syrian government's use of chemical weapons and the potential

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security risk of losing said chemical weapons to sub-state groups in Syria. Per the Chemical Weapons Convention language, Syria was expected to destroy its chemical weapons as soon as possible, as the Organization for the Prohibition of Chemical Weapons (OPCW) Executive Council determined the order of destruction and verification procedures.

The challenge was, how exactly this exercise would unfold.

Because the Syrian government lacked the resources (and possibly inclination) to design, operate, and complete a chemical disposal program, it fell to the international community, led by the United States, to come up with a plan of action. The final resolution was to develop an expeditionary disposal system that would be operated on a ship in the middle of the Mediterranean Sea, while shipping other precursors and waste products to several nations for disposal. To say that this was a novel approach would be an understatement. How this program was developed and executed within a year of the Ghouta attack represents a remarkable achievement by many organizations within and outside of the United States. The U.S. Army's experience in chemical demilitarization projects was instrumental in developing a technical solution to this particular challenge. The U.S. government has executed cooperative threat reduction programs – supporting another government's elimination of chemical weapons – for decades, but not in such a grand and international scope.

Three years after the Ghouta attack, the United Nations Secretary-General submitted a report to the Security Council that detailed at least two attacks, possibly up to five attacks, by Syrian military helicopters using improvised aerial bombs that held chlorine gas against civilian targets. These attacks would represent a violation of Syria's accession to the Chemical Weapons Convention as well as UN Resolution 2118, which called for taking action against the unauthorized transfer or use of chemical weapons by anyone (state or sub-state) in Syria. Does this later event mean that President Obama's threat of military strikes had failed to deter continued Syrian chemical weapons use? Does it mean that the international effort to eliminate Syria's chemical weapons program was a failure? The answer to both is simply "no."

As a result of the president's resolve, Syrian military forces did not use mustard or nerve agents against the populace through the end of his administration, and the Syrian regime has acceded to the Chemical Weapons Convention. This act led to the verified elimination of a declared capability to develop, manufacture, and use military weapon systems that dispense chemical warfare agents for the purposes of causing mass casualties over large areas. While Syria's continued use of improvised chemical weapons is of concern, we should not diminish the success of dismantling a state's chemical weapons production capability. The Syrian military's continued use of improvised chlorine bombs after October 2013 and alleged use of a nerve agent in April 2017 is a clear violation of its treaty agreements.

However ideal it would be to eliminate chemical weapons use from all future conflicts, we should not overlook the hard-driven, if not incremental, progress toward national security policy objectives. The collaboration within the U.S. government to execute this program, supported by many nation-states and international organizations, was commendable, and similar elimination missions may be required in the future by other states that still retain chemical weapons programs. It may be that the circumstances of how the U.S. military developed this capability, what and how many chemical agents were being addressed, and how the Syrian government complied with the mandate, represent such a unique situation that it would not be duplicated in any future contingency. As such, it behooves us to understand the circumstances of how this effort unfolded and what lessons were learned, prior to debating the proper role of the U.S. government in executing such missions.

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Introduction

Without getting into a deep discussion of Middle East politics, one can identify the key points of Syria's domestic and foreign policy as a basis for discussing its unconventional weapons program. The combination of religious differences, significant oil reserves, and significant arms sales in the region has made the Middle East a very turbulent region. Syria had allied itself with other Arab nations to go to war with Israel on numerous occasions between 1948 and 1982, armed with weaponry largely supplied by the former Soviet Union. As such, Syria's actions prior to 1991 were often viewed poorly by the United States government, who criticized the regime's record on human rights violations and its support of, in its view, national resistance movements that others would call terrorist groups. President Hafiz al-Assad, who took power in 1970, sought to establish a stronger link with the United States as Soviet support began to dry up in the late 1980s. The Persian Gulf War provided an opportunity for Syria to join the U.S. coalition against Iraq and to provide a "moderate" face of the Arab nations.⁴ Syria provided more than 14,000 troops in a significant, if largely symbolic, show of support during that conflict.

Syria and Israel worked toward a comprehensive peace agreement through much of the 1990s, which was to include discussions of the return of the Golan Heights to Syria, but were unable to conclude terms amenable to both sides. Hafiz al-Assad's death in 2000 brought his son Bashar al-Assad into power. While some in the West had hoped that a young, Western-educated leader would open up Syria to Western values and conclude peace talks with Israel, internal domestic challenges, an increasingly interventionist U.S. government policy, and continued turmoil in Lebanon have complicated that goal.⁵ However, the new president did reach out to the political leaders of United Kingdom, France, Iraq, Lebanon, and Turkey between 2001 and 2008.

Political dynamics have placed Syria in a very precarious position relative to regional Middle East politics. Its southern neighbor and long-time adversary, Israel, continues to have a dominant conventional military force and is alleged to have a mature nuclear weapons capability.⁶ Turkey, a U.S. ally and NATO partner, has had challenged relations with its neighbor Syria over the past decades. Jordan, a past ally, is perhaps closer to the United States in regional security matters than to Syria. Iraq under Saddam Hussein was not a friend of Syria, and given the

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significant U.S. forces in Iraq, remains a source of concern. Significant U.S. military forces in the Mediterranean Sea and throughout the Middle East also pose a perceived threat to Syria, given regional events over the last 15 years.⁷ Syria's concern about U.S. military forces was not assuaged by being included in the "Axis of Evil" in 2002 and (then) Under Secretary of State John Bolton's strong language condemning Syria's "weapons of mass destruction and missile development programs" in 2003.⁸

To put things into perspective, the concept of a Middle Eastern nation developing nuclear, biological, or chemical weapons is certainly not a novel one. Between 1970 and today, Egypt, Iran, Iraq, Israel, Libya, Saudi Arabia, and Syria have all been suspected of developing unconventional weapons at one time or another. In particular, the combination of unconventional weapons and ballistic missiles has been seen as particularly destabilizing against regional security concerns.⁹ Syria's unconventional weapons program may have begun around 1982, after Israel invaded Lebanon and its military forces trounced Syrian military forces there. Given inferior military forces and reduced support from the Soviet Union, President Hafiz al-Assad decided to start a chemical weapons program to enable a form of strategic deterrence against the challenge of superior conventional attacks by Israel.¹⁰

The DOD's 1997 *Proliferation: Threat and Response* report suggested that Syria may have started a program in the 1970s, supported by the Soviet Union and Egypt. Syria relied on external chemical industries for many of its chemical precursors, claiming that the intended use was for agriculture. Syria also had a long-time relationship with the former Soviet Union for the purposes of procuring military hardware and military support.¹¹ A 1983 CIA report stated that the Soviet Union and Czechoslovakia had supplied Syria with chemical agents, delivery systems, and training.¹² Nevertheless, its attempts in the 1980s was to develop an indigenous capability not reliant on external sponsors.¹³

Official unclassified U.S. assessments of Syria's chemical weapons capability in 2013 suggested a stockpile of more than 1,000 metric tons of chemical warfare agents and precursors, including mustard agent in "ready-to-use form" and sarin and VX nerve agents in their binary components ("ready-to-mix"). Despite the desire to have a self-sufficient production capability, Syria remained reliant upon external economic sources for precursor chemicals. The main delivery systems were thought to be short-range ballistic missiles (Scud variants), 250-kilogram aerial bombs, and BM-21 multiple rocket launchers. While the media gave breathless reports about Syria having "the largest chemical weapons arsenal" in 2012 and 2013,¹⁴ one should use the U.S. chemical weapons program (which produced in excess of 30,000 tons at its height) as a metric for perspective.¹⁵ These public statements were released after most other nations with former chemical weapons stockpiles had either completely destroyed their weapons or were in the final steps of destroying them.

The traditional view is that Assad developed chemical or biological weapons as a strategic deterrent against Israel's superior conventional capability. He was concerned that Israeli forces could easily overrun Damascus and overthrow the regime, if they had any intention of doing so. Whether Assad would have actually ordered the Syrian military to use chemical weapons against Israel, if that nation attacked Syria, is a separate discussion. In addition, there is no evidence that Syria would have ever allowed sub-state groups to obtain chemical weapons from its stockpile, perhaps due to concerns that these groups might use those weapons against Israel or other adversaries and the resulting retaliation that might come back against Syria.¹⁶

When Syrian security forces killed dozens of people in Daraa in March 2011 in an attempt to suppress public demonstrations, it caused a wave of continuing mass protests across the nation. Assad's attempts to quiet the protests with force led to U.S. and European economic sanctions against Syria and the rise of Syrian opposition groups. Within a year, the internal conflict had claimed estimates of eight to ten thousand dead.

In early February 2012, prior to the escalation of chemical incidents in Syria, the Obama administration revealed that they were reviewing military options with the Defense Department and U.S. Central Command. One of the potential scenarios included using U.S. military forces to secure Syria's chemical weapons sites.¹⁷ Government estimates between 50,000 and 75,000 personnel were floated in the media. While this was cited as a "worst-case scenario," the prospect of entering a war zone for the purpose of securing the sites while the Syrian civil conflict was ongoing, and possibly without international assistance, was daunting. Other military options, to include bombing the chemical weapons program-related sites, were not seen as feasible due to the possibility of collateral damage caused by the dispersion of chemical agents.¹⁸

On July 23, 2012, the Syrian Foreign Ministry's spokesperson suggested – for the first time in public – that Syria had an unconventional weapons capability, but that these weapons would not be used except in the event of "external aggression" against Syria. He also noted that the Syrian regime saw the opposition forces as being externally funded and driven by foreign parties.¹⁹

In response to this statement, President Barack Obama spoke from the White House in August 2012 stating that Syria's use of chemical weapons would be "a red line for us and that there would be enormous consequences if we start seeing movement on the chemical weapons front or the use of chemical weapons."²⁰ He repeated this warning in December at the National Defense University, saying "The use of chemical weapons is and would be totally unacceptable. And if you make the tragic mistake of using these weapons, there will be consequences, and you will be held accountable." This was widely interpreted as a threat to use military force. On the same day of the president's warning, the Syrian Foreign Ministry stated that "Syria has stressed repeatedly that it will not use these types of weapons, if they were available, under any circumstances against its people."²¹

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Reports from Syria suggested otherwise. The following table notes the alleged chemical attacks in 2012 and leading up to August 2013, as reported by various government agencies. Not all of these attacks were verified as to the exact source or type of munitions or numbers of casualties. There was often little in the way of formal attribution of the attacks as to the weapon source and/or the exact agent, in large part due to the inability to obtain clinical or environmental samples taken directly from the victims or the sites of the alleged attacks. In some cases, it may have been chlorine or tear gases. In other cases, it may have been sarin diluted with other chemicals to mask the nature of the attack. No persistent chemical agents were used, perhaps as a deliberate method to avoid attribution.

Date	Location	Type of Attack
October 17, 2012	Salquin	Lethal, unknown
December 23, 2012	Homs	Unknown
Mid-January 2013	Qusayr	Unknown
March 13, 2013	Darayya	Unknown
March 19, 2013	Khan al-Assal (Aleppo), Otaybah	Rockets, sarin
March 24, 2013	Adra	Rockets, possibly white phosphorus
April 12-14, 2013	Jobar	Sarin
April 13, 2013	Sheik Maqsood	Sarin
April 25, 2013	Darayya	Unknown
April 29, 2013	Sarqueb	Helicopter, sarin
May 14, 2013	Qasr Aba Samrah	Unknown
May 23, 2013	Adra	Unknown

Table 1. Alleged Chemical Weapons Incidents in Syria (prior to the Ghouta attack)²²

In most if not all of these early cases, the number of casualties was relatively low – they were point attacks using a small number of rounds to hit a hardened position, rather than a largescale area attack involving many munitions. A former Syrian scientist who had left the country stated that the regime was purposefully using sarin nerve agent in small quantities to stop insurgent progress around Damascus and to incapacitate those fighting forces, rather than cause mass casualties. By keeping casualties low, the Syrian regime may have been seeking to cast doubt on the insurgents' claims of chemical weapons use and to test the limit of President Obama's "red line."²³

Between April and June 2013, U.S., U.K., French, and Israeli government officials made public statements that they believed the Syrian regime was using chemical weapons, or at the least, sarin nerve agent was being used in attacks against the civilian population.²⁴ Director of National Intelligence James Clapper told Congress in March 2013 that Syria had an advanced chemical warfare program

and assessed that the Assad regime “might be prepared to use [chemical weapons] against the Syrian people” and that “groups or individuals in Syria could gain access to [chemical weapons]-related materials.”²⁵ Ben Rhodes, deputy national security advisor for strategic communications, stated June 13, 2013, the U.S. intelligence community “assesses that the Assad regime has used chemical weapons, including the nerve agent sarin, on a small scale against the opposition multiple times in the last year.” The administration’s response to this use was to increase support to the political opposition in Syria.²⁶ The Syrian military forces stepped over that “red line” on August 21, 2013, when they attacked west and east Ghouta with multiple attacks using sarin nerve agent.

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The Ghouta Attack

Between 2-5 a.m. on August 21, 2013, several surface-to-surface rockets containing sarin nerve agent landed in west and east Ghouta. This geographical region lies south and east of Damascus, including some 60 towns and villages and hosted about two million people prior to the Syrian civil war. The weather that morning had created a temperature inversion in which aerosols and vapors would stay close to the ground, thus maximizing the effects of a chemical attack. The western attack was decidedly the smaller of the two attacks, believed to be a number of artillery rockets (4-7) that landed in Moadamiya around 5 a.m. According to Human Rights Watch, these rockets may have been M-14 projectiles, which are 140-mm rockets that from a BM-14 launcher. The Syrian military is believed to have procured about 200 of these launchers from the former Soviet Union in the late 1960s. Each round can hold about 2.2 kilograms of sarin. While no evidence of the rocket warhead has been recovered, remnants of the rocket at a few impact sites suggest this was the weapon system used. The range of the weapon system could place the source of the attack coming from a local Syrian military base, and the clinical analysis of blood and urine samples suggest sarin was used.²⁷

The eastern attack against Zamalka was significantly more lethal, with evidence that at least eight large artillery rockets were used to deliver sarin nerve agent against the population center. These rockets appear to be of a Syrian design referred to as the family of “Volcano” rockets, which can have either a chemical or high-yield explosive warhead.²⁸ These rockets were based on the 122-mm artillery rocket (made popular by the Soviet BM-21 Grad multiple rocket launcher), sporting 330-mm stabilizing fins (thus the press reports and investigation reports referring to a “330-mm” rocket) and 350-mm wide warhead that may have held up to 50 or 60 liters of sarin (see Figure 1). These rockets could have been launched from the Iranian Falaq-2 333-mm rocket launching system, known to be operated by the Syrian military forces. The lack of large impact craters and clinical evaluation of the casualties suggested a chemical, not high explosive, attack.²⁹ Estimated casualties from these attacks ranged from 300-1,400 dead and more than 3,600 injured (see Figure 2).³⁰

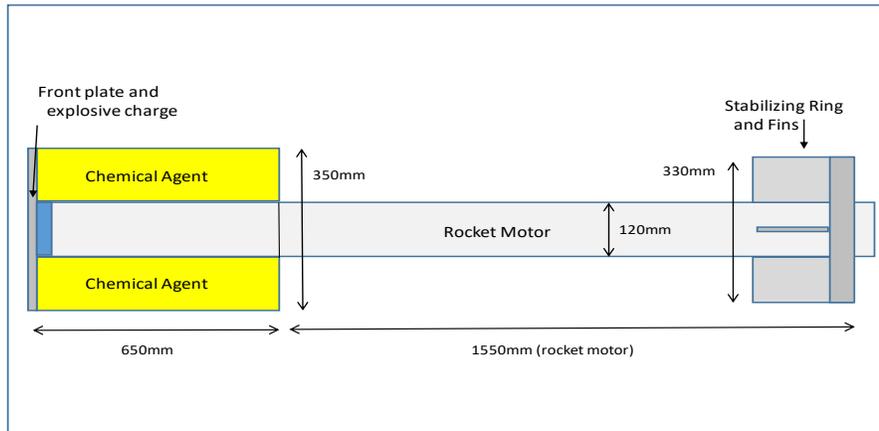


Figure 1. Diagram of 330-mm “Volcano” Rocket

This attack surprised many in the national security community. First, the use of an improvised, indigenous artillery rocket was not expected. The attack didn't fit the profile of using former Soviet Union delivery systems. Second, it was a tactical strike aimed at achieving limited gains. Clearly, Assad was not saving chemical weapons for use only as a strategic deterrent against Israeli conventional forces. Given the increased focus from the international community on earlier chemical attacks, it was difficult to understand why Assad would authorize such a high visibility attack.

To be clear, this was not an isolated artillery strike. The Syrian military targeted the same areas with intensive artillery and rocket barrages for the next four days, using conventional high explosive rounds. Following government control of the area, buildings were demolished, forcing civilians out of the area. It is unclear as to whether this was just part of a continued campaign against the insurgents or an attempt to eliminate forensic evidence of the chemical attacks. Following an emergency meeting by the United Nations Security Council, UN Secretary General Ban Ki-moon announced the intent to conduct an investigation of the attack. The Syrian government agreed to allow a UN investigation team, which was already in country investigating other alleged chemical incidents, access to the site of the August 25 attacks. The White House released its assessment on August 30, “assessing with high confidence” that the Syrian government had carried out the chemical weapons attack.

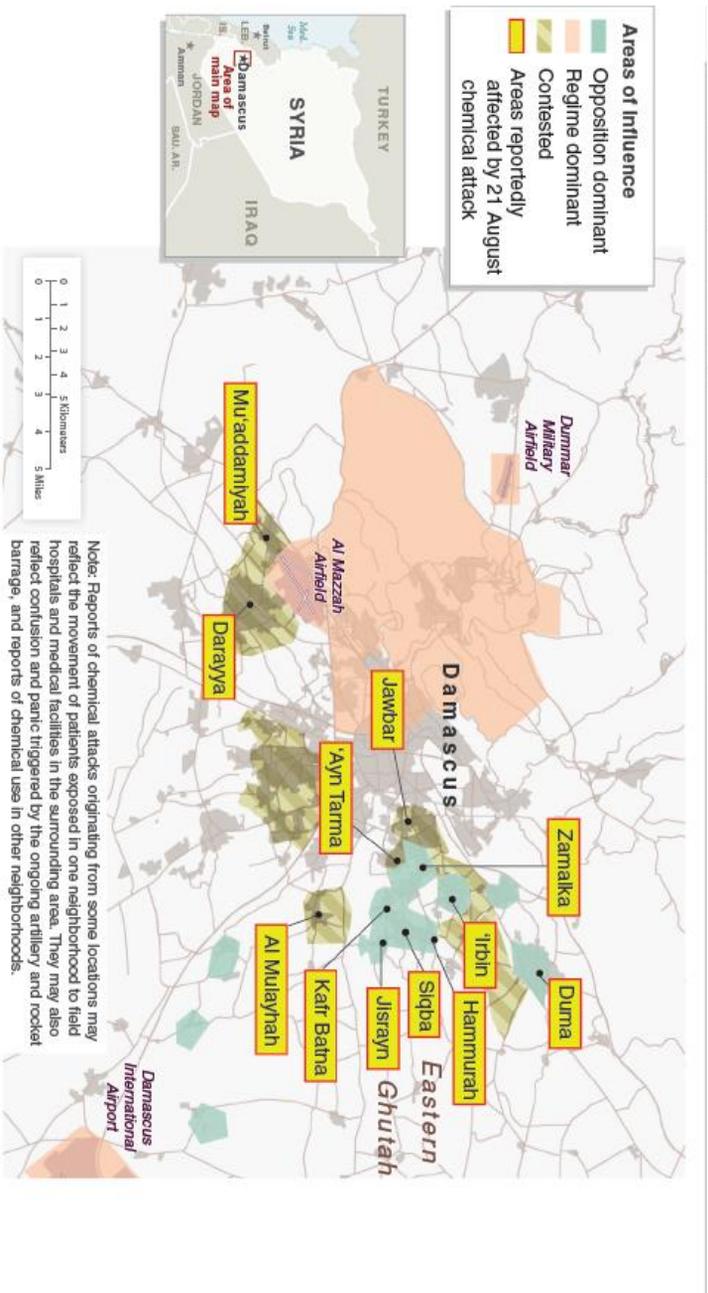


Figure 2. Damascus Areas Reportedly Affected by August Chemical Attack

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Syria did not necessarily violate the 1925 Geneva Protocol in its conduct of this attack, as many interpret the treaty as only prohibiting first use of a chemical weapon against another state party.³¹ It did violate the “international norms” that viewed chemical weapons use as a taboo issue in the context of contemporary military conflict. Samantha Powers, the US ambassador to the United Nations and a strong vocal proponent of the “responsibility to protect” concept, stated on August 26 that “Assad has used CWs against civilians in violation of [international] norm.”³² The threat was not just to the Syrian people or regional stability, but in the nature of a precedent that might cause further chemical weapons proliferation across the globe, to include attacks against U.S. national security interests.

The next day, President Obama stated that he would seek authorization for the use of force from Congress for a limited military strike against Syria. It was not clear as to whether these strikes would be against Syrian government buildings, its military forces, or sites associated with its chemical weapons program. Certainly, there was reluctance to attack the chemical agent storage sites themselves, an act that could have caused significant civilian casualties as a result of any hazardous releases. The Defense Department developed plans in coordination with French forces to attack 50 targets in Syria, starting with Navy Arleigh Burke-class destroyers firing Tomahawk cruise missiles and followed by air strikes.³³

This announcement appeared to have caused Assad to pause his chemical weapons attacks (through 2013 and most of 2014, at least). Russian Foreign Minister Sergey Lavov's announced on September 9 that Syria would agree to dismantle its chemical weapons program in return for a hold on U.S. military action against its regime. Shortly following this, Assad formally acceded to the Chemical Weapons Convention, which opened the door to formal actions by the Organization for the Prohibition of Chemical Weapons (OPCW) to monitor and verify the elimination of Syria's declared chemical weapons program.³⁴

As noted above, the OPCW had already arrived in Syria due to the Syrian government's request to the United Nations for an impartial, independent investigation of an alleged chemical weapons attack by the Syrian insurgents in the Aleppo area March 19, 2013. An advance team had traveled to Cyprus in April and began working with various governments on fact-finding missions.³⁵ A UN Mission team traveled to Damascus in August to conduct activities that were to investigate allegations of chemical weapons use and to visit the sites, as possible. The Ghouta incident forced a refocus of its initial activities, given the large scale and relative location of the attacks. The team spent two weeks in Damascus under an agreement with the Syrian government. This was not without peril, as the UN inspectors' convoys were targeted by sniper fire as they traveled to the incident sites.³⁶

The UN team interviewed survivors of the attack as well as medical responders, and gathered both clinical and environmental samples in the area. The survivors described their symptoms as including shortness of breath, eye irritation, nausea, and vomiting, all consistent signs of nerve agent poisoning. The clinical samples of

nearly all of the patients tested positive for sarin nerve agent exposure. The team also was able to examine and photograph the impact sites, as well as collect rocket fragments that also tested positive for sarin. As a result, the Mission Team concluded that “surface-to-surface rockets containing the nerve agent sarin were used... in the Ghouta area of Damascus.”³⁷

Notably, this report did not attribute the attack to the Syrian government, although certainly the circumstantial evidence pointed in that direction. The particular weapon systems used, the military-grade sarin nerve agent involved, the proximity of Syrian government forces, and the target of the attacks all would lead one to all but declare the Syrian Arab Republic as the instigator of the attacks. However, given the United Nation’s need to remain impartial and to encourage nation-states to cooperate in its investigations into chemical weapons possession, attribution without hard facts is not in its portfolio. The U.S., British, and French governments relied on releases of unclassified intelligence assessments to make their public allegations of Syria’s responsibility.

Social media was prominent in rapidly identifying the areas under attack and resulting chemical casualties. The French government suggested that the initial casualties were at least 700 based on an inspection of videos online. Human rights observers in the field used satellite phones to filter information at the site.³⁸ At the same time, skeptics tried to use social media as a tool to cast doubt on the notion of a chemical attack or to suggest that the Syrian insurgents had done it.

Part of the intelligence may have included U.S. monitoring of the communications to Syrian military units that actually conducted the attack. According to one news article, translation issues prevented the White House from realizing that there was going to be a chemical attack on Ghouta. In addition, message traffic within Syria suggests that the Syrian military commanders had not anticipated such a large number of casualties from the limited artillery attack in east Ghouta. It may be that the intent was to continue the trend of small-scale chemical attacks against the insurgents and the civilian population, rather than the respectively larger attack that occurred.³⁹

On the other hand, it may have been that the attack was a deliberate gambit. If the international community responded weakly to the Ghouta attack, Assad could continue to use sarin in larger amounts than just single point attacks. If the international community objected, then he could offer the option of giving up his chemical weapons in return for security guarantees that the Western nations would not attack him in retaliation. Either way, he had an angle.⁴⁰

President Bashar al-Assad disputed the UN findings, claiming that the attack was caused by the Syrian insurgents, and that it wouldn’t make sense to use chemical weapons in an area where Syrian military forces were operating. The Russian government supported this argument, suggesting that the Syrian opposition was trying to provoke an international response by causing this attack.⁴¹ Interestingly enough, the Syrian government reported alleged nerve agent attacks against its military forces occurring on August 22, 24, and 25, attributing these

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attacks to the Syrian insurgents. The UN Mission was given environmental and clinical samples that tested positive to sarin, but the impact sites did not lead to any evidence of attribution.⁴²

There is no evidence that the insurgents had either the capability to manufacture sarin nerve agent in the quantities required for this attack or the military delivery systems to cause the widespread casualties (as suggested by Seymour Hersh and others).⁴³ Regardless, Russian Foreign Minister Sergey Lavrov, in a number of talks with Secretary of State John Kerry, proposed that securing Syria's chemical weapons and removing them from the country might be a feasible political solution. This led to a series of technical discussions as to what could be acceptable to the two nations with respect to a Syrian chemical disposal program. After a meeting in Geneva in mid-September, the two announced a framework by which Syria's chemical weapons would be eliminated.

This was not a novel concept initiated by the Russian government. Senator Richard Lugar (R-IN) had spoken to Russian officials about the possibility of a joint U.S.-Russian effort to eliminate Syria's chemical stockpiles prior to the Ghouta incident, but had been rebuffed. The Russians claimed that they couldn't support an elimination effort as Syria was not a signatory to the Chemical Weapons Convention.⁴⁴ While it was true that Syria was not a signatory to the treaty, this would not have prevented the U.S. government from using the successful Cooperative Threat Reduction (CTR) program as a basis for eliminating Syrian chemical weapons, assuming the Syrian government agreed to cooperate. It is more probable that the Russian government did not want to see U.S. military operations against the Syrian government, and so came back to this option to forestall U.S. military attacks.

The deal rested on an accelerated schedule in which Syria would immediately declare its stockpile and provide full access to all of its chemical weapons sites. OPCW inspectors would complete their initial inspections by November and all of Syria's chemical weapons and agents were to be destroyed by June 30, 2014. President Assad sent a letter to the United Nations on September 12, formally acceding to the Chemical Weapons Convention, and by September 20, had submitted an initial disclosure of its chemical weapons program. In return for Syria's complying under the Chemical Weapons Convention, the U.S. government would not attack Syria. Technically, Assad had 30 days before the treaty would enter into force with respect to his program. On October 23, the Syrian government formally submitted the initial declaration to the OPCW.

The United Nations Security Council passed a resolution on September 27, 2013 to formalize the U.S.-Russian framework, calling for the complete elimination of all chemical weapons material and equipment by the first half of 2014. It was the mechanism to allow the OPCW to carry out its verification activities and to establish a fund through which other nations could support the mission.⁴⁵ A nine-month deadline was "exactly on the borderline of being technically feasible and utterly insane," said former State Department official Tom Countryman.⁴⁶

Developing a Response

Syria’s declaration to the OPCW was not made available to the public, but a summary of its declaration was released in later discussions of how the disposal would take place. The declared Syrian chemical weapons program included about 1,300 metric tons of chemicals and more than 20 sites that hosted more than 40 distinct facilities. While the Russian government was still being cagey about Syrian regime issues, they were open to meetings with U.S. security officials between September and December 2012. These talks included intelligence sharing on the contents and locations of the Syrian chemical weapons sites.⁴⁷ Table 2 offers a listing of the declared substances and facilities. Interestingly, there were no actual stocks of sarin or VX nerve agents declared, as the Syrian military supposedly used a binary chemical formula to mix those chemical warfare agents immediately prior to using them. Certainly, the Syrian government may have left off some sites that may have had an association with the chemical weapons program, but it is unclear as to whether this is a deliberate deception on behalf of the Syrian government or merely a difference of definition as to what had to be declared.

Chemical agents	580 metric tons of methylphosphonyl difluoride (DF, a precursor for sarin)
	20 metric tons of mustard agent
	130 metric tons of isopropyl alcohol
	310 metric tons of four “other category 1 industrial chemicals”
	260 metric tons of 13 different “category 2 industrial chemicals” including chloroethylamine, phosphorus trichloride, phosphorus oxychloride, hexamine, hydrogen chloride, and hydrogen fluoride
Chemical sites	1 research and development, 10 production (including 27 production facilities), and 12 storage sites
Chemical weapons	1,230 unfilled munitions (aerial bombs, missile warheads)

Table 2. Syria’s Declared Chemical Weapons Program⁴⁸

In developing options for destroying Syria’s chemical weapons, one must go back in time to U.S. government concerns as to the possible loss of Syrian

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government control over its chemical weapons stockpiles to Syrian insurgents, which included the Islamic State (ISIS) and al Qaeda. An alternate concern was that Assad would be pushed by insurgent successes to use chemical weapons in a mass attack. In part, this was due to past concerns relative to Libya, as that country's civil war in 2011 stopped the dismantlement of its chemical weapons program and put the question of the security of its chemical weapons stockpile up for consideration. Although the Libyan National Transition Council assured the OPCW as to its intent to secure the sites and continue the destruction of weapons, the potential for the loss of control of military-grade chemical weapons to sub-state groups remained.

Following the Syrian government's public disclosure that it did in fact have a chemical weapons program, discussion on U.S. policy options intensified. U.S. military action was an option in the event that Syria's government might collapse and the security of its chemical stockpile sites was in question. Previously, in April 2013, Prime Minister Benjamin Netanyahu suggested to Defense Secretary Chuck Hagel that the British, Americans, and Israelis should collaboratively plan to either disable or secure Syria's chemical weapons sites with special operations forces. This suggestion for collaborative action was not acted upon, but the understanding was that something had to be done.⁴⁹ The idea of a massive U.S. military operation in Syria was not popular, in particular due to the not-forgotten emphasis that the U.S. government had put on the Iraqi WMD program in 2002-2003 (and the resulting controversy over that operation).

The possibility existed that the Syrian regime would fall and that the U.S. military would need to secure and dispose of the chemical stockpile, similar to what happened in Iraq. Assuming that a transitional government was taking control but that didn't quite yet have its security forces deployed, a relatively small U.S. military force augmented with chemical weapons specialists could secure two storage sites in Syria until technical forces could dispose of the agents and munitions. This would at least reduce the chance of al Qaeda and ISIS gaining access to tons of chemical weapons. If this plan of action were followed, the military would require some form of destruction capability in the theater of operations. U.S. Central Command formally identified the need for a deployable chemical weapons destruction capability in 2012.

In August 2012, The Assistant Secretary of Defense for Nuclear, Chemical, and Biological Defense programs (ASD[NCB]) directed the Defense Threat Reduction Agency (DTRA) to develop options using the CTR program and to support building partner capacity efforts in the region. In response, DTRA created a "Regional Contingency Team" to coordinate the many agencies within DTRA on this issue. DTRA's mission included hosting a joint force headquarters with the responsibility of organizing missions to eliminate unconventional weapons stockpiles.

Between 2004 and 2012, the Defense Department had numerous internal discussions on how a "WMD elimination capability" might be formed, where U.S. military forces would lead a U.S. government effort to dismantle and dispose of an adversarial nation's WMD program. Following the ad-hoc effort by the Defense

Department to find an active WMD program in Iraq in 2003,⁵⁰ Defense Secretary Donald Rumsfeld and his successor Bob Gates both continued to advocate for an institutionalized force that could locate, exploit, and eliminate unconventional weapons recovered on foreign territory in a future conflict.⁵¹ After years of debate as to what this desired capability was and how it should be formed,⁵² General Robert Kehler, commander of U.S. Strategic Command, formally activated the Standing Joint Task Force Headquarters for Elimination on February 3, 2012.

This was a small command and control element designed to be the center of a joint task force that would be composed largely of Army chemical, biological, radiological, and nuclear (CBRN) defense forces and other military elements as required.⁵³ However, it would not be the central facet of the Defense Department's response to the task of destroying Syria's chemical weapons. The elimination headquarters was effectively hobbled by a lack of dedicated personnel and an immature operational concept that inherently relied on non-defense government agencies to fulfill roles that they had not acknowledged as resourced requirements and had never practiced.⁵⁴

In the fall of 2012, Defense Secretary Ash Carter tasked Frank Kendall, the undersecretary for acquisition, technology and logistics (AT&L), to develop technical and policy options for possible contingencies, assess military capabilities, and work the interagency to address this threat.⁵⁵ In addition, the DOD's Threat Reduction Advisory Committee (TRAC), an advisory group sponsored by the AT&L office, also engaged the challenge of threat reduction and WMD elimination "for cooperative and non-cooperative engagement" with foreign nations.⁵⁶ One of the TRAC's recommendations in late December 2012 was that the Army's Edgewood Chemical-Biological Center (ECBC) at Aberdeen Proving Ground should conduct a capabilities assessment that would identify technologies that would be capable of destroying bulk liquid chemicals in a remote, hostile location.⁵⁷

In January 2013, the AT&L formally directed the establishment of a Syria Chemical Weapons Senior Integration Group (SIG), composed of senior leaders who would meet every two weeks to work technical and policy issues and to address interagency processes. This SIG would develop working groups as needed to address distinct parts of the program. One of these groups was the technical community responsible for developing a disposal platform. This group was called the Syria WMD Operational Response and Dismantlement (SWORD) team, which included the Joint Program Executive Office for Chemical-Biological Defense, DTRA and its related elements (the STRATCOM Center for Combating WMD and the Standing Joint Force Headquarters for Elimination), and from Aberdeen Proving Ground, ECBC, U.S. Army Chemical Materials Agency, and the 20th CBRNE Command.

Contingency Options

The AT&L office told the team that President Obama had directed them to determine how the U.S. government could move the chemical weapons out of Syria

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as soon as possible and destroy them, but was not looking at any particular technology. If no suitable technology existed, they needed to figure out how to manufacture it. There were a number of options under which this effort could take place, but there were complications in each one. Technically speaking, parties to the Chemical Weapons Convention (to include the United States) were not supposed to accept chemical weapons from another state. There was no exception for disposal operations (as the owning state is supposed to dispose of the agents). This would require the United Nations grant an exception to the treaty's language.

Ideally, using the traditional approach, Syria should have taken the lead responsibility to build a disposal facility and, under supervision by OPCW inspectors, destroyed the agents and dismantled its facilities. However, Syria claimed it didn't have the resources to build a disposal facility. The U.S. government was prevented from funding the construction of a Syrian disposal facility because it was an identified state sponsor of terrorism, and the security of disposal operations would be imperiled if built in a war zone. Option one then focused on finding a host nation that would either incinerate the chemicals or build an incineration plant for the short-term purpose of destroying the Syrian stockpile. There was a precedent for this – in 2006-2007, DTRA supported Albania's destruction of 16 tons of bulk chemical agents using an incineration plant that was built and operated using CTR.

The second option would be to move the chemicals to another state and allow the U.S. government to deploy a disposal system to eliminate the chemical agents. The technical team proposed to develop a deployable neutralization platform based on the technology used at Aberdeen Proving Ground to destroy 1,800 tons of mustard and at Newport Army Depot to destroy nearly 1,700 tons of VX nerve agent. This technology could also be used to destroy ricin, of which Syria was suspected of producing (also a reportable chemical under the Chemical Weapons Convention). This exercise would be a "CTR-like" operation rather than a WMD elimination mission.

As a historical note, the U.S. Army had experience with building chemical disposal systems using neutralization technologies, such as the Chemical Agent Munitions Disposal System or CAMDS, used to destroy chemical agents at various locations within the United States between 1979 and 2009. This system had destroyed more than 363,000 pounds of chemical agent and more than 40,000 munitions without adversely affecting the environment or causing harm to its operators.⁵⁸ Additionally, this was not the first time that the Defense Department had tried to destroy chemical agents on a ship. In 1977, a Dutch-owned ship M/T *Vulcanus* was used as an operating base to incinerate nearly 25,000 drums of Agent Orange at Johnston Atoll under "Operation Pacer."⁵⁹

The current requirement was to develop a platform for destroying metric tons of toxic chemicals to an efficiency of 99.9 percent, operating 24 hours a day, seven days a week, in a form that was easily transported to overseas locations, operating at remote (bare-bone) sites, and ready to operate at full capacity within 10 days of

arriving on site. This meant that the design had to be modular, using proven technology, with a large degree of self-sufficiency, and relatively easy to set up and operate. This led to the prototype of the Field Deployable Hydrolysis System (FDHS), first demonstrated in late June 2013 (see Figure 3).⁶⁰ The Army planned to develop six additional systems over the next year, allowing for options to expand to more than one operating site, as needed.

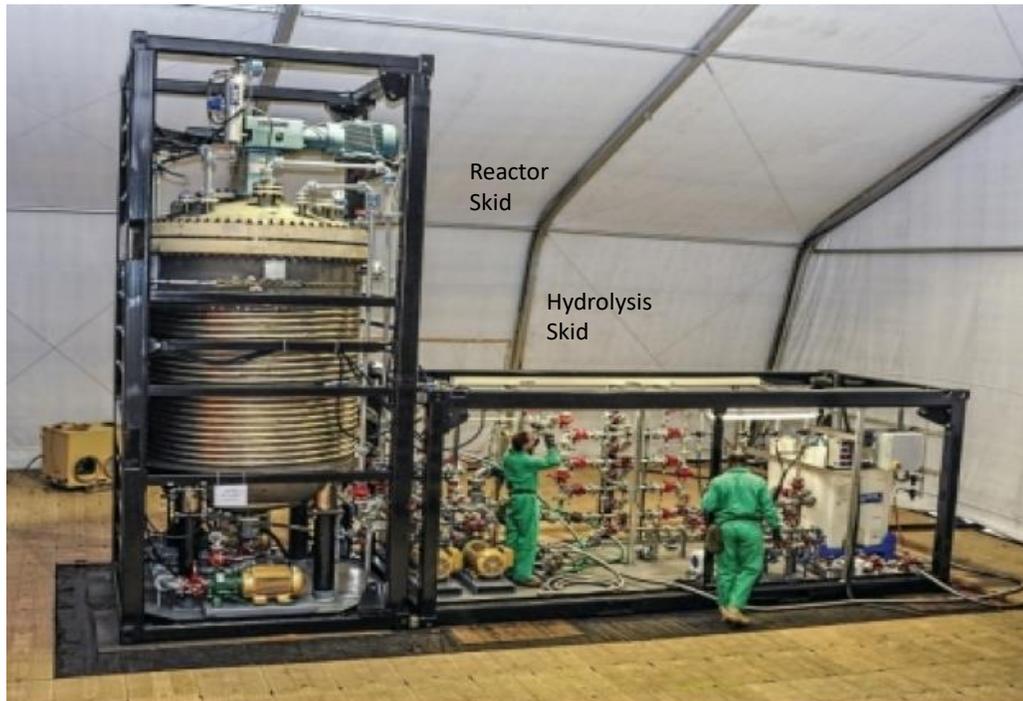


Figure 3. Army Field Deployable Hydrolysis System – Reactor and Hydrolysis Sections (courtesy of the U.S. Army)

In April, U.S. Strategic Command, as the Department of Defense’s combatant command advocate for combating WMD issues, published a Joint Emergent Operational Need statement to officially establish the requirement to build hardware that would address the elimination of bulk chemical warfare materials. The Joint Requirements Oversight Council quickly approved the statement, allowing the Army’s acquisition team to start developing the FDHS. Each system would cost about \$4 million to build, using a combination of DTRA funds, Army chemical demilitarization program funds, and other Army funds. The first two systems (following the initial prototype) would be ready to go by September 2013.

The U.S. government petitioned several nations between September and November 2013 to be the host for a chemical disposal effort, either using their own facilities or to allow the U.S. government to bring a chemical disposal system into

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their country. These countries included Italy, Jordan, France, Belgium, Norway, Russia, and Germany. France and Belgium had extensive experience in destroying World War I chemical munitions, and Russia had its own significant chemical disposal program. None of these countries were willing to take on the mission, more due to public perception than to the actual safety concerns relating to handling the chemicals.⁶¹ In mid-October 2013, the Albanian ambassador to the United Nations indicated that his government might consider the responsibility of hosting the disposal operations. Not more than a month later, the Albanian prime minister formally rejected the proposition, citing public concerns as to environmental and health hazards.⁶²

Following the failure to find a host nation for disposal operations, the planning switched to option three: removing the chemical weapons to international waters and destroying them while at sea. This would involve putting two FDHS platforms on a U.S. Maritime Administration ship called the *M/V Cape Ray*. The *Cape Ray* is a Ready Reserve Force ship that, when activated, falls under the Military Sealift Command, which is a part of U.S. Transportation Command. Its normal mission is to move vehicles across the ocean in a “roll-on, roll-off” configuration. With its cargo space of more than 175,000 square feet, vast open deck space, and high overhead height clearances, it had the right characteristics to hold the two operational systems, the chemicals to be neutralized, and the waste effluent that resulted from the operation. There was one disadvantage, in that the ship could not carry enough storage tanks to hold all six chemicals categorized as “category 1” in a single trip, which meant it would have to focus on destroying the mustard agent and DF chemical.⁶³ This paper will not go into the modifications required for the ship to be operated as a chemical disposal facility or the technical process by which the chemicals were neutralized and stored on the ship (see Figure 4).⁶⁴

Certainly, there were technical and policy challenges in adopting this process. This particular system was not tested in as much as the Army knew the process would work in theory, but it had no experience in actually operating this particular system in an operational environment. The system had to be safe to operate, not just for the crew and technical operators on the ship, but also due to the possibility of any spillage into the ocean. While developed under the defense acquisition process, this project was “fast-tracked” and did not go through the formal process of operational testing and evaluation, as nearly all defense programs must. The nations bordering the Mediterranean Sea and Greenpeace in particular were keenly aware of past practices of burying chemical munitions at sea (pre-CWC).⁶⁵ The overall effort had to be transparent to concerned public parties but, at the same time, cognizant of the need for security measures to protect the chemicals from being taken by hostile actors. Additionally, the planners had to account for potential bad weather, resupply, and rotating personnel on and off the ship.



Cape Ray Field Deployable Hydrolysis System Operations

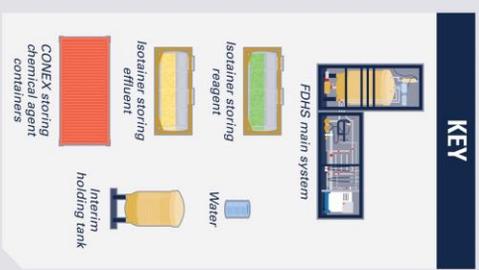
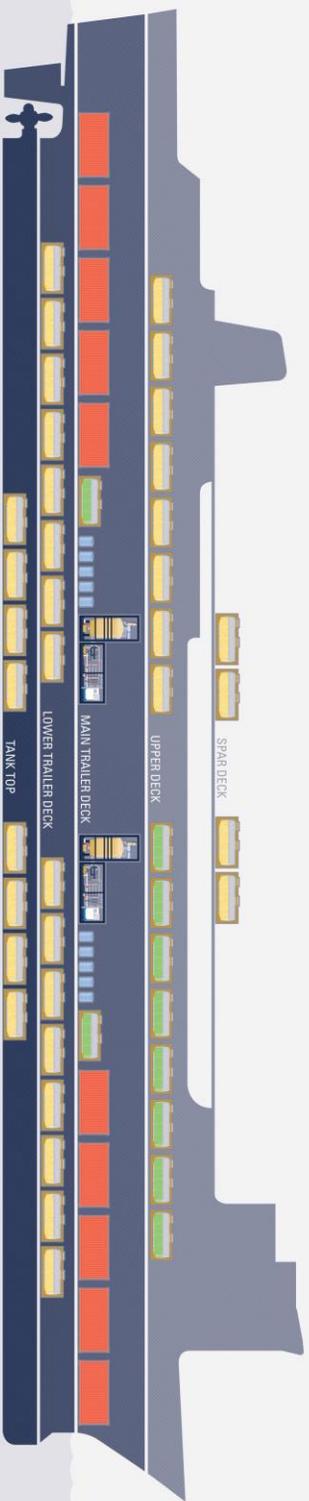


Figure 4. The U.S. M/V Cape Ray and FDHS Layout (courtesy of the U.S. Army)

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The equipment, to include a laboratory, decontamination station, and a collective protection system, was installed on the *Cape Ray* in December, and the ship participated in sea trials in early January to prepare for its mission. It departed from Portsmouth, Virginia, January 27, 2014, with a crew of 36 civilian mariners and more than 60 technical specialists, a security team, and other military members. The *Cape Ray* arrived at U.S. Naval Station Rota, Spain, February 13, 2013, and settled in to wait for Syria to remove its chemical weapons and move them to its port, Latakia. Unfortunately, the Syrian government was behind schedule and missed its deadline of February 5 to have all of its chemical weapons and precursor chemicals out of country. In fact, it would not be until early March when Syria was able to move more than a third of its stockpile to the port and loaded onto ships.

About this time, members of environmental, public health, nonproliferation and arms control groups released a public letter to Secretaries Kerry and Hagel to remind the U.S. government that they were watching the disposal process with great interest. The letter emphasized the need for full transparency and outreach to allow engagement with “all stakeholders,” including those advocacy groups who saw themselves as government watchdogs over former and current U.S. government chemical demilitarization efforts.⁶⁶ The U.S. government did not respond to the letter. In March, there were large public protests in Crete against the plans to destroy the chemical agents at sea.⁶⁷ These protests, focusing on the potential for environmental damage in the event of an accident, would continue throughout the summer.

While the crew was waiting for the completion of the Syrian movement of chemicals out of country, the *Cape Ray* hosted a “European Media Day” between April 10 and April 12. In addition to the ship captain, the director of operations for U.S. Naval Forces Europe and an OPCW spokesperson provided comments. Reporters were provided access to all parts of the vessel. CNN, al Jazeera, and the BBC provided video broadcasts, while the UK Guardian, Der Spiegel, the Wall Street Journal, Reuters and others wrote articles. The safety features of the vessel were highlighted as well as the technical equipment that sat in the cargo hold.

Implementing a Disposal Program

Up to the point of operationalizing this effort, it had taken an enormous amount of coordination, not just between the State Department, Department of Transportation, and Defense Department, but within the Defense Department – Army technical offices, DTRA and OSD funding, Navy operators, U.S. Transportation Command, U.S. European Command, U.S. Central Command, the United Nations, the OPCW, defense contractors – and now there was a considerable international element, not to mention the commercial industry's interest.

The OPCW team would train the Syrians on how to safely secure and handle the chemicals as well as oversee the disposal process on the *Cape Ray*. Russia provided equipment and transportation assets to the Syrian government for moving the chemicals to Latakia. A Danish and a Norwegian ship would take on the chemicals and move them to Italy. Security for the ships would be provided by Chinese, Danish, Norwegian, and Russian warships. Italy would provide the port of Gioia Tauro as a transload point to move the Syrian chemicals to the *Cape Ray*. Other security support would be provided by Finland, Germany, Italy, the United Kingdom, and Turkey.⁶⁸ Jordan and Turkey accepted U.S. aid in the form of chemical-biological defense equipment and training to support border security and crisis response.⁶⁹

Industrial facilities in Germany, Finland, the United States, and United Kingdom would destroy the industrial chemicals and waste effluents. The OPCW had 35 private companies expressing interest in the operation, of which 14 industrial companies provided bids to handle the final disposition of the chemicals. Two companies were awarded contracts (Veolia ES Technical Solutions and Ekokem Riihimaki). The German government offered the services of GEKA MBH and the UK government offered Mexichem for an unplanned shipment. Other nations, to include Japan, Canada, and the European Union, contributed funds to the United Nations and the OPCW.

Some of the disposal work already had begun in the fall of 2013. The OPCW had verified that 21 of the 23 initially-declared production facilities had been shut down, the last two being closer to active fighting and not deemed safe to visit. The Syrian government committed to destroying the stocks of isopropyl alcohol, containers with residual mustard agent, and unfilled chemical munitions by January 31, 2014. But no chemicals had been moved to Latakia by the end of the year. The first shipments to the port would come in early January, and the last shipments

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before the end of June.⁷⁰ The shipments were behind schedule, with Syria having moved about half by late March, but continued in good faith. Some of the containers had to be repacked due to leaks. All of them had to be inspected and inventoried before being packed in compliance with international rules of transportation of hazardous materials.

Moving the chemicals from the port to waiting ships was not a trivial matter. The *Cape Ray*, because it resembled a U.S. warship (in color, not due to weapon systems) and carried U.S. military personnel, could not directly load the chemicals at Latakia due to diplomatic sensitivities and security concerns. Denmark volunteered its merchant vessel M/V *Ark Futura* to carry the mustard agent drums and DF to Italy for transloading to the *Cape Ray*, along with shipping other industrial chemicals to the United Kingdom and Finland. The Norwegian vessel M/V *Taiko* would similarly carry category 2 industrial chemicals for disposal to Finland and the United States (see Figure 5). The ships were shadowed by military warships throughout the process. There were no security incidents throughout the event.

For security purposes, the two ships stationed at Cyprus while the Syrian chemicals were stockpiled at Latakia. The ships docked about 20 times at Latakia to take on their cargo, remaining only a few hours at a time and while all other operations in the port were suspended. The *Taiko* picked up its category 1 and 2 chemicals in early June and carried them to the Ekokem waste facility in Finland and the Veolia waste disposal facility at Port Arthur, Texas, completing its travel by July 9.⁷¹ The *Ark Futura* would eventually hold 224 storage tanks filled with DF and 15 storage tanks of mustard agent, moving these to Gioia Tauro July 1, 2014, for a one-day transload to the Cape May. It also would carry other industrial chemicals to the Ellesmere Port waste facility in the United Kingdom and Finland, completing its mission by July 20. Table 3 identifies the disposal facilities and chemicals shipped to each.

The *Cape Ray's* technical team was able to process the 600 metric tons of chemicals in 42 days, completing its disposal operations by August 17. Crews worked in 12-hour shifts to maintain operations around the clock. The team neutralized the DF first, running both FDHS systems in parallel, before moving on to the mustard agent. As the technical team monitored the hydrolysis process and the flow of agents and effluent from and to the storage tanks, OPCW inspectors watched the process by video cameras and verified that all of the removed chemicals had been destroyed.⁷² In the process of neutralizing the 600 metric tons of toxic chemicals, more than 6,000 metric tons of waste effluent was created. The *Cape Ray* transported more than 330 metric tons of HD effluent to Bremerhaven, which was moved to the GEKA waste facility near Hamburg, Germany, and then sailed to the port of HaminaKotka, Finland, to off-load other 5,900 metric tons of DF effluent. The *Cape Ray* returned to Portsmouth September 17, 2014 and was cleared for unlimited operations in January.

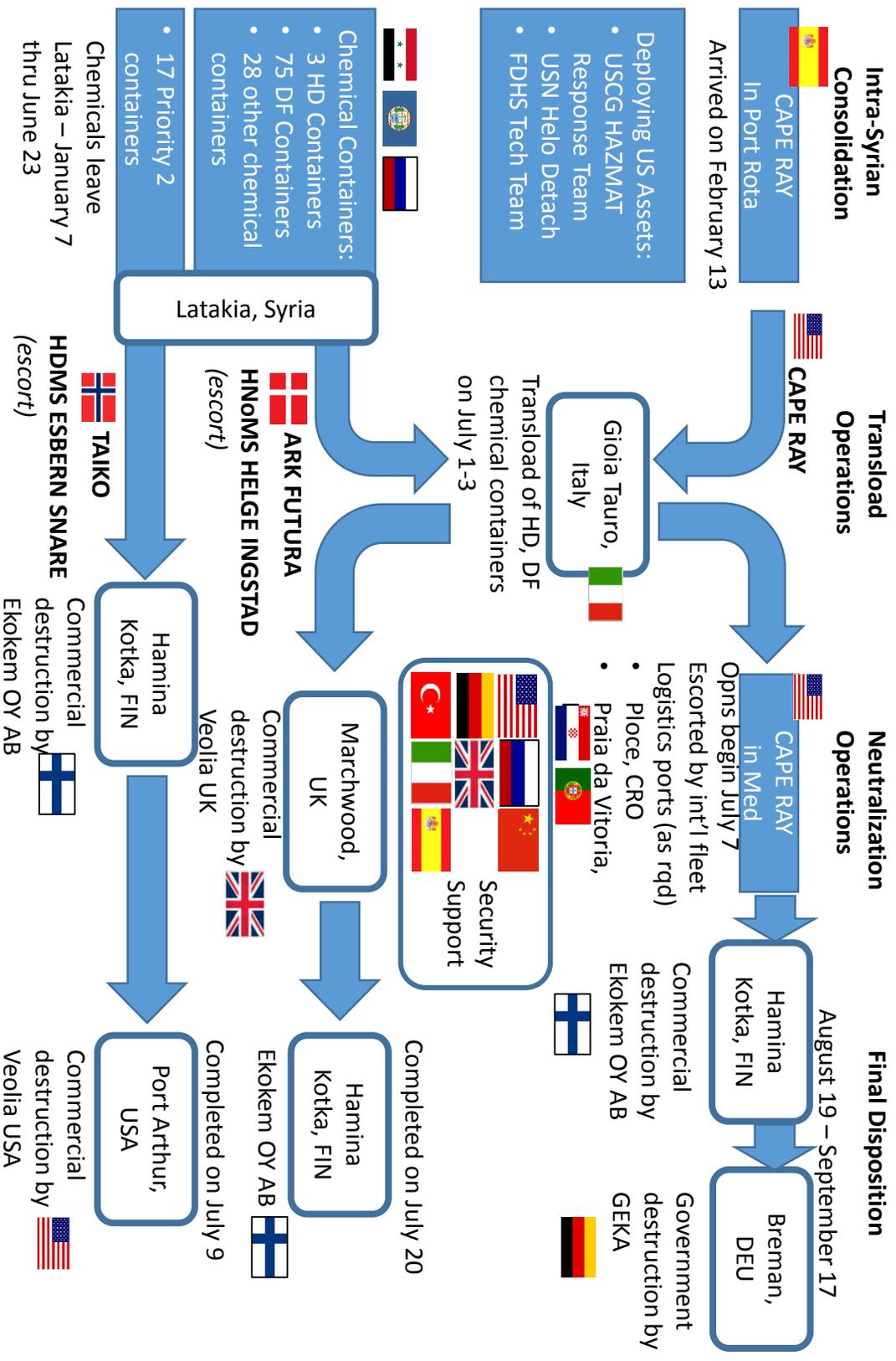


Figure 5 . Multinational Support to the Syrian Disposal Mission

Waste Treatment Facility	Disposal Technology	Chemicals Destroyed
Ellesmere Port (Veolia), UK	High temperature incineration	180 tons cat 1 & 2 chemicals
Mexichem, UK	Chemical neutralization	7 tons hydrogen fluoride
GEKA, Germany	High temperature incineration	330 tons HD effluent
Ekokem, Finland	High temperature incineration	5,867 tons DF effluent 320 tons cat 1 & 2 chemicals
Veolia Technical Solutions, USA	High temperature incineration	60 tons cat 2 chemicals

Table 3. Disposing of the Waste Products

As a minor note, without going into detail as to each facility's capabilities, the amount of hazardous chemicals treated as a result of the Syrian chemical disposal operation was very small in comparison to the annual treatment of industrial hazardous waste taken on at each facility. For instance, a 2015 Ekokem report talks about 1,500 kilotons of waste treated annually, compared to the nearly six kilotons treated in this operation.⁷³ The Ellesmere Port facility destroys about 100,000 tons of industrial waste each year.⁷⁴ This was not the hard part of the disposal operation.

The only reason for highlighting the disposal technologies used is to elaborate on the long-standing policy debate on how chemical warfare agents are destroyed in bulk. Environmental advocates, such as Green Cross International, Greenpeace, and the Sierra Club, prefer neutralization technologies as alternatives to incineration because they claim that incineration allows for releases of toxins or other hazardous material, even when pollution-abatement systems such as filters are used.⁷⁵ There is no evidence that any incineration plant operated by the U.S. Army to destroy chemical warfare agents has ever resulted in a hazardous chemical agent release that put public citizens or the environment at risk, but these claims by environmental advocates continue.

Ideally, incineration is a more feasible technology for destroying chemical agents because it is agnostic to what's being fed to the furnace – neutralization technologies are agent-specific and have to be carefully controlled to achieve full disposal of the agent. Incineration is a well-researched technology, is less expensive to operate and creates fewer waste products as compared to neutralization, and contrary to environmental groups' claims, is relatively safe to operate. Congress directed the U.S. Army to use neutralization technologies at four of its nine chemical disposal sites, two of which dealt with bulk liquid agent stored in ton-containers. The Army had also used neutralization technology in destroying the

nerve agent precursor DF in its Nonstockpile Chemical Munitions Program between 2003 and 2006. Both technologies are viable disposal processes today.

The Army had investigated neutralization technologies back in the 1970s, given the possibility that neutralization could offer a quick solution to eliminate immediate hazards with ton-containers of sarin nerve agent, for instance. Neutralization through hydrolysis prevents the release of toxins into the air, but creates a much larger waste product than incineration – in this case, the waste product was 10 times the amount of the original targeted chemicals. Neutralization is a more complex process than incineration in that one has to carefully control the rate of feed of the neutralent and output of hazardous waste. But the absence of “smokestacks” has been a powerful incentive to green groups and like-minded public citizens, even as the overall costs of operations of neutralization plants has been much higher than comparable costs of incineration. At last examination, Congress has authorized \$10-11 billion to dispose of the last 10 percent of the U.S. chemical weapons stockpile (specifically, Pueblo and Blue Grass Army Depots), both using neutralization processes.⁷⁶ It will have cost short of \$25 billion to dispose of the first 90 percent. And eventually, all of that waste still returns, in some final form, diluted and fed to the oceans or buried in a landfill.

The Army’s chemical demilitarization program was highly politicized after its initial decision in the early 1990s to use incineration as a safe, cost-effective, and proven technology, leading to the direction by Congress to consider “alternative technologies” as potential candidates for disposal. Studies by the National Academies were directed to avoid cost and efficiency comparisons between the two different approaches. But with regard to the Syrian chemical disposal effort, while neutralization was the initial treatment process, practically all of the waste effluent was incinerated – or as some in the waste disposal business say today, “detoxified” – in the final deposition of the material.

Postscript

By January 4, 2015, the OPCW declared that all of Syria’s declared chemical stockpile was destroyed. Destruction of 12 chemical weapons production facilities (seven aircraft hangers and five underground facilities) in Syria was still under way but scheduled to be completed by late summer. By mid-June, the waste effluents at GEKA and Ekokem had been verified as destroyed, and only 16 tons of hydrogen fluoride remained at the Veolia Port Arthur complex. Veolia reported the final disposal of the hydrogen fluoride to the OPCW in early January 2016, completing the elimination of Syria’s declared chemical stockpile.

The cost of the disposal operations is not entirely clear. The initial building and testing of the FDHS prototype cost \$10 million (from DTRA), and the other six required \$25 million to build (from Army). Funds allocated from the chemical weapons destruction program amounted to about \$60 million. The Defense Department identified \$150 million as funding issued through the CTR program. These funds paid for training, equipment, protective gear, logistics support, and

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medical countermeasures for the OPCW inspection teams as well as for border control forces in Jordan and Turkey. The OPCW spent approximately \$50-55 million for contracts with Ekokem and Veolia. The funds collected by the United Nations Trust Fund from other countries has not been detailed (other than the European Union, which donated about \$25 million). Additional costs for operations and maintenance, outfitting and operating the *Cape May* and providing security for the ongoing operations have not been identified. Total costs could have run up to \$400-500 million, by one estimate.⁷⁷

The question remains, did Syria's government declare all of its stockpile and production facilities? Given the alleged Syrian military use of a nerve agent against Syrian insurgents in April 2017, there is always the possibility that there are undeclared sites where these chemical weapons still exist. In May 2015, OPCW inspectors found traces of precursors required to make sarin and VX in an undeclared military research site. Other analysts suspect that the Syrian regime deliberately failed to account for 10-15 percent of its stockpile.⁷⁸ Does this mean that the international effort to destroy Syria's chemical weapons program was a failure? Not necessarily.

As a party to the Chemical Weapons Convention, Syria is liable to challenge inspections brought on by other states. If there is credible evidence suggesting that Syria is holding out with a reserve of chemical weapons, any nation can call for the OPCW to inspect and verify the allegation. At the least, Syria's ability to use military-grade chemical weapons has been significantly degraded. There have been allegations that Syrian military forces continue to use chlorine barrel-bombs in attacks against Syrian civilians and the insurgency.⁷⁹ In 2016, the United Nations specifically identified the Syrian government as responsible for at least two chemical attacks in the past two years (in Talmenes in April 2014 and in Sarmin in March 2015).⁸⁰ On April 4, 2017, a Syrian Su-22 aircraft may have dropped a nerve agent-filled munition in Idlib province, causing more than 80 deaths and hundreds of casualties.⁸¹ Why the Syrian military is continuing these chemical attacks is unclear; it may be that the regime is bent on demonstrating that it has not been cowed by the international community's determined push to dismantle its chemical weapons program.

Use of improvised chemical weapons (the chlorine barrel bombs) is still a violation of the Chemical Weapons Convention, even if Syria's government does not have a formal weapons program. However, the challenge remains, what should the United States and other nations' response be to this issue? The U.S. government is already supporting the Syrian insurgents with both financial and military support. Any direct military response needs to be proportional to the threat, which would seem to dismiss any massive bombing campaign against the Syrian regime or its military forces. The Russian and Chinese governments have vetoed a UN Security Council resolution that proposed to punish Syria for using chemical weapons.⁸²

At minimum, the U.S. government was able to force Syria to abide by the international treaty to dismantle a significant part of its chemical weapons

production capability. That is the main purpose of the Chemical Weapons Convention, to eliminate a nation-state's chemical weapons program as a method of warfare. However, the Syrian regime, now bolstered by Russian military support, intends to continue its fight to maintain its state security interests, by whatever means possible. The effort to dismantle Syria's chemical weapons program, in particular its research, development, production, and storage sites, still offers lessons for future threat reduction efforts.

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Lessons Learned

The *Nonproliferation Review* recently published a collection of articles on WMD elimination, with one chapter summarizing the “lessons from the last quarter-century.”⁸³ While its coverage was across six case studies (South Africa 1991, former Soviet Union 1990s, Iraq 1990s, Iraq 2003, Libya 2000s, Syria 2014), the “lessons learned” chapter provides a good framework to review the Syria case study. This monograph will build upon that chapter to provide a slightly different perspective on the topic.

One of the first points, and perhaps a fundamental point, is the need to review how the U.S. government defines WMD and WMD elimination. Despite having used the acronym “WMD” for more than 15 years, the U.S. government still has no single, generally-accepted definition for this term. As a result, the U.S. government (and other nations) debate what “WMD” means in each new incident, based on whether the argument is about military operations, global disarmament, human rights, counter-terrorism, or law enforcement. The very term “WMD” is unhelpful in developing responses to crises involving unconventional weapons. This also applies to the phrase “WMD elimination,” which has the added challenge of being phased out and replaced by the phrase “WMD disablement and disposal.” The lack of a common terminology and concept for a “whole of government” operation has retarded the discussion. The *Nonproliferation Review* identifies six different case studies that form at least four different typologies, depending on whether the decision to eliminate an arsenal was imposed, coerced, or voluntary, and whether the dismantlement was external, cooperative, or internally executed. No one seems to agree on exactly what WMD elimination is or should be.

Three of the six case studies are (more or less) traditional cooperative threat reduction efforts (the former Soviet Union, Libya, and Syria). One could also add the Albania chemical demilitarization project to that list (not one of the six case studies). This leads to the question – is cooperative threat reduction, a well-established program executed between the State and Defense Departments, a subset of WMD elimination, or is WMD elimination, a poorly-established, ad-hoc effort executed primarily by the Defense Department, just a coercive form of threat reduction? The point is in the constant search to define and establish a new “mission area” in the counter-WMD operational concept, it would make more sense for interagency purposes to just eliminate the term “WMD elimination” and use “threat reduction” as the policy objective.

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The original argument for WMD elimination – originally WMD exploitation – was based on an artificial worst-case scenario that postulated, during a major combat operation or as a regime collapsed in upon itself, sub-state actors would swoop in for the purposes of claiming WMD program-related materials or technology. Because U.S. government policy is to prevent uncontrolled and illicit transfers of WMD program-related materials, especially to sub-state groups, the thought was there needed to be a capability to get U.S. technical specialists into battle zones for the purposes of securing and moving this material. One could not wait for the battle to be over to start dismantling the adversary's WMD program. In short, the U.S. military concept of operations is to separate counter-WMD activities from the general military campaign, given most U.S. commanders' relative unfamiliarity in dealing with these special events.

That pessimistic scenario did not play out in Iraq 2003, Libya 2011, or Syria 2014. While in each case there were sub-state actors present as national chemical stockpiles were being secured and destroyed, the actual operation of securing and disposing of the material was conducted without incident. Sub-state groups remain focused on gaining access to conventional firearms and explosives rather than unconventional weapons. However, this assumption of U.S. forces having to search for WMD stockpiles in the middle of a war zone remains present in the North Korea scenario. In fact, a RAND study suggests that the number of U.S. military personnel required to take on the WMD elimination mission if North Korea collapsed – to seize, secure, and clear 23 large sites – could exceed 188,000 troops. The RAND analysts recommend that the U.S. military fully resource this mission.⁸⁴ Given the history of U.S. military priorities in this field, it is highly unlikely that this will in fact happen.

The Defense Department, and in particular the U.S. Army, had been exploring the idea of a “Joint Task Force for Elimination” since at least 2006, when the Army integrated WMD elimination exercises into the Ulchi Focus Lens exercise that takes place in the Republic of Korea. DTRA fielded a “Joint Elimination Coordination Cell” at the time, composed of less than 30 personnel, which would eventually be the catalyst for later discussions of a standing Joint Task Force and then a Standing Joint Force Headquarters for Elimination.⁸⁵ Between 2009 and 2015, there was no appetite within the four services or U.S. Strategic Command to fully outfit and institutionalize this capability.

The Army continues to work on this concept, but without a joint component, any future exercise would again be an ad-hoc pick-up game. With the failure of the WMD elimination concept to gain traction and the recent disestablishment of the Standing Joint Force Headquarters for Elimination, one must revisit this assumption to determine whether the U.S. government really needs a WMD elimination capability. If one takes away the Jack Bauer ticking clock, a CTR-led program, led by the State Department and executed by the Defense Department, still makes the most sense as an established, well-regarded – and most importantly, resourced – effort.

There is no well-defined process and no dedicated resources for WMD elimination, as a result of a failure to institutionalize this activity and the numerous government agencies involved, to include the international community. The many different WMD elimination scenarios work against having a “playbook” or single advocate. Let’s get past the definitional problems – every WMD elimination case study has dealt with one singular type of unconventional weapon – either nuclear, biological, or chemical, but (generally speaking) not all at once. The primary focus has been on the WMD material, rather than on the people and institutional knowledge within a regime (the exception being the former Soviet Union). Some of the cases required discussions within the United Nations; others were based on bilateral agreements. There is no generic concept and no single government agency that can execute this mission. It will always be an ad-hoc effort because of the unique nature of the situations.

It remains unclear how the U.S. government should approach this particular national security concern. One approach is to create a carefully-designed and engineered response force based on a well-defined threat – this approach can be costly to maintain and, if the threat turns out to be something other than expected, the response fails. The other approach is to create a response force that has a mix of technical skills and functional abilities, but is not fully staffed (to lower maintenance costs) – rather, additional forces are added as needed to address the specific threat. The Defense Department seems set on the second approach, but partnership with other needed government agencies is not certain.

Most defense analysts who discuss the Syrian chemical disposal case study agree that this was a unique situation, that the opportunity of a U.S. government having the time to develop a tailored solution to an adversarial government’s WMD program prior to its agreement to disarm, added to an accelerated time schedule and relatively limited (but willing) participation of the host government, will not be seen again. The number of state or sub-state actors with active chemical weapons program continues to shrink. Having said that, it seems fruitless to call for either a defined concept of employment or the establishment of an institutionalized program within any government agency. And yet this hasn’t stopped the Defense Department from continuing to push for a generic joint concept that will allow for the organization of technical units and acquisition of specialized equipment.

Looking not just at the Syria case but all six elimination cases, the call for a “checklist” or playbook will be difficult if not impossible to create and will not be helpful because of the unique aspects of each mission. The U.S. Army in particular continues to focus on the operational and tactical aspects of CBRN response, rather than the strategic demands of counter-WMD operations. DTRA has a long history of executing the CTR program, but is challenged by resourcing issues. Between the two agencies, they have the necessary skills and capabilities to address future contingencies, as directed.

This cannot be an unresourced requirement mandated by higher headquarters, but rather an investment in existing Army programs – in particular, its chemical

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demilitarization program and the “CBRN response” capabilities within the 20th CBRNE Command. However, if the U.S. Army fails to invest the necessary intellectual energy into examining strategic challenges and developing partnerships with other government agencies, it will not be prepared for future contingencies. As Dwight Eisenhower once stated, “plans are worthless, but planning is everything.”

Obviously, the State Department's arms control branch and the Defense Department's policy and acquisition offices need to guide and foster this capability, if it is seen as an absolutely necessary mission. Without advocacy from political appointees, this mission will lack for resources and fail in prioritization against other competing programs. The technical community does not necessarily have the skill set or contacts to oversee or lead a multinational, diplomatically-sensitive operation. In the past, U.S. Strategic Command has turned away from advocating for counter-WMD programs, and it is unlikely that U.S. Special Operations Command will advocate for this mission either. The combatant commands are operators, focused on near-real-time challenges, and lack the policy focus to champion for these activities.

Collaborating with other nations and nongovernmental organizations is difficult but not an impediment to success. But certainly the State Department and the offices of the Under Secretary of Defense for Policy do, and are expected to, work complex policy issues. It's difficult to call for a new program effort that demands long-term, institutional support for counter-WMD activities such as this elimination mission. Although counter-WMD activities are a high priority within the U.S. government, they are not routine, and they do not fit neatly into the usual operational tempo of ongoing political-military discussions. It will be difficult, if not impossible, to avoid surprise. The necessary funds and commitment will not be there to ensure a readily-applicable platform for every possible contingency.

This comes to one last observation. The Syria chemical disposal mission was overseen by the AT&L office and executed largely through a collection of technical experts. The framework for management included a principal-level group and several working groups dominated by the acquisition community, because they had the funding and personnel to meet frequently and to discuss the technical aspects of the mission. The Syria SIG membership was very similar to a National Security Council Interagency Policy Committee. The State Department, OSD policy, Joint Staff, and military operators were not so well-funded or staffed to balance the technical community's size and influence. As a result, there were duplications in effort and challenges in the integration of other defense functions. The operation was run by the technical community because it had the resources, and thus the implicit authorities, to do what they did. One report notes that this imbalance caused tensions as the effort transitioned from a material development effort to an operational mission, without any change in how the effort was managed. In particular, the Syria chemical disposal mission was not a “named” combatant command operation, and perceptions were that the technical community, in running

the operations, overstepped its authorities and responsibilities.⁸⁶

There are certainly advantages to having a “named” combatant command operation, and in particular, there are other vehicles for organizing interagency efforts, such as the formation of a Joint Interagency Task Force or Joint Interagency Coordination Group. National efforts for counter-drug operations and homeland security have traditionally used these vehicles. When the Defense Department was debating how to operationalize WMD elimination between 2009 and 2012, the leadership consciously rejected the idea of a permanent joint task force because of the constraints of manpower and cost of maintaining the force at a particular military base. But as an operational construct, certainly establishing a Joint Interagency Task Force would have been appropriate for this operation.⁸⁷

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Conclusions

The removal and destruction of Syrian chemical weapons and associated facilities was successful and should be viewed as a great achievement by the U.S. government and United Nations. Convincing Syria to give up its declared chemical weapons and to act against a significantly accelerated schedule, using a unique form of technology at sea, with no significant incidents or loss of chemical agents, was a remarkable effort – and a very unique one. It would be difficult to say that this effort was either a deliberate, thoughtful development of military capabilities or a process which the U.S. government would necessarily want to use for other nations' unconventional weapons programs. By all accounts, the National Security Council did not have a ready play-book for this issue in 2012-2013, but as President Obama remarked later, he was more concerned with policy results than being graded on style.⁸⁸ That said, there are some conclusions that we can take away from this case study.

Destroying Syria's declared chemical weapons program did not stop the civil war, did not stop the indiscriminate killing of civilians, and did not stop the continued use of chlorine barrel bombs beyond Syria's accession to the Chemical Weapons Convention. The total number of chemical casualties within Syria amounts to less than one percent of overall civilian casualties, measured up to February 2015.⁸⁹ The elimination of Syria's chemical weapons program was important, however, from the aspect of strengthening the international arms control regime that has near universality on a global ban of chemical weapons production and use. It was a success in that the liberal international order was able to convince the Syrian regime to cooperate in eliminating one particular class of unconventional weapons, not just improving regional stability (perhaps by a small measure, but regardless) but also by preventing the possible loss of control of military-grade chemical weapons to sub-state groups.

It was possible for the U.S. government and international community to separate the singular task of eliminating these chemical weapons from the larger context of addressing Assad's reprehensible actions in Syria. For instance, there was considerable congressional debate as to the extent and role of U.S. military action when President Obama declared the intent to conduct limited strikes against Syrian forces in response to the Ghouta attack.⁹⁰ The president stated that the purpose of the strikes was to deter Assad's regime from continuing to use chemical weapons, not to remove Assad from power.⁹¹ Two days after that speech, the Assad regime sent a letter to the United Nations stating its intent to accede to the Chemical

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Weapons Convention. Deterrence works.

But even deterrence has to be put in context. To be effective, deterrence has to be seen by the other party as credible, i.e., that there is a capability and willingness to use that capability. The threat of U.S. military strikes in response to continued Syrian chemical attacks that caused mass casualties was seen as credible. It may be that the Syrian regime did not believe the United States or other nations would use military force in response to its use of chlorine barrel bombs that caused much more limited casualties. While the Syrian government's declared chemical weapons program has been dismantled (for the sake of argument, at least most of it has), the international community cannot ban Syria from producing chlorine as a vital part of its industrial capabilities.

Of course the continued use of chlorine as a weapon is a violation of the Chemical Weapons Convention, and there are diplomatic processes to address this casual flouting of the treaty. The OPCW should continue its investigations of any allegations of chemical weapons use in Syria as evidence of human rights violations for war crimes trials and present those results to the United Nations for action. It may be that Russia and China will continue to block any attempts to punish Syria for its draconic measures to enforce security matters within its own borders. This should not diminish the success of the enterprise in taking Syria's mustard and nerve agents off the table.

The future of the Defense Department's role in eliminating unconventional weapons in a non-permissive (combat) environment remains an open question. The 2014 DOD Strategy for Countering WMD notes that "DOD may also lead or assist in the disposal of residual adversary WMD capabilities until such time that a civilian or international entity can assume these responsibilities." It identifies the need to control, defeat, disable, and dispose of WMD as "specialized activities and tasks."⁹² The term "elimination" is no longer used; instead, the terms "disablement and disposal" are the key missions. The overall intent is the same, but the effort to split the singular term "elimination" into two separate parts allows the Defense Department to discuss military lead responsibilities to "disable" a nation-state's WMD program from what one might expect as State Department-led responsibilities under "disposition" of a nation-state's WMD program. In fact, the Standing Joint Force Headquarters for Elimination was stood down in 2017, commensurate with the U.S. Special Operations Command taking over the role of the DOD lead in planning counter-WMD operations from U.S. Strategic Command.

It remains unclear as to whether the responsibility to lead the disablement and disposal missions requires a full-time, dedicated force of professionals, or whether future cases of eliminating a nation-state's ability to produce and use unconventional weapons will require uniquely tailored solutions, as the Syrian case required. The following recommendations should be considered:

- **Use established organizations for task forces.** Given that there is no singular WMD threat scenario, that each one is unique and will require distinct planning characteristics, the U.S. government should consider the use of temporary organizations such as the Joint Interagency Task Force and Joint Interagency Coordination Group, rather than a standing joint task force. This concept needs to be focused on addressing the particular theater campaign plans rather than on dealing with the technical nature of unconventional weapons. This would reduce the friction between the technical community and the military operators as to who is running the operation, as well as improve interagency and international coordination. In addition, there needs to be a forum to support war gaming on future scenarios involving the disposal of unconventional weapons, including participation from the interagency, non-governmental groups, and academia.
- **Eliminate the term “WMD elimination.”** For years, WMD elimination in a non-permissive environment was emphasized as a “must-do” mission but has never been adequately resourced. The Syria case suggests that this is a much more complicated process that requires a permissive environment to be successful. To be clear, it may be too costly and risky to perform “WMD elimination” in a non-permissive environment, and emphasis should be on more traditional threat reduction efforts. Demanding a new capability that involves forcible removal of unconventional weapons in an active conflict zone will call for significantly more resources and manpower, and that has not been a winning formula in the past. Terminology regarding WMD issues needs to be standardized across the interagency; otherwise we risk failure in progressing against critical national security concerns.
- **Enhance cooperative threat reduction capabilities.** It is unlikely that a single government institution will ever have the full set of skills and resources to manage “WMD elimination” or “WMD disablement and disposal” missions on its own. This mission can be better executed as a “whole of government” cooperative threat reduction program under the State Department leadership, as the current CTR program has done for decades. The Defense Department will obviously have a significant supporting role in this area, but is unlikely to prioritize this to the degree necessary to fully execute it. Given the international and interagency aspects of threat reduction, the leadership needs to be with the State Department.
- **Build and retain critical technical skill competencies.** There will be a continued need to maintain technically-qualified specialists who are experienced in handling and disposing of unconventional weapons and

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associated materials. With the eventual completion of the U.S. Army's chemical demilitarization responsibilities, there is a possibility of losing said experience as programs close out. The current DOD Strategy for Countering WMD talks to this point of maintaining expertise, but the actual path to accomplishing this task remains unclear. The Army and DTRA experience here is unmatched and needs to be retained in some fashion as long as the possibility of future threat reduction missions exists. The Air Force and Navy (to include the Marine Corps) have a very limited investment in specialized personnel and research programs that support countering WMD capabilities.

- **Elevate and resource counter-WMD planners.** The need for qualified counter-WMD planners in the military combatant commands – both geographic and global – is clearly illustrated in this case study. U.S. Central Command, U.S. European Command, U.S. Strategic Command, and U.S. Transportation Command all had significant stakes in the execution of this mission. Certainly U.S. Pacific Command will have similar challenges in the future on the Korean Peninsula, and U.S. Special Operations Command may have a similar requirement of eliminating (smaller) sub-state groups' unconventional weapons programs. We need both the right level of leadership – colonels/captains prepared for interagency and international discussions – and adequate numbers of trained specialists within the commands to support complex contingencies such as this. Concurrent with this issue is the need to have the four Services more committed to developing its personnel to better understand the impact of unconventional weapons on future military operations.

The Defense Department faces the same choice as it did in 2004 as it struggles to develop a coherent construct for countering WMD. Will it continue to ignore the significant challenges of addressing the impact of unconventional weapons on contemporary security operations and continue to develop ad-hoc approaches with its interagency partners and the international community, relearning the same lessons after each crisis? Or will the Defense Department take the time to develop the required policy objectives and resource the necessary capabilities required to lead the “whole-of-government” discussions that will happen in the near future? The question remains open.

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