BESA PERSPECTIVES
TWENTY YEARS OF STRATEGIC FORESIGHT
THE BEGIN-SADAT CENTER FOR STRATEGIC STUDIES

Syria's Chemical Weapons: Is Disarmament Possible?

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BESA Center Perspectives Paper No. 214, September 24, 2013

EXECUTIVE SUMMARY: Implementing chemical disarmament in Syria will be an enormous challenge, and the prospects for accomplishing it are doubtful. Appreciable portions of the chemical weapons arsenal have been trans-located, in part untraceably. Moreover, the timetable for Syrian disarmament announced by the US and Russia seems too condensed, even if "good will" and "fair play" are (mistakenly) assumed. Syria possesses a huge chemical warfare alignment, with dozens of multiform facilities and installations. Just an up-to-date mapping of this alignment is a very complex mission. The plausible possibility that various Iraqi chemical and biological weapons were added to the Syrian CBW inventory significantly complicates the situation. Moreover, Syria is likely to methodically further develop biological weapons as a powerful alternative to chemical weapons; and the US-Russia accord does not deal with this.

This Begin-Sadat Center Perspectives Paper constitutes an update and expansion of the author's previous seminal articles on this topic, including Chemical and Biological Weapons in the Arab Countries and Iran – An Existential Threat to Israel? (Hebrew, Begin-Sadat Center for Strategic Studies in Hebrew, 1999), and Guile, Gas and Germs: Syria's Ultimate Weapons and Poisoned Missiles: Syria's Doomsday Deterrent (Middle East Quarterly, 2002).

Introduction

While various events and assessments related to the Syrian chemical weapons (CW) capabilities and conducts have been largely covered in the media since the civil war began, the picture concerning the program's evolution – both conceptual and technological, which led to Syria's vast CW arsenal – have remained nearly unnoticed. Comprehending the evolution of the chemical program is a prime tool for coping with the current complex situation,

particularly since Syria is about to join the international CW convention. Above all, hovers the question of whether President Bashar al-Assad is indeed ready to give up Syria's non-conventional arms. This essay addresses these issues and provides a detailed picture about the Syrian CW program, from its inception to the present.

Syria today is a prominent member of the chemical and biological weapons (CBW) club. As early as 1992, the US Defense Department ranked Syria as the sole Muslim state possessing a "chemical systems capability in all critical elements"[1] for chemical weapons. And in recent years, Syria has added biological weapons to its arsenal. Money is also there, and in plenty; the picture of poverty that is drawn for the Syrian army's conventional ordnance is misleading. Syria spends between $1 billion and $2 billion annually on its ballistic and CBW capabilities, an enormous share of its military budget.[2]

Syria's successful development of its CBW capabilities is a textbook case of how a small but determined state can operate beneath the radar of international scrutiny, building a formidable array of non-conventional capabilities under an ostensibly scientific cover. Yet media reports and most discussions of Syrian CBW programs have been far from adequate.[3] What strategic concepts inform Syria's programs? And what is the nature and composition of the Syrian CBW alignment? A thorough analysis of those questions would clarify some aspects of Syria's chemical arsenal.

Syria's Strategic Doctrine

The origins of Syria's strategic doctrine on non-conventional weapons lie in its joint preparations with Egypt for their October 1973 attack on Israel. Thanks to transfers from Egypt, Syria for the first time acquired a chemical offensive capability. Damascus received artillery shells and aerial bombs, containing a non-persistent, lethal chemical warfare agent (sarin nerve agent) and a persistent agent (mustard blistering agent). This was the first time one Arab state supplied chemical weapons to another.

By that time, both Egypt and Syria must have been certain that Israel possessed powerful non-conventional weapons. Syria's new chemical

[1] The Military Critical Technologies List, US Department of Defense, Office of the Undersecretary of Defense for Acquisition, Oct. 1992.
[2] Shawn Pine, "Preparing for Peace? Syrian Defense Expenditures and Its Drive for Regional Hegemony," Policy Paper no. 98, Ariel Center for Policy Research, at http://www.acpr.org.il/publications/policy-papers/pp098-xs.html.
[3] M. Zuhair Diab, "Syria's Chemical and Biological Weapons: Assessing Capabilities and Motivations," The Nonproliferation Review, Fall 1997, pp. 104-111.

weapons were probably in constant operational readiness during the war. But they were never used, despite the fact that toward the end of the war Damascus was within Israeli artillery range.

The war's outcome persuaded Syrian president Hafez al-Assad that Syria had to bolster its independent military capabilities. Egypt's post-war moves toward bilateral agreements and a separate peace with Israel led Assad to respond with the "strategic parity" doctrine. Its objective was to provide Syria with a balanced defensive and offensive capability vis-à-vis Israel.

Following, the 1973 war, Syria thus decided to explore the CBW option. When the chemical weapons Syria received from Egypt became obsolete, Syria moved into two main areas of self-armament: the first, aerial bombs and surface-to-surface missile warheads containing nerve agents; and the second, biological weapons.

In the early 1980s, traces of the decision could be detected in the Syrian military literature, in articles published by retired officers. But by the late 1980s, the hints and allusions were emanating from the highest echelons. In January 1987, President Assad told a Kuwaiti newspaper that Syria was seeking a technical solution that would constitute a direct counterweight to Israel's nuclear weapons. A few months later, in May 1987, Radio Damascus emphasized that Syria had an answer to the Israeli nuclear threat, possibly of even greater power. A year later, Syrian chief of staff Hikmat ash-Shihabi noted that Syria possessed deterrent weapons against Israel's extremely lethal weapons. For those who read between the lines, these statements confirmed the existence of chemical weapons in Syria, and even alluded to biological weapons either in Syria's possession or in the process of development.

Syrian diplomacy also arrayed itself against chemical disarmament. Foreign Minister Faruq a-Shara, representing Syria at the Conference on Chemical Disarmament in Paris in 1989, said that Syria would commit itself to the elimination of all types of weapons of mass destruction (WMD) – if Israel did. Chemical weapons, he argued, could only be eliminated in the context of a total elimination of all WMD.[4] Syria pressed other Arab states and the Arab League to endorse its rejection of the Chemical Weapons Convention (as did Egypt). In December 1992, a few weeks before the signing of the convention, a-Shara announced that Syria would not sign, "because it will not agree to be exposed to the non-conventional threat from Israel."[5]

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[4] *Le Monde*, Jan. 6, 1989.
[5] *Al-Hayat* (London), Dec. 18, 1992.

The Kuwait war of 1990-1991 compelled Syria to take a public stance on strategic weapons in their totality, including ballistic missiles. In this somewhat different context, Syria argued that the destruction of one state's strategic weapons – in this case, Iraq's – could only be justified if linked to the destruction of the strategic weapons of all Middle Eastern states. When asked about Syria's Scud-C missiles and non-conventional capabilities, Assad declared, in a press interview, that their purpose was defensive.[6]

In 1993, Assad announced that a Syrian solution existed for regaining the Golan Heights, despite Israel's nuclear supremacy.[7] In 1995, Syria's information minister declared that Syria possessed "cards" that it had not yet played, but would play according to need in case of a military confrontation with Israel.[8] On other occasions, Assad alluded to "other types of weapons" which Syria would dispose of "only after Israel's nuclear disarmament," or to "special weapons" that could cause Israel great damage.[9]

Syria's public statements leave little room for doubt about the Syrian motive: Syria sees its CB arsenal as a counter to Israel's nuclear arsenal. Satellite photographs of Syria's deployment of Scud-C missiles have revealed the integration of chemical warheads. The missiles are deployed such that they could be launched at Israel's nuclear reactor in Dimona, and at Israel's airports and large cities.[10] Syria also moved many of the facilities for production and storage of chemical and biological weapons to underground installations. This makes it more difficult to monitor and strike them.

On the battlefield itself – presumably, the Golan Heights – Syria also envisioned CB weapons as a counter to Israeli superiority in artillery and armor. And despite the supremacy of the Israeli air force, the Syrian air force is also part of the strategy, through its deployment of chemical-tipped aerial bombs. The thrust of Syrian strategy has been the reinforcement of its ballistic-chemical-biological nexus, with the goal of maximizing its power and preparedness, while minimizing its transparency and vulnerability.

The Core Components

To build its capability, Syria mounted a sustained, covert effort over several

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[6] Theodore Hotchkiss Clark, "Proliferation of Surface-to-Surface Missiles and Weapons of Mass Destruction and the Emerging Role of Tactical Missile Defense in Israel, Syria and Iran" (Ph.D. diss., Tufts University, 1993), pp. 134-97.
[7] *Tishrin* (Damascus), Feb. 25, 1993.
[8] *Al-Qabas* (Kuwait), Oct. 27, 1995.
[9] *Ma'ariv* (Tel Aviv), May 2, 1997.
[10] *The Foreign Report* (London), May 12, 1998.

decades. It all began with Abdullah Watiq Shahid, a senior Syrian nuclear physicist, who was appointed minister of higher education in Syria in 1967. Shahid envisioned mobilizing Syria's meager technological and scientific resources for the national goal of weapons development. In 1971, in implementation of a presidential directive of 1969, an instrument for this activity was established: the Scientific Studies and Research Center (SSRC), an ostensibly civilian agency. Shahid was appointed director-general.

In 1973, President Assad issued a new directive, officially authorizing relations between the SSRC and the Syrian army. The SSRC, which had its own link to the president's office, immediately became the principal engine for the local development and refinement of weapons for the Syrian army. In 1974, Shahid was appointed chairman of the Committee for Scientific Manpower, apparently to make it easier for him to channel manpower and financial resources to the SSRC. He simultaneously controlled the Supreme Syrian Committee for Science.

When Shahid and Assad concluded that Syria could not develop nuclear weapons, Shahid began to explore the CBW option. Its main instrument would be the SSRC, which promoted itself internationally as a civilian science agency. For example, the SSRC had departments of chemistry and biology under one roof, together with various armament departments, itself an unusual combination. These departments were working on chemical and bacteriological pollution of rivers, sewage treatment, and the building of water purification facilities. In 1978, the SSRC sponsored the creation of an open scientific body called the Arab School for Science and Technology (ASST). This provided additional cover.

Concealment of the military mission of the SSRC was crucial to its operation, especially for its prospects of winning international funding. In the summer of 1979, when Shahid led a Syrian delegation to a UN scientific conference in Vienna, he described the SSRC as "designed along the lines of other national institutions, and devoted to research that is specifically aimed at serving various aspects of development."[11] Shahid stated that "the Center concentrates its attention on a number of critical technical problems of interest to Syria in the fields of: applied and industrial chemistry, applied physics, electronics, mechanical engineering, applications of computer science, and science policy."[12]

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[11] Report on the United Nations Conference on Science and Technology for Development, Vienna, Austria, August 1979 (New York: United Nations, 1979), A/CONF.81/INF.8.

[12] Antoine B. Zahlan, *Science and Science Policy in the Arab World* (London: Croom Helm, 1980), p. 66.

Eventually, the SSRC did secure some financial support from the United Nations Educational, Scientific, and Cultural Organization (UNESCO) for the purchase of equipment. And it received financial backing from the Kuwait Institute for Scientific Research (KISR), for organizing professional symposia, held formally under the auspices of the Arab School for Science and Technology. Leading foreign scientists, mainly from the West, took part in the symposia; the SSRC was the main beneficiary. The Arab League extended official sponsorship to the conferences held in Syria. The Kuwaiti connection provided invaluable financial resources, allowing the SSRC to dispatch dozens of scientists abroad, where they acquired vital technological information and equipment.

Of course, people in the know, knew the truth. In 1982, Ziauddin Sardar published his book, *Science and Technology in the Middle East*, and did not hesitate to characterize the SSRC as a body that "belongs to the Syrian defense ministry, and conducts military research."[13] Assad published a directive on October 4, 1983, which upgraded SSRC's departments to the status of research institutes, and the director-general was accorded the rank of a minister. The directive also stipulated that the chief of staff would appoint members of the board of the SSRC, as well as its technical staff. (The president would continue to appoint the SSRC director-general.) The military would also authorize all appointments in the SSRC's new branch for applied sciences, the Higher Institute of Applied Sciences and Technology (HIAST).[14] It is this institute that has trained professional personnel in chemical, ballistic, and other fields.

Behind the scenes, the independent production of chemical munitions became one of the core projects of the SSRC. The SSRC set up the first facility for the industrial production of chemical weapons: the "Borosilicate Glass Project," outfitted by the West German glass company Schott. The components of the facility included chemical-reaction vessels and pipes, all of them chlorine-resistant. The project produced di-chloro, a substance that is the main source of the nerve gas sarin.

Press reports identified production sites for sarin nerve agent, VX nerve agent, and mustard gas in plants near Damascus, Hama, Homs, Aleppo, and Latakia. Some or all of these facilities were founded ostensibly as civilian extensions of the SSRC. Syria can also tap the production capability of over a

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[13] Ziauddin Sardar, *Science and Technology in the Middle East* (London: Longman Group Limited, 1982), p. 76.

[14] For the history of HIAST, see Majd Alwan and Nour Eddine Cheikh Obeid, "Collaboration between Educational and Research Institutes and Industry in Developing Countries: Experience of Syria and HIAST," at http://nmit.georgetown.edu/papers/alwanobeid.htm.

dozen government-controlled pharmaceutical plants, likewise spread across the country.

The SSRC also promoted the establishment of various plants for the acquisition of dual-use chemicals. For example, a Damascus company named Setma imported 90 tons of trimethyl phosphate from an Indian company, supposedly for the production of the organophosphate insecticide DDVP. The compound is a precursor of nerve agents. Another Syrian company, GAS group, made similar acquisitions. But the SSRC itself remained the major "civilian" buyer, taking advantage of its ramified connections with chemical firms around the world.[15]

In 1992, the German government warned German research institutes not to maintain contacts with the SSRC, on the grounds that it belonged to the Syrian defense ministry, and that it simultaneously conducted military and civilian activities, including the production of chemical and biological weapons.[16] Up to that point the SSRC had operated for years without arousing any suspicions. But before the specter of proliferation loomed large, the SSRC had siphoned off an impressive amount of knowledge and material from the scientific cornucopia of the developed world.

Foreign Suppliers

Syria's achievements in CW development and production are impressive and stand in striking contrast to the very low level of Syria's technical and scientific infrastructure. How did they close the gap?

First, they achieved an optimal integration of their covert and overt program. The Syrians adhered to their objective, admitted their own limitations, and carefully distinguished between limitations they could change and those they could not.

Second, Syria found plenty of willing suppliers of technology, who may or may not have been aware of the end uses of the transfers, and whose governments may or may not have known Syria's real objectives. In the late 1970s and during the 1980s, Syria made important strides thanks to knowledge obtained from the Soviet Union (and later, Russia), West Germany, France, and Iran.

The Soviet contribution to the Syrian chemical enterprise is not completely

[15] *Mednews*, Sep. 28, 1992.
[16] *Al-Usbu' al-'Arabi*, Nov. 30, 1992.

clear, but it seems to have included institutional transfer of information (in part, by the Soviet Chemical Corps), turning a blind eye to information collection by Syrian scientists and chemists-in-training who came to the Soviet Union, and the provision of sample components of munitions.[17]

When the Syrians first developed an aerial bomb containing binary sarin nerve gas, they made use of the Soviet aerial incendiary bomb ZAB for the weaponization of DF and isopropyl alcohol. From these, sarin is obtained in a binary system. By the time the commander of the Soviet Chemical Corps visited Syria in 1988, it was widely assumed that the Soviet Union had provided its Syrian clients with the capacity to arm Scud missile warheads with the persistent nerve agent VX.[18]

The connection has continued between Syria and post-Soviet Russia. In 1993, Syria acquired at least 800 kilograms of raw material for production of an updated version of VX, through a straw company established by the retired general Anatoly Kuntsevich, at that time Russian President Boris Yeltsin's adviser on chemical disarmament and commander of the Russian Military Academy for Chemical Warfare. The material was smuggled from the academy, apparently together with technological knowledge about its use. (Kuntsevich was later sacked.) Russian suppliers are believed to have provided additional raw materials via Cyprus, and to have facilitated Syria's production of advanced VX and its development of improved cluster chemical warheads.[19]

The Russian role is most pronounced in delivery systems. Russian arms manufacturers have been actively marketing upgraded weapons systems to Syria.[20] Syria sees its missile arsenal as compensation for Israel's air superiority. Some of these systems are particularly suited to WMD, especially a new optically-guided Scud missile that might be capable of penetrating US and Israeli-made missile defense systems. According to the Russian sources, the upgraded Scud is much more accurate than its predecessors, with a miss distance not exceeding 10 to 20 meters. Accuracy is crucial to delivering the extremely persistent nerve agent VX.

Syria chose two German companies to provide necessary equipment: Schott

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[17] Yosi Melman (*Ha'aretz* reporter), personal communication, Dec. 1996.
[18] J. H. Jackson, "When Terrorists Turn to Chemical Weapons," Jane's Intelligence Review—International, Nov. 1992, p. 520.
[19] *The Jerusalem Post*, Aug. 30, 1996; *Ha'aretz*, Apr. 29, 1997; *The Foreign Report* (London), May 12, 1998; *The Times* (London), Jan. 24, 1999.
[20] Ziad K. Abdelnour, "Russia Marketing New Scud in Damascus," *The Middle East Intelligence Bulletin*, Apr. 2001, at http://www.meib.org/articles/0104_s2.htm.

and Sigri.[21] The first Syrian project involved setting up a production line for serial manufacturing of di-fluoro (DF), from which sarin nerve gas for binary munitions is obtained. The process involves two stages. The first requires resistance to a compound that includes chlorine, which has to be produced before the DF; and the second requires resistance to fluoride, an even more destructive component than chlorine. The processes require highly resistant industrial glass components.

Schott's commercial name, Boresist, highlights its specialization in installations for the production of chemicals, made from glass of high durability in which boric oxide is a supplement to silicon oxide. It was this that led the SSRC to camouflage the entire operation under the name "Borosilicate Glass Project," whose components – chlorine-resistant chemical-reaction vessels and pipes – were supplied by Schott. Thus began the production of chemical weapons in Syria. A few years later, after many tons of the chlorine compound di-chloro (and from it, DF) had been manufactured, a spokesman of the Schott Glasswerke explained that the company had no idea of the real purpose the Syrians had intended for the equipment Schott sold them.[22]

The German company Sigri provided essential equipment for the Syrian production line.[23] Sigri specialized in internal Teflon coatings for reaction vessels and for other instruments in the chemical industry that are made of stainless steel. Teflon, in its optimal configuration, is fluoride-resistant, and the accumulated experience of the Sigri company had taught its engineers how to weld Teflon surfaces at various thicknesses, for every requirement. The German companies Weber, Leifeld, Carl Schenck, Ferrostaal, and others also supplied the SSRC with mixing vessels, high-temperature furnaces, hot isostatic presses, and sophisticated mechanical instruments.[24]

The raw materials for DF production were purchased from various western European companies; conspicuous among them was, again, a German company, Gerit-van-Delden. The technologies, equipment, and raw materials for production of chemical and biological weapons were supplied to Syria mainly by large chemical middleman and brokerage offices, located in Germany, the Netherlands, Switzerland, France, Britain, and Austria. Syria –

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[21] Kenneth Timmerman, *Weapons of Mass Destruction – The Case of Iran, Syria and Libya* (Los Angeles: Simon Wiesenthal Center, Aug. 1992), pp. 58-79; *Middle East Defense News*, Oct. 24, 1988; *The Wall Street Journal*, Sept. 16, 1988; "The Proliferation of Chemical Weapons in the Middle East," memorandum by the Israeli embassy in Brussels, Mar. 11, 1990.

[22] *The Wall Street Journal*, Sep. 16, 1988.

[23] "The Proliferation of Chemical Weapons in the Middle East."

[24] *Mednews*, Sep. 28, 1992.

together with Egypt, Iraq, Libya, Sudan, and some further 50 countries – is still named by Britain as an importer of chemicals included in the "Australia Group" list of chemicals used in weapons production.[25]

In their development of munitions that contained sarin, the Syrians were aided by classified information obtained by a Syrian-born German, Rif'at Ramahi, who spied for Syria while working for a company that specialized in the clean-up of chemical munitions sites. In 1992-1994, Syrian military intelligence ran another German agent, one Hans-Joachim Rose, who provided industrial secrets. A German court later charged him with industrial espionage.[26]

French scientific institutes also played a role, through their relations with the SSRC. The tradition of Franco-Syrian relations extended to science, with the SSRC – in French, the Centre d'Etudes et de Recherches Scientifiques (CERS) – presenting itself as the equivalent of the French Centre National de la Recherche Scientifique (CNRS). The Syrians took away from their French scientific exchanges a storehouse of knowledge applicable to the biological field.[27]

In the 1980s, a pattern developed, whereby the same western European companies were contracted to carry out Syrian and Iranian projects, suggesting that the close relations that developed in these years between Syria and Iran included consultations on CBW. For example, Karl Kolb, a West German firm, worked on questionable projects in Iran, after it had done similar work in Syria (and Iraq). Uhde, another West German firm, assisted in the establishment of a suspicious plant for medicines in Syria, after it had established a suspicious plant for insecticides in Iran. The British company MW Kellogg simultaneously set up identical plants (for ammonia and for urea) in Syria and in Iran.[28] These plants produced dual-use products. As the Syrian-Iranian relationship deepened, it would have been naïve to assume that CBW technologies and material did not pass freely between them.

As a result, Syria now possesses most formidable CW capabilities, exceeding those of Egypt and probably Iran, in quantity and quality. Yet in building from scratch, under the rule of Hafez al-Assad, Syria has always managed to stay just outside the spotlight of international scrutiny. The West has for a

[25] The Third Annual Report on Strategic Export Controls for 1999 (London: United Kingdom Foreign and Commonwealth Office, July 2000), at http://www.fco.gov.uk/news/newstext.asp?3991.
[26] *Reuters*, Sep. 16, 1998.
[27] *Mednews*, Sep. 28, 1992
[28] *Middle East Economy Digest*, Feb. 21, 1992.

prolonged period of time had some reason *not* to include Syria on its blacklist. While regional problems have diverted attention away from Syria, it persisted in building and upgrading its chemical and biological weaponry.

The Chemical Course

In the early years, even before Syria had missiles, it built delivery systems for chemical weapons. Since the mid-1980s, Syria has manufactured varieties of aerial bombs containing sarin in great numbers. Syria also has acquired several thousand tactical munitions, including rockets and artillery shells containing sarin.[29]

The rockets and shells have tactical value, as do the aerial bombs (which also have some strategic value). But the major leap forward towards creation of a strategic deterrent took place only when Syria began to amass chemical warheads for Scud missiles. Syria's adversaries were not capable then – and may not be fully capable now – of intercepting such mass of missiles. To add to the deterrent power of the missiles, Syria moved to acquire the nerve gas VX, with the intention of deploying it in missile-borne warheads.

In contrast to sarin, VX has a high persistence and is much more lethal when encountered through the respiratory system and the skin. Since 1988, there has been a flood of reports confirming Syrian production of VX i. In 1998, the CIA affirmed that Syria had completed the development of more potent, more toxic, and more persistent nerve agents, referring, in fact, to VX. [30]

Almost as soon as Syria had VX, Syria sought to load it in Scud warheads. The head of the Scud-B missile underwent experimental adaptations for carrying the large nozzles and dispersal mechanisms that are needed for chemical warfare agents, especially for spraying a persistent agent such as VX. Syria also began to explore the possibility of installing VX in short-range Soviet missiles (SS-21) and rockets (FROG-7) already in Syria's possession.

By 1993, Syria possessed between 100 and 200 chemical Scud-B warheads. Moreover, Syria also armed some sixty Scud-C missiles with chemical warheads. And with the assistance of Russian specialists, Syria has developed a cluster warhead capable of delivering chemical or biological bomblets for

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[29] Bennett, "The Syrian Military."

[30] Central Intelligence Agency, Unclassified Report to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions, 1 January through 30 June 1998(Washington, D.C.: Central Intelligence Agency, 1998), at http://www.cia.gov/cia/publications/bian/bian.html#syria.

the Scud-D.[31]

At least one test firing of a Scud-C missile tipped with VX was conducted near Damascus in May 1998.[32] Syria also conducted successful field tests of two indigenously manufactured Scud-D missiles armed with advanced conventional and non-conventional warheads in September 2000. In July 2001, a Scud-B missile carrying a chemical warhead was launched in a test flight from near Aleppo to a point just short of the Israeli border. Reportedly, Syrian sources confirmed the flight, explaining that this was "a message to Israel not to launch any attack on Damascus."[33]

Syria's main objective has been the completion of an arsenal of enhanced-range surface-to-surface missiles tipped with chemical and biological warheads. At that stage, the focus was on the installation of chemical warheads on the Scud-C, the Scud-D, and the anticipated M-9. Beyond that, the next stage could include cruise missiles that carry warheads with chemical or biological cluster munitions (Syria possesses SS-N-3b cruise missiles).

Developments of the 2000-2010 Decade

Certain developments during that decade brought about notable upgrades in the chemical arsenal. It is plausible that during 2003 large portions of the Iraqi CW and BW arsenals were secretly smuggled into Syria, and became part of the Syrian inventory; this being the case, it may be regarded as a very significant addition to the Syrian non-conventional power, both quantitatively and qualitatively.[34] The issue aroused a heavy debate, amplifying CIA failures, but in 2006 it was no other than former US Deputy Undersecretary of Defense for International Technology Security, John Shaw, who confirmed that a wide-scale smuggling operation of CBW from Iraq to Syria took place in 2003. The goal of the clean-up was "to erase all trace of Russian involvement" in Iraqi WMD programs, and "was a masterpiece of military camouflage and deception." Shaw noted this type of Russian GRU operation, known as "Sarandar," or "emergency exit," has long been familiar to US intelligence as standard GRU practice. Naturally, the CIA strongly repelled the information posed by Shaw.[35] Also in 2003, Syria was for the first time reported to have at least 100 VX-tipped ballistic missiles aimed at central

[31] *The Washington Times*, Nov. 26, 1999; *The Jerusalem Post*, Nov. 26, 1999.
[32] "The Great Arsenal of Autocracy: Syria's Weapons of Mass Destruction," Middle East Intelligence Bulletin, Feb. 1999, at http://www.meib.org/issues/9902.htm#me2.
[33] *Middle East Newsline*, July 1 and 15, 2001.
[34] Dany Shoham, "An antithesis on the fate of Iraq's chemical and biological weapons," *International J. of Intelligence and Counterintelligence,* Vol. 19, No. 1, pp. 59-83, 2006.
[35] *Newsmax*, Feb. 19, 2013.

Israel.[36] Syrian attempt to fit medium-range rockets with chemical warheads, in conjunction with Hizballah, has been reported one year later to the Israeli Cabinet during a briefing by the Head of the IDF Intelligence Branch Ze'evi Farkash.[37]

Extensive works were conducted in Syria and aiming to construct a secret underground complex to manufacture and store ballistic missiles, mainly Scuds, capable of striking Israel, apparently tipped with chemical warheads. The complex reportedly includes thirty reinforced concrete bunkers, production facilities, development laboratories, and command posts; the chemical warfare agents are stored in a separate facility.[38] More specifically, a review of satellite images taken between 2005 and 2008 showed an increase in operations at a suspected chemical weapons facility at al-Safir, according to a report in Jane's Intelligence Review. The images taken by GeoEye and DigitalGlobe appeared to show that new structures for warehousing and manufacturing complex chemical materials have been built. The buildings reportedly had sophisticated filtration systems and cooling towers; bays for specially adapted Scud missiles had also been built. Christian Le Miere, editor of the *Review*, wrote: "The satellite imagery that *Jane's* has examined suggests that Damascus has sought to expand and develop al-Safir and its chemical weapons arsenal. The al-Safir facility appears to be the most significant chemical weapons production, storage and weaponization site in Syria. Its presence indicates Syria's desire to develop unconventional weapons, either to act as a deterrent to conflict with Israel or as a force enhancer should any conflict ensue. Further expansion of al-Safir is likely to antagonize Israel and highlight mutual mistrust, even as peace talks between the two neighbors progress intermittently." In a statement, Jane's Information Group noted: "The site contains not only a number of the defining features of a chemical weapons facility but also that significant levels of construction have taken place at the facility's production plant and adjacent missile base.[39]

Alongside with the profound assistance lent by Iran and North Korea, the utilization of Europe did not discontinue. The European Union initiated a $14.6 million technical assistance program, ostensibly for the Syrian Ministry of Industry development of safety standards for products and laboratories. Dually defined as "equipment for preparation and analysis of biological substances; standards for calibration laboratories; and equipment and consumables for chemical analysis laboratory," the program was very useful

[36] *Jane's Foreign Report*, July 29, 2003.
[37] *The Jerusalem Post*, July 25, 2004.
[38] *Yediot Ahronot*, Apr. 30, 2007

[39] The CBW Convention Bulletin, July 2009, p. 44.

for upgrading various biological and chemical weapons.[40] Also, an intention to procure a large quantity of pinacolyl alcohol, a typical precursor to the advanced soman nerve gas, indicated that the latter is apt to join, tentatively, the Syrian inventory.[41] But the interface between Syria and Iran regarding CW technologies broadly increased, and became the predominant one.

The Syrian Civil War (2011-present)

Although it is definite that the Syrian army has a wide, diversified arsenal of CW, the picture is not plain as to what types of chemical warfare agents are included in it, beyond the well-established list of sarin, VX, and sulfur mustard gas, particularly that the category of highly potent incapacitating agents is missing. Likewise, within the Syrian inventory of delivery systems – including surface to surface missiles, aerial bombs, and artillery rockets – the category of short-range tactical delivery systems is not listed. Those two specific missing categories may account for the military characteristics of the CW-employment episodes during the civil war. Reference should be made, connectedly, to the unexplored possibility that CW held in the past by Iraq were smuggled to Syria, for instance the notably powerful incapacitating substance Agent 15. The enigmatic chemical warfare agent effectively employed by Russian security forces in the Moscow Theater incident in 2002 might add another dimension of actual relevance.[42]

As for delivery systems, during the civil war it was found out that two new systems became operational. The first is a helicopter-modified system for dropping containers (at least two) filled with toxic materials, and described as "box-like with a hollow concrete casing inside."[43] The second is a modified MiG-21 aircraft, such as the one flown by Col. Hassan Hamada, who defected to Jordan in June 2012. According to some sources, the aircraft was modified as an "Optionally Piloted Aircraft," thought to be used in remotely-controlled, unmanned configuration for carrying chemical weapons.[44]

However, short-range tactical delivery systems were experimentally field tested in August 2012 by the Syrian army. The tests were conducted near the al-Safir CW research and development, east of Aleppo. Several empty shells devised for delivering chemical warfare agents were fired by tanks at a site called Diraiham, in the desert near the village of Khanasir. Iranian officers

[40] *PublicTenders.net*, Feb. 15, 2011.
[41] *CBRNe World*, Dec. 2012.
[42] Dany Shoham, "The Employment of Chemical Weapons in Syria," *Diplomacy & Foreign Affairs*, July 12, 2013.
[43] *Saraqeb*, Apr. 2013.
[44] *Defense-Update*, "Unmanned Syrian Mig-21 were fitted for chemical warfare?"

believed to be members of the Revolutionary Guards were flown in for the testing. Officially referred to as a major offshoot of the Damascus military Scientific Studies and Research Center, the al-Safir compound is regarded as Syria's largest testing site for CW. Scientists from Iran and North Korea appear to work in the expansive, fenced-off complex, according to Western intelligence agencies, and field test toxic substances on animals. A parallel effort apparently concentrated on finding solutions to stabilize sarin and other agents in small munitions like short-range artillery shells.

Another endeavor has been taken aiming to form mixtures of different chemical agents – like sarin and tear gas, as one example – in order to create a mélange of symptoms that would make the cause hard to identify. Occasionally, such a concoction has indeed been faced, in actuality. Fundamentally, this misleading line is compatible with one of the principles underlying the Russian – rather Soviet – chemical warfare doctrine. Besides, the borderline ostensibly separating between riot-control agents and stronger chemical warfare agents has always been a fragile one.

The Syrian-Iranian Nexus

Above all is the Syrian-Iranian nexus that constitutes the most cardinal element of the Syrian CWB program. It so happened that the Iraq-Iran War triggered a new alliance in the Middle East, involving an Arab country (Syria) and an Islamic, non-Arab state (Iran). Iran had continuingly been afflicted by Iraqi chemical weapons and at the time did not have the ability to retaliate in kind. Iran was aware, though, of the chemical weapons arsenal held by Syria – by that time an advanced, self-made Syrian chemical inventory – and of the deep rivalry between Saddam Hussein and Hafez al-Assad, and hence asked Assad to supply a portion of that inventory. Assad refused, but the seeds of the new alliance were sown nevertheless.

Unfortunately, that preliminary nexus gradually, yet persistently, turned to be a solid, profound, and far-reaching strategic axis, already lasting for nearly 30 years. In fact, during these 30 years, no interface between two Islamic countries equaled or neared the depth and intense of the Syrian-Iranian interface. Throughout that period of time Iran became a regional power in the areas of ballistic missiles and weapons of mass destruction. Like Syria, it fully mastered the technologies related to chemical weapons and has an operational arsenal, including chemical warheads for long-range ballistic missiles. But appreciably ahead of Syria, Iran is in the same position regarding biological weapons. Therefore, Iran is, both potentially and practically a great supporter of Syria in those areas. The Syrian-Iranian nexus has been flourishing foremost, strategically, within the dimensions of ballistic

missiles and WMD. It seems as if a meaningful climax took place, connectedly, in 2005, when Syria has agreed to store Iranian nuclear and additional materials, should Tehran come under UN sanctions. According to that approach, Syria has committed to allow Iran to safely store weapons, sensitive equipment, or even hazardous materials on Syrian soil should Iran need such help in a time of crisis (and vice versa).

Indeed, in 2005 Syria pursued "an innovative chemical warfare program in co-operation with Iran [further to an Iranian contractual commitment], made to Syria a few months earlier," according to *Jane's Defence Weekly*, quoting an unidentified "diplomatic source." Iran, it was reported, will assist Syria in the planning, establishment and pilot operation of about four or five facilities throughout Syria for the production of precursors for VX and sarin nerve agents and mustard blister agent. With Iranian help, Syria hoped to acquire an independent production capability of precursors for producing chemical warfare agents, which it had thus far been unable to achieve. The source referred to the project as "unprecedented" and said that "millions of US dollars have been allocated to implement it…The project includes building major facilities, including advanced equipment to produce tens to hundreds of tonnes of chemical warfare precursors per year that are sufficient for chemical warfare industrial manufacturing pilot production."[45] Technology transfer for various non-conventional warheads has been a prime component of Iranian contributions to Syria's missile development programs. Iran indeed intended to furnish Syria with industrial equipment for the production of CW agent precursors, and in all likelihood implemented that intention.

An accident that happened in 2007 in a Syrian chemically-armed ballistic missile installation drew attention to one of five suspected Syrian CW facilities supported technologically by Iran, part of them in conjunction with North Koreans experts. A further defense cooperation agreement was signed in December 2009 by Iranian Defense Minister Ahmad Vahidi and his Syrian counterpart Ali Mohammad Habib Mahmoud, aiming to face "common enemies and challenges." Two years later, when the civil war started in Syria, Iran increasingly fulfilled its undertakings.

Peculiarly, new Iranian Foreign Minister Mohammad Javad Zarif said Iran had sent an official memo to the United States through the Swiss Embassy in Tehran (which serves as the US interests section in Iran) last December, in which Washington had been forewarned that "handmade articles of chemical weapons, including sarin gas, are being transferred into Syria. In the same

[45] The CBW Convention Bulletin, September-December 2005, p. 62.

note, we warned [Washington] that radical groups might be planning to use these chemical agents."[46] The Iranian foreign ministry said Iran is behind Russia's offer to work with Syria to put its chemical weapons under international control.[47]

Finally, Iran's President Hassan Rohani has underlined that the Iranian administration supports the decision by the Syrian government to join the international convention on the prohibition of CW.[48]

Possessing a large CW arsenal of its own for years, while at the same time being a party to the CWC, Iran may have some advices, suggestions, and proposals for Syria. Although Russia plays the pivotal role in the diplomatic sphere with respect to the CW crisis, it is certainly Iran who is profoundly involved in any other aspect related to the Syrian CBW program and conducts.

What Will Syria Lose in Consequence of Chemical Disarmament?

What will Syria sacrifice if it loses its chemical arms?

This arsenal is intended first for a military encounter with Israel. At present, analysts regard the likelihood of chemical warfare between Syria and Israel to be low. Syria's weapons are conceived as a deterrent; apparently, they were built in the hope they would not have to be used. Therefore it will lose some deterrence.

Syria may lose also some of its capabilities if it plans a Gloan grab in a limited war. Such scenario entails deployment of long-range launch systems and long-lasting chemical warfare agents in order to neutralize military targets (air force bases, command and control centers, radar stations, reserve mobilization and assembly areas, and equipment warehouses). Short-range launch systems would implement volatile chemical warfare agents at the front in order to ease the rapid penetration of Syrian ground forces. The idea would be to enable Syria to achieve its goal of seizing the Golan Heights before the IDF could complete the mobilization of its reserves, presenting the international community with a *fait accompli*.

Another scenario that Syria may want to use chemical weapons is on the brink of defeat in order to avoid disaster. The Syrians would justify the use of

[46] *Global Research*, Sep. 1, 2013
[47] *Reuters*, Sep. 10, 2013.
[48] *SyriaNews*, Sep. 13, 2013.

chemical weapons by claiming that their very survival was at stake. Under these circumstances, a chemical attack on civilian targets cannot be ruled out, especially if it could accelerate superpower intervention for a ceasefire.

Moreover, Syria's acquisition of a CBW option has not occurred in a vacuum. It also has to be viewed in the context of Syria's own alliances. And the most important of Syria's strategic ties are not with its "brother" Arab states. For decades, Syria's closest strategic and military bond has been with Iran – a large, powerful Muslim state, one that is close to acquiring nuclear weapons and that has missiles capable of reaching Israel.

Could Syria one day find itself under an Iranian nuclear umbrella? If it did – and the road to that point may not be so long – Syria's threshold for first use of CBW could be lowered. For example, in a grab for the Golan, Syria might contemplate a limited chemical exchange with Israel, on the assumption that Israel would not retaliate with a nuclear escalation. Given the futility of all past Syrian attempts to gain military superiority over Israel by means of conventional forces, the CBW option might grow legitimate in Syrian eyes. And if a nuclear Iran gave assurances to Syria, it might diminish Syrian fears and inhibitions in employing its CBW weapons.

All in all, Iran is formally supposed to lose a cardinal card, one that was accentuated in 1999, already, by then Israeli Prime Minister Ehud Barak, who explained the urgency of pursuing a peace agreement with Syria: "Syria has surface-to-surface missiles that are neatly organized and can cover the whole country with nerve gas."[49] Since 1999, Syria extensively continued to augment its CBW. It has been estimated that about half of Syria's Scud-B plus Scud-C – and, deductively, Scud-D – missiles are chemically armed.[50] Biological warheads might probably be around the corner. The missiles became much more hidden and sheltered in their new, reinforced underground silos.

Conclusion

In practical terms, if Syria were to fully be disarmed according to the Chemical Weapons Convention, this would in theory bring about the loss of its entire chemical warfare agents inventory – in addition to certain biological toxins it probably possesses which are covered partially by the CWC – the warheads containing/intended to carry them, and the facilities dedicated for production and development. In such case, and as long as Syria is deprived of nuclear capability, the alternative strategic operational capacities Syria could

[49] *Ha'aretz*, June 18, 1999.
[50] Bennet, "The Syrian Military."

rely on are ballistic missiles tipped either with conventional or biological warheads, the latter containing pathogens and toxins.

This is basically the comparative calculation Assad has to do in order to decide to what extent Syria will comply with the CWC. In other words, how far should Syria attempt to retain, rather than sacrifice, parts of its CW capabilities? And the actual question indeed seems to be "how far," rather than "whether." The Russians and the Iranians might have influence on his decision-making in that regard. First, they both would meticulously take care to eliminate any traces that might indicate assistance given by them to the Syrian CW program, when the latter practically becomes under CWC control. Second, they might expectedly encourage and help Assad to retain parts of Syria's CW capabilities, particularly the Iranians. Such help may even include clandestine conveyance of CW to Iran, and possibly Russia, especially of components indicating the assistance lent to the Syrian CW program by them.

Irrespective of the Russian and Iranian interests and conducts, the implementation of Syria's chemical disarmament would at any rate be a very complicated task, because appreciable portions of the CW arsenal have been trans-located, in part untraceably. And translocations will probably be carried on. Some 1,000[51] to 1,500[52] tons of Syrian-made chemical warfare agents are to be spotted. It would be a harsh confrontation between intelligence and counter-intelligence systems. However, even if "good will' and "fair play" may be assumed, theoretically, the timetable seems to be too condensed. It is a huge CW alignment that Syria possesses, with dozens of multiform facilities and installations. Just an up-to-date mapping of this alignment is a very complex mission. Let alone, that the chances for "good will" and "fair play" are likely slim. The plausible possibility that various Iraqi CW and BW were added to the Syrian CBW inventory meaningfully entangles the situation. If the chemical disarmament of Syria is eventually accomplished, presumably, there is the biological option, which Syria is prone to methodically cultivate as an alternative powerful arm.

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of the Greg Rosshandler Family

[51] *Agence France-Presse*, "Syria has some 1,000 tonnes chemical agents: Kerry," Sep. 10, 2013.
[52] John Ismay, "The Sarin Sweepstakes," *Foreign Policy*, July 16, 2013.