Initial Observations on the "Final Report of the United Nations Mission to Investigate Allegations of the Use of Chemical Weapons in the Syrian Arab Republic"

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The 12 December 2013 UN/OPCW report is a lengthy document, and I have only had time to comment on portions of it of particular interest to lines of inquiry that I have been pursuing in the past. As time permits I will issue further observations and comments.

Fluoride reactivation / regeneration techniques:

Many observers, myself included, were worried about whether too much time had elapsed between exposure of alleged victims and the collection of biomedical samples. I was also discouraged by the fact that the UN's earlier report did not go into any great detail on the technical methods used for analysis of the samples. Much of the technical discussion at the time involved techniques that were used in the aftermath of the 1994 and 1995 Japanese incidents, which have shortcomings. Acetylcholinesterase counting is non-specific and can't tie the sample to an exact causative agent. Measurement of direct Sarin, IMPA and MPA levels is rather time limited, due to hydrolysis of Sarin and the body's gradual elimination of IMPA and MPA. With regard to the incidents in Syria, the time elapsed between alleged exposure and the collection of biomedical samples meant that, at best, these older techniques would have been at the outside edge of their usefulness, if not useless entirely.

The final UN report provides some additional details about the technical methodology that I find reassuring. Plasma and whole blood samples were prepared for definitive analysis by using a technique known variously as fluoride regeneration or fluoride reactivation. Fluoride reactivation is a technique has been explored since at least the early 2000s. This technique obviates some of the deficiencies of older procedures. Sarin not only reacts with the water in the blood plasma through hydrolysis (forming so-called 'free metabolites'), but also reacts with various proteins to form 'protein adducts'. These protein adducts are not so easily removed from the body, and remain for a longer period of time than the free metabolites. One clear advantage of this process is that the period, post-exposure, for determination of Sarin exposure is much longer, possibly 5 to 8 weeks according to at least one study. (Polhuijs M. et. al., link below)

http://ftp.rta.nato.int/public/PubFullText/RTO/TR/RTO-TR-HFM-041/TR-HFM-041-1999-Files/Brussels%20CD-ROM/Brussels/OP%20POISONING/Polhuijs.DOC)

The fluoride reactivation process adds fluoride (often by use of a sodium fluoride solution) to the protein adducts to re-create the original Sarin, which can be measured by a number of conventional techniques. As there are no other reasons why Sarin would be generated by fluoridation of protein adducts in a given blood

sample, this technique is a very good indication that the person had been exposed to Sarin. Also, as the fluoride reactivation specifically creates Sarin molecules, this technique discriminates between the various organophosphates. In other words, this technique has good specificity – it rules out exposure to other nerve agents or organophosphate pesticides as the causative agent. Based on my review of the available literature and discussion with several scientists in this area, I believe that this technique is the best available for this sort of analysis. I have no reasons to doubt the test results.

A more lengthy technical explanation of some of the earlier work in this area from 2003 and 2004 is contained in an article by E.M. Jakubowski, et. al., which is available online[1].

Detection technologies used in laboratory analysis:

The combination of gas chromatography and mass spectrometry is widely considered as highly definitive for identification of specific chemical compounds. Numerous variants of this technique are routinely used around the world for chemical identification. The final report shows the following techniques were used by the OPCW laboratories:

- Gas chromatography–High resolution mass spectrometry
- Gas chromatography–Tandem mass spectrometry
- Liquid chromatography–Tandem mass spectrometry
- Gas chromatography–Flame photometric detection.

This list of techniques is consistent with my expectations. As long as proper procedures were used, these methods are more than adequate for the chemical identification task.

Analysis of Appendix 5 of the Final Report

The final report, as expected, provides a greater amount of information about the environmental samples collected at Moadamiyah and Zamalka. There are numerous small differences between the original interim report's Appendix 7 and the new Appendix 5. I will summarize the differences I have discovered:

1. Appendix 5 (i.e. the new report) contains more detailed descriptions of the how and what was sampled.

2. Diisopropyl Methylphosphonate (DIMP) has been recategorized from "degradation and/or byproducts" to "other interesting chemicals." There's no explanation for this re-categorization.

3. Several of the detections of actual Sarin (GB) are further annotated to indicate either trace or high concentrations. These terms are not defined. Only laboratory 2 makes this distinction.

4. There are some instances of minor discrepancies between the earlier report and the final report. In sample 1, lab 1 shows hexamine, where none was

shown in the earlier report. There can be many reasons why this is the case, including reexamination of samples after the interim report was issued, but that is only speculation. As a general summary, more chemicals are shown in the final report.

Specific examples in Appendix 5 that I feel are revelatory:

Sample 25. The fact that a "high concentration" was found on this metal bolt, combined with paint and rust, is exactly where I would suspect the highest concentration to be found in the remnants of a weapon system. Experience, not widely published or circulated, from both Iraq and the US chemical demilitarization effort have indicated that screw threads can trap nerve agents for a long time and that paints and coatings can trap Sarin between the paint and the metal, greatly increasing its persistence.

Sample 28. The rubber window gasket is another place where a high concentration of Sarin was found. Many rubber and plastic substances can be quite good at absorbing Sarin liquid and vapor, and only slowly desorbing the agent.

I think that these two samples are very important. Of all the samples, these would be the two where I would expect the highest concentration to be. But that assessment is only based on many years of work in this field. I also think that someone deliberately planting evidence to fake this incident is not likely to have known what I know about field behavior of Sarin. Very few people would have known to put the Sarin on the screw threads if it wasn't there already from leakage from the munition. Likewise, who would have put it into the window gasket?

Hexamine may be the smoking gun

Hexamine was discovered in a wide variety of the environmental samples. Hexamine also appears in the declared inventory of significant chemicals reported by the OPCW after disclosure and inspections subsequent to Syria's accession to the Chemical Weapons Convention. It would have been informative if the UN and OPCW had explained why they considered hexamethylenetetramine ('hexamine') to be considered as a chemical of significance to this investigation. I do not think that hexamine's normal uses as a heating fuel and component of some conventional explosives do not merit its inclusion as a chemical of concern by the OPCW, nor would it merit inclusion in the declared stockpile[2] that needs to be destroyed.

However, based on numerous sources of information I have deduced the chemical warfare significance of hexamine, both in the numerous environmental samples and in the declared chemical inventory. Hexamine is apparently being used by the Syrian government as an additive to binary Sarin. The inspections subsequent to the UN/OPCW investigation covered by this report reveal that the Syrian concept of operations was to employ binary chemical weapons[3].

Binary Sarin weapon systems combine methylphosphonic difluoride, also known as DF, with isopropyl alcohol to form Sarin. The resulting mixture has a lot of residual acid in it, in the form of hydrogen fluoride (HF), which is highly destructive, possibly to the point of ruining the weapon system. The US Army's cold war era Sarin

program used isopropylamine to reduce this excess HF. Several chemists and engineers knowledgeable in the matter have confirmed to me that hexamine is useful as a Sarin additive for the same reason. One hexamine molecule can bind to as many as four HF molecules. This would explain the declared Syrian stockpile of 80 tons of hexamine. Interestingly, the same stockpile contains 40 tons of isopropylamine as well.

I consider the presence of hexamine both in the field samples and in the official stockpile of the Syrian government to be very damning evidence of government culpability in the Ghouta attacks. 7 weeks of research on this subject reveal no public domain evidence of hexamine being used in this way in other Sarin programs. The likelihood of both a Syrian government research and development program AND a non-state actor both coming up with the same innovation seems negligible to me. It seems improbable that some other actor wanting to plant evidence would know to freely spread hexamine around the target areas.

About the author: Dan Kaszeta is the author of "CBRN and Hazmat Incidents at Major Public Events: Planning and Response" (Wiley, 2012) as well as a number of magazine articles and conference papers. He has 22 years of experience in CBRN, having served as an officer in the US Army Chemical Corps, as CBRN advisor for the White House Military Office, and as a specialist in the US Secret Service. He now runs Strongpoint Security, a London-based CBRN and antiterrorism consultancy. Mr. Kaszeta also holds a part-time post as Senior Research Fellow with the International Institute of Nonproliferation Studies and is a contributor to Wikistrat.

References:

[1] http://jat.oxfordjournals.org/content/28/5/357.full.pdf

[2] http://www.opcw.org/fileadmin/OPCW/ADM/PSB/Tender/Request_for_EOI_OPCWCDB_EOI012013.pdf

[3] http://www.opcw.org/index.php?eID=dam_frontend_push&docID=16847%20l