A Brief Assessment of the Veracity of Published Statements in the Press and Elsewhere Made by *Dan Kaszeta*, A Self-Described Expert on the Science and Technology of Chemical Weapons

by

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Dan Kaszeta describes himself in public statements as having "over twenty years of diverse experience" as "a former US Army and US Secret Service specialist on chemical, biological, and radiological defense."

Following the release on September 13, 2013 of the UN report on the use of chemicals in Syria, Mr. Kaszeta started making statements that the fact that hexamine was found by UN inspectors in soil samples and on metal fragments from chemical munitions indicated a "smoking gun" that connected the August 21, 2013 nerve agent attack to the Syrian government. In repeated articles and statements he has claimed that he has scientific evidence that supports this important claim, which if true could well indicate that the Syrian government was the perpetrator of the attack.

Because my colleague, Richard Lloyd, and I have been drawn into scientific and technical analyses of the August 21, 2013 atrocity, and of the far ranging implications of Mr. Kaszeta's claim, we decided to contact Mr. Kaszeta to get the information needed to confirm the scientific basis of his statements.

During this extensive exchange, Mr. Kaszeta was unable to provide even a single technical document that was relevant to his claims. When we pressed him about the absence of his ability to provide technical information, he claimed that he had information from statements made by Åka Sellström, the head of the *United Nations Mission to Investigate Allegations of the Use of Chemical Weapons in the Syrian Arab Republic,* as saying that hexamine proved that the Syrian government was the perpetrator of the attack (see Appendix 1 for entire record of emails).

Because I was unable to get any constructive information from Mr. Kaszeta, I wrote to Professor Sellström and asked him about the hexamine claim. I asked him if he could respond to me as if I were a reporter. My letter of request and his response are in Appendix 2.

During my fruitless effort to obtain any technical information in support of Mr. Kaszeta's dramatic claim, I enlisted the help of a young quantum chemist who writes under the pen name "Syrian Sister." Syrian Sister provided valuable technical information and advice in support of my effort to obtain the information from Kaszeta that would demonstrate that he had a technical basis for his claim. Syrian Sister provided valuable information on the solubility of hexamine in isopropanol, on the problems encountered if one were to try to use a very low solubility material like hexamine in a process for manufacturing sarin, and on chemical equilibrium constants, which provide important predictive insights into the equilibrium states of chemical mixtures. Syrian Sister's support was totally professional, and often constructively critical of the analysis I was presenting to Mr. Kaszeta.

Mr. Kaszeta is very active on Twitter, and his communications offer additional insights into his attitudes towards this very serious question of whether hexamine unambiguously implicates the Syrian government in the attack. For example, in his twitter exchanges, he refers to those who question his claim as "trolls." He has also attacked the integrity of Syrian Sister in the emails where I was trying to obtain technical information from him in support of his claims.

Mr. Kaszeta has occasionally referred to a book he has published titled, *CBRN and Hazmat Incidents at Major Public Events: Planning and Response* (see Appendix 3) as evidence that he is truly an expert in the science and technology of chemical weapons. However, the book he claims for his expertise is essentially a planning manual for local police forces and event planners where there is a concern that hazardous material could be released. There is essentially no technical or scientific information in this manual that cannot be obtained by a superficial search of entries available on the Internet.

Appendix 4 shows why the matter of Mr. Kaszeta's claims are important. This appendix contains a New York Times article that treats false technical information as if it is real and uses that information to make inferences that are extremely important in the debate and analysis of who might have been responsible for the sarin attack of August 21, 2013. Since the US administration was arguing for military action against Syria, and openly accusing Russia in the UN of making false statements about their assessment that the attack might not have been executed by the Syrian government, the implications of this false technical information were far ranging.

Appendix 5 contains additional false technical information produced by Human Rights Watch and published on the front page of the New York Times that was also inflammatory and misleading.

Appendix 6 shows a letter that my colleague, Richard Lloyd and I wrote to the London Review of Books making corrections to a large number of false technical claims that were being promulgated by Mr. Kaszeta, and his close colleague Eliot Higgins.

Appendix 7 shows an article written by Mr. Kaszeta where he claims

> This article explains the what, why, and how of the 'Hexamine Hypothesis'.
>
> I have spent a lot of time and effort studying the history of Sarin and the particularly obtuse history of industrial efforts to produce Sarin. There are at least 20 production pathways to Sarin, each of at least 5 steps.

As is evident from the email exchange between Kaszeta and Postol, Mr. Kaszeta has no expertise at any level on the questions of how sarin could be produced.

This very short summary is aimed at exposing a counterfeit expert and his cohort, Eliot Higgins, who were empowered by a serious failure of the mainstream Western press. This empowerment was due to an essentially complete failure of these major journals to exercise the most rudimentary levels of editorial due diligence. This has resulted in controversy that has no basis in sound science. This ill-informed and inflammatory use of false technical facts by the press could have played a role in a US military involvement in Syria. In addition, it is now clear, as reported by the New York Times itself, that by being a highway for the introduction of extremist Sunni jihadists, Turkey has played a major role in exacerbating an already out-of-control situation.

Based on the public information we now have, we cannot say for sure who executed the atrocity of August 21, 2013. But what we can say is that there is now substantial evidence that points to the possibility that the August atrocity in Damascus was a false flag attack by certain Sunni rebel forces that are now operating freely in Iraq as well as in Syria.

The collapse of the mainstream press over the past 10 years has had a major negative impact on the American system of democracy, which like all democracies, cannot function without an informed electorate. It is essential that everything be done by the mainstream press, and its citizen supporters, to encourage it in its role as a guardian of democracy.

The rush to judgment by members of the press who failed to execute their due diligence responsibilities is an important matter that I hope will be noted and corrected by the mainstream press.

Theodore A. Postol
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Massachusetts Institute Of Technology
Cambridge, Massachusetts
July 10, 2014

APPENDIX 1
Communications with Dan Kaszeta

From: postol@tpostol.com
Sent: Sunday, June 08, 2014 12:24 AM
To: Dan Kaszeta
Cc: Richard Lloyd
Subject: Questions About a Physics-based Analysis That Shows That Hexamine Could Not Possibly Be Used in the Production of Sarin

Dear Mr. Kaszeta

As you know, Dick and I have been looking at issues associated with the mixing, manufacture, and production of the nerve agent sarin. We have done quite a bit of work on this and have not been able to confirm the technical accuracy of your conclusion that a sample of hexamine that was found by the UN in the aftermath of the August 21, 2013 nerve agent attack in Damascus indicates a "smoking gun" that shows the sarin was manufactured by the Syrian government.

We have reviewed numerous documents and scientific papers that contain information about the fabrication of sarin and have found absolutely no references to the use of hexamine in the manufacture or maintenance of sarin: A short, and hardly complete, list of these documents is as follows:

1. *Handbook of Chemical and Biological Warfare Agents,* D. Hank Ellison
2. *Compendium of the Iraq's Proscribed Weapons Programs in the Chemical, Biological and Missile Areas,* United Nations Monitoring, Verification and Inspection Commission (UNMOVIC), June 2007
3. *Stability of Iraq's CW stockpile,* CIA, 071596_CIA_72569_72569_01.
4. *Chemical Warfare Agents: Chemistry, Pharmacology, Toxicology, and Therapeutics,* edited by James A. Romano, Brian J. Lukey and Harry Salem, CRC Press, (2008).
5. *Monitoring Chemicals with Possible Chemical Weapons Applications,* Fact Sheet 7, (Organization for the Prohibition of Chemical Weapons)
6. *Comprehensive Report of the Special Advisor to the DCI on Iraq's WMD,* 30 September 2004, Charles Duelfer.
7. *Chemical Weapons Technology,* US Department Of Defense, Office of the under Secretary Of Defense for Acquisition and Technology, February 1998.
8. *A Laboratory History of Chemical Warfare Agents,* Jared Ledgard
9. *Technical Aspects of Chemical Weapon Proliferation, from Technologies Underlying Weapons of Mass Destruction,* OTA, 934408.

Because we were unable to find any references to use of hexamine in the production and storage of sarin we decided to do our own review of the plausibility that hexamine could be used as an acid scavenger in the manufacture of sarin.

Our conclusions is that it is physically impossible to dissolve enough hexamine, even if it were desirable, or chemically possible, to substitute hexamine for isopropylamine to scavenge the acid product of the reactants Methylphosphonyl difluoride and isopropyl alcohol. The only possible way this conclusion could be wrong is if it were possible to dissolve at least 37 percent by weight hexamine in isopropanol. The information we have suggests that the solubility of hexamine in isopropyl alcohol is likely between five and

50 times smaller than the required 37 percent by weight. If you can provide a technical reference that shows otherwise we would greatly appreciate the reference.

The analysis that leads to this very strong conclusion is outlined in the six slides below. We will briefly describe the contents of each of the slides and invite you to review them so you understand the basis for this strong conclusion.

Slide number one shows the two chemical reactions that are critical for the production of stable sarin. The chemical reaction shown at the top of the slide simply shows the products of the reaction between Methylphosphonyl difluoride and isopropyl alcohol. The products are sarin and hydrogen fluoride. As you well know, the hydrogen fluoride has a powerful effect on sarin causing it to be transformed into other far less lethal byproducts. As such, one of the very important additional reactions needed to produce military grade sarin is the use of a chemical that removes the hydrogen fluoride molecules.

This is achieved by adding 28 percent by weight isopropylamine in isopropanol. The chemistry reactions that occur with this substitution are shown in the second chemical equation in slide one.

Slide two shows the source that describes the amount of isopropylamine needed to adequately scavenge the resulting hydrogen fluoride from the sarin. The source is solid, as it is a US government document that is produced for individuals who handle and work with chemical agents.

Slide three shows how very elementary chemical reasoning leads to the conclusion that roughly 0.4 moles of isopropyl amine are required per mole of isopropanol in order to remove the HF that is produced along with the sarin. This indicates that each isopropylamine molecule is in reactions that lead to roughly 2.5 fluorine's being removed from the bath of chemical products. This is an important result.

We have not been unable to find any papers that describe hexamine reacting with hydrogen fluoride or being dissolved in isopropanol in order to function as an acid scavenger. However, we have found one reference to a paper that was published in the Journal Of Canadian Research in 1950. The reference is described as reporting that between one and four fluorine's can be picked up by a hexamine molecule. There is no information about under what conditions this occurs, but as you will see, this particular detail plays no role in determining that hexamine cannot possibly be an acid scavenger in the production of sarin.

Slide four shows a simple ansatz that shows the ***minimum*** amount of hexamine that would have to be dissolved in isopropanol for the hexamine to work as an adequate acid scavenger.

If one makes the heroic assumption that each hexamine can in fact remove four fluorine atoms from the product chain, then it would require 0.25 moles of hexamine for each mole of fluorine to be removed. The molecular weight of hexamine is quite high, roughly 140 grams per mole, which leads to the conclusion that any mixture of isopropanol and hexamine that can function as a scavenger must contain at least 35 grams of hexamine per mole of isopropanol. This leads to the conclusion that the hexamine would have to be 37 percent by weight soluble in isopropanol.

Slide five shows the only solubility data we have been able to obtain for hexamine in ethanol, methanol, and acetone. One of the industrial processes for manufacturing isopropanol is simply to hydrogenate acetone, which is chemically very close to isopropanol (see slide 6). The solubility of hexamine and acetone is roughly 6/10 of one percent by weight. Even if the hydrogenation of acetone drastically changed its solubility characteristics, the best case where there is information is methanol, which at best could dissolve seven percent by weight hexamine. I suspect that the solubility of hexamine in isopropanol has not been reported because the solubility is so low, but I would be surprised if there is not a source of solubility data somewhere.

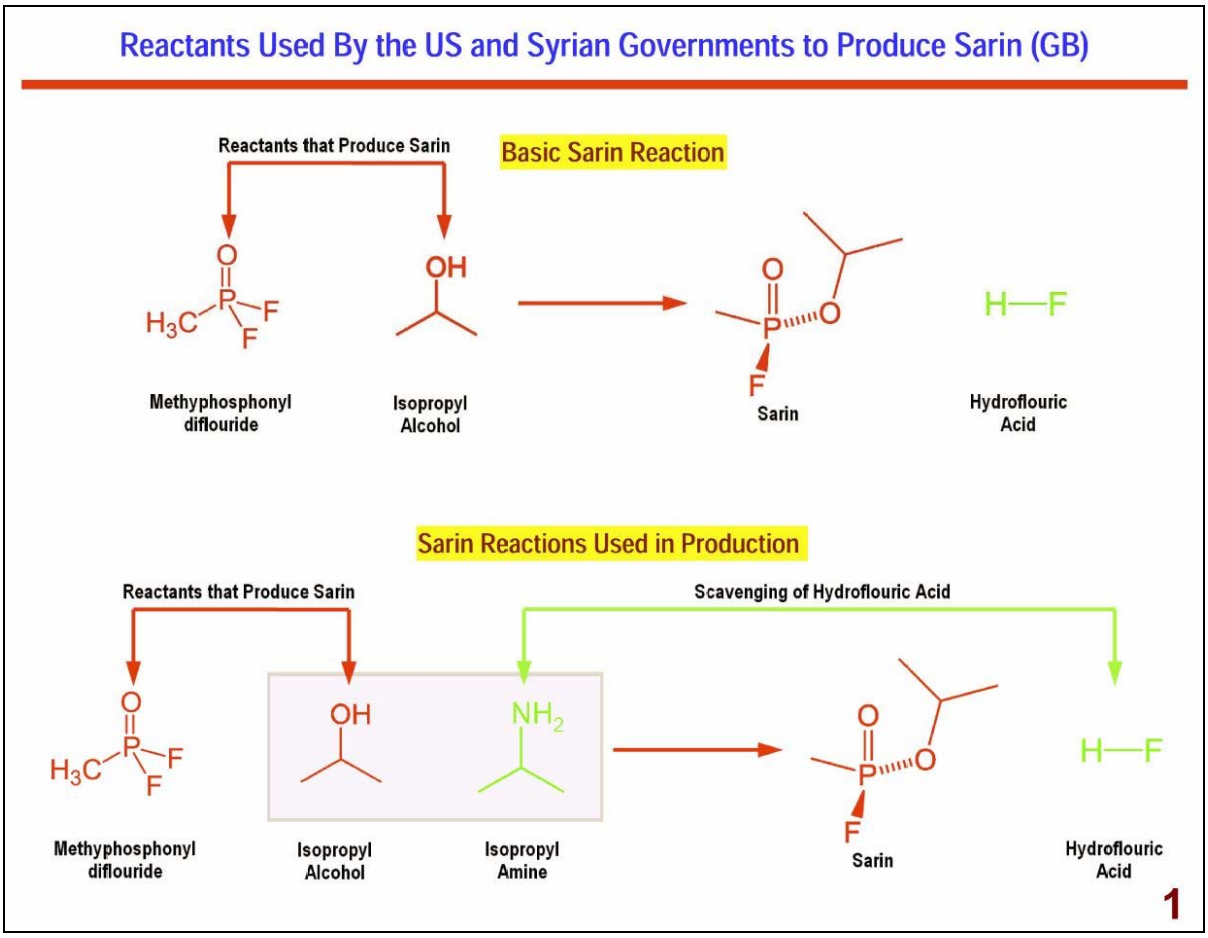
If you think you can point me to a scientific paper that lists the solubility of hexamine in isopropanol, the matter would be completely settled that hexamine cannot possibly be used in the manufacture of sarin unless hexamine has a drastically higher solubility in isopropanol.

This is extremely unlikely to be the case.

As a result, our review of the technical literature, indicates that hexamine could not possibly be used in the manufacture of sarin, and as such, it could not possibly be a “smoking gun” indicating that the particular sarin at issue was produced by the Syrian government (or anyone else, for that matter).

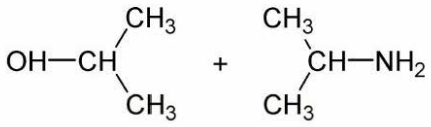
If you have any technical information at all that raises questions about our conclusions, we would be very pleased to get it and to incorporate it into our ongoing analyses.

Best regards, Ted Postol and Richard Lloyd



Isopropyl Amine and Isopropyl Alcohol Mixture Used in the Production of Military Grade Storable Sarin

Table II-53. OPA

Alternate Designations: N/A
Chemical Name: 2-Propanol (isopropyl alcohol) and Isopropyl amine mixture
Synonyms: N/A
CAS Registry Number: 2-Propanol: 67-63-0; Isopropyl amine: 75-31-0
RTECS Number: 2-Propanol: NT8050000; Isopropyl amine: NT8400000
Physical and Chemical Properties
Structural Formula:  72 wt% 2-Propanol 28 wt% Isopropylamine
Molecular Formula: C_3H_8O and C_3H_9N Molecular Weight: 2-Propanol: 60.10; Isopropyl amine: 59.11; Average: 59.81 (based on 72:28 wt. %)

II-72 Isopropylamine and Isopropyl Alcohol (OPA)

Table from: *Potential Military Chemical/Biological Agents and Compounds*, FM3-11.9, January 2005, http://www.fas.org/irp/doddir/army/fm3-11-9.pdf

2

Estimation of Molecular Acid Scavenging Capabilities of Isopropylamine (OPA)

Known H-F Acid Scavenging Capabilities of Isopropyl Amine

72% Wt Isopropyl Alcohol 28% Wt Isopropyl Amine

Weight Ratio of 72% to 28% indicates that for each mole of Isopropyl Alcohol there is:

28/72*59.11 = 23 g of IsopropylAmine

This is 23/59.11= 0.39 Moles of IsopropylAmine

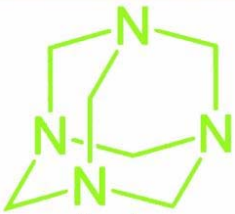
Since 1 mole of Isopropyl Alcohol produces 1 mole of HF-
Then:
Each molecule of Isopropylamine must pick up roughly 2.5 Flourine atoms

3

Estimation of Required Solubility of Hexamine Needed to Replace (OPA) as the Acid Scavenging Agents in Sarin Production

Weight of Hexamine Needed for Adequate H-F Acid Scavenging

Isopropyl Alcohol
60.1 g/mol



Hexamine
140.2 g/mol

If Each Hexamine Molecule Can Acquire a Maximum of Four Flourine Atoms
Then

0.25 moles of Hexamine can Scavenge 1 Mole of H-F Acid.

Thus, a mixture of 1 mole Isopropyl Alcohol + 0.25 moles Hexamine is required to produce 1 mole of Sarin while removing 1 mole of H-F side product

The weight of 0.25 moles of Hexamine id 0.25 × 140.2 g/mole = 35 g of Hexamine.`

This indicates that the required *weight fraction of Hexamine* in Isopropyl Alcohol must be for Hexamine to functiona s an acid scavenger in the production of Sarin from Methyphosphonyl diflouride.:

$$\frac{35}{60.1+35} = 37\%$$

4

Solubility Data for Hexamine Indicates that It Cannot Be An Adequate Acid Scavenging Agent in Sarin Production

http://www.sinachem.com/index.php?option=com_content&view=article&id=23&Itemid=87

Hexamine Min. 99.5 Percent

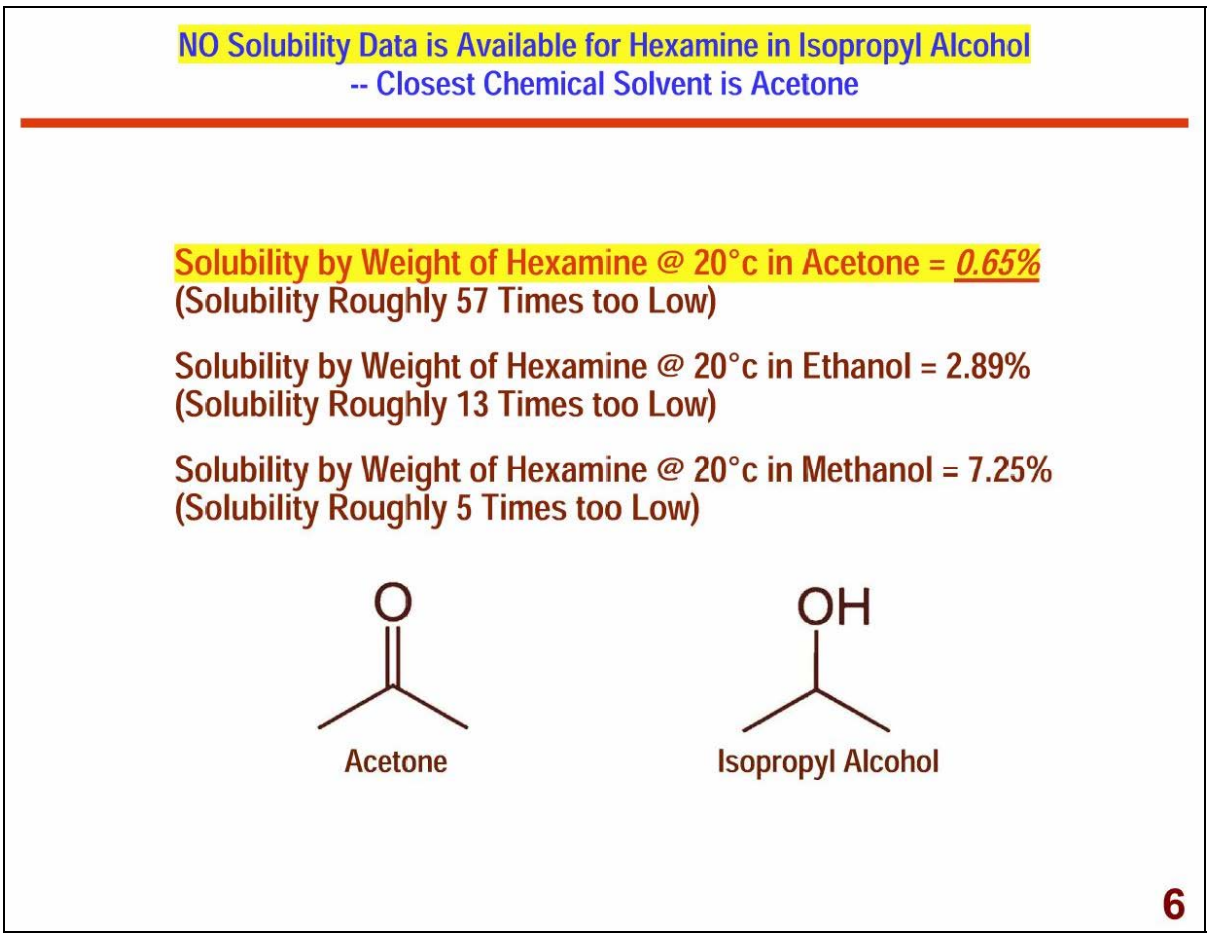
HEXAMINE (C6H12N4) / Capacity : 5000 MTPY

HEXAMINE STABILIZED (0.5 -1.5 %)

Hexamine is formed by the reaction of formaldehyde and ammonia, reacts as formaldehyde in many instances and therefore may be regarded as a special form of formaldehyde from the stand point of use.

Hexamine Unstabilized		
Specification	Unit	Result
Appearance		white Crystelline powder
Purity	wt%	Min. 99.5
Ash Content	wt%	Max. 0.03
Humidity	wt%	Max. 0.25
Ammonia	wt%	Max. 0.02
Formaldehyde	wt%	Max. 0.02
Chloride		Nil
Sulfate		Nil
Heavy metal		Nil
pH (10% Aq. solution.)		8 - 9
Mesh Size		80 - 800 Micron US mesh 20 - 170 0.08 - 0.8 mm
Molecular Weight	gr	140.2
Melting Point	°c	270 (Decomposition)
Density	gr/cm3	1.33
Bulk weight	gr/cm3	0.7 - 0.8
Solubility @ 12°c in: Water	wt%	81.3
Solubility @ 20°c in: Methanol	wt%	7.25
Solubility @ 20°c in: Absolute Ethanol	wt%	2.89
Solubility @ 20°c in: Acetone	wt%	0.65
Hexamine Stabilized (0.5Wt% Silica) *		
Appearance		white Crystelline
Purity	wt%	Min. 99
Ash Content	wt%	Max. 0.53
Humidity	wt%	Max. 0.25
Ammonia	wt%	Max. 0.02
Formaldehyde	wt%	Max. 0.02
Chloride		Nil
Sulfate		Nil
Heavy metal		Nil
pH (10% Aq. solution)		8 - 9
Mesh Size		80 - 800 micron US Mesh 20 - 170 0.08 - 0.8 mm

5



From: Dan Kaszeta
Sent: Sunday, June 08, 2014 12:16 PM
To: mailto:postol@tpostol.com
Cc: Lloyd Richard
Subject: Re: Questions About a Physics-based Analysis That Shows That Hexamine Could Not Possibly Be Used in the Production of Sarin

Dr Postol

Thanks for this. A lot for me to consider and digest. I will send a more detailed reply within a few days.

Dan Kaszeta

From: postol@tpostol.com
Sent: Friday, June 13, 2014 1:27 PM
To: Dan Kaszeta
Cc: Richard Lloyd
Subject: Follow-Up On Questions About a Physics-based Analysis That Shows That Hexamine Could Not Possibly Be Used in the Production of Sarin

June 13, 2014

Dear Mr. Kaszeta:

This is just a reminder that I am looking forward to receiving the technical information about my query of last week on the solubility of hexamine in isopropanol and how the Syrian manufacturing process must be altered to use hexamine rather than isopropyl amine.

Since my last note to you, I have done a lot more research on how or whether hexamine could be used as a practical acid scavenger in the production of sarin.

It is now clear that hexamine has limited solubility in isopropyl alcohol. This means that the only way of using it as an acid scavenger would be to use considerable volumes of hexamine saturated isopropanol solution and then remove the excess isopropanol from the remaining mixture of sarin and excess isopropanol. My initial "guesstimate" is that the volume of isopropanol in the end product will be perhaps 5 to 10 times larger than would be the case in the process that uses isopropyl amine.

As I have not received any information from you about the solubility of hexamine in isopropyl alcohol, nor have I received any information about the fluorine capacity of hexamine, these estimates must be considered approximate. However, it is now clear that a manufacturing process of sarin that uses hexamine will have a very substantial additional set of processes to remove large volumes of isopropanol from a relatively dilute solution of sarin.

In spite of a very determined effort, including consulting with an old college friend who is now an internationally known organic chemist, I have not been able to find any technical information on the solubility of hexamine in isopropyl alcohol. One possibility is that hexamine is ***not*** soluble in isopropyl alcohol and hence, there is no solubility number reported for it.

I have done a fairly careful review of the chemistry literature on the phenomenology of the solubility of organic compounds in organic solvents, and have concluded that it is likely that hexamine has a solubility in isopropyl alcohol similar to that in ethanol and methanol. The analysis follows traditional chemical analysis of material solubility.

Basically the assumption is that the "Polarity Index" of a fluid is an important indicator of the potential solubility of a material in a solution. The polarity Index for water is 9, with essentially all other relevant molecules having lower electrical dipole moments. There are additional differences that can be important – since alcohols have an OH complex that increases the effects of hydrogen bonding that influence the solubility of materials.

So, for example acetone, which is extremely close in chemical structure to isopropanol, has a hexamine solubility of only 0.65 percent. However, Isopropanol which simply adds a hydrogen bond to the oxygen in acetone and a hydrogen atom to the adjacent carbon atom could potentially have a much higher solubility due to the introduction of an OH radical, perhaps five percent hexamine by weight. If this is correct, it would essentially be due to the conversion of the double bonded oxygen to an OH radical. This, uncertainty, of course will be resolved when I get solubility data for hexamine in isopropanol from you.

The following data shows both the polarity Index and the solubility by weight percentage of hexamine in various solvents:

Molecule	Polarity Index	Solubility by Weight Percent
Water	9	89.5 @ 20ºC
Chloroform	4.1	13.4
Ethanol	5.2	2.9
Methanol	5.1	7.2
Isopropanol	3.9	??
Acetone	5.1	0.65
Xylene	2.5	0.1
trichloroethylene	1	0.1
Most Other Solvents		Immiscible

Since the alcohols form a special class of solvent due to the hydrogen bonding from the OH radical, we can make a "guess" for the solubility by weight of hexamine in isopropanol. We can then adjust our conclusions when we get the actual solubility information I requested from you in my earlier email. I will assume five percent solubility, but I understand the number could be different.

As shown in the email I sent you on June 6, assuming each hexamine molecule can scavenge 4 fluorine ions, then hexamine would have to be soluble to 37 percent by weight.

Under the assumption that hexamine is only five percent soluble in isopropyl alcohol, and each hexamine molecule can scavenge 4 fluorine atoms from the mixture, means that the volume of five percent hexamine in isopropyl alcohol needed for the industrial production of sarin would be roughly 7 (37/5~7). If the hexamine molecule can only scavenge 3 fluorine atoms, then the ratio of isopropyl alcohol to sarin after the scavenging step goes to about 9 (44/5~9). If hexamine can scavenge only 2 fluorine's, the ratio of isopropanol to sarin in the end product would then be roughly 11 (54/5~11).

So, under the assumption of five percent solubility of hexamine in isopropanol we get a volume ratio of between seven and nine of isopropanol to sarin in the final product solution.

If we then assume that hexamine is only 2.5 percent soluble by weight in isopropanol, the ratios of isopropanol to sarin in the final product double. If, instead, the solubility of hexamine in isopropanol is 10 percent, the ratio of isopropanol to sarin in the final product is half of what we estimated relative to the 5 percent solubility of hexamine in isopropanol.

Thus, there are several critical pieces of information, that we need from you to provide scientific verification for your statement that the presence of hexamine in a single sample taken by the UN following the attack of August 21, 2014, is a "smoking gun" that the sarin came from the Syrian government.

To summarize, these pieces of data are:

1. We need a scientific reference that provides us with the solubility of hexamine in isopropanol.

2. We need a scientific reference that provides us with the number of fluorine's that can be expected to be scavenged per molecule of hexamine.

3. We need an explanation of what mass production processes are evident in Syria's sarin production methods that would indicate steps to remove very large amounts of excess isopropanol associated with the use of hexamine, rather than isopropyl amine in the production of sarin.

As you are an expert with decades of experience in the area of chemical weapons, we assume you should be able to provide this information relatively quickly.

We look forward to receiving the scientific references.

Best regards, Ted Postol and Richard Lloyd.

From: Dan Kaszeta
Sent: Friday, June 13, 2014 2:30 PM
To: postol@tpostol.com
Cc: Richard Lloyd ; rlloyd@tesla.net
Subject: Re: Follow-Up On Questions About a Physics-based Analysis That Shows That Hexamine Could Not Possibly Be Used in the Production of Sarin

Dr. Postol and Dr. Lloyd

I apologize that my reply is delayed. I have a regular consulting job and clients that I must do work for, so my efforts in this regard have to be shoe-horned around other things.

The scientific reference I found regarding hexamine and HF is here, citing that a mol of hexamine can bind up to 4 mols of who in turn cites a Russian source: http://etheses.dur.ac.uk/6562/1/6562_3865.PDF?UkUDh:CyT - Not being fully convinced of

this based on one document, I ran the basic concept past 5 chemists (2 with established chemical warfare agent careers) and an engineer well versed in Sarin chemistry, all of whom concurred with this basic finding, as amine-acid reactions seem to be well understood in general, even if this particular permutation is not often written about.

I will synopsize my thinking, but please understand that I am working on a more detailed paperto send back to you. Let me synopsize my thinking, however.

The following factors are significant:

- Ever since I saw detailed photographs of the rocket remnants, I have pretty well figured that the devices were not designed for in-flight mixing as that is actually quite hard to do, as demonstrated by the difficulties in the US M687 program, which I have studied in depth.

- Having seen your calculations, I can no longer support a hypothesis that a useful amount of hexamine was somehow dissolved in isopropanol in a Volcano rocket. You are completely right. The numbers do not work.

- Because the munition was not designed for in-flight mixing, the DF and isopropanol had to be combined before-hand.

- The OPCW's documentation clearly states that Sarin was not kept on hand in Syria, but was kept as binary components.

- Without some acid reduction step, it seems unlikely that Sarin heavily contaminated with HF was going to last very long.

- US experience with mechanical methods for reducing HF were largely a failure, necessitating a complete change in production path to a method resulting HCl as the residual in order to allow for a complex heavy-industry distillation process at great effort and expense. The DF + Isopropyl process was not used, as I am sure you know, for the many thousands of tons of Sarin made for the "unitary"/filled munition stockpile that the US amassed. This appears to not be the case in Syria, and seems to not be the case because of the lack of degradation products of the precursors used in the US method.

-Much hexamine was present in the field samples. It was concomitant with the Sarin and/or the immediate degradation products of Sarin in all of the places where a pool or droplet of liquid may have been present. The one exception was in a head scarf (no Sarin, only degradation products, no hexamine), which leads me to believe that head scarf had a significant vapor exposure but not a liquid exposure.

- There's no mention of any HF-Hexamine salts or complexes, the expected cocktail of hexamine+ 1 to 4 HF molecules, in the field results. But the hexamine is there nonetheless. This has bothered me and others for a while.

- 80 tons of hexamine were declared as a component of the Syrian chemical warfare manufacturing program, a quantity seemingly difficult to justify for other reasons, as you have so clearly stated that published uses of hexamine, apart from obsolete uses for WW1-era Levinstein mustard stabilization or as an impregnating agent to protect against phosgene exposure.

- Ake Sellstrom stated that it was an acid scavenger and was in the formula by the Syrian government. Perhaps he did not mean to make this admission but he did. I spoke at length to Gwyn Winfield, the editor of CBRNe World magazine who got this salient point.

- An OPCW staffer in a hearing to the US congress, suggested hexamine as an acid reducer.

- OPCW documents and media reports both talk extensively of destruction of filling and mixing apparatus, both fixed and mobile.

All of this is circumstantial, of course, but leads to a combination of circumstances that are difficult to explain. It leads me to at least one hypothesis:

Hypothesis: Refining HF out of the Sarin is a practical necessity and must have happened to some degree. Hexamine was used as a "quick cheap and easy" refining method. This method would have created a significant waste stream of hexamine-HF complexes, which could easily have been considered under the very broad and loose definition of "fluorinated effluents", of which Syria declared a very large inventory - 4.4 million liters. The hexamine-HF complexes could have been precipitated or sieved out. (I am currently researching other industrial processes where amines are used for acid reduction, but have had to take advice on that as I am no chemical engineer). The hexamine in the field samples would have been remnants of unreacted hexamine, the vast majority of the hexamine used in the process having been sieved out.

This refining process would have created a waste stream that would have been wasteful in the Western sense, and create the sort of waste in the process that the old US Rocky Mountain Arsenal engineers, even in the relatively environmentally un-enlightened 1950s, would never have countenanced. But I assume that the Syrian government would be less encumbered by worries about the waste stream and was more worried about expediency.

I have yet no firm conclusion why hexamine would be superior to isopranolamine for this particular task. However, I do have the following observations and ideas:

- We do not know at this time which would be superior as an acid reducer. This bears more inquiry.
- Isopropanolamine's primary benefit was its solubility in isopropanol. If that isn't needed, then it may lose its advantage. I know that other amines were examined for the US M687 program.
-The vapor pressure of isopropanolamine is not inconsequential, whereas the vapor pressure of hexamine is negligible. Perhaps there was concerns for flammability? This seems a low concern, however, given the quantities of isopropanol clearly needed.
-Hexamine is clearly synthesizable in a low-tech industrial base and has other uses. Economic and logistical considerations may have played a part, particularly if there was a supply chain already in existence to produce hexamine for high explosives synthesis.
-Isopropanolamine is clearly associated with binary Sarin and its procurement, mid-war, may be problematic. It would set off alarm bells, much like sodium fluoride or thionyl chloride
-Isopropanolamine may have been reserved for some other weapon system that was intended to have in-flight mixing
-We cannot exclude that some cocktail of amines may have been used, and we are only seeing the non-volatile one, because of the intervening days between use and sample collection.

- I have unconfirmed anecdotal information that hexamine may have been used by the Yugoslavian (Tito-era)military for acid reduction in Sarin. However, much of this information is

lost to us and remains shrouded in deep secrecy. I continue to research this angle. There were clear military ties between the CBRN troops of the Yugoslav military and the Syrian military. There is some possibility that this is a Yugoslav innovation that got exported to Syria.

I do not pretend that this explanation is perfect. However, we are in the area of Occam's Razor, where we can only hope for "least bad" rather than best. The other explanatory narratives I've heard, and I have heard many by this point, range from problematic to ludicrous.

If you have an alternative theory, I would love to hear it. Despite what may be said about me on the internet, I don't have a political agenda in this. I just want to be able to square the declarations with the environmental/medical samples and the reports of the actual incident.

I would be curious as to any alternative explanation you might have that accounts for the hexamine, both in the government stockpile and the field samples. Indeed, if you have some narrative or scenario, I think it would be intellectually stimulating if we could both write up our scenarios from beginning to end, and then we could compare them. It would be very useful.

Best regards,

Dan Kaszeta

From: postol@tpostol.com
Sent: Saturday, June 14, 2014 1:52 AM
To: Dan Kaszeta
Cc: Richard Lloyd ; rlloyd@tesla.net
Subject: Science-Based Questions We Have About Your Responses to Our Questions

Dear Mr. Kaszeta:

Thank you for getting back to us. We accept your statement that as a sought after expert on chemical munitions you have many commitments that you need to balance.

We have examined your response to us and are puzzled by essentially every technical point that you made. We list the issues that puzzle us, and explain why we are puzzled below:

Your Reference Has No Relationship to the Question of Whether Hexamine Can Be Used As an Acid Scavenger in the Production of Sarin

We have looked at the only scientific reference you have so far sent to us. We do not understand how this article has anything to do with the issue of how, or if, hexamine can be, or was, used as an acid scavenger in the production of Sarin by the Syrian government. We would greatly appreciate clarification on this matter as explained below.

You provided us with the reference in the form of the URL:

:"http://etheses.dur.ac.uk/6562/1/6562_3865.PDF?UkUDh:CyT"

The URL points to a PhD thesis finished in 1989, titled *Mechanistic Studies of the Interactions of Hexamine and Some Derivatives with Electrophiles*.

The full reference is:

Scranage, John Keith (1989) Mechanistic studies of the interactions of hexamine and some derivatives with electrophiles. Durham theses, Durham University.

The first line of the abstract describes the subject of the thesis as being on:

> "Mechanistic studies of the ***nitration*** (emphasis added) of hexamethylenetetramine and ***some derivatives*** (emphasis added) are reported and are compared with acetylation reactions.

Studies of nitration and acetylation reactions have nothing to do with the subject we have been discussing with you.

The only statement in the entire nearly 200 page document that refers to the possibility that hexamine could acquire four molecules of fluorine is the following:

> "The molecule possess full 3m symmetry, and is isostructural with $C_6H_{12}N_4$-HBr, the monohydrobromide salt of hexamine. The monohydroiodide salt is also known. With hydrogen fluoride , complexes containing 1-4 molecules of HF per molecule of hexamine are formed."

This statement has nothing to do with the role that hexamine could play as an acid scavenger when dissolved in isopropanol.

The material $C_6H_{12}N_4$-HBr, referred to in the thesis, is a salt that is quickly broken down by chemical reaction with water. It is called ***Hexamethylenetetramine*** hydrobromide (note the reference to the same molecule in the first sentence of the thesis). The other material referred to in the thesis, $C_6H_{12}N_4$-HI, which is mentioned only in passing, is a closely related salt that is called. Hexamethylenetetramine hydriodide.

According to this passing statement in the thesis, if either of these salts are put in a solution of hydrogen fluoride the result is the production of Hexamethylenetetramine tetraflouride.

Aqueous hydrogen fluoride is such a highly polar material that it in many cases behaves as an ionic solvent. If hydrogen fluoride is a dilute component of a covalent solvent like isopropyl alcohol, the dominant phenomenology will be controlled by the covalent nature of the dominant solvent – isopropanol. Thus, the fact that hydrogen fluoride can dissolve Hexamethylenetetramine hydrobromide has no bearing on whether a different solvent like isopropanol would have anything like the same chemistry.

It would be very helpful to us if you explained how this reference tells us anything we already didn't know?

We Do Not Understand Why You Have Raised the Question of Binary Nerve Agent Ignitions

You you spoke extensively in your reply to us about the possibility that the chemical munitions used in the attack of August 21, 2014 were binary.

We do not understand why you would raise this issue with us.

As you know, we were the first to identify how that munition worked. Roughly 2 weeks after our finding on the design of the munition was published in the New York Times, the UN report on the attack of August 21 reported that it found exactly what we predicted would be found. There was never any evidence of any kind that would lead an informed professional to believe that this munition was binary – and we certainly never suggested this as a possibility.

It would be helpful to us if you could explain why you raise this issue with us?

We Cannot Find Any References, in the Scientific Literature or Quotes in the Press, That Would SuggestThat There Is a Process for Making Sarin That Employs Hexamine

In your response to us you said:

Ake Sellstrom stated that it was an acid scavenger and was in the formula by the Syrian government. Perhaps he did not mean to make this admission but he did. I spoke at length to Gwyn Winfield, the editor of CBRNe World magazine who got this salient point.

We are unaware of any statement by Åka Sellström that has been reported in the press with regard to hexamine being an acid scavenger that was in the formula by the Syrian government.

Could you provide us with a reference to his statement?

Also could you provide us with a science-based reference that describes the chemical process that uses hexamine?

The Existence of Fluorinated Effluents Does Not, As You Suggest, Indicate the Use of Hexamine in the Production of Sarin

Your claim that the existence of a waste stream of 4.4 million liters of "fluorinated effluents"leads to a conclusion that "hexamine was used as a 'quick cheap and easy 'refining method" does not indicate what you suggest

The fluorinated effluents you describe are the result of the well-known procedures for making sarin.

Sarin is produced by mixing Methylphosphonyl di*fluoride* with isopropyl alcohol.

The Methylphosphonyl di*fluoride* is obtained by mixing Methylphosphonic di*chloride* with hydrogen fluoride. This reaction is shown below:

<clip_image002[3][2].png>

As such, the existence of fluorinated effluents does not indicate that some form of hexamine-based production of sarin occurred.

Summary and Conclusions

We are finding your replies to us very informative. But it would be most helpful if you could simply provide us with the information we requested from you in our original email.

Those questions are as follows:

1. We need a scientific reference that provides us with the solubility of hexamine in isopropanol.

2. We need a scientific reference that provides us with the number of fluorine's that can be expected to be scavenged per molecule of hexamine.

3. We need an explanation of what mass production processes are evident in Syria's sarin production methods that would indicate steps to remove very large amounts of excess isopropanol associated with the use of hexamine, rather than isopropyl amine in the production of sarin.

Best regards, Ted Postol and Richard Lloyd

From: Dan Kaszeta
Sent: Monday, June 16, 2014 5:01 AM
To: postol@tpostol.com
Cc: Richard Lloyd
Subject: Re: Science-Based Questions We Have About Your Responses to Our Questions

Drs. Postol and Lloyd,

In order to clarify various points that I made and your various ripostes to them, I am conducting some additional research and am consulting several chemists I have worked with in the past on CW issues. I will give a more detailed reply when I can, other duties permitting.

Dan Kaszeta

From: Dan Kaszeta
Sent: Monday, June 16, 2014 5:39 AM
To: postol@tpostol.com
Cc: Richard Lloyd
Subject: Ake Sellstrom and OPCW public statements re: Hexamine as acid scavenger

Dr. Postol,

With reference to your previous email, I beg to differ. Public statements were indeed made. I refer you to the following two sources:

1. CSPAN 13 December 2013.
http://archive.org/details/CSPAN_20131213_210000_Key_Capitol_Hill_Hearings

Please see the parts from approximately 4:53pm onward in this recording. This is a matter of public record and CSPAN is a credible source.

2. Gwyn Winfield's interview with Ake Sellstrom.

The following was reported as the interaction between Gwyn Winfield and Ake Sellstrom, as specifically stated by Mr. Winfield:

Gwyn Winfield:

"Why was hexamine on the list of chemical scheduled to be destroyed - it has many other battlefield uses as well as sarin? Did you request to put it on the list or had the Syrian's claimed that they were using it?"

Ake Sellstrom: "It is in their formula, it is their acid scavenger."

I communicated with Dr. Sellstrom by email on 4 February 2014. He did not deny making the statement and confirmed to me that hexamine could be used as an acid scavenger. If you have questions about the veracity of this, I suggest you can confirm with Gwyn Winfield (gwyn.winfield@cbrneworld.com) or Dr. Sellstrom.

As you can see, when confronted by the statements of someone who was on the ground and was in direct contact with the experts in both field and lab, I'm in no position to refute such established authorities. I am merely seeking to flesh out a hypothesis and scenario that accounts for all of this.

As stated in previous correspondence, a more thorough reply will be forthcoming, pending more research.

Regards,

Dan Kaszeta

From: postol@tpostol.com
Sent: Monday, June 16, 2014 1:05 PM
To: Dan Kaszeta
Cc: Richard Lloyd ; syr sis
Subject: Reply to Your Communications: Ake Sellstrom and OPCW public statements; and Hexamine as acid scavenger

Dear Mr. Kaszeta:

Thank you for getting back to us so promptly.

As you know, we have been trying to get basic scientific data from you that would support your multiple claims about hexamine being a "smoking gun" that shows that the Syrian government was the source of the sarin in the nerve agent attack of August 21, 2013.

During this process we have not been able to obtain from you a single *science-based* piece of evidence for your multiple claims. In fact, the only science-based statements you have communicated to us were either wrong, misleading, or irrelevant to the issue we clearly laid out for you in our first email. It is deeply problematic that you would make such assertions when you have absolutely no scientific evidence to support them.

In your most recent email to us, you now claim that you have direct information from the head of the UN team that collected samples, Professor Åka Sellström, after the August 21, 2013 attack.

You quote Professor Sellström with regard to your claims about hexamine as saying:

> "It [hexamine] is in their [the Syrian government's] formula, it is their acid scavenger."

You also say in your email that

> I communicated with Dr. Sellstrom by email on 4 February 2014. "He did not deny making the statement and confirmed to me that hexamine could be used as an acid scavenger." If you have questions about the veracity of this, I suggest you can confirm with Gwyn Winfield or Dr. Sellstrom.
>
> As you can see, when confronted by the statements of someone who was on the ground and was in direct contact with the experts in both field and lab, I'm in no position to refute such established authorities. I am merely seeking to flesh out a hypothesis and scenario that accounts for all of this.

We have also been in direct contact with Professor Sellström by email, and he states that:

> That the presence of Hexamine in samples taken by his UN team "in no way conclusively points to the [Syrian] governement.

Sellström also states that:

> "hexamin found in samples may be derived from other sources for example, explosives."

On the separate matter of the solubility of hexamine in isopropanol, we have finally gotten a solid scientific source. This technical information was provided to us with full scientific references by *Syrian Sister*, an organic chemist who we conferred with when we were unable to get this basic information from you.

The solubility of hexamine in isopropanol is 0.6 percent by weight, which is essentially the same as its solubility in the closely related material, acetone. This science-based information indicates that any

process that uses hexamine as an acid scavenger to produce sarin would require between 60 and 70 excess liters of isopropanol-hexamine solution per liter of Methylphosphonyl difluoride.

The standard process for manufacturing sarin uses isopropyl amine as the acid scavenger, which requires only one liter of Methylphosphonyl difluoride per liter of isopropanol solution.

The 60 liters per liter number would be required if each hexamine molecule could retain four fluorine atoms and the 70 liters per liter number would be required if each hexamine molecule could retain three fluorine atoms.

Thus, your statement in an earlier email that

> "Hexamine was used as a "quick cheap and easy" refining method."

Is yet another of numerous examples of the complete absence of the scientific integrity of your claims.

In summary, you have not been able to provide a single reference to back up your assertions that hexamine in the UN samples was a "smoking gun" that indicated the Syrian government executed the attack of August 21, 2013. In addition, you have falsely ascribed claims about this assertion to the UN's Head-of-Team on the ground in Syria.

We do not claim to know who executed these attacks, but what has become clear to us is that you have made numerous false science-based claims, invoked quotes that were not made by the individuals who you cited, and have claimed scientific expertise that you have amply demonstrated you do not have.

Because your false claims have complicated the public debate on this most important question of who might have executed the atrocity of August 21, 2013, we will be preparing a full documentation of the communications between us and releasing them to the public.

Sincerely yours,
Ted Postol and Richard Lloyd.

From: Dan Kaszeta
Sent: Monday, June 16, 2014 2:07 PM
To: postol@tpostol.com
Cc: Richard Lloyd
Subject: Re: Reply to Your Communications: Ake Sellstrom and OPCW public statements; and Hexamine as acid scavenger

Sir,

You seem to have misunderstood me at various levels and points. There seems to be some miscommunication afoot. Perhaps I have not made myself clear, as it appears that some point I made have not properly lodged themselves with you. Particularly with reference to the hexamine and isopropanol solubility, it appears that you have not notice my point that it actually does not matter. My operative hypothesis, which I summarized for you in previous correspondence does not require hexamine to be dissolved into isopropanol. Indeed, I agree with you that dissolving hexamine into isopropanol is not the way this situation could have worked. If the solubility of hexamine in isopropanol still bothers you, might I suggest that an empirical measurement cannot be too hard to do, as pure isopropanol and pure hexamine are both probably easily acquired by the chemistry department at your institution for very little money.

Also, if you don't mind, please ask my permission before cc-ing other people into the conversation. You can understand that having discussions about nerve agent technology with unidentified Syrian nationals can cause me serious legal issues, particularly legal/regulatory matters and my various NDAs. Indeed, it could cause you trouble, so I advise caution in this regard. I have seen people get into legal trouble for far less.

I am working on a very lengthy letter/article that will address most, if not all, of your concerns. As you can understand, the gravity of the situation requires serious answers and I cannot just type away in haste. As you can understand, this will take some time and there are only so many hours in the day. Some of the books I need to consult require 48 hours advance notice to summon at the British Library and the chemists I am consulting have regular jobs and work in other time zones, so I am at their mercy and subject to their own priorities. I am consulting with people who are far more versed in the chemistry than I am. As you know, I am not a chemist so I often have to take advice from chemists and chemical engineers on various aspects of this subject. It will take me several weeks to write the article that fully addresses your concerns.

With regard to statements by Dr. Sellstrom, I can say that if you have some disagreement or misunderstanding about what Dr. Sellstrom said, getting angry at me, who can only report what was said on CSPAN, in an email to me, and in correspondence with Mr. Winfield. If Dr. Sellstrom is saying something different to different people that can hardly be considered my fault, as you understand. Indeed, such a circumstance muddies the waters of discourse more than I ever could.

In the meantime, I plead to you to approach this discourse in a civil manner and to avoid unnecessarily poisoning the discourse with accusations. I have only ever maintained a civil tone, and I request that you afford me the same courtesy.

Can I also point out that you do not have my permission to publish what I considered to be private correspondence between the two of us. By all means, let you, Dr. Lloyd and I continue this dialogue amongst us.

Best regards,

Dan Kaszeta

From: postol@tpostol.com
Sent: Monday, June 16, 2014 2:32 PM
To: Dan Kaszeta
Cc: Richard Lloyd ; syr sis
Subject: Re: Reply to Your Communications: Ake Sellstrom and OPCW public statements; and Hexamine as acid scavenger

Dear Mr. Kaszeta:

Thank you very much for responding so quickly.

I am sorry that you think I was being “uncivil” but I am not sure why you believe this is the case.

All I have done in my discussions with you is to point out incorrect, misleading, and irrelevant scientific statements that you have, without exceptions, made from the beginning to the end of our discussions. In addition, you have misquoted professor Sellström, as verified in my direct communications with him.

These are simple facts that I have stated – with no intention of being uncivil – but with the intention of being factual,professional and direct.

I am currently busy with visiting family for the remainder of this week and I will be returning to Boston from Palo Alto at the end of the week. I will be happy to continue discussions with you, with the emphasis continuing to be civil, professional, and frank. However, I do not think you should mix up being frank and professional with accusations that such discussions are uncivil.

The facts demonstrated throughout our communications is that you have repeatedly, and without exception, made science-based statements that were simply not correct, and just as importantly, not researched before you made the statements. In addition, you ascribed statements to professor Sellstrom that were simply not true.

I look forward to having further discussions with you, assuming you are able to provide serious scientific information that advances our discussion. Again, I do not think it is constructive to invent accusations about incivility when the discussion has instead been entirely focused on specific scientific matters.

Best regards, Ted Postol

From: Dan Kaszeta
Sent: Wednesday, June 18, 2014 12:23 PM
To: postol@tpostol.com
Cc: Richard Lloyd
Subject: Communications

Dr. Postol,

Unfortunately and with great sorrow, I must ask that our communications now cease. This is principally due to the activities of "SyrianSister".

Dan Kaszeta
London, UK

From: postol@tpostol.com
Sent: Wednesday, June 18, 2014 1:16 PM
To: Dan Kaszeta
Cc: Richard Lloyd ; ake.sellstrom@cbrnecenter.eu ; syr sis
Subject: Thanks for Alerting Us to Your Final Communication

Dear Mr. Kaszeta:

Thank you for informing me that your most recent email is the last that will be between us.

I am troubled that you would state that the reason for ending communications with us is “principally due to the activities of ‘SyrianSister’.” This particular action is consistent with your public tweets where you refer to people as “trolls” when they raise legitimate questions about your numerous false claims.

Our experience with SyrianSister is that she has conducted herself in a totally professional way. She has provided us with technical information that we have needed to advance our analyses, alerted us to technical issues in chemistry that we were not aware of, and has responsibly contributed very useful information to the various technical matters we were investigating. By all professional standards, and by all standards of courtesy, SyrianSister has distinguished herself as a consummate professional.

You, on the other hand, have made an unbroken string of technically false claims. By your own repeated admissions, you have made these claims without either knowledge or even cursory investigation. In addition, you keep coming up with new false claims, that further indicate you have not done any work on the matter of the chemistry of hexamine and that you do not have even an elementary understanding of chemical processes that underlie either your old or your new false claims.

In addition, you have deliberately ascribed false statements to, Professor Åka Sellström, the Head of the UN inspection team that investigated the atrocity of August 21, 2013.

None of this is in any way close to professional conduct – nor is it close to civil discourse. In fact, your conduct has been so persistently dishonest, that the most appropriate way to describe it is as fraud.

You have only gotten some notoriety because of the scandalous failure of due diligence by the mainstream Western press. In different times, before the tragic destruction of large parts of mainstream journalism, you would properly have properly been identified as a fake and ignored.

Your thirst for notoriety is what got you into your current predicament.

There is an old saying,

> It is better to be thought a fool and to keep your mouth shut, then to open your mouth and remove all doubt.

In your case, you have failed to follow the good advice in this proverb.

Sincerely yours, Ted Postol

Theodore A. Postol
Professor of Science, Technology, and National Security Policy
Massachusetts Institute of Technology

Currently in Palo Alto, CA

APPENDIX 2

Communications with Åka Sellström

From: Åke Sellström
Sent: Monday, June 16, 2014 9:44 AM
To: postol@tpostol.com
Subject: SV: An Inquiry Into a Small Technical Matter

Dear Professor Postol,

The presence of hexamine may mean that this substance was used as scavanger for protons when producing sarin.

It is a product simple to get hold of and in no way conclusively points to the governement.

In addition hexamin found in samples may be derived from other sources for example, explosives.

All the best

Åke Sellström

Self proclaimed expert who has absolutely no technical knowledge on the subjects he purports to be an expert designed

From: postol@tpostol.com
Sent: Monday, June 09, 2014 8:48 PM
To: ake.sellstrom@cbrnecenter.eu
Subject: An Inquiry Into a Small Technical Matter

Dear Professor Sellström:

As you may know, my colleague, Richard Lloyd, and I have been examining aspects of the nerve agent attack in Damascus of August 21, 2013. We have inadvertently found ourselves involved in discussions with a man, Dan Kaszeta, who represents himself as an expert on chemical munitions.

Mr. Kaszeta has widely made a claim that hexamine found in a UN sample taken from the Damascus attack site is, to use his words, a “Smoking Gun” that unambiguously points to the Syrian government as the perpetrator of the attack.

My colleague and I have no primary knowledge that would allow us to determine who might have been responsible for the attack, but we have not been able to establish any credible science that could support the claim that hexamine is unique to sarin manufactured by the Syrian government.

I am attaching below an email I sent recently to Mr. Kaszeta raising technical questions about his assertion that the presence of hexamine uniquely identifies the Syrian government as the culprit.

We have carefully reviewed all of the available technical and scientific literature we could find on the subject, and have determined from statements Mr. Kaszeta has made in his twitter conversations that he is claiming that you are the source of his information that hexamine is used by Syria as an acid scavenger in the production of sarin.

To be clear, the source of his claim is as follows:

Kaszeta states that in an interview with Gwyn Winfield, you told her that hexamine could be used as an acid scavenger in the production of sarin. Mr. Kaszeta claims that Ms. Winfield reported your comment in a draft of her article, but it was removed by her editor from the article because of space constraints. Thus,

according to Mr. Kaszeta you are the source of a statement that he uses to claim that hexamine in a UN sample points a smoking gun at the Syrian government.

Mr. Lloyd and I have grown increasingly skeptical about the veracity of statements made by both Mr. Kaszeta and Mr. Higgins, both work together closely. To put it bluntly, we have not been able to verify the accuracy of any technical claims they have made.

I would appreciate it if you could treat this query as if it were from a reporter and answer the following question. Is there any evidence that hexamine is used as an acid scavenger in the production of sarin by the Syrian government?

I am attaching the email I sent to Mr. Kaszeta raising questions about his claim. As a matter of professional standard, I do not believe it is appropriate to cite a claim without technical evidence. I have an old friend from college who is a highly accomplished organic chemist and I am seeking additional information from him. My training is as a physicist, and I make no exalted claims to a background in organic chemistry. That is to say, my only interest is to know whether or not you have information that would indicate that hexamine has been used by the Syrian government to mass produce sarin.

As American citizens, Mr. Lloyd and I have been quite concerned about White House claims that could have led to US military involvement in Syria. This is mostly because we can now say for sure that the White House claims are not based on accurate intelligence. I understand that as a UN staff member you have significant constraints on what you can say. But I hope you will be able to answer my very simple technical question about whether or not you made such a statement to Ms. Winfield and if you have information that indicates hexamine has been used in the mass production of sarin by the Syrian government.

I would appreciate it if you would keep the email attached below confidential for the moment. My reason is simple, I want to give Mr. Kaszeta a chance to answer the questions I have raised in that email. If you are interested, I will be happy to share the entire exchange with you once it is completed.

With best regards, Ted Postol
Professor of Science, Technology, and National Security Policy
Massachusetts Institute Of Technology

From: postol@tpostol.com
Sent: Sunday, June 08, 2014 12:24 AM
To: Dan Kaszeta
Cc: Richard Lloyd
Subject: Questions About a Physics-based Analysis That Shows That Hexamine Could Not Possibly Be Used in the Production of Sarin

Dear Mr. Kaszeta

As you know, Dick and I have been looking at issues associated with the mixing, manufacture, and production of the nerve agent sarin. We have done quite a bit of work on this and have not been able to confirm the technical accuracy of your conclusion that a sample of hexamine that was found by the UN in the aftermath of the August 21, 2013 nerve agent attack in Damascus indicates a “smoking gun” that shows the sarin was manufactured by the Syrian government.

We have reviewed numerous documents and scientific papers that contain information about the fabrication of sarin and have found absolutely no references to the use of hexamine in the manufacture or maintenance of sarin: A short, and hardly complete, list of these documents is as follows:

1. *Handbook of Chemical and Biological Warfare Agents,* D. Hank Ellison
2. *Compendium of the Iraq’s Proscribed Weapons Programs in the Chemical, Biological and Missile Areas,* United Nations Monitoring, Verification and Inspection Commission (UNMOVIC), June 2007

3. *Stability of Iraq's CW stockpile,* CIA, 071596_CIA_72569_72569_01.
4. *Chemical Warfare Agents: Chemistry, Pharmacology, Toxicology, and Therapeutics,* edited by James A. Romano, Brian J. Lukey and Harry Salem, CRC Press, (2008).
5. *Monitoring Chemicals with Possible Chemical Weapons Applications,* Fact Sheet 7, (Organization for the Prohibition of Chemical Weapons)
6. *Comprehensive Report of the Special Advisor to the DCI on Iraq's WMD,* 30 September 2004, Charles Duelfer.
7. *Chemical Weapons Technology,* US Department Of Defense, Office of the under Secretary Of Defense for Acquisition and Technology, February 1998.
8. *A Laboratory History of Chemical Warfare Agents,* Jared Ledgard
9. *Technical Aspects of Chemical Weapon Proliferation, from Technologies Underlying Weapons of Mass Destruction,* OTA, 934408.

Because we were unable to find any references to use of hexamine in the production and storage of sarin we decided to do our own review of the plausibility that hexamine could be used as an acid scavenger in the manufacture of sarin.

Our conclusions is that it is physically impossible to dissolve enough hexamine, even if it were desirable, or chemically possible, to substitute hexamine for isopropylamine to scavenge the acid product of the reactants Methylphosphonyl difluoride and isopropyl alcohol. The only possible way this conclusion could be wrong is if it were possible to dissolve at least 37 percent by weight hexamine in isopropanol. The information we have suggests that the solubility of hexamine in isopropyl alcohol is likely between five and 50 times smaller than the required 37 percent by weight. If you can provide a technical reference that shows otherwise we would greatly appreciate the reference.

The analysis that leads to this very strong conclusion is outlined in the six slides below. We will briefly describe the contents of each of the slides and invite you to review them so you understand the basis for this strong conclusion.

Slide number one shows the two chemical reactions that are critical for the production of stable sarin. The chemical reaction shown at the top of the slide simply shows the products of the reaction between Methylphosphonyl difluoride and isopropyl alcohol. The products are sarin and hydrogen fluoride. As you well know, the hydrogen fluoride has a powerful effect on sarin causing it to be transformed into other far less lethal byproducts. As such, one of the very important additional reactions needed to produce military grade sarin is the use of a chemical that removes the hydrogen fluoride molecules.

This is achieved by adding 28 percent by weight isopropylamine in isopropanol. The chemistry reactions that occur with this substitution are shown in the second chemical equation in slide one.

Slide two shows the source that describes the amount of isopropylamine needed to adequately scavenge the resulting hydrogen fluoride from the sarin. The source is solid, as it is a US government document that is produced for individuals who handle and work with chemical agents.

Slide three shows how very elementary chemical reasoning leads to the conclusion that roughly 0.4 moles of isopropyl amine are required per mole of isopropanol in order to remove the HF that is produced along with the sarin. This indicates that each isopropylamine molecule is in reactions that lead to roughly 2.5 fluorine's being removed from the bath of chemical products. This is an important result.

We have not been unable to find any papers that describe hexamine reacting with hydrogen fluoride or being dissolved in isopropanol in order to function as an acid scavenger. However, we have found one reference to a paper that was published in the Journal Of Canadian Research in 1950. The reference is described as reporting that between one and four fluorine's can be picked up by a hexamine molecule. There is no information about under what conditions this occurs, but as you will see, this particular detail plays no role in determining that hexamine cannot possibly be an acid scavenger in the production of sarin.

Slide four shows a simple ansatz that shows the ***minimum*** amount of hexamine that would have to be dissolved in isopropanol for the hexamine to work as an adequate acid scavenger.

If one makes the heroic assumption that each hexamine can in fact remove four fluorine atoms from the product chain, then it would require 0.25 moles of hexamine for each mole of fluorine to be removed. The molecular weight of hexamine is quite high, roughly 140 grams per mole, which leads to the conclusion that any mixture of isopropanol and hexamine that can function as a scavenger must contain at least 35 grams of hexamine per mole of isopropanol. This leads to the conclusion that the hexamine would have to be 37 percent by weight soluble in isopropanol.

Slide five shows the only solubility data we have been able to obtain for hexamine in ethanol, methanol, and acetone. One of the industrial processes for manufacturing isopropanol is simply to hydrogenate acetone, which is chemically very close to isopropanol (see slide 6). The solubility of hexamine and acetone is roughly 6/10 of one percent by weight. Even if the hydrogenation of acetone drastically changed its solubility characteristics, the best case where there is information is methanol, which at best could dissolve seven percent by weight hexamine. I suspect that the solubility of hexamine in isopropanol has not been reported because the solubility is so low, but I would be surprised if there is not a source of solubility data somewhere.

If you think you can point me to a scientific paper that lists the solubility of hexamine in isopropanol, the matter would be completely settled that hexamine cannot possibly be used in the manufacture of sarin unless hexamine has a drastically higher solubility in isopropanol.

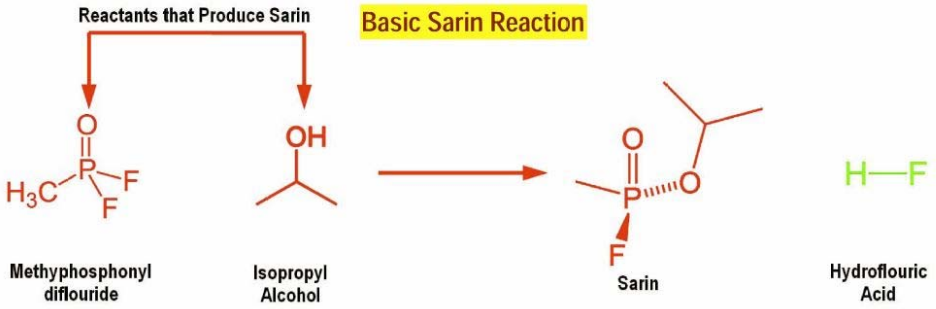
This is extremely unlikely to be the case.

As a result, our review of the technical literature, indicates that hexamine could not possibly be used in the manufacture of sarin, and as such, it could not possibly be a “smoking gun” indicating that the particular sarin at issue was produced by the Syrian government (or anyone else, for that matter).

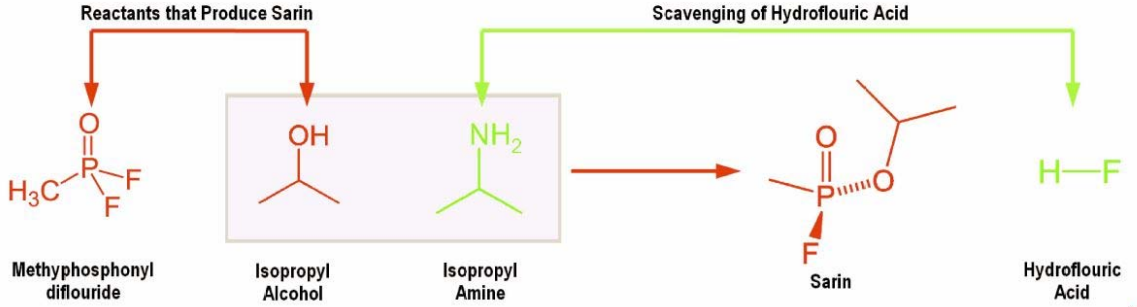
If you have any technical information at all that raises questions about our conclusions, we would be very pleased to get it and to incorporate it into our ongoing analyses.

Best regards, Ted Postol and Richard Lloyd

Reactants Used By the US and Syrian Governments to Produce Sarin (GB)



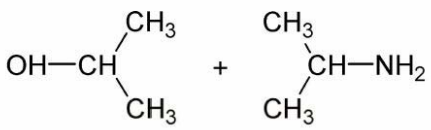
Sarin Reactions Used in Production



1

Isopropyl Amine and Isopropyl Alcohol Mixture Used in the Production of Military Grade Storable Sarin

Table II-53. OPA

Alternate Designations: N/A
Chemical Name: 2-Propanol (isopropyl alcohol) and Isopropyl amine mixture
Synonyms: N/A
CAS Registry Number: 2-Propanol: 67-63-0; Isopropyl amine: 75-31-0
RTECS Number: 2-Propanol: NT8050000; Isopropyl amine: NT8400000
Physical and Chemical Properties
Structural Formula:  72 wt% 2-Propanol 28 wt% Isopropylamine
Molecular Formula: C_3H_8O and C_3H_9N Molecular Weight: 2-Propanol: 60.10; Isopropyl amine: 59.11; Average: 59.81 (based on 72:28 wt. %)

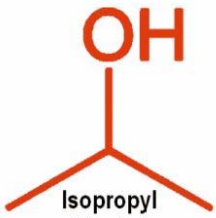
II-72 Isopropylamine and Isopropyl Alcohol (OPA)

Table from: *Potential Military Chemical/Biological Agents and Compounds*, FM3-11.9, January 2005, http://www.fas.org/irp/doddir/army/fm3-11-9.pdf

2

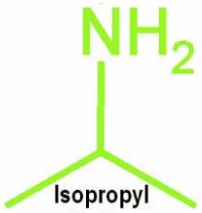
Estimation of Molecular Acid Scavenging Capabilities of Isopropylamine (OPA)

Known H-F Acid Scavenging Capabilities of Isopropyl Amine



Isopropyl Alcohol
60.1 g/mol

OPA



Isopropyl Amine
59.11 g/mol

72% Wt Isopropyl Alcohol

28% Wt Isopropyl Amine

Weight Ratio of 72% to 28% indicates that for each mole of Isopropyl Alcohol there is:

28/72*59.11 = 23 g of IsopropylAmine

This is 23/59.11= 0.39 Moles of IsopropylAmine

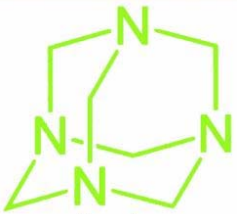
Since 1 mole of Isopropyl Alcohol produces 1 mole of HF-
Then:
Each molecule of Isopropylamine must pick up roughly 2.5 Flourine atoms

3

Estimation of Required Solubility of Hexamine Needed to Replace (OPA) as the Acid Scavenging Agents in Sarin Production

Weight of Hexamine Needed for Adequate H-F Acid Scavenging

Isopropyl Alcohol
60.1 g/mol



Hexamine
140.2 g/mol

If Each Hexamine Molecule Can Acquire a Maximum of Four Flourine Atoms
Then

0.25 moles of Hexamine can Scavenge 1 Mole of H-F Acid.

Thus, a mixture of 1 mole Isopropyl Alcohol + 0.25 moles Hexamine is required to produce 1 mole of Sarin while removing 1 mole of H-F side product

The weight of 0.25 moles of Hexamine id 0.25 × 140.2 g/mole = 35 g of Hexamine.`

This indicates that the required *weight fraction of Hexamine* in Isopropyl Alcohol must be for Hexamine to functiona s an acid scavenger in the production of Sarin from Methyphosphonyl diflouride.:

$$\frac{35}{60.1+35} = 37\%$$

4

Solubility Data for Hexamine Indicates that It Cannot Be An Adequate Acid Scavenging Agent in Sarin Production

http://www.sinachem.com/index.php?option=com_content&view=article&id=23&Itemid=87

Hexamine Min. 99.5 Percent

HEXAMINE (C6H12N4) / Capacity : 5000 MTPY

HEXAMINE STABILIZED (0.5 -1.5 %)

Hexamine is formed by the reaction of formaldehyde and ammonia, reacts as formaldehyde in many instances and therefore may be regarded as a special form of formaldehyde from the stand point of use.

Hexamine Unstabilized		
Specification	**Unit**	**Result**
Appearance		white Crystalline powder
Purity	wt%	Min. 99.5
Ash Content	wt%	Max. 0.03
Humidity	wt%	Max. 0.25
Ammonia	wt%	Max. 0.02
Formaldehyde	wt%	Max. 0.02
Chloride		Nil
Sulfate		Nil
Heavy metal		Nil
pH (10% Aq. solution.)		8 - 9
Mesh Size		80 - 800 Micron US mesh 2C - 170 0.08 - 0.8 mm
Molecular Weight	gr	140.2
Melting Point	°c	270 (Decomposition)
Density	gr/cm3	1.33
Bulk weight	gr/cm3	0.7 - 0.8
Solubility @ 12°c in: Water	wt%	81.3
Solubility @ 20°c in: Methanol	wt%	7.25
Solubility @ 20°c in: Absolute Ethanol	wt%	2.89
Solubility @ 20°c in: Acetone	wt%	0.65
Hexamine Stabilized (0.5Wt% Silica) *		
Appearance		white Crystalline
Purity	wt%	Min. 99
Ash Content	wt%	Max. 0.53
Humidity	wt%	Max. 0.25
Ammonia	wt%	Max. 0.02
Formaldehyde	wt%	Max. 0.02
Chloride		Nil
Sulfate		Nil
Heavy metal		Nil
pH (10% Aq. solution)		8 - 9
Mesh Size		80 - 800 micron US Mesh 2C - 170 0.08 - 0.8 mm

5

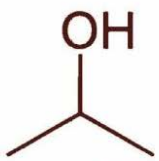
NO Solubility Data is Available for Hexamine in Isopropyl Alcohol -- Closest Chemical Solvent is Acetone

Solubility by Weight of Hexamine @ 20°c in Acetone = *0.65%*
(Solubility Roughly 57 Times too Low)

Solubility by Weight of Hexamine @ 20°c in Ethanol = 2.89%
(Solubility Roughly 13 Times too Low)

Solubility by Weight of Hexamine @ 20°c in Methanol = 7.25%
(Solubility Roughly 5 Times too Low)

Acetone

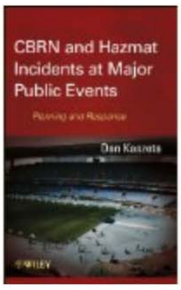


Isopropyl Alcohol

6

APPENDIX 3

Book by Kaszeta is a Procedural Manual for Local Police and Organizations Planning Public Events Where there are Concerns that Hazardous Materials Might be Released

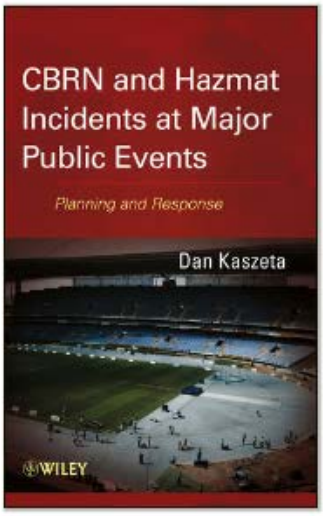


Cbrn and Hazmat Incidents at Major Public Events: Planning and Response

(10)

Formats	Price	New	Used
Unknown Binding			
Currently unavailable			

Currently Unavailable at Amazon



E-BOOK

CBRN and Hazmat Incidents at Major Public Events: Planning and Response

Dan Kaszeta

ISBN: 978-1-118-52970-6

448 pages
November 2012

WHY AM I QUALIFIED TO WRITE THIS BOOK?

First, by definition I am more qualified than anyone else who has written a book on this subject, because nobody else has a book in print on this specific subject. However, that's just a technicality. I have been working for 20 years in the field of CBRN defense and HAZMAT response. My career has taken me on a grand tour through the whole sphere of CBRN/HAZMAT, while also giving me experience in other related sectors such as emergency medicine, military operations, law enforcement, and emergency planning. As we have already discussed, planning for major events sits at the nexus of several different important operational disciplines, and I feel particularly privileged to have worked precisely in that nexus. I was originally trained as a Chemical Corps officer in the United States Army, but my career path forced me to receive training and experience in many other disciplines, including protective security, emergency management, intelligence, radiation safety and health physics, incident command, explosives/demolition, fire safety, hazardous materials, and physical security.

FIGURE 9.1 Make sure you know how to handle a crime scene.
Source: U.S. National Institutes of Health, image released into public domain.

FIGURE 8.2 Hospitals need to be ready to perform decontamination.
Source: U.S. Armed Forces Radiobiology Research Institute public-domain image.

Additional Note on Mr. Kaszeta's Training:
He has a Bachelor of Arts in Political Science from Georgetown University
and a Master of Arts in XXX from YYY.

FIGURE 9.2 Example of police CBRN PPE.
Source: U.S. National Institutes of Justice, image released into public domain.

APPENDIX 4

New York Times Article That Uncritically Reports Fraudulent Claims Made by Dan Kaszeta about Hexamine Indicating Syrian Government Involvement in the Nerve Agent Attack of August 21, 201 3

The New York Times

Wednesday, December 18, 2013

Report Detail Could Further Implicate Syria in Chemical Attack, Analysts Say

By SOMINI SENGUPTA
Published: December 18, 2013

UNITED NATIONS — Buried in the annex of a United Nations inquiry into chemical weapons use in Syria is information that some outside analysts say could further implicate the government of Syria in the deadliest of the five confirmed attacks.

The investigators, who released their final report last week, said they had found a chemical called hexamethylenetetramine from environmental samples in Ghouta, the Damascus suburb that was the site of the deadliest attack, on Aug. 21. Hexamine, as the chemical is also known, can be used as an additive in the production of chemical weapons using sarin, the nerve agent, according to analysts, along with other commercial uses. The Syrian government happens to have a stockpile of hexamine; it is part of a list of chemicals scheduled to be destroyed as part of the deal to dismantle Syria's chemical weapons program.

United Nations investigators who conducted the inquiry pointedly steered clear of assigning blame for any of the attacks. The investigators have declined to explain Syria's purpose in amassing the hexamine, a common commercial chemical.

Bassam Khabieh/Reuters

Investigators said they found a chemical in Ghouta, a Damascus suburb that was the site of a deadly attack on Aug. 21, above, that can be used to produce some chemical weapons.

But some experts who reviewed the panel's final report said the presence of hexamine at Ghouta was in some ways akin to the police finding red lipstick in a woman's purse that matches collar stains on a murder victim. While considered circumstantial evidence, it added to information in the panel's interim report on Ghouta released in September, on the type of projectiles used that appeared to implicate the Syrian government.

The hexamine connection was pointed out last week by Dan Kaszeta, an independent security consultant and former officer in the United States Army's Chemical Corps. He argued that the presence of hexamine pointed to the involvement of the government in the attack on Ghouta.

"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," Mr. Kaszeta wrote on his website.

The Syrian government, which has denied carrying out any of the attacks, declared possession of 80 tons of hexamine. It is listed among substances that need to be treated and disposed, according to the Organization for the Prohibition of Chemical Weapons, or O.P.C.W., a group based in The Hague working with the United Nations to oversee the dismantling of Syria's arsenal.

The group in November invited bids from companies that could carry out the disposal. Before that bidding invitation was made public, it had not been widely known that Syria had hexamine. The group has not said whether and how Syria used hexamine.

Asked about the presence of hexamine in the annex of the United Nations panel's report, Scott Cairns, a chemical weapons expert who is a member of the panel, would say only that hexamine is a chemical that could be used in the production of weapons using sarin. It is also commonly found in heating fuel, as well as in conventional explosives.

Ron Manley, a chemical arms expert who headed the verification team at the Organization for the Prohibition of Chemical Weapons from 1993 to 2002, said hexamine was certainly part of the government's chemical weapons arsenal. Otherwise, it would not have been listed on the items that must be destroyed.

"The fact that they declared it to the O.P.C.W. means it was part of their C.W. program," he said "There's no doubt it was part of their program. What part it played we don't know."

Both Mr. Manley and Mr. Kaszeta said hexamine could be particularly valuable in reducing the corrosive effects of what are known as binary sarin weapons. Those weapons can produce highly destructive acids that can corrode even the metal cylinders that hold the nerve agent. Hexamine can neutralize the acids, ensuring that they do not destroy the weapon itself. That could explain, Mr. Kaszeta said, why the government had so much hexamine.

While hexamine is not a common additive to stabilize sarin, both analysts said it could have been used for that purpose.

Since hexamine is also widely available commercially, analysts noted, it is impossible to point to hexamine's presence on the battlefield as conclusive evidence of who made the chemical weapons used in the Ghouta attack.

Other chemists have said hexamine could have been used in the blaster components of the weapons that dispersed the nerve agent, but that would not explain why hexamine was on the list of chemicals in the government's arsenal.

The United Nations investigators have repeatedly said that their mandate was limited to establishing the facts of what happened and not who was responsible. They investigated seven possible episodes in all, from March to August. In five, including Ghouta, they found credible evidence that chemical weapons had been used. In Ghouta, they collected the most information, including environmental samples from where the ordnance landed. Their final report was submitted to Ban Ki-moon, the United Nations secretary general, last Thursday and made public.

Their report lists several places where they found hexamine in Ghouta, including on the floor and a wall of a house where a rocket had landed, a piece of ordnance from the floor of an outdoor terrace next door, and in a rocket fragment found on a nearby roof.

The investigation yielded few details on the four other episodes. The United Nations team was unable to go to the site of the attacks in some cases and could not collect biomedical or environmental samples directly. Unlike in Ghouta, some of the attacks appeared to have been small-scale efforts, using unusual methods, including what witnesses described to be plastic grenades dropped from helicopters.

The Syrian government, which has blamed insurgents for all the attacks, has been unusually cooperative in getting rid of its arsenal since making the pledge to ban them in September. The Syrian ambassador to the United Nations, Bashar Jaafari, told reporters on Monday that in his country, “the chapter is closed.”

A version of this article appears in print on December 19, 2013, on page A18 of the New York edition with the headline: Report Detail Could Further Implicate Syria in Chemical Attack, Analysts Say.

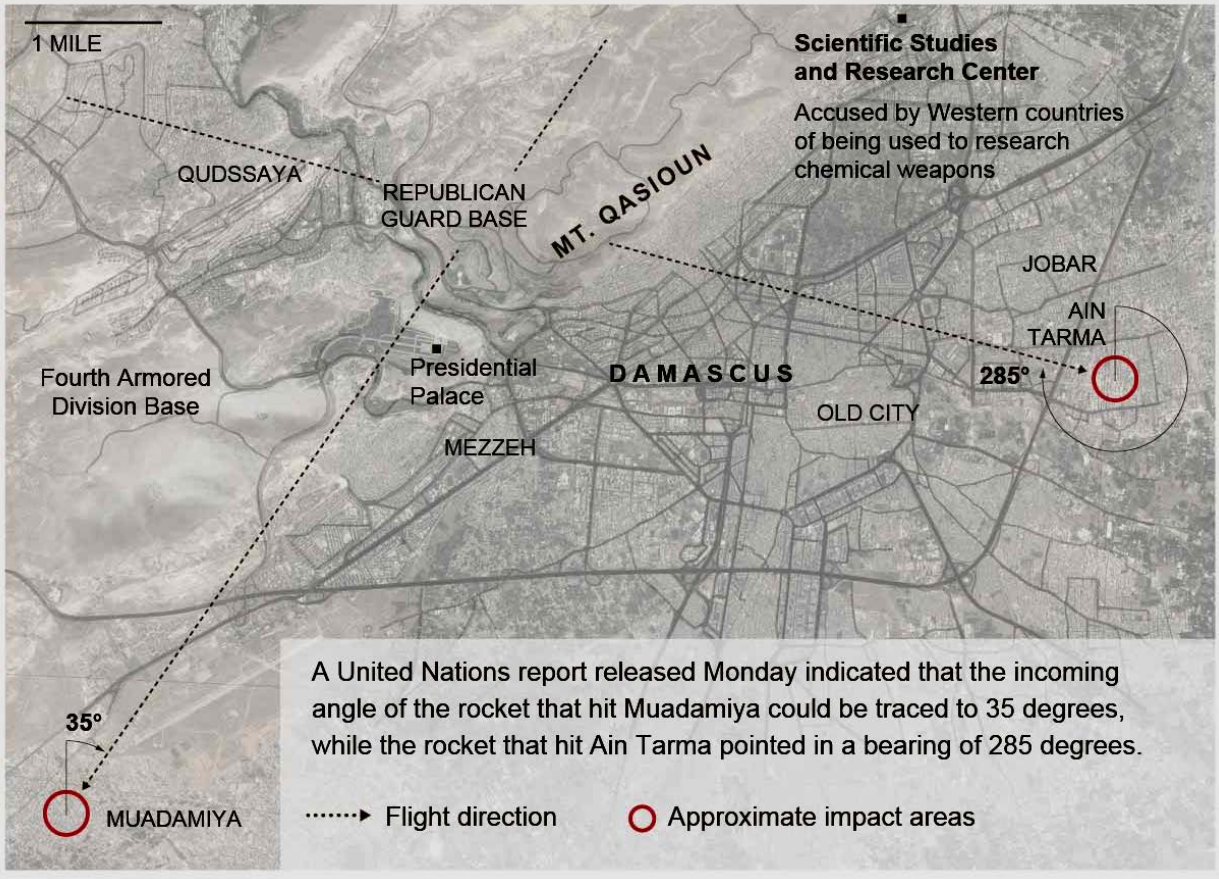
APPENDIX 5

Map Published on the First Page of the New York Times Uncritically Reported Incorrect Assertions About the Source of the Attack by Human Rights Watch. When Lloyd and Postol Found that the Human Rights Watch Claims Could Not be Correct, Human Rights Watch Did Not Respond their Several Attempts to Engage in Technical Discussions on the Incorrect Finding

Published: September 17, 2013

Clues in the United Nations Report

Related Article »



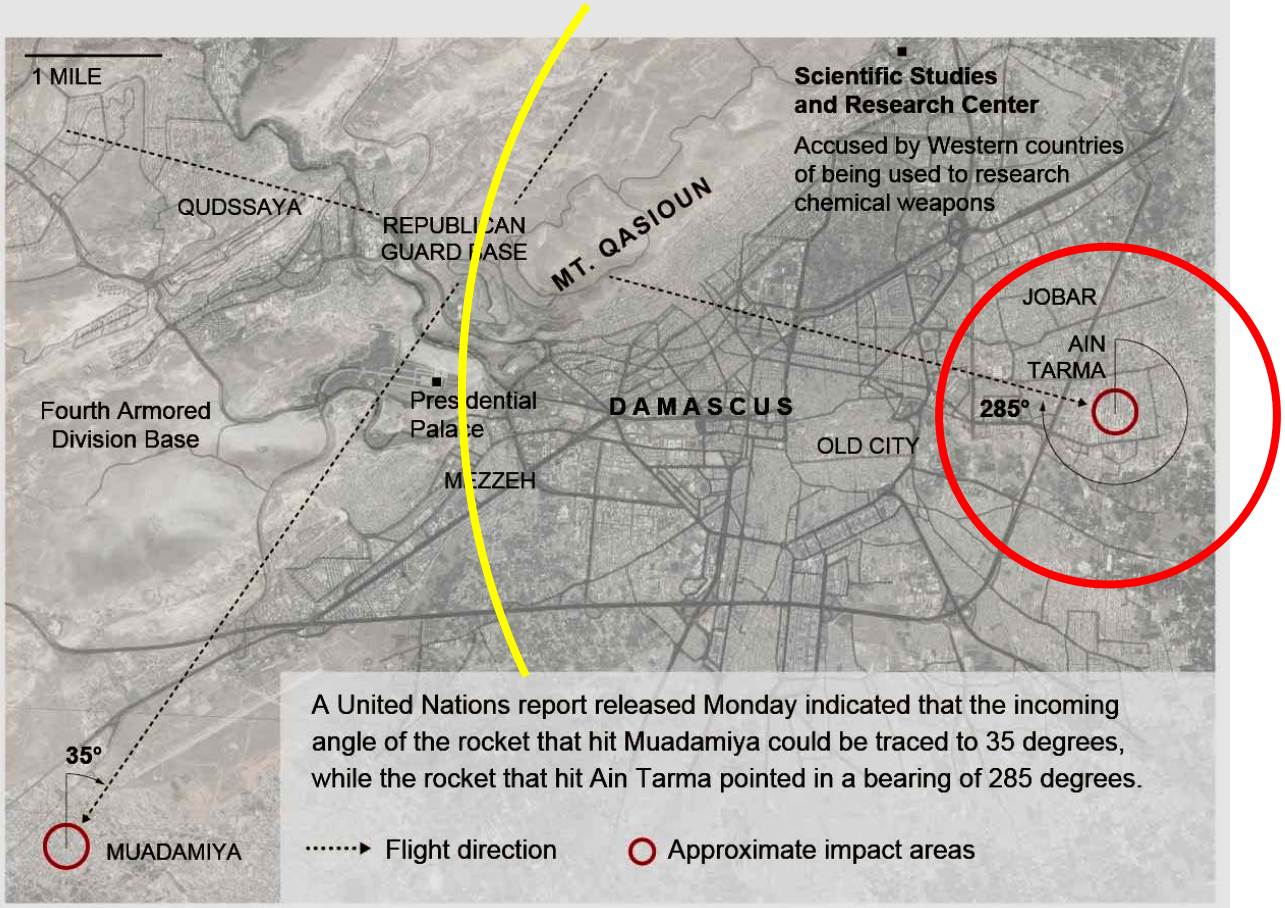
APPENDIX 5

Map Below Shows the Ranges of the Chemical Munitions *Assumed* by Human Rights Watch (Yellow Line) and the Range Calculated from First Principles by Lloyd and Postol. When the Lloyd /Postol Munition Range was Confirmed in a Press Conference by Akak Sellstrom, in response to a Question from the Press, Eliot Higgins, Mr Kaszeta's Close Associate All of a SuddenStarted Claiming that He Had Evidence that Syrian Government Forces Were Able to Launch the Attack from Rebel Controlled Areas that Were Much Closer to the Target Area.

Published: September 17, 2013

Clues in the United Nations Report

Related Article »



APPENDIX 6

http://www.lrb.co.uk/v36/n10/letters

London Review of Books

Letters

Vol. 36 No. 10 • 22 May 2014 Year: 2014 Issue: 10

Whose sarin?

Jamie Allinson makes some false technical claims in his critique of Seymour Hersh (Letters, 8 May). What Hersh reports is entirely plausible, and consistent with facts that emerged from our more limited but irrefutable technical studies of the circumstances surrounding the nerve agent attack in Damascus on 21 August 2013. Our findings, which have become the basis for the 'new' arguments being made against Hersh by people like Allinson, and supposedly knowledgeable non-government organisations like Human Rights Watch and the *New York Times*, raise the most serious questions about whether the White House lied about technical intelligence associated with the attack.

Allinson is correct that the improvised rockets he calls Volcanoes each contained about fifty litres of sarin, but wrong in his claim that they were fired from a regime-held area 'to the north'. These claims are not original, but repeat those of Eliot Higgins, a blogger who, although he has been widely quoted as an expert in the American mainstream media, has changed his facts every time new technical information has challenged his conclusion that the Syrian government must have been responsible for the sarin attack. In addition, the claims that Higgins makes that are correct are all derived from our findings, which have been transmitted to him in numerous exchanges.

Before we began reporting findings from our analyses, there were published reports estimating that the sarin load carried by the rockets was about five litres. We showed, from detailed engineering analyses of rocket debris, that the rockets contained as much as fifty litres. This finding was hailed by members of the US government and non-government organisations, such as Human Rights Watch and the *New York Times*, as proof that the Syrian government had executed the atrocity of 21 August. In a follow-up analysis, we found that it could not possibly have been the case that the deadly rockets were fired from Syrian government- controlled areas as far as ten kilometres away, as claimed by the US government and non-government organisations. We showed that the shape of the rockets resulted in extreme aerodynamic drag, limiting their range to about 2 to 2.5 kilometres. This finding was met with great resistance in the media.

We also analysed the impact debris from the single rocket for which data was available (there is no data for multiple rocket impacts despite Allinson's claim). We showed that those who argued that the Syrian government had fired the rockets had incorrectly determined the direction of arrival as being from the northwest. We showed that the actual direction was from the north. This new technical insight quickly prompted a new 'discovery'. There was a checkpoint to the north, close to the area controlled by Syrian government forces, from which the deadly short-range rockets could have been launched. However, if they had been fired from this location, the impact pattern of the rockets used in the attack would have required them to have a range well in excess of five kilometres - which we have shown cannot be the case.

We do not claim to know who was actually behind the attack of 21 August in Damascus. But we can say for sure that neither do the people who claim to have clear evidence that it was the Syrian government. The mainstream American media have done a disservice to the public by allowing politically motivated individuals, governments, and non-government organisations to misrepresent facts that clearly point to serious breaches of the truth by the White House.

Richard Lloyd; Ted Postol

Spokane, Washington; Massachusetts Institute of Technology

APPENDIX 7

April 2014

CBRNE NEWSLETTER TERRORISM

E-Journal for CBRNE & CT First Responders

2 April 2014

Why Nigel Farage has it all wrong: Smoking guns, Hexamine, and Syrian Sarin

By Dan Kaszeta

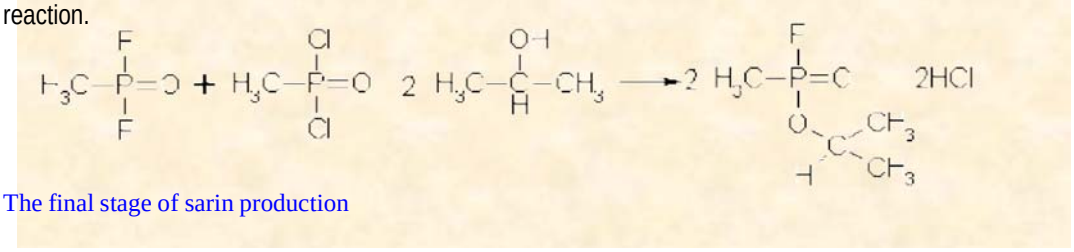
This evening witnessed the odd spectacle[i] of Mr. Nigel Farage, MEP and head of the rightwing UK Independence Party, giving ventilation to discredited theories. This is not the first time strange utterances have come from Mr. Farage, but this time he has parked himself squarely in the lane of my expertise. Sadly, he's placed himself on the side of the brutal Assad dictatorship by repeating conspiracy theories that somehow Syrian rebels perpetrated the 21 August 2013 attacks on themselves. This canard has been proved to be substantially wrong. Others address it by means of analysis[ii] of the rockets used, but I rely on the technical aspects of the chemical weapon that was used. I am using this particular opportunity to summarize the work myself and many others have done over the last months to get to the bottom of the 8/21 attacks.

The UN Office of the High Commissioner for Human Rights issued a UN report[iii] that confirms what I have known to be the case for some time. There is evidence tying the Sarin chemical warfare agent used at Ghouta last year to the significant chemical warfare stockpile of the Syrian government. I originally formulated my ideas in November of last year, and provisionally called them the 'Hexamine Hypothesis', a theory which now appears to be vindicated. Indeed, I believe that the chemical hexamine is a unique link tying the Ghouta war crimes to the Syrian government. This article explains the what, why, and how of the 'Hexamine Hypothesis'.

Note: In spite of claiming knowledge of at least 20 production paths to Sarin, Mr. Kaszeta could not produce even a single scientific or technical paper on how Hexamine can be used to produce Sarin (T. A. Postol)

Two general categories of Sarin:

To the layman, Sarin is Sarin. But that's simply not true. I have spent a lot of time and effort studying the history of Sarin and the particularly obtuse history of industrial efforts to produce Sarin. There are at least 20 production pathways to Sarin, each of at least 5 steps. I do not exclude the theoretical possibility of additional pathways to Sarin being developed in a laboratory at some point in the future. All of these methods rely on one of two reactions to produce Sarin in the final chemical reaction. For the purposes of this discussion, we can divide Sarin into two basic categories, based on the final chemical reaction.



The final stage of sarin production

DF + Isopropanol reaction. The simplest methods react DF and Isopropanol. Often, online sources, some of which are of dubious provenance, refer exclusively to these methods. Most of the 20 or so Sarin production pathways use this reaction. This reaction combines DF (methylphosphonyl difluoride) with isopropyl alcohol. 1 mol DF + 1 mol Isopropanol react to create 1 mol Sarin + 1 mol HF (hydrogen fluoride). By mass, this works out to 140 g of HF for each 1 kg of Sarin produced. As you probably can understand, this residual HF is highly dangerous and destructive. It is corrosive to most materials and seriously reduces the shelf-life of the Sarin. Indeed, this reaction is really only suitable for binary-type weapons, and even then only if you do something about the residual HF acid. (More on this later.) The Japanese Aum Shin Rikyo cult, which used Sarin in 1994-1995 in terrorist attacks in Japan used one of the methods using this step. If you are making Sarin to keep for a long period of time, production processes that use this reaction are not very useful as it is indeed hard to get rid of this HF. Saddam Hussein's Iraq discovered this, because they used these methods, and the shelf life of their Sarin could be measured in weeks. The US military used this method in the M687 binary Sarin artillery shell, and found that, without some method to counteract the HF, the binary Sarin weapon systems barely survived the six to ten seconds time of flight of an artillery shell.

"High quality Sarin" – Some critics have made points about whether or not the 8/21

Sarin was "high quality" or not. It should be noted that this DF + Isopropanol reaction cannot make "pure" or "high grade Sarin" by definition. This process produces a cocktail of Sarin and HF. It produces a mix that is, at best, 50% Sarin by mol or 87% if you go by weight.

The DC+DF reaction (The "di-di" process.) - The US and the Soviet Union both realized that DF+Isopropyl worked, but created Sarin that was not very useful for long-term storage. Both the US and the Soviet Union wanted to have weapons that could be kept in long-term storage until they were needed, not artillery shells and rockets that had only a few months shelf-life. In this method, equal parts of DC (methylphosphonic dichloride) and DF are reacted with alcohol to produce Sarin and HCl. From an economic and industrial viewpoint, these DC+DF methods are more complicated, because they require effectively two parallel production paths, one for DF and one for DC. The important difference is the residual contaminant in the Sarin. In the di-di process, the residual is hydrogen chloride (HCl) not HF. While being corrosive and dangerous, is not as difficult to deal with the HCl as is the HF in the other methods. More importantly, it is much more possible on an industrial scale to refine this residual HCl out of the Sarin and get a high purity product. Getting rid of this excess HCl is still not easy and both the US and the Soviet Union had to do a lot of research and spend much time and money to figure out how to do it. These issues were eventually solved, but the effort to do so was measured in years and millions of dollars. It was a complex industrial process and is still considered a secret. Indeed, the US had to re-refine its earlier stockpiles of Sarin in order to ensure a long shelf-life for its Sarin.

Environmental and biomedical samples after 8/21:

The joint UN/OPCW mission collected a number of biomedical and environmental samples. If we delve into the details of both the interim and the final reports as well as various reports and statement made by the OPCW, there are interesting conclusions we can make if we carefully examine the fine details. These are as follows:

- Sarin was used, not some other chemical. We know this for the following reasons:
  - Sarin was actually detected in field samples
  - Both unique and generic Sarin decomposition products were detected in field samples
  - Sarin was re-generated out of protein adducts in human blood using a sophisticated method known as fluoride regeneration.
- The Sarin was binary, produced from a DF + alcohol method. We know this for several reasons:
  - The OPCW's own documents[iv] refer to the Syrian government having binary methods for production of chemical warfare agents. A chemical known as MPFA (methylphosphonofluoridic acid) was found in many of the environmental samples. This is a hydrolysis product of DF. DF degrades quickly into MPFA in the environment. This is no smoking gun on its own, as MPFA is also a decomposition product of Sarin under alkaline conditions.
  - No DF was found. But I would not expect this, as DF is far more volatile than Sarin, and would have either evaporated or degraded.
  - A DC+DF method requires DC. There is no evidence of DC production, DC precursors, or DC decomposition products.
- The chemical hexamine, also known as hexamethylenetetramine, was present in large numbers of the field samples. It would appear that the munitions contained hexamine for some reason. The significance of this finding was unknown to me at the time. But with only one exception (a headscarf), hexamine was in every sample that had Sarin or Sarin decomposition products. There were also many samples that had hexamine, but no Sarin, but this is a logical state of affairs as hexamine does not evaporate like Sarin does.

The Syrian Regime's Declared Inventory of Chemicals

An interesting revelation occurred 20 November 2013. The OPCW issued a document called a "Request for Expression of Interest[v]" for the disposal of chemicals from Syria. This document described the OPCW's requirements to safely get rid of various chemicals from the Syrian government's chemical weapons program. The serious high-grade chemicals, such as chemical warfare agents themselves

and immediate precursors aren't listed. So this document represents an effort to get rid of the various feedstock, additive, and waste chemicals that represent less of a proliferation hazard. For example, the list contains 30 tons of phosphorous trichloride, which is an early feedstock chemical in many of the production methods for making Sarin. The list also included 80 tons of hexamine. This is really interesting. There's hexamine all over the battlefield and hexamine in the storage vaults of the Syrian government.

Knowing how the Chemical Weapons Convention is written and understanding how the OPCW works, one can make several assumptions from this revelation.

- *Assad's government admitted to having 80 tons of hexamine*. This kind of list would only be made based on declarations by the Syrian government. The OPCW inspectors did not have the resources or wherewithal to crawl into every nook and cranny of Syria during an active war. If 80 tons of hexamine are on this list, it is likely because this list was given to the OPCW by the Syrian government.
- *The Hexamine is for chemical weapons purposes*: The OPCW operates within the terms of its mandate. Hexamine isn't a substance on the various schedules of the CWC. The OPCW has no remit to deal hexamine for its numerous commercial and industrial uses, including the manufacture of RDX, an explosive. If it is on this list, it is because either the OPCW believes it has a use in chemical weapons industrial processes, the Syrians said that it was for such processes, or both.
- *80 tons ain't cheap to get rid of:* The OPCW is not going to spend money getting rid of 80 tons of a chemical unrelated to either its remit or the problem at hand.
- *Hexamine would have been easy to deny*: If the Assad regime wanted to deny the 8/21 attacks, they would have had ample opportunity to do so by not declaring the hexamine. As it is not a scheduled chemical under the CWC it would have been quite easy for Syria to not declare it.

The Hexamine Hypothesis

So, what is the hexamine doing on the list? And why is it all over the battlefield. There are many commercial and industrial uses of hexamine[vi], as a cooking and heating fuel, as the most common example. It also has uses as an anti-corrosion aide. However, it has very little history of use in the history of chemical warfare. Indeed, I researched the subject at some length and the only use I could find was its sporadic use as an anticorrosion additive in the seriously outdated Levinstein Mustard, an older form of Sulfur Mustard (commonly misnamed "Mustard Gas"). There's no use for hexamine in Mustard production processes after the 1920s, and it does not occur as trace content in published specifications for either older or more recent US Mustard, nor does it have any use as a precursor.

Hexamine's anti-corrosion properties stem partly or even largely from its ability to bind with acid molecules. This is where it gets interesting. The US Army spent a lot of time trying to turn binary Sarin, made by the DF + Isopropanol method into a useful weapon system. This process, described in detail above, results not in pure Sarin but in a cocktail of Sarin and Hydrogen Fluoride (HF). When the US tried to make weapons, like the M687 155mm howitzer round, using the binary method, this surplus HF was like a wrecking ball inside the munition. Most of the information from the M687 program is still not available, but it takes little imagination or technical knowledge to realize that HF, one of the most corrosive chemicals in existence, will have a serious deleterious effect on things like the case of the shell, the fuze, and the conventional explosive bursting charge. The US military found that the chemical isopropylamine (also noted in the Syrian inventory, by the way) was an isopropanolamine as an additive[vii] to reduce the HF content in Sarin produced by the DF + Isopropanol method. The US M687 howitzer shell combined a cartridge of DF with a cartridge containing a mix of 72% isopropyl alcohol and 28% isopropylamine, a ratio published in the US Army's Field Manual 3-9.

While isopropylamine is the amine compound of record for use in Sarin, other amines are of use for acid scavenging, including hexamine. I found a dissertation on the usefulness of hexamine specifically as an HF scavenger[viii], noting the ability of one molecule of hexamine to bind up to four molecules of HF. I consulted 5 chemists and an engineer, all of whom affirmed to me that hexamine's utility of an acid scavenger. Hexamine can be used in binary Sarin as an acid scavenger, either on its own or in conjunction with isopropylamine. Because this is an "off-label" use of hexamine, and one never done before, if hexamine was in the Syrian government recipe (as implied by the inventory) AND in the field samples, it is strong evidence that the 8/21 Sarin came from government inventories and was made using a unique Syrian government process.

Of particular interest is environmental sample 25, which was taken from the screwthread of a bolt on one of the rockets. No amount of hexamine in the ambient environment for cooking purposes could explain the presence of hexamine on this component of the actual weapon system. There's no physical or mechanical mechanism to explain why hexamine elsewhere in the environment would get onto a screw-thread. Hexamine on the screw thread is consistent with hexamine dissolved in the expected cocktail of substances that result from a binary reaction.

The Hypothesis Confirmed

After working hard to confirm my suspicions about hexamine as the acid reducer in Sarin, I originally broached this idea in an article in NOW Lebanon[ix] in early December 2013. Somini Sengupta at the New York Times interviewed me at length, and an appropriate question was put to the OPCW in congressional hearings on 13 December 2013[x]. Ms. Sengupta put forward the hexamine hypothesis in the New York Times[xi] on 18 December 2013. I knew I was onto something serious because of the furious onslaught of trolling, threats, and general cyberbullying I received as a result of voicing the hexamine hypothesis. Ake Sellstrom, Swedish CBRNE expert and head of the UN/OPCW inspection mission, acknowledged the role of hexamine in the following extract from Sellstrom interview[xii] from his interview with CBRNe World magazine:

CBRNe World *- Why was hexamine on the list of chemical scheduled to be destroyed - it has many other battlefield uses as well as Sarin? Did you request to put it on the list or had the Syrian's claimed that they were using it?*

Sellstrom - *It is in their formula, it is their acid scavenger*.

I confirmed the veracity of this statement in an email exchange with Prof. Sellstrom, although he did not provide further elaboration. This is as close as I can ever hope to a confirmation of my hexamine hypothesis, and I believe that this was one of the reasons, if not the strongest reason, that the UN firmly concluded that the 8/21 Sarin came from Syrian government stockpiles.

The lack of compelling alternative narratives helps to reinforce the conclusion. Other attempts to come up with a logical explanation for hexamine are based on some combination of wishful thinking, stretches in credibility, and/or faulty chemistry.

Conclusion

I believe the regime committed the 8/21 Sarin attack. The following formula is a useful summation of the evidence:

Nobody's used hexamine previously as a Sarin additive

+

There's hexamine in the field samples

+

There's 80 tons of hexamine in the declared inventory of the Assad Regime

+

The Syrian government's admission to Sellstrom's team

EQUALS

The Assad Regime Did the Wicked Deed

April 2014

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(Highlighting Added)

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