

## **What Happened? If it isn't Sarin, what is it?**

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### **Some General Notes and Observations**

1. This is strictly an opinion document, applying my own experience and education to the evidence that I have seen and the information that has been provided to me.
2. If anyone has any additional information of use, please let me know. Several contributors have been very helpful.
3. A very bad tragedy, probably man-made and deliberate, has occurred. A few commentators have made the logical leap from my skepticism about the exact causative agent to some sort of belief that because I think it may not have been Sarin, somehow I am denying the tragedy. I categorically deny this assertion.
4. This document replaces the document entitled "If it isn't Sarin, what is it?" I wrote on 23 August. Most of this document is the same, with a few additions and changes based on more recent information.
5. Significant efforts to peer review this document have been made and a number of people with significant expertise in the field have told me that they broadly agree with my reasoning.
6. Issues of chemical warfare forensics, evidence collection, and crime scene investigation are very important. I will try to prepare a paper on this subject and present it in the next few days. I encourage readers interested in this subject to read my notes on it in pages 286-295 of my book (<http://strongpointsecurity.co.uk/new-book/>) or the excellent books by Steven Drieland.

### **Who did it?**

I believe that it is likely that this was a deliberate attack, not some strange accident. I think that there are multiple hypotheses about who may have perpetrated this attack. However, I am now making the conscious decision to leave the arguments about who did it to others. My experience is best focused on the "what" and the "how" and there are others with greater knowledge of the politics and factors on the ground who can speculate about the "who." Like any murder investigation (which this is), much can be determined about the "who did it" if we can gain more information on the "what" and "how."

**Why I think that the Damascus-area attacks probably were not caused by Sarin or another of the "nerve agent" family of chemical warfare agents:**

Much in-depth information about Sarin is in my lengthy paper on the subject available at this link: <http://tinyurl.com/jwmtge4>

1. The number of people affected indicates to me that whatever toxic substance was used, a large volume of material is needed. Whatever this was, there was a lot of it.
2. Sarin and the other nerve agents are liquids at room temperature. Nerve agents pose a strong contamination hazard. They soak into soil and clothing. It seems unlikely that a large number of people were affected without a number of them being exposed to agent in liquid form, contaminating skin, hair, and/or clothing to some extent.
3. If one of the nerve agents was used, I would expect a portion of the casualties to have come into contact with liquid agent. This would be even more pronounced if a nerve agent other than Sarin, e.g. Tabun, Soman, or VX was used, as they evaporate more slowly. This is because Sarin does evaporate quickly, due to both its high vapor pressure and relatively low latent heat of vaporization. Liquid sarin in the open at warm temperatures cannot be expected to stay in liquid form for very long. Sarin in liquid form can be expected to last 30 minutes at +15 deg C before evaporation<sup>1</sup>. It will, however, get trapped in hair and clothing.
4. Available military manuals<sup>2</sup> tell me that Sarin vapors can be trapped in clothing.
5. In the videos, people are standing around both the dead and injured. Medical providers, both professional and obvious amateurs are handling injured people and their clothing, with no protective equipment. Many dead bodies are handled with no gloves. If some of the dead and injured were contaminated with even minute amounts of nerve agent, other people would be getting ill very quickly.
6. There are now reports of secondary effects, well after the event, of medical providers showing symptoms. This is, indeed, an indication in the direction of a possible nerve agent. This is a very interesting development and more information is needed about exact signs/symptoms, time of onset, and duration of symptoms in order for this to form useful intelligence. Nerve agents, such as sarin, have cumulative effects. In other words, low level doses over a period of time can have the same effects as a larger acute dose. However, more information about is needed to be able to form a conclusion.
7. In many of the videos, water is used for decontamination of skin and eyes. In some cases clothing is removed. But the clothing and water is left on the floor and many people are seen walking in the water and stepping on the clothing. This tells me one of the following is likely to be the case, all of which lead away from nerve agents, not towards nerve agents as a cause:
  - a. There is nothing on the clothing, skin, or eyes to be removed.

- b. There is something, but it does not cause immediate adverse affects to people in the area.
- c. There is something bad present, but water inactivates it.
- d. There is something toxic, but it has a delayed effect.

So... ***Where is the contamination?***

- 8. The most prevalent and obvious symptoms seem to be difficulty breathing, respiratory irritation, and irritation to the eyes. While indeed very serious, these symptoms in themselves are very generic and can be caused by literally thousands of possible toxic chemicals.
- 9. Some, but not all of the signs and symptoms of nerve agent poisoning are present. Many of the principal indicators of nerve agent poisoning are not widespread or are present in confusing manners:
  - a. Some victims appear to have miosis (pinpointed pupils), but some of them are clearly having a bright light shined in their eyes. Some of the supposed examples are not pronounced. (I examined my own pupils in the mirror while shaving to form a basis of comparison.) Diagnosing miosis merely by watching videos is very troublesome and inaccurate. (Note to medics: Use the dimmest light you can and creep in from the side of the eye, avoiding shining the light into the pupil itself.)
  - b. In the event of nerve agent use, pinpoint pupils would be nearly ubiquitous among the affected population. The people with more serious symptoms would also have pinpoint pupils. Some of the people in the videos with serious symptoms appear to have miosis, while others do not. In fact, some pupils appear dilated. (This can be a sign of atropine administration.)
  - c. Pinpoint pupils caused by nerve agent can last for weeks.<sup>3</sup> People with mild symptoms of nerve agent exposure should be showing some degree of miosis (and concomitant difficulty seeing in darkness) for a long period after the attack. *Some miosis should be evident today, as of the date of this writing.*
  - d. There is an apparent lack of vomiting. I have seen very little evidence of this, and no vomit on the floors or clothing of otherwise gravely ill victims. Nerve agents cause vomiting. If someone has enough exposure to make them ill, there will be vomiting, defecation, and urination.
  - e. Convulsions appear inconsistent with many of the aspects of nerve agent poisoning.

- i. Some victims are convulsing only in their legs, not their arms, or vice versa. Localized fasciculations are certainly possible based on absorption of liquid nerve agent through the skin. But that would mean presence of liquid contamination and, hence, vapor exposure and illness to the persons in the area.
  - ii. Many of the children with convulsions or tremors appear to be hyperventilating, leading me to consider carbon dioxide tetany<sup>4</sup> as a differential diagnosis.
  - iii. Some victims are frothing from the mouth, but not their noses.
- f. Diaphoresis, i.e. profuse sweating, is very hard to diagnose in the videos due to widespread use of water for improvised decontamination.

10. Doctors Without Borders has provided an initial report on the medical care efforts following the incident.<sup>5</sup> This report indicates the use of large quantities of atropine. Atropine is the first line of treatment for organophosphate (the category of chemicals that includes Sarin and the other nerve agents) and carbamate poisoning. The mere use of atropine doesn't mean that nerve agents were used, merely that providers on the scene thought it was indicated. This is, in effect, helpful indirect witness testimony.

- a. There are some reports that patients improved after atropine administration
  - i. This could mean that a nerve agent was involved.
  - ii. This could also mean that the atropine simply didn't make the patient worse.
- b. Another report I received was that people treated with atropine got worse, not better. This is not indicative of nerve agent poisoning.
- c. Atropine will often cause secretions (salivation, nasal secretions, sweating) to stop, even in the absence of a nerve agent. I have personally witnessed two incidents of accidental atropine overdose.
- d. There are accounts of hydrocortisone administration<sup>6</sup> and I am not a doctor or a pharmacologist, so I cannot speculate how this may have affected the presentation of signs/symptoms. I am not aware of any treatment protocol indicating use of this drug for nerve agents. If any readers know of any, please let me know.

11. Various witness accounts I have seen in the media have reported the following phenomena, some of which are inconsistent with nerve agents. It should be noted that, at the time of writing, all of these circumstances should be considered strictly anecdotal.

- a. Burning sensations
- b. People appearing to be dead "coming back to life" after some hours

- c. Odor of sulfur. (Sarin is odorless. All of the nerve agents are odorless except at concentrations that are quickly lethal.)
- d. Odor of “cooking gas” (cooking gases are odorless, but artificial scents such as mercaptans are added to indicate leaks)
- e. Odor of vinegar
- f. Odor of rotting fish
- g. Drowsiness
- h. Itchiness
- i. Reddening of eyes

**Was it another type of chemical warfare agent:**

I really don't think so. This table shows the various other chemicals generally considered to be “chemical warfare agents.”

<b>Chemical warfare agent</b>	<b>Why it doesn't seem to be the culprit</b>
Mustard / Sulfur Mustard / Nitrogen Mustard	No blisters are apparent. Liquid contamination would be prolific. Effects are very delayed, often 6+ hours. Causes very distinctive blistering.
Lewisite	No blistering to skin. Causes painful skin irritation. Has distinctive odor of geraniums, not noted.
Hydrogen cyanide	Has a very specific syndrome of signs and symptoms. Causes death, but no illness. With Hydrogen Cyanide you have dead people and unharmed victims, with very few or no victims showing illness in between death and asymptomatic. Has distinct odor of almonds, not noted.
Phosgene	Onset of symptoms is very delayed, sometimes even 12+ hours. Distinct odor of new mown hay or green corn, not noted.
Phosgene oxime	Causes much skin irritation, not otherwise seen in the videos.
Chlorine	Can cause much skin damage and burns. Chlorine odor not noted in this incident.

## What was the means of dissemination?

There is still no firm, conclusive evidence as to what the exact method of dissemination was responsible for dispersal of the mystery toxic substance. Was it rockets, missile warheads, artillery shells, mortar shells, a chemical tanker, aerial spray, aerial bomb, or some other means? Was it a mysterious wall of gas that drifted into the area?

- Many observers, including ones that I think are credible (such as the Brown Moses blog) seem to indicate that rockets were used.
- The number of rockets to perpetrate an attack of this scale would have to be large, not just a handful. It would need to be hundreds not dozens of rockets.
- People are seen in videos handling the remnants of these rockets, without apparent illness or injury.
- The expended munitions we see may be only a small proportion of the ones used. Are we seeing only the ones that didn't explode or partly explode?
- Are these conventional rounds that merely happened to be used at the same time as this chemical incident?
- Were conventional weapons used to get people to take refuge in shelters to make them deliberately more vulnerable to a heavier than air toxic chemical?

In other words... ***Where is the murder weapon?***

## "SC3" and The FSA Press Release

Reuter published the following report, which was repeated elsewhere:

*"Not all of the missiles appeared to have carried chemical warheads, the FSA spokesman said, but those that did were suspected to have contained sarin, a Russian-made nerve agent called SC3 and liquid ammonia supplied by Iran."*<sup>7</sup>

I view this as highly suspect. It is nonsensical to me. The following reasons make this statement seem very strange to me:

1. I have made numerous inquiries among experts I know and have conducted extensive research in the various books and documents at my disposal. I can find no reference to any substance Russian/Soviet or otherwise, known as SC3. My inquiries continue and I have reached out to some former Soviet-bloc countries for more information.
2. SC3 is a nonsensical designation for an allegedly Russian chemical compound. S and C are the same character in the Cyrillic alphabet used in Russian language. (I studied Russian language for 3 years in university and for a bit in graduate school as well.) Is this a transliteration error?

3. It is patently absurd to mix Sarin and liquid ammonia. Liquid ammonia reacts very quickly with Sarin due to its extreme pH. Liquid ammonia will inactivate Sarin within seconds or minutes depending on the concentration. Even someone with a basic knowledge of nerve agent chemistry ought to know that basic pH levels decontaminate Sarin. It seems perverse that someone would construct a device in this manner.

### **What could be the cause? Possible alternative theories:**

It is obvious to me that **something** of a chemical nature caused this terrible incident. But there are many possible explanations. As new information has come to light recently, some of my earlier theories seem less plausible. Some possible explanations:

#### **Use of a toxic industrial chemical**

The most useful theory that I have at this point is use of a toxic industrial chemical. There are many chemicals used in commerce and industry that are just as dangerous as military chemical warfare agents. Many toxic industrial chemicals (TICs) have additional dangerous properties that make them less than handy for use in military munitions. The generic nature of the symptoms and the widespread nature of the incident indicates to me that a TIC may have been the cause. The question is: has a deliberate **Bhopal-like** incident occurred?

Some notes pertinent to this possible scenario:

- There are literally hundreds of thousands of TICs. Even a short list of ones that would be reasonably available in volume in a place like Syria would number in the hundreds.
- Strong odors reported are consistent with some kinds of TICs. However, several distinct and different types of odors have been reported. None of this is definitive, and the various indicators are contradictory:
  - Cooking gas smell – indicative of mercaptans
  - Rotten fish smell – indicative of phosphine
  - Sulfur/rotten egg smell – indicative of hydrogen sulfide, sulfur dioxide or other sulfur compound
  - Vinegar – indicative of many acids
- Whatever was used appears to not be corrosive. No burns or skin damage is evident. This rules out many TICs.
- A flammable TIC probably would have led to widespread fires, which have not been reported.
- The apparent lack of contamination (as discussed above) leads me to believe that a liquid was not used... the TIC would have been in gas or vapor form.
- The generic symptoms seen are consistent with a wide number
- Generally, I would not expect rockets to be the most useful or effective means of disseminating TICs. A relatively high volume of TIC material would be needed,

which is a bit inconsistent with the numbers of expended rockets thus far reported.

- The majority of TICs in gas/vapor form are heavier than air. This could make people in confined areas like cellars and shelters more vulnerable to attack from a TIC.
- One report (Human Rights Watch)<sup>8</sup> indicates the presence of a pharmaceutical factory in the region of the attacks.
- Another report indicated significant presence of small and medium-sized tannery operations in the Ghouta region, which would use a large variety of chemical.
- If an accident were legitimately to blame for this event, we would probably have more information that would lead in that direction after this amount of time has elapsed.

### **Use of a Mix or Cocktail?**

One plausible explanation for the wide variety of signs, symptoms, and witness accounts may be that a variety of chemical substances were used. Use of different substances at different places or even a “cocktail” in the same place or device would considerably confuse the clinical picture (i.e. how the victims look) and any kind of physical evidence. Of course, many chemicals are not compatible with each other. This “cocktail” scenario merits further examination.

### **Riot control agents**

There are so-called “non-lethal” riot control agents, such as CS, PS (‘Chlorpicrin’), CR, CN, DM, and OC (‘pepper spray’). Most riot control agents have levels and concentrations at which they are lethal to humans.<sup>9</sup> Originally, I thought that a heavy concentration of riot control agents could have been used against people in confined spaces to cause this incident. I now think that this is an improbable explanation.

- Many of the victims were in confined spaces such as cellars, making it theoretically easier for a high concentration of riot control agents to build up.
- There is a relative lack of evidence of vomiting. Many of the more common riot control agents, such as CS, cause vomiting.
- There is a lack of obvious skin damage. High concentrations of riot control agents.
- It would be difficult to kill that many people with riot control agents.

### **Conventional Explosives / Fuel Air Explosives / Thermobaric Devices**

There are certain types of conventional devices called as “fuel air explosives”<sup>10</sup> or thermobaric devices. These can cause situations where all of the air is sucked out of a confined space. This could certainly cause the asphyxiation death of many people in cellars or shelters. Further injuries are possible from smoke being sucked back into the cellars. I think that this possible explanation is not all that plausible at this point. I am not an expert on thermobaric weapons. I would direct anyone interested in this point to



examine the blog <http://syriaanalysis.wordpress.com/2013/08/23/10/> - I am not enough an expert in this particular area to comment with any degree of authority

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### Some Disclaimers:

1. Based on information I have read the open media and or that has been presented to me as of 26 August 2013.
  2. I cannot understand Arabic, so the primary information source has been visual observation of the various videos.
  3. Videos are a poor substitute for the situational awareness of actually being at the scene.
  4. I reserve the right to change my opinion as new information comes available.
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**About the author:** Dan Kaszeta is the author of “CBRN and Hazmat Incidents at Major Public Events: Planning and Response” (Wiley, 2012) as well as a number of magazine articles and conference papers. He has 22 years of experience in CBRN, having served as an officer in the US Army Chemical Corps, as CBRN advisor for the White House Military Office, and as a specialist in the US Secret Service. He now runs Strongpoint Security, a London-based CBRN and antiterrorism consultancy and is also a Senior Research Fellow with the International Institute of Nonproliferation Studies.

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<sup>1</sup> A. Richardt, et al. eds. **CBRN Protection**. Wiley-VCH, 2013, page 357.

<sup>2</sup> **US Army Field Manual 3-9**, 1993 edition. Page 20.

<sup>3</sup> **Medical Aspects of Chemical Warfare**, 2008 edition, US Army Office of the Surgeon General.

<sup>4</sup> <http://en.wikipedia.org/wiki/Tetany>

<sup>5</sup> <http://www.doctorswithoutborders.org/press/release.cfm?id=7029>

<sup>6</sup> <http://www.npr.org/blogs/parallels/2013/08/22/214544301/syrian-doctors-desperate-patients-flooded-in-at-3-a-m>

<sup>7</sup> <http://www.reuters.com/article/2013/08/23/us-syria-chemicals-idUSBRE97M0U820130823>

<sup>8</sup> <http://www.hrw.org/news/2013/08/21/syria-witnesses-describe-alleged-chemical-attacks>

<sup>9</sup> See: [https://ke.army.mil/bordeninstitute/published\\_volumes/chemwarfare/Ch13\\_Pg441\\_484.pdf](https://ke.army.mil/bordeninstitute/published_volumes/chemwarfare/Ch13_Pg441_484.pdf)

<sup>10</sup> See: [http://en.wikipedia.org/wiki/Fuel-air\\_explosive](http://en.wikipedia.org/wiki/Fuel-air_explosive)