In this short note I describe why the chemical forensic analysis and logic described in the French Intelligence Report of April 26, 2017 (FIR) could lead to a high confidence conclusion that an indigenous nerve agent attack in Denver, Colorado was perpetrated by the Syrian government.

France therefore independently and categorically confirms that sarin was used on 4 April. The United States, the United Kingdom, Turkey and the Director-General of the OPCW have also established that sarin was employed on the basis of analysis of biomedical samples.

c) According to the intelligence obtained by the French services, the process of synthesizing sarin, developed by the Scientific Studies and Research Centre (SSRC) and employed by the Syrian armed forces and security services, involves the use of hexamine as a stabilizer. DIMP is also known as a by-product generated by this process.

d) This intelligence on the process used by the regime, which is a sign of its responsibility in the attack on 4 April, is based notably on the analysis of the content of an unexploded grenade which was used with certainty by the Syrian regime during the Saraqib attack on 29 April 2013.

Aside from the lack of a rational linkage of asserted observations, the FIR falsely claims (or implies that) the presence of DIMP is a unique indicator that the sarin found by the French at Saraqib must have been produced by the Syrian government. As it turns out, DIMP is likely to be found at any location where sarin has been introduced into the environment. In the case of hexamine, this chemical can be produced by the military explosives in a sarin nerve agent dispensing munition or from explosives produced in military attacks unrelated to the use of sarin.

The diagram on the next page below shows the path from sarin that leads to DIMP.

Sarin is a complex unstable molecule that can easily be disrupted by impurities contained in the final product. It is commonly produced by mixing a complex and difficult to produce chemical known as DF with isopropyl alcohol. The chemical reactions that produce sarin also produce hydrogen fluoride, a powerful and highly corrosive acid. In order to remove the hydrogen fluoride produced along with the sarin, a “fluorine scavenging agent” is mixed with the isopropyl alcohol when the two binary components are combined. The component that is typically used as a fluorine scavenger is isopropyl amine. The isopropyl amine does not play a role in producing sarin, its purpose is simply to chemically bond with the fluorine ions in the simultaneously produced hydrogen fluoride.

Another chemical that is capable of scavenging fluorine from the hydrogen fluoride is hexamine. Hexamine is a solid and is relatively insoluble in isopropyl alcohol – but if it is mixed with decaying sarin, it can remove
The single fluorine atom that is attached to sarin molecules. Figure 1 below shows a structural diagram that indicates the sequence of processes that could lead to the production of DIMP.

**Figure 1**

The sequence of steps that result in sarin being transformed into DIMP which FIR implies is a unique signature associated with sarin produced by the Syrian government. In fact, DIMP could easily be produced in many circumstances from the normal breakdown of sarin after its use.

The point that DIMP is an expected product to be found in the aftermath of a sarin attack is made in a statement from United States Agency for Toxic Substances and Disease Registry (ATSDR) which is an arm of the Center for Disease Control (CDC). The ATSDR document that describes DIMP can be found at [https://www.atsdr.cdc.gov/ToxProfiles/tp119-c1-b.pdf](https://www.atsdr.cdc.gov/ToxProfiles/tp119-c1-b.pdf).

We quote from this document below:

Diisopropyl methylphosphonate, or **DIMP**, is a chemical by-product resulting from the manufacture and detoxification of GB (also called Sarin), a nerve gas that the Army produced from 1953 to 1957. … You might find diisopropyl methylphosphonate in places where GB has been produced, stored, or used, for example, the Rocky Mountain Arsenal (RMA) outside of Denver, Colorado.

It is therefore clear that if the FIR analysis that led to the identification of sarin as being produced by the Syrian government would have led to the same unsupported conclusion from the FIR if it were applied to an indigenous sarin attack in Denver Colorado.

This would particularly be the case if a sarin dispersing munition similar to the one described by FIR in the sarin nerve agent attack of April 29, 2013 was used in the postulated indigenous attack. That particular munition had a small charge of military explosives to rupture the container and disperse the sarin. The explosive would have certainly produced hexamine as a byproduct. The hexamine could have readily broken the fluorine bonds on some of the sarin residue leading to the production of DIMP. However, this is not the only path for producing DIMP the residues from a sarin attack.

Hand grenade designed to disperse about 2 ounces of sarin using a small explosive charge to burst the container. The FIR claims, without either reasoning for scientific proof, that this munition found in an April 29, 2013 sarin attack is in proof that the attack of April 4, 2017 was perpetrated by the Syrian government.

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This Public Health Statement is the summary chapter from the Toxicological Profile for Diisopropyl methylphosphonate. It is one in a series of Public Health Statements about hazardous substances and their health effects. A shorter version, the ToxFAQs\textsuperscript{TM} is also available. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present. For more information, call the ATSDR Information Center at 1-888-422-8737.

This public health statement tells you about diisopropyl methylphosphonate and the effects of exposure.

The Environmental Protection Agency (EPA) identifies the most serious hazardous waste sites in the nation. These sites make up the National Priorities List (NPL) and are the sites targeted for long-term federal clean-up. Diisopropyl methylphosphonate has been found in at least 2 of the 1,416 current or former NPL sites. However, it's unknown how many NPL sites have been evaluated for this substance. This is important because exposure to this substance may harm you and because these sites may be sources of exposure.

When a substance is released from a large area, such as an industrial plant, or from a container, such as a drum or bottle, it enters the environment. This release does not always lead to exposure. You are exposed to a substance only when you come in contact with it. You may be exposed by breathing, eating, or drinking the substance or by skin contact.

If you are exposed to diisopropyl methylphosphonate, many factors determine whether you'll be harmed. These factors include the dose (how much), the duration (how long), and how you come in contact with it. You must also consider the other chemicals you're exposed to and your age, sex, diet, family traits, lifestyle, and state of health.

1.1 WHAT IS DIISOPROPYL METHYLPHOSPHONATE?

Diisopropyl methylphosphonate is a colorless liquid at normal temperatures. It is also known as methyl,bis-(1-methyl-ethyl)ester, phosphonic acid, and methyl-diisopropyl ester.

Diisopropyl methylphosphonate, or DIMP, is a chemical by-product resulting from the manufacture and detoxification of GB (also called Sarin), a nerve gas that the Army produced from 1953 to 1957. A chemical by-product is a chemical that is formed while making another substance. You might find diisopropyl methylphosphonate in places where GB has been produced, stored, or used, for example, the Rocky Mountain Arsenal (RMA) outside of Denver, Colorado. The RMA is where GB was produced for loading into chemical warfare munitions. Production of GB was discontinued in 1957, and it is not likely that GB, or diisopropyl methylphosphonate, will be produced in the United States in the future because of signing of a chemical treaty that bans not only the use but also the production and stockpiling of poison gases. Diisopropyl methylphosphonate is a colorless liquid. A small amount (0.1%, or 1g of DIMP in 1,000 mL of water) of it dissolves in water, but some scientists have found it to be more soluble.
This document is based on declassified intelligence from France's own sources.

On 4 April 2017, air strikes against civilians in the city of Khan Sheikhoun killed more than 80 people. According to our experts, the symptoms observed immediately afterwards (pupil contraction, suffocation, bluing of lips, white foam on faces, convulsions), the high number of deaths, and the fact that certain responders and medical staff suffered secondary contamination are consistent with the use of a highly lethal neurotoxic agent. This has now been confirmed scientifically.

These strikes come in the context of continuous use since 2013 of chemical weapons or chemical agents in Syria, particularly during air strikes, including after the Syrian regime committed to dismantling its chemical weapons arsenal on 25 October 2013. France has collected biomedical and environmental samples and munitions and pieces of munitions in Syria on several occasions, and has been able to confirm the use of chlorine and sarin several times. The attached table lists France's evaluations.

1. - Technical analysis of the chemical attack on 4 April

   a) France has deployed the required resources to obtain its own samples from the alleged sarin attack on 4 April 2017 in Idlib Governorate.

   b) The analyses carried out by French experts on the environmental samples collected at one of the impact points of the chemical attack at Khan Sheikhoun on 4 April 2017 reveal the presence of sarin, of a specific secondary product (diisopropyl methylphosphonate - DIMP) formed during synthesis of sarin from isopropanol and DF (methylphosphonyl difluoride), and hexamine. Analysis of biomedical samples also shows that a victim of the Khan Sheikhoun attack, a sample of whose blood was taken in Syria on the very day of the attack, was exposed to sarin.

   France therefore independently and categorically confirms that sarin was used on 4 April. The United States, the United Kingdom, Turkey and the Director-General of the OPCW have also established that sarin was employed on the basis of analysis of biomedical samples.

   c) According to the intelligence obtained by the French services, the process of synthesizing sarin, developed by the Scientific Studies and Research Centre (SSRC) and employed by the Syrian armed forces and security services, involves the use of hexamine as a stabilizer. DIMP is also known as a by-product generated by this process.

   d) This intelligence on the process used by the regime, which is a sign of its responsibility in the attack on 4 April, is based notably on the analysis of the content of an unexploded grenade which was used with certainty by the Syrian regime during the Saraqib attack on 29 April 2013. That mid-afternoon, a helicopter arriving from the north-east flew over the city of Saraqib at high altitude. Three unidentified objects, emitting white smoke, were dropped on neighbourhoods to the west of the city, on a north-south trajectory.
Reaction That Produces Sarin from DF and Isopropyl Alcohol

Reactions and “Flourine Scavenging Agent” Used in the Production of Sarin