Is it Mustard or Not?

Guidelines for assessing claimed use of the Mustard family of Blister Agents

By Dan Kaszeta

There have been a number of alleged incidents claiming to involve “Mustard Gas” (i.e. Sulfur Mustard or one of its variants) in the last year. Some are more credible than others, but it seems that allegations of Mustard usage are becoming more commonplace. Some examples of claimed use include the following:

Venezuela: In February 2014, it was alleged that the Venezuelan government was using “Mustard Gas” against student demonstrators.

https://twitter.com/1954candanga/status/435183777849946112

Ferguson Missouri: Numerous tweets and posts alleged use of “Mustard Gas” by police in August 2014. Most are now deleted.

Gaza: Several people alleged that Mustard was used in Gaza in July 2014. https://twitter.com/longitude0/status/499867285142908928

Kobane, Syria: It is alleged that some sort of blister agent, possibly Mustard, was used in at least one incident by ISIS against Kurdish forces.

http://www.ibtimes.co.in/isis-using-chemical-weapons-against-kurdish-fighters-kobane-photos-611223

Some of the last of the US Army’s Mustard Shells on their way to destruction. Photo: US Army, 2011

Facts about Mustard

The apparent willingness with which people jump to announce that Mustard has been used, in some cases quicker than the onset of signs and symptoms would be for actual Mustard, means that there is a definite need for a basic guideline to assess claims of Mustard use. My own experience in the last year is that very few people understand the basic facts about the Mustard-series of blister agents. The following guideline is to help assess as to whether a situation MIGHT involve Mustard. There are several minor sub-variants of Mustard, but the form generally known to have been in Syrian, Iraqi, US, and Soviet stockpiles is overwhelmingly Sulfur Mustard. Importantly, none of the sub-variants cause rapid effects.

A vial of Mustard liquid.
Photo: US Army

Physical Properties:

What are the physical properties of the material that caused the problem? Sulfur Mustard or Distilled Mustard (often referred to somewhat erroneously as "Mustard Gas") is an oily liquid, not a gas. The volatility of liquid Mustard (i.e. its propensity to give off fumes) is actually quite low except at very high temperatures. Mustard is considered It is a solid at lower temperatures.

Might Be Mustard:

Encountered as a clear, pale yellow, or brown-ish liquid
The liquid will be thicker and more viscous than water
Strong odour similar to garlic or horseradish
Dispersed in combat as either a liquid or a mist of droplets
Liquid that takes time to evaporate
Dispersed
Vapours heavier than air
Solid below 14 deg C
Does not dissolve easily in water

Likely <u>Not</u> Mustard:

Opaque liquid or colours other than above
Liquid is runny like water, not thick or oily
Visible cloud of gas or vapour
Cloud or fog with any perceptible colour. (Mustard is not yellow)
Vapours lighter than air
Liquid at temperatures below 14 deg C
Liquid that evaporates quickly
Dissolves easily in water

Rate of Effects:

Perhaps the most important question to ask if assessing a potential Mustard incident: How quickly were people affected by the unknown substance? Although smell will be noticed immediately, and minor eye irritation within a few minutes are possible, the effects of Mustard take hours, in some cases many hours, to develop. The following table shows the likely signs/symptoms and their rate of onset for Mustard.

TABLE 8-3

INITIAL CLINICAL EFFECTS FROM MUSTARD EXPOSURE

Organ	Severity	Effects	Onset of First Effect
Eyes	Mild	Tearing Itching Burning Gritty feeling	4–12 h
	Moderate	Above effects, plus: Reddening Lid edema Moderate pain	3–6 h
	Severe	Marked lid edema Possible corneal damage Severe pain	1–2 h
Airways	Mild	Rhinorrhea Sneezing Epistaxis Hoarseness Hacking cough	6–24 h
	Severe	Above effects, plus: Productive cough Mild-to-severe dyspnea	2–6 h
Skin	Mild	Erythema	2–24 h
	Severe	Vesication	4–12 h

From: **Medical Aspects of Chemical Warfare,** 2008. US Army

Might Be Mustard:

Any of the above effects within the designated timeline
Blistering of affected skin after 4 to 12 hours. Blisters will be filled with clear fluid.

Likely not Mustard:

Effects faster than the chart above
Serious immediate pain or effects, upon exposure.
Rapid painful irritation of the eyes (like tear gas)
Charring or singing
Any indirect sign of thermal burns, such as charred or singed clothing or hair
Seizures, muscle spasms, or convulsions
Rapid suffocation and asphyxiation.
Vomiting

The bottom line is: IF THERE ARE SERIOUS IMMEDIATE EFFECTS the causative agent is not likely to be Mustard.

Fatalities:

The lethality of Mustard is actually quite low compared to many other chemical warfare agents. Although Mustard was used prolifically in the First World War, it was responsible only for a minority of the chemical warfare fatalities during the conflict. Only 3% of Mustard injuries were fatal in World War 1, despite the general lack of modern medicine. However, Mustard is theoretically capable of killing. The important thing to note is that Mustard does not kill quickly. Mustard generally kills from respiratory complications, after some days of illness. The statistics about how quickly someone died after Mustard exposure during World War 1 are shown below:

TABLE 8-4

DAY OF DEATH AFTER EXPOSURE IN WORLD WAR I FATAL MUSTARD CASUALTIES*

Day of Death (After Exposure)	Percentage of Deaths
≤1	1
2	2
3	5
4	8
5	22
≥6	62

*In 4,167 British troops who died from mustard exposure.

From: **Medical Aspects of Chemical Warfare,** 2008. US Army

As can be seen from the table, only a total of 8% of the fatalities occurred within the first three days after exposure.

There are some loose rules of thumb, based largely on WW1 and Iran-Iraq war experiences, about how to estimate if someone has received a possibly lethal dose of Mustard:

- Redness and swelling over 50% or more of body surface
- Difficulty breathing if the onset time is as fast 4 to 6 hours after exposure

Once again, the bottom line: IF THERE ARE RAPID FATALITIES it isn't Mustard that is the killer. Mustard might indeed be there, but it doesn't kill that quickly.

Notes:

Medical Aspects of Chemical Warfare is available freely at http://www.cs.amedd.army.mil/borden/Portlet.aspx?id=d3d11f5a-f2ef-4b4e-b75b-6ba4b64e4fb2 . Mustard is discussed at length in chapter 8.

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.