

This is a good example of how bad news spreads much faster than the truth, which is often far more prosaic. It is also how urban myths arise.¹

Background

Fluoroelastomers are a class of synthetic rubber compounds, which contain fluorine. Several companies have manufactured them under various trade names for the last 30 years: Du Pont (Viton), Montefluos (Technoflon) and 3M (Fluorel). They are used in small automotive and aerospace O-rings, gaskets, seals and hoses that require high temperature performance. They can be used safely at temperatures up to 275 degrees C.²

Fluoroelastomers will only burn in the presence of an external flame, and the combustion products include hydrofluoric acid, which forms in unsafe concentrations when temperatures rise above 316 degrees C. As far as vehicles are concerned, any fluoroelastomer based material if not totally consumed in a fire, would remain as a sticky, black mass.

How news can travel!

The manufacturers were aware of a possible hydrofluoric acid exposure, if fluoroelastomers were involved in a fire, and they have published appropriate safety measures.³ The sensational aspect didn't develop until 1991, when someone who identified himself as Tim Scherer issued an Intelligence Bulletin on behalf of the Office of the Fire Marshall of the State of Alabama in the US.⁴ The Bulletin is reproduced exactly as follows (including the omissions and spelling errors):

"To: All Officers / All Divisions

From: Criminal Intelligence Unit

Source: L.E.S. Tim Scherer, Arson Squad

Subject: Officer Safety

Officers should use caution in handling burnt vehicles.

Following information furnished by Deputy Scherer.

Ref: Fluoroelastomec

Date: 12/10/91

Fluoroelastomec, or Veton by its other name, is a material that is being used to make brake seals and fuel pipes, as well as other components in vehicles. This material becomes dangerous after it has been burnt, ie in a vehicle fire. The material melts into a HIGHLY CORROSIVE ACID, which if it gets onto the skin CANNOT be removed. The only treatment is AMPUTATION. This melted state will remain dangerous for a minimum period of two years, and only professional decontamination will remove it safely. AMPUTATION is the only treatment, and it is required if the materials gets onto the – there is no second chance."

The problem is - Tim Scherer doesn't exist. The Marshall's Office has disclaimed all responsibility, and at the last report, were on the lookout for the author.⁵

However, it did not stop the news based on the Bulletin from spreading. And then when someone discovered an incident⁶ which involved an amputation, things really took off.

An amputation

The circumstances involving the amputation occurred some 10 years prior to the Bulletin in 1981, at the National Nuclear Corporation in the UK. Some experiments were being conducted involving fluoroelastomers (not Viton), in which they were heated at 400 degrees C in a sealed tube for a prolonged period.

On cooling, the reaction product condensed onto the walls of the vessel as a clear liquid, and when the technician opened the vessel, some of the condensate came into contact with the tip of his finger. The technician promptly washed it off, however he did not follow it up with any further proper first aid, and this lead to a progressive burn, which in the end required partial amputation of the finger.

The technician should have known hydrofluoric acid was going to be a likely product, but was either too complacent or ignorant to appreciate the consequences.

In Australia

As far as Australia is concerned, this information did not become widely known until about 1996,^{7,8,9,10,11,12} when several articles associated with the car industry appeared. These articles varied quite widely in accuracy and sensationalism, but they did catch the eye of several fire fighters who sent in three of them. Unfortunately they did not advise of the reference sources (note references 7 – 9), but they were obviously from different magazines, "You Can Lose an Arm and a Leg in the Auto Industry."

And while they certainly captured people's attention, the problem remains – what are the facts.

The facts

So could you lose an arm or a leg on contact with hydrofluoric acid? Yes! And is there no hope if contact occurs? Not quite! Immediate washing with water and treatment with calcium gluconate is usually effective.

But then could this happen with a burnt gasket or O-ring made of fluoroelastomer?

A search has been conducted in all the available literature, databases and the Internet, and no cases of exposure under these circumstances have been found. This is one indication given the time these materials

have been on the market and their widespread use, that the risk of exposure via this avenue is very low.

This level of risk can be further deduced when considering the properties of hydrofluoric acid. Hydrofluoric acid is extremely volatile and once released would be taken up in the smoke plume. It is also extremely soluble in water, and would be washed away with any water used to extinguish a fire. It is also so reactive that it would not remain as a free agent in the environment for any length of time. For example, it could react either with soil particulates or rust to form extremely insoluble fluorides.

Any hydrofluoric acid retained in the sticky, black mass left after a fire would continue to move to the surface and diffuse out into the atmosphere as the vehicle cooled down. The rate of diffusion being temperature dependent, would be rapid while it remained hot until it cooled down to ambient temperature.

To have any possible skin exposure to hydrofluoric acid, it would have to be through direct contact with the sticky, black mass after a fire, and then it would have to diffuse through onto the skin. This would be a relatively slow process at ambient temperature, and under this scenario, any exposure leading to an acid burn would be extremely unlikely.

The only other possibility would be diffusion into water condensate lodged at the metal / mass site at a time after the engine had cooled completely. Even then it would either quickly disappear as the water evaporated or by reaction with the metal surface.

There would no chance any hydrogen fluoride would be present after two years, as suggested in the Bulletin.

In conclusion

While the news was overdone at that time, it at least made everybody stand up and take notice.

While this article will not stray into operational matters, it makes sense to avoid any contact with black, sticky deposits that might remain on burnt out vehicles or other machinery, and if that is not possible to take the appropriate precautions or use protective equipment.

¹ Based on an article prepared for 'The Communicator,' December, 1997

² Du Pont, Viton Fluoroelastomer, Handling Precautions for Viton and Related Chemicals, VT-100.1, April 1987

³ Du Pont MSDS, Viton, 21-11-1996, CCINFO MSDS database, 97-2

⁴ Anatomy of an Urban Myth, FL Fire, Fire Engineering, August, 1992, p59-69

⁵ Memorandum, "Re: Fluoroelastomer / Fluoroelastomer / Viton, Bulletin, State of Alabama, Department of Insurance, Fire Marshall's Office, March 31, 1992

⁶ Du Pont Australia, Viton Fluoroelastomer, May, 1992

⁷ NRMA, Tech Topics 3/96, "Viton Gasket / Seal / Belt – Extreme Temperature Dangers

⁸ Article entitled, "You Can Lose an Arm and a Leg in the Auto Industry," source unknown

⁹ Article entitled, "You Can Lose an Arm and a Leg in the Auto Industry," source unknown

¹⁰ Article entitled, "You Can Lose an Arm and a Leg in the Auto Industry," source unknown

¹¹ Fluoroelastomers, The Automotive Engineer, May/June, 1997

¹² NRMA, Tech Topics 2/97, "More on Viton and Extreme Temperature Dangers

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