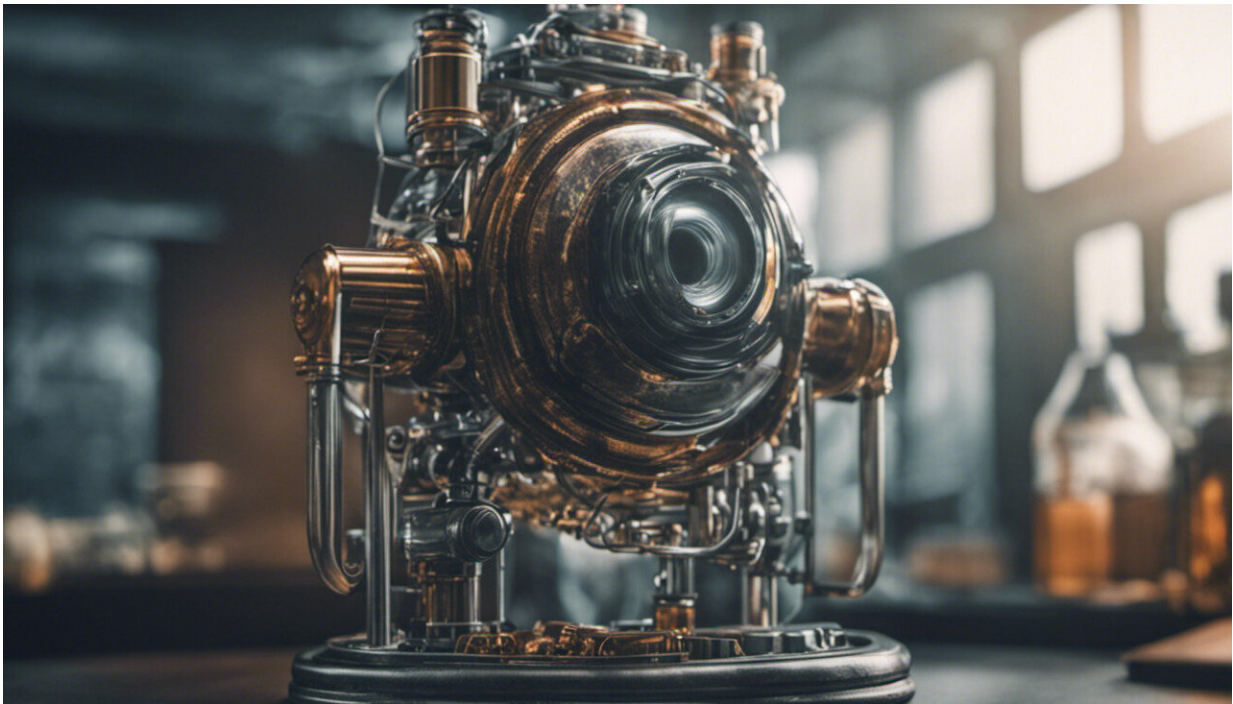


What's in vapes? Toxins, heavy metals, maybe radioactive polonium

August 12 2023, by Alexander Larcombe



Credit: AI-generated image ([disclaimer](#))

If you asked me what's in e-cigarettes, disposable vapes or e-liquids, my short answer would be "we don't fully know."

The huge and increasing range of products and flavors on the market, changes to ingredients when they are heated or interact with each other,

and inadequate labeling make this a complicated question to answer.

[Analytical chemistry](#), including [my own team's research](#), gives some answers. But understanding the health impacts adds another level of complexity. E-cigarettes' risk to health varies depending on [many factors](#) including which device or flavors are used, and how people use them.

So vapers just don't know what they're inhaling and cannot be certain of the [health impacts](#).

What do we know?

Despite these complexities, there are some consistencies between what different laboratories find.

Ingredients include nicotine, flavoring chemicals, and the liquids that carry them—primarily propylene glycol and glycerine.

[Concerningly](#), we also find [volatile organic compounds](#), [particulate matter](#) and carcinogens (agents that can cause cancer), many of which we know are harmful.

Our [previous research](#) also found 2-chlorophenol in about half of e-liquids users buy to top-up re-fillable e-cigarettes. This is one example of a chemical with no valid reason to be there. Globally, it's [classified](#) as "harmful if inhaled." Its presence is likely due to contamination during manufacturing.

How about polonium?

One potential ingredient that has been in the news in recent weeks is radioactive polonium-210, the same substance used to assassinate former

Russian spy Alexander Litvinenko in 2006. The Queensland government is [now testing](#) vapes for it.

Polonium-210 [can be found](#) in traditional cigarettes and other [tobacco products](#). That's because tobacco plants [absorb it](#) and other [radioactive materials](#) from the soil, air and high-phosphate fertilizer.

Whether polonium-210 is found in aerosols produced by e-cigarettes remains to be seen. Although it is feasible if the glycerine in e-liquids comes from plants and similar fertilizers are used to grow them.

It's not just the ingredients

Aside from their ingredients, the materials e-cigarette devices are made from can end up in our bodies.

[Toxic metals](#) and [related substances](#) such as arsenic, lead, chromium and nickel can be detected in both e-liquids and vapers' urine, saliva and blood.

These substances can pose serious health risks (such as being carcinogenic). They can leach from several parts of an e-cigarette, including the heating coil, wires and soldered joints.

That's not all

The process of heating e-liquids to create an inhalable aerosol also changes their chemical make-up to produce [degradation products](#).

These include:

- formaldehyde (a substance used to embalm dead bodies)

- acetaldehyde (a key substance that contributes to a hangover after drinking alcohol)
- acrolein (used as a chemical weapon in the first world war and now used as a herbicide).

These chemicals are [often detected](#) in [e-cigarette samples](#). However due to different devices and how the samples are collected, the [levels measured vary widely](#) between studies.

Often, the levels are very low, leading to proponents of vaping arguing e-cigarettes are far safer than tobacco smoking.

But this argument does not acknowledge that many e-cigarette users (particularly adolescents) [were or are not cigarette smokers](#), meaning a better comparison is between [e-cigarette use](#) and breathing "fresh" air.

An [e-cigarette](#) user is undoubtedly exposed to more toxins and [harmful substances](#) than a non-smoker. People who buy tobacco cigarettes are also confronted with a plethora of warnings about the hazards of smoking, while vapers generally are not.

How about labeling?

This leads to another reason why it's impossible to tell what is in vapes—the lack of information, including warnings, [on the label](#).

Even if labels are present, they don't always reflect what's in the product. Nicotine concentration of e-liquids is often quite different to what is on the label, and "nicotine-free" e-liquids often [contain nicotine](#).

Products are also labeled with generic flavor names such as "berry" or "tobacco." But there is no way for a user to know what chemicals have been added to make those "berry" or "tobacco" flavors or the changes in

these chemicals that may occur with heating and/or interacting with other ingredients and the device components. "Berry" [flavor](#) alone could be made from [more than 35](#) different chemicals.

Flavoring chemicals may be "food grade" or classified as safe-to-eat. However mixing them into e-liquids, heating and inhaling them is a very different type of exposure, compared to eating them.

One example is benzaldehyde (an almond flavoring). When this is inhaled, it [impairs](#) the [immune function](#) of lung cells. This could potentially reduce a vaper's ability to deal with other inhaled toxins, or respiratory infections.

Benzaldehyde is one of only [eight](#) banned e-liquid ingredients in Australia. The list is so short because we don't have enough information on the health effects if inhaled of other flavoring chemicals, and their interactions with other e-liquid ingredients.

Where to next?

For us to better assess the health risks of vapes, we need to learn more about:

- what happens when flavor chemicals are heated and inhaled
- the interactions between different [e-liquid](#) ingredients
- what other contaminants may be present in e-liquids
- new, potentially harmful, substances in e-cigarettes.

Finally, we need to know more about how people use e-cigarettes so we can better understand and quantify the health risks in the real world.

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