

# Hand Sanitizer Made with Technical-Grade Ethanol

## Safety Considerations

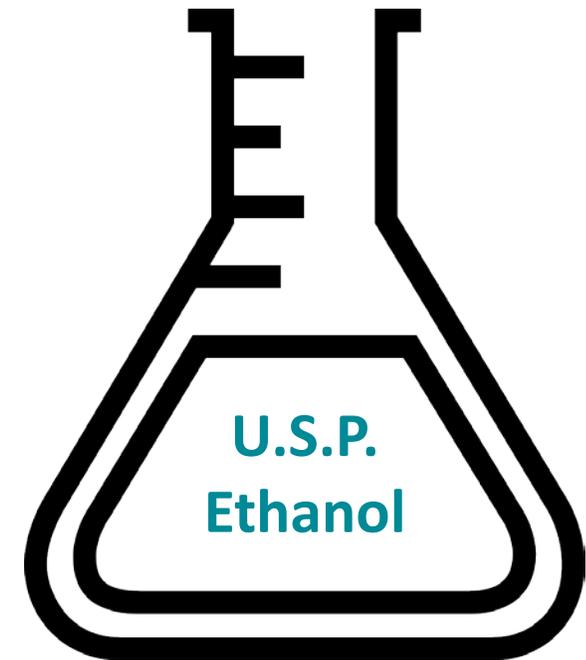
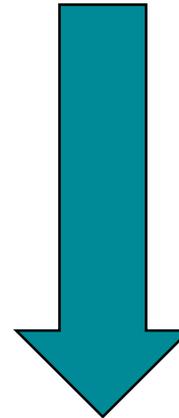


June 25, 2020

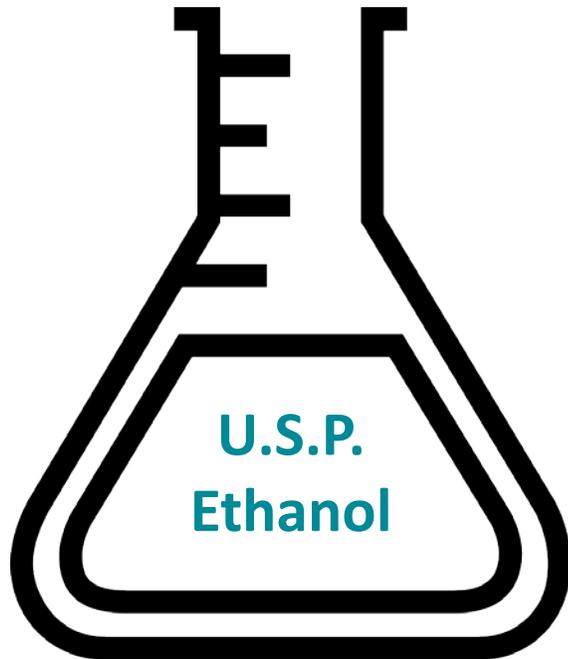


- A key ingredient in hand sanitizer is ethanol.
- Hand sanitizer is usually made with USP-grade ethanol (“pharmaceutical grade” ethanol).

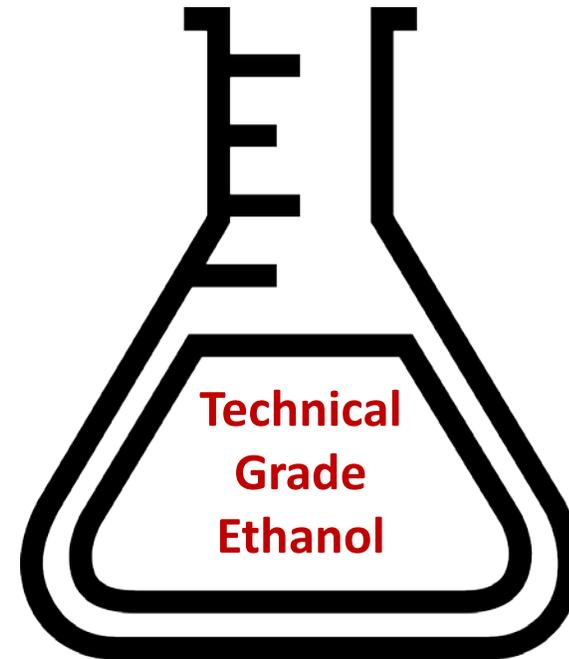
Due to the COVID-19 pandemic, the demand for hand sanitizer has increased dramatically, resulting in shortages of USP-grade ethanol.



To maintain the supply of hand sanitizer, Health Canada has authorized the use of **technical-grade ethanol** to make hand sanitizer.



- Purity standards are strict
- Maximum allowable level of acetaldehyde, a natural and commonly found impurity in ethanol, is 10 ppm\*

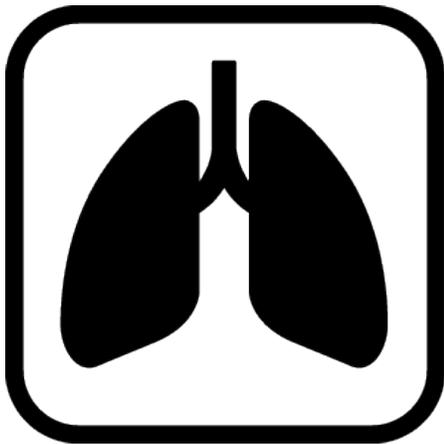


- Purity standards are less strict
- Acetaldehyde content can be as high as 800 to 1000 ppm

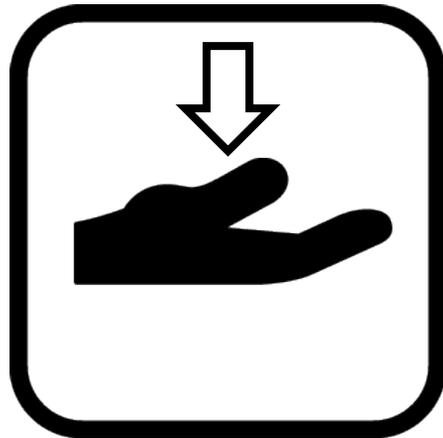
\* part per million



- There are several ways that someone can be exposed to a chemical substance such as acetaldehyde.
- For acetaldehyde contained within hand sanitizer, the only relevant exposure routes to consider further are inhalation and skin absorption.



Inhalation



Skin Absorption

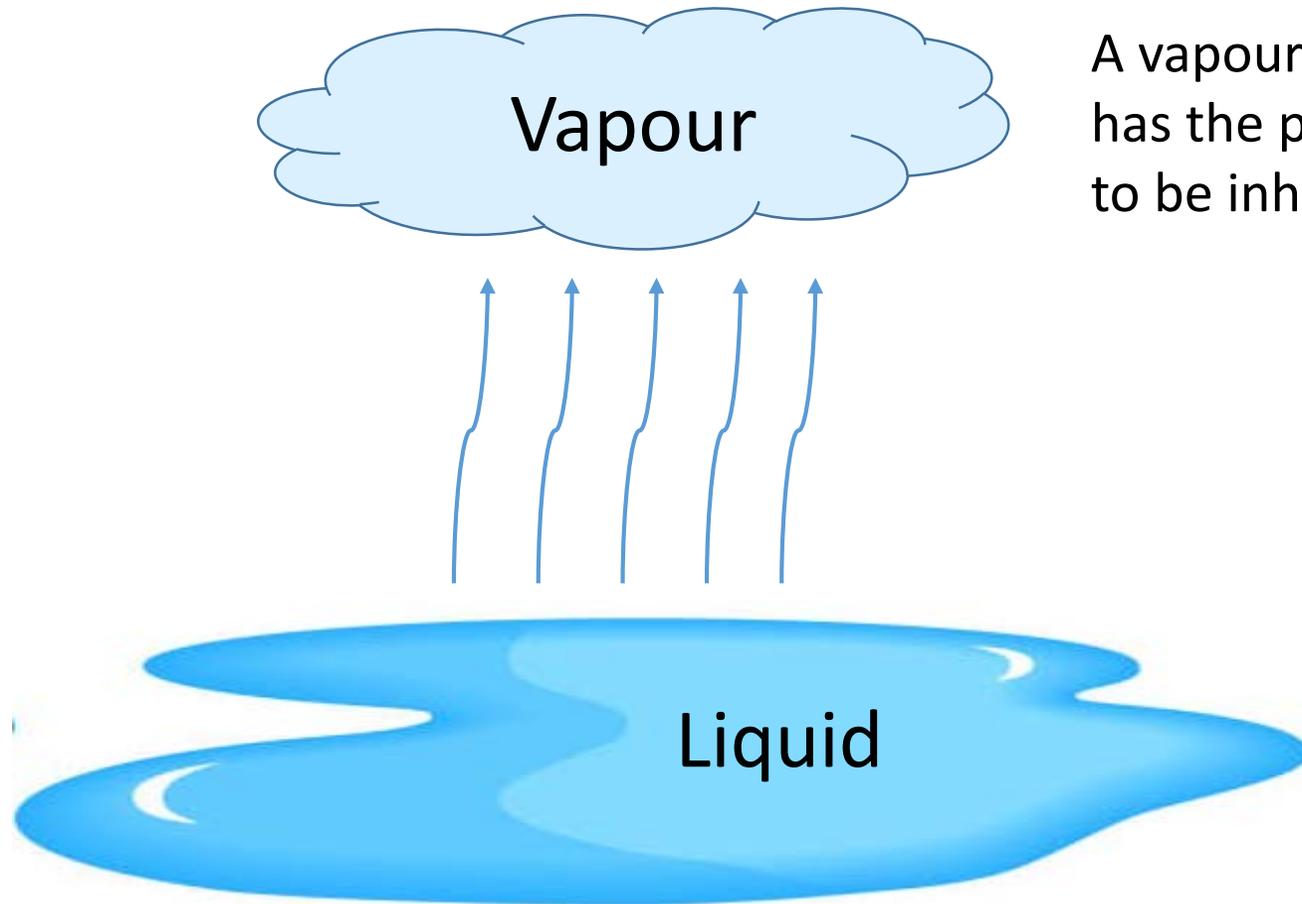


Ingestion

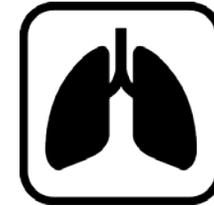


Injection

Hand sanitizer is a liquid. A **liquid** has the potential to release a **vapour** through evaporation.



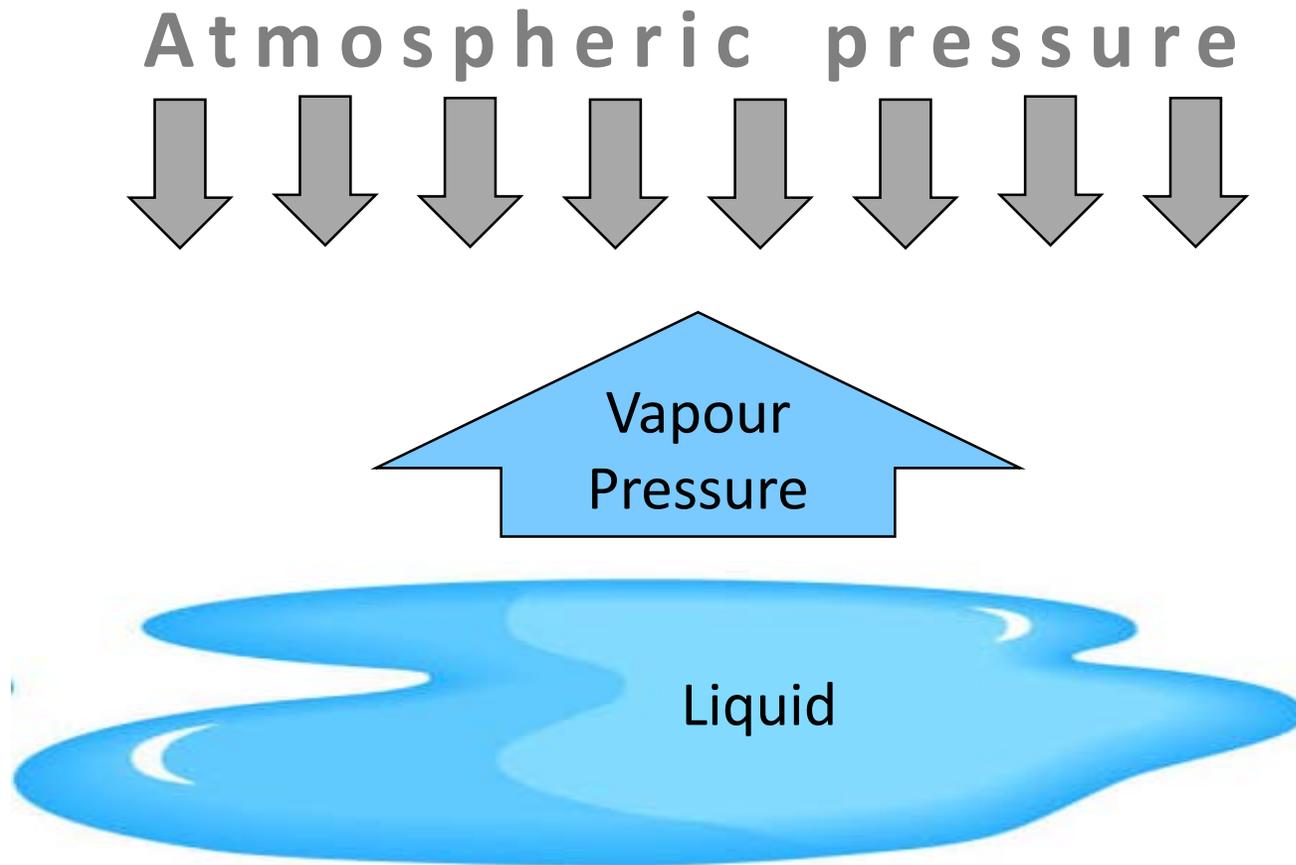
A vapour in the air has the potential to be inhaled



A liquid on the skin's surface has the potential to be absorbed through the skin

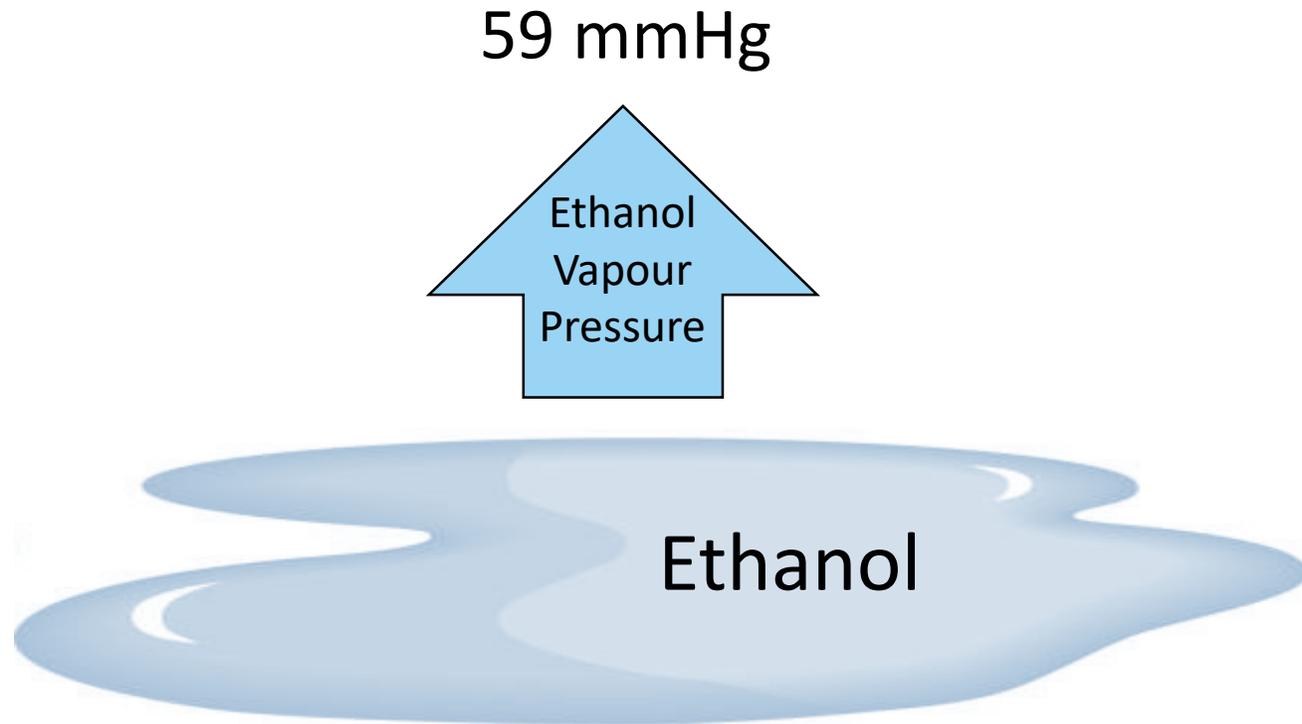


All liquids have a vapour pressure.



- Conceptually, a liquid's vapour "pushes" against the atmosphere
- The higher the vapour pressure, the faster a liquid evaporates

The key ingredient in hand sanitizer is ethanol.



- Ethanol's vapour pressure is 59 mmHg, which means that ethanol evaporates quite readily.
- This is why your hands do not stay wet for very long after hand sanitizer is applied.
- If a liquid does not stay on the skin for very long, then there is limited opportunity for it to be absorbed through the skin.

# Hand sanitizer use and ethanol absorption

- Studies have demonstrated how small amounts of ethanol may enter the body when hand sanitizer is used.
- One study<sup>1</sup> compared normal use (Condition 1) and use when inhalation of ethanol vapour was prevented (Condition 2).
- In Condition 1 (where **inhalation** of ethanol vapour could occur), the peak amount of ethanol absorbed into the body was almost **20 times greater** than the peak amount of ethanol absorbed when the inhalation of ethanol vapour was prevented (Condition 2).

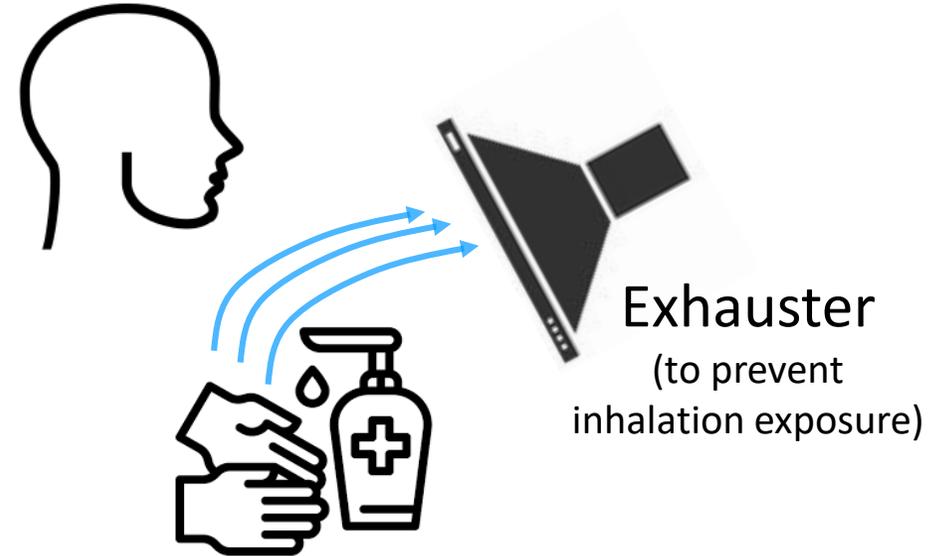
## Condition 1

Inhalation + skin absorption

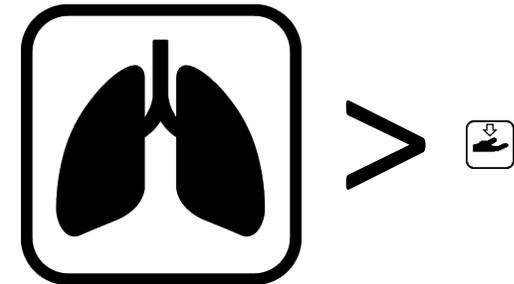


## Condition 2

Skin absorption only

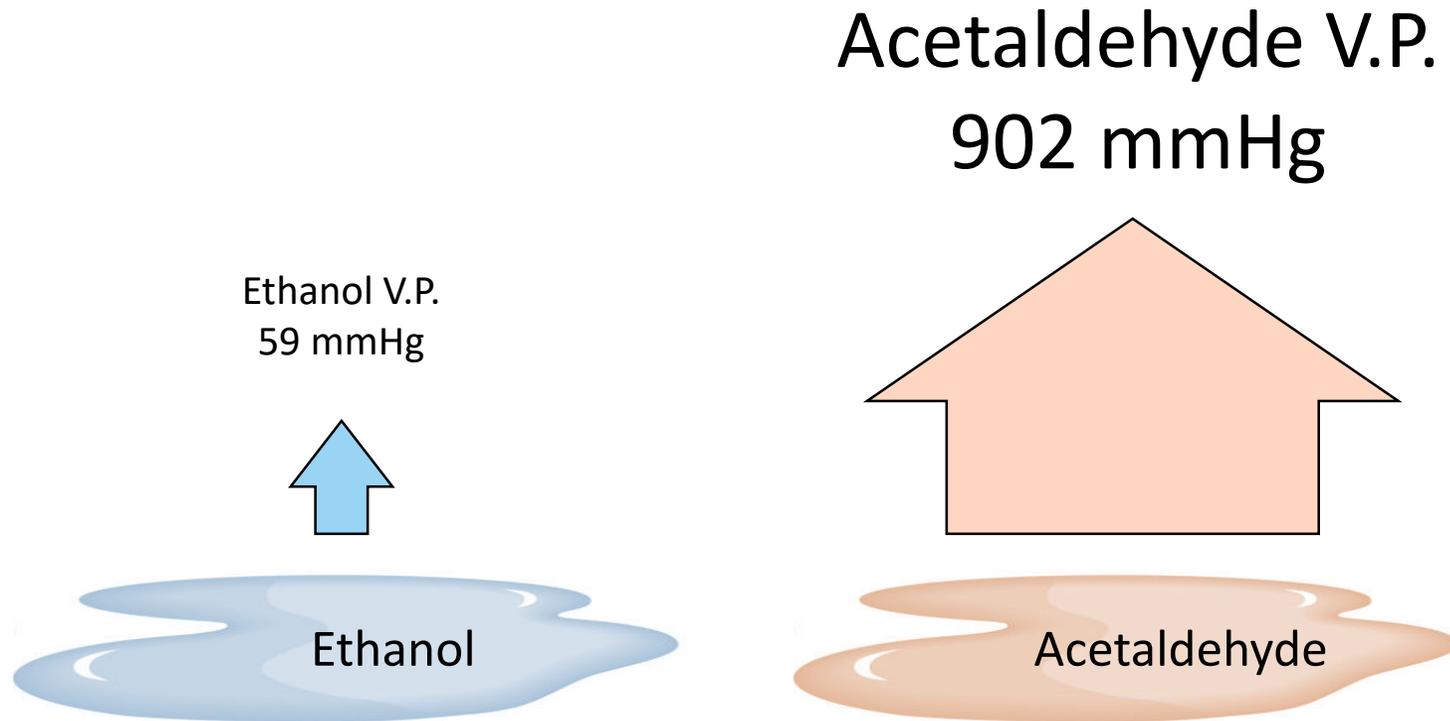


When hand sanitizer is used, any ethanol exposure occurs mainly through **inhalation of ethanol vapour**. Very little, if any, ethanol is absorbed through the skin.

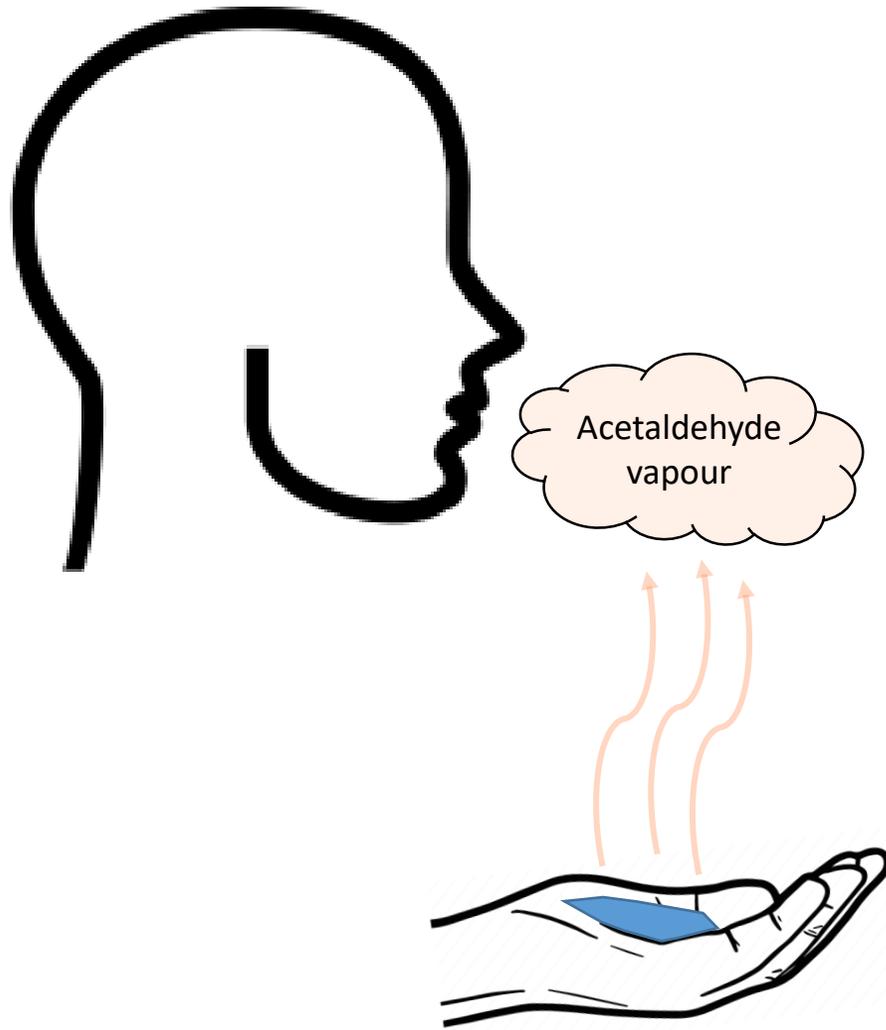


<sup>1</sup> Arndt, T., et al. Inhalation but not transdermal resorption of hand sanitizer ethanol causes positive ethyl glucuronide findings in urine. Forensic Science International 2014; 237: 126-130

# Ethanol and acetaldehyde have different vapour pressures.



- The vapour pressure of acetaldehyde is 15 times greater than the vapour pressure of ethanol.
- Acetaldehyde's higher vapour pressure means that it will evaporate much more quickly than ethanol.
- Therefore, acetaldehyde in hand sanitizer would be even less likely to be absorbed through the skin than the ethanol in hand sanitizer.

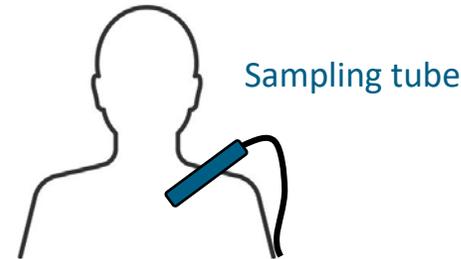


- If one were to be exposed to the acetaldehyde present in hand sanitizer made with technical-grade ethanol, the main route of exposure would be inhalation of acetaldehyde vapour.
- This is reflected in the Alberta Occupational Health & Safety Code, which specifies an Occupational Exposure Limit for acetaldehyde vapour, and notes that acetaldehyde is NOT “a substance [that] may be readily absorbed through intact skin”.
- By measuring the concentration of acetaldehyde vapour when hand sanitizer is used, acetaldehyde exposure can be determined.

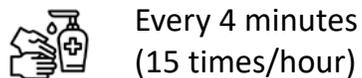
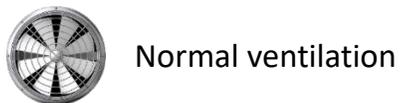
# Acetaldehyde measurements conducted by AHS

- In order to determine potential acetaldehyde exposure from the use of hand sanitizer made with technical-grade ethanol, AHS measured acetaldehyde vapour when hand sanitizer was used.

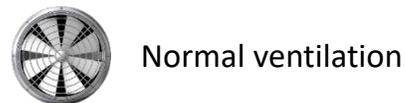
While applying hand sanitizer containing technical-grade ethanol, under four separate conditions, air in a volunteer's breathing zone was drawn through a sampling tube that captured acetaldehyde.



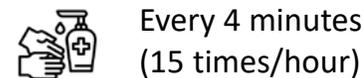
## Condition 1



## Condition 2



## Condition 3



## Condition 4



# Results of acetaldehyde measurements conducted by AHS

## Condition 1



Medium-sized room



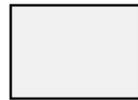
Normal ventilation



Every 4 minutes  
(15 times/hour)

0.02 ppm

## Condition 2



Medium-sized room



Normal ventilation



Every 80 seconds  
(45 times/hour)

0.04 ppm

## Condition 3



Small room



No ventilation



Every 4 minutes  
(15 times/hour)

0.08 ppm

## Condition 4



Small room



No ventilation



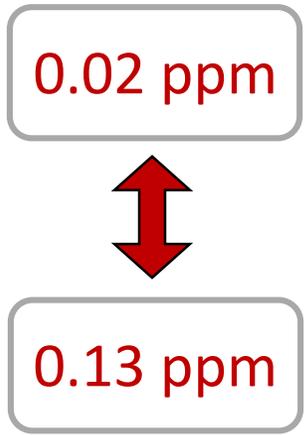
Every 80 seconds  
(45 times/hour)

0.13 ppm

**Airborne Acetaldehyde Concentration**

# Results of acetaldehyde measurements conducted by AHS

The airborne acetaldehyde concentration resulting from the use of hand sanitizer containing technical-grade ethanol ranged from:



Province of Alberta

As per the Alberta Occupational Health & Safety Code, the Occupational Exposure Limit<sup>1</sup> for acetaldehyde is:

25 ppm

In other words, airborne acetaldehyde concentrations resulting from the use of hand sanitizer containing technical-grade ethanol are approximately:

**200 to 1200 times**

**LESS**

than the Alberta Occupational Exposure Limit that is meant to keep workers safe

<sup>1</sup> The 25 ppm occupational exposure limit for acetaldehyde is the same across all provinces and in federally-regulated workplaces as well.

These results demonstrated a considerable margin of safety in respect of occupational exposure, and should reassure staff that hand sanitizer containing technical-grade ethanol is safe when used as directed.

Health Canada has indicated the following warnings regarding hand sanitizer containing technical-grade ethanol:

- Adults only
- Do not use on broken or damaged skin
- Do not inhale
- Not recommended for use by women who are pregnant or breastfeeding

AHS is committed to ensuring the ongoing supply and availability of hand sanitizer during a temporary disruption in the production of Microsan<sup>®</sup> as the supplier switches back to using pharmaceutical-grade ethanol. Alternate products continue to be temporarily sourced from a variety of suppliers and manufacturers. Areas that are using technical-grade hand sanitizer will have labels applied to the dispensers. Areas that are using pharmaceutical grade hand sanitizer do not have labels. As technical grade hand sanitizer is replaced by pharmaceutical grade hand sanitizer, labels will also be removed. If you have questions about the labelling of hand sanitizer or the hand sanitizer product used in your area, please contact [PPE@ahs.ca](mailto:PPE@ahs.ca).