



# Healthcare Employee Safety: Avoiding VOCs and QACs

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Employees who spend every day working in the healthcare environment face some unique challenges to their own health. For instance, doctors and nurses that treat patients with highly contagious illnesses run the risk of contracting those illnesses themselves. Environmental services personnel that clean operating rooms, exam rooms, and patient rooms must be careful to protect themselves against coming into contact with body fluids that could carry infection.

One health threat that all of these employees have in common, yet one that has been far less well addressed, is the presence of volatile organic compounds and quaternary ammonium compounds in the atmosphere of the hospital or medical facility setting. These compounds present a serious threat to the long-term health of those who spend large amounts of time in these environments, greatly increasing their risk of developing COPD and other chronic respiratory conditions.

In this piece, we share the sources of these hazardous compounds, the potential damage to healthcare employees' long-term health, and how the risks can be mitigated through the use of disinfecting products that do not produce VOCs or QACs.

## Source of VOCs and QACs

Volatile organic compounds (often abbreviated as VOCs) and quaternary ammonium compounds (QACs) are chemical compounds that pose significant health risks to humans. While they differ in important respects, including their levels of health threat, biodegradability, and functionality, it makes sense to discuss them both in the context of risk to healthcare workers. This is because both VOCs and QACs are produced by the use of common cleaning, sanitizing, and disinfecting products in medical settings, where they can interact with employees' skin, respiratory, and immune systems on an hourly basis.

One of the most significant differences between these two categories of compounds is the immediacy of their effects on the human body. Anyone who has accidentally mixed cleaning products, splashed



a cleaning chemical on their hand, or suffered burning eyes while using chemicals in a small space has experienced the direct effects of QACs.

VOCs, on the other hand, encompass a large number of different airborne compounds, many of which are odorless and unable to be detected by humans directly. While the presence of VOCs sometimes triggers dizziness or shortness of breath, the more serious hazard is the long-term detrimental effect that VOCs can have on the respiratory system as they constantly make their way into the lungs and airways over time.

While healthcare employees usually undergo extensive training on the safe use of chemicals to [clean and disinfect surfaces](#), i.e. avoiding mixing chemicals and direct skin/eye/breathing exposure, the long-term negative effects of VOCs and QACs being present in the workplace are far less well understood and not top of mind for facility administrators and employees. As studies reveal more and more of those negative effects, it becomes more of a priority for environmental services departments to seek out disinfection and cleaning solutions that are free of these chemicals in order to provide a safe working environment for the nurses, doctors, and support staff that spend so many hours every day in close proximity to them.

## Volatile Organic Compounds

### *Definition*

The term VOC describes a category of compounds, each of which is unique in its composition and effect on the body. The important common threads between all VOCs are:

- Insolubility in water
- High vapor pressure
- Emitted as gas from solids and liquids
- Tend to remain concentrated in indoor environments

Examples of familiar VOCs include:

- The odor of a permanent marker
- Paint stripper/stain fumes
- The smell of copier/printer toner



While these VOCs are easily noticeable due to their distinctive odors, many VOCs are odorless and escape direct detection, leaving them unnoticed and unaddressed. Many chemical cleaning and disinfecting solutions emit VOCs during use or even in storage, creating a constant presence of potentially harmful VOCs in an environment like a hospital where these activities are frequent.

## **Short-term Threats**

One of the complicating factors of studying the effects of VOCs on the human body is that every respiratory and immune system is unique. Some employees may be able to work in an environment with many airborne VOCs without any observable immediate ill effects, while others may find themselves nearly incapacitated as their systems struggle to combat the incoming foreign chemicals.

Accordingly, the most dramatic effects of airborne VOCs are observed in individuals who already suffer from chronic respiratory conditions such as asthma, COPD, or bronchitis. These compromised respiratory systems are unable to cope with the added strain of filtering out oxygen-stealing chemical compounds, and breathing becomes extremely difficult and exhausting.

Even in a healthy individual without chronic breathing issues, however, VOCs continue to put increased pressure on the respiratory system. For employees working in a high-pressure, strenuous environment like a medical center for long hours, this added strain on the body leads to physical fatigue, mental fatigue, and a weakened immune system that is vulnerable to other health threats.

## **Long-term Threats**

The long-term threats of exposure to VOCs, while even harder to study, are likely much more detrimental than the short-term threats. Given the presence of VOCs in healthcare settings due to the frequent use of chemical disinfectants, researchers continue to explore the connections between the chemical compounds and chronic respiratory diseases. One study conducted at a hospital in France revealed that more than 40 VOCs were present in the atmosphere. While the level of each individual VOC was below the recommended limit for workplace safety, the interactions between VOCs are still very poorly understood and likely pose increased risks to employees who experience constant exposure to them.



Recent research also suggests linkage between VOC exposure and COPD, one of the most common chronic respiratory diseases. As the investigation into these relationships continues, it becomes more pressing for hospital managers to help improve their employees' health by avoiding the use of products with high levels of VOCs wherever possible.

## Quaternary Ammonium Compounds

QACs, sometimes also referred to as “quats,” are central components of many disinfecting and sanitizing solutions. While they are attractive to product manufacturers due to their high level of effectiveness in killing pathogens, they also present severe short-term health risks to employees. Products containing QACs often feature extensive handling and use instructions, require the use of little to no PPE during application, and must be stored according to strict protocols.

### Short-term Threats

Direct contact with the skin, eyes, mouth, or airways usually produces immediate and painful effects, such as burning, itching, rash, difficulty breathing, and coughing. Mitigation strategies usually involve rinsing the affected area with water to remove the chemical compounds.

### Long-term Threats

The long-term effects of prolonged exposure to QACs comprise an area of intense current research. Preliminary data from a number of independent studies indicate that QACs are linked to the development of asthma and to worsening the symptoms of existing asthma conditions.

## Hydrolyte®: VOC and QAC Free Disinfectant

While the assumption in many cases is that VOCs and QACs are an unpleasant but necessary component of hospital grade [disinfectants](#), sanitizers, and cleaners, the truth is that there are good options available that do not produce these harmful chemical compounds. One of the most powerful of these alternatives is Hydrolyte®, the flagship product of 21st Century Healthcare Inc.

Rather than using chemical compounds that escape into the air, remain in the environment in concentrated amounts for long periods of time, and negatively affect the health of employees every



day, Hydrolyte® relies on the functionality of hypochlorous acid (HOCl), a compound with low toxicity and a zero HMIS hazard rating. There are no special requirements for storing Hydrolyte® safely, and

employees can use little to no PPE during application to protect their respiratory systems from airborne VOCs.

Medical facility administrators do not sacrifice efficacy by selecting Hydrolyte® over competing products that produce VOCs; as indicated on the disinfectant's product label, Hydrolyte® is 99.9999% effective against MRSA, C. diff, salmonella, and many other bacteria/viruses that pose a threat to patients and staff in healthcare settings. Within 10 minutes of application to hard, nonporous surfaces, Hydrolyte® is highly efficacious against product label listed pathogens.

With a resident epidemiologist on staff, [21st Century Healthcare Inc.](https://www.21stcenturyhealthcare.com) invites hospital managers to contact their team directly to learn more about Hydrolyte®, the functionality of HOCl to kill harmful bacteria and virus cells, and other benefits of using this anolyte solution to disinfect surfaces.

## References

*PLOS One: February 2013, Volume 8, Issue 2.* "VOC Contamination in Hospital, from Stationary Sampling of a Large Panel of Compounds, in View of Healthcare Workers and Patients Exposure Assessment." [www.plosone.org](http://www.plosone.org), accessed 8/13/2022.

*Bellevue/NYU Occupational & Environmental Medicine Clinic.* "Quaternary Ammonium Compounds in Cleaning Products: Health & Safety Information for Health Professionals." [www.med.nyu.edu/pophealth/bellevue-nyu-occupational-environmental-medicine-clinic](http://www.med.nyu.edu/pophealth/bellevue-nyu-occupational-environmental-medicine-clinic), accessed 8/13/2022.

*USA Environmental Protection Agency.* <https://www.epa.gov/indoor-air-quality-iaq/what-are-volatile-organic-compounds-vocs>, accessed 8/18/2022.

*Minnesota Department of Health.*

[https://www.health.state.mn.us/communities/environment/air/toxins/voc.htm#:~:text=Volatile%20Organic%20Compounds%20\(VOCs\)%20are,the%20indoor%20air%20we%20breathe.](https://www.health.state.mn.us/communities/environment/air/toxins/voc.htm#:~:text=Volatile%20Organic%20Compounds%20(VOCs)%20are,the%20indoor%20air%20we%20breathe.), accessed 8/18/2022.



### Author Bio



Ronnie Syverson, Senior Epidemiologist for PCT Corp. since 2017. Ronnie holds a Bachelor of Science in Biology and Nursing. In 1997 he completed North Carolina's Statewide Program in Infection Control and Epidemiology (SPICE) at the University of North Carolina Chapel Hill. He is currently licensed as a Registered Nurse in North Carolina. Ronnie holds a Certification in Infection Control and Epidemiology (CIC) from the Certification Board for Infection Control and Epidemiology (CBIC). He has been employed in healthcare since 1983, working in Infection Control and Occupational Health and Disease Management in the hospital environment. In 2016 Ronnie became Director of Infection Control for Greenspeed. He joined PCT Corp. in 2017 as Senior Infection Control Director. His vast knowledge in infection control and epidemiology has helped PCT Corp. develop the Annihilyzer, an onsite generating disinfection and cleaning system.