

Evaluation of Disinfectant Health Hazards and Risks

Introduction

The US Occupational Safety and Health Administration (OSHA) requires employers to perform a work site assessment and implement appropriate controls to help keep workers healthy and safe. The site-specific assessment should include evaluation of chemical exposures. This Technical Bulletin provides some considerations to assist health and safety professionals in work site evaluation of disinfectants.

Human health risks from chemicals like disinfectants depend on both the hazards of the chemical and the amount of exposure a person has. Chemical hazard information can be found in many places but the Safety Data Sheet (SDS) and product label are common sources. Some chemicals will have worker (occupational) exposure limits developed for them, usually because they are volatile enough to get into the air and/or have significant health hazards. It is important to understand that those limits are only appropriate for healthy adult working populations and may not be appropriate for the general public, who may be more vulnerable.

Once risk is characterized, by looking both at the chemical hazards and the amount of exposure, occupational health and safety professionals can determine how to manage it using controls like ventilation, work practices, and personal protective equipment (PPE). The following gives more detail on the process of evaluating disinfectant health hazards and risks, along with some general hazard and exposure limit information on commonly used disinfectant chemistries.

Evaluation Steps

- 1) **Hazard Identification** – Use Toxicology Studies, Epidemiology Studies and professional judgment and experience to identify hazards, including those communicated on Safety Data Sheets and labels. The following table provides examples of potential information that can be helpful to identify potential hazards for a few disinfectant types.

Disinfectant Type	Potential Health Hazards Include:*		Occupational Exposure Limits (Air Concentration)
	Concentrate	Ready-to-Use (RTU)	
Phenolics	Burns	Mild irritation	5 ppm (as phenol) OSHA PEL-TWA
Peroxyacetic (Peracetic) acid	Burns; harmful if inhaled, swallowed or absorbed through skin	Harmful if swallowed	0.4 ppm ACGIH TLV-STEL
Hydrogen peroxide	Irritation; harmful if swallowed	Low health hazard	1 ppm OSHA PEL-TWA
Chlorine Bleach	Burns	Depends on dilution	1 ppm (as chlorine) ACGIH TLV-STEL
Quats (Quaternary Ammonium Compounds)	Burns; harmful if swallowed or absorbed through skin	Low health hazard	Not developed
Isopropyl Alcohol	Not applicable	Irritation; may cause drowsiness or dizziness	Isopropanol = 200 ppm ACGIH TLV-TWA

*Based on the United Nations Globally Harmonized System (GHS) of classification and labeling of chemicals for typical formulations and concentrations.

There are some references in the published literature to quats causing allergic respiratory reaction, but you may notice that is not included as a hazard on the table. This is because available data doesn't meet the criteria for classifying quats as a respiratory allergen on an SDS or EPA label. Quats are widely used and there are recent case studies of respiratory health effects associated with them.¹ Human case studies are often unreliable in linking chemical exposure to respiratory effects because of other factors that may be present that may also contribute to these effects (eg. presence of other respiratory diseases or allergies, smoking habits, etc.). Scientists often use other tests (eg. animal studies, in vitro tests etc.) to better understand the connection between chemical exposure and a specific health hazard. These types of studies allow the scientists to control factors such as genetic differences and other environmental factors that may also cause a similar health effect. Additional scientific data is needed to understand if the use of quat disinfectants may result in human health effects.

2) **Exposure Assessment** – Measuring airborne chemicals and comparing to exposure limits.

The next step once potential hazards have been identified is to determine the extent of exposure. Inhalation and skin exposure are typically of more concern since ingestion of disinfectants is less likely in a workplace setting. Gloves are often used to limit skin contact but inhalation can occur if disinfectants become airborne as gases, vapors or aerosol particulates. Air concentrations should be kept below limits, where they are applicable, and sometimes testing of the air may be needed to verify exposure limits are not exceeded. The likelihood of exposure over limits depends on many things such as how volatile the chemical is and how much is used. In the past when mostly quats were used, exposure concerns were low as they were considered low hazard and low volatility. But with the low exposure limits of some of the newer disinfectant chemicals and the large amounts of surface area they may be applied to, chemical exposure assessment may be needed when these new disinfectants are used – even if they are not sprayed, as wiping large amounts of surface area could result in enough chemical evaporation to go over their low exposure limits.

3) **Risk Characterization and Management** – Making changes when needed to reduce risk.

If the evaluation indicates there is too much health risk, exposure reduction may be needed. Approaches could include using a different disinfectant, reducing the amount of exposure, additional PPE or ventilation, and changing work practices. In general, the Hierarchy of Controls approach should be used so that controls other than PPE are considered first. It should be noted that product use, including application methods, must follow the disinfectant EPA Label instructions, which may limit the potential for controlling risk by changing the way a product is used.

References

¹Allergy Asthma Clin Immunol. 2019; 15: 69. Methodological evaluation of human research on asthmagenicity and occupational cleaning: a case study of quaternary ammonium compounds (“quats”)

Additional References

American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLV) 2014.

Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PEL).

Plog, Barbara. Fundamentals of Industrial Hygiene, 6th Edition, 2012, National Safety Council.

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