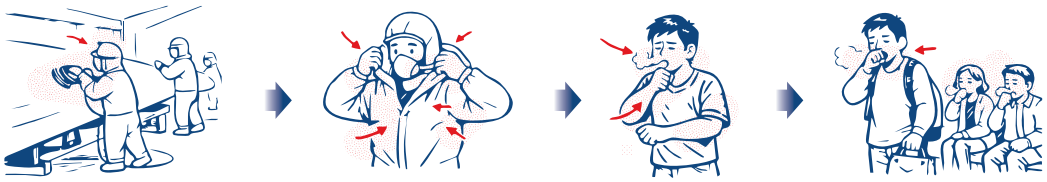
THE CHALLENGE OF DECONTAMINATION FOR CHEMICAL PROTECTIVE CLOTHING

Wearing chemical protective clothing (CPC) is only one part of chemical exposure control. The doffing process is also critical to minimize the risk of contaminants on the surface of CPC transferring to skin or inner clothing. Therefore, decontamination is a recommended process to protect worker health and safety by reducing potential contact with contaminants on the PPE surface during doffing.

I. Common Misconception About Decontamination

A common misconception is that decontamination is required only in emergency response scenarios or for Level A garments. In reality, any worker exposed to hazardous chemicals — whether liquid, gas, particulate, or microbiological — may require decontamination to reduce the risk of secondary exposure during PPE removal.

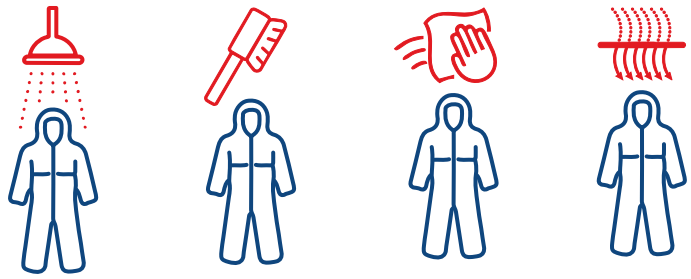
For example, in wind blade manufacturing, workers often wear Type 5 protective garments to protect against fine fiberglass and resin dust generated during grinding and finishing operations. During PPE removal, particulate contamination on the PPE surface may become airborne, resulting in skin and inhalational exposure; particles adhering on inner clothing or hair may also be transported beyond the work area, creating a potential for secondary exposure. In such cases, air shower may be considered as an engineering control to reduce the particulate contamination prior to doffing.



II. Decontamination Methods

At a high level, decontamination is accomplished by physically removing contaminants, chemically converting them to a less hazardous form, or combining both approaches. Below are the regular decontamination methods for reference.

Physical removal: Water rinsing, scraping, wiping off, air shower, etc.



Chemical reaction: Neutralization, oxidation/reduction, dissolution, disinfection, etc.

III. Decontamination Agent Selection

Decontamination agent selection should be guided by hazard assessment and professional judgment. The goal is to reduce risk—without introducing any new hazards or degrading PPE material.

Key considerations include the exposure scenario, the physical and chemical properties of contaminants (e.g., state, temperature, concentration, water-soluble or reactive), the potential for hazardous reactions during decontamination, and the compatibility of the decontamination agent with the PPE materials. Any selected agent should be compatible with PPE to avoid chemical reaction and/or material degradation that could reduce protective performance and lead to secondary exposure.

For example, high-concentration sulfuric acid can generate significant heat upon contact with water, which is a well-known exothermic reaction. As a result, if a garment is heavily contaminated with this kind of chemical, there is a risk of damage during decontamination with water or water-based agents. In such cases, it is advisable to remove any excess water-reactive chemicals with absorbent materials — such as spill absorbent cotton or other non-reactive absorbents — rather than applying a water or water-based decontamination procedure directly.

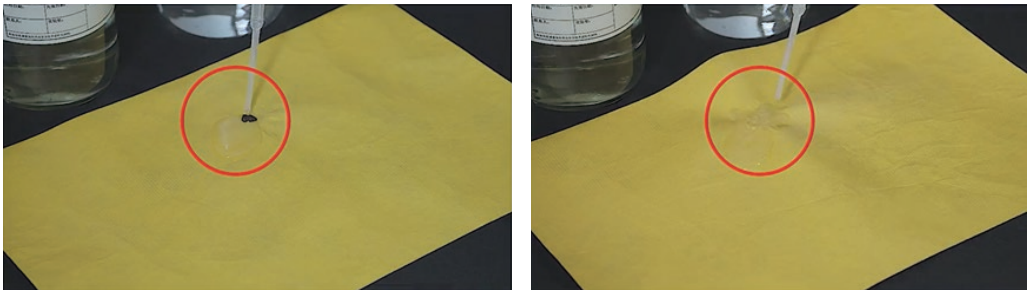


Figure 1. Exothermic reaction caused by contact between 98% H_2SO_4 and water
***#GetTheFacts Video:** What Happens When Sulfuric Acid Contaminated Clothing Is Rinsed with Water?*

The table below provides a general guide to the solubility of several contaminant categories in four types of solvents: water, dilute acids, dilute bases, and organic solvents. Due to the potential hazards involved, chemical decontamination should be performed only when recommended by an industrial hygienist or other qualified health professional.

SOLVENT	SOLUBLE CONTAMINANTS
Water	Low-chain hydrocarbons Inorganic compounds Salts Some organic acids and other polar compounds
Dilute Acids	Basic (caustic) compounds. Amines Hydrazines
Dilute Bases For example: -detergent -soap	Acid compounds Phenols Thiols Some nitro and sulfonic compounds.
Organic Solvents* For example -alcohols -ethers -ketones -aromatics -straight-chain alkanes (e.g., hexane) -common petroleum products (e.g., fuel oil, kerosene)	Nonpolar compounds (e.g., some organic compounds).

**WARNING: Some organic solvents can permeate and/or degrade the protective clothing.*

Figure 2. General Guide to Solubility of Contaminants In Four Solvent Types
Source: OSHA - Decontamination

IV. The Purpose of Decontamination

In general, decontamination serves two primary purposes: hygiene and reuse. Therefore, before establishing a decontamination process, it is essential to clearly define its intended purpose from the outset.

- **Hygienic purpose:** reduce the concentration of contaminants on the PPE surface to a level that allows safe doffing.

- **Reuse purpose:** eliminate chemicals not only from the surface but also from within the fabric of the garment, ensuring that no chemical residue remains for future use.

These two objectives imply different endpoints and verification approaches. A process that is adequate for safe doffing may be insufficient for reuse, particularly for contaminants that can permeate into fabrics, seams, or accessories.

V. Challenges for Reusable Garments

Chemicals may permeate into fabrics and persist for long periods. As a result, decontaminated garments may emit odors and/or show visible color changes after prolonged storage.

This raises a critical question: how can we confirm whether a garment has been decontaminated completely? Visual inspection or simple tests are often used; however, these methods cannot detect chemical residues within materials. Component analysis tests can provide more definitive results, but such testing is generally destructive. Even when testing shows no chemical residues on or within the fabric, the garment cannot be reused since it has been destroyed during testing.

Compounding this challenge, most manufacturers of reusable chemical protective clothing do not provide validated, use-specific decontamination methods, which places responsibility on end users to establish and validate decontamination processes intended to support garment reuse.

VI. Conclusion

Decontamination is a critical control measure to protect the health and safety of workers during PPE doffing following exposure to hazardous chemicals. A thorough risk assessment is essential before decontamination to assess whether the selected process and agent are appropriate for the specific chemicals/PPE/exposure conditions.

For reusable CPC, additional decontamination is required to fully remove residual chemicals prior to future use, and appropriate verification is necessary to assess the effectiveness. In the absence of validated decontamination and verification methods, reuse of chemical protective garments should be avoided due to the potential risk of residual chemical exposure.

About DuPont Personal Protection

DuPont is committed to developing innovative solutions with purpose, foresight, and collaboration at the core. Guided by our fundamental values—Safety and health, Respect for people, Highest ethical behavior, Protecting the planet—we believe safety is not just a priority, but a strategic business value. It stands as one of the four pillars of our operations and management philosophy.

DuPont Personal Protection is recognized as one of the most trusted brands in the personal protective equipment (PPE) industry. We understand that those who work with or around hazardous substances every day need absolute confidence in their protective apparel. That's why DuPont™ Tyvek®, Tychem®, and ProShield® garments are engineered to deliver superior protection for frontline workers, combining long-lasting barrier performance with exceptional comfort through advanced fabric technology and seam design.

Every hero deserves protection. DuPont Personal Protection is dedicated to safeguarding every step of your journey.