



| Chemical | Butyl | Rubber | Neoprene | Nitrile | PE | PVAL | PVC | Silver Shield® |
|---|-------|--------|----------|---------|----|------|-----|----------------|
| Acetic acid | VG | P | F | P | P | P | P | VG |
| Acetone | VG | P | P | P | P | P | P | VG |
| Ammonium carbonate | - | VG | VG | VG | - | - | - | - |
| Ammonium hydroxide (30-70%) | VG | P | G | G | P | P | F | - |
| Aniline | VG | P | P | P | P | VG | P | VG |
| Benzene | P | P | P | P | P | VG | P | VG |
| Benzyl alcohol | VG | P | F | G | - | P | P | VG |
| Calcium hydroxide | - | - | VG | VG | VG | - | - | - |
| Citric acid (30-70%) | VG | VG | VG | VG | VG | P | VG | - |
| Ethyl acetate | F | P | P | P | P | G | P | VG |
| Ethanol | VG | P | G | F | F | P | P | VG |
| Ethylene glycol | VG | VG | VG | VG | VG | F | VG | VG |
| Ferric chloride | - | - | VG | VG | - | P | G | - |
| Formic acid (>70%) | VG | P | VG | F | P | P | G | F |
| Glycerin/Glycerol | VG | VG | VG | VG | - | - | VG | VG |
| Hydrochloric acid (<30%) | VG | VG | VG | VG | F | P | G | G |
| Hydrofluoric acid (30-70%) | VG | F | VG | P | F | P | F | G |
| Hydrogen peroxide (30-70%) | VG | VG | VG | VG | VG | P | G | G |
| Iodine, solid | VG | - | VG | VG | G | - | - | - |
| Isooctane | P | P | F | VG | - | G | P | - |
| Isopropanol | VG | P | VG | VG | P | P | F | VG |
| Methanol | VG | P | F | P | P | P | P | F |
| Methylcellosolve (methyl glycol) | VG | P | P | P | - | P | P | G |
| Methylene chloride | P | P | P | P | P | VG | P | G |
| Methyl ethyl ketone | G | P | P | P | P | P | P | VG |
| Methyl methacrylate | F | P | P | P | P | VG | P | VG |
| Naphthalene | P | P | P | P | - | - | P | - |
| Naphtha, 15-20% aromatics, (Mineral spirits) | P | P | F | VG | P | G | F | VG |
| Naphtha, <30% aromatics, (Petroleum benzine/VM&P) | P | P | P | G | - | G | P | - |
| Nitric acid (30-70%) | VG | P | VG | P | G | P | F | G |
| Oxalic acid (<30%) | VG | VG | VG | VG | - | P | VG | VG |
| Petroleum ether, <1% aromatics | P | P | P | VG | P | - | P | VG |
| Phenol (>70%) | VG | P | F | P | P | F | P | G |
| Phosphoric acid (>70%) | VG | VG | VG | VG | VG | P | VG | VG |
| Potassium hydroxide | VG | VG | VG | VG | - | P | VG | G |
| Propanol | VG | P | G | G | - | P | F | G |
| Sodium hydroxide | - | - | - | - | VG | - | - | - |
| Sodium thiosulfate | VG | VG | VG | VG | - | - | VG | - |
| Stoddard solvent | P | P | F | VG | - | G | P | - |
| Sulfuric acid (30-70%) | VG | VG | VG | F | VG | P | VG | VG |
| Tetrahydrofuran | P | P | P | P | P | F | P | VG |
| Toluene | P | P | P | P | P | VG | P | VG |
| o-Toluidine | VG | - | F | - | P | - | P | VG |
| Trichloroethylene | P | P | P | P | P | VG | P | VG |
| Triethanolamine | VG | F | G | F | - | - | F | G |
| Turpentine | P | P | P | F | - | G | P | VG |
| Xylene | P | P | P | P | P | VG | P | VG |

¹ Recommendations from Forsberg, K and Mansdorf, SZ. 2007. *Quick Selection Guide to Chemical Protective Clothing, 5th Edition*. New Jersey: Wiley & Sons Inc. Recommendations are not valid for very thin Natural Rubber, Neoprene, Nitrile and PVC gloves (0.3mm or less).

Recommendations are based on resistance to chemical breakthrough under conditions of continuous contact:

VG = Recommended (> 8 hours of resistance)

G = Recommended (4- 8 hours of resistance)

F = Use with caution (1-4 hours of resistance); only suitable for short periods and with chemicals having minimal dermal hazards

P = Not Recommended (< 1 hour of resistance)

- = Not Tested

Rubber = Natural Rubber/Latex

PE = polyethylene

PVAL = polyvinyl alcohol

PVC = polyvinylchloride

Silver Shield = North Silver Shield® laminate of polyamide/ethylene vinyl acetate/polyethylene plastic films



Choosing Gloves: Quick Selection Guide

As part of a conservator's personal protective equipment (PPE) toolbox, appropriate gloves should be available for use with a given chemical. There are a variety of glove materials from which to choose such as nitrile, latex, neoprene, and butyl, in addition to trade name gloves made from multiple materials that provide greater chemical protection.

The **PPE Chemical Protective Material Selection Guide** was created by the Health & Safety Network to help conservators select the appropriate material for chemical use based on data from the *Quick Selection Guide to Chemical Protective Clothing* (Forsberg and Mansdorf 2007). No single type of glove is perfect for all chemicals. Please note that this guide represents the safest materials for both immersion and incidental contact based on results from continuous chemical contact. Therefore, while the chart may indicate that a certain material is rated fair or poor, this rating may not be indicative of splash resistance, or reflect the effectiveness of a particular brand or trade name product. The manufacturer's recommendations also should be consulted when selecting the suitable material, particularly when the gloved hands will be immersed in the chemical.

In addition to chemical protection, the working properties of the gloves, for example flexibility and tear resistance that can vary by material, must also be taken into consideration when choosing the appropriate glove for a task. Non-disposable gloves usually provide excellent chemical barriers and perform better under mechanical stresses but tend to be thicker and must be cleaned after each use. Most of these gloves are available in flexible models to address dexterity issues or with slip resistance at the palm and/or fingertips to help with grip. Disposable gloves are typically thinner and allow for greater movement, but they generally only provide splash protection, may have shorter breakthrough and permeation times, and should be replaced after any chemical contact or after removing them for any reason. Doubling up gloves of the same material or using gloves that are a combination of materials (e.g., Silver Shield®) may lengthen breakthrough time and provide more physical and chemical protection.

Technical assistance is always available from glove manufacturers and vendors to help determine the correct product for use. Finally, while Safety Data Sheets (SDSs) may be vague about the specific glove materials required for use with a particular chemical, they should be reviewed to assess the overall risk for chemical exposure. Prudent health and safety practices should always be observed to provide a safe working environment.

Important Considerations for the Selection and Use of Chemical Protective Clothing

(Adapted from Forsberg, K and Mansdorf, SZ. 2007. *Quick Selection Guide to Chemical Protective Clothing, 5th Edition*. New Jersey: Wiley & Sons Inc.)

1. All chemicals eventually pass or permeate through any protective barrier. Replace periodically and at any change in appearance.
2. Even the best protective clothing products will not perform properly if they are torn, cut or damaged. Always check for leaks and holes.
3. A barrier may protect against one chemical very well but perform poorly against another or a mixture of chemicals.
4. Recommendations are generally based on tests that have been performed at room temperature; higher temperature usually decreases the breakthrough time of chemicals.
5. Generally, thicker is better. The use of multiple layers of the same material (i.e., double gloving) can increase protection.
6. Chemically resistant gloves and other chemical protective clothing may all look alike. Be sure that the material you are using is the right one for the job you are doing.
7. Once the barrier material has absorbed a chemical, it will continue to permeate (pass through) the material.
8. Many recommendations for glove use give the common generic name of the glove material. Most of the polymer formations in each material type vary by manufacturer and can vary by product lot.
9. Some protective clothing has a shelf life and/or requires special storage measures, such as avoidance of sunlight, ozone, or moisture and temperature extremes.
10. Very thin ultra-lightweight gloves in rubber and polyethylene often offer poor chemical and mechanical resistance.

For more properties of glove materials, definitions of terms, links to glove manufacturers and suppliers, and an online version of the guide, visit the Network's wiki pages:

www.conservation-wiki.com/wiki/Health_&_Safety