AIC AMERICAN INSTITUTE FOR CONSERVATION OF HISTORIC AND ARTISTIC WORKS

Health & Safety Committee

PPE Chemical Protective Material Selection Guide[1] (2014)

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

Health & Safety Committee

Choosing Gloves: A 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 Health & Safety Committee has created the **PPE Chemical Protective Material Selection Guide** 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 Committee's website and wiki pages:

www.conservation-us.org/HealthandSafety