



PPE Questions Addressed for Chemical Applications

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Using the right personal protective equipment (PPE)—and disposing of it properly—is especially important in chemical plants where workers may be exposed to harsh and even dangerous chemicals. Below are questions often asked about selecting and using hand protection products and apparel in processing and handling applications.

What safety guidelines should we follow when wearing disposable nitrile gloves in the laboratory?

No disposable glove on the market today will provide perfect protection. Workers, therefore, should be careful to avoid contact with any chemicals as much as possible and to clean up spills or broken glass immediately. If hazardous chemicals are spilled on the gloves, the gloves should be discarded and replaced immediately.

Nitrile gloves are the right choice when working with aliphatic hydrocarbons. These gloves will not deteriorate when exposed to animal fats, lubricating oils and similar products, and they will protect against water solutions of highly polar materials such as hydrochloric acid, phosphoric acids, sodium hydroxide and most salts. Nitrile gloves, however, are not appropriate for working with highly concentrated sulfuric and nitric acids, although they will resist these acids if the acids are diluted to no more than 50 percent concentration.

Nitrile gloves are not recommended for use with medium-polar solvents such as trichloroethylene, acetone, ethyl acetate and other solvents with similar polarity. In some cases, workers may substitute natural rubber latex gloves. In other cases, they may need laminate gloves since this is the only type of hand protection that will provide sufficient chemical resistance. Laminate gloves are also thin enough to provide the dexterity needed to handle laboratory equipment.

Technicians in our organic prep laboratory work with methylene chloride, hexane and acetone. What kind of glove can they use that will provide some grip for handling separatory funnels yet supply the dexterity they need to work with glassware and beakers?

One certain glove polymer may be better than another for handling a specific chemical. However, neoprene provides excellent broad range splash resistance in a thin mil glove. Neoprene is also better than other disposable gloves in providing splash protection from DMSO, DMAC and DMF, which are common chemicals used in most pharmaceutical laboratories as splitting agents. Considering the many different chemicals used in an analytical lab setting, neoprene is the best all-around, disposable glove option.

Neoprene, however, is not a perfect solution. Methylene chloride degrades neoprene and every other glove polymer that is currently available in a thin, close-fitting glove style suitable for laboratory applications. Laminate gloves are preferable for working with methylene chloride. For close fit and better grip, the laminate gloves can be used as liners under neoprene or other similar disposable gloves.

What chemical resistant gloves are recommended for applications that require static control, such as when employees are working with flammable chemicals, gasoline and other volatile fuels?

Several types of static dissipative/low charging chemical resistant glove styles are available that are suited for use with these substances—depending on the specific chemicals handled. Nitrile, neoprene and butyl are the most common glove polymers used in electrostatic discharge (ESD) controlled areas. Unsupported nitrile or neoprene gloves are ideal for applications that require dexterity and durability.

For physically demanding applications such as valve assembly, line breaking or general maintenance, supported nitrile or neoprene gloves may be best, depending upon the degree of grip, flexibility and durability required. Vinyl gloves are also a good choice for these types of tasks if they can resist the types of chemicals used. Consulting the glove manufacturer would be best.

It is extremely important, however, to understand that ESD control will depend on the entire system rather than a single product. Environmental conditions, appropriate grounding and even air ionization should always be considered if it is critical to eliminate ESD events.

You should also keep in mind that not all gloves are made the same—even if they contain the same polymer. You should always request electrical property data from your selected glove manufacturer to assure the hand protection products you choose meet the static dissipative/low charging performance required for your application.

We are concerned about latex allergies since our workers wear latex to perform various tasks. What causes latex allergies and what can be done to prevent an allergic reaction to latex?

Type I latex allergies are caused by allergenic proteins that naturally occur in the rubber trees used to make natural rubber latex. While manufacturers have been successful in reducing the residual amounts of these allergenic proteins in gloves, they have not been able to remove them entirely.

Workers who know or suspect they have a latex allergy should consider switching to a synthetic alternative, such as nitrile, neoprene or vinyl (PVC) gloves, which are available from various manufacturers.

Workers within our processing facility often handle lubricated objects that have a slippery surface, which makes them hard to grasp. Are gloves available that will help workers maintain a more secure grip?

Gloves are offered that include a textured finish on the fingertips, which is ideal for grasping smaller and lighter objects such as test tubes and glassware. For larger, heavier objects, gloves are available that incorporate a unique new technology that creates a roughened surface comprised of microscopic channels in a patented ultra-thin coating, which directs fluids away from the grip surface. These gloves can allow workers to maintain almost the same grip in oily applications that is possible in dry conditions.

Why are supported nitrile gloves tougher and safer to use in an oil refinery application than the inexpensive black PVC gloves that were used for many years?

Supported nitrile glove products work much better than the PVC gloves previously used because they provide longer and broader chemical resistance. PVC gloves do not offer much resistance to many of the chemicals used during the refining process because they allow certain aromatic chemicals—like toluene and xylene—to permeate without causing any visual change in the gloves, except some stiffening.

Some of our employees appear to be allergic to vinyl disposable gloves. What is causing this problem?

Genuine allergic reactions to vinyl gloves are almost nonexistent. Workers may experience contact urticaria, which is a simple skin irritation caused by perspiration and lack of ventilation inside the glove.

Leakage is another possibility. Although disposable vinyl gloves exhibit chemical resistance when tested in the laboratory, once the gloves are worn for about an hour, they will begin to leak. The "allergies" experienced may be reactions to the chemicals workers are handling.

If workers are actually allergic to vinyl gloves, the allergy probably results from additives in the vinyl formulation. Natural or synthetic (neoprene or nitrile) rubber gloves use entirely different additives. Workers who are allergic to plastics additives generally do not react to rubber additives, too.

Most manufacturers do not provide permeation testing for their aprons. Why is this?

Most manufacturers do not provide this type of testing because it is expensive and the chemicals that permeate aprons do not contribute significantly to a worker's total exposure. To reach the skin, a chemical must be splashed onto the apron and permeate the material. It must then evaporate, travel through the air space between the apron and the clothing beneath it, and permeate the clothing before reaching the skin.

A chemical with a high enough vapor pressure to follow this route is more likely to evaporate from its container or from the location where it was splashed, and then move as a vapor around

the apron and contact the skin in only one step. If this occurs, the chemical will reach all of the skin—not just the skin beneath the apron. This route of exposure is much more likely.

Degradation is usually a more critical factor as far as aprons are concerned. Many manufacturers provide degradation guidelines for their products.

How can I determine what size of gloves I need to provide workers?

Because proper fit is essential to comfort and dexterity, it is worth the time required to physically measure each worker's hand. Use a dressmaker's cloth tape to measure around the hand, above the thumb and below the fingers. Or, wrap a strip of paper around the hand, mark the length, and then flatten the paper and use an ordinary ruler to determine the length. The diameter of the hand (rounded to the nearest half-inch) is numerically equal to the worker's nominal glove size.

This type of measurement, however, does not account for possible variations in the size and shape of each worker's hands. Some people, for example, have long, slim fingers and others have short, stubby fingers. Because hands are so different, the most comfortable glove for an individual worker may be one-half or even one full size larger or smaller than the person's measured hand size.

What are your recommendations for disposing of used gloves?

The answer will depend on how the gloves were used. If they were contaminated with a toxic compound or biomaterial that is covered by disposal regulations, the gloves must be handled in the same way as the toxic material if the material in or on the gloves exceeds the limit specified in the regulation.

If the gloves are not contaminated or have been properly decontaminated, they may be incinerated or disposed of in a landfill. Since ordinary aerobic or anaerobic decomposition processes in gloves will not form any toxic products, the gloves may be disposed of in an ordinary landfill. Their breakdown, however, will be very slow—except for cotton and natural rubber products, which are more easily degraded by microbial attack.

A well-designed, properly-operated incinerator should be able to completely burn all types of gloves and any intermediate decomposition product that forms during the incineration process. The higher the temperature and the longer the exposure time, the more complete the combustion.

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