

# The Importance of Proper Glove Storage

Healthcare workers wear gloves to protect themselves and their patients from blood-borne pathogens. In order to maintain optimal barrier integrity prior to use, it is imperative to store gloves appropriately to prevent degradation and maintain glove reliability.

Extreme temperatures adversely affect gloves. To obtain peak performance of any glove, most glove manufacturers recommend that gloves be stored in a cool, dry environment with a temperature ranging between 50°-72° F (10°-22° C).

## Spontaneous Combustion

In 1995, chlorinated, powder-free, latex exam gloves had a number of reported incidences of spontaneous combustion. This phenomenon occurred in warehouses and involved large inventories of non-sterile, powder-free, chlorinated latex gloves being stored on pallets.

A preliminary investigation, conducted by the FDA, the Bureau of Alcohol, Tobacco & Firearms (BATF), and local fire departments, concluded that fire due to spontaneous combustion of gloves occurs as a result of high temperatures. High temperatures may accelerate a hypothermic chemical reaction on the chlorinated gloves to the point where latex ignites. The investigation, published June 27, 1996, also indicated several factors that may increase the potential risk for fires. The most important of these are the storage environment temperatures and mass of the gloves. Therefore, do not store large quantities of powder-free, latex, patient examination gloves in conditions of extreme heat (1)

All known fires occurred in at least one pallet in warehouses without temperature controls. One or more pallets stored in a warm to hot location would be considered to be a large quantity of powder-free latex gloves. While it is not possible to identify a maximum safe storage temperature, research has confirmed that the greater the mass quantity of gloves, the cooler the temperature must be to avoid fires.

The FDA recommends the following precautions:

- Avoid a large inventory of powder-free, latex gloves
- Remove shrink-wrap from pallets of stacked cartons
- Break apart stacked cartons on each pallet and restack or reconfigure cartons to facilitate cooling ventilation
- Periodically, check powder-free, latex gloves for characteristics suggesting deterioration, such as brittleness, tackiness, or an acrid chemical odor or stench
- Rotate your powder-free, latex glove stock using "first-in-first-out" practices (2)

If any type of glove exhibits deterioration characteristics, they should not be used as it is uncertain whether or not they will provide a sufficient protective barrier. According to the FDA should these characteristics be noted, or if evidence of combustion is observed:

1. Immediately break apart the stacks to dissipate heat
2. Identify gloves as hazardous and quarantine or remove
3. Contact your District FDA office or call FDA Emergency Operations at (301) 443 1240
4. Contact your local Health Department or local environmental agency regarding the proper disposal of hazardous materials (3)

### **Ozone and Ultraviolet (UV) Light**

The next area of importance in preventing glove degradation is to shield natural rubber latex gloves from ozone and ultraviolet (UV) light. Natural rubber latex gloves are extremely susceptible to degradation by UV light. Even low levels of UV from fluorescent lights can effect the characteristics of gloves. (4) Ozone is a colorless, odorless, invisible gas and oxidizing agent that attacks latex chemical bonds. Ozone can rapidly deteriorate latex products. (This is the same ozone we talk about when we “fear for the depletion of the ozone layer”). Ozone gas penetrates glove packaging, and therefore, may not protect gloves from ozone damage. In a concentrated ozone environment, packaged gloves will exhibit holes and large rips and tears at folds and creases. (5)

Ozone sources include electric motors, furnaces, air conditioners, fans, and other electric motorized devices. Also included are high-energy sources, such as fluorescent light transformers, arcing equipment, electrocautery units, and spark generators.

Heat accelerates ozone damage and latex degradation. The oxidation rate of latex film doubles for each 8.3°C rise in temperature. (6) Therefore, the oxidative rate of latex goods stored against the ceiling is greater than that of similar goods stored at floor level.

When exposed to UV radiation, oxygen reacts to form ozone. Minute cracks of the exposed surface are formed from exposure of latex film to UV light. Plastic or cellophane packages allow UV light into the gloves and will produce discoloration. Since ozone damage may not be immediately obvious, it is vital to check gloves during the donning process. Look for any signs of deterioration. Weakened latex causes pinholes and tears to form, fingers to tear or fall off, and cuffs to tear or pull off. To identify ozone damage, look for white lines, holes, or tears at stress points (cuff folds and creases). If a glove is of normal color, stretches without surface cracks, and can be pulled onto a hand without breaking, ripping or tearing, then it should protect as well as a fresh glove will. (7)

### **Age**

In the case of surgical and medical exam gloves, the US Food and Drug Administration (FDA) has not established any guidelines for specifying storage lives, nor has it mandated that expiration dates be affixed to surgical gloves. Age is vital to the integrity of the glove. Store the gloves so that your gloves are rotated, using the oldest gloves first. Keep gloves in their original packaging until needed. Since glove shelf life varies by

manufacturer, it is important to follow manufacturers' suggested storage temperatures and storage guidelines to ensure optimal life of the latex glove.

In the case of sterile gloves of any type, the Association of Operating Room Nurses 2004 *Standards, Recommended Practices, and Guidelines* recommends, "To ensure that only sterile items are presented to the sterile field, all items should be inspected immediately before presentation to the field for proper packaging, processing, seal, package container integrity, and inclusion of a sterilization indicator that has changed color demonstrating that sterilization parameters were met. If an expiration date is provided, the date should be checked before opening the package and delivering the contents to the sterile field. Outdated items should not be used." (8)

### **Summary and guidelines to storing natural rubber latex gloves**

- Store gloves in a cool dry, environment with a temperature ranging between 50°-72° F (10°-22° C)
- Avoid storing gloves near chemicals, heat, humidity, ultraviolet light, high-energy radiation, ozone, and stress
- Avoid a large inventory of palletized powder-free, latex gloves
- Remove shrink-wrap from pallets of stacked cartons
- Break apart, stacked cartons on each pallet and restack or reconfigure cartons to facilitate cooling ventilation
- Check all gloves for characteristics suggesting deterioration, such as brittleness, tackiness, or an acid chemical odor or stench and discard if any abnormalities are noted
- Rotate your powder-free, latex glove stock using "first in, first out" practices

### **Sources**

- (1) FDA Public Health Advisory. *Potential Risk of Spontaneous Combustion in Large Quantities of Patient Examination Gloves*. Center for Devices and Radiological Health, Food and Drug Administration. Rockwell, MD; 1996 (June 27). Internet website <http://www.fda.gov/cdrh/glovepha.html> March 4th, 2005
- (2) Ibid
- (3) FDA Public Health Advisory. *Potential Risk of Spontaneous Combustion in Large Quantities of Patient Examination Gloves*. Center for Devices and Radiological Health, Food and Drug Administration. Rockwell, MD; 1996 (June 27). Internet website <http://www.fda.gov/cdrh/glovepha.html> March 4th, 2005
- (4) Holt, Rinehart and Winston, Inc. *Introduction of inorganic Chemistry*. 3<sup>rd</sup> Edition, Prentice-Hall, Inc. 1960:8.
- (5) Ansell Perry Inc. *Proper Storage of Latex Gloves to Prevent Ozone Damage*. 1995 (May).
- (6) Ibid
- (7) Berkheimer H, et al. *The Vanderbilt Latex Handbook*. 3rd Ed., RT Vanderbilt Company, Inc., Norwalk, CT 1987: 117-27.

- (8) "Recommended practices for maintaining a sterile field," in *Standards, Recommended Practices, and Guidelines* (Denver: AORN, Inc, 2004) page 368.

## References

Ansell Perry Inc. *Proper Storage of Latex Gloves to Prevent Ozone Damage*. 1995 (May)

Berkheimer H, et al. *The Vanderbilt Latex Handbook*. 3rd Ed., RT Vanderbilt Company, Inc. Norwalk, CT 1987: 117-27

FDA Public Health Advisory. *Potential Risk of Spontaneous Combustion in Large Quantities of Patient Examination Gloves*. Center for Devices and Radiological Health, Food and Drug Administration. Rockwell, MD; 1996 (June 27). Internet website <http://www.fda.gov/cdrh/glovepha.html> March 4th, 2005

*Natural Rubber Technical Information Sheet L17*. 1977 Latex Series of the Malaysian Rubber Producers' Research Association, England

"Recommended practices for maintaining a sterile field," in *Standards, Recommended Practices, and Guidelines* (Denver: AORN, Inc, 2004) page 368

Walsh DL, Chwirut DJ, Kotz R, and Dawson J: *Environmental Degradation of Latex Gloves: The Effects of Elevated Temperature on Tensile Strength*. DMMS Report #96-05. FDA, Rockville, MD