The Glove May Not Always Fit

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Objectives

Understand federal guidelines that pertain to personal protective equipment (PPE).

Understand the different ASTM testing standards for gloves.

Review the elements of a hazard assessment and how to conduct a job hazard assessment for different occupational roles in healthcare.

Learn the tools and information needed for proper glove selection.
Hand Injuries by the numbers

9.6

The rate of injuries and illnesses resulting from cuts, lacerations, or punctures per 10,000 full-time workers in 2015, up from 8.8 cases in 2014.
Hierarchy of Controls

- Elimination/Substitution
- Engineering Controls
- Work practice/Administrative controls
- PPE

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Why are gloves worn?

- Infection Prevention/ Hand Hygiene
- Protection against biological, chemical, and physical hazards
Karen Wetterhahn’s Story
Routes of Exposure

- **Skin Contact**
  - Contact with body fluids, biological hazards and chemicals

- **Skin Penetration**
  - Injection
  - Absorption - water soluble materials

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Glove use in Healthcare

- General Patient Care
- Facilities Maintenance
- Food Service
- Pharmacy
- Laboratory
- Radiology
- Environmental Services

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OSHA Regulations that Include PPE Use

• 29 CFR 1910.95 - Occupational Noise Exposure
• 29 CFR 1910.120 - Hazardous waste operations and emergency response
• 29 CFR 1910.132 - PPE General Requirements
• 29 CFR 1910.134 - Respiratory Protection
• 29 CFR 1910.136 - Foot Protection
• 29 CFR 1910.137 - Electrical protective equipment
• 29 CFR 1910.138 - Hand protection
Based upon the results of the preliminary site evaluation, an ensemble of PPE shall be selected and used during initial site entry which will provide protection to a level of exposure below permissible exposure limits and published exposure levels for known or suspected hazardous substances and health hazards and which will provide protection against other known and suspected hazards identified during the preliminary site evaluation. If there is no permissible exposure limit or published exposure level, the employer may use other published studies and information as a guide to appropriate personal protective equipment.
29 CFR 1910.132- Personal Protective Equipment

• Hazard assessment and equipment selection
  • 1910.132(d)(2)

  • The employer shall verify that the required workplace hazard assessment has been performed through a written certification that identifies the workplace evaluated; the person certifying that the evaluation has been performed; the date(s) of the hazard assessment; and, which identifies the document as a certification of hazard assessment.

• Covers payment, maintenance and training

• 1910.138(a)

• General requirements. Employers shall select and require employees to use appropriate hand protection when employees' hands are exposed to hazards such as those from skin absorption of harmful substances; severe cuts or lacerations; severe abrasions; punctures; chemical burns; thermal burns; and harmful temperature extremes.

• 1910.138(b)

• Selection. Employers shall base the selection of the appropriate hand protection on an evaluation of the performance characteristics of the hand protection relative to the task(s) to be performed, conditions present, duration of use, and the hazards and potential hazards identified.
Job Hazard Analysis

- Job Hazard Analysis (JHA) or Job Safety Analysis (JSA) is a technique to identify the dangers of specific tasks in order to reduce the risk of injury to workers.
Job Hazard Analysis

OSHA 3071
2002 (Revised)

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# Appendix 3
## Sample Job Hazard Analysis Form

<table>
<thead>
<tr>
<th>Task #</th>
<th>Task Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hazard Type:</td>
<td>Hazard Description:</td>
</tr>
<tr>
<td>Consequence:</td>
<td>Hazard Controls:</td>
</tr>
<tr>
<td>Rational or Comment:</td>
<td></td>
</tr>
</tbody>
</table>
## PPE Hazard Assessment Certification Form

**Name of work place:** [ ]

**Work place address:** [ ]

**Work area(s):** [ ]

**Assessment conducted by:** [ ]

**Date of assessment:** [ ]

**Job/Task(s):** [ ]

---

### EYES

- **Work activities, such as:**
  - abrasive blasting
  - sanding
  - chopping
  - cutting
  - grinding
  - drilling
  - welding
  - punch press operations
  - other: [ ]

- **Work-related exposure to:**
  - airborne dust
  - flying particles
  - blood splashes
  - hazardous liquid chemicals
  - intense light
  - other: [ ]

- **Can hazard be eliminated without the use of PPE?**
  - Yes [ ]
  - No [ ]

- **If no use:**
  - Safety glasses
  - Side shields
  - Safety goggles
  - Dust-tight goggles
  - Shading/Filter (#______)
  - Welding shield
  - Other: [ ]

### FACE

- **Work activities, such as:**
  - cleaning
  - cooking
  - siphoning
  - painting
  - dip tank operations
  - other: [ ]

- **Work-related exposure to:**
  - foundry work
  - welding
  - mixing
  - pouring molten metal
  - other: [ ]

- **Can hazard be eliminated without the use of PPE?**
  - Yes [ ]
  - No [ ]

- **If no use:**
  - Face shield
  - Shading/Filter (#______)
  - Welding shield
  - Other: [ ]

### HEAD

- **Work activities, such as:**
  - building maintenance
  - confined space operations
  - construction
  - electrical wiring
  - walking/working under catwalks
  - walking/working under conveyor belts
  - walking/working under crane loads
  - utility work
  - other: [ ]

- **Work-related exposure to:**
  - beams
  - pipes
  - exposed electrical wiring or components
  - falling objects
  - machine parts
  - other: [ ]

- **Can hazard be eliminated without the use of PPE?**
  - Yes [ ]
  - No [ ]

- **If no use:**
  - Protective Helmet
    - Type A (low voltage)
    - Type B (high voltage)
    - Type C
    - Bump cap (not ANSI-approved)
    - Hair net or soft cap
    - Other: [ ]
## Job Hazard Analysis for Personal Protective Equipment (PPE) Assessment

<table>
<thead>
<tr>
<th>Job/Task Step</th>
<th>Hazard Type</th>
<th>Hazard Source</th>
<th>Body Parts At Risk</th>
<th>Severity</th>
<th>Probability</th>
<th>Risk Code</th>
<th>Control Method</th>
</tr>
</thead>
</table>

### Certification of Assessment

*Name of work place:* 

*Address:* 

*Assessment Conducted By:* 

*Title:* 

*Date(s) of Assessment:* 

Implementation of Controls Approved By: 

*Title:* 

Date: 

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Steps to Selecting the Right Glove

1. Identify the hazards of the materials the job is working with.
2. Determine if contact is incidental or extended contact.
3. Disposal of gloves after use.

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Identify the hazards of the materials being worked with

Base selection on the type of exposure and nature of the hazard

Some chemicals can easily penetrate gloves that work very well for other chemicals.

Consider these factors:

- Chemical type
- pH
- Toxicity
- Temperature extremes, cryogenic properties
- Physical hazards (sharps, piercing objects)
- Infectious potential of biological hazards
Determine Incidental/ Extended Contact with the Hazardous Materials

• Incidental contact includes these situations:
  • Accidental spills or splashes
  • Accidental overspray from a dispensing device
  • Handling infectious agents that require barrier protection
  • To prevent contamination of materials during handling

• Extended contact includes these situations:
  • Handling highly contaminated materials
  • Submerging hands in a chemical or other hazardous substance
  • Need for physical protection from temperature extremes or sharp/piercing objects

• Specific Use
Incidental Contact

Type of glove: Disposable, surgical-type gloves are appropriate for incidental contact.

Disposable glove usage:
- Check for rips or punctures before use.
- Remove and replace gloves immediately with new ones when a chemical spills or splashes on them.
- Never wash or reuse disposable gloves.
- Always remove glove before touching common objects such as doorknobs, phones, or elevator buttons.
Extended Contact

Type of glove: More substantial gloves are required for extended use.

Reusable glove usage. Check the gloves for:
- Rips or punctures before and after each use
- Prior contamination
- Signs of degradation (change in color or texture)
- Replace gloves as soon as signs of degradation appear.
- Wash after removal and air dry in location where being used.
- Consider wearing inner surgical gloves for extra protection.
Labeling of Gloves

- Medical Gloves - are regulated by FDA as Class I reserved medical devices.
  - FDA reviews to ensure that performance criteria such as leak resistance, tear resistance, and biocompatibility are met.

- 2017 FDA banned
  - Powdered surgeon’s gloves
  - Powdered patient examination gloves
  - Absorbable powder for lubricating a surgeon’s glove
Testing of Gloves - ASTM

- Mechanical Protection
- Chemical Protection
  - Permeation Standard F739
- Heat and Flame Protection
- Protection from Cold

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Testing of Gloves- ASTM

• Medical Exam


• ASTM F1671 / F1671M - 13 Standard Test Method for Resistance of Materials Used in Protective Clothing to Penetration by Blood-Borne Pathogens Using Phi-X174 Bacteriophage Penetration as a Test System
### Glove Types

<table>
<thead>
<tr>
<th>Gloves Type</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disposable Gloves</td>
<td>• Usually made of light-weight plastic</td>
</tr>
<tr>
<td></td>
<td>• Can help guard against mild irritants</td>
</tr>
<tr>
<td>Fabric Gloves</td>
<td>• Used to improve grip when handling slippery objects</td>
</tr>
<tr>
<td></td>
<td>• Help insulate hands from mild heat or cold</td>
</tr>
<tr>
<td>Leather Gloves</td>
<td>• Used to guard against injuries from sparks or scraping rough surfaces</td>
</tr>
<tr>
<td></td>
<td>• Used in combination with an insulated liner when working with electricity</td>
</tr>
<tr>
<td>Metal Mesh Gloves</td>
<td>• Used to protect from accidental cuts and scratches</td>
</tr>
<tr>
<td>Aluminized Gloves</td>
<td>• Designed to insulate hands from intense heat</td>
</tr>
<tr>
<td>Chemical Resistance Gloves</td>
<td>• Protect hands from corrosives, oils, and solvents</td>
</tr>
</tbody>
</table>
# Medical Glove Types - FDA Classifications

<table>
<thead>
<tr>
<th>Patient Examination Gloves</th>
<th>Surgeon’s Gloves:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Disposable device</td>
<td>• Must be sterile. FDA will not accept submissions for a non-sterile surgeon’s glove.</td>
</tr>
<tr>
<td>• Intended for medical purposes that is worn on the examiner’s hand or finger to prevent contamination between patient and examiner.</td>
<td></td>
</tr>
<tr>
<td>• Dental Patient Examination Gloves: worn during dental cleaning, filling, and other dental procedures and are patient examination gloves.</td>
<td>• Dental Surgeon’s Glove</td>
</tr>
<tr>
<td></td>
<td>• Mircosurgery Glove:</td>
</tr>
<tr>
<td></td>
<td>• Orthopedic Surgeon’s Glove:</td>
</tr>
<tr>
<td></td>
<td>• Autopsy Surgeon’s Glove:</td>
</tr>
<tr>
<td></td>
<td>• Surgeon’s Glove with Chemotherapy Claim.</td>
</tr>
</tbody>
</table>

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Chemotherapy Claims

• ASTM D6978-05
  • Uses at least nine chemotherapy drugs.
  • Tested for permeability
  • Make sure that the gloves you choose have been tested against the types of chemotherapy used in practice.

• Two pairs of chemotherapy-tested gloves should be worn for all hazardous drug handling activities.

• Nitrile, neoprene, or latex- with chemotherapy preparation, sterile gloves should be worn as the outer glove.
Radiology Attenuating Surgeon’s Glove

- Used during surgical procedures involving radiation exposure to the hands.

- Offer some degree of protection to the hand from radiation exposure as well as protection from transmission of infectious agents.

- Use includes surgical procedures that require the use of fluoroscopy or radiography.

- Have to have technical data that show that their attenuation claims meet the energy range of x-rays normally used in medical procedures.
Other Non-Medical Gloves

Embalming Gloves
- OSHA regulates embalming gloves and ASTM testing standard

Food Service Gloves (NOT MEDICAL DEVICES)
- FDA considers food service gloves to be a food contact surface which may result in the addition of indirect food additives to the food handled. FDA’s Center for Food Safety and applied Nutrition (CFSAN) regulates Food Service gloves.

Cleaning Gloves
- FDA does not regulate gloves used for routine janitorial functions in medical facilities. Gloves that are used for cleaning patients, or cleaning or handling surfaces or items contaminated with patient waste or fluids are medical gloves- should meet FDA requirements for patient exam gloves.

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THREE GLOVE SIZES:

LARGE, MEDIUM, AND EMPTY BOX

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Glove Materials

- Gloves made of leather, canvas, or metal mesh
- Fabric and coated fabric gloves
- Chemical- and liquid- resistant gloves
- Insulating rubber gloves (electrical work)
# Natural Rubber

<table>
<thead>
<tr>
<th>Advantage</th>
<th>Disadvantage</th>
<th>Use Against</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low cost</td>
<td>Poor vs. oils, greases, organics</td>
<td>Bases</td>
</tr>
<tr>
<td>Good physical properties</td>
<td>Frequently imported; may be of poor quality (sensitivity issues)</td>
<td>Alcohols</td>
</tr>
<tr>
<td>Dexterity</td>
<td></td>
<td>Dilute water solutions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fair vs. aldehydes, ketones.</td>
</tr>
</tbody>
</table>
### Natural Rubber Blends

<table>
<thead>
<tr>
<th>Advantage</th>
<th>Disadvantage</th>
<th>Use Against</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Low cost</td>
<td>• Physical properties frequently inferior to natural rubber</td>
<td>• Same as natural rubber</td>
</tr>
<tr>
<td>• Dexterity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Better chemical resistance than natural rubber vs. some chemicals</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Nitrile

## Advantage
- Low cost
- Excellent physical properties
- Dexterity

## Disadvantage
- Poor vs benzene
- Methylene chloride
- Trichlorethylene
- Many ketones

## Use Against
- Oils
- Greases
- Aliphatic chemicals
- Xylene
- Perchloroethylene
- Trichloroethane
- Fair vs toluene
# Neoprene

<table>
<thead>
<tr>
<th>Advantage</th>
<th>Disadvantage</th>
<th>Use Against</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Medium cost</td>
<td>• NA</td>
<td>• Oxidizing acids</td>
</tr>
<tr>
<td>• Medium chemical resistance</td>
<td></td>
<td>• Anilines</td>
</tr>
<tr>
<td>• Medium physical properties</td>
<td></td>
<td>• Phenol</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Glycol ethers</td>
</tr>
</tbody>
</table>
# Polyvinyl Chloride (PVC)

<table>
<thead>
<tr>
<th>Advantage</th>
<th>Disadvantage</th>
<th>Use Against</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Low cost</td>
<td>• Plasticizers can be stripped;</td>
<td>• Strong acids and bases</td>
</tr>
<tr>
<td>• Very good physical properties</td>
<td>• Frequently imported may be poor quality</td>
<td>• Salts</td>
</tr>
<tr>
<td>• Medium cost</td>
<td></td>
<td>• Other water solutions</td>
</tr>
<tr>
<td>• Medium chemical resistance</td>
<td></td>
<td>• Alcohols</td>
</tr>
</tbody>
</table>

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The Glove may not Always Fit

**Norfoil (Silver Shield)**

<table>
<thead>
<tr>
<th>Advantage</th>
<th>Disadvantage</th>
<th>Use Against</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Excellent chemical resistance</td>
<td>• Poor fit</td>
<td>• Hazmat work</td>
</tr>
<tr>
<td></td>
<td>• Easily punctures</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Poor Grip</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Stiff</td>
<td></td>
</tr>
</tbody>
</table>
### Glove Properties

#### Viral Penetration

The viral penetration test determines if a glove provides an effective barrier against one of the smallest measurable viruses in the world, phiX174. If the glove is a barrier to the phiX174 virus, it also provides a barrier against larger viruses. All of Medline's exam gloves have passed the viral penetration test.

#### Chemical Resistance and Barrier Guide

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<td>Acid 15%</td>
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<td>Alkali 15%</td>
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<td>Isopropanol 38%</td>
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<td>Benzene</td>
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<tr>
<td>Chlorinated Rubber 95%</td>
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<td>A08411270</td>
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<td>Chlorinated Alcohol 1%</td>
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**Rating Guide:** The basis of the rating code is breakthrough time in minutes only. We have color coded the ratings for your convenience.

- **Not Recommended:** Breakthrough occurs in less than 30 minutes and all other ratings of glove with this chemical.
- **Excellent:** Breakthrough occurs in 30 minutes or longer. This glove should be used on skin and oral cavity procedures.
- **Recommended:** Breakthrough occurs in 60 minutes or longer. This glove should be used for application of this chemical.
- **Not Tested:** Breakthrough occurs in more than 60 minutes or longer. This glove should not be used for application of this chemical.

The Glove may not always Fit...
Ways Gloves can become compromised

- Penetration: the passage of chemicals through material without changing its properties. Passes through pores and imperfections.
  - Penetration testing is a defect test
Ways Gloves Can Become Compromised

• Permeation: chemicals move through protective garments without passing through voids or imperfections. Permeation can occur in the absence of penetration.
  • Permeation testing looks at
    • How a given test chemical is absorbed into the contact surface of a garment
    • Diffusion of the chemical through the material
    • Desorption of the chemical from the opposite side.

• Permeation rates- Measurement of how quickly a chemical passes through a material at the molecular level.
Ways Gloves can Become Compromised

• Degradation: physical changes to the material caused by the chemical, which can include:
  • Swelling
  • Stiffening
  • Wrinkling
  • Changes in color
  • Physical deterioration

The Glove may not Always Fit
Glove Storage Considerations

• Always keep PPE away from sunlight

• Train workers how to recognize compromised PPE and what to do.

• Do not reuse PPE that is not intended to be reused.
Does your glove fit?
References/ Resources


- www.OSHA.gov
- https://www.cdc.gov/niosh