Selecting a Disposable Glove for Protection against Chemicals: Step 1 Identifying Skin Hazards

By Robert N. Phalen, Ph.D., CIH

Selecting the correct type of disposable glove for protection against chemicals in the workplace can be a difficult task. Some of the problems cannot be easily solved, such as when gloves are required or what do with multiple chemical hazards in the workplace, but nonetheless a decision must be made. The first step in this process, identifying the skin contact hazards, is sometimes the most difficult, because most of us are not toxicologists. Here are some guidelines and useful resources to help with this first step in the glove selection process.

Step 1: Identifying Skin Contact Hazards

It is important to identify those chemical hazards in the workplace that can be of concern if they contact the skin. Just knowing where to find this type of information can be a challenge, but luckily there are guides and data banks for many common chemicals. The best approach is to make a list of the chemicals workers are working with and then identify which chemicals are a hazard regarding skin contact. The big question is what chemical properties are of concern regarding skin contact? Here are some toxic chemical classifications you should look for when identifying skin contact hazards:

> Irritants and Corrosives: Irritation can range from a mild to severe. Even though irritation may seem minor it can affect worker productivity and some individuals are affected more by certain irritants than others. Corrosives are chemicals that can eat away things like metals and the skin. Many irritants are corrosive when they are in a more concentrated form. For example, hydrochloric acid (muriatic acid) can be a mild irritant when diluted in pool water, but highly corrosive in the original container. Skin protection against corrosives is very important.

> Corrosive Pictogram (http://commons.wikimedia.org/wiki/File:GHS-pictogram-acid.svg)

> Sensitizers: These are chemicals that some individuals may develop an allergic reaction to after repeated exposure. Poison ivy is an example of a potent sensitizer. It is important to protect workers against contact with a sensitizer, even if they do not show a reaction at first. Once a person becomes sensitized the allergic reaction can become severe and in some cases that person will not be able to work around the chemical at all. Even very small amounts can elicit a severe reaction. Thus, if at all possible, it is best to avoid exposure altogether and eliminate or substitute the sensitizer for a safer alternative.

Toxic substances: If a chemical has been identified as having toxic properties, then most likely small amounts will be harmful. Although the chemical may not directly damage the skin, it may be able to penetrate the skin and enter the blood or be an ingestion hazard if it gets on the skin. Lead is an example of a toxic chemical that commonly enters the body through ingestion. Lead dust can deposit on the hands and then be transferred to the mouth later when the person eats or touches his/her fingers to the mouth.

Poison symbol (Skull and Crossbones)

(http://en.wikipedia.org/wiki/File:Skull_and_crossbones.svg)

Carcinogens: Similar to toxic substances, carcinogens may not directly affect the skin but they may gain entry into the body following skin contact. Because cancer is such a challenging and often tragic disease, it is best to use caution around chemicals identified as human carcinogens. If at all possible, it is best to avoid exposure altogether and eliminate or substitute the carcinogen for a safer alternative.

Carcinogen Pictogram (http://commons.wikimedia.org/wiki/File:GHS-pictogram-silhouete.svg)

Reproductive/Developmental Poisons: Some chemicals can damage the reproductive system, which can affect one's ability to have children. This is obviously not good. Developmental poisons affect the unborn child or fetus and can result in birth defects, such as mental retardation. Lead is an example of a chemical associated with low sperm counts and impotence in males, as well as birth defects. It is always best to error on the side of caution when working with reproductive and developmental poisons.

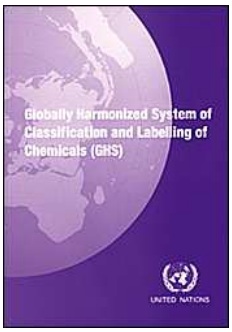
Central Nervous System (CNS) Depressants: Many organic solvents are CNS depressants, which are primarily an inhalation hazard. The vapors can often pass through the lung tissues, enter the blood, and dissolve in the nervous tissues of the CNS. Ethanol (e.g., alcohol) is an example of an organic solvent used in industry that is also used as a recreational drug to depress (slow down)

the CNS. However, the non-polar or oily properties of these solvents also allow them to interact with the skin or readily penetrate the skin and enter the blood. Many organic solvents can remove protective oils from the skin, or even "defat" the skin, which compromises the skin's protective barrier properties. Examples of organic solvents include acetone, many alcohols, chloroform, cyclohexane, diethyl ether, ethanol (an alcohol), hexane, methanol (an alcohol), methylene chloride, toluene, and xylenes. Direct contact with these solvents or CNS depressants in general should be avoided. Both hexane (n-hexane to be more specific) and methanol have additional toxic properties and are classified as poisons. Benzene, an organic solvent that is not use much anymore but may be present in gasoline, is a known human carcinogen.

This is not a complete list and some data banks may use other terms to describe the chemical hazards associated with a chemical. Thus, it is important to review a couple sources on chemical hazards to make a proper decision on whether or not gloves are necessary. Some useful sources of information on chemical hazards are listed below. For a chemical product with unidentified chemicals the chemical label and material safety data sheet (MSDS) must be used to identify hazardous components.

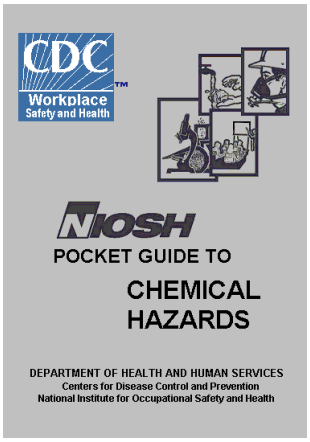
1. Chemical labels – Chemical manufacturers of consumer products are required to provide, directly on the label, information on the hazardous properties, much like the warnings on a bottle of aspirin. This may include warnings, cautions and precautions. The precautions, if any are listed, will often indicate if skin contact is an issue.

2. Material Data Safety Sheet (MSDS) – Most of us are familiar with the MSDS, but all too often they just collect dust waiting for an OSHA inspector to show up. MSDSs are a great source of information on the hazardous properties of a chemical product and even what type of protective clothing one should wear. However, always use caution when following the advice of a MSDS, as it could be outdated or the chemical reformulated to contain different chemical components than show on the MSDS. Use of a matching and up-to-date MSDS is critical. Currently, there is a switch towards a globally harmonized system (GHS) for classifying and labeling chemical hazards. Be aware of coming changes to chemical labels and safety data sheets.



GHS Classification and Labeling of Hazards
(http://www.osha.gov/dsg/hazcom/ghs.html)

3. NIOSH Pocket Guide to Chemical Hazards – This handy guide, which is available online at http://www.cdc.gov/niosh/npg/, provides information on personal protection for the skin, as well as first aid measures if skin contact occurs. Pay special attention to the *Exposure Limits* section and look for the "[skin]" notation, as this means that the chemical can potentially penetrate the skin barrier and enter the blood via skin contact. The guide also provides information on when additional eye and/or respiratory protection may be required.

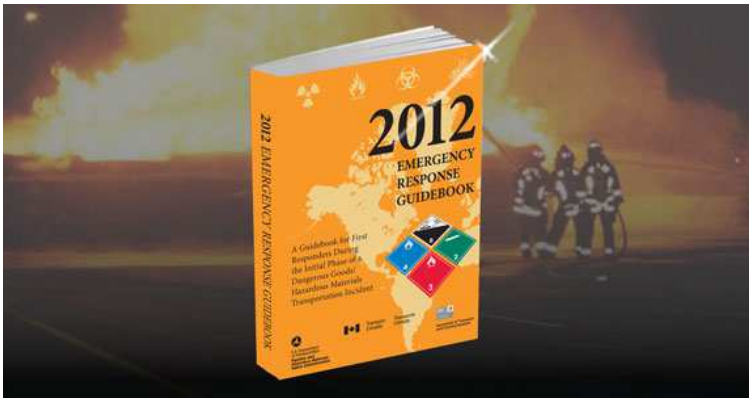


NIOSH Pocket Guide to Chemical Hazards
(http://www.cdc.gov/niosh/npg/)

4. International Chemical Safety Cards (ICSC) – The International Programme on Chemical Safety and European Commission publish these useful guides (at http://www.ilo.org/dyn/icsc/showcard.home) on common chemical hazards. The *Exposure* section lists the acute hazards, symptoms and prevention measures for the skin, as well as for inhalation and eye contact. Also, look for a "skin" notation in the *Occupational Exposure Limits* section to determine if skin absorption is an issue. The online NIOSH Pocket Guide (above) has direct links to the respective ICSCs data sheets. However, be sure to check both data banks separately.

5. 2012 Emergency Response Guidebook (ERG 2012) – The U.S. Department of Transportation (DOT) and Transport Canada publish this guide (available online at http://www.phmsa.dot.gov/hazmat/erg2012) for first responders, but the guide is useful for anyone looking to identify the hazards associated with a chemical. The primary advantage of this guide is that you can use the shipping identification number (UN or NA number) in the yellow section or look up the chemical by name in the blue section to identify a generic guide on the hazard. The guide numbers refer to the orange section, which provides information on the health hazards, first aid procedures, and protective clothing. The beginning of the guide also explains the diamond-shaped placards (e.g., labels) on shipping containers, which can identify the type of hazard. For skin contact, the Class 3 (flammable liquids), Class 4 (flammable solids), Class 5 (oxidizing substances), Class 6 (toxic substances), and Class 8 (corrosive agents) may all indicate a potential skin contact hazard. However, other classes may also pose a skin hazard,

thus it is important to review the guide. The main disadvantage of the ERG 2012 is that the protective clothing information in the orange guide section is for first responders and fire fighters responding to a hazardous material (HAZMAT) spill or fire, which most of us know what that looks like. It is not practical to use a self-contained breathing apparatus (SCBA) and fully-enclosing HAZMAT suit in the workplace. Regardless, the health and first aid sections can provide useful information that will aid in the decision process. They may even help save someone's life if a spill occurs.



Emergency Response Guidebook (ERG 2012)
(http://phmsa.dot.gov/staticfiles//PHMSA/ImageCollections/Images/ERG-on-Display.jpg)

6. Hazardous substance Data Bank (HSDB) – This data bank (available online at http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB) is an essential resource for health and safety professionals, but can be of use to those charged with making health and safety decisions without extensive training in toxicology or the sciences. You just need to know where to go. Here are some tips.
    a. Review the *Toxicity Summary* under the *Human Health Effects* section to get an idea if skin protection is needed. A toxicologist probably wrote it, so if it seems too technical then skip ahead to the sections listed below.
    b. The *Emergency Medical Treatment* section is an excellent source of information on the hazards of skin or dermal contact. Look at the *Dermal* or *Dermatologic* sections under the *Clinical Effects* section. You may need to use an online medical dictionary for some of the terminology.
    c. The *Chemical Safety and Handling* section has details on hazard classification and even personal protective equipment and clothing recommendations. The wording "prevent skin contact" may be the only thing you see, but this is better than nothing at all.
    d. Lastly, the *Occupational Exposure Standards* section can provide information on whether a "skin" notation exists for the chemical agent. Most of the numbers you will see are for inhalation, but the "skin" notation means that the chemical can potentially penetrate the skin barrier and enter the bloodstream via skin contact.

TOXNET Hazardous Substance Data Bank (National Library of Medicine) (http://www.nlm.nih.gov/pubs/techbull/ma07/graphics/hsdb_fig2_largest.gif)

7. NIOSH Occupational Health Guidelines for Chemical Hazards – This is an outdated, but still useful guide for common chemical hazards in the workplace. The guides can be accessed at http://www.cdc.gov/niosh/docs/81-123/. The guides provide information on potential skin/dermal hazards and also a detailed section on *Personal Protective Equipment*.

It may be best to make a table (or spreadsheet) with alphabetized chemical names and columns for each of the potential hazards or if skin protection is recommended. Here is a brief example of the table format.

Chemical name	Irritant	Corrosive	Sensitizer	Toxic	Carcinogen	Reproductive or Developmental Poison	CNS depressant	Skin Protection Recommended
Chemical A	Yes	Yes	No	No	No	No	No	Yes
Chemical B	Yes	No	No	Yes	Yes	No	Yes	Yes
Chemical C	No	No	No	No	No	No	No	No

Chemical A would likely be some type of an acid or base. Chemical B would likely be an example of an organic solvent that is also carcinogenic. Chemical C represents a non-toxic chemical, such as water. The "*Skin Protection Recommended*" section can be for those cases where the chemical label, MSDS, guide, or data bank indicates that skin contact should be avoided. This table may even help identify and remove some more hazardous chemicals from the workplace. For example, irritants are generally preferred over corrosives and sensitizers. Likewise, CNS depressants are often favored over carcinogens or toxic poisons that can affect the reproductive system or unborn child/fetus. In the end, this may seem like a lot of work, but it will make the decision process easier and could even improve working conditions or worker productivity. As a sufferer of contact dermatitis who worked in the automotive and contract laboratory industries, I can tell you that cracked and bleeding hands will slow down one's productivity and can even lead to a job change. Working with pain and even discomfort can make a routine work day seem long and difficult. I no longer work in either of those industries, which was in part due to the lack of proper protective gloves at the time.

Next, we will discuss how to select the correct type of disposable glove for protection against chemical hazards.

References and Additional Reading:

1. Anna, Ed. (2003) *Chemical Protective Clothing, Second Edition.* AIHA Press, Falls Church, VA.
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3. Forsberg and Mansdorf (2003) *Quick Selection Guide to Chemical Protective Clothing, Fourth Edition*. Wiley-Interscience, Hoboken, NJ.
4. Occupational Safety and Health Administration (OSHA) *Chemical Protective Clothing* in *OSHA Technical Manual.* Accessed online (July 30, 2012) at http://www.osha.gov/dts/osta/otm/otm_viii/otm_viii_1.html.
5. Plog, Niland, and Quinlan, Eds. (2001) *Fundamentals of Industrial Hygiene*, Fifth Edition. National Safety Council, Itasca, IL.