RESPECT YOUR SKIN

Working with Epoxy Resin Systems in Construction

Best Practices Guide to Skin Protection

CPWR THE CENTER FOR CONSTRUCTION RESEARCH AND TRAINING

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Introduction

- A 26-year-old tiler has severe itching, cracking, and swelling of his hands. He cannot use gloves or barrier creams. His symptoms improve when he is away from work for a few days.
- A 17-year-old painter has had itchy, flaky, and scaly sores on his face and fingers for the past 15 days.
- A 53-year-old floor layer has had a severe rash on his face during the past 4 years. The sores healed when he was away from work for two weeks but came back when he returned to his job.

What do these workers have in common?
They all handle epoxy products. The tiler uses epoxy adhesives. The painter applies epoxy varnishes. The floor layer coats floors with epoxy components mixed with powder.

The past 40 years has seen enormous growth in the use of products containing epoxy resin systems.* These products are valued commercially for their strong adhesive properties, chemical and heat resistance, and toughness. They are also used to strengthen structures and to add decorative effects to treated surfaces.

But as the cases above illustrate, there is a downside to epoxies. Exposure can cause *dermatitis* (skin inflammation), ranging from mild irritation to severe allergic rashes. The ingredients in epoxy resin systems can also cause other health problems, such as eye, nose, and throat irritation, and asthma. Finished, hardened epoxy products usually are hazardous only if they are burned, cut, or sanded.

The purpose of this guide is to help contractors protect construction workers from the hazards posed by epoxy resin systems. The guide focuses on preventing *skin disorders*, but also briefly discusses other epoxy hazards and control measures.

The guide presents practical methods for protecting workers in the often rugged and dynamic construction environment. The guide can also be used to *train* employers, supervisors, and employees about the hazards of epoxies and ways to reduce exposure.

* In this guide, the terms *epoxies, epoxy resins*, and *epoxy resin systems* are used interchangeably.

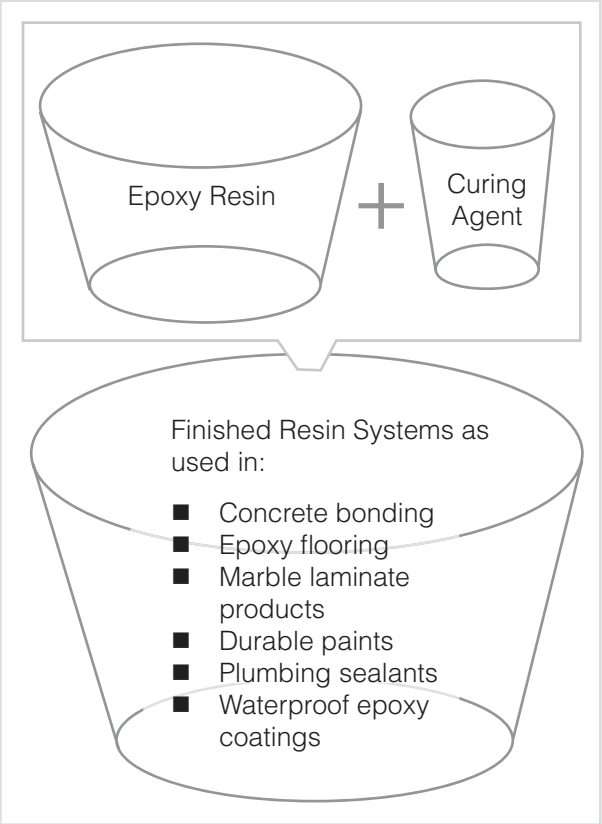
1 What are Epoxy Resin Systems?

Epoxy resin systems are chemical mixtures containing two main parts, the epoxy resin and the curing agent (also called hardener). When combined, these chemicals form a hard, durable plastic material commonly known as epoxy. Epoxy resin systems also contain other chemicals, such as solvents, pigments, and fillers.

The most common epoxy resins are glycidyl ethers of alcohols. Liquid epoxy resin is the diglycidyl ether of bisphenol-A (DGEBA) and accounts for more than 75% of the epoxy resin used in industrial applications. The most common curing agents come from a large class of compounds called amines. Both of these components are potent skin irritants.

Epoxy molecules are extremely reactive and easily combine with curing agents. This process, known as cross-linking or curing, produces very strong bonds. As the mixture cures, it hardens. Depending on the desired characteristics of the final product, epoxies may cure in a few minutes, or may require more time or heat.

Chemical additives such as plasticizers, solvents, fillers, and pigments are mixed with the epoxy resin system to speed up the process or to produce a certain effect. Fillers include fiberglass, calcium carbonate, powdered metals, pigments, and sand. Solvents may be present in the epoxy resin system or may be used to clean up equipment and spills in areas where epoxies are handled. Commonly used solvents include acetone, methyl ethyl ketone, toluene, xylene, glycol ethers, and alcohols.



2 How are Epoxy Resin Systems Used in Construction?

Construction workers use epoxy resin systems in many different trades. Here is a partial list:

- Cement Workers are exposed to epoxies that are mixed with cement. Epoxies are also used to bond concrete to itself or to steel or stone, as in monument restoration. In addition to the skin hazards posed by epoxies, exposure to cement is a well-known cause of skin disorders, including irritant contact dermatitis.

- Floor Layers and Terrazzo Workers apply paints, liquid pastes, or mortars containing epoxies to produce resilient, industrial floor covering. Epoxy resin-based flooring is used in high traffic areas, such as shopping malls, hospitals, and industrial buildings.

- Marble Workers work with marble strips that are sometimes treated with epoxy resin for decorative or strengthening purposes.

- Painters use many paints that contain epoxy resins, especially when coating surfaces that require toughness and durability, such as steel structures and bridges.

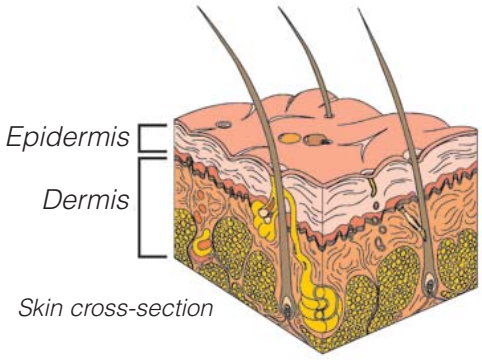
- Tilers and Grouters use epoxy adhesives to bond tiles to the substrate. Grouts containing epoxies are also used widely.

- Plumbers are exposed to epoxy resins in leak-proof sealants used in pipelines. Epoxies are also used in plumbing bonding adhesives.

- Brick, Concrete, and Masonry Workers use waterproof epoxy coatings to protect structures from corrosion. These workers apply epoxies to structures that come in contact with materials such as chemicals, fresh or salt water, sewage, food acids, or damaging pollutants.

3 Epoxy-Related Dermatitis

Dermatitis is a general term for skin rashes and other skin ailments. Exposure to the compounds in epoxy resin systems can cause skin problems ranging from mild irritation to severe and long-lasting sores and rashes. The two main skin conditions caused by exposure to epoxy resin systems are *irritant contact dermatitis* and *allergic contact dermatitis*.



Skin cross-section

Irritant Contact Dermatitis (ICD) is skin damage caused by contact with irritants. Signs of ICD include stinging, blisters, dead skin, scabs, scaling, cracks, redness, swelling, bumps, and watery discharge. Itching is common, and there is often pain in the affected areas. Both chemical and physical actions (such as abrasion) on the skin can cause ICD. Strong chemical irritants include acids and caustics. Soap and water and solvents are weak skin irritants. Weak irritants are slower to cause skin reactions than strong irritants, **but both can damage the skin with enough contact.** Epoxy resin system fillers, such as fiberglass, cause skin abrasions. These abrasions make the skin more vulnerable to other irritants in the epoxies. Anyone who has contact with skin irritants can get ICD. In most cases, ICD clears up when the skin no longer contacts the irritant.

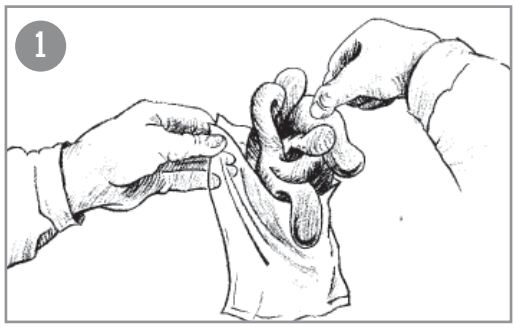

Contact dermititis on hand

Allergic Contact Dermatitis (ACD) is skin damage caused by contact with *allergens*. An allergen is a substance that causes reactions only in people who are allergic, or *sensitive*, to that substance. The skin rashes caused by poison ivy and poison oak are well-known forms of ACD. ACD includes many of the same symptoms as ICD. The severity of the symptoms varies widely from one person to another, depending on the individual's sensitivity to the allergen. But most people can become allergic if they are exposed to an allergen often enough.

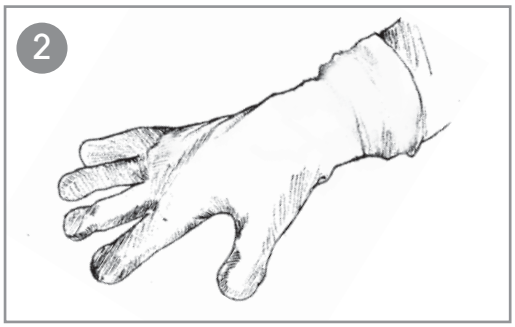
ACD can develop without warning and is difficult to cure. The allergy may last a lifetime, and symptoms can recur each time skin is exposed to the allergen, even in tiny amounts. Epoxies, especially those containing bisphenol-A and amine hardeners, are powerful skin allergens. Contact with solvents can make skin more vulnerable to developing ACD from epoxy resin systems.

4 Using Best Practices to Protect Workers

Workers who are exposed to epoxies need proper skin protection. Epoxy-related dermatitis can be prevented by following these four simple steps:

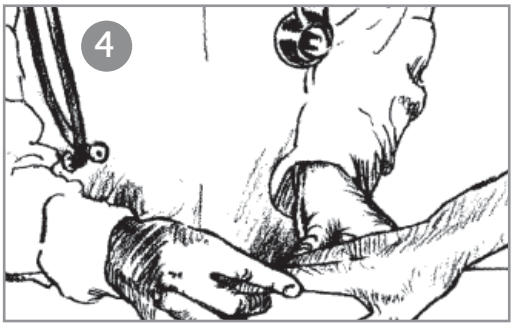


Train workers in safe work practices, personal protective equipment, and skin protection, especially proper glove use and hand washing techniques.



Provide gloves that best protect hands from the specific chemicals in the epoxy product.

Provide wash stations with warm water and mild liquid soap and ensure that workers wash their skin regularly. (pH neutral or slightly acidic soap is recommended.)



Make it a stated policy to allow workers time to follow best practices, and not to penalize workers for reporting an illness or seeking medical care.

These measures will be described in detail in upcoming chapters.

OSHA requirements

The U.S. Occupational Safety and Health Administration (OSHA) has not issued any specific standards for working epoxy resins systems. But many of the practices outlined in this guide are required by other OSHA construction industry standards. For instance, OSHA has requirements for:

- Hazard communication
- Worker training
- Personal protective equipment
- Housekeeping
- Personal hygiene
- Exposure to airborne contaminants.

5 Best Practices: Training

Training is the cornerstone of an effective safety and health program. The more workers know about the substances they handle, the better prepared they will be to protect themselves and their co-workers.

The following topics are covered in this guide and can be used to develop individual toolbox training sessions:

- Epoxy chemicals – getting information from labels and MSDSs
- Epoxy dermatitis – what causes it and how to prevent it
- Epoxies and gloves – selecting the right ones and using them properly
- Protective clothing and safety equipment – protecting skin and eyes
- Safe work practices – limiting contact with epoxy chemicals
- Ventilation – using it correctly

Material Safety Data Sheets (MSDSs) and labels

Manufacturers are required to provide MSDSs for every **hazardous** product they market. **According to the OSHA Hazard Communication Standard**, every MSDS must contain the following information:

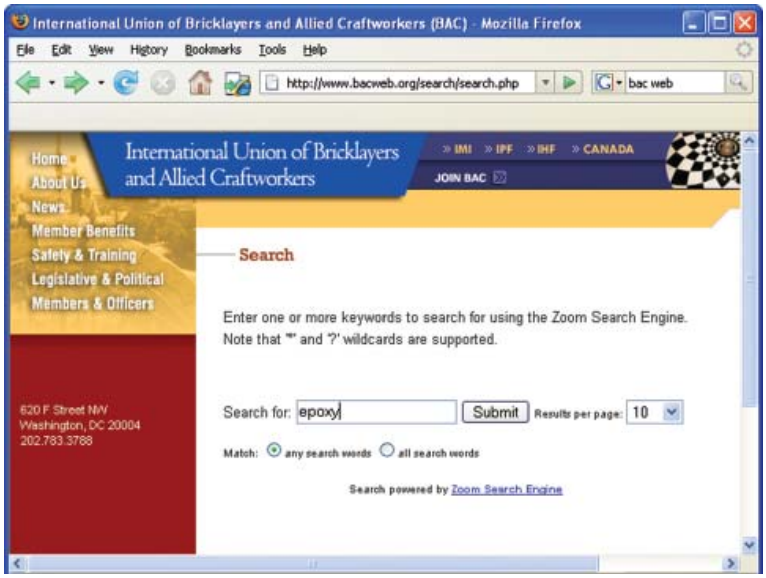
- Product name, manufacturer, and contact information
- Chemical ingredients, amount in product, physical properties
- Health effects such as dermatitis, respiratory irritation, and nervous system effects
- Exposure limits and fire hazards
- Protective measures – gloves, clothing, ventilation controls
- Spill response procedures

Employers must ensure that there is an MSDS for each hazardous product in use at the job site. MSDSs that meet only the minimum requirements of the OSHA standard may lack details about health hazards or worker protection. *Do not hesitate to contact the manufacturer directly, especially if you have questions about the health hazards or safe handling of specific products*.

Labels also contain useful information about product hazards and worker protection. All labels should have the name of the product and manufacturer, a brief description of health effects, and recommendations for safe handling.

Other Resources

Numerous groups offer cost-effective and practical methods and equipment for protecting workers from epoxy hazards. For instance, suppliers of the epoxy products can be a link to the product manufacturer, who is required to provide information on safe handling of the product. Suppliers can also help employers locate safety equipment vendors. Trade organizations and other groups dedicated to promoting their products and their industry also serve as vital resources.



http://www.bacweb.org

One group that serves the painting industry is the Society for Protective Coatings (SSPC). A group that serves the masonry and tile industry is the International Masonry Institute (IMI), the International Union of Bricklayers and Allied Craftworkers' (BAC) labor-management trust, available at http://www.imiweb.org or http://www.bacweb.org. Many of these groups are funded by joint labor-management health and welfare funds.

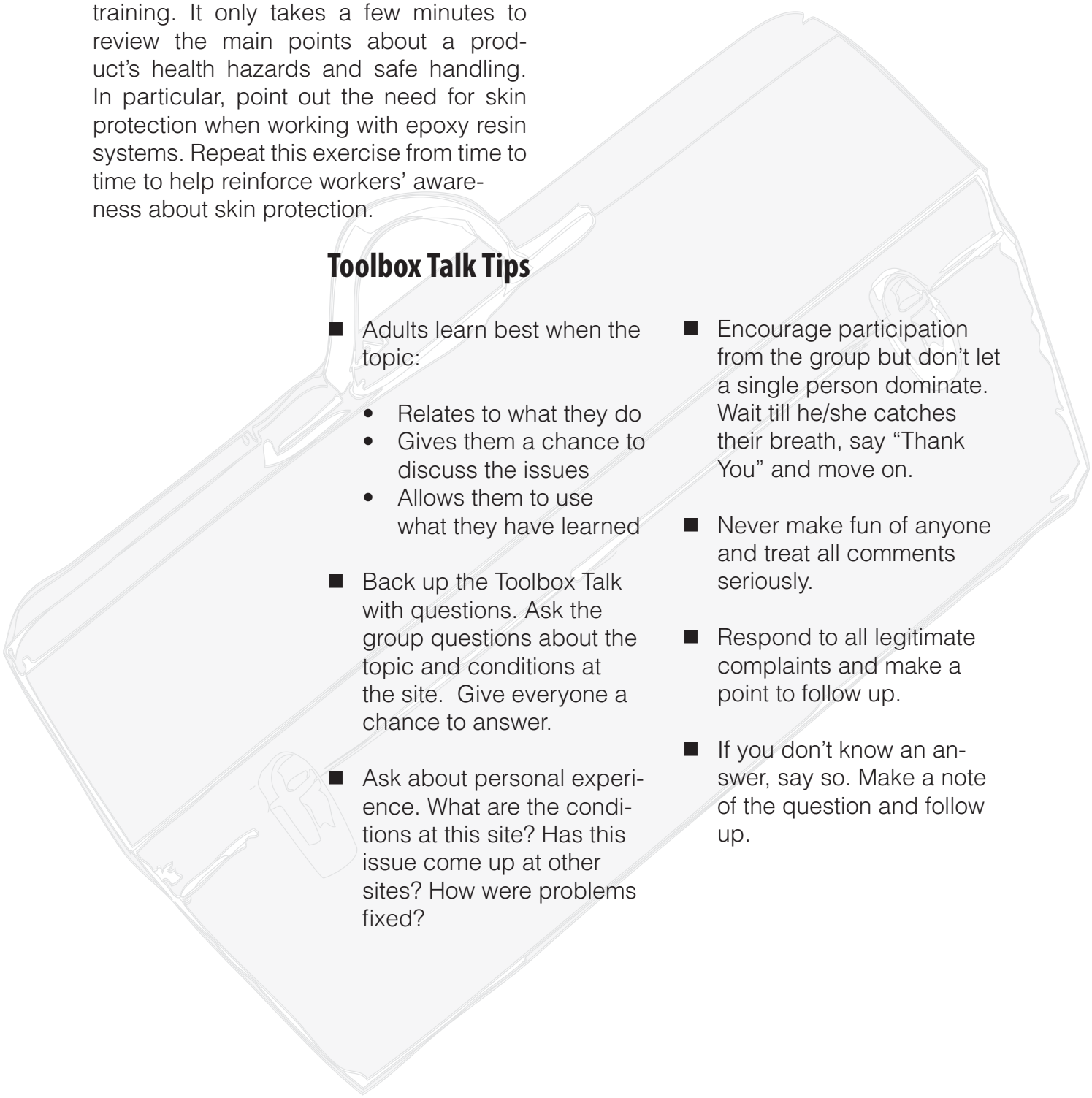
There is also a wealth of available information on Internet search engines and other Web sites. For instance, a Google search on "epoxy resins and gloves" provides many sources.

One recommended site is the Electronic Library of Occupational Safety and Health (eLCOSH), which covers this and many other topics and is available at http://www.cdc.gov/elcosh.

http://www.cdc.gov/elcosh

Making it work: Toolbox Talks

Use MSDSs and labels in toolbox safety training. It only takes a few minutes to review the main points about a product's health hazards and safe handling. In particular, point out the need for skin protection when working with epoxy resin systems. Repeat this exercise from time to time to help reinforce workers' awareness about skin protection.



Toolbox Talk Tips

- Adults learn best when the topic:
  - Relates to what they do
  - Gives them a chance to discuss the issues
  - Allows them to use what they have learned
- Back up the Toolbox Talk with questions. Ask the group questions about the topic and conditions at the site. Give everyone a chance to answer.
- Ask about personal experience. What are the conditions at this site? Has this issue come up at other sites? How were problems fixed?
- Encourage participation from the group but don't let a single person dominate. Wait till he/she catches their breath, say "Thank You" and move on.
- Never make fun of anyone and treat all comments seriously.
- Respond to all legitimate complaints and make a point to follow up.
- If you don't know an answer, say so. Make a note of the question and follow up.

6 Best Practices: Washing & Personal Hygiene

Protecting skin is not just a matter of wearing gloves. To prevent skin problems, epoxy resins must be removed from the skin by thorough washing. Follow these steps to minimize workers' skin contact with epoxy resins:

- Install a hand washing station equipped with water, mild soap (pH-neutral or slightly acidic), and towels. Warm water is best. Liquid soaps are generally the mildest.
- Locate the washing station in a place that workers can access throughout the shift.
- Maintain adequate supplies of soap, dry towels, and warm water.
- Train workers on the need to wash hands regularly.
- Make sure workers wash hands and other exposed skin parts of the body before lunch and breaks, after gloves are removed, in the event of chemical splash, and at the end of the shift.
- Ensure that supervisors give enough time for workers to wash up during the work shift.

Practical hints:

- Each worker needs at least 5 to 7 gallons of clean running water per day.
- If large quantities of chemicals are used or stored at the site, much larger amounts of water may be needed for washing and spill clean-up.
- Prohibit cleaning with abrasive or solvent-containing products. These include waterless hand cleaners such as the alcohol-based gels or citrus cleaners. These cleaners may increase the risk of skin irritation.
- **Some epoxies cannot be readily removed by soap and water.**
  Always check with the epoxy product manufacturer for recommended hand-washing procedures and products.

7 Best Practices: Selecting & Using Gloves

Workers' hands are the most frequent site of skin problems because they are the most exposed parts of the body. Gloves are the single most important way to protect workers from the skin hazards posed by epoxies.

Not all gloves are alike and there is no single glove that protects the skin from all chemicals. When looking for the right glove, consider the following factors:

- Specific chemicals in the epoxy resin system
- Work tasks and physical requirements, such as abrasion protection, grip, and manual dexterity
- Potential skin contact – hands only or hands and forearms

Selecting chemical resistant gloves

Epoxy resin systems contain a variety of chemicals—resins, hardeners, solvents, and fillers—that can cause skin problems. Gloves often protect against only some of these ingredients. Select a glove that offers the best protection for the mixture of ingredients in the epoxy resin systems you use.

Glove manufacturers rate gloves for use with specific chemicals, by evaluating *permeation* and *degradation* properties of the glove material:

- Permeation rate measures how quickly specific chemicals or classes of chemicals travel through, or permeate, the glove materials. Choose gloves with low permeability rates for the chemicals you handle. Keep in mind that most chemicals can eventually pass through gloves and contact the skin.
- Degradation rate measures how quickly a chemical breaks down the glove material. Many of the chemicals in epoxy resins cause glove materials to degrade over time.

Workers need to change gloves before permeation or degradation can occur.

Ask your epoxy product supplier for glove recommendations. Also, check with glove manufacturers about the epoxy system you are using. They issue glove selection charts and may be able to help you select the best glove.

Guidelines on Glove Materials & Chemical Resistance

Generic Glove Material	Epoxy Resins Systems/ Components			
	Epoxy Resins, Liquid or Solid	Modified Epoxy Resins	Hardeners/ Curing Agents	Solvents
Ethyl Vinyl Alcohol (EVAL) laminate	Excellent	Excellent	Excellent	Excellent
Butyl Rubber	Excellent	Excellent	Excellent	Good
Nitrile (NBR)	Excellent	Good	Fair	Fair
Neoprene	Excellent	Good	Fair	Fair

Keep in mind that this table presents general guidelines only. The glove materials listed in the table may not perform the same way with the epoxy product you are using.

Rule of thumb: Gloves made of butyl rubber or nitrile are often recommended for use with epoxies and solvents. Nitrile gloves often come in different thicknesses. Gloves that are too thin can break down quickly.

Selecting gloves for the task

Once you've chosen the right chemically-resistant glove, you need to choose a glove that fits the task. Gloves come in a variety of designs, coatings, and thickness. Gloves can be chosen based on physical requirements, such as:

- Dexterity
- Wet grip
- Resistance to cuts, tears, punctures, and abrasion

Selecting gloves with proper fit and coverage

Gloves come in a variety of styles and sizes. Select gloves that cover hands and arms adequately. Make sure to choose gloves that fit the individual workers on the job. Glove suppliers are usually willing to provide glove samples.

When ordering gloves:

- Order gloves that fit snugly – loose gloves can let chemicals in.
- Consider length of gloves for covering forearms.
- Keep replacement supplies on hand.

Practical hint: Let workers try different gloves. Even with help from manufacturers, it may take some trial and error to find the right gloves. Once a glove has been found that has both the proper chemical resistance and worker acceptance, stick with it.

Using the wrong glove puts workers at risk of developing serious skin problems!

- Never use cotton gloves when working with epoxies. Cotton absorbs chemicals used in epoxies and holds the chemicals against the skin. Even though cotton gloves are readily available, inexpensive, and comfortable, they do not protect the hands from epoxy resins and may actually cause more serious skin problems!

- Never use latex gloves when working with epoxies. Latex absorbs chemicals used in epoxies, and may even dissolve in contact with these chemicals. Latex is highly permeable and degrades easily. What's more, latex is known to cause allergic reactions in some people.

- Don't use barrier creams with epoxies. Barrier creams, or "invisible gloves," are not recommended for many kinds of epoxy work. Contact with abrasive materials can break the seal of the barrier cream. Also, reapplying the cream in the work area may seal the chemicals to the skin.

Making it work

- Train workers in proper methods for donning and removing gloves.
- Instruct workers to keep the inside of gloves free from epoxy materials. *Even tiny amounts of epoxy trapped inside the glove can trigger dermatitis.*
- Instruct workers to wash hands and dry them thoroughly each time they put on gloves.

- If employees remove gloves during work, they must wash again with clean water and pH-neutral or acidic soap before putting the gloves back on. If not, epoxy residue will enter the gloves.
- Don't allow employees to rinse their hands in tool rinse buckets.
- Many experts recommend wearing long sleeves and taping them inside gauntlet gloves to prevent sleeves from becoming saturated with wet epoxy resin. If this happens, the shirt must be removed immediately to prevent skin contact. Workers can also wear protective sleeves over arms.
- Wearing thin cotton glove liners inside heavy-duty gloves helps keep hands clean and dry. Always keep the inside of gloves free of epoxy!
- Consider using disposable gloves. They can make it easier for employees to keep their hands clean. *Make sure that workers do not reuse them*!! To remove disposable gloves, peel back from the top, turning them inside out. Discard disposable gloves at the jobsite each day.

- If you use reusable gloves, clean them daily. Follow the manufacturer's instructions for proper use. Place clean, dry gloves in a plastic bag. Store gloves away from tools and materials in a cool, dark, dry place.

How to remove reusable gloves

1

Before removing gloves, always clean off the outsides. Follow the manufacturer's instructions. Watch for pinholes which can let in contaminated rinse water.

2

To remove gloves, first loosen them on both hands. Hold hands down so contaminated water will not drip onto skin or clothing.

3

Remove the first glove only to the fingers.

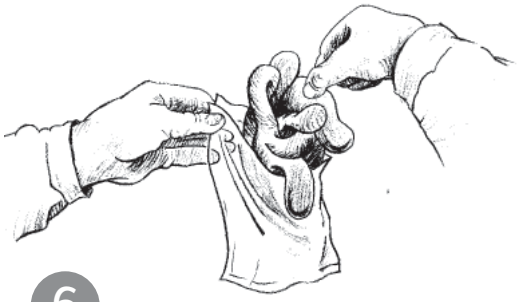
The cuff of the glove will remain over the palm.

4

Now, grabbing the second glove with the first glove, remove the second glove. The first glove should slip off.

5

Try to handle gloves by the insides only. Don't touch the outsides.



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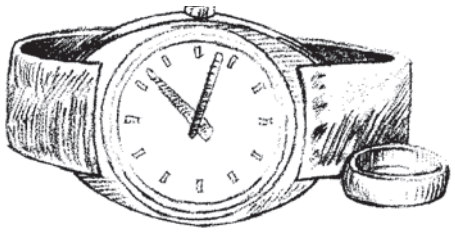
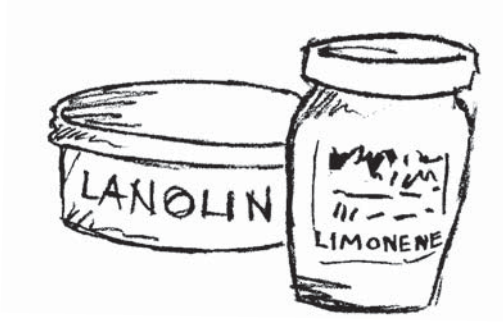
Reminder: Store clean, dry reusable gloves in a plastic bag, away from tools and materials in a cool, dark, dry place.

Here are some more suggestions for preventing skin exposure to epoxy resin systems:

No Jewelry At Work:

Chemicals can collect under rings, watches, and necklaces. Epoxy chemicals trapped against skin for long periods can cause severe harm.





Do not use lanolin, petroleum jelly, or other skin softening products at work

Skin-softening products can seal chemicals to skin. They can also increase the skin's ability to absorb contaminants and can irritate the skin. Skin-softening products should be applied only to clean skin in clean environments.

An epoxy worker may use these products, if desired, at home after showering or bathing with **pH-neutral** or **slightly acidic soap**.

But workers should be aware that skin-softening products may contain fragrances, lanolin, or other chemicals that can cause ACD in some workers.

8 Best Practices: Protective Clothing & Safety Equipment

Personal protective equipment (PPE) creates a barrier between the body and harmful substances. PPE includes clothing, safety goggles, and respirators. Choosing the right clothing and equipment is critical to ensure adequate protection. Follow the manufacturer's recommendations about safety equipment when working with specific epoxy products.

Considerations for choosing the right PPE:

- What specific tasks, such as mixing or pouring, put the worker at risk of contact with epoxies?
- What parts of the body are potentially exposed? Skin? Eyes?
- Are the epoxies in liquid, solid, or powder form?
- What type of clothing materials provide appropriate protection from the specific epoxy products?
- Can clothing and equipment be cleaned and reused?
- Are disposable items more practical for the job conditions?
- What are the initial costs and replacement costs of the various clothing and equipment options?

Making it work:

- Designate appropriate protective clothing and equipment for each job or task.
- Purchase adequate supplies of PPE. Consider both initial use and re-supply. Maintain an inventory of sizes and styles.
- Maintain a clean equipment storage area separate from work site hazards.
- Train workers and supervisors on the need for protection, the right way to don and remove clothing and equipment, when to replace, how to maintain.
- Purchase appropriate cleaning and maintenance supplies if items are to be reused.
- Designate disposal containers for used clothing.
- Instruct workers to keep a spare set of dry, clean work clothes at the site in case a change of clothes is needed during the shift.

Chemical-resistant gloves are essential protective clothing; dermatitis most often appears on the hands and arms. Never use cotton gloves or latex gloves. *See Chapter 7 for more details*.

Chemical-resistant overalls should be worn over work clothes to prevent epoxy chemicals from soaking into clothing and contacting skin. The longer the epoxy materials stay on the skin, the more harm they can cause. Coveralls also protect the skin from powdered materials. Tyvek® coveralls can provide adequate protection for work with dry materials. There are numerous suppliers of chemical-resistant coveralls and other protective garments.

Protective sleeves can be worn with gloves to protect arms from chemical contact and splashes.

Aprons can be used instead of coveralls or as additional protection. Select chemical-resistant apron materials, such as butyl rubber.

If clothing gets wet from contact with chemicals, the worker should immediately remove the clothing and wash the affected area before putting on clean clothes.

Rubber boots with pants taped inside help protect the skin and prevent chemicals from entering through the top of the boots.

Respirators may be needed to protect workers from dusts and other airborne hazards. The safety and health officer for the project should assess the need for respirators on the job. Workers mixing and applying epoxy resins may be exposed to solvent and other chemical vapors.

Workers grinding or sanding hardened epoxies may be exposed to irritant dust. Implement the following steps to protect workers from airborne hazards:

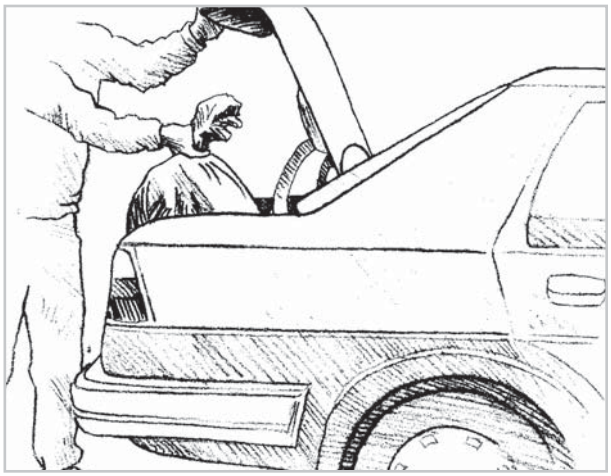
- Determine the potential for airborne hazards, such as dusts and vapors.
- Estimate exposures by air monitoring or consultation with product manufacturer and other users.
- Select the right respirator for the conditions on the job.
- Make sure workers are medically cleared to wear respirators.
- Make sure workers have received proper respirator use training and fit-testing.

Enforce safe use, maintenance, and storage of respirators.

Chemical goggles, with side shields to protect against splashes, should be used during chemical mixing and whenever there is a risk of getting hazardous chemicals in the eyes.

Encourage employees to change into clean clothes at the end of the shift, BEFORE leaving work.

Removing work clothes *at work* protects the worker and the worker's family from being exposed to harmful substances carried on clothing. Also, changing into clean clothing stops chemicals from spreading to workers' car or truck interiors. If used work clothes cannot be left at the job, they should be taken home in a separate, sealed container. A plastic trash bag works great for storing used work clothes.



9 Best Practices: Work Practices & Housekeeping

Following safe work practices helps to minimize exposure to epoxy chemicals. Experienced workers often devise safe work practices of their own. Here are two suggestions:

- Try using disposable cardboard cups, instead of bowls, for mixing and pouring, to reduce chemical handling during clean-up.
- Cut down on exposure by purchasing resins and hardeners in packaging that allows the worker to mix the ingredients together without opening the bags first.

Good housekeeping is a simple, inexpensive yet critical method of preventing exposure:

- Keep work and storage areas uncluttered and clean.
- Keep chemical containers tightly covered when not in use.
- Wipe up spills with cotton rags or other adsorbent materials promptly, and dispose of rags in closed containers. *Be sure to wear proper PPE, such as gloves, for clean-up.*
- Clean tools after use.
- Provide a changing area where workers can change out of work clothes and keep street clothes separate from work clothes.
- Provide a clean area for breaks and lunch, separate from the epoxy use area.

Making it work:

- Provide housekeeping supplies - brooms, mops, chemical absorbers for floors, water, and waste receptacles.
- Train workers and supervisors on the need for good housekeeping.
- **Provide enough time for regular clean-up during the shift.**

10 | Best Practices: Engineering Controls

Engineering controls help keep chemical dust and vapors from building up in the work area. The most frequently used engineering controls in construction are ventilation and water (used mainly for dust control). Epoxy product labels often say, "use with adequate ventilation." Adequate ventilation means more than opening a window or turning on a fan. There are two kinds of ventilation controls – local exhaust and general dilution.

Local exhaust ventilation

Dust collectors on power tools are examples of local exhaust systems. Local exhaust systems on floor grinders and sanders capture dust before it enters the work area. Such devices also help keep dust and debris from accumulating in the work area. Whenever possible, use tools equipped with local ventilation. Tool vendors can provide information on the availability, operation, and cost of this equipment.

Grinder with local exhaust attachment

Dilution ventilation

Although not nearly as effective as local exhaust, dilution ventilation can help reduce the level of chemical vapors and dust in the air. Use fans and open windows to bring fresh air into work areas. A portable exhaust fan attached to a flexible hose can be effective at reducing exposure to epoxy vapors if placed in the right location. Place the fan close to the task to draw air away from the workspace. *But make sure that the fans do not direct harmful vapors towards any workers. Also, make sure not to exhaust the vapors into another occupied space.*

Engineering Controls Cont.

Dust suppression – wet methods
Water can be used to suppress dust from many operations and tools. Water mists from garden sprayers and wet mopping of work areas can be used to reduce dust. Some pieces of equipment come with water dispensers to cool equipment parts that may also reduce dust in the work area.

Note: Some chemicals are water-reactive, meaning they can release harmful vapors in the presence of water. Check with the epoxy product manufacturer to make sure using water on the product is a safe method of controlling dust.

Grinder with attached water sprayer

11 Best Practices: Safer Substitutes for Epoxy Resins

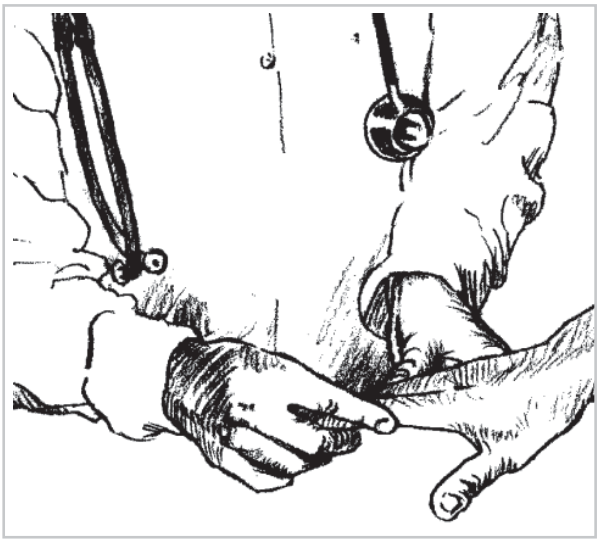
The best way to *protect workers from hazardous substances is to substitute them with safer materials*. Epoxy resin systems are used widely because of the durability and hardness of the finish, their compatibility with a variety of substrates, and easy application. Finding safer products that achieve the same effects requires the commitment and cooperation of architects, owners, product manufacturers and suppliers, contractor associations, labor-management groups, and unions. Suppliers want to sell products. If end-users push for new, less hazardous products, suppliers and manufacturers are more likely to pursue safer replacements.

Here are a few points to consider when seeking safer epoxy resin systems:

- **Single-component epoxy systems** are usually safer than two-part products. The hazardous monomers in the single component epoxies are already partly reacted.
- **Polyamide and cycloaliphatic amine** curing agents are generally less irritating than the simpler aliphatic chemicals.
- **High-molecular-weight resins** are less potent skin sensitizers than bisphenol-A and other low-molecular weight resins.
- **Reduced-solvent content** or solvent-free products minimize health effects due to solvents.

12 | Seeking Medical Help for Epoxy-Related Dermatitis

Many workers ignore skin problems until the ailment becomes extremely painful or makes it difficult to work. But skin conditions caused by epoxies will not go away on their own, and could lead to severe and disabling skin disorders. Workers with suspected epoxy-related skin problems should be seen right away by a dermatologist, preferably one trained in diagnosing and treating skin disorders. If allergic contact dermatitis is suspected, an allergist should be consulted right away.



These steps can help protect workers from developing severe and disabling skin disorders:

- Train workers to recognize symptoms of potentially serious skin disorders. Signs of both irritant and allergic contact dermatitis include stinging, blisters, dead skin, scabs, scaling, cracks, redness, swelling, bumps and watery discharge. Itching is common, and there is often pain in the affected areas.
- Train workers to note the time of onset and improvement of any skin condition. This will help determine if the problem is related to exposures at work. If the symptoms lessen when the worker is away from the job, especially for several days or weeks, the disorder is likely related to workplace exposures.
- Stress the need for quick action to prevent disabling skin damage.
- Actions should focus on minimizing workers' pain and ensuring their ability to return to work.
- Make it a stated policy not to penalize workers for reporting or seeking treatment for skin conditions. Assure workers that no adverse action will result from taking time off for treatment or recovery.
- Follow the steps described in this guide to help workers prevent skin contact with epoxies.

13 Additional Resources

There is a wealth of information on epoxy resin systems, ranging from epoxy chemistry and production to health effects and exposure control. The following resources address worker protection in particular. If you wish to obtain more information, searching the Internet is an excellent place to start.

Safety and Health Guides to Skin Protection

The Center to Protect Workers' Rights (CPWR) has published a series of booklets on skin protection. Although these materials focus on work with cement, much of the information is applicable to work with epoxies:

- A Safety & Health Practitioner's Guide to Skin Protection: For Work with Cement in Construction
- An Employer's Guide to Skin Protection: For Work with Cement in Construction
- Save Your Skin: A 15-Minute ToolBox Session
- Physicians' Alert: Occupational Contact Dermatitis (meant to be given to physician treating a worker)

These documents can be accessed by going to www.cpwr.com and clicking on eLCOSH, which stands for Electronic Library of Construction Occupational Safety and Health, an excellent resource on a range of construction industry safety and health topics. The publications are also available directly at: http://www.cdc.gov/elcosh/docs/hazard/chemical_cement.html

Information on glove selection and use

Glove manufacturers include Ansell, Best Manufacturing, Magid Gloves and Safety, and North Safety Products. Their Web sites provide a wealth of information about glove selection. For instance, Best Manufacturers' Web site at www.bestglove.com, has a link to "Chemrest," a site that helps you select the right glove for your application. Glove manufacturers also can provide product catalogs and glove samples.

Obtaining Material Safety Data Sheets (MSDSs)

The vendor or manufacturer of epoxy products is required by OSHA to provide users with an MSDS for each of their products. Ask your product supplier if you need help obtaining MSDSs. Also, many MSDSs can be viewed online by conducting a search on the name of the manufacturer and product. Online searches often yield more detailed information on safety-related topics than found in MSDSs.

Best Practices Checklist for Workers:

Educate Yourself!

___ 1. Always follow epoxy product safety instructions *(if uncertain, ask for training from your foreman, product supplier, or manufacturer's helpline)*.
___ 2. Review a copy of the product's Material Safety Data Sheet (MSDS).

Glove Selection and Use:

___ 1. Select the right gloves for the job! Check with the product manufacturer/ MSDS for the recommended glove type.
___ 2. Gloves should allow finger and hand dexterity, wet grip, and resistance to tearing.
___ 3. Avoid cotton gloves except for use as liners.
___ 4. Never use latex gloves with epoxy products.
___ 5. Wash and dry hands before and after each use of gloves using clean running water, a mild (pH neutral or slightly acidic) soap, and clean towels.
___ 6. Never use abrasive, solvent-containing, or waterless cleaning products on hands when using epoxies.
___ 7. Clean reusable gloves after each use or use disposable gloves.

Other Skin & Body Protection:

___ 1. No jewelry at work; chemicals can collect under rings, watches, and necklaces.
___ 2. Do not use barrier creams or skin softening products like lanolin or petroleum jelly while at work.
___ 3. Tape or button long sleeves inside gloves.
___ 4. Use Chemical-resistant overalls or aprons to avoid skin contact when using wet products.
___ 5. Tyvek® coveralls can provide protection when creating dry dust containing epoxy chemicals.
___ 6. Respirators may be needed to avoid inhaling airborne hazards. Your employer should determine if they are required.
___ 7. Use chemical goggles with side shields during mixing and when there is a danger of splashing.
___ 8. See a doctor for any persistent skin problem.

Daily Cleanup:

___ 1. Change into clean clothes at the end of the shift BEFORE leaving jobsite.
___ 2. Bring home dirty clothes in a plastic trash bag and launder separately.
___ 3. If using reusable gloves, store in a bag in a cool, dark, dry place at the end of each day.

Engineering Controls:

___ 1. Use local exhaust ventilation.
___ 2. Use dilution ventilation.
___ 3. Use wet methods to suppress dust where possible.
___ 4. Substitute safer products where possible.

Epoxy Resin Systems

Epoxy resin systems are chemical mixtures containing two main parts, the epoxy resin and the curing agent (also called hardener). When combined, these chemicals form a hard, durable plastic material commonly known as epoxy. Epoxy resin systems also contain other chemicals, such as solvents, pigments, and fillers. Epoxies can cause severe skin problems.

Dry skin may include irritation, scaling, itchiness, burning, and redness.

Irritant contact dermatitis (ICD) can be acute or chronic. Symptoms include stinging, pain, itching, blisters, dead skin, scabs, scaling, fissures, redness, swelling, lumps, rash, and watery discharge.

Allergic contact dermatitis (ACD) includes many of the same symptoms as ICD. Epoxies, especially those containing bisphenol-A and amine hardeners, are powerful skin allergens. ACD is difficult to cure and may persist for years.

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How are Epoxy Resin Systems Used in Construction?

Construction workers use epoxy resin systems in many different trades. Here is a partial list:

- Brick, Concrete, and Masonry Workers use waterproof epoxy coatings to protect structures from corrosion. These workers apply epoxies to structures that come in contact with materials such as chemicals, fresh or salt water, sewage, food acids, or damaging pollutants.
- Cement Workers are exposed to epoxies that are mixed with cement. Epoxies are also used to bond concrete to itself or to steel or stone, as in monument restoration. In addition to the skin hazards posed by epoxies, exposure to cement is a well-known cause of skin disorders, including irritant and allergic contact dermatitis.
- Tilers and Grouters use epoxy adhesives to bond tiles to the substrate. Grouts containing epoxies are also used widely.
- Floor Layers and Terrazzo Workers apply paints, liquid pastes, or mortars containing epoxies to produce resilient, industrial floor covering. Epoxy resin-based flooring is used in high traffic areas, such as shopping malls, hospitals, and industrial buildings.
- Marble Workers work with marble strips that are sometimes treated with epoxy resin for decorative or strengthening purposes.
- Painters use many paints that contain epoxy resins, especially when coating surfaces that require toughness and durability, such as steel structures and bridges.
- Plumbers are exposed to epoxy resins in leak-proof sealants used in pipelines. Epoxies are also used in plumbing bonding adhesives.

Working with Epoxy Resin Systems in Construction

Best Practices Guide to Skin Protection:

CPWR

THE CENTER FOR CONSTRUCTION
RESEARCH AND TRAINING

www.cpwr.com

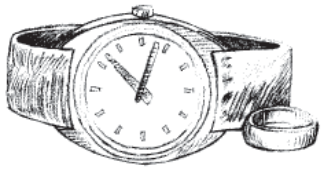
Best Practices

Protecting skins means more than wearing gloves. These best protective practices are recommended by experts. Maybe you can't do all these practices. But you should do as many as possible, starting with the easiest ones.

Wash with pH-neutral or slightly acidic soap. Your pharmacist can recommend one. This helps normalize your skin's pH.

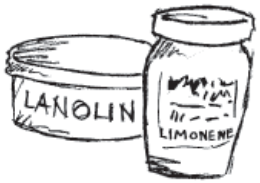
Wash before putting on gloves and each time you remove them.

Don't wear jewelry at work. It can trap material against your skin.



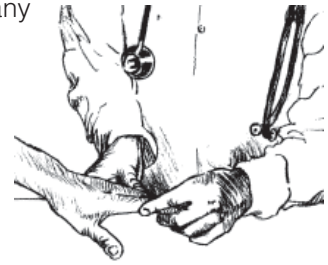
Change out of work clothes at work. Take work clothes home in a separate container, like a trash bag.

Launder work clothes separately to protect your family or your roommates.



Avoid lanolin, petroleum jelly, and other skin softening products at work. These substances can seal epoxy residue against your skin. These products should be applied only to clean skin in clean environments.

See a doctor for any persistent skin problem, even a minor one. In allergic dermatitis, early diagnosis and treatment makes the difference in preventing chronic disease. Tell the doctor you work with epoxies.



Choose the right gloves. Butyl rubber or nitrile gloves may provide the best protection, but always check w/ the epoxy manufacturer to be sure. Clean gloves daily. When gloves become grossly contaminated, throw them away and get new ones.

How to remove gloves

Before removing gloves, always clean off the outsides.
Follow the manufacturer's instructions. Watch for pinholes which can let in contaminated rinse water.

To remove gloves, first loosen them on both hands. Hold hands down so contaminated water will not drip onto skin or clothing.

Remove the first glove only to the fingers. The cuff of the glove will remain over the palm.

Now, grabbing the second glove with the first glove, remove the second glove. The first glove should slip off.

Try to handle gloves by the insides only. Don't touch the outsides.

Keep gloves in a bag until the next use.

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