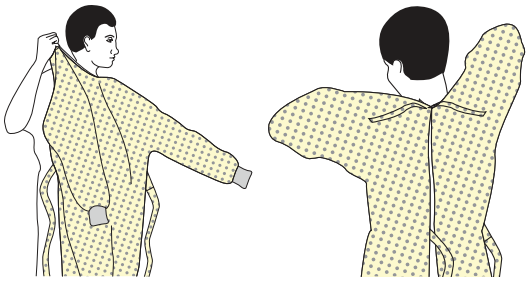
SEQUENCE FOR PUTTING ON PERSONAL PROTECTIVE EQUIPMENT (PPE)

The type of PPE used will vary based on the level of precautions required, such as standard and contact, droplet or airborne infection isolation precautions. The procedure for putting on and removing PPE should be tailored to the specific type of PPE.

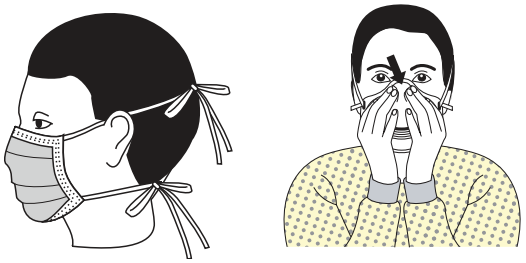
1. GOWN

- Fully cover torso from neck to knees, arms to end of wrists, and wrap around the back
- Fasten in back of neck and waist



2. MASK OR RESPIRATOR

- Secure ties or elastic bands at middle of head and neck
- Fit flexible band to nose bridge
- Fit snug to face and below chin
- Fit-check respirator

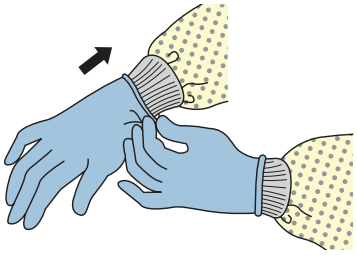


3. GOGGLES OR FACE SHIELD

- Place over face and eyes and adjust to fit

4. GLOVES

- Extend to cover wrist of isolation gown



USE SAFE WORK PRACTICES TO PROTECT YOURSELF AND LIMIT THE SPREAD OF CONTAMINATION

- Keep hands away from face
- Limit surfaces touched
- Change gloves when torn or heavily contaminated
- Perform hand hygiene

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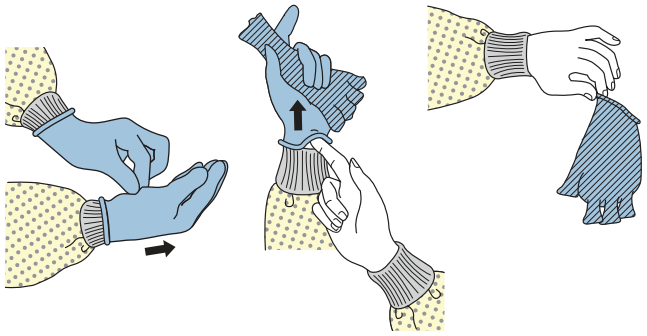
HOW TO SAFELY REMOVE PERSONAL PROTECTIVE EQUIPMENT (PPE) EXAMPLE 1

There are a variety of ways to safely remove PPE without contaminating your clothing, skin, or mucous membranes with potentially infectious materials. Here is one example. **Remove all PPE before exiting the patient room** except a respirator, if worn. Remove the respirator **after** leaving the patient room and closing the door. Remove PPE in the following sequence:

1. GLOVES

- Outside of gloves are contaminated!
- If your hands get contaminated during glove removal, immediately wash your hands or use an alcohol-based hand sanitizer
- Using a gloved hand, grasp the palm area of the other gloved hand and peel off first glove
- Hold removed glove in gloved hand
- Slide fingers of ungloved hand under remaining glove at wrist and peel off second glove over first glove
- Discard gloves in a waste container

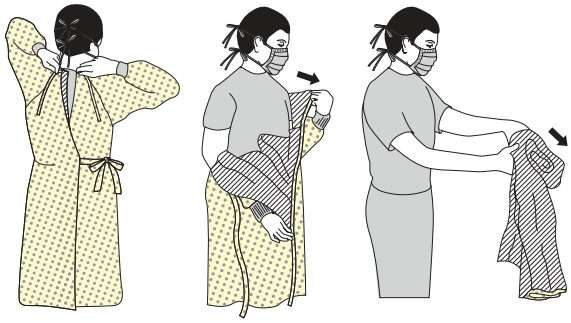


2. GOGGLES OR FACE SHIELD

- Outside of goggles or face shield are contaminated!
- If your hands get contaminated during goggle or face shield removal, immediately wash your hands or use an alcohol-based hand sanitizer
- Remove goggles or face shield from the back by lifting head band or ear pieces
- If the item is reusable, place in designated receptacle for reprocessing. Otherwise, discard in a waste container

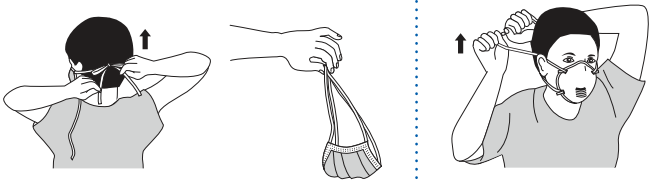
3. GOWN

- Gown front and sleeves are contaminated!
- If your hands get contaminated during gown removal, immediately wash your hands or use an alcohol-based hand sanitizer
- Unfasten gown ties, taking care that sleeves don't contact your body when reaching for ties
- Pull gown away from neck and shoulders, touching inside of gown only
- Turn gown inside out
- Fold or roll into a bundle and discard in a waste container

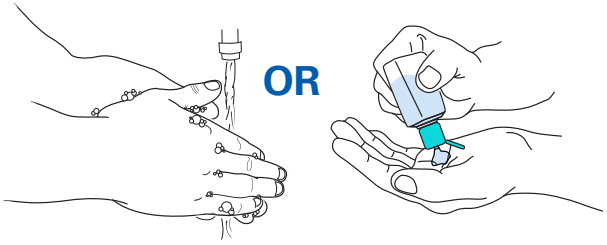


4. MASK OR RESPIRATOR

- Front of mask/respirator is contaminated — DO NOT TOUCH!
- If your hands get contaminated during mask/respirator removal, immediately wash your hands or use an alcohol-based hand sanitizer
- Grasp bottom ties or elastics of the mask/respirator, then the ones at the top, and remove without touching the front
- Discard in a waste container



5. WASH HANDS OR USE AN ALCOHOL-BASED HAND SANITIZER IMMEDIATELY AFTER REMOVING ALL PPE



PERFORM HAND HYGIENE BETWEEN STEPS IF HANDS BECOME CONTAMINATED AND IMMEDIATELY AFTER REMOVING ALL PPE

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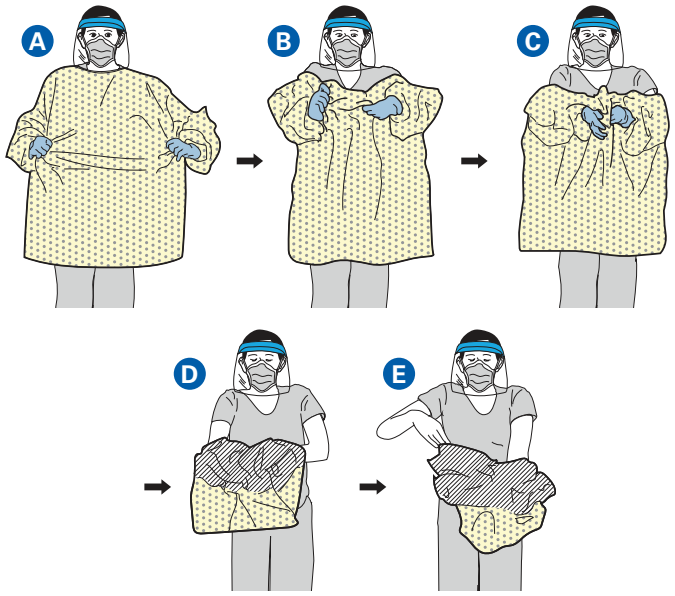
HOW TO SAFELY REMOVE PERSONAL PROTECTIVE EQUIPMENT (PPE) EXAMPLE 2

Here is another way to safely remove PPE without contaminating your clothing, skin, or mucous membranes with potentially infectious materials. **Remove all PPE before exiting the patient room** except a respirator, if worn. Remove the respirator **after** leaving the patient room and closing the door. Remove PPE in the following sequence:

1. GOWN AND GLOVES

- Gown front and sleeves and the outside of gloves are contaminated!
- If your hands get contaminated during gown or glove removal, immediately wash your hands or use an alcohol-based hand sanitizer
- Grasp the gown in the front and pull away from your body so that the ties break, touching outside of gown only with gloved hands
- While removing the gown, fold or roll the gown inside-out into a bundle
- As you are removing the gown, peel off your gloves at the same time, only touching the inside of the gloves and gown with your bare hands. Place the gown and gloves into a waste container

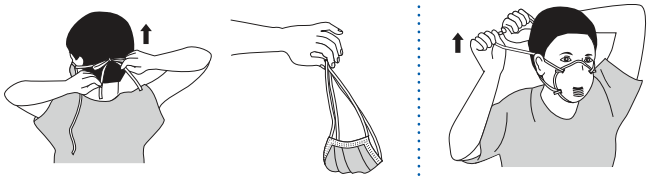


2. GOGGLES OR FACE SHIELD

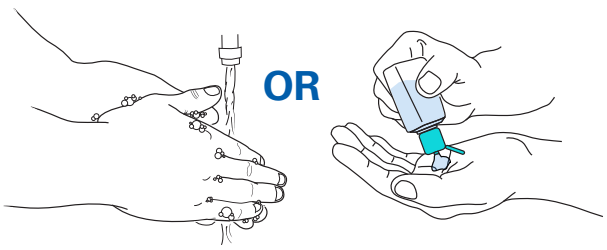
- Outside of goggles or face shield are contaminated!
- If your hands get contaminated during goggle or face shield removal, immediately wash your hands or use an alcohol-based hand sanitizer
- Remove goggles or face shield from the back by lifting head band and without touching the front of the goggles or face shield
- If the item is reusable, place in designated receptacle for reprocessing. Otherwise, discard in a waste container

3. MASK OR RESPIRATOR

- Front of mask/respirator is contaminated — DO NOT TOUCH!
- If your hands get contaminated during mask/respirator removal, immediately wash your hands or use an alcohol-based hand sanitizer
- Grasp bottom ties or elastics of the mask/respirator, then the ones at the top, and remove without touching the front
- Discard in a waste container



4. WASH HANDS OR USE AN ALCOHOL-BASED HAND SANITIZER IMMEDIATELY AFTER REMOVING ALL PPE



PERFORM HAND HYGIENE BETWEEN STEPS IF HANDS BECOME CONTAMINATED AND IMMEDIATELY AFTER REMOVING ALL PPE

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ALEXANDRA WALSH

THE CASE FOR DECONTAMINATION

Decontaminating clothing and equipment is a must after work on some jobsites.

Removing or neutralizing contaminants that have accumulated on materials worn by workers and equipment is critical to health and safety at water well drilling sites where workers might be exposed to hazardous waste or other substances.

Decontamination protects workers from hazardous substances that may contaminate and eventually permeate protective clothing, respiratory equipment, tools, vehicles, and other equipment used on jobsites.

Decontamination protects all personnel at the site by minimizing harmful materials being transferred into clean areas and helps prevent mixing incompatible chemicals.

Finally, the decontamination process protects the community at large by preventing uncontrolled transport of contaminants from the drilling site.

Planning for Decontamination

A decontamination plan should be developed as part of the site safety plan and set up before any personnel or equipment enter areas where any potential for exposure to hazardous substances exists. The decontamination plan should:

- Determine the number and layout of decontamination stations
- Determine the decontamination equipment needed
- Determine appropriate decontamination methods
- Establish procedures to prevent contamination of clean areas
- Establish methods and procedures to minimize workers contacting contaminants while removing personal protective clothing and on equipment
- Establish methods for disposing of clothing and equipment that are not completely decontaminated.

The decontamination plan should be revised whenever the type of personal protective clothing or equipment changes, conditions at the site change, or hazards at the site are reassessed based on new information.

Prevention of Contamination

The first step in decontamination is to establish standard operating procedures (SOPs) that minimize contact with waste and thus the potential for contamination.

Here are some examples:

- Stress work practices that minimize contact with hazardous substances (don't walk through areas of obvious contamination; don't directly touch potentially hazardous substances).
- Use remote sampling, handling, and container-opening techniques (drum grapplers, pneumatic impact wrenches).
- Protect monitoring and sampling instruments by bagging (make openings in the bags for sample ports and sensors that must contact site materials).
- Wear disposable outer garments and use disposable equipment where appropriate.
- Cover equipment and tools with a strippable coating that can be removed during decontamination.
- Encase the source of contaminants with plastic sheeting or overpacks.

In addition, SOPs should be established that maximize worker protection. For example, proper procedures for dressing prior to entering the contaminated area (generally referred to as the exclusion zone) will minimize the potential for contaminants bypassing the protective clothing and escaping decontamination.

In general, all fasteners should be used (zippers fully closed, all buttons used, all snaps closed). Gloves and boots should be tucked in under the sleeves and legs of outer clothing, and hoods (if not attached) should be worn outside the collar.

Another pair of tough outer gloves is often worn over the sleeves. All areas where clothing connects with the body should be taped to prevent contaminants from running inside the gloves, boots, jackets, or one-piece suits.

Prior to each use, the personal protective equipment should be checked to make sure it contains no cuts or punctures that could expose workers to wastes.

Similarly, any cuts and scratches to the skin surface may enhance the potential for chemicals or infectious agents that directly contact the worker's skin to penetrate into their body. Particular care should be taken to protect these areas. Workers with large areas of damaged skin should be kept from working onsite until their skin heals.

All personnel should be trained in the SOPs for minimizing contact and maximizing worker protection—and these procedures should be enforced throughout operations at the site.

Types of Contamination

Contaminants can be located on the surface of personal protective equipment or permeated into its material. Contaminants on the surface can be easy to detect and remove, but contaminants that have permeated a material are often difficult or almost impossible to detect, let alone remove.

Published in *Water Well Journal*'s September 2019 issue.

Five major factors affect the extent of permeation:

- *Time.* The longer amount of time a contaminant is in contact with an object, the greater the probability and extent of permeating. For this reason, minimizing contact time is one of the most important objectives of a decontamination program.
- *Concentration.* Molecules flow from areas of high concentration to areas of low concentration. As concentrations of wastes increase, the potential for permeating personal protective clothing increases.
- *Temperature.* An increase in temperature generally increases the permeation rate of contaminants.
- *Size.* Permeation increases as the size of the contaminant molecule becomes smaller, and the size of the pore space in the material being permeated becomes larger.
- *Speed.* Gases, vapors, and low-viscosity liquids as a rule tend to permeate more readily than high-viscosity liquids or solids.

Methods of Decontamination

Decontamination methods either (1) physically remove contaminants, (2) inactivate contaminants by chemical detoxification or disinfection/sterilization, or (3) remove contaminants by a combination of both physical and chemical means.

Physical removal

In many cases, contamination can be removed by physical means involving dislodging/displacement, rinsing, wiping off, and evaporation.

Physical methods involving high pressure or heat should be used only as necessary and with caution since they can spread contamination and cause burns.

Contaminants that can be removed by physical means can be categorized as follows:

- *Loose contaminants.* Dusts and vapors that cling to equipment and workers or become trapped in small openings, such as the weave of clothing fabrics, can be removed with water or a liquid rinse. Removal of electrostatically attached materials can be enhanced by coating the clothing or equipment with anti-static solutions. These are available commercially as wash additives or anti-static sprays.
- *Adhering contaminants.* Some contaminants cling by forces other than electrostatic attraction. Contaminants such as glues, cements, resins, and muds have much greater adhesive properties and are difficult to remove by physical means. Physical removal for contaminants include scraping, brushing, and wiping. Removal of adhesive contaminants can be enhanced through solidifying, freezing with dry ice or ice water, adsorption or absorption using powdered lime or kitty litter, or melting.
- *Volatile liquids.* Volatile liquid contaminants can be removed from protective clothing or equipment by evaporation followed by a water rinse. Evaporation of volatile liquids can be enhanced by using steam jets. With any evaporation or vaporization, care must be taken to prevent workers inhaling the vaporized chemicals.

Chemical removal

Physical removal of contaminants should be followed by a wash/rinse process using cleaning solutions. These cleaning solutions normally use one or more of the following methods:

- Chemical removal of surface contaminants can be accomplished by dissolving them in a solvent. The solvent must be chemically compatible with the equipment being cleaned. This is particularly important when decontaminating personal protective clothing constructed of organic materials that could be damaged or dissolved by organic solvents. In addition, care must be taken in selecting, using, and disposing of any organic solvents that may be flammable or potentially toxic. Organic solvents include alcohols, ethers, ketones, aromatics, straight-chain alkanes, and common petroleum products.

  Halogenated solvents generally are incompatible with personal protective equipment and are toxic. They should only be used for decontamination in extreme cases where other cleaning agents will not remove the contaminant.

  Because of the potential hazards, decontamination using chemicals should be done only if recommended by an industrial hygienist or other qualified health professional.
- Surfactants enhance physical cleaning by reducing adhesion forces between contaminants and the surface being cleaned, and preventing redeposit of the contaminants. Household detergents are among the most common surfactants. Some detergents can be used with organic solvents to improve the dissolving and dispersal of contaminants into the solvent.
- Turning liquid or gel contaminants into a solid can enhance their physical removal. Solidifying works by (1) removing moisture using absorbents such as grounded clay or powdered lime; (2) chemical reactions using polymerization catalysts and chemical reagents; and (3) freezing using ice water.
- Rinsing removes contaminants through dilution, physical attraction, and dissolving in liquid. Multiple rinses with clean solutions remove more contaminants than a single rinse with the same volume of solution. Continuous rinsing with large volumes will remove even more contaminants than multiple rinsings with a lesser total volume.
- Chemical disinfectants are a practical means of inactivating infectious agents. Unfortunately, standard sterilization techniques are generally impractical for large equipment and for personal protective clothing equipment. For this reason, disposable PPE is recommended for use with infectious agents.

Decontamination methods vary in their effectiveness for removing different substances. The effectiveness of any decontamination method should be assessed at the beginning of a program and periodically throughout the lifetime of the program. WWJ

Alexandra Walsh is the vice president of Association Vision, a Washington, D.C.–area communications company. She has extensive experience in management positions with a range of organizations.

PPE BEST PRACTICES

Select equipment specific to jobsite hazards and teach proper use.

SAMUEL SANGUEDOLCE

Jobsites for water wells can be dangerous. Knowing that, it is the employer's job to make certain all recognized safety hazards are identified, eliminated, or controlled as much as possible to protect the employees.

Ideally, site hazards are eliminated or controlled through safety engineering or safe work practices. However, when this can't happen, employers must provide personal protective equipment (PPE) and see it is properly used.

Employers are required to first identify the job-specific hazards that will determine the required PPE. Then employees must be trained how to properly use each piece of equipment. Training should take place before the employee starts work and should include an identification of hazards on the jobsite, an explanation of the required PPE and how it provides protection, and an explanation of how to wear, care for, and store PPE.

Employers should not assume workers understand how to wear PPE properly—not even the most common items.

Head protection

It's not unusual to see workers wearing hard hats with the brim partially blocking their vision or worn backwards because it's more comfortable. The intent of wearing a hard hat is to absorb the impact of an object hitting the head. When worn properly, it will provide a clearance of 1 inch between the hat's outer shell and the employee's head. If not worn properly, it won't adequately protect the worker.

When training employees, be sure they understand not all PPE is the same.

The American National Standards Institute (ANSI) has divided protective helmets into two types and three classes, based upon the type of protection required. Type 1 provides protection from an impact resulting from a blow only to the top of the head. Type 2 protects from a sideways impact resulting from a blow received off-center, from the side to the top of the head.

ANSI further classifies hard hats for employees who work with electricity. Class E (Electric) is worn for work up to 20,000 volts. Class G (General) provides limited protection tested to 2200 volts. Class C (Conductive) is not intended to provide electrical protection.

Besides hard hats, other types of PPE may be required.

Eye protection

Safety glasses, the most common eye protection, must be ANSI-approved. A side shield protects workers who are exposed to flying particles associated with grinding, sanding, sawing, chipping, or any other activity generating fragments that could hit the eye.

Face shields provide protection against a chemical splashing and should be worn with safety glasses or goggles for complete protection.

Goggles completely shield the eyes by creating a seal around the face to prevent liquid splashing, harmful vapors, and airborne dust entering the eyes. Goggles with air ventilation on the top and sides (direct ventilation) protect from flying particles—but not fine dust or chemicals. Goggles with indirect ventilation must be worn when handling chemicals or any liquid that can splash into the eyes. Welding goggles have a filtered lens protecting the eyes against ultraviolet and infrared light.

In addition to thoroughly familiarizing employees to jobsite hazards and required PPE before they begin working on the site, I recommend another best practice—a toolbox safety talk.

Safety goggles can be worn over prescription eyeglasses, and safety glasses can be made with corrective lenses using the same prescription the worker uses for their regular eyeglasses.

Hearing protection

Earplugs effectively reduce the decibel level of noisy machines and tools when properly inserted. There are three steps: roll the earplug, pull the ear open, and insert.

Earmuffs provide a cushioned plastic cap over each ear. Sometimes safety glasses interfere with the seal of earmuffs.

Also, some high noise level situations require workers to wear both earplugs and earmuffs.

Hand protection

Leather gloves are common on many well drilling sites, but employers should select gloves based upon the nature of the work to be performed on the site.

Rubber or neoprene gloves may be required for workers who are required to handle chemicals. Wool, leather, or specialty gloves can protect against heat or electricity.

All gloves should completely cover the hand, not show any rips or tears in either glove, and fit comfortably.

Published in *Water Well Journal*'s October 2017 issue.

If the worker is handling rotating equipment, like drill bits, be aware of the possibility for bulky gloves to get caught in the equipment. When workers handle chemicals, training should include how to safely remove the gloves without allowing chemical residue on the glove to touch the skin.

Foot protection

Typically, work shoes should possess a sturdy leather upper and non-skid soles, but the proper shoe or boot required will be determined by the work performed.

Boots that include toe and foot guards, also known as metatarsal protection, are required for employees working in situations where heavy material or a load can land on the foot, or if they handle heavy hand carts.

Boots made of impermeable rubber or rubberized material are required when the employee works with corrosives or handles chemicals.

Employees exposed to electrical hazards must wear boots without nails or metal parts and with non-conductive soles.

Although employers must pay for boots with special requirements such as foot guards, the Occupational Safety and Health Administration does not require employers to pay for "non-specialty safety-toe protective footwear, including steel-toe shoes or boots, if the employer permits them to be worn off the jobsite."

For a listing of employer payment obligations and exceptions, go to *www.osha.gov/dte/outreach/intro_osha/7_employee_ppe.pdf.*

Respiratory protection

Respirators may be required for employees working in confined spaces, and activities generating a lot of dust—jackhammering on concrete, handling chemicals with strong vapors, or welding.

The requirements for respirators in construction are identical to the requirements for general industry, so contractors should follow 29 CFR 1910.134.

The type of respiratory protection required is determined by the concentration of vapor or airborne contamination. Typically, some type of workplace evaluation in the form of air testing will help in identifying the level of protection needed.

Toolbox safety talks

Although employers are required to post signs identifying site-specific hazards and the PPE required in that area, the challenge on a well drilling site is it can change every day. In addition to thoroughly familiarizing employees to jobsite hazards and required PPE before they begin working on the site, I recommend another best practice—a toolbox safety talk at the start of each shift.

Changes in the jobsite, such as a new excavation that could pose a fall hazard or the movement of equipment into a new area requiring hearing protection, are all topics easily covered in a short safety talk beforehand. Supervisors should encourage workers to actively take part in the meetings and voice any safety hazards or concerns they may have or notice.

Others at the jobsite

Don't forget about visitors.

Customers, inspectors, or suppliers who will be visiting the site must be required to wear the appropriate PPE in each area they walk through. This may include hearing protection in high noise areas, hard hats, or safety glasses.

Another best practice is a brief, 10-minute safety orientation for visitors that covers the hazards specific to that site, procedures in case of an emergency, dangers associated with equipment moving on the site, and the importance of staying with the group while touring the site.

Well drilling site safety and the correct use of PPE is a team effort. Supervisors and senior managers must send the message the employer is serious about safety by making sure workers always wear PPE properly when required.

Finally, be sure employees understand the importance of and the underlying reason for PPE: We want everyone to go home safely at the end of their shift. WWJ

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