

A Guide to Eyewash and Safety Shower Facilities



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A Guide to Eyewash and Safety Shower Facilities was prepared by L.A. Weaver Company of Raleigh, N.C., a firm that specializes in occupational and environmental safety and health. The information in this guide was updated in 2010.

This guide is intended to be consistent with all existing OSHA standards. If an area is considered by the reader to be inconsistent with a standard, then the appropriate state or federal standard should be followed.

To obtain additional copies of this guide, or if you have questions about North Carolina occupational safety and health standards or rules, please contact:

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Phone: (919) 807-2875 or 1-800-NC-LABOR (1-800-625-2267)

Additional sources of information are listed on the inside back cover of this guide.

The projected cost of the NCDOL OSH program for federal fiscal year 2009–2010 is \$17,534,771. Federal funding provides approximately 30 percent (\$5,180,700) of this total.



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Foreword

We ask a lot from employees when we ask them to work with hazardous chemicals and products. They know one accident could cost them their sight or leave scars that never disappear. These workers deserve to know that help is always within reach.

A Guide to Eyewash and Safety Shower Facilities looks at the kinds of safety equipment these workers need to have in their workplaces. It explains what employers are required by OSHA to provide in eyewash and safety shower stations.

In North Carolina, the N.C. Department of Labor enforces the federal Occupational Safety and Health Act. NCDOL offers many educational programs to the public and produces publications to help inform people about their rights and responsibilities regarding occupational safety and health.

When reading this guide, please remember the NCDOL mission is greater than just regulatory enforcement. An equally important goal is to help citizens find ways to create safe workplaces. Everyone profits when managers and employees work together for safety. This booklet, like the other educational materials produced by the N.C. Department of Labor, can help.

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Introduction

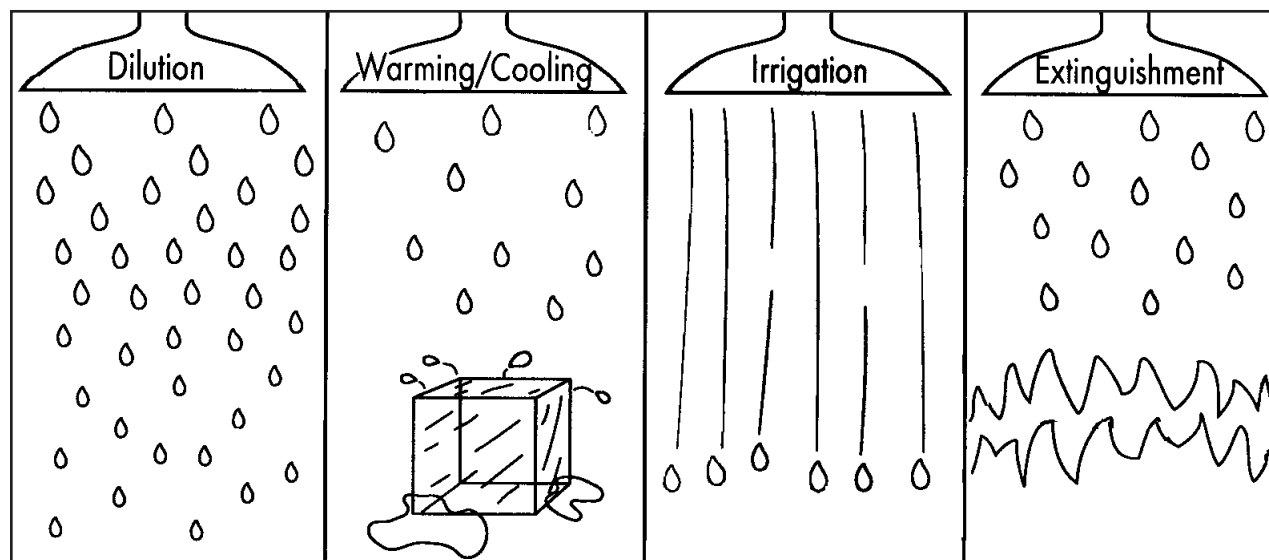
In today's industries, many safety precautions and types of emergency equipment must be used to protect and ensure the health of employees. Although regulations and standards, personal protective equipment, and safety training are used, accidents still happen. Accidents involving hazardous chemicals can be especially severe. Employees who manufacture hazardous chemical products are at risk, of course. Hazardous chemicals can also affect people who work in food industries, or with cleaning solutions, and in manufacturing industries and service establishments.

Eyewashes and safety showers were developed in response to the increased use of hazardous chemicals. Eyewashes and safety showers are emergency systems used in both public and private industry to protect an employee from injury in case of contact with hazardous chemicals, chemical compounds or fire. The four basic ways these safety systems are used (see Figure 1) include:

1. Dilution—diluting the chemicals that are on the skin or in the eyes to a nonharmful level.
2. Warming/cooling—warming or cooling the body or eyes because of a change in temperature due to chemical exposure.
3. Irrigation—flushing the chemicals out of the eyes or off the skin.
4. Extinguishment—putting out fires of clothing on the body.

Figure 1

Four Ways Eyewashes and Safety Showers Are Used



Eyewash and emergency showers were first used around 1928. Since that time, industrial chemical use has grown rapidly. According to a N.C. Department of Labor report on chemical injuries, only one chemical injury was reported in 1965. By 1978 there were reports of 356 injuries in North Carolina from chemical contact. In North Carolina, from 1988 through 1990, workers' compensation claims were paid for 1,263 heat burns and 274 chemical burns. Because of the increased use of hazardous substances, eyewash and safety showers are essential for employees who work with or around chemicals. Employees must be trained to use their emergency systems.

Because some chemicals can irritate or damage skin upon contact, affected areas should be flushed with water as soon as possible. Even when only a small amount of a harmful substance is splashed on the skin, the substance must be washed from the area immediately. In most cases an emergency shower should be used. When the body is to be flushed following chemical contact, equipment and clothing must be removed once the shower has been activated.

Modesty has no place in emergency situations. If necessary, fellow employees must help remove contaminated clothing. If a helper becomes contaminated, he or she may have to use the facility along with the initial individual, to flush the affected area. Appropriate medical help must be contacted immediately. The affected person should always remain in the shower or continue flushing the eyes for no less than 15 minutes.

Appropriate personal protective equipment should be used to protect against hazardous chemicals. Personal protective equipment should be used if a person is handling chemicals, even though such equipment may not totally guarantee that hazardous chemicals will not pass through to the worker. One federal Bureau of Labor Statistics survey of 1,052 industrial eye injuries revealed that most workers were injured while performing their normal job activities at their worksites. Sixty percent of these persons surveyed said that they were not wearing eye protection at the time of their injury. When asked why, the majority responded that eye protection was not normally used, or they felt it was not needed.

Personal protective equipment should fit the task. In 1989, the U.S. Department of Labor released the results of a separate survey of people injured by chemicals in the workplace. The results showed that 66 percent were wearing protective equipment when injured. These employees said that the chemicals passed under or around the safety gear (usually glasses, goggles or face shields). Many workers were accustomed to using the material that injured them. Part 4 of this guide lists and discusses occupational safety and health standards applicable to relevant personal protective equipment.

Employees should be informed about hazardous chemicals to which they are exposed, and they should be trained to work with such chemicals. In the U.S. Department of Labor survey mentioned above, nearly three-fifths of the injured employees said they worked with or near the chemicals daily or almost daily; and one-tenth worked with or near the agents weekly. Three-fifths of the injured employees said that they had not been made aware of the dangers of chemicals on their job. During the period between collecting the data and release of the final report for the survey, the federal Occupational Safety and Health Administration issued its Hazard Communication Standard.

That standard requires employers to inform employees about the hazards of chemicals through labeling containers, material safety data sheets and special training. The standard was subsequently adopted under the Occupational Safety and Health Act of North Carolina by the N.C. Department of Labor. You can obtain a copy of the standard by writing or calling the N.C. Department of Labor, Occupational Safety and Health Division, Education, Training and Technical Assistance Bureau. (See the inside back cover of this publication for the address and telephone number.)

Because safety equipment may not be totally protective and because there may be employees who fail to wear protective clothing, safety showers and eyewash systems should be within easy reach and every employee should know how to use them. Since the eye is one of the most vulnerable and important organs, special care should be taken to counteract chemical eye injuries. Chemical eye injuries can be divided into acid or basic types. Both types are burn injuries that have the same appearance—small, abundant cuts to the eye and eyelids, redness, and swelling. These injuries also produce corneal changes, and the eyelids are usually swollen shut. Whether the chemical is splashed in the eye or on the body, decontamination with water from an eyewash or safety shower should be the first aid.

Treatment strategies for injuries from hazardous chemicals vary from water to neutralizing agents. But, when an accident occurs, time should not be spent looking for agents when water is usually readily available. If a special agent is needed, it can be used after irrigation with water. Chemical burns should be attended by a doctor or emergency medical personnel who can locate and administer the needed solutions.

Because some chemicals, such as concentrated ammonia, can penetrate the cornea and enter the anterior chamber of the eye within six to eight seconds, it is extremely important to flush the chemical out immediately, before it causes severe damage or blindness.

Since it may take 15 minutes or longer before an injured person can be treated by a physician, the affected area must be flushed with water as soon as possible. Neutralizing solutions neutralize an acid or other chemical while water irrigation helps remove the chemical. Chemical burns caused by vapors should be treated in the same manner as those caused by splashes. According to the Humana Burn Center, the affected area should be irrigated with water for 15 minutes or longer, "no other option should take priority," and by no means should an ointment, salve, grease or other remedy be applied. Early irrigation of the affected area is the most important treatment for a chemical burn.

Selecting the Appropriate Unit

Safety showers and eyewashes help prevent long-lasting medical problems and scarring. The N.C. Department of Labor has appropriate standards with which employers must abide. (See Part 4 of this guide.) Many OSHA standards address the neutralization of injurious corrosive materials after an employee is exposed to them. The emergency eyewash and shower group of the Industrial Safety Equipment Association has also developed a relevant standard. That standard (ANSI/ISEA Z358.1-2009) includes information regarding six different types of emergency eyewash and shower equipment. Table 1 summarizes the key points in the standard.

Table 1

Summary of ANSI/ISEA Z358.1-2009

Equipment Type	Physical Features	Location	Maintenance	Training
Emergency Shower	Water column between 82" and 96" with 20" minimum diameter of column at 60" above surface. Should deliver 20 gpm. Enclosures, if used, require minimum 34" unobstructed diameter.	Accessible within 10 seconds. Path free from obstructions.	Plumbed units activated weekly to flush lines and verify operation. Self-contained units—visually inspect fluid for change and to supplement in accordance with manufacturer's instructions.	Required for all employees who might be exposed to a chemical splash.
Eyewash	Flow rate of 0.4 gpm for 15 minutes required. Water nozzles 33" to 45" above floor and 6" from wall or obstruction.	Accessible within 10 seconds. Path free from obstructions.	Plumbed units activated weekly to flush lines and verify operation. Self-contained units—visually inspect fluid for change and to supplement in accordance with manufacturer's instructions.	Required for all employees who might be exposed to a chemical splash.
Personal Eyewash	Not addressed.	Accessible within 10 seconds. Path free from obstructions.	Inspected and maintained in accordance with manufacturer's instructions.	Required for all employees who might be exposed to a chemical splash.
Eye/Face Wash	Flow rate of 3.0 gpm for 15 minutes required. Water nozzles 33" to 45" above floor and 6" from wall or nearest obstruction.	Accessible within 10 seconds. Path free from obstructions.	Plumbed units activated weekly to flush lines and verify operation. Self-contained units—visually inspect fluid for change and to supplement in accordance with manufacturer's instructions.	Required for all employees who might be exposed to a chemical splash.
Hand-held Drench Hose	May be considered an eyewash or eye/face wash if meets the requirements of either.	Accessible within 10 seconds. Path free from obstructions.	Plumbed units activated weekly to flush lines and verify operation. Self-contained units—visually inspect fluid for change and to supplement in accordance with manufacturer's instructions.	Required for all employees who might be exposed to a chemical splash.
Combination Units	Must meet physical requirement of component parts.	Accessible within 10 seconds. Path free from obstructions.	Plumbed units activated weekly to flush lines and verify operation. Self-contained units—visually inspect fluid for change and to supplement in accordance with manufacturer's instructions.	Required for all employees who might be exposed to a chemical splash.

The types of equipment addressed by the ANSI standard include:

- *Emergency shower.* The emergency shower is “a unit that enables a user to have water cascading over the entire body.” This unit is used for general irrigation of the body and although it can be used to rinse the face, the unit is not meant for flushing of the eyes.
- *Eyewash.* The eyewash is a unit that supplies fluid to irrigate and flush the eyes.
- *Personal eyewash.* The personal eyewash is “a supplementary eyewash that supports plumbed units, self-contained units, or both by delivering immediate flushing for less than 15 minutes.” The major difference between self-contained or plumbed and personal eyewash equipment is that the self-contained or plumbed one must have at least a 15-minute supply of water while the personal units have less than a 15-minute supply. Because of this, the personal eyewash is used on the site for immediate flushing and while the victim is moved to another unit. Irrigation should continue once the victim reaches the other unit.
- *Eye/face wash.* This device is “used to irrigate and flush both the face and the eyes.”
- *Hand-held drench hose.* This arrangement is “a flexible hose connected to a water supply and used to irrigate and flush eyes, face, and body areas.” With this unit it may be necessary for another person to hold the hose to allow the victim to hold his or her eyes open.
- *Combination unit.* The combination unit combines a shower with an eyewash or eye/face wash, or with a drench hose, or with both into one assembly. (See Figure 2.)
- *Plumbed unit.* A plumbed unit is permanently connected to a potable water source.
- *Self-contained unit.* A self-contained unit is not permanently installed and must be refilled or replaced after use.

In general, the type of hazard and the number and availability of personnel help to determine what type of emergency equipment to install. The most commonly used emergency wash equipment is the overhead deluge shower, the combination deluge shower with multiple-spray units, and the complete multiple-spray decontamination unit.

Radioactive or highly toxic materials may require a total decontamination shower. These are booth-type showers with numerous spray nozzles that may be combined with central overhead sprayers. A complete safety station combines the eye/face wash fountain with a drench shower. A very useful addition to an eyewash fountain is a face spray ring that sprays the face gently to remove contaminants.

A laboratory safety shower does not always give the same drenching effect of the standard overhead shower. Because of the type of shower head and the angle the water falls, the person using a laboratory safety shower must turn and strain to make sure all chemicals are washed away. This type of shower is suitable where the upper front portion of the body is exposed to chemicals (such as bench work in a laboratory). Even then, the overhead shower should be considered as a backup precaution. The drench shower is not suitable for washing out the eyes because too much water is flowing downward making it difficult to position the face under the shower.

Figure 2

Types of Eyewash and Safety Shower Equipment



Combination Shower/Eyewash



Non-Pressurized Self-Contained Eyewash



Pressurized Self-Contained Eyewash



Shower Test Assembly



Sink-Mounted Eyewash

3

Training, Locating, Maintaining

Training to Use Eyewash and Safety Shower Facilities

Employees must be properly instructed and trained in the use of eyewash and safety showers regardless of how well they have worked around the chemicals in the past. Directions for use of safety equipment should be written, available and frequently reviewed. Training should be simplified so that there is only one emergency procedure throughout the facility that must be followed whenever eyewashes and safety showers are needed.

Since timing is so important to avoid long-term injuries from toxic or corrosive substances, training should ensure that each person is familiar with controls and operating devices of the unit. Because the muscles of the eyes react quickly and strongly to chemicals, it is almost impossible to keep the eyes open for irrigation purposes. For this reason, the ANSI standard requires that valves be located so that they can be turned on easily and will remain on until effort is made to turn them off. Training should emphasize that an injured employee may need assistance in reaching the shower or eyewash and in getting medical attention. Therefore, fellow employees should know how to assist and contact medical help, whether they work directly with chemicals or not. If a fellow employee becomes contaminated while assisting an injured worker, he or she may use the shower with the victim to flush the affected area.

The following checklist offers additional information for training employees in the proper use of eyewash and safety shower facilities:

- In case of chemical exposure, flush skin or eyes with cool water for at least 15 minutes. DO NOT RUB!
- Get medical assistance immediately following flushing.
- If possible, continue flushing while on way to medical help.
- Know the effects of chemicals with which you are working. Read, ask questions about, and understand material safety data sheets for each chemical with which you work.
- Always wear personal protective equipment.
- Learn the location and use of all emergency equipment, even if you are working in a new area for only a brief time.
- Know how to help others reach showers or eyewashes and how to help them get medical assistance.
- Hold your eyes open with your hands while using an eyewash to be sure water reaches the eyes.
- Remove contaminated clothing after the shower has been activated.
- Immediately wash off even small amounts of chemicals.

Locating Eyewash and Safety Shower Facilities

Because the first few seconds after exposure to a chemical are critical, eyewash and safety shower facilities must be within 10 or fewer seconds of an employee's reach. If the chemical is left in the eye or on the body for even seconds too long, permanent scarring may result. Therefore, the most important step in treatment is getting to the eyewash or shower as quickly as possible and getting the affected area washed thoroughly before the chemical can cause further damage.

Minor exposures generally are reversible, and healing is normal with immediate treatment. Severe or extended exposure, however, may cause permanent and irreversible damage. The first 15 seconds after injury is generally accepted as the most critical time, so none of this period should be spent looking for an eyewash or safety shower. Shower and eyewash stations should be located close to potential hazard sites.

Eyewash and safety shower facilities should not be separated from the hazard site by a wall or partition that would cause an employee to go through a doorway. If the shower or eyewash is located in a usual traffic pattern or conspicuous place, it will be easier to reach when needed. Care should be taken to locate the shower and eyewash and their controls where they will not be blocked or contaminated by other materials.

Use ANSI/ISEA Z358.1-2009 (Table 2) as a guide to locate eyewash and safety shower facilities so that they may be reached within ten seconds.

Table 2
ANSI/ISEA Z358.1-2009
Emergency Eyewash and Shower Equipment

LOCATION			DESCRIPTION
UNIT	BLOCK	TAG NUMBER	TYPE OF EQUIPMENT
HAZARD			

SHOWER

DESCRIPTION	PERFORMANCE REQUIREMENTS	COMPLIES	DOESN'T COMPLY
Shower Height	Not less than 82" not more than 96" from standing level		
Water Spray Pattern	20" minimum diameter—60" from standing level		
Center of Water Spray	16" from any obstruction		
Water Delivery—Potable	Minimum of 20 gpm/meeting water spray pattern		
Control Valve and Actuator	Stay ON type—Off to ON one second—easily located		
Location to Hazard	Maximum 10 seconds from hazard		
Identification	Well lighted, sign, highly visible		

EYE/FACE WASH

DESCRIPTION	PERFORMANCE REQUIREMENTS	COMPLIES	DOESN'T COMPLY
Water Delivery—Potable	Minimum of 3 gpm—dual stream flushing		
Velocity	Soft spent stream		
Location to Hazard	Maximum 10 seconds from hazard		
Nozzles	Covers to protect from airborne contaminants		
Nozzle Height	Not less than 33" not more than 45" from standing level		
Control Valve and Actuator	Stay ON type—Off to ON one second—easily located		
Identification	Well lighted, sign, highly visible		

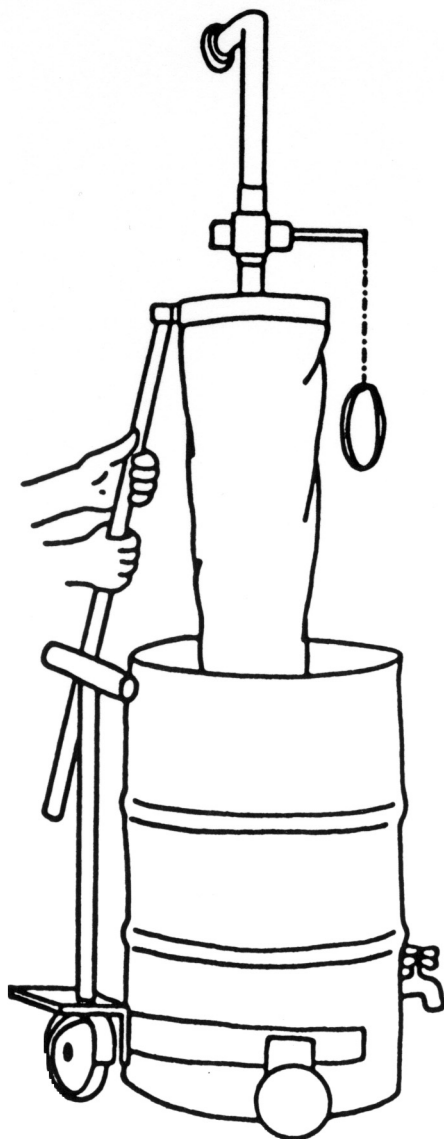
DRENCH HOSE

DESCRIPTION	PERFORMANCE REQUIREMENTS	COMPLIES	DOESN'T COMPLY
Water Delivery—Potable	Minimum of 3 gpm—low velocity		
Location to Hazard	Maximum 10 seconds or from hazard		
Control Valve	OFF to ON one second—easy to locate and operate		

According to ANSI/ISEA Z358.1-2009, plumbed equipment must be activated weekly to flush the line and to verify proper operation. Installing an eyewash or safety shower in poor drainage area facilities may deter scheduled flushing. But if such location is unavoidable, a bucket or drum mounted on a dolly or roller may be used to collect water during routine flushing. The person testing the showers and eyewashes should turn them to full flow to allow residues and other substances accumulated in the lines to be pushed out and washed away. If the showers and eyewashes are not tested at full flow, they may become so clogged that they are not useful when needed. See Figure 3.

Figure 3

Testing a Safety Shower at Full Flow Draining the Flow Into a Drum



4

OSHA/NCDOL Standards

This section identifies and discusses OSHA standards as enforced by the NCDOL Occupational Safety and Health Division. Generally speaking, 29 CFR 1910 standards apply to general industry and 29 CFR 1926 standards apply to the construction industry. However, in instances where there are gaps in coverage, standards may apply across boundaries.

Eyewash and Safety Shower Facilities

Some requirements in the standards listed below are quite specific (e.g., the requirement to provide a 50-gallon container of water); some language in the standards lacks specificity (e.g., the requirement to provide “suitable” facilities or an “easily accessible” shower). The following comments are offered as guidelines for the standard provisions that are not specific.

a. Facilities should be provided and designated for the purpose of serving as emergency eyewash or shower facilities. The facilities should not be used for any other purpose which might inhibit their immediate use as emergency eyewash or shower facilities. Apparatus such as hoses, buckets and spigots, which are used in conjunction with other activities or processes, may serve as emergency eyewash or shower facilities only if they meet the applicable OSHA standard. In any event, use in conjunction with other activities must not diminish their accessibility or effectiveness as an emergency eyewash or shower.

b. Facilities for emergency eyewash and showers should be provided where the hazard warrants. Eyewash and shower facilities should be installed so that they may be used simultaneously.

c. Emergency eyewash or emergency shower facilities may be either a fixed commercially available apparatus designed specifically as an eyewash or shower or an apparatus of similar design and equal effectiveness.

d. Minimum requirements for emergency eyewash facilities may be met by a hose of adequate length and flexibility to allow the user to direct a flow of water into the eyes. A pressure-reducing, divergent flow or “spent stream” nozzle and quick opening valve (providing full on/full off control with one-hand operation) located at the nozzle must be attached to the hose. It is recommended that the nozzle be mounted at a height between 33 and 45 inches (so that both hands can be free to assist in irrigation of the eyes).

e. Minimum requirements for emergency shower facilities may be met by an overhead mounted nozzle that provides a deluge or other soft flow of water equipped with a quick opening valve (providing full on/full off control in less than 180 degree arc) that can be operated by a person standing within the effective area of the shower.

f. Location. All required emergency eyewash and shower facilities should be located within a distance from the point of hazardous exposure that can be negotiated in 10 seconds or less. Factors that must be considered are physical layout of work area and decreased vision and mobility that may result from employee exposures of varying severity.

g. Water supply/flow rates. All facilities used for compliance with the standards should provide a copious flow of potable water for at least 15 minutes. No action may be required of the user other than the opening of a valve. (Examples of prohibited devices are squeeze bottles or manually operated pumps. However, such devices may be provided in addition to protections required by the standards.)

h. Verification of operation. The employer should ensure the dependability of all emergency eyewash and shower facilities through protection from freezing, deterioration and physical damage and through appropriate inspection and maintenance.

i. Temperature. The temperature of the water used for emergency eyewash or shower facilities must be maintained above freezing. It is recommended that the temperature be maintained above 60°F to reduce hypothermia and below 100°F to minimize harm to the eyes.

j. At construction sites and in commercial and manufacturing facilities, at locations where powered industrial trucks are parked for overnight storage and routine battery recharging only, there is no need for emergency facilities unless there is the potential for exposing an employee to electrolyte.

k. At construction sites and in commercial and manufacturing facilities where batteries (such as industrial truck batteries) are serviced and handled, proper eyewash and body drenching equipment must be available regardless of the personal protective equipment required or used.

General requirements for dipping and coating operations—29 CFR 1910.124(g). **What hygiene facilities must I [employer] provide?** When your employees work with liquids that may burn, irritate or otherwise harm the skin, you must provide, in accordance with 1910.124(g)(2), an emergency shower and eyewash station close to the dipping or coating operation. In place of this equipment, you may use a water hose that is at least 4 feet long and at least $\frac{3}{4}$ of an inch thick with a quick-opening valve and carrying a pressure of 25 pounds per square inch or less.

Medical services and first aid—29 CFR 1910.151(c). Where the eyes or body of any person may be exposed to injurious corrosive materials, suitable facilities for quick drenching or flushing of the eyes and body shall be provided within the work area for immediate emergency use.

Chemical processes of making pulp—29 CFR 1910.261(g)(18)(i). Quick operating showers, bubblers, etc., shall be available for emergency use in case of caustic soda burns.

Textiles—29 CFR 1910.262(pp). First aid. Wherever acids or caustics are used, provisions shall be made for a copious and flowing supply of fresh, clean water.

Telecommunications—29 CFR 1910.268(b)(2)(i). Facilities for quick drenching or flushing of the eyes and body shall be provided unless the storage batteries are of the enclosed type and equipped with explosion proof vents, in which case sealed water rinse or neutralizing packs may be substituted for the quick drenching or flushing facilities.

Storage and handling of anhydrous ammonia—29 CFR 1910.111(b)(10)(iii). Stationary storage installations shall have an easily accessible shower or a 50-gallon drum of water.

Storage and handling of anhydrous ammonia—29 CFR 1910.111(b)(10)(iv). Each vehicle transporting ammonia in bulk except farm applicator vehicles shall carry a container of at least five gallons of water and shall be equipped with a full face mask.

Carcinogens—29 CFR.1910.1003(d)(2)(vi). Emergency deluge showers and eyewash fountains supplied with running potable water shall be located near, within sight of, and on the same level with locations where a direct exposure to Ethyleneimine or beta-Propiolactone only would be most likely as a result of equipment failure or improper work practice.

Formaldehyde—29 CFR 1910.1048(i)(2). If employees' skin may become splashed with solutions containing 1 percent or greater formaldehyde, for example, because of equipment failure or improper work practices, the employer shall provide conveniently located quick drench showers and assure that affected employees use these facilities immediately. (3) If there is any possibility that an employee's eyes may be splashed with solutions containing 0.1 percent or greater formaldehyde, the employer shall provide acceptable eyewash facilities within the immediate work area for emergency use.

Methylene chloride—29 CFR 1910.1052(i). Hygiene facilities. (1) If it is reasonably foreseeable that employees' skin may contact solutions containing 0.1 percent or greater MC (for example, through splashes, spills or improper work practices), the employer shall provide conveniently located washing facilities capable of removing the MC, and shall ensure that affected employees use these facilities as needed. (2) If it is reasonably foreseeable that an employee's eyes may contact solutions containing 0.1 percent or greater MC for example, through splashes, spills or improper work practices), the employer shall provide appropriate eyewash facilities within the immediate work area for emergency use, and shall ensure that affected employees use those facilities when necessary.

Batteries and battery charging—29 CFR 1926.441(a)(6). Facilities for quick drenching of the eyes and body shall be provided within 25 feet (7.62 m) of battery handling areas.

Medical services and first aid—29 CFR 1926.50(g). Where the eyes or body of any person may be exposed to injurious corrosive materials, suitable facilities for quick drenching or flushing of the eyes and body shall be provided within the work area for immediate emergency use.

Eye and Face Personal Protective Equipment and First Aid for Chemical Operations

Chemical usage may occur in almost any work environment, either general industry or construction, and usually involves hot or corrosive liquids, vapors, gases, and in some cases solids. The hazards associated with these operations are physical or chemical burns to the eyes or skin, eye or skin irritation, and distraction or temporary blindness resulting in other physical injury from operations or equipment involved.

Degrees of irritation likely to result from exposure to chemicals may be determined by label information, manufacturer's material safety data sheets, chemical dictionaries and injury records. Factors that should be considered are exposure time, concentration and temperature. Mixtures of hazardous chemicals may increase or reduce the overall hazard, but the hazard should be assumed to be at least that of the most hazardous component. Professional judgment guided by knowledgeable inquiry and evaluation is a most important factor in determining the hazard and deciding the level of protection required.

Based on the standards listed below, the specific requirements of ANSI Z87.1-1989, and the hazards involved, the determination of eye and face protective equipment required in chemical operations should derive from the following:

1. Highly corrosive or toxic by eye or skin absorption liquids, vapors, gases or airborne particles will require ventilated acid fume hood, full face respirator or special protective suits.
2. Hot, strongly irritative and/or corrosive liquids, vapors, gases or airborne particles require both chemical goggles and face shield or special chemical hood.
3. Moderate irritants will require chemical goggles and face shield.
4. Slight irritants require chemical goggles or face shield used with safety glasses with side shields.

The provision of adequate emergency eyewash and safety shower facilities does not diminish the obligation to provide and require the use of personal protective equipment and the need for first aid.

Medical services and first aid—29 CFR 1910.151(b). In the absence of an infirmary, clinic, or hospital in near proximity to the workplace which is used for the treatment of all injured employees, a person or persons shall be adequately trained to render first aid. Adequate first aid supplies shall be readily available.

General requirements—29 CFR 1910.132(a). Application. Protective equipment, including personal protective equipment for eyes, face, head, and extremities, protective clothing, respiratory devices, and protective shields and barriers, shall be provided, used, and maintained in a sanitary and reliable condition wherever it is necessary by reason of hazards of processes or environment, chemical hazards, radiological hazards, or mechanical irritants encountered in a manner capable of causing injury or impairment in the function of any part of the body through absorption, inhalation, or physical contact.

General requirements—29 CFR 1910.132(c). Design. All personal protective equipment shall be of safe design and construction for the work to be performed.

Eye and face protection—29 CFR 1910.133(a)(1). General requirements. The employer shall ensure that each affected employee uses appropriate eye or face protection when exposed to eye or face hazards from flying particles, molten metal, liquid chemicals, acids or caustic liquids, chemical gasses or vapors, or potentially injurious light radiation.

Eye and face protection—29 CFR 1910.133(a)(2). General requirements. The employer shall ensure that each affected employee uses eye protection that provides side protection when there is a hazard from flying objects.

Personal protective equipment—29 CFR 1926.28(a). The employer is responsible for requiring the wearing of appropriate personal protective equipment in all operations where there is an exposure to hazardous conditions or where this part indicates the need for using such equipment to reduce the hazards to the employees.

Eye and face protection—29 CFR 1926.102(a)(1). General. Employees shall be provided with eye and face protection equipment when machines or operations present possible eye or face injury from physical, chemical, or radiation agents.

Eye and face protection—29 CFR 1926.102(a)(2). General. Eye and face protection equipment required by this part shall meet the requirements specified in American National Standards Institute Z87.1-1968, Practice for Occupational and Educational Eye and Face Protection.

Glossary

Acids. Any compound that reacts with a base to form a salt, 0–7 pH.

ANSI. American National Standards Institute.

Caustics. Corrosive substances usually in reference to strong alkaline chemicals such as sodium and potassium hydroxide; terms base, caustic, alkali and hydroxide are interchangeable.

Chemicals. Of, made by or used in chemistry.

Compounds. A substance containing two or more elements chemically combined in fixed proportions.

Corrosives. Substances that can eat or wear away.

Cryogenics. The science that deals with the effects of very low temperatures on the properties of matter.

Decontamination. Removal of a polluting or harmful substance from air, water, earth surface, etc.

Deluge. Heavy downpour of water.

Dilution. Usually with water—to weaken another substance.

Ergonomics. The study of interaction between people and their total working environment.

Irrigation. To wash out.

ISEA. International Safety Equipment Association.

Nonpotable. Nondrinkable water.

Noxious Substances. Substances with toxic effects on animals or humans.

OSHA. Occupational Safety and Health Administration.

Personal Protective Equipment. Any material or device worn to protect.

Potable Water. Drinkable water.

Radioactive. Giving off radiant energy in particles or rays by the disintegration of atomic nuclei.

Toxins. Poisonous product of microorganisms.

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The following industry guides are available from the N.C. Department of Labor's Occupational Safety and Health Division:

- #1. *A Guide to Safety in Confined Spaces*
- #2. *A Guide to Procedures of the N.C. Safety and Health Review Commission* (downloadable PDF **ONLY**)
- #3. *A Guide to Machine Safeguarding*
- #4. *A Guide to OSHA in North Carolina*
- #5. *A Guide for Persons Employed in Cotton Dust Environments* (downloadable PDF **ONLY**)
- #6. *A Guide to Lead Exposure in the Construction Industry* (downloadable PDF **ONLY**)
- #7. *A Guide to Bloodborne Pathogens in the Workplace*
- #8. *A Guide to Voluntary Training and Training Requirements in OSHA Standards*
- #9. *A Guide to Ergonomics*
- #10. *A Guide to Farm Safety and Health* (downloadable PDF **ONLY**)
- #11. *A Guide to Radio Frequency Hazards With Electric Detonators* (downloadable PDF **ONLY**)
- #12. *A Guide to Forklift Operator Training*
- #13. *A Guide to the Safe Storage of Explosive Materials* (downloadable PDF **ONLY**)
- #14. *A Guide to the OSHA Excavations Standard*
- #15. *A Guide to Developing and Maintaining an Effective Hearing Conservation Program*
- #16. *A Guide to Construction Jobsite Safety and Health/Guía de Seguridad y Salud para el Trabajo de Construcción*
- #17. *A Guide to Asbestos for Industry*
- #18. *A Guide to Electrical Safety*
- #19. *A Guide to Occupational Exposure to Wood, Wood Dust and Combustible Dust Hazards* (downloadable PDF **ONLY**)
- #20. *A Guide to Cranes and Derricks*
- #23. *A Guide to Working With Electricity*
- #25. *A Guide to Personal Protective Equipment*
- #26. *A Guide to Manual Materials Handling and Back Safety*
- #27. *A Guide to the Control of Hazardous Energy (Lockout/Tagout)*
- #28. *A Guide to Eye Wash and Safety Shower Facilities*
- #29. *A Guide to Safety and Health in Feed and Grain Mills* (downloadable PDF **ONLY**)
- #30. *A Guide to Working With Corrosive Substances* (downloadable PDF **ONLY**)
- #31. *A Guide to Formaldehyde* (downloadable PDF **ONLY**)
- #32. *A Guide to Fall Prevention in Industry*
- #32s. *Guía de Prevención de las Caídas en la Industria (Spanish version of #32)*
- #33. *A Guide to Office Safety and Health* (downloadable PDF **ONLY**)
- #34. *A Guide to Safety and Health in the Poultry Industry* (downloadable PDF **ONLY**)
- #35. *A Guide to Preventing Heat Stress*
- #38. *A Guide to Safe Scaffolding*
- #40. *A Guide to Emergency Action Planning*
- #41. *A Guide to OSHA for Small Businesses in North Carolina*
- #41s. *Guía OSHA para Pequeños Negocios en Carolina del Norte (Spanish version of #41)*
- #42. *A Guide to Transportation Safety*
- #43. *A Guide to Combustible Dusts*
- #44. *A Guide to Respiratory Protection*

Occupational Safety and Health (OSH)

Sources of Information

You may call 1-800-NC-LABOR (1-800-625-2267) to reach any division of the N.C. Department of Labor; or visit the NCDOL home page on the World Wide Web: <http://www.nclabor.com>.

N.C. Occupational Safety and Health Division

Mailing Address:
1101 Mail Service Center
Raleigh, NC 27699-1101
Local Telephone: (919) 807-2900 Fax: (919) 807-2856

Physical Location:
111 Hillsborough St.
(Old Revenue Building, 3rd Floor)

For information concerning education, training and interpretations of occupational safety and health standards contact:

Education, Training and Technical Assistance Bureau

Mailing Address:
1101 Mail Service Center
Raleigh, NC 27699-1101
Telephone: (919) 807-2875 Fax: (919) 807-2876

Physical Location:
111 Hillsborough St.
(Old Revenue Building, 4th Floor)

For information concerning occupational safety and health consultative services and safety awards programs contact:

Consultative Services Bureau

Mailing Address:
1101 Mail Service Center
Raleigh, NC 27699-1101
Telephone: (919) 807-2899 Fax: (919) 807-2902

Physical Location:
111 Hillsborough St.
(Old Revenue Building, 3rd Floor)

For information concerning migrant housing inspections and other related activities contact:

Agricultural Safety and Health Bureau

Mailing Address:
1101 Mail Service Center
Raleigh, NC 27699-1101
Telephone: (919) 807-2923 Fax: (919) 807-2924

Physical Location:
111 Hillsborough St.
(Old Revenue Building, 2nd Floor)

For information concerning occupational safety and health compliance contact:

Safety and Health Compliance District Offices

Raleigh District Office (3801 Lake Boone Trail, Suite 300, Raleigh, NC 27607)

Telephone: (919) 779-8570 Fax: (919) 420-7966

Asheville District Office (204 Charlotte Highway, Suite B, Asheville, NC 28803-8681)

Telephone: (828) 299-8232 Fax: (828) 299-8266

Charlotte District Office (901 Blairhill Road, Suite 200, Charlotte, NC 28217-1578)

Telephone: (704) 665-4341 Fax: (704) 665-4342

Winston-Salem District Office (4964 University Parkway, Suite 202, Winston-Salem, NC 27106-2800)

Telephone: (336) 776-4420 Fax: (336) 776-4422

Wilmington District Office (1200 N. 23rd St., Suite 205, Wilmington, NC 28405-1824)

Telephone: (910) 251-2678 Fax: (910) 251-2654

To make an OSHA Complaint, **OSH Complaint Desk:** (919) 807-2796

For statistical information concerning program activities contact:

Planning, Statistics and Information Management Bureau

Mailing Address:
1101 Mail Service Center
Raleigh, NC 27699-1101
Telephone: (919) 807-2950 Fax: (919) 807-2951

Physical Location:
111 Hillsborough St.
(Old Revenue Building, 2nd Floor)

For information about books, periodicals, vertical files, videos, films, audio/slide sets and computer databases contact:

N.C. Department of Labor Library

Mailing Address:
1101 Mail Service Center
Raleigh, NC 27699-1101
Telephone: (919) 807-2848 Fax: (919) 807-2849

Physical Location:
111 Hillsborough St.
(Old Revenue Building, 5th Floor)

N.C. Department of Labor (Other than OSH)

1101 Mail Service Center
Raleigh, NC 27699-1101
Telephone: (919) 733-7166 Fax: (919) 733-6197