The Story on Emergency Eyewashes and Showers

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Code of Federal Regulations, Title 29, section 1910.151(c) states "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." This short sentence continuously causes questions among safety personnel. What is immediate? What are suitable? What are the flow requirements? How often should they be tested? This article will seek to answer those questions.

The source document for emergency eyewash and shower requirements is ANSI Standard Z358.1, "Emergency Eyewash and Shower Equipment"(1). The current version is 1998. Previous versions were produced in 1990 and 1981. This document describes the physical construction of eyewashes, showers and hoses, as well as flow requirements and testing frequencies.

General Requirements

1. Water Quality

    - Temperature. The water has to be tepid (Appendix B-6). Temperatures exceeding 38^{o}C have proven to be harmful and may enhance chemical interaction. Cold flushing may help reduce chemical interaction; however, prolonged exposure may effect body temperature in the case of showers. If located in areas subject to freezing, the unit must be protected from freezing.

    - Potability. Water used must meet at least drinking water standards.

2. Access. The shower and/or eyewash has to be "immediately available", which has been interpreted to mean within 10 seconds of unobstructed travel. The new ANSI standard indicates that when using strong acids or bases, the unit should be next to the workstation. The area around the unit should be unobstructed to enable the user to get to it unhindered.

3. Signs. A highly visible sign must mark the unit location. Shower areas have to be well lighted. ANSI recommends that an alarm be attached to warn others that the unit is in operation. Be sure to deactivate the alarms during weekly activation.

4. Water Delivery

    - Water capacity. The inlet supply must be at least 30 psi. Normal design levels are usually 45 psi. Pressures over 80 psi are considered excessive and may injury the exposed employee.

    - Valve Operation. The valve must activate within 1 second and remain on without being held on. Self-closing valves may be permitted in a school laboratory as a limited option.

5. Testing or fluid replacement.

    - Plumbed units are to be activated weekly to flush the line and verify operation[1]. "Flush" is not defined. However, water testing has shown that pathogenic microorganisms (Acanthamoeba, Pseudomonas and Legionella subspecies) can buildup (2,3). To prevent this, at least a 3-minute flush is recommended (2,4). Units must be tested annually to verify conformance with ANSI requirements.

    - Fluid replacement frequency in self-contained units depends on whether a preservative is used.
        - Plain water: weekly replacement
        - If a preservative is used, 1-4 month replacement depending upon conditions
        - If a factory prepared concentrate with an additive is used, then follow the manufacturer's instructions
        - If factory-sealed cartridges are used, up to two years may be acceptable. (these units do not need flow testing).

6. Waste Disposal. A shower operating for 15 minutes will deliver between 300 and 450 gallons. If a drain is not present, a considerable volume of water will accumulate. Some facilities have a sump to collect the shower waste to enable the water to be tested before final disposal to ensure that it meets discharge requirements. Sewer odors may develop if the unit is not tested frequently because the water trap is drying out. If weekly activation is performed, water will remain in the trap and eliminate the odors.

7. Training. Employees have to be instructed where the showers/eyewashes, including personal eyewash units and drench hoses, are located and how to use them. For eyewash use, employees have to be instructed to hold their eyelids open and rolling the eyeballs to permit flushing.

<u>Eyewashes</u>

A variety of eyewashes exist. Units are divided into installed and portable units. Plumbed units must have a 30-psi water supply. Flow is to be provided to both eyes simultaneously and at a velocity low enough to injury the eyes. Plumbed and self-contained units must perform as follows:

- Eyewash: 0.4 gpm for 15 minutes;
- Eye/face wash: 3 gpm for 15 minutes

[1] Interestingly, the California requirement (8 CCR 5162) is only monthly activation.

The difference between the eye and eye/face wash is the size of the nozzle and spray pattern. The unit has to be installed between 33 inches and 45 inches above ground level and 6 inches away from the wall. The must be enough room to allow the eyelids to be held open with the hands while the eyes are in the flushing water stream.

Since the nozzles face upward to operate properly, dust and other contaminants could fall into the openings clogging them or providing a breeding area. Therefore, the nozzles have to be protected in such a way as to not require a separate movement to remove them when the unit is activated.

Annual testing of an eyewash or eye/facewash includes:

- Measure the flow with a flow meter or even a 1-gallon container can be used. The eyewash will fill it in 2.5 minutes or less; the eye/face wash will fill it in 20 seconds or less. The flowmeter should show at least 0.4 gpm.

- Test the valve actuation: it should open in one second or less and stay on without being held.

- Flushing to both eyes must be provided simultaneously. A special gauge is described in the standard which should be place on top of the stream. The fluid should cover the area between the interior and exterior lines when the gauge is lowered to 1.5 inches below the peak of the fluid.

Showers

Safety showers must be installed between 82 and 96 inches above ground level. If a privacy enclosure is used, it should be at least 34 inches in diameter. The showerhead should have a spray pattern of at least 20 inches in diameter 60 inches above the floor. The center of the spray pattern must be at least 16 inches away from any obstructions. The valve pull handle must not be more than 69 inches above the are where the employee will stand.

Plumbed units must have a 1-inch supply line at minimum. Flow rates for both plumbed and self-contained units must be 20 gpm[2] for 15 minutes. Earlier versions of ANSI required 30 gpm for plumbed units.

Annual testing of the shower includes:

- Visually inspecting the piping for leaks

- Open the valve fully and verify that it stays open without the use of hands

- Measure the shower head height

[2] The California standard, Title 8, California Code of Regulations, section 5162 refers to the Z358.1-1981 which requires a 30 gpm flow rate on emergency showers.

- Measure the diameter of the spray pattern with the valve “full on”. The diameter should be at least 20 inches at 60 inches above the standing surface. The center of the spray should be 16 inches from obstructions.

- Not specified in ANSI is a flow test. This can be accomplished by using a five-gallon container (with a mark at the three gallon level) and a curtain to channel the flow into the container. After activation, the level on the container should be reached within 9 seconds or less.

Combination Units

Combination units incorporate both the shower and an eyewash or eye/facewash. Both systems must be capable of operating at the same time. Flow rates are the same as the individual systems.

Other ANSI Systems

ANSI Z358.1 mentions other methods that are useful, but do not meet the requirements of an emergency eyewash or shower and are not considered acceptable substitutes. These include personal eyewash units (bottles) and drench hoses.

Personal Eyewash equipment are supposed to provide immediate flushing without injuring the user. They can be used to support plumbed or self-contained eyewashes, but may not supplant them. The key requirement is that instructions and the expiration date must be permanently marked on the containers. Inspection and maintenance must be performed to in conformance with the manufacturer’s instructions.

Hand-held Drench hoses can be used to irrigate the eyes, face or body and should provide a flow rate of at least 3 gpm for 15 minutes. They are designed to support emergency showers and eyewashes, but cannot be used instead. A drench hose must be identified by a highly visible sign, placed in a well-lighted area and shall be free of obstructions that may interfere with operation. Drench hoses should also be activated weekly to check the operation and annually inspected to ensure that the valve opens within 1 second, and the 3 gpm flow rate is achieved.

References

1. "American National Standard for Emergency Eyewash and Shower Equipment", American National Standards Institute, Z358.1-1998

2. "Potentially Hazardous Amoebae found in Eyewash Stations", US DOE Env. Safety & Health Bulletin #15, May 1986

3. "Isolation of Amoebae and *Pseudomonas* and *Legionella* spp. From Eyewash Stations", C. Pasko-Kolva, H. Yamamoto, M. Shahamat, T. Sawyer, G. Morris and R. Colwell, Applied and Environmental Microbiology, Jan 1991, p. 163-167.

4. "Potentially Hazardous Amoebae Found in Eyewash Stations", Occupational Safety and Health Administration Hazard Information Bulletin, December 23, 1986.