Liability

Preventing Burns and Scalding Injuries from Tap Water

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Abstract

Children, the elderly, and individuals with disabilities are more susceptible to burns. Daycare centers, nursing homes, and long-term care facilities require precautionary effort to protect occupants from burns. Multi-family or apartment property owners must also consider the water heater settings and the tap water scalding hazard. This report describes actions that property owners can take to reduce the hazard of burns and scalding injuries from tap water.

Introduction

Although the incidence of burns from hot tap water is far fewer than in the past, due to improvements in plumbing engineering design, the pain and suffering that result from burns, and the prolonged healing time make the problem a serious one. Indeed, burn incidents make up an important percentage of malpractice, neglect, and liability cases.

Both the elderly and young children have very sensitive skin that can burn and scald easily. Since baths and showers are often the cause of such burns, it is essential for precautions to be taken in preparing baths for the very elderly, the fragile, and children; and they should be supervised and aided when necessary.

What Is a Burn?

A burn is a result of exposure to high temperature over time. A third-degree burn is a burn that completely penetrates the skin leaving it unable to heal. The population vulnerable to burns and scalding injuries can have slower reaction times or be less aware of temperature changes on the skin, resulting in their being more susceptible to scalding injuries.

How Do Tap Water Burns and Scalding Injuries Happen?

According to the American Burn Association, more than 61,000 patients were hospitalized for burn injuries in the United States last year. Burns rank fourth as a cause of unintentional injury for children. Some common causes of tap-water burns include slipping and falling in a shower or tub and not being able to get up, not checking water before touching it, temperature changes that occur when water is being used in another area (also known as thermal shock), or a plumbing malfunction that can cause a sudden burst of scalding water. Burns can occur in as short a time span as 2 seconds if the water temperature is 140°F (60°C). A chart illustrating the harmful effects of increasing water temperature and how the temperature of tap water quickly becomes dangerous is illustrated in Table 1.

Liability claims and lawsuits often allege negligence, personal injury, and, depending on the type of facility, breach of duty and breach of contract. Defendants of such lawsuits or claims can include the property owner, the mixing valve manufacturer, the water heater manufacturer, the plumbing service contractor, and even the tub or shower manufacturer. Plaintiff attorneys have a tap water burn litigation group with their own website at: www.tap-water-burn.com.

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Preventing Burns and Scalding Injuries from Tap Water

Burns and scalding injuries are preventable. There are products to address safety concerns related to hot water storage and delivery. There are standards and protocols that will reduce or eliminate the chance of scalding injuries from tap water. Yet, many facilities are not taking advantage of this guidance. The following describes efforts taken to reduce burns and scalding injuries.

Table 1. The Skin: How Hot Water and Time Contribute to Burns and Scalding Injuries*

Temperature		Time Required for 3rd Degree Burn to Occur
°F (Fahrenheit)	°C (Celsius)	
100	37	Safe temperature for bathing
120	48	5 minutes
124	51	3 minutes
127	52	1 minute
133	56	15 seconds
140	60	5 seconds
148	64	2 seconds

*Moritz, A.R., and F.C. Herriques. *Studies of Thermal Injuries: II The Relative Importance of Time and Surface Temperature in the Causation of Cutaneous Burns*. American Journal of Pathology, 1947.

Preventing Burns and Scalding Injuries

In the mid-1970s, the U.S. Consumer Product Safety Commission (CPSC) published a report titled, "A Systematic Program to Reduce Incidence and Severity of Bathtub and Shower Area Injuries." This report led to the development of standards by the American Society of Testing Materials (ASTM). The standards address performance requirements related to protection from scalding injuries in shower installations by thermal shock-preventing mixing valves or pressure-balancing valves.

A pressure-balanced thermostatic mixing valve installed as an integral part of a bathtub and/or shower valve limits the water temperature to 120°F (49°C). This point-of-use mixing valve has been required by model plumbing codes for installation on new bathing facilities since the mid-1990s. The design and installation requirements have been refined to address thermal shock and sudden pressure changes, thus reducing the likelihood of scalding injuries. Regulators and valves that limit temperatures can easily be installed.

By the mid-1990s, the Americans with Disabilities Act Accessibility Guidelines (ADAAG) added requirements addressing controls to limit scalding hazards. The water delivered to "shower and bathtub/shower facilities" must be "thermal shock-protected to 120° F (49°C) maximum."

Hospitals, nursing homes, and other facilities for persons with limited sensory or mobility issues may have slightly different requirements. Some local health departments have set minimum and maximum temperatures that are slightly different, with tighter tolerances, for these types of occupancies. It is important to check with the local authority having jurisdiction to help verify that an installation is in accordance with local codes.

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To evaluate the temperature of the hot water, it should be tested after the water has run for at least three minutes. A patient should never be left alone while he or she is bathing, and there should be no water running while the patient is in a bathtub.

Plumbing Considerations

When plumbing work is performed, it should be by a licensed plumber who performs work in accordance with local codes. If the facility serves certain populations, be sure to incorporate the necessary requirements as they relate to hot water storage and use. Check with local code officials for information about state and federal requirements, as well as to obtain proper permits and inspections.

Water Heaters

Maintaining domestic water heaters at 140° F (60° C) with water at the faucet near 122° F (50° C) or higher is a common practice in some building systems. This puts the property on a collision course due to possible scald incidents. Many property owners insist on this practice due to fears of Legionella Bacteria (LB). In fact, guidance to help minimize the risk of scalding from the Center for Disease Control and Prevention (CDC), *Guidelines for Environmental Infection Control in Healthcare Facilities* recommends:

- Maintain hot water at the return at the highest temperature allowable by state regulations or codes.
- Explore engineering options (e.g., install pre-set thermostatic valves in point-of-use fixtures for baths, showers, and sinks).

The Occupational Safety and Health Administration (OSHA) prescribes storing water at 140°F (60° C) and delivering it at a minimum of 122°F (50° C) to all outlets. Maintaining 122°F (50° C) as a minimum water temperature throughout the main hot water piping loop would require supplying it at 127°F (53° C). 122°F (50° C) is hot enough to prevent LB amplification, but low enough to prevent many scalding injuries.

The American Burn Association suggests that if hot water systems were operated in accordance with the OSHA recommendation, even without point-of-use mixing valves, most water scald injuries would be avoided and those that still occurred would be substantially less severe. For property owners who may cling to the need to keep the water heater temperature high, consider the following information: Modern appliances, such as dishwashers and clothes washers, have their own internal heaters. Some high-end models have sterilizing cycles and heat the water to 160°F (71° C), so they no longer rely on the house water heating system to provide hot water for cleaning and disinfecting.

Mixing Valves

In 1973, the American Society of Sanitary Engineering (ASSE) incorporated the scald provisions of the ASTM 1016 standard to address requirements for shower or tub/shower valves. The ASSE standard called for a maximum temperature limit stop of 120° F (49°C). The ASSE scald prevention standards include provisions that have evolved to respond to a series of concerns and still provide adequate health and safety requirements to protect the consumer. A key provision was replacing specific reference to "…control valves for bathing facilities…" with "…control valves for individual fixtures…"

Depending on the application, a product complying with ASSE 1016 could be used in applications requiring the mixing of hot and cold water. It was never the intent to negate the thermal shock protection that the standard provided the user/bather. Addressing this gap resulted in the development of ASSE 1016, ASSE 1069, and ASSE 1070. These standards responded to the following questions:

- Does the application require scald protection only (where further mixing of hot or cold water downstream of the device is allowed)?

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- Does the application require thermal shock protection (where further mixing of hot or cold water downstream of the device is not allowed)?
- What is the degree of hazard in the application (lavatory, shower, etc)?

ASSE Standard #1017-2009, *Temperature Actuated Mixing Valves for Hot Water Distribution Systems* addresses how to control in-line water temperatures in domestic hot water systems. It requires that the mixing valves be installed at the hot water source. They are not intended for end-use applications, such as emergency eyewash and shower equipment. A listing of plumbing codes and standards that specify 120°F as the maximum allowable discharge temperature is available in Table 2.

The above information addresses new construction, but what about existing properties? Since there is no doubt about the effectiveness of the engineering controls described above, it is highly recommended that property owners complete a plumbing hardware audit to identify the types of pressure, thermal, or combination valves installed. The audit should evaluate and document if the installed valves meet the recommended plumbing codes to prevent scalding and thermal shock. The audit should review the recordkeeping and maintenance efforts to verify that the valves are being maintained in working order and that the water heater is maintained in accordance with manufacturer specifications.

Table 2. Standards and Plumbing Codes Specifying 120°F as the Maximum Allowable Discharge Temperature

Organization	Standard	Title
ASTM International	ASTM F444	Standard Consumer Safety Specification for Scald-Prevention Devices and Systems in Bathing Areas.
American Society of Sanitary Engineers (ASSE)	ASSE 1016	Individual Thermostatic Pressure Balancing and Combination Control Valves for Bathing Facilities.
ASSE	ASSE 1062	Temperature Actuated Flow Reducers for Individual Fixture Fittings.
American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE)	Guideline 29	Guideline 29-2009, Guideline for Risk Management of Public Health and Safety in Buildings.
International Code Council (ICC)	IPC	International Plumbing Code®

See CH-40-16, *Preventing Burns and Scalding Injuries from Water Systems,* to perform an audit of existing plumbing systems.

Maintenance

The Burn Foundation recommends 120° F (49° C) at the faucet. To meet this challenge, it is necessary to add another element to the preventive maintenance program. Continuing maintenance of the mixing valve ensures the proper mix of hot and cold water when being used by an individual. A recirculating water system with a main mixing valve located at the boiler and a point-of-use pressure-balanced thermostatic mixing valve provides redundant protection against instantaneous or nearly instantaneous third-degree burns if/when one of the valves fails.

Perform Field Acceptance Tests

Many installers of domestic water heating equipment, multi-family as well as single family, do not verify that the system performs as intended. Water temperature and pressure variations should be examined at the most remote locations where water will be used. Toilets should be flushed in adjacent units while monitoring temperatures and pressures at test locations.

Testing and Monitoring Water Systems Reduces Failures

Testing is the only way a hot water system's performance can be ensured and occupants protected. Since equipment fails, instruments lose their calibration, demands on water systems change, and environmental conditions change, ongoing monitoring is necessary to ensure proper system operation and to alert operators and users when a hazardous condition occurs.

Water systems that depend on water recirculation to sense and control temperatures are uncontrolled if the water is not circulating. This is an important consideration with environmental monitoring systems designed to provide cost-saving efficiencies as they shut down or scale back recirculation during non-peak operating times. Consideration for maintaining the protection from burns must be incorporated when designing these systems.

Preventative Maintenance Program

A property owner's preventative maintenance program should include plumbing. It is recommended that water temperature be routinely monitored to detect elevated temperature. A large number of burns occur in apartment complexes, hotels/motels, and correctional facilities. Investigations revealed that the injuries were due to:

- Thermostats set too high.
- Faulty thermostats.
- A lack of or malfunction of temperature and pressure balancing valves at the point of source.

These components should be tested regularly for proper functioning and replaced as recommended by the manufacturer. There should be a process for documenting the results. Many building systems rely on computer controls that contain hardware and software that could alarm and/or page an operator if temperatures exceed a pre-set level. These systems must be properly configured in order to take advantage of their benefits. The cost of installing equipment necessary to perform this function is nominal.

Hot water system components require maintenance and servicing as outlined by the manufacturer. A service schedule should have been provided to the property owner when the facility was newly constructed. Tempering and mixing valves require maintenance and adjustment. The equipment may require adjustment when there are changes in water usage.

Chronic water fluctuations and temperature changes can occur in older buildings. Performing periodic hot water system assessments will determine if water is being provided in sufficient quantity, at a safe temperature, and without excessive pressure variation.

Safety Tips

According to the data from the National Safe Kids Campaign, four thousand to five thousand children are scalded each year. The average bathtub burn covers 12% of the body surface. According to the CPSC, there are approximately three thousand eight hundred injuries from scalding tap water each year. The sheer number of injuries indicates a need to educate parents and caregivers about how to protect against tap water burns. Here are a few safety tips to consider:

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- Observe tub/shower water temperature. Follow any formal procedures required by the facility (e.g., healthcare, daycare etc.).
- Use a reliable, dial-stem thermometer to measure water temperature after allowing water to run for 3-5 minutes. In addition, test the water with the back of a hand and check for redness. If the water is too warm, adjust hot and cold water or make corrections before proceeding.
- Post instructions for how to check water temperature in a prominent location so that it can be referenced by any staff or occupant.
- Post information on "First Aid for Burns from Tap Water" should a scald or burn injury occur. Here is an example of the type of information to include:
    - Quickly remove clothing, if you can. This helps the heat escape from the skin. Leave the clothes on, however, if stuck to the skin. This will avoid further major skin damage.
    - Immediately pour lots of cold water gently over the scald for 15 – 20 minutes.
    - Never use ice, oil, butter, or ointments. These can further damage the skin.
    - Cover the scald with a clean cloth.
    - Keep the person warm with a blanket.
    - See a doctor if the scald is on the hands, feet, genitals or buttocks, or is blistered.
    - In an emergency, telephone for an ambulance.

More safety information is available from a variety of governmental, plumbing industry, and non-profit organizations. A listing is provided in Table 3.

Table 3. Organizations that Provide Resources About Burns and Scalding Injuries

Organization	Website
Consumer Product Safety Commission	http://www.cpsc.gov/CPSCPUB/PUBS/5098.pdf
Burn Prevention Foundation	www.burnprevention.org/
National Safe Kids Campaign	http://www.safekids.org/safety-basics/safety-resources-by-risk-area/fire-burn-and-scalds/
Burn Survivor Resource Center	http://www.burnsurvivor.com/survivorlinks.html
Shriners' Burns Institute	http://www.shrinershq.org/Hospitals/Boston/
American Trauma Society	http://www.amtrauma.org/
American Correctional Association	https://www.aca.org/standards/
U.S. Department of Health & Human Services	http://www.hhs.gov/

Summary

Survival from serious burns has been improving. The success of engineering design changes for various hot water system components is providing a safer environment. They are more effective than efforts to change behavior. Advances in technology and design have reduced the chance of scalding. Incorporating the suggestions for maintenance and monitoring will help reduce the hazards even more. Recent changes in design and in the subsequent best practices to prevent burns and scalding injuries are outlined in the ASSE and ASTM standards. When it comes to preventing burns and scalding injuries, taking action and establishing routine procedures will not only reduce hospitalizations, it will prevent them.

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