HAZARD

BURN INJURY FACTS

-Arc Flash / Blast-

PREVENTION

April 2006
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Electricity can cause two types of burns: electrical burns from direct contact with current and thermal burns from arc flashes and blasts. An arc flash occurs when powerful, high-amperage currents travel, or arc, through the air. This can occur when high voltage differences exist across a gap between conductors. The result is an instant release of tremendous amounts of energy. Temperatures as high as 36,000˚F have been recorded in arc flashes.

Hazards of Arc Flash/Blast

- The intense heat and light emitted by an arc flash can cause severe burns, destroying skin and tissue. An arc flash can ignite or melt clothing, resulting in further burns. Victims sometimes require skin grafts or amputations. Death is more likely with increased severity of burns, the percent of body area affected and age.

- A high-amperage arc can produce a pressure wave blast with a force of up to 1000 pounds. The victim can be thrown by the force of this pressure. Injuries can occur from falling or colliding with nearby objects. Hearing loss may also result from the blast.

- The intense heat may melt metal electrical components and blast molten droplets considerable distances. These droplets harden rapidly and can lodge in a person's skin, ignite clothing and may cause lung damage.

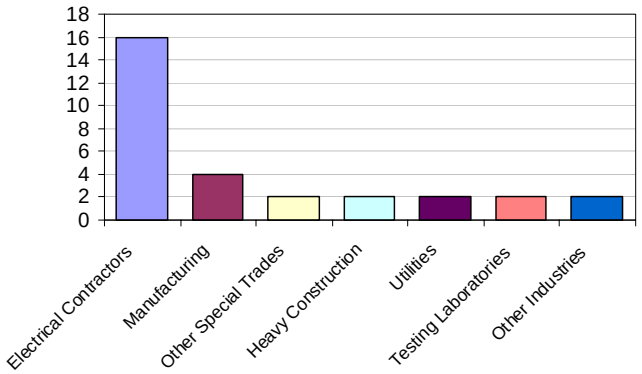
The Consequences of Arc Flash Burns Are Severe

Physically, victims may suffer from chronic pain and scarring. Workers may also have difficulty re-integrating into the community, and may experience anxiety, depression, or other psychological symptoms. The social and economic costs may also be high. Workers' compensation pays only a portion of lost wages. Some workers may not be able to return to their pre-injury job. Employers bear the costs associated with lost productivity, reduced competitiveness, employee rehiring and retraining, as well being subject to increases in workers' compensation premiums.

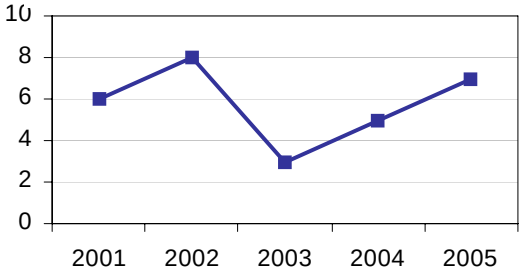
Washington State Workers and Arc Flash Burns

From September 2000 through December 2005, 350 Washington workers were hospitalized for serious burn injuries occurring at work. Of these, 30 (9%) were due to arc flash/blast explosions. Total Workers' Compensation costs associated with these 30 claims exceeded $1.3 million, including reimbursement for almost 1,800 days of lost work time.

Number of Arc Flash Burns by Industry in Washington State, 9/2000 – 12/2005



Number of Arc Flash Burns by Year of Injury in Washington State



Just a Few Workers' Stories…

Case 1: A Journeyman Electrician was working on an electrical panel when an arc flash/blast occurred. He was pushed back by the force of the blast and his shirt caught fire. He sustained burns to 20% of his body, including deep burns to his wrists and hands.

Case 2: An Electrical Foreman with over 20 years experience was working on a high-voltage circuit that he thought was de-energized. Unfortunately, he had de-energized the wrong circuit. He was thrown back by an arc flash/blast and received burns to his arm, neck, and face.

Case 3: A Journeyman Lineman was holding an energized 2,200 volt wire when it grounded out through his leg. He sustained electric shock burns to his trunk and leg and associated flash burns to his hands.

Case 4: A Journeyman Electrician was installing a high voltage panel when an arc blast occurred for unknown reasons. The explosion caused the worker to lose consciousness. He sustained burns to his hands, wrists, and face.

Summary: Each of these workers was hospitalized, some required multiple hospitalizations and surgeries. In addition, at least two of these workers suffered psychological symptoms, including post-traumatic stress disorder as a result of the arc flash incidents.

No worker has ever been injured or killed by an arc flash while working in an Electrically Safe Work Condition!

Burns from Arc Flash Explosions are Preventable

Job planning and adherence to the "Hierarchy of Controls" can greatly reduce the likelihood of one of these tragic accidents. "The Hierarchy of Controls" details a strategy for the elimination and mitigation of hazards. It recognizes that multiple safety precautions may be required in different situations. Generally, safety precautions should be implemented in the order below.

- **Elimination/Substitution –** Can jobs be scheduled so that power sources can be de-energized, grounded and tested thereby eliminating the hazard? Can an outdated or worn piece of electrical equipment be removed from service or can a newer safer model replace it?

- **Engineering Controls –** Prevent accidents by engineering barriers to dangerous locations. Locked electrical vaults and high fences around transformers are examples of engineering controls.

Lock-out tag-out saves lives.

- **Administrative Controls –** An effective lockout/tagout program that includes all necessary training and equipment needed to implement it is an example of an administrative control. To be successful it must have the earnest support of management and labor.

- **Work Practice Controls –** These are matters of supervisor and worker knowledge, training and education. Does management set expectations for safe work practices? Do workers meet or exceed safety rules and best work practices? Do supervisors encourage and if necessary enforce safety rules and best practices? Is a culture of safety proactively endorsed and practiced by all levels of the organization?

- **Personal Protective Equipment PPE –** This is normally considered the least effective method of protection. However, sometimes PPE may be necessitated by administrative or work practice controls and by the potential hazards of the work being performed. For instance, wearing insulated gloves, fire resistant clothing and a face shield when working on energized electrical equipment.

Working on energized equipment should be the EXCEPTION not the RULE.

Work Safely… Work De-Energized!

Initial Response to an Electrical Injury and First Aid

- If an injured worker is in contact with an energized circuit, **do not touch the victim, shut off the power and call 911!** If you can't de-energize the circuit, dislodge the victim from the circuit with non-conductive material. Rescue should only be performed by knowledgeable persons trained in electrical hazards and rescue techniques. If the victim is on fire, smother or douse the flames. Remove smoldering clothing, but not clothing that is melted to the skin.

- Tell a conscious victim not to move. There may be other associated injuries besides the burns, such as a neck or spine injury. **Moving an injured person can make injuries worse.**

- **Check for respiration and pulse.** If the victim is not breathing, rescue breathing from trained personnel should begin immediately. If a pulse is absent, the victim needs CPR. To be effective CPR should begin in less than 4 minutes.

- **Run cool, not cold, water over the burn.** Do not apply creams, ointments or ice. After the burn has been cooled, cover it with a clean dry cloth. Keep the victim warm.

- **Do not give the victim any food or water.**

- **Always see a doctor following an electrical shock or burn.** Even a victim who feels OK may have suffered internal injuries that won't become apparent until later.

For More Information

- **Division of Occupational Safety and Health Services Consultation Program**
  Washington State Department of Labor and Industries
  www.LNI.wa.gov/Safety/KeepSafe/Assistance/Consultation

  Region 1 – (Northwest Washington) Everett, 425-290-1300
  Region 2 – (King County) Seattle, 206-515-2800
  Region 3 – (Pierce, Kitsap, Clallam, and Jefferson Counties) Tacoma, 253-596-3800
  Region 4 – (Southwest Washington) Olympia, 360-902-5799
  Region 5 – (Central and Southeastern Washington) East Wenatchee, 509-886-6500
  Region 6 – (Eastern Washington) Spokane, 509-324-2600

- **NFPA 70E 2004 Edition, Article 130.1-130.7F –** *Standard for Electrical Safety in the Workplace* - for best work practices

- **Washington Administrative Code (WAC) 296-155-Part I-** for mandatory requirements

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