

# Brewery Burns - Causes and Avoidance

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# Don't Get Burned!

- **Burns are...**

- *VERY PAINFUL*
- *SOMETIMES FATAL*
- *SLOW TO HEAL*
- *EMOTIONALLY SCARRING*
- *EXPENSIVE*

- **Burns in the Brewery...**

- *HAVE MANY CAUSES*
- *MORE COMMON THAN REPORTED*
- *CAUSE LONGTERM DISRUPTION*
- *EMBARASSING FOR VICTIMS*

**Good News! Burns are preventable through improved work practices, engineering controls and personal protective equipment.**

# Cost Example of a Serious Burn <sup>[1]</sup>

COST ELEMENT	TYPICAL COST	COMMENTS
Direct costs	\$ 37,389	Workers Comp
Indirect costs	\$ 41,127	Employer pays
Total before fines	<b>\$ 78,516</b>	
Sales to cover total before fines	<b>\$ 314,064</b>	Assume 25% gross sales margin
Incidentals...		
OSHA fine(s)	\$ 12,000	Minimum for each “serious violation”
Workers Comp premium EMR	? ? ?	Min. 3 yrs before rate returns to pre-burn multiplier
<sup>[1]</sup> Source: 2017 Brewery Safety Boot Camp Loss of productivity	? ? ?	Hiring, training a replacement; equipment upgrades

# Today's Talk

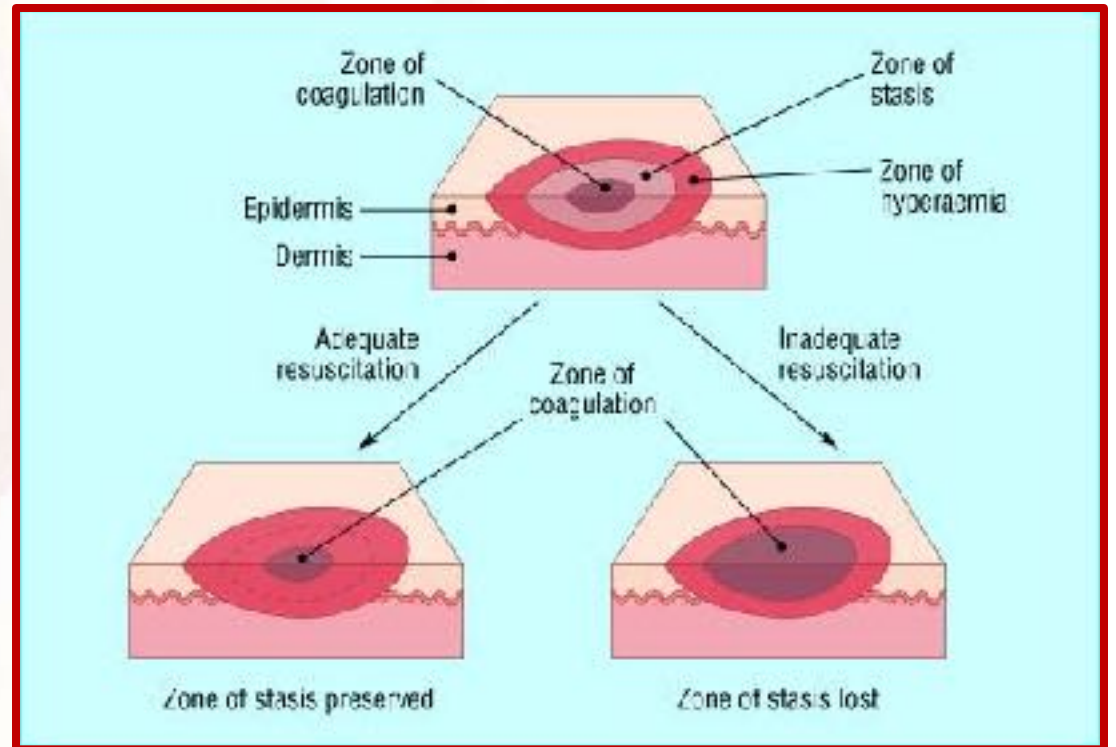
- What is a Burn?
- Root Causes of Burns
- Burn Hazard Assessment
- Types of Burns
  - *Hazard assessment*
  - *Avoidance strategies*
- Experiences of Your Peers

**Viewer  
discretion  
is advised.**

# What is a Burn?

***Tissue damage caused by rapid heating or chemical reaction***

- ***Severity increases due to***
  - Energy transfer
  - Duration
- ***Results***
  - Tissue and nerve damage
  - Slow, painful recovery
  - Skin grafting or replacement
  - Physical and psychological scars
  - Systemic effects if >30% of body

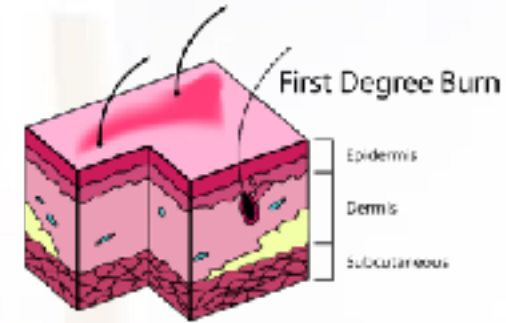


Source: National Center for Biotechnology Information, after Jackson, 1947.

# Burning by Degree

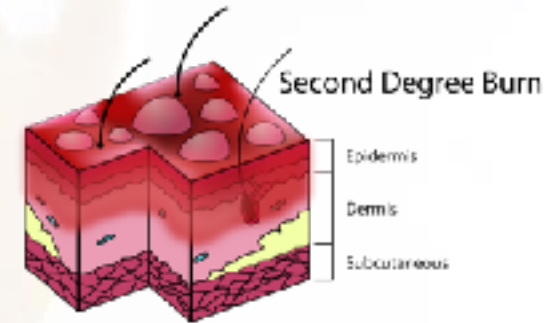
## **1<sup>st</sup> Degree (“superficial thickness”)**

- Epidermis injured
- Usually no lasting affects



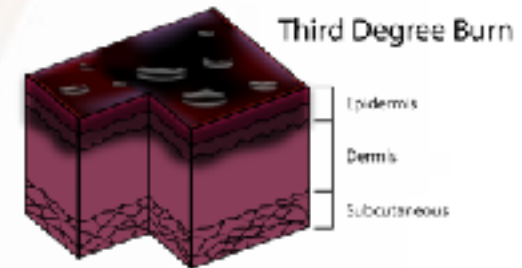
## **2<sup>nd</sup> Degree (“deep partial thickness”)**

- Tissue damage to epidermis and dermis
- Blistering is common



## **3<sup>rd</sup> Degree (“full thickness”)**

- Destruction of epidermis and dermis
- Triggering widespread systemic response
- Lengthy, complex treatment required

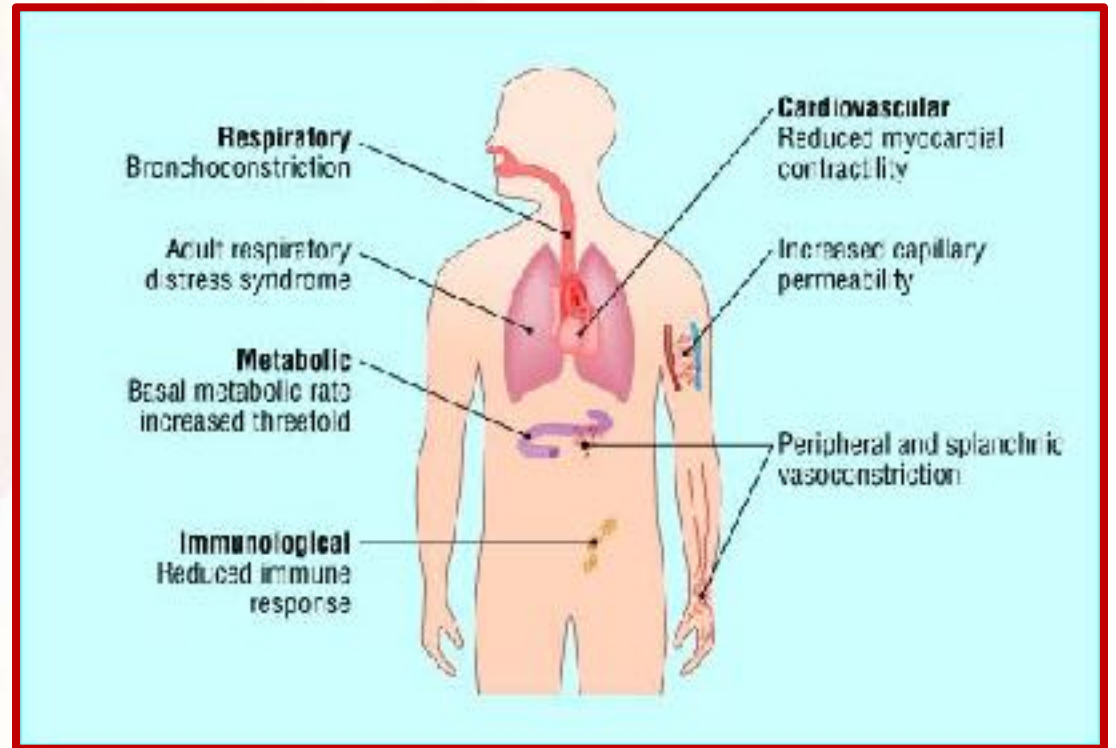


Source: Nurselabs.com.



# Systemic Effects Beyond the Burn Site

- ***Body Responds to Burn by***
  - Releasing cytokines and other anti-inflammatory mediators
- ***Results***
  - Bronchoconstriction
  - Increased basal metabolic rate
  - Cardiovascular issues
    - Heart contractions decreased
    - Vasoconstriction of organs
  - Reduced immune response



Source: National Center for Biotechnology Information, US National Library of Medicine.

# Root Causes of Burn Accidents

- **Failure to Understand Hazards**

- ***Hazard Assessment Process***

1. Walk through each task
2. ID hazards and sources
3. Organize hazards step by step
4. Analyze hazards: type, severity, likelihood
5. Specify “hazard controls”

- ***Utilizing Hazard Controls***

- Preventative and protective steps that eliminate or minimize hazards
    - Build hazard controls into SOPs

- **Human Factors**

- ***State of Mind***

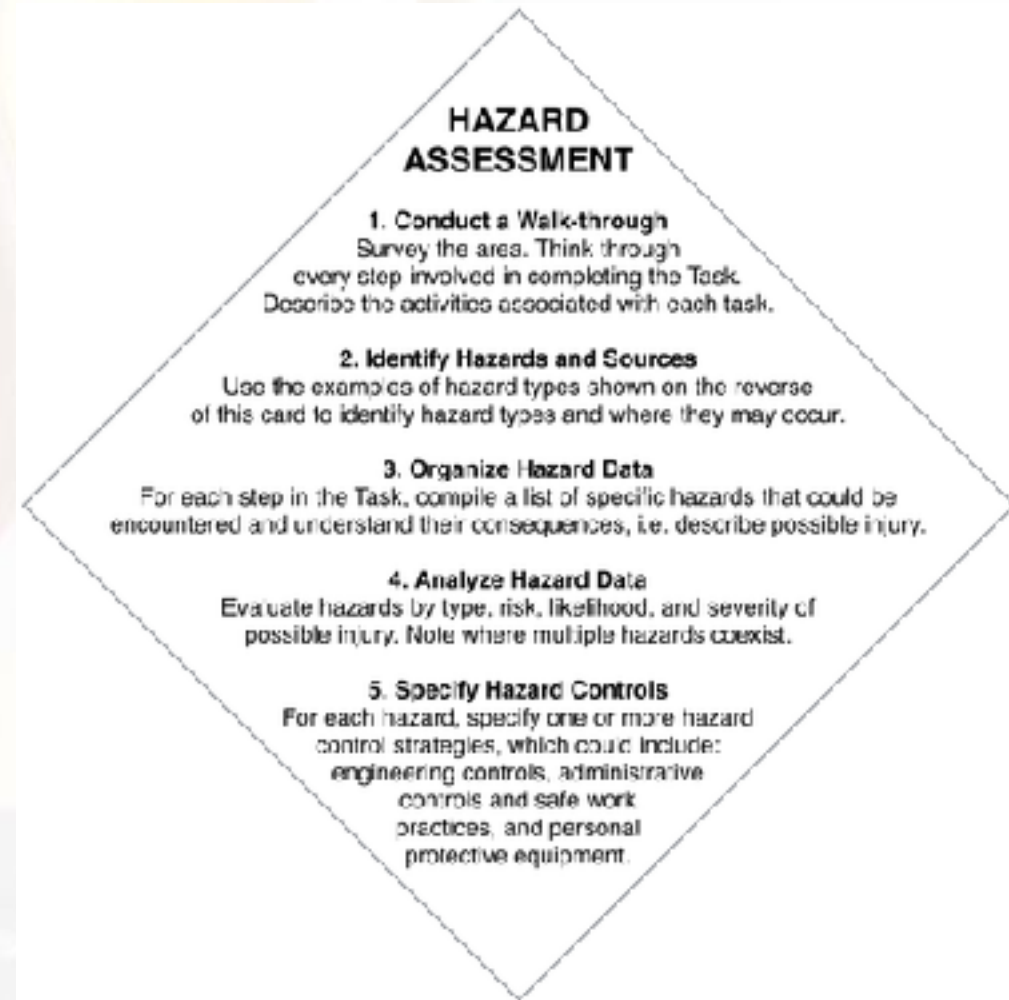
- Rushing, Frustration
    - Fatigue, Complacency
    - Distraction

- ***Risky Behavior***

- Exceeding design specs
    - Line of fire
    - Balance-traction-grip



# Brewery Hazards & Hazard Assessment Tool



# Hazard Assessment for Burn Hazards

1. Walk through each task
2. ID hazards and sources
3. Organize hazards step by step
4. Analyze hazards by type, severity, likelihood
5. Specify “hazard controls”



# Types of Burns

## 1. *Thermal Burns*

1. Scalding liquids
2. Boiling liquids
3. Steam
4. Surface contact – hot & cold

## 2. *Chemical Burns*

1. Corrosives – acids & caustics
2. Oxidizing sanitizers

## 3. *Electrical Burns*

1. Electrocution
2. Arc flash

## 4. *Robert Burns*

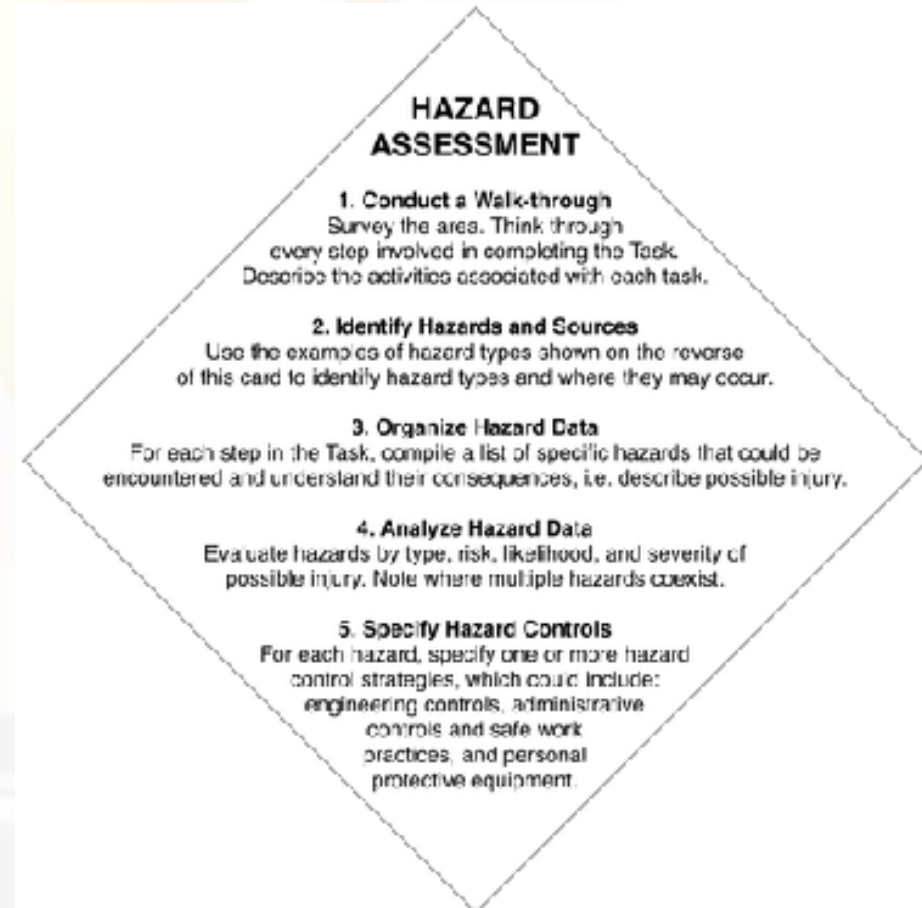
*“There is no  
such uncertainty  
as a sure thing.”*



# Hazard Assessment for Various Burns

## HA – *Name of Hazard*

- Description of principal hazard
- What causes this hazard?
- Likelihood/Severity
- Hazard Controls
  - Safe Work Practices
  - Administrative Controls
  - Engineering Controls
  - Personal Protective Equipment





# 1. Thermal Burns in Brewhouse Ops

## 1.1 HA – Hot Water Contact

- **Hazard**  
Scalding water/wort 140-180°F
- **Failures/Errors**  
Hose/fittings/sprayer failure  
Manual valve operational mistake
- **Likelihood/Severity**  
Brief exposure, 1<sup>st</sup> - 2<sup>nd</sup> degree burns
- **Hazard Controls**  
Maintain equipment  
SOPs/Operational training  
Hand/eye/skin protection  
Long pants over boots



# 1. Thermal Burns in Brewhouse Ops (cont.)

## 1.2 HA – Boiling Wort Contact

- **Hazard**

Scalding wort 180-215°F

- **Failures/Errors**

Procedural

- Overcharging kettle volume
- Applying excessive heat
- No foam inhibitor
- Valve/clamp mistake

Equipment

- Absence of foam cutoff switch

- **Failures/Errors**

Behavioral

- Adding hops too quickly
- Exposed position near manway
- Exposed beneath kettle/deck

Garments

- Not wearing long pants
- Not wearing industrial boots
- Tucking pants into boots
- Not wearing eye, hand, foot protection



# 1. Thermal Burns in Brewhouse Ops (cont.)

## 1.2 HA – Boiling Wort Contact

- **Likelihood/Severity**

Extended exposure – wort is sticky

Large contact area on body

Severe: 2<sup>nd</sup> & 3<sup>rd</sup> degree burns

- **Hazard controls**

SOPs

Safety training

- **Hazard controls (cont.)**

Procedural knowledge

- Trimming heat appropriately
- Caution in hop addition
- Use of foam inhibitor
- Double check plumbing/wort route
- Established emergency procedures

Equipment selection

- Properly sized kettle
- Foam cutoff switch
- Hand/eye/skin protection
- Long pants over boots

# Real Brewery Burns

**Hot Water Immersion**



**Boiling Wort Burn**



# 1. Thermal Burns in Brewhouse Ops (cont.)

## 1.3 JHA: Steam Contact

- **Hazard**  
Steam is  $>212^{\circ}\text{F}$
- **Failures/Errors**  
Kettle/whirlpool manway proximity  
Steam line failure (unlikely)
- **Likelihood/Severity**  
Brief exposure, 3<sup>rd</sup> degree burns
- **Hazard Controls**  
SOPs/Operational training  
Hand/eye/skin protection  
Properly installed/maintained steam equipment





# 1. Thermal Burns in Brewery Operations

## 1.4 JHA: Direct Contact

- **Hazard**
  - Hot surfaces >140°F
  - Frost, liquified gases <32°F
- **Failures/Errors**
  - Unmarked/unprotected surfaces
  - Slipping/falling into surface contact
- **Likelihood/Severity**
  - Brief-extended exposure
  - 1<sup>st</sup>-2<sup>nd</sup> degree burns
  - Frostbite
- **Hazard Controls**
  - SOPs/Operational training
  - Skin protection
  - Hazard warning signs/markings



# More Real Burns

## Hot Surface Contact



## Cryogenic Gas Contact



Four days after  
frostbite injury  
due to contact  
with liquified gas.

Sixteen  
months  
after  
injury.



Source: Turkish journal of trauma & emergency  
surgery: TJTES 16(5):433-8 · September 2010

# Case Study 1

## Wort Boilover





## 2. Chemical Burns

### 2.1 HA -- Acid/Caustic Contact

- **Hazard**
  - Chemical reactions with tissue
- **Failures/Errors**
  - Careless dispensing/mixing
  - Slipping/falling into surface contact
- **Likelihood/Severity**
  - Common exposure, severity varies
  - Strength of agent
  - Getting garments off
  - Washing off with copious water
- **Hazard Controls**
  - Hand/eye/skin protection
  - Emergency shower close by
  - Operational training



## 2. Chemical Burns (cont.)

### 2.2 JHA -- Oxidizing Sanitizer Contact

- **Hazard**  
Chemical reactions with tissue
- **Failures/Errors**  
Careless dispensing/mixing  
Slipping/falling into surface contact
- **Likelihood/Severity**  
Common exposure, severity varies  
Strength of agent  
Getting garments off  
Washing off with copious water
- **Hazard Controls**  
Hand/eye/skin protection  
Emergency shower close by  
Operational training



# Case Study 2

## Hot Caustic Washdown



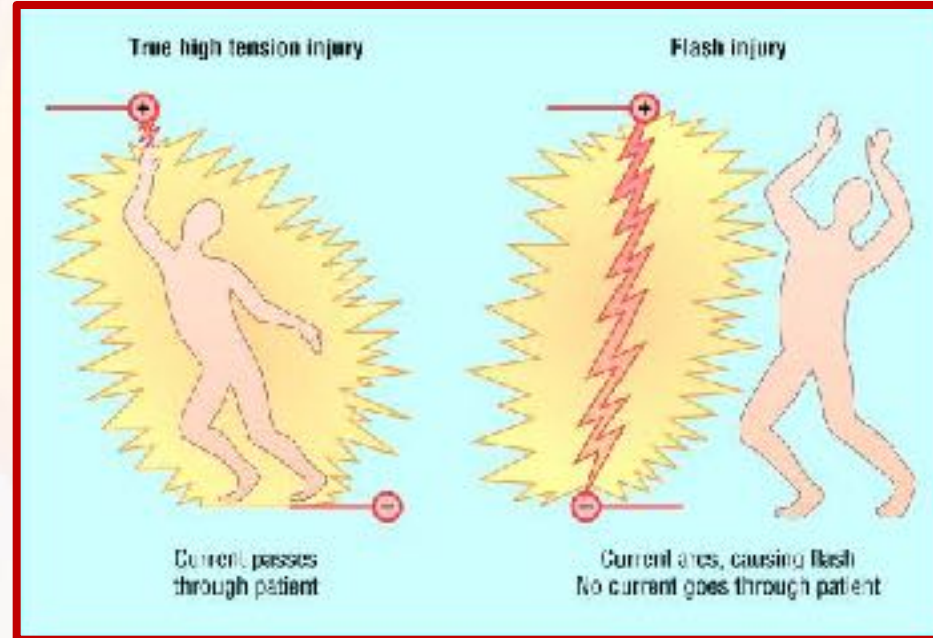
# 3. Electrical Burns

## 1. Electric Shock

- Electricity travels through the body
- <500 V not lasting
- >500 V serious injury

### Symptoms

- Heart arrhythmia
- Organ, brain damage
- Difficulty breathing, speaking, hearing
- Entry/exit wounds



Source: National Center for Biotechnology Information, US National Library of Medicine.

## 2. Arc Fault

- High voltage flash
- Current through air or unintended path
- Vaporizes metal
- Expands air
- Arc blast pressure
- 4x heat of the sun

### Symptoms

- 3<sup>rd</sup> degree burns
- Loss of eyesight, hearing, memory
- Concussion - trauma



# 3. Electrical Burns (cont.)

## 3.1 HA -- Electrical Shock / Burns

- **Hazard**  
Current through conductive tissues
- **Failures/Errors**  
Amateur / unmaintained wiring  
Direct contact with active circuits
- **Likelihood/Severity**  
Brief exposure, 1<sup>st</sup> - 3<sup>rd</sup> degree
- **Hazard Controls**  
De-energization - Lockout/tagout  
Ground fault protection (GFCI)  
Waterproof housings – switch-rated plugs  
Rubberized hand/skin/foot protection

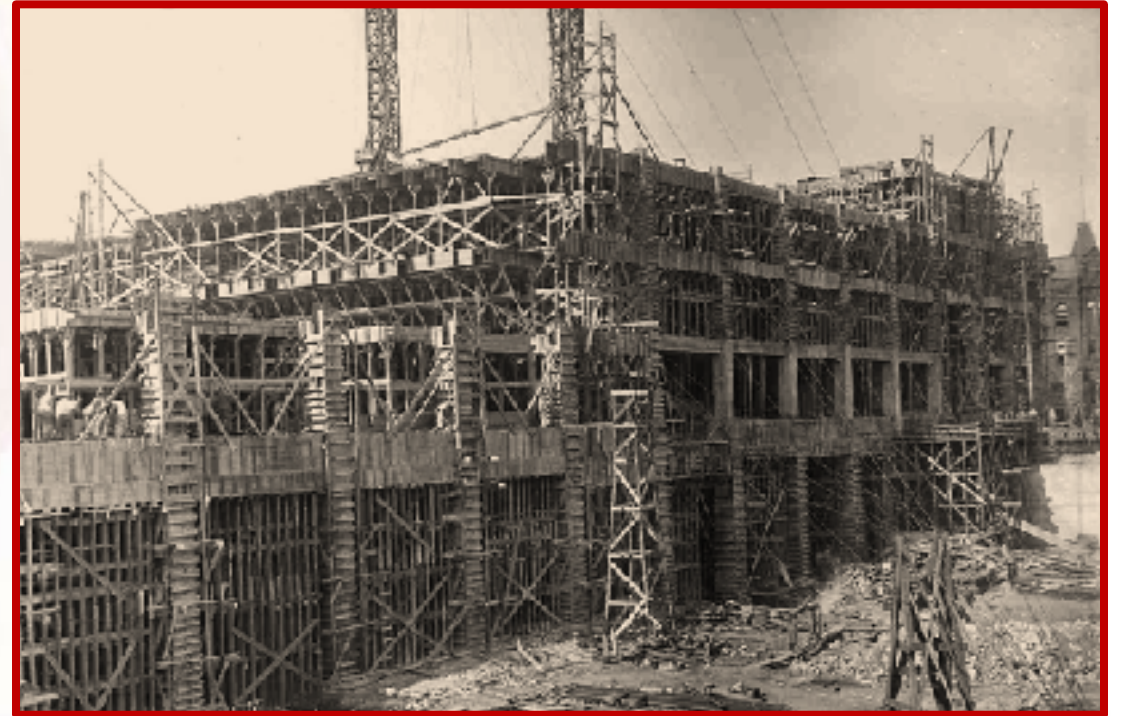


# Real Brewery Burns

## EIGHT MEN **ELECTROCUTED** AT NEW BEVO PLANT

Eight men were **electrocuted** and three suffered severe electric shocks when a wire cable which the men were handling at a new "Bevo" building of the Anheuser-Busch Brewing Association, St. Louis, broke December 4 and fell on a cable belonging to the Union Electric Co., which supplies current used in the construction work.

Fourteen men, employed by the Gilsonite Construction Co., were wrecking a tower which had been used for raising concrete to the upper floors of the new building.



Source: *The Western Brewer and Journal of the Barley, Malt and Hop Trades*, Dec. 1917.

Source: <http://www.usgennet.org/>. Thomas Kempland collection, 1914-17.



# 3. Electrical Burns (cont.)

## 3.2 HA -- Arc Fault

- **Hazard**  
Unintentional discharge of electricity through an unplanned path
- **Failures/Errors**  
Direct contact with active circuits
- **Likelihood/Severity**  
Brief exposure, burning metal, shock wave, extraordinary temperatures
- **Hazard Controls**  
De-energization - Lockout/tagout  
Arc fault circuit interruptor (AFGI)  
Special training, tools, PPE



# Case Study 3

## Arc Flash



# First Aid for Burns

## 1<sup>st</sup> degree (superficial) burns

- Cool water
- Treat to prevent infection
- Ointments are ok
- Protect during healing

## 2<sup>nd</sup>/3<sup>rd</sup> degree (full thickness) burns

- Immediate medical help / call 9-1-1
- Do not remove clothing if stuck
- No ice, ointments, cotton balls, etc.
- No home remedies, e.g. butter, eggs



# Brewery Burns are Real



2 workers, Boston Beer Co., Breinigsville, PA

Boiler explosion, eye and head injuries, asbestos.



40 yr old worker, Anheuser-Busch, Van Nuys, CA

Fell into hot mash. 30% 1<sup>st</sup> & 2<sup>nd</sup> degree burns. Hospitalized.



# Brewery Burns are Real



Jeff Carlson, Harmon Brewing Co., Tacoma, WA

Scalding mash water in boot. Skin grafts.



Kerry Thomas, Edge Brewing Co, Boise ID

Wort boilover. Nearly fatal complications.  
Skin grafts. PTSD. 5 months away from work.

# Brewery Burns are Real



Nichole Reiman, Odd13 Brewing, Lafayette, CO

Direct contact surface burn. Superficial.



Adam Chandler, Oak Pond Brewing Co.  
Skowhegan, ME

Hot caustic spray.



# Brewery Burns are Real



Andrew Childs and Jason Bathgate,  
8 Wired Brewery, Warkworth, NZ

Wort boilover. Months away from work. Skin grafts.



Jimmy Vollmer, Benson Brewery  
Omaha, NE

Wort boilover.

# Brewery Burns are Real



Teri Fahrendorf, Great Western, Vancouver, WA

Boiling water in boot. Skin grafts.



Mark Moynihan, Knoxville, TN

Oxygen enrichment fire inside a fermenter.  
75 days in burn unit. Died from injuries.

# Summary – Don't Get Burned!

## Causes and Avoidance

- 1. ASSESS EACH TASK**
- 2. KNOW THE BURN HAZARDS**
  - Thermal burns
  - Chemical burns
  - Electrical burns
- 3. UNDERSTAND BURNS BY TYPE, LIKELIHOOD, AND SEVERITY**
- 4. IMPLEMENT HAZARD CONTROLS**
  - Preventative: avoid exposure
  - Protective: reduce exposure
  - Develop and adhere to procedure

**Your family, coworkers, and customers want you  
in one piece so you can keep making the beer!**

# Thank You

**Especially to those who shared their personal experiences.**

**Engage in the Safety Dialogue through:**

**Brewers Association - The Forum, Safety Exchange, Lessons Learned**

**Your Local Brewers Guilds and Safety Trade Associations**

**Talk to your Coworkers and Colleagues**