Construction Work in Thermally Stressful Environment

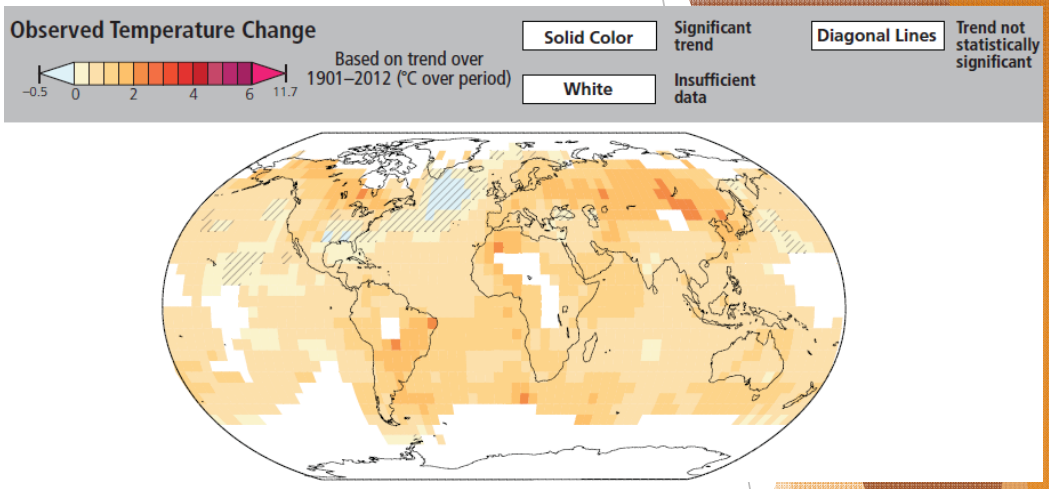
CM 598 Term Project

May 26, 2016

Michiya Kitayama

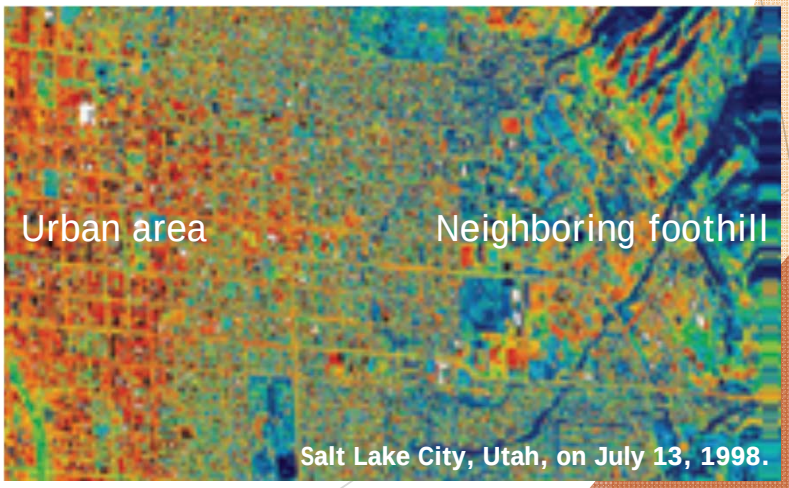
Background

(Source) AGC of America., & Zurich Insurance. (n.d.).



(Source) IPCC. (2014).

(Source) Magee & Associate, LLC



(Source) US Environmental Protection Agency. (2008).

Heat illness and Symptoms

Heat Rash

- A red cluster of pimples or small blisters

Heat Cramps

- Muscle cramps, pain, or spasms in the abdomen, arms or legs

Heat Exhaustion

- Headache
- Nausea
- Dizziness
- Irritability
- Thirst
- Heavy sweating
- Elevated body temperature
- Decreased urine output

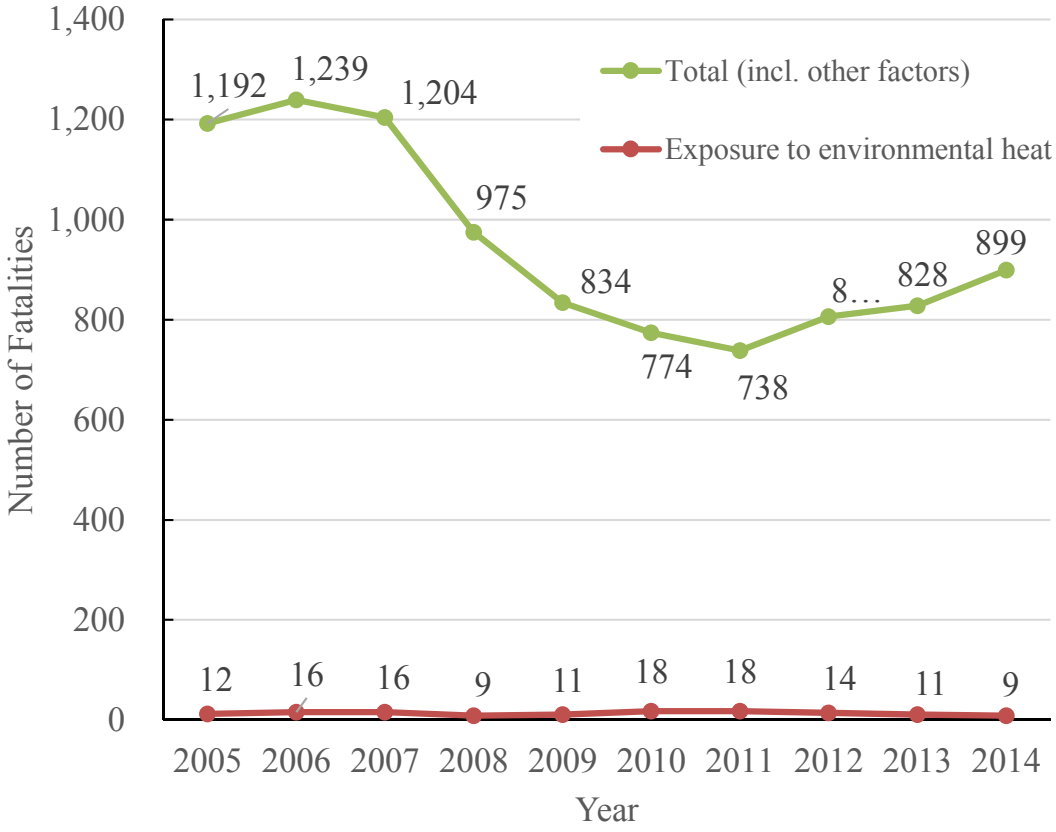
Heat Stroke

- Confusion
- Loss of consciousness
- Seizures
- Very high body temperature
- Hot dry skin or profuse sweating

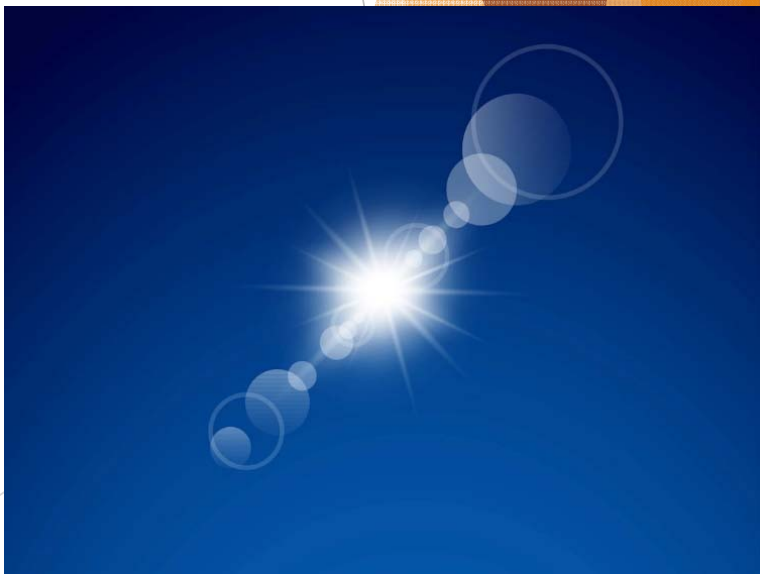
(source) Eason (2013); OSHA-NIOSH Infosheet (May 2011); OSHA a heat safety fact sheet (2013); and NIOSH Fast Facts (2010).

Number of fatalities

- Around 10-20 fatalities per year

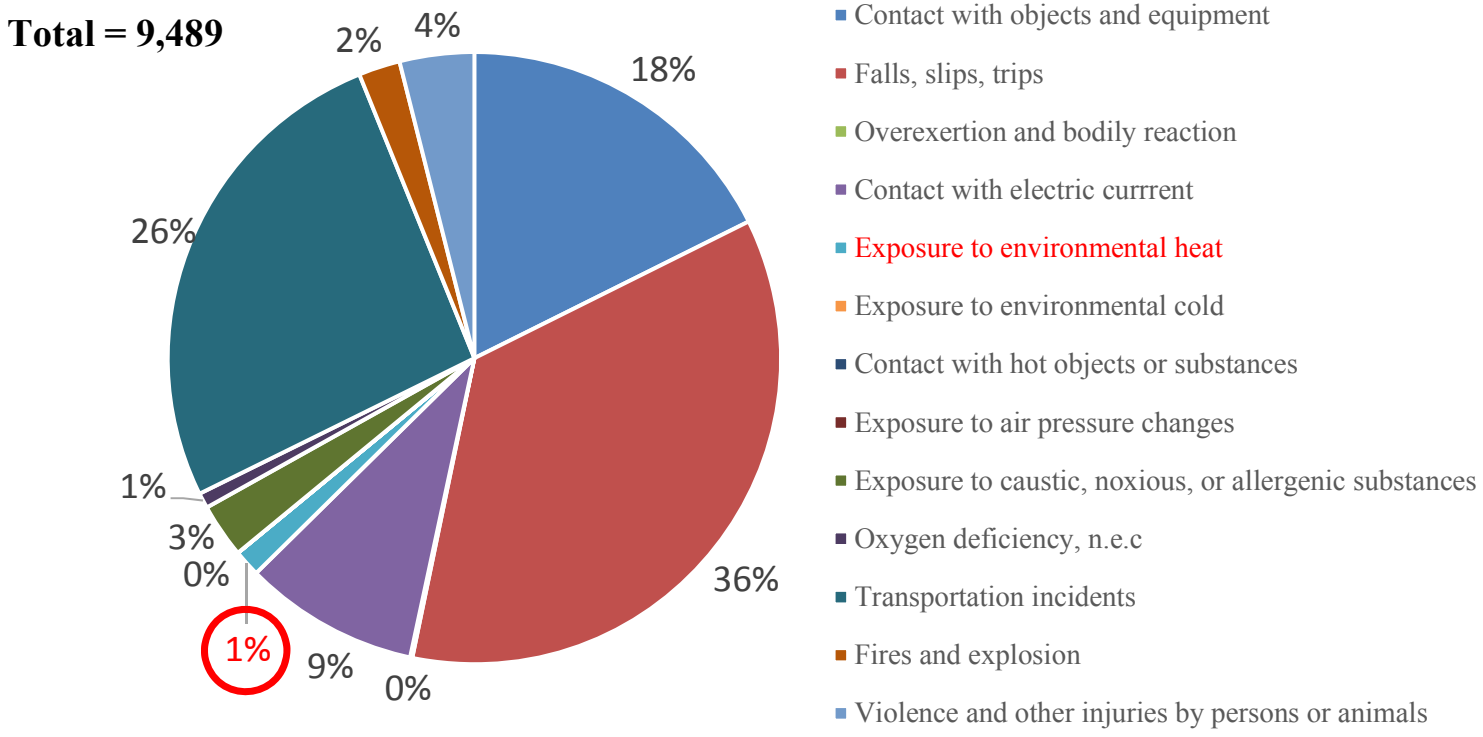


(source) http://www.bls.gov/iif/oshcfoi1.htm



Fatalities in U.S. by factors (from 2005 to 2014)

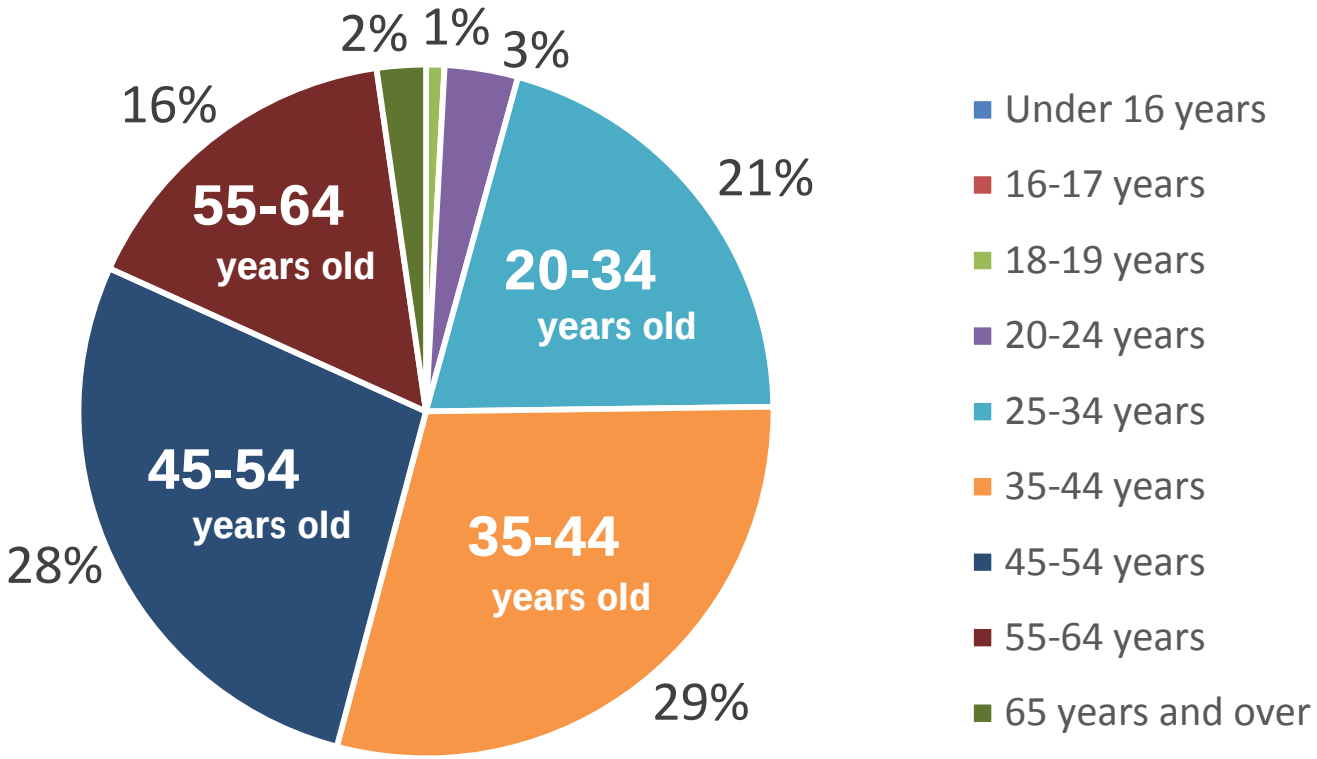
- Environmental heat is relatively a minor factor (about 1 %)



(source) http://www.bls.gov/iif/oshcfoi1.htm

Number of fatalities by Age Groups

- Fatalities occur not only senior workers but also youngers.



Note: This data includes fatalities in all industries.

(source) http://www.bls.gov/iif/oshcfoi1.htm

Geographical Distribution

- Fatalities occur mainly in southern regions
- Some occurs in northern regions

Note: Fatalities occurred between 2008 and 2014. Includes other industries.

(source) https://www.osha.gov/SLTC/heatillness/map.html

Type of workers mostly impacted

According to OSHA, workers with higher risk of heat-related illness are:

- **Not acclimatized** to hot environment
- Work **in direct sunlight**
- Perform **prolonged or strenuous work**
- Wear **heavy protective clothing** or **impermeable suits**
- **65+ years old**
- **Overweight**
- Have **heart disease**, **high blood pressure**

Potential factors related to heat illness

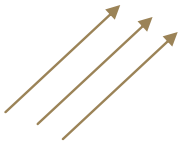
Environmental

Solar Radiation

Air movement

Temperature

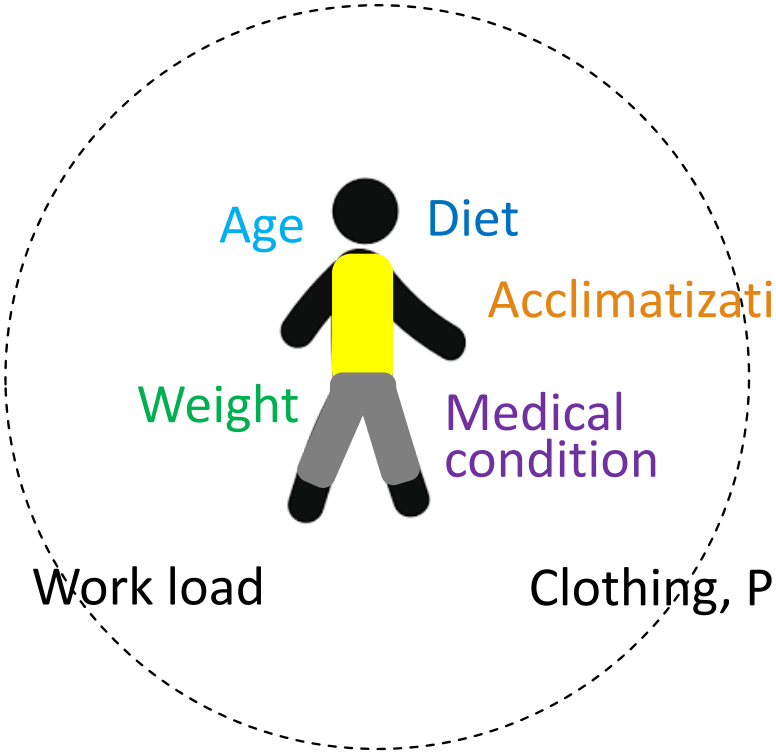
humidity



Reflected heat

Hot equipment, material

Personal



Heat Stress Index

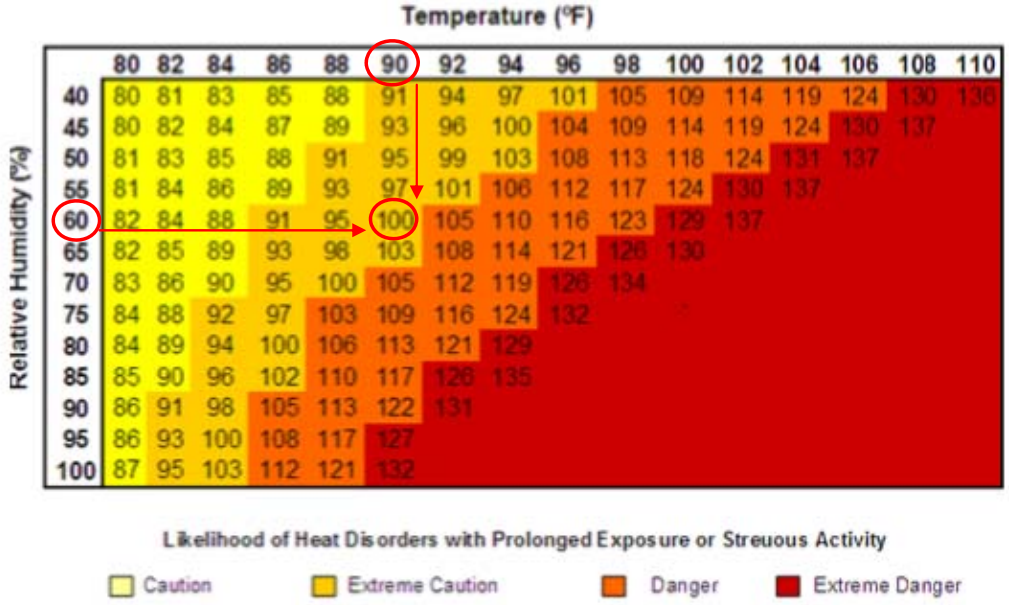
- 60 + indexes have been developed
- Regulations do not define standardized indexes

- Heat Index (HI)
  - Presented by OSHA as a reference
  - Use air temperature and relative humidity
  - Heat alerts are issued based on this index in many cities in the US

- Wet –Bulb Globe Temperature (WBGT)
  - Widely used internationally (e.g. USA, Europe, Australia, China, Japan, etc.)
  - Use air temperature, wet bulb temperature, and 150mm black globe
  - Developed during 1950s in the training camps of US Army and Marine Corps
  - Stipulated by International Standard (ISO 7243 etc.)

Heat Index (HI)

- The index combines temperature and relative humidity into a single value



Note: **This figure is for shady, light wind conditions, and exposure to full sunshine can heat index value by up to 15 F**. Strong wind, with hot dry air, can be extremely hazardous.

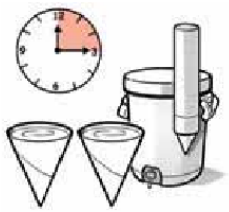
(source) https://www.osha.gov/SLTC/heatillness/heat_index/pdfs/all_in_one.pdf

Heat Index	Risk Level	Protective Measures
Less than 91 F	Lower (Caution)	- Provide drinking water - Acclimatize workers - Ensure that adequate medical service are available - Encourage workers to wear sunscreen - Plan ahead for times when heat index is higher, including worker heat safety training
91 F to 103 F	Moderate	In addition to the steps listed above: - Remind workers to drink water often (about 4 cups/hour) - Review heat-related illness topic with workers (e.g. how to recognize heat-related illness) - Schedule frequent breaks in cool, shaded area - Set up buddy system/instruct supervisors to watch workers for signs of heat-related illness
103 F to 115 F	High	In addition to the steps listed above: - Alert workers of high risk conditions - Limit physical exertion (e.g. use mechanical lifts) - Actively encourage workers to drink plenty of water (about 4 cups/hour) - Have a knowledgeable person at the worksite who is well-informed about heat-related illness and able to determine appropriate work/rest schedules - Establish and enforce work/rest schedules - Adjust work activities (e.g., reschedule/pace/rotate work) - Use cooling techniques - Watch/communicate with workers at all times - When possible, reschedule activities to a time when heat index is lower
Greater than 115 F	Very High to Extreme	Reschedule non-essential activity for days w/ a reduced heat index or to a time when the heat index is lower. Move essential work tasks to the coolest part of the work shift; consider earlier start times, split shifts, or evening and night shifts. Strenuous work tasks and those requiring the use of heavy or non-breathable clothing or impermeable chemical protective clothing should not be conducted. If essential work must be done, in addition to the steps listed above: - Alert workers of extreme heat hazards - Establish water drinking schedule (about 4 cups/hour) - Develop, enforce protective work/rest schedules - Conduct physiological monitoring (e.g., pulse, temp.) - Stop work if essential control methods are inadequate or unavailable.

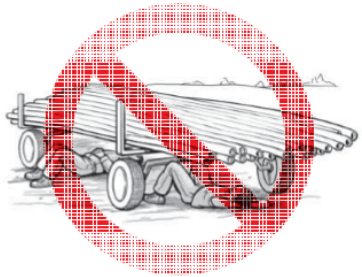
Protective Measures

Administrative Controls

Drink water even if you aren't thirsty – every 15 minutes.



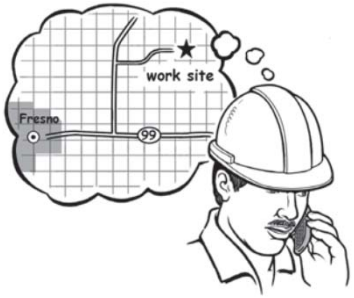
Rest in the shade.



Watch out for each other. (e.g. Buddy System)

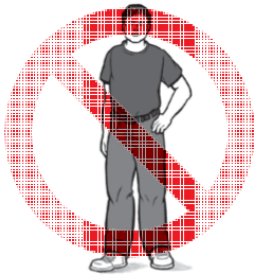
Training and emergency plan.

Know where you are working in case you need to call 911.



PPE

Wear hats, light-colored clothing, and sunscreen.



(Source) https://www.osha.gov/SLTC/heatillness/3431_wksiteposter_en.pdf

Regulations

- Federal OHSA:
  - No specific standard that covers working in hot environment
  - Employers must protect workers from heat hazards under the **General Duty Clause**

- In Washington State:
  - WAC 296-62-095 through 296-62-09560

WAC 296-62-09510

- Outdoor work environments from May 1 to Sep 30
- When exposures are at or above temperature in the Table below

Clothing condition	Outdoor Temperature
All other clothing	**89°**
Double-layer woven clothes including coveralls, jackets, and sweatshirts	**77°**
Nonbreathing clothes including vapor barrier clothing or PPE such as chemical resistant suits	**52°**

(Source) Washington State Legislature. (2008). WAC 296-62-095 through 296-62-09560.

WAC 296-62-09530 to 09560

- Employers' responsibility includes;
  - Address safety program in written accident prevention program
  - Encourage employees to frequently consume water, beverage
  - Ensure that all employees have the opportunity to drink at least one quart of drinking water per hour.
  - Respond to signs and symptoms of heat-related illness
  - Provide information and training at least annually

(Source) Washington State Legislature. (2008). WAC 296-62-095 through 296-62-09560.

Summary

- Heat illness is a minor contributor to work-related fatalities
- However, it can be a deadly risk
- Most workers need attention. Even in northern region, young workers
- Related risk factors are various:
  - Environmental factors (temperature, humidity, radiation, etc.)
  - Body factors (acclimatization, clothing, age, etc.),
    work condition (duration, intensity, etc.)
- Use a heat stress index for proper control of work
- Implement appropriate measures in accordance with Federal OSHA General Duty Clause and WAC 296-62-095 through 296-62-09560

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