Heat Stress & Vector Borne Disease

Mother Nature vs. Flame Resistant & Arc Rated Clothing

This presentation is for informational purposes only

Customers of Bulwark Protection are solely responsible for conducting their own Hazard Risk Assessment to identify safety hazards in their work environment.

Customers of Bulwark Protection are solely responsible for selecting appropriate garments and personal protective equipment for their employees. Employers must ensure wearers use, care and maintain their garments and personal protective equipment properly. As working conditions and other factors vary, Bulwark Protection does not make any representation that these garments and personal protective equipment will protect wearers from injury.

Premise – we receive a lot of questions around FR/AR clothing and what to do in the case of extreme conditions, specifically – the heat of the summer and those inevitable accompanying insects

What you will take away….

- What is heat stress?
- Does your FR/AR clothing play a factor?
- What are some best practices to avoid heat stress
- How do you protect against disease carrying insects when DEET is not an option.

A few definitions…

Fire retardant - is a chemical additive that suppresses fire by interrupting the fire flow (fire tetrahedron).

Flame resistant – self extinguishes does not support combustion, does not melt, drip or add to the injury

Arc Rated – tested to the electric arc flash hazard

FR/AR – flame resistant/arc rated garments

Heat Stress - is the general name for several medical conditions as it relates to exposure to heat

Vector Borne Disease - is the general name for insect delivered disease

We work in hazardous environments and sometimes Mother Nature is the hazard

Risk of Environmental stress….

Anyone working in the environment may be at risk of Heat Stress and Vector Borne Disease:

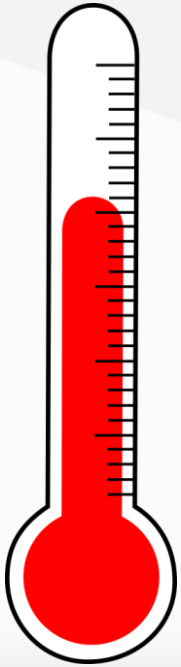
- Line crews
- Drilling crews
- Landscapers
- Sanitation workers
- First responders
- Tree Trimmers

What is Heat Stress?

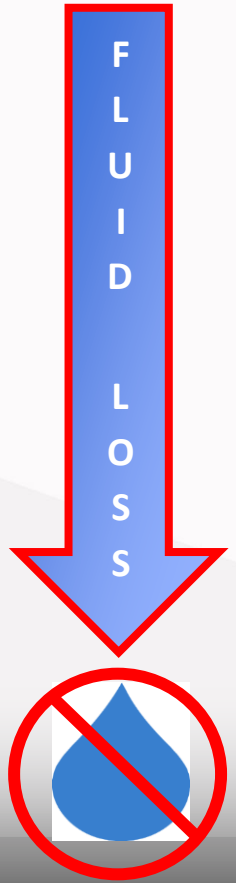
Heat stress is a buildup of body heat generated either internally by muscle use or externally by the environment. Several heat induced illnesses can result in heat rash, heat cramps, heat exhaustion and heat stroke.

We know the contributors -

- **Poor hydration**
- **Lack of rest breaks**
- **Lack of shade**
- **Poor physical fitness**



Types of Heat-related Illnesses



Heat rash is a skin irritation caused by excessive sweating during hot, humid weather.

Heat cramps usually affect workers who sweat a lot during strenuous activity. This sweating depletes the body's salt and moisture levels. Low salt levels in muscles causes painful cramps. Heat cramps may also be a symptom of heat exhaustion.

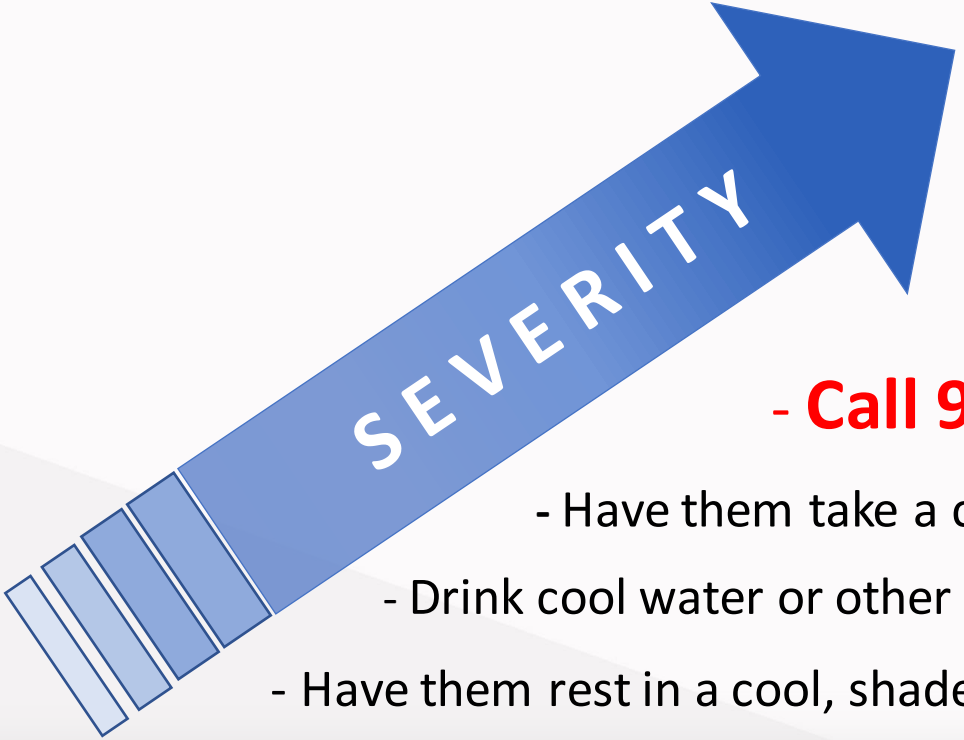
Heat exhaustion is the body's response to an excessive loss of the water and salt, usually through excessive sweating. Workers most prone to heat exhaustion are those that are elderly, have high blood pressure, and those working in a hot environment.

Heat stroke is the most serious heat-related illness. It occurs when the body is unable to control its temperature: the body's temperature rises rapidly, the sweating mechanism fails, and the body is unable to cool down.

Heat stroke can cause death or permanent disability if emergency treatment is not given

https://www.cdc.gov/niosh/topics/heatstress/heatrelillness.html

Response escalation…



- **Call 911**

- Have them take a cool shower, bath, or sponge bath

- Drink cool water or other cool, beverages ideally w/electrolytes

- Have them rest in a cool, shaded or air-conditioned area

Common Factors that Contribute to Heat Stress

1. **Age** – Ability to produce sweat decreases with age
2. **Fitness level** – "Efficiency" of sweat
3. **Body Mass Index (BMI)** – Higher BMI insulates the core, increasing sweat production
4. **Dehydration - contributing factors include:**
    a. **Not consuming enough water/electrolytes**
    b. **Use of alcohol**
    c. **Use of caffeine, including sodas and energy drinks**
    d. **Use of certain medications**
5. **Diet**
6. **Activity level**
7. **Lack of Acclimation**

Understanding the Body's Cooling Mechanisms

The body is continuously generating heat, which must be released to maintain a core temperature of **98.6° F.**

Four Basic Cooling Mechanisms:

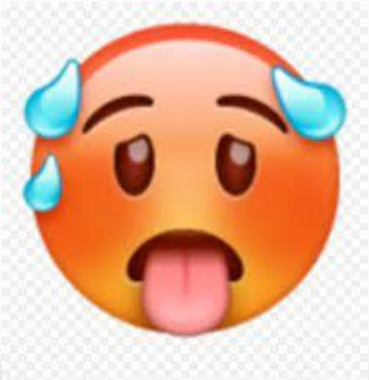
- **Radiation** – Heat is radiated through the skin and absorbed by the surrounding cooler air
- **Conduction** – Direct contact with cooler objects like water
- **Convection** – Moving air from breeze, fans, etc.
- **Evaporative Cooling** – Sweat evaporates, which leads to a heat transfer from the liquid to the gaseous state, resulting in a cooling effect

https://www.scientificamerican.com/article/chilling-science-evaporative-cooling-with-liquids/

The Challenge is….

When the ambient temperature is above body temperature, then radiation, conduction and convection struggle to cool the body.

The only mechanism left to cool the body is evaporation of perspiration. **SWEAT!**



Preventing heat stress

- Know the symptoms of heat stress.
- Monitor your physical condition and that of your coworkers.
- Dress properly for the heat.
- Schedule regular breaks - rest in the shade.
- Stay hydrated, drink cold fluids (no alcohol) include electrolytes.
- Use proper engineering controls, safe work practices, and personal protective equipment (PPE) provided by your employer.

Getting worse….

Both NASA and the American Meteorological Society predict we can expect both more intense and more frequent heat and cold events across the country in coming decades, with huge implications for both indoor and outdoor workers.

NPR.org As Planet Warms, Advocates Urge U.S. To Set Rules To Protect Workers From Heat

August 27, 20183:36 PM ET KATIE LAWRIE

Getting worse….

How what you wear can assist in Cooling….

Effective fabrics will mimic the body's cooling mechanisms typically through a combination of:

Light weight – Less insulating allows more heat release (radiation)

Open Weave – More air permeable allows more air to cool and evaporate moisture (convection)

Moisture Wicking – Moves more moisture to the surface for the evaporative cooling (evaporation)

When clothing is also your PPE…

When we must factor in your FR/AR protection:

Wearing the right clothing made from the right fabrics is important

Remember, for tasks that can potentially involve exposure to short duration thermal energy; such as an arc flash and/or a flash fire, garments must first protect and insulate then factor in comfort attributes.

5 – KEY Things to do in the Heat

FR/AR: Things to do….. In the Heat

Thing 1: We know sweat is not as free to evaporate when the skin is covered even with breathable clothing compared to not being covered but that is not really an option, **SO…**

- **Keep Hydrated, better yet show up hydrated**
- **Schedule rest breaks**
- **Provide shade, better yet cool area**
- **Stay in shape, careful of medications, caffeine, and alcohol**

FR/AR : Things to do….. In the Heat

Thing 2: Look for FR clothing that facilitates evaporation:

- Moisture wicking fibers (not a finish)
- Open weave to allow air permeability

The Challenge: When the ambient temperature is above body temperature the only mechanism left to cool the body is evaporation of perspiration. Use garments that can mimic evaporation

FR/AR: Things to do….. In the Heat

Thing 3: Be careful utilizing PPE that involves layers and/or barriers such as:

- Arc Flash suits
- Raingear
- Hi Vis vests
- Chem protection
- Soil protection (disposable coverall)

All can contribute to heat stress.

FR/AR: Things to do….. In the Heat

Thing 4: Single layer FR/AR Clothing, is no more a contributor to heat stress than Non-FR clothing. (CAF adjustment to WBGT for heat Index, ACGIH - American Conference of Governmental Industrial Hygienists)

Clothing in general can interfere with evaporation which is key to cooling.

- This includes the discussion around long sleeve vs. short sleeves (long sleeves can protect against the radiant heat load, sun burn)

OH&S The Truth About Heat Stress and FRC May 01, 2019

https://www.npr.org/2012/07/25/157302810/summer-science-clothes-keep-you-cool-more-or-less

FR/AR: Things to do….. In the Heat

Thing 5: Factor in your baselayers Regardless of the hazard arc flash or flash fire when discussing undergarments only natural fibers are allowed per the standards no meltable fibers can be used in under layers.

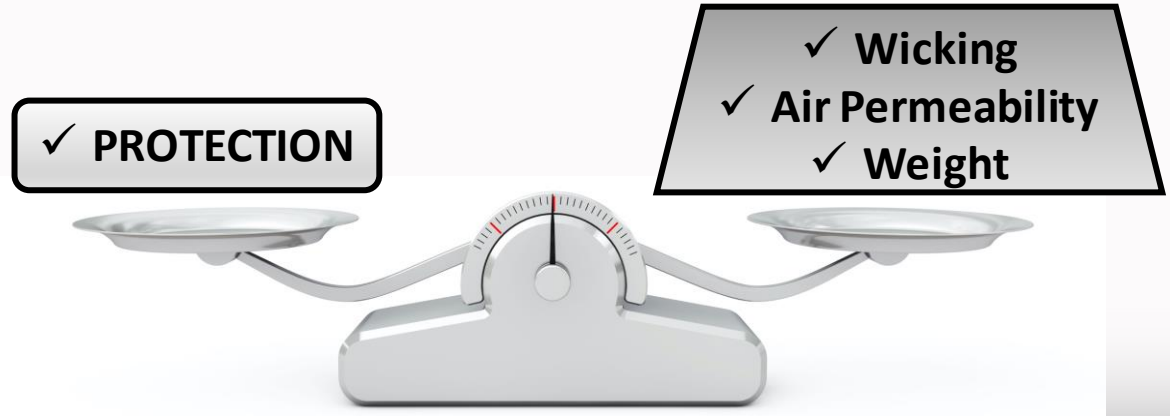
There is mounting evidence due to the improved fabrics for FR/AR baselayers that along with the improved protection that it allows for lighter weight outer layers, thus reducing weight, allowing for a more open weave as fiber density is not as essential to maximize arc rating.

Finding the balance…

Look deeper than just the brochure…

- High air perm alone is not an indicator of comfort (aka a screen door)
- Make sure moisture wicking is a property of the fiber blend and not a finish (all wicking finishes are temporary)

Remember: there must be a balance



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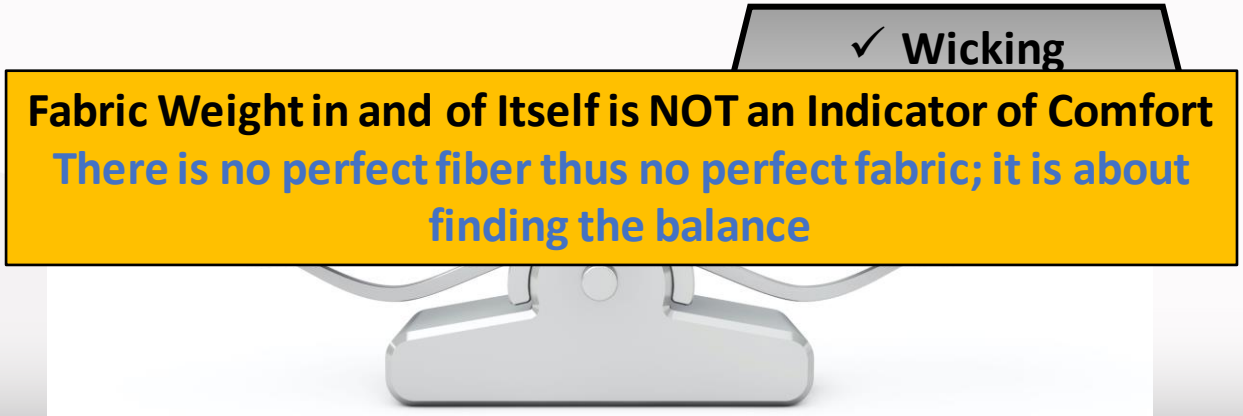


Mother Nature can bring additional hazards

VECTOR BORNE DISEASE

Vector Borne Diseases are a real Hazard

Insects carry a variety of diseases:

- Lyme disease
- West Nile virus
- Malaria
- Zika Virus
- Dengue fever

Per the CDC almost all the US is covered by either Zika, West Nile and/or Lyme disease

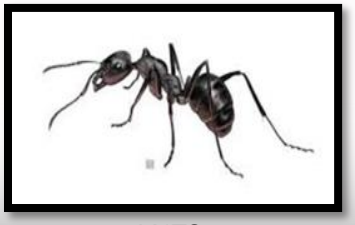
MOSQUITOS

NO-SEE-UMS (MIDGES)

TICKS

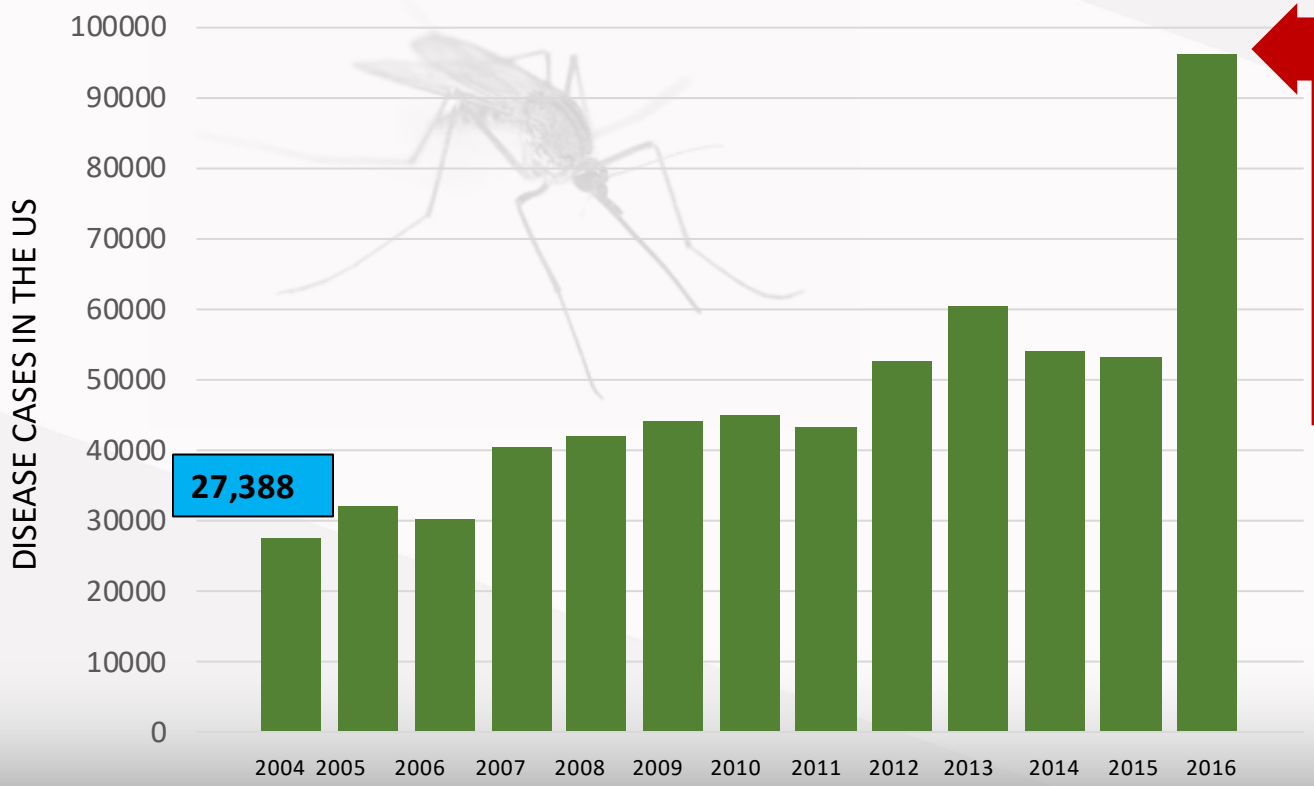
FLIES

CHIGGERS



ANTS

Vector Borne Disease is on the Rise

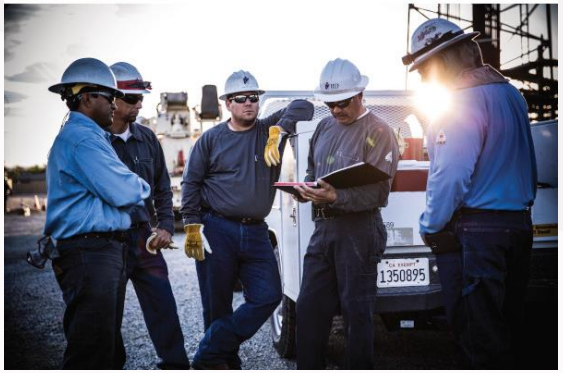


96,075

Disease cases from infected mosquitos, ticks, and fleas have tripled in 13 years.

All of Our Core Markets are Exposed

Electric & Gas Utilities



Oil and Gas

- Upstream
- Mid-stream
- Down Stream

You can't use DEET Insect Repellant

- Used to repel biting insect
- DEET is the active ingredient in many insect repellant products
- DEET has a low flash point and is highly flammable both wet and dry
- Spray DEET on skin only, never on garments

So, then what is our solution:

PERMETHRIN TREATED CLOTHING.

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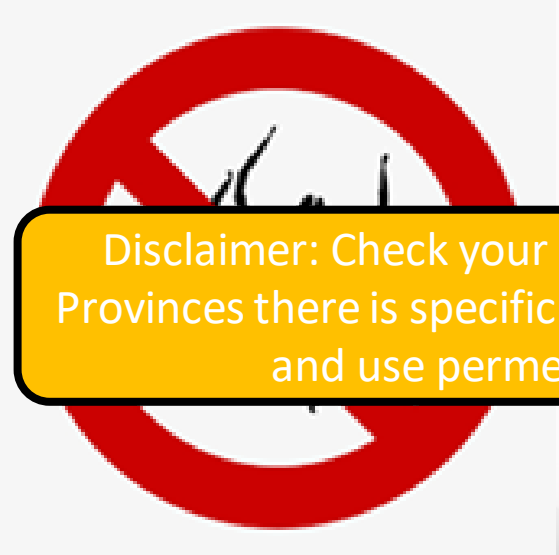
PERMETHRIN TREATED CLOTHING.



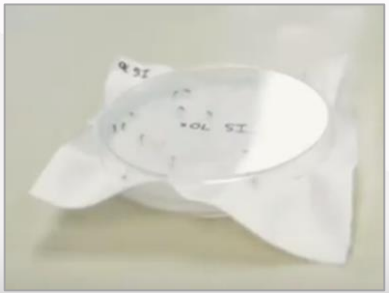
Disclaimer: Check your local Laws – in some Countries, Provinces there is specific guidance to how you can acquire and use permethrin treated clothing.

How does Permithrin Work?

The insect repellent is permethrin (which has been effectively used in FR clothing for close to a quarter century).

HOW IT WORKS:

Insects sense the presence of permethrin and either drop off, fly off or don't even land on clothing (This is tested via **Knockdown Testing:** the most common scientific method for determining the efficacy repellent-treated textile products.)



Flash Fire and Arc Flash Testing

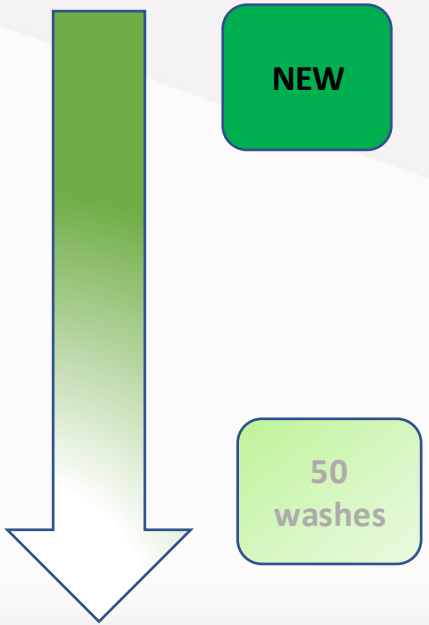
It is essential that FR/AR performance was maintained after being treated with Permethrin -

Manikin Test

Arc Test

Permethrin – KNOCK DOWN!

- Why do we say 50 washes – our work to date across all our fabrics and weights we do see a significant drop off of the “knock down” capability after 50
- Does that mean if I wash my garments every week the insect repellency is gone in a year – Yes it does. It is still FR for the life of the garment, but the insect shield is done.
- A possible option is to rotate inventory – those with IS and those with out



Advantages of Garments Treated with Permethrin vs. Spray?

- **NOT** harmful to the eyes
- **NO** chance to inhale or swallow
- **NO** potential for over-use
- Repellency near but **NOT** on the skin
- Longer lasting - **NO** re-application required
- **NO** treatment transfer to car seat, furniture etc.
- **Odorless**
- **NO *Additional*** laundry requirements needed
- Does **NOT** affect flame-resistant characteristics
- Does **NOT** affect physical properties of garment (color)
- **Effective at repelling a variety of insects**

Why - Permethrin

- **Does NOT** affect flame-resistant characteristics
- **EPA proven** (Environmental Protection Agency - Reg. No. 74843-2), long-lasting, effective and convenient insect protection.
- **Over 20 years** of performance in military uniforms.
- The insect repellent in Insect Shield® is permethrin (which has been effectively **used in FR clothing for close to a quarter century**).
- Bulwark garments with Insect Shield® are **UL certified to NFPA® 2112**
- Effective at **repelling a variety of insects**

The Bottom Line…..

1. Hydration, rest breaks and shade/cover are the most effective control methods, with the **right** hydration being by far the most important.
2. Acclimatization programs and exposure limits with rest/work cycles.
3. Get them out of the radiant load
4. Schedule heavy work during the cooler part of the day
5. Have them rest in cooling tents
6. Dress in Layers – understand how your layers work, cover your head
7. Wear trials are the most effective way to judge comfort.
8. Understand how insect repellents work and pick what's best for your team

RESOURCES

While OSHA currently offers guidelines and endorses NIOSH's criteria for a recommended standard, it has no enforceable rules specifically requiring employers to provide water, rest, shade, acclimatization programs, or training to recognize symptoms of serious heat illness.

Thus far, three states, California, Washington, and Minnesota, have implemented their own standards protecting outdoor (California and Washington) and indoor (Minnesota) workers. The U.S military has also developed guidelines including heat exposure limits and acclimatization programs. Next January, California is also scheduled to issue a heat stress standard for indoor workers

Inspection Guidance for Heat-Related Hazards 9/1/2021

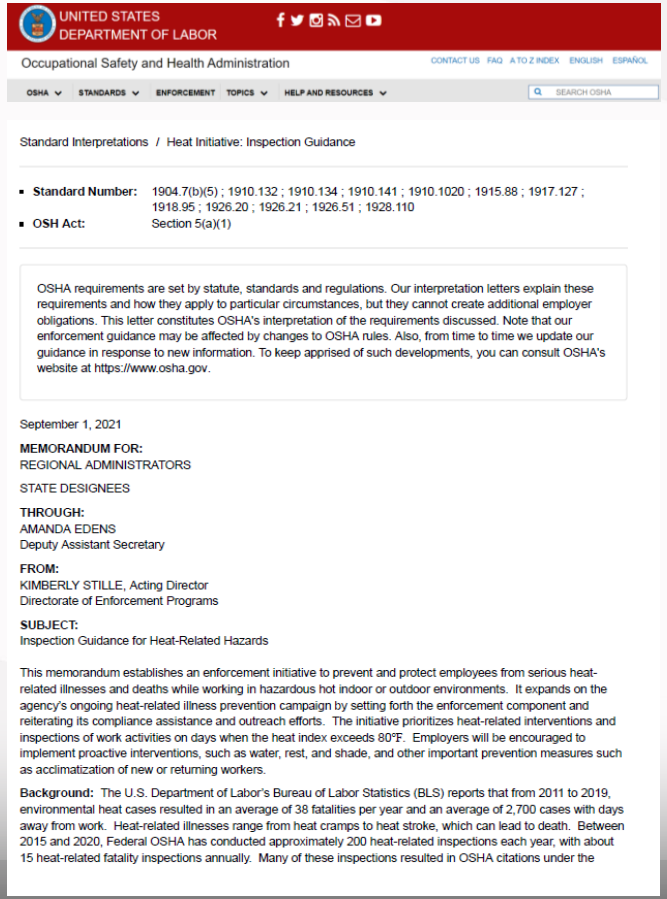
Background: The U.S. Department of Labor's Bureau of Labor Statistics (BLS) reports that from 2011 to 2019, environmental heat cases resulted in an average of 38 fatalities per year and an average of 2,700 cases with days away from work. However, the total number of heat-related fatalities may be underreported. The cause of death is often listed as a heart attack, when the actual cause was exposure to a heat-related hazard.

Area Offices should become familiar with the various types of warnings, alerts, and advisories, https://www.weather.gov/safety/heat-ww issued by the U.S. National Oceanographic Atmospheric Administration (NOAA) National Weather Service (NWS). **Heat Advisory, Heat Wave, Excessive Heat Warning, Excessive Heat Watches, Excessive Heat Outlooks**

Heat Initiative: Inspection Guidance | Occupational Safety and Health Administration (osha.gov)

Employers Need to be Ready for New OSHA Heat Measures - EHS Daily Advisor (blr.com)

September 1, 2021
SUBJECT: Inspection Guidance for Heat-Related Hazards



UNITED STATES DEPARTMENT OF LABOR

Occupational Safety and Health Administration

CONTACT US FAQ A TO Z INDEX ENGLISH ESPAÑOL

OSHA STANDARDS ENFORCEMENT TOPICS HELP AND RESOURCES SEARCH OSHA

Standard Interpretations / Heat Initiative: Inspection Guidance

- **Standard Number:** 1904.7(b)(5) ; 1910.132 ; 1910.134 ; 1910.141 ; 1910.1020 ; 1915.88 ; 1917.127 ; 1918.95 ; 1926.20 ; 1926.21 ; 1926.51 ; 1928.110
- **OSH Act:** Section 5(a)(1)

OSHA requirements are set by statute, standards and regulations. Our interpretation letters explain these requirements and how they apply to particular circumstances, but they cannot create additional employer obligations. This letter constitutes OSHA's interpretation of the requirements discussed. Note that our enforcement guidance may be affected by changes to OSHA rules. Also, from time to time we update our guidance in response to new information. To keep apprised of such developments, you can consult OSHA's website at https://www.osha.gov.

September 1, 2021

MEMORANDUM FOR:
REGIONAL ADMINISTRATORS

STATE DESIGNEES

THROUGH:
AMANDA EDENS
Deputy Assistant Secretary

FROM:
KIMBERLY STILLE, Acting Director
Directorate of Enforcement Programs

SUBJECT:
Inspection Guidance for Heat-Related Hazards

This memorandum establishes an enforcement initiative to prevent and protect employees from serious heat-related illnesses and deaths while working in hazardous hot indoor or outdoor environments. It expands on the agency's ongoing heat-related illness prevention campaign by setting forth the enforcement component and reiterating its compliance assistance and outreach efforts. The initiative prioritizes heat-related interventions and inspections of work activities on days when the heat index exceeds 80°F. Employers will be encouraged to implement proactive interventions, such as water, rest, and shade, and other important prevention measures such as acclimatization of new or returning workers.

Background: The U.S. Department of Labor's Bureau of Labor Statistics (BLS) reports that from 2011 to 2019, environmental heat cases resulted in an average of 38 fatalities per year and an average of 2,700 cases with days away from work. Heat-related illnesses range from heat cramps to heat stroke, which can lead to death. Between 2015 and 2020, Federal OSHA has conducted approximately 200 heat-related inspections each year, with about 15 heat-related fatality inspections annually. Many of these inspections resulted in OSHA citations under the

September 1, 2021
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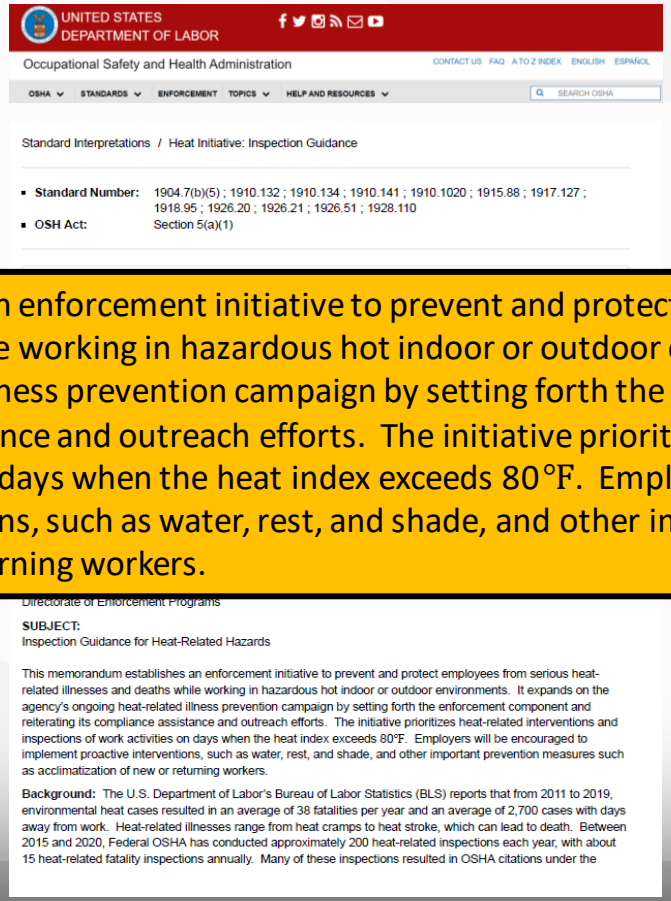

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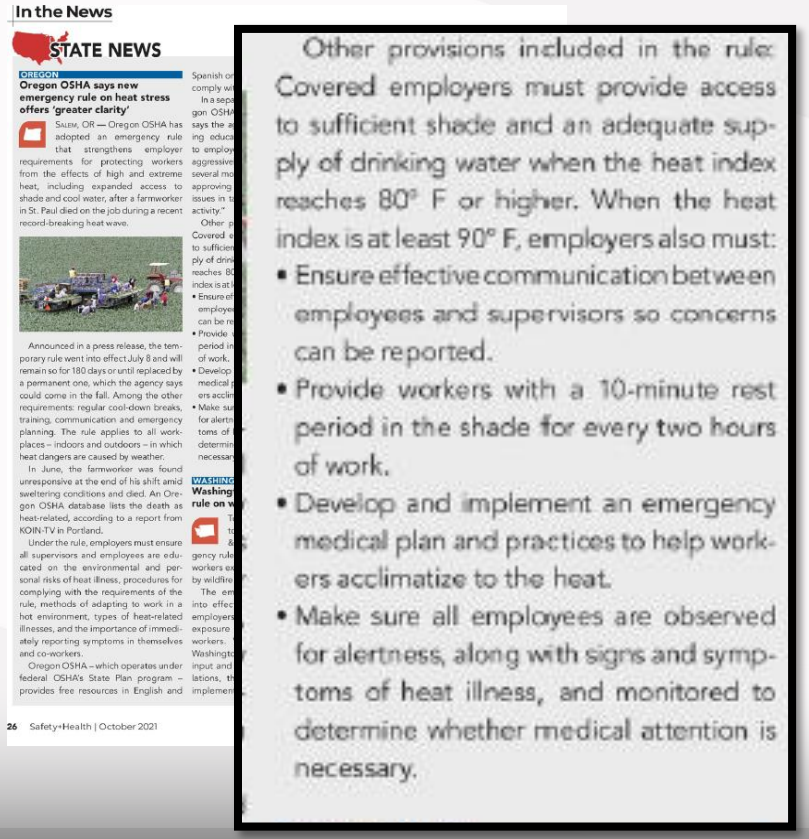
States Implementing Emergency Rules…



In the News

STATE NEWS

OREGON

Oregon OSHA says new emergency rule on heat stress offers 'greater clarity'

SALEM, OR — Oregon OSHA has adopted an emergency rule that strengthens employer requirements for protecting workers from the effects of high and extreme heat, including expanded access to shade and cool water, after a farmworker in St. Paul died on the job during a recent record-breaking heat wave.

Announced in a press release, the temporary rule went into effect July 8 and will remain so for 180 days or until replaced by a permanent one, which the agency says could come in the fall. Among the other requirements: regular cool-down breaks, training, communication and emergency planning. The rule applies to all workplaces – indoors and outdoors – in which heat dangers are caused by weather.

In June, the farmworker was found unresponsive at the end of his shift amid sweltering conditions and died. An Oregon OSHA database lists the death as heat-related, according to a report from KOIN-TV in Portland.

Under the rule, employers must ensure all supervisors and employees are educated on the environmental and personal risks of heat illness, procedures for complying with the requirements of the rule, methods of adapting to work in a hot environment, types of heat-related illnesses, and the importance of immediately reporting symptoms in themselves and co-workers.

Oregon OSHA – which operates under federal OSHA's State Plan program – provides free resources in English and

26 Safety+Health | October 2021

Other provisions included in the rule: Covered employers must provide access to sufficient shade and an adequate supply of drinking water when the heat index reaches 80° F or higher. When the heat index is at least 90° F, employers also must:

- Ensure effective communication between employees and supervisors so concerns can be reported.
- Provide workers with a 10-minute rest period in the shade for every two hours of work.
- Develop and implement an emergency medical plan and practices to help workers acclimatize to the heat.
- Make sure all employees are observed for alertness, along with signs and symptoms of heat illness, and monitored to determine whether medical attention is necessary.

https://www.osha.gov/Publications/osha3154.pdf

OSHA® QUICK CARD™

Protecting Workers from Heat Stress

Heat Illness

Exposure to heat can cause illness and death. The most serious heat illness is heat stroke. Other heat illnesses, such as heat exhaustion, heat cramps and heat rash, should also be avoided.

There are precautions your employer should take any time temperatures are high and the job involves physical work.

Risk Factors for Heat Illness

- High temperature and humidity, direct sun exposure, no breeze or wind
- Low liquid intake
- Heavy physical labor
- Waterproof clothing
- No recent exposure to hot workplaces

Symptoms of Heat Exhaustion

- Headache, dizziness, or fainting
- Weakness and wet skin
- Irritability or confusion
- Thirst, nausea, or vomiting

Symptoms of Heat Stroke

- May be confused, unable to think clearly, pass out, collapse, or have seizures (fits)
- May stop sweating

To Prevent Heat Illness, Your Employer Should

- Provide training about the hazards leading to heat stress and how to prevent them.
- Provide a lot of cool water to workers close to the work area. At least one pint of water per hour is needed.

For more information:

OSHA® Occupational Safety and Health Administration

OSHA® QUICK CARD™

- Schedule frequent rest periods with water breaks in shaded or air-conditioned areas.
- Routinely check workers who are at risk of heat stress due to protective clothing and high temperature.
- Consider protective clothing that provides cooling.

How You Can Protect Yourself and Others

- Know signs/symptoms of heat illnesses; monitor yourself; use a buddy system.
- Block out direct sun and other heat sources.
- Drink plenty of fluids. Drink often and BEFORE you are thirsty. Drink water every 15 minutes.
- Avoid beverages containing alcohol or caffeine.
- Wear lightweight, light colored, loose-fitting clothes.

What to Do When a Worker is Ill from the Heat

- Call a supervisor for help. If the supervisor is not available, call 911.
- Have someone stay with the worker until help arrives.
- Move the worker to a cooler/shaded area.
- Remove outer clothing.
- Fan and mist the worker with water; apply ice (ice bags or ice towels).
- Provide cool drinking water, if able to drink.

IF THE WORKER IS NOT ALERT or seems confused, this may be a heat stroke. CALL 911 IMMEDIATELY and apply ice as soon as possible.

If you have any questions or concerns, call OSHA at 1-800-321-OSHA (6742).

For more information:

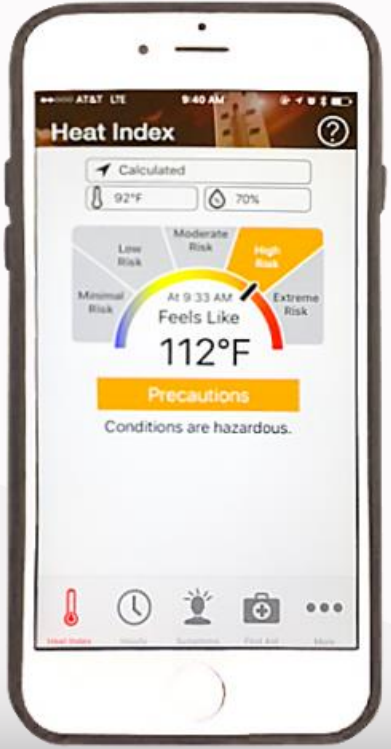
OSHA® Occupational Safety and Health Administration

Using the Heat Index: A Guide for Employers

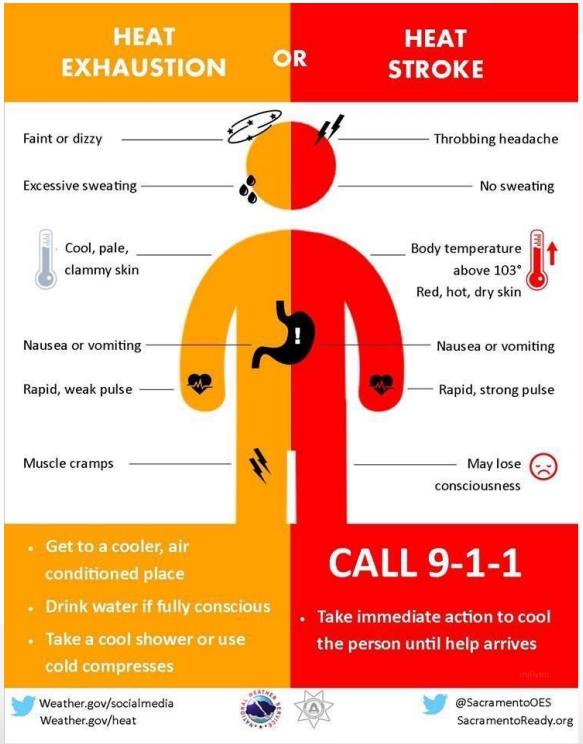
Heat Index	Risk Level	Protective Measures
Less than 91°F	Lower (Caution)	Basic heat safety and planning
91° to 103°F	Moderate	Implement precautions and heighten awareness
103° to 115°F	High	Additional precautions to protect workers
Greater than 115°F	Very High to Extreme	Triggers even more aggressive protective measures

https://www.nalc.org/workplace-issues/body/OSHA-All-in-One-Heat-Guide.pdf

OSHA Heat Index App



When in doubt call 911…



Clothing Adjustment Factor (CAF) –

Clothing-Adjustment Factors

Clothing Type	Adjustment to WBGT (°F)
Level D - Work clothes	0
Cloth (woven material) coveralls	0
Double-layer woven clothing	5.4
SMS polypropylene coveralls (e.g. Quantum Wear)	0.9
Polyolefin coveralls (no hood) (e.g. Tyvek)	1.8
Polyolefin coveralls (with hood) (e.g. Tyvek)	3.6
Fire fighter turn out gear	18.0
Limited-use vapor-barrier coveralls (e.g. Saranex)	19.8

https://orau.org/ihos/downloads/meetings/support-files/2019/ANL_thermal-stress.pdf

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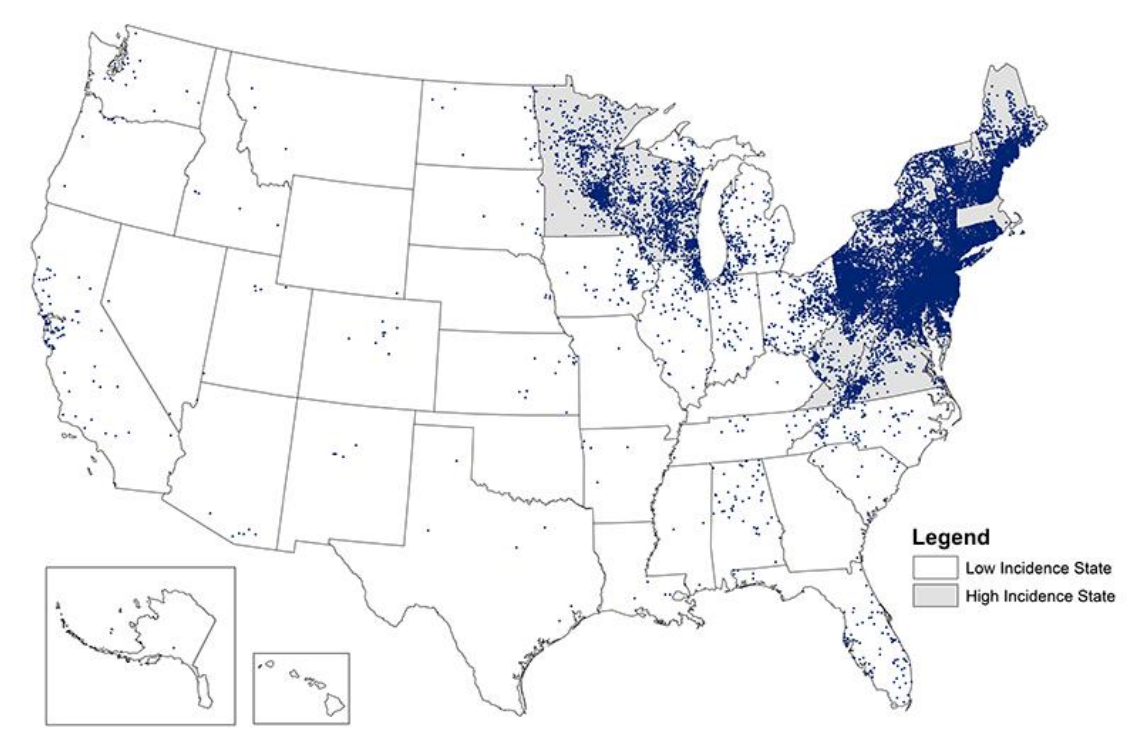
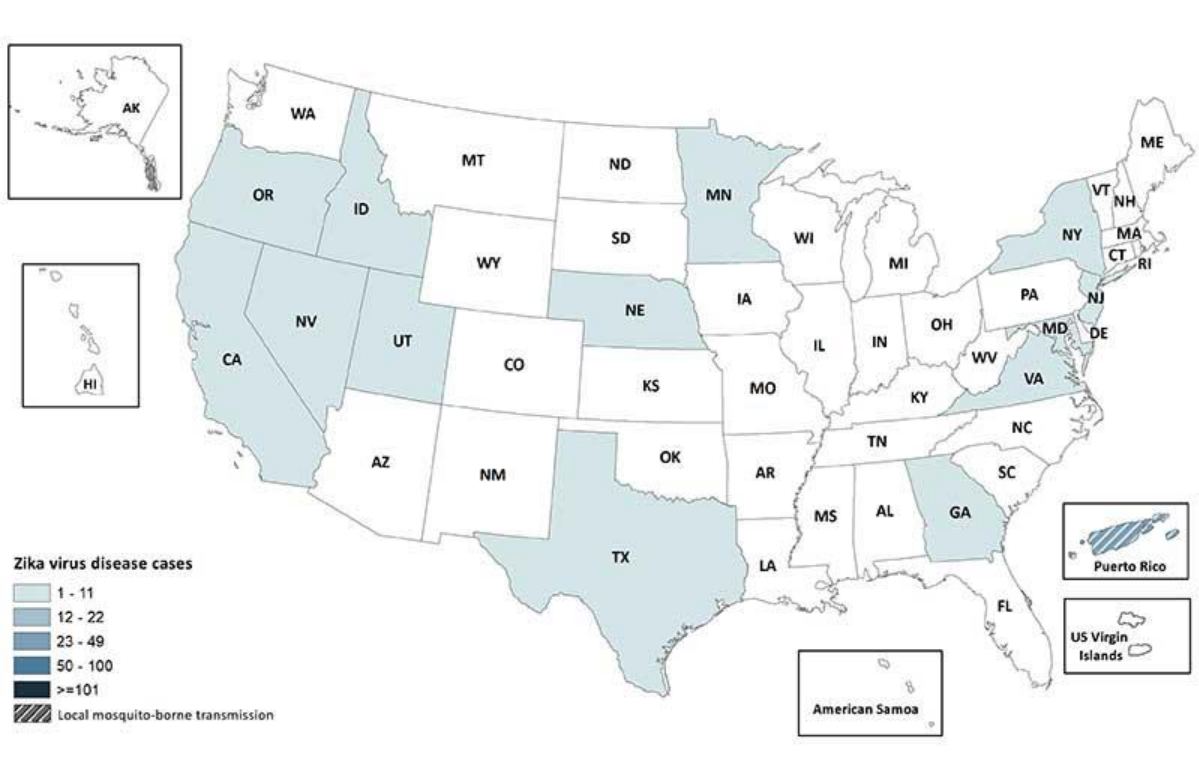
Lyme Disease Maps: Most Recent Year



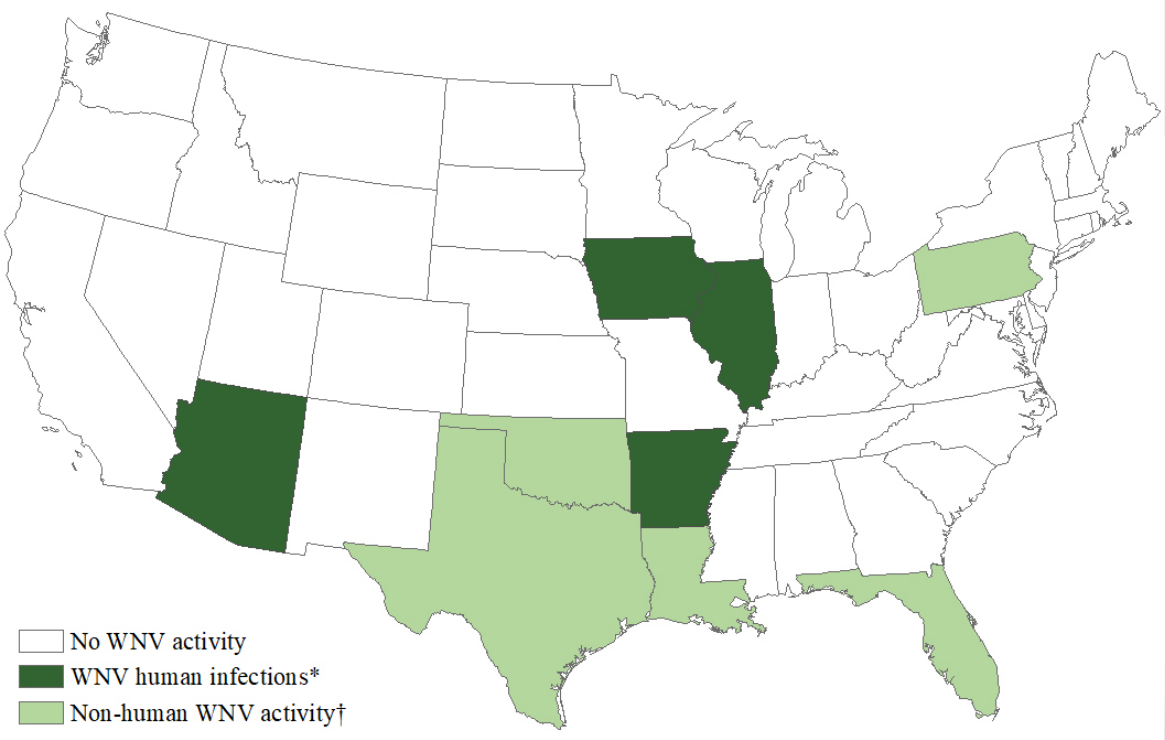
Lyme Disease Maps: Most Recent Year | Lyme Disease | CDC

Zika virus disease cases - United States, 2019



Mosquito-Borne Diseases | NIOSH | CDC

West Nile Virus Activity by State 2021



Prevention | West Nile Virus | CDC

Wear long-sleeved shirts and long pants

Treat clothing and gear

Use 0.5% permethrin to treat clothing and gear (such as boots, pants, socks, and tents) or buy permethrin-treated clothing and gear.

- Permethrin is an insecticide that kills or repels mosquitoes.
- Permethrin-treated clothing provides protection after multiple washings.
- Read product information to find out how long the protection will last.

If treating items, yourself, follow the product instructions.

Do not use permethrin products directly on skin.

Watch the video, What You Need to Know About Permethrin.

Thank You!

Questions & Discussion

Bulwark Protective Apparel

Derek Sang

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