

# Rapid Lesson Sharing

**Event Type:** Firefighter Heat Stress Study

**Date:** July 7, 2015



## KEY POINTS

### From the Firefighter Heat Stress Study

- ✓ **Hydration alone will not prevent a heat-related injury.** You need to combine hydration with good physical fitness and adequate recovery from high-heat producing physical tasks.
- ✓ Your initial hike sets your body's core temperature for the day.
- ✓ Your PPE weight (pack and tool) contributes to high physical demands and higher body temperatures.
- ✓ Performing physical tasks—such as hiking up hills—can increase your body temperature to near-critical levels.
- ✓ Physical work is our biggest producer of body heat. Breaks and appropriate levels of physical exertion are important in mitigating adverse heat related issues.

## BACKGROUND

Several important insights regarding firefighter heat stress have been spotlighted from the ongoing NWCG Wildland Fire Heat Illness Study that is being coordinated in conjunction with the Missoula Technology and Development Center (MTDC). This study has been receiving heat-related illness reports from wildland firefighters over the past several years. (Click below to download a copy of this report form [shown on right]:)

<http://bit.ly/HRIform>

The overall objective of this study is to better understand heat-related illnesses within the wildland fire environment and associated job duties. These findings will result in improved mitigation measures for protecting firefighters from heat illnesses.

Since 2013, 76 individual reports of heat-related incidents have been received. (Many others such incidents have probably been unreported.) From these reports, hiking (20 cases) proved to be the predominant activity when heat illness occurred, followed by line construction (18 cases), and mop-up (16 cases).

NWCG Wildland Fire Heat Illness Report	
<p>Complete this report for any wildland firefighter heat illness or suspected heat illness (including during any training and/or operational activities). A list of "Heat-Related Injuries" (HRI) is listed in NWCG Incident Response Pocket Guide (IRPG), pink pages. The reporting of wildland firefighter HRI is necessary to fully understand HRI within the wildland fire environment/job duties, which in turn will result in improved mitigation measures to further protect firefighters against heat illnesses. This reporting will also augment the Missoula Technology and Development Center (MTDC) Heat Illness Study. This report does not replace official accident/illness agency reporting requirements. There is NO patient Personal Identifiable Information (PII) requested within this report form.</p>	
<p><b>Submit report to:</b>            MTDC            Attn: Dr. Joe Donatovich, Heat Illness Study Program            5783 Highway 10 West            Missoula, MT 59808; or email to:            jdonatovich@fs.fed.us</p>	
Submitted by: _____	Agency: _____
Phone: _____	Email: _____
<p><b>General Information (No names please!)</b></p>	
Date of event: _____ Time: _____	Resource Type (check appropriate):
Fire/Incident Name and Location: _____	<input type="checkbox"/> SMI Rappel <input type="checkbox"/> Engine, Doser
State Where Patient(s) is/are Based: _____	<input type="checkbox"/> Helimick <input type="checkbox"/> Wildland Fire Module
Days on Current Assignment: _____	<input type="checkbox"/> HHC <input type="checkbox"/> Single Resource
	<input type="checkbox"/> Type 2 IA, Type 2 Crew <input type="checkbox"/> Other: _____
Level of Medical Treatment:	Brief description of incident: _____
<input type="checkbox"/> Crew Agency EMB/EMT	
<input type="checkbox"/> Incident Medical Unit	
<input type="checkbox"/> Local Clinic or Hospital	
<input type="checkbox"/> Other: _____	
Illness Occurred During:	Describe activities during operational period: _____
<input type="checkbox"/> Fire Operations	
<input type="checkbox"/> Training	
<input type="checkbox"/> Other: _____	
Exertion level: <input type="checkbox"/> Low <input type="checkbox"/> Moderate <input type="checkbox"/> High <input type="checkbox"/> Direct fireline <input type="checkbox"/> Indirect fireline	
<p><b>Environmental Information (day of this incident)</b></p>	
Temperature (Degrees F): _____	Fuel Model (1-13): _____
RH (%) Wind (mph): _____	
Cloud Cover (%): _____	
Sources of Heat:	<b>Fuel Models: (1-13)</b>
<input type="checkbox"/> PPE (Select all that apply):	1 Grass and grass-dominated
<input type="checkbox"/> Single layer	2 Bare grass (1 foot)
<input type="checkbox"/> Kevlar pant	3 Timber (grass and understorey)
<input type="checkbox"/> Non-kevlar pant	4 Tall grass (2.5 feet)
<input type="checkbox"/> Other PPE: _____	5 Chaparral and shrub fields
<input type="checkbox"/> Fuelline pack weight: _____	6 Chaparral (5 feet)
	7 Break (2 feet)
	8 Dorsant brush, hardwood slash
	9 Southern rough
	10 Closed timber litter
	11 Hardwood litter
	12 Timber (pine and understorey)
	13 Slash
	14 Light logging slash
	15 Medium logging slash
	16 Heavy logging slash

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**Despite adequate hydration,  
it is still possible to have  
issues in the heat.**

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More than three-quarters of these heat-related incidents occurred during the first seven days of an assignment. More than half of the heat-related incidents happened in the firefighter's home state. And, one-half transpired when the individual was in a new position in fire on a wildland fire incident.

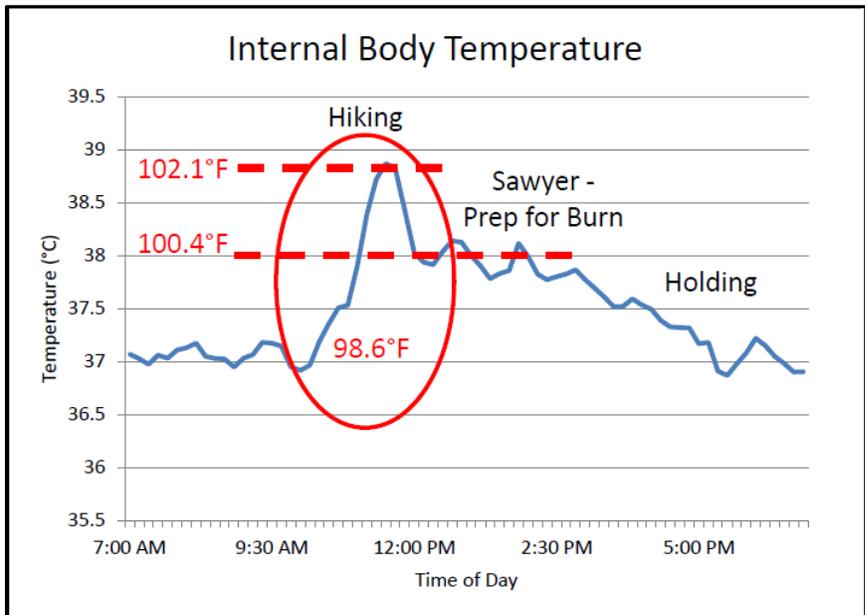
**150 FIREFIGHTERS MONITORED BY MTDC**

In an attempt to best represent the demand of the occupation and expand upon this data from the heat illness reports, nearly 150 firefighters have also been monitored throughout recent fire seasons by MTDC. Outfitted with a chest strap monitor, several clip-on devices, and having ingested an electronic thermometer capsule, entire work shifts have been recorded since May 2013. More than 60 tasks have been identified in trying to categorize activities on the line. Because firefighters are only sedentary for brief periods of time, these activities can be separated into primarily physical or non-physical activities.

**Hiking into Fire in Morning Showed Highest Physical Demands**

Only 30 percent of energy used in a muscle contraction is used for force of contraction, while 70 percent of the energy is released as heat. This underscores how physical work results in heat production. The heat produced by our bodies is what causes heat illness—when we cannot get rid of this heat fast enough.

For wildland firefighters, adding to this energy output demand is their pack weight (excluding tool weight), ranging from 35 to 51 pounds. Under this load, hiking into the fire in the morning showcased some of the highest physical demands in firefighting.



During this high-demand activity, as firefighters hike up hills, their body temperature also climbs—often reaching 102°F. Depending on the activity and environment, recovery rarely allows the individual to return to a normal temperature for the next few hours of the work shift. During this extended time period, firefighters have a diminished margin of error in battling the heat, while they battle many other margins on the fire. (See graph above.)

**Important to Maintain Low Skin Temperature**

Despite adequate hydration, it is still possible to have issues in the heat. Maintaining a low skin temperature is important in allowing heat to transfer from the body. At the same time, monitoring your activity level is crucial for keeping your internal furnace from producing excess heat.

The environment, however, can combat your ability to keep a low skin temperature. Radiant heat from the sun—very prevalent in mop-up and many other fire tasks—warms the skin and impairs the ability of your skin to release heat. In addition, high humidity conditions can reduce the wicking of moisture off your skin to release heat.

The ability to balance heat is different between individuals, and varies on a daily basis.

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**Each case is unique.**

**Only the individual truly knows if they are OK.**

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### **Signs and Symptoms**

When looking at the signs and symptoms reported on the NWCG Heat Illness forms, there is “standard” case of signs and symptoms of a heat related injury. While these common signs and symptoms (see IRPG page 103) will continue to be communicated and underscored, a crew supervisor is not going to truly know if their firefighter is OK. Each case is unique. Only the individual truly knows if they are OK.

### **Training Hikes**

Research on training hikes shows considerable increases in body temperature to near-critical levels. Periods of rest and nutrition/hydration after these hikes allow for the body to recover and adapt to the stress presented in the hike.

Self-awareness of energy, soreness, and body temperature is crucial to ensure that these hikes aren’t pushing past what is needed and to allow for adequate recovery to avoid injury. Recovery is not just a shift-to-shift concept. It is also task-to-task and even minute-to-minute recovery process.

### **REMEMBER:**

- ✓ There is more to heat stress than maintaining your hydration out there.
- ✓ The initial shift hike is a key player in resetting the body temperature for the shift. Spiking crews to reduce that initial heavy physical task could be beneficial.
- ✓ Risk management of protection with PPE and releasing body heat needs to be constantly assessed.
- ✓ If you do suspect a heat illness, stop work and begin treatment to cool down the body.

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