Fire Fighter Safety During Extreme Hot Weather

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Fire fighting is a hazardous profession. Firemen are asked to enter into dangerous situations on a regular basis and to make miracles happen. Fire fighters must be able to adapt an overcome all sorts of circumstances, and must be able to organize chaos. At times, fire fighters are required to suffer through long operational periods at large incidents, and are forced to make their bodies adapt to their surroundings. If there is a blizzard blowing through town, the fire department is still expected to respond to the emergencies and handle them as they would on a day with better weather conditions. In situations where there is an emergency at hand, fire fighters **must** respond, and often times additional precautions are necessary in order to be safe in performance of duties. Fire fighters are also required to do a substantial amount of training each year to remain current with certifications, and proficient in the many facets of the job. So the question I pose is this: Should fire fighters be out training during times of

extreme heat? Is it worth a fire fighter losing their life from heat stroke just to make sure a training evolution is completed? At what point does learning stop, and the fire fighter's body go into "survival" mode? I met with Mason Fire Chief Richard Fletcher regarding this issue, and about my feelings regarding the lack of safety in training. I will give background on the situation, about what gave rise to the concern, and about the recommended steps to help increase the safety of fire fighters who are training in extremely hot weather conditions. I will discuss humiture, heat stroke, and the irreversible effects of excessive heat on the body. I will also talk the advantages, and added safety brought about by aggressive, proactive rehab units and the role they play in this debate.

In August of 2007, the City of Mason Fire Department acquired several houses that were scheduled for demolishment in order to conduct training evolutions. The houses were prepped for the training so as to eliminate any safety hazards, and the training was to begin. The department had about a month to conduct all sorts of training exercises from ladder evolutions, to search and rescue, and eventually a live fire training day and burn down at the end of the month. Those who are from the greater Cincinnati area recall the extreme heat that plagued the area during that time. There was a span where temperatures reached nearly one hundred degrees each day for the period of about three weeks. Crews were attending the training, sometimes during the heat of the day. We all discussed our feelings on the lack of safety, and about the fact that many members of the department probably weren't fit for the training and shouldn't be there because of the risk of a serious medical situation occurring. Despite the concerns,

the training continued and it was decided by someone that the infrequence of getting an actual house to train in warranted the department training even in the hottest of conditions. I disagreed with this assessment, and still do. A training exercise was scheduled for a hot morning in August, and I was scheduled to be one of the instructors. The evolution was search and rescue, and crews were to be in full gear, SCBA, and crawl into this house in zero visibility, locate, and remove a simulated victim. Each session included a few of these types of evolutions, and then the day would be over. On this particular day, temperatures were high, probably in the mid-nineties, and humidity was high. That day, the first evolution was stopped when a fire fighter "went down" inside the training house because of exhaustion. The second evolution was stopped when a fire fighter had to be assisted out of the training house with chest pain and trouble breathing, and then was transported to the hospital. At this point, I decided action needed taken, and that this would be the safety topic of interest that needed addressed.

I did some research on the topic, and found many department policies on heat related training. I met with Chief Richard Fletcher regarding my findings, and was hoping, as the President of the Fire Fighter's Association, that my position would help the department, and the fire fighters come to some sort of agreement on how we can increase the safety during this training. Several recommendations came out of this meeting, including stopping training at a certain level of humiture, which I will discuss down below, improving rehab policies and procedures, and also ensuring fire fighters' fitness for duty prior to placing them in IDLH conditions.

Fire fighters should be fit for duty prior to ever engaging in any type of emergency, or non-emergency activity as a member of the fire department. Many fire fighter deaths each year are from heart attacks. Fire fighters should have an annual physical to help find any conditions that could potentially make them unsafe for duty, and fire departments should have physical fitness programs to help the fire fighters stay in shape. One of the most admirable of these programs is found at a department near where I work. There is a doctor who specializes in fire department physicals, and fire fighter wellness. Dr. Bill Lovett has set up a one-stop shop for these physicals and travels around to the departments he serves performing them. Fire fighters stay healthy, and if they aren't Dr. Lovett will not certify them as being capable of being on duty. The priority here is the safety of personnel, and it is certainly a best practice for a fire department to have policy in place for ensuring that their members are fit for duty. In this case, one hundred percent trust is being placed in the Dr's hands. Second, all departments should have a mandatory physical fitness training program. In Ohio, the Ohio Administrative Code states that an entity that employs fire fighters must have a mandatory, non-punitive physical fitness program for its fire fighters. In other words, you must do it, but the City or Township can't issue discipline to a person based on their performance. In the case of the City of Mason Fire Department, neither of these two above steps are being currently taken.

Fire fighters, who are working in extreme heat, are potentially susceptible to heat stroke. Persons who are performing strenuous activities in direct sunlight and hot temperatures are particularly susceptible to this scenario according to

www.medicinenet.com. A person who suffers heat stroke is suffering potentially irreversible damage and must be cooled immediately. The primary ways to prevent heat stroke are first, to remain hydrated, and second, and perhaps more importantly, to stay out of the poor climate conditions when possible. In my mind, staying out of the heat during training, and or canceling various outdoor activities fits into the group "when possible."

There is a ratio called humiture, which is found when combining the temperature with the percent of relative humidity. Humiture is essentially, "how hot it feels," outside on any given day. The concept of dry heat best illustrates humiture. When the temperature is high and the relative humidity is low, it does not feel as hot outside as a day when both the temperature and the humidity are high. How hot it feels, and how high the humiture is going to be directly proportional to the effect that the heat has on the bodies of the fire fighters who are working in these conditions. The following is a chart on humiture, and gives a good perspective of just how hot it is when both the temperature and the relative humidity are high. In the Ohio Valley, in the summer time, this is a fairly common occurrence. Note, on a day when the temperature is one hundred degrees Fahrenheit, and the relative humidity is sixty percent, the humiture is over one hundred thirty degrees. It is my estimate that on the particular training day, the humiture was somewhere between one hundred twenty, and one hundred thirty degrees.

Temperature + Humidity = Humiture (How hot it feels)
Relative Humidity %

		10	20	30	40	50	60	70	80	90
T	**104**	98	104	110	120	132				
e	**102**	97	101	108	117	125				
m	**100**	95	99	105	110	120	132			
p	**98**	93	97	101	106	110	125			
e	**96**	91	95	98	104	108	120	128		
r	**94**	89	93	95	100	105	111	122		
a	**92**	87	90	92	96	100	106	115	122	
t	**90**	85	88	90	92	96	100	106	114	122
u	**88**	82	86	87	89	93	95	100	106	115
r	**86**	80	84	85	87	90	92	96	100	109
e	**84**	78	81	83	85	86	89	91	95	99
	82	77	79	80	81	84	86	89	91	95
o	**80**	75	77	78	79	81	81	85	86	89
	78	72	75	77	78	79	80	81	83	85
F	**76**	70	72	75	76	77	77	77	78	79
	74	68	70	73	74	75	75	75	76	77

Now what does humiture mean to the fire department? Fire departments must sometimes subject their fire fighters to extreme heat conditions through the fact that they must respond to emergency runs. We will talk about how to best address these situations in later paragraphs. However, during training, and other non-emergency activities, fire departments should have a standard operating procedure in place that requires the cessation of training activities and other non-essential functions when the humiture is over a certain temperature. The United States Military has policies on when to cease training, why shouldn't the fire department? After reading through several policies related to training in inclement weather, it was determined that the generally acceptable humiture to stop all outdoor physical activities is 105. If the training or activities are

strenuous, the humiture that is the limit is 95. Policies reviewed include everywhere from F.D.N.Y. who uses a flag system to identify when the temperature is too high and places a time limit on outside activities, to the U.S. Federal Fire Department stations who operate on bases in Texas and New Mexico in the desert. Montgomery County Maryland's Policy is the policy that we utilized for our new guideline on the specific limits for various outdoor activities.

In addition to the policies referenced above, Chief Fletcher and I reviewed NFPA 1403, which gives specific direction to have policies about when to cease training during extreme heat conditions. The NFPA does not give a specific number as a recommendation on when to stop the outdoor activity, but it does require that a department have a policy regarding the issue. For all the above reasons, we felt it was imperative to put this into place, and we did.

As I mentioned above, there are some times when fire fighters must go out into the heat to perform various duties. The runs still come in even when it's a hundred degrees outside, and we still must go and mitigate the various situations. The best solution for a fire department to help its people stay safe is through the creation of, and the following of rehab policies that are proactive and aggressive.

There are many ways that the responder rehab component of the emergency services gets viewed. Some people view it as a place for the old squad folks to go and to wait until the fire fighters come to take a break. Some departments view it as a medical issue where they keep detailed records of the vital signs of the fire fighters, and actually have policies that prohibit the continuance of duties for people who are not within a certain range. I view rehab

as a combination of all views. Best practices would be for a department to have some policies about when people go to rehab, have a policy on the documentation of their condition while at rehab, and will have a policy on what happens when someone is sick or injured on the fire scene. Rehab is a place where fire fighters must go, and rest, so as to lower the strenuous nature of the job on the body. NFL players sit on the sideline, take oxygen, have IV's placed in them at half-time, and do all sorts of other things to prepare for the next series out on the field. And come to think of it, there's no fire for them, no people trapped, and they get to breathe their own air and not the air out of a tank strapped to their back. What is wrong with fire fighters doing the rehab thing religiously also? It's pride. Fire fighters don't want to sit down and rest, they might get looked upon as inferior if they do. They might not feel as macho as they think they need to. For this reason, it is the responsibility of the department before the fire, and of incident command at the fire to ensure that the people are well rested, and ready to continue. NFPA 1561 feels the same way. It states a department should have standard operating procedures to provide for a systematic approach to fire fighter rehabilitation. National Fire Protection Standard 1584 is the rehab guideline. The very first part states that department members should be familiar with the SOP's related to rehab.

How often do departments set up rehab…specifically, our department is the question Chief Fletcher and I discussed. And is rehab something that only should be set up on the structure fire, or should we have a formalized and systematic approach to rehab at the training fires that we do? Our finding is that

rehab is not done very well in this area. People ignore the necessity for it, and there has never been an incident where it was really needed, not done, and something bad happen as a result. A few months prior, I went to Baltimore, MD to the Fire Expo and was part of a live burn training where Morning Pride had their Kore Kooler Rehab chairs. This product is based off some scientific research done by the Canadian navy that says the best way to cool someone off is to immerse their arms in cooler water. The chairs are like a basic camping chair, and have reservoirs on the sides of them to place your arms under the water. The chairs worked well, and I noticed that the people there were very receptive to them. I asked Perry Denehy to come to the live fire training with a few of these chairs, and to assist us with rehab. When he did this many people on the department took an interest to the chairs, and helped to realize the importance, and the added value of taking a break, and truly letting your body cool down in an effective way. At this point, we in Mason decided to purchase a few of these chairs and use them regularly on the fires.

In addition to cooling the body off, it is important for fire fighters to be sure and replenish body fluids lost during hot weather activities, and for that matter during all times of extreme physical exertion. Rehydration is important for many reasons to the fire fighter. For one, it restores some of the decreased fluid volume and assists with some of the effects of hypovolemia. If the fire fighter does not rehydrate, valuable nutrients will not flow into the muscles as well, and the body will continue to starve for water. The fire fighter may have to suffer through headaches, cramps, and other sometimes more serious symptoms because

they are not properly rehydrated. There are many different ways people consider rehydrating themselves, and I will make the blanket statement that as a whole, the fire service, and people in general are not well informed about how to properly rehydrate after rigorous activity. There has been a substantial amount of information published on what the most effective ways for a person to replenish fluid is, and the general consensus is that simply guzzling water or other drinks following a workout is not the best way to accomplish the replenishment of body fluids. Sports drinks are of a benefit because they replace electrolytes, and generally drinks that are higher in sodium work well because they help the absorbtion of water. There is an excellent website that discusses some of this research: http://www.pponline.co.uk/encyc/0138.htm. There are also many other online sources including www.firerescuerehab.com, and www.medicinenet.com. I encourage anyone to evaluate this information and to look into your department operations as to what you will do to help keep your people well hydrated on emergency scenes. It is apparent that just plain water may not be enough and may not provide the optimum level of safety for our personnel.

Another way to help enhance the rehab was to educate the members on the effects on the body when it is not given a break, and specifically the heat's effect on the body. Studies have concluded that stroke volume, or the amount of blood that the heart discharges with each pump decreases during times of intense activity in heat conditions. This creates a potentially dangerous situation for those who overdo things. Once the value, and the safety aspect of the rehab was trained

to the folks, people were much more cognizant of the importance of being careful in the heat during times when we are forced to be in it.

Fire fighting operations during hot weather conditions can be very hazardous to personnel. Departments must have a multifold approach to effectively minimize this risk to their people, and must continuously remember the dangers associated with the heat. All departments should make sure their people are in shape, and ready to perform the job, departments should have policies in place limiting outdoor activities during non-emergency activities, and then when they are forced to go out into the heat, the department must take steps to ensure an aggressive and proactive rehab component to the command structure. There is no excuse for a department to not take the above steps to help promote the safety of their personnel each and every time they walk through the door to go to work.