

Lessons Learned



Angeles National Forest June 8, 2014

Heat-related illness; Interagency Hotshot Crew (IHC) crewmember

“Hey Cap. I’m callin’ it! [The crewmember] needs to go to the hospital.” — EMT rendering aid to crewmember.

Chain of events:

Note: Italicized remarks indicate pertinent information regarding actions taken by the crewmember with the heat-related illness.

Weather @1400: High 88°, RH 39%, South Aspect

0830 On June 8, 2014, we returned to work after our days off and were getting started with our day. Shortly after the raising of the flag, the crew got ready for our physical training (PT) hike.

0845 The crew stretched, geared up, lined out, and started the hike up the Colby/Garcia Trail. The sawyers and swampers were carrying saws, as they typically will do. The rest of the crew carried hand tools. Drivers drove to the top of the trail and geared up to hike down to support the crew push up the trail.

The crewmember in question is currently on a saw team and carried a chainsaw on the PT hike. Crewmember was on a saw team the previous year as well.

0930 We all arrived at the top; a few crewmembers had a rough time and were fatigued. After the PT, the overhead planned to run a medical simulation for training before completing line construction training.

Crewmember drank his entire Camelback of water, 100oz.

0940 We started our medical simulation. We identified two role-playing patients that were suffering from heat-related illness, and two observers to take notes. The remaining crew was to handle the simulation as if it was real.

Crewmember was one of the runners that retrieved the medical equipment from the crew carriers that were parked about 600 feet away, down a slight grassy slope, and back up. A relay of equipment back up was done.

1030-1130 We cleaned up and got all of our gear and equipment fire ready, which included topping off all water, then gathered around and started the After Action Review (AAR). We discussed the PT hike and the medical simulation. During this time each crewmember drank a Gatorade and water.

Crewmember drank a Gatorade and a bottle of water during the A.A.R.

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1145 The crew loaded up, and we drove to the designated location for line construction. The crew was told to grab some food and pack their lunches before we started our line construction.

During the drive the crewmember drank another Gatorade and ate a peanut butter and jelly sandwich.

1200-1215 The crew geared up, lined out, and we started a five-minute hike up a ridge. At the top we stopped and gave a quick briefing, and then we hiked another five minutes down another ridge to the designated area for line construction.

1215-1225 The overhead conducted a briefing, and we started line construction. The line specs were 8 and 2: an 8-foot wide cut, and a 2-foot wide scrape to mineral soil with trenches. For this training we were in our actual tool configuration. We ran three saw teams, and the remaining crewmembers were scrapers for the line dig.

1225-1350 The saw teams began cutting line. Initially, we were running three saws, but about five minutes into it, the third saw was having mechanical issues and shut down. This left the other two saw teams to complete the line. A crew captain was working closely with the two saw teams.

Crewmember initially was a swamper for a tank (until the saw runs out of fuel; then the team will swap duties). During the first tank of fuel, the crewmember's team threw a chain off the bar and took about two minutes to put the chain back on, during which time the crewmember rested. The crewmember's team started cutting once again until the saw ran out of fuel. The team refueled, and now the crewmember was the sawyer or chainsaw operator. The crewmember ran the saw until it was out of fuel. At this time the crewmember and his partner refueled the saw and shared a Gatorade. Now the crewmember was again the swamper. Shortly after the saw team started cutting again, the captain working with the saw teams noticed the crewmember was fatigued and was drinking consistently from his camelback, and asked what was up. Crewmember told the captain that running the saw fatigued his shoulders. The captain said OK, take a minute, and fire up when you're ready. Then the captain asked the swamper from the saw team with the non-operable chainsaw to help with the swamping. The saw teams completed another five minutes of cutting, and the line cutting was complete. All the saw teams were told to come up to the ridge while the scrapers completed the line dig. A few of the saw team members voluntarily joined in with the remaining work. The crewmember and his saw partner sat on the ridge and ate Gu Chomps energy chews, which have a blend of carbohydrates and electrolytes.

1410 Due to the non-operable chainsaw and time of day, the crew leadership decided to call it and head back to the station. The crew lined out and started to hike up the ridge back to the trucks. Once we started hiking, the crewmember fell out of the front of the line, and the captain that was working with the saw team stopped and asked what was wrong. *The crewmember said his quads were cramping.* The captain asked an EMT(1) who was right behind him in line to take a look at the crewmember. At this time the rest of the crew hiked back to the crew trucks. The EMT(1) assessed the crewmember and both were able to make it back to the crew trucks about five minutes behind the rest of the crew. The crew got fire ready and topped off their waters and drank Gatorades.

During the hike back there were a few breaks due to the crewmember's cramping. Another crewmember carried the crewmember's pack back to the vehicles. The crewmember's camelback was completely empty.

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1430-1510 The crew loaded into the vehicles and drove back to the station. The crewmember and EMT (1) were on the same module, and there was a constant assessment of the crewmember. Sitting next to the crewmember was another EMT (2). During the drive back to the station the EMT (1) notified the captain that the crewmember's cramps were getting worse. Shortly after the update the EMT (1) said "Hey, Cap. I'm callin' it! [The crewmember] needs to go to the hospital." The captain said, "OK, I'll notify the superintendent, and we'll make it happen."

1510 The crewmember's module arrived back at the station. The captain went to notify the superintendent about the crewmember. Assuming the crewmember was suffering from an elevated body temperature due to heat-related illness, a squad boss pulled a hose over to a large ice chest filled with ice to fill it with water so the crewmember could submerge his arms to reduce his body temperature. EMTs (1)&(2) were recording vital signs from the crewmember. Assisting crewmembers helped the crewmember get his arms into the ice chest. The crewmember tried to keep his arms in the ice chest, but it was difficult because it was painful due to the cramping in his back, a little awkward, and was not a position of comfort for him. At this time, the crewmember's temperature was taken with a temporal thermometer and his temperature was 96.7 (normal body temperature is 98.6). Realizing that the crewmember's body temperature was not the problem, the EMT (1) said, "He may be too far along for the submerging to help. The submerging was not effective. [His] cramping has not improved, and seems to be getting worse." The superintendent and captain realized they were not going to be able to transport the crewmember, and that immediate action was required.

1520 The crewmember's captain notified the Emergency Communications Center that the crew had a medical emergency, heat-related illness, and requested Los Angeles County Fire to respond, and handled the response with dispatch as the incident commander. The superintendent notified the district division chief, who in turn notified the district ranger.

1530 Los Angeles County Fire and ambulance arrived at the station, as well as the division chief. At this time, County Fire began patient assessment of the crewmember, and care of the crewmember was transferred to County Fire. The County paramedic asked if the crewmember wanted to go the hospital and the crewmember said no. The crewmember's captain said, "I want [the crewmember] to go," and the paramedic said, "I guess you're going to the hospital."

1540 The crewmember was transported to the hospital. A squad boss who is an EMT went with the crewmember in the ambulance to the hospital.

Crewmember:

- Had three days off prior to heat-related illness.
- Had three healthy meals each day all weekend, and a healthy breakfast on the day of the heat-related illness.
- Does not consume coffee or energy drinks.
- Did not consume any alcohol the day before; is a social drinker on days off.
- Does not take pre-exercise supplements.
- Has no history of heat-related illness.
- Is not on any medication.

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Medical evaluation and treatment:

The crewmember was initially treated for hyponatremia (abnormally low blood sodium) and heat cramps. A blood test was done, checking sodium levels and kidney function. A Creatine Phosphokinase (CPK) test was also preformed.

- Hyponatremia is the severe imbalance of water to salt. Sweat contains a large amount of sodium, and drinking water and not enough fluids with electrolytes may result in hyponatremia.
- CPK, potassium phosphate, and myoglobin are all measured in separate tests. CPK it reflects the level of muscle-tissue cell damage/death. Blood is typically drawn for patients complaining of chest pain/discomfort to rule out a heart attack. It is not typically drawn for a firefighter complaining of leg cramps. Heat cramps are often associated with standard dehydration, so a CPK test is not always ordered. Potassium phosphate is a standard hospital emergency department test. Elevated potassium levels in the blood (hyperkalemia) can result from cell damage, which can cause lethal cardiac arrhythmias. However, not everyone with elevated CPK levels due to rhabdomyolysis will have elevated potassium levels. (Rhabdomyolysis is a serious syndrome caused by a direct or indirect muscle injury. It results from a breakdown of muscle fibers and release of their contents into the bloodstream.) CPK enzyme testing is crucial. Myoglobin is the substance that clogs up the kidneys causing acute renal failure. In some cases of rhabdo, chronic renal failure has occurred. Myoglobin levels are not usually assessed unless CPK and renal panel are abnormal.

The squad boss asked the nurse treating the crewmember if the crewmember was tested for rhabdomyolysis. The nurse said the crewmember didn't need to be tested for that. The squad boss was persistent and repeatedly asked for the test, which was later completed. The Primary Care Physician (PCP) discussed the results of the tests with the crewmember and the squad boss and notified them that the test for rhabdomyolysis was completed. The PCP said the crewmember's blood had substantially low sodium levels, and the crewmember did not have rhabdomyolysis. The low sodium levels were likely caused by excessive sweating and not replenishing his electrolytes. The crewmember was treated and released the same day, was to take the next day off, and had a follow-up appointment two days later.

On June 10, at the follow-up appointment, the crewmember underwent a blood test, checking for sodium levels, kidney function, and CPK. Tests results showed that the crewmember had a mild case of rhabdomyolysis. The crewmember was instructed to continue drinking plenty of fluids, abstain from physical activity, and get plenty of rest.

At the third follow-up appointment, on June 12, another blood test and CPK test were completed. The results were normal and the crewmember was released to full duty.

Lessons Learned

Documents cited, and support the recommendation to request a CPK test:

- National Wildfire Coordinating Group, 2011 – Rhabdomyolysis Epidemiological Study Results and Recommendations
- John J. Walsh, MD and Steven M. Page, MD. Rhabdomyolysis and Compartment Syndrome in Military Trainees
- Journal of the American Society of Nephrology – Rhabdo (see exertional rhabdomyolysis section for detailed understanding of the pathophysiology)

Lessons Learned :

- Know yourself and know each other. Each person must monitor their water and sports drink intake. Supervisors must ensure all crewmembers are getting adequate electrolyte replacement.
- Recognize fatigue and take action early, before it can lead to a heat-related illness. This may require taking breaks due to environmental conditions.
- Do not count on observing classic heat-illness symptoms; patient may not present the symptoms you have been trained to look for.
- The patient is not the one who decides if he or she goes to the hospital. It is the decision of the first responder, EMT, or higher-ranking individual, due to the nature and/or severity of the injury/illness and/or agency protocol.
- If employees are treated for heat-related illness, the treating facility should be asked to check for rhabdomyolysis. The patient's representative must insist that CPK, potassium phosphate, and myoglobin tests are done initially and on the follow up appointment.