

# GREEN SHEET

## California Department of Forestry and Fire Protection (CAL FIRE)

### Informational Summary Report of Serious CAL FIRE Injuries, Illnesses, Accidents and Near Serious Incidents



**FAE Suffered from Rhabdomyolysis**

**May 1, 2015**

**15-CA-MVU-008881**

#### **California Southern Region**

A Board of Review has not approved this Informational Summary Report. It is intended as a safety and training tool, an aid to preventing future occurrences, and to inform interested parties. Because it is published on a short time frame, the information contained herein is subject to revision as further investigation is conducted and additional information is developed.

**Lookouts**

**Communications**

**Escape Routes**

**Safety Zones**

## **SUMMARY**

On Thursday, April 3, 2015, the San Diego Unit (MVU) was conducting a vegetation management plan (VMP) burn along Highway 94 and Rancho Jamul Dr. In conjunction with the VMP, the training bureau was providing a C234 Intermediate Firing Methods class with approximately 22 students from MVU. The class was completed at approximately 1700 hours, and all of the students and equipment were released. At approximately 1800 hours, a CAL FIRE fire apparatus engineer (FAE1), who was a student in the class, returned to their assigned fire station to complete their regular shift. At approximately 1930 hours, FAE1 experienced muscle fatigue and cramping in both arms. FAE1 was evaluated by a physician the following morning at Sharp Rees Stealy occupational medicine. FAE1 was admitted to Palomar Hospital and was subsequently treated for rhabdomyolysis.

## **CONDITIONS**

Weather conditions on the day of the Intermediate Firing class were mostly sunny with a max temperature of around 91 degrees with relative humidity of 15%. Winds were west 3 -5 MPH becoming 8 –12 MPH by 1200 hours. The area of the burn was relatively flat consisting of annual grasses.

## **SEQUENCE OF EVENTS**

Beginning April 20 through April 23, 2015, FAE1 attended a four day “C” faller chainsaw class. The class consisted of one day classroom and three days field training. The field training consisted of falling, limbing and bucking. FAE1 experienced upper forearm muscle cramping to both arms on the first day of the field training. Subsequent field days employee experienced no pain. Following the “C” faller course, employee returned home for a period of three days with no significant physical activity. On April 27, FAE1 returned for an overtime shift with no significant physical activity, but did experience limited sleep due to multiple emergency responses during the night.

On April 28, FAE1 worked a second overtime shift and participated in an arduous upper body workout. This workout consisted of high repetition, limited rest cycle involving the upper body with targeted areas of the shoulders, back and arms. FAE1 hadn't participated in this type of physical activity in the last 30 days. FAE1 experienced muscle soreness and fatigue consistent with this type of arduous physical activity. FAE1 received four hours of sleep due to a nighttime emergency response.

On April 29, FAE1 returned to their normally assigned station for the beginning of a three day shift. At approximately 1000 hours, the station crew participated in routine hike of approximately 1.5 miles in length with varying slope and elevation. The temperature during the hike was approximately 90 degrees. The entire crew noted above normal perspiration for their hike. The evening of April 29, FAE1 had difficulty falling asleep and obtained approximately six to seven hours of sleep.

On April 30, FAE1 attended a C-234 Intermediate Firing Methods class. The weather conditions were mostly sunny with a maximum temperature of 91 degrees and relative humidity of 15%. Winds were light out of the west 3-5 MPH. The area of the burn was relatively flat consisting of annual grasses. A tailgate safety briefing was conducted by the instructors detailing the necessity for hydration, caloric intake and rest. Shade and hydration were provided at the training site. Multiple breaks were held over the course of the training day. The safety officer monitored all personnel for hydration and heat related illnesses. FAE1 rotated through multiple firing evolutions with breaks in between. At approximately 1500 hours FAE1 had completed their final training evolution. At this time FAE1 experienced muscle fatigue in the arms and general weakness throughout the body but didn't report the symptoms. FAE1 returned to their normal duty station at approximately 1800 hours. FAE1 continued to experience muscle fatigue and cramping in the arms. Following dinner, FAE1 observed dark color urine and proceeded to notify the direct supervisor of the symptoms noted. The following morning, FAE1 was driven to an occupational medicine facility for further evaluation. The occupational medicine facility released FAE1 to their residence pending laboratory blood tests results. FAE1's laboratory blood tests revealed high level of enzyme called creatine kinase (CK) which initiated immediate follow up with the nearby emergency department. FAE1 was subsequently treated and monitored for rhabdomyolysis in a hospital setting for a total of four days receiving treatment for rhabdomyolysis. FAE1 was released and referred to an occupational medicine facility for follow up care. During the timeframe encompassing the faller class through the release from the hospital the employee maintained a healthy, balanced food intake and sufficient hydration.

### **INJURIES/DAMAGES**

FAE1 was hospitalized for four days for treatment related to rhabdomyolysis. Many things can trigger rhabdomyolysis. Anything damaging the muscles can cause rhabdomyolysis. Rhabdomyolysis is a potentially life-threatening condition occurring as a result of muscle breakdown and body fluid shifting brought on by excessive exercise or extreme physical exertion. The breakdown of muscle tissue leaks cellular chemicals into the blood vessels that can potentially result in renal failure. Rhabdomyolysis is always triggered by muscle injury. An injury can be caused by physical means (crushed by weight, starved by blocked blood vessel) or by chemical means (toxins, heat, or drugs). The breakdown products when muscle is damaged include a protein called myoglobin. Myoglobin is related to hemoglobin; both are proteins in the body. Hemoglobin transports oxygen in the blood, myoglobin stores oxygen in muscles. When myoglobin is released into the blood after muscle injury, it is filtered out of the body by the kidneys. Since myoglobin is toxic to the small tubules of the kidneys, high levels of this protein can damage the kidneys and may result in acute renal failure. The laboratory test for rhabdomyolysis is an analysis of drawn blood for levels of total creatinine kinase (CK) or creatinine phosphokinase (CPK). A normal laboratory value for serum CPK is normal range is 22 to 198 U/L (units per liter). People may have CK levels significantly increased depending upon muscle damage severity. Those who

have rhabdomyolysis may have CK levels 100 times normal levels. FAE1 was found to have CPK levels of 67,000 U/L.

### **SAFETY ISSUES FOR REVIEW**

Review CAL FIRE Handbooks related to the CAL FIRE Exercise Program (Handbooks Health and Fitness 1831-1838). When planning a workout routine, keep total activity in mind and consider work demands in addition to physical fitness activities. High repetition, highly dynamic workouts have their place in an overall fitness regimen, but the high physical demands of the workplace require some amount of functional reserve in order to perform effectively. Additionally, the amount of sleep, or lack of sleep, must be considered as a factor when planning physical activity and exercise. Due to the prolonged exertion wildland firefighters may undergo, during training and fire response activities, we are at increased risk for rhabdomyolysis. Carrying heavy loads (e.g., pack weights up to 110 lbs) across steep terrain, heat stress, and dehydration are exacerbating factors encountered by firefighters as they do their job. Recently, several cases of rhabdomyolysis have been diagnosed in wildland firefighters with some becoming permanently disabled.

These signs and symptoms are common with rhabdomyolysis:

- Muscle pain, especially in the shoulders, thighs or lower back
- Muscle weakness or trouble moving arms or legs
- Abdominal pain
- Nausea or vomiting
- Fever, rapid heart rate
- Confusion, dehydration, fever, or lack of consciousness
- Dark red or brown urine; reduced or no urine output

If an employee experiences any of these signs or symptoms it is imperative that these are reported promptly to their immediate supervisor in order to arrange for medical evaluation and care. Drink lots of water following strenuous exercise and activity to prevent rhabdomyolysis. Water assists with flush myoglobin from the kidneys and dilutes your urine. Hydration is also central to the treatment of rhabdomyolysis. Fluids may be delivered intravenously, depending on the severity of the condition. Kidney dialysis may also be administered in individual cases. Medications such as diuretics and bicarbonates are included as part of a treatment plan in some cases. If you develop rhabdomyolysis, the prognosis depends on the extent and severity of your symptoms. Prompt medical attention improves your chances of restoring your renal function completely. Clinicians should have a high index of suspicion for rhabdomyolysis in wildland firefighters who present for treatment for heat stress and dehydration, muscle pain, or exercise intolerance. A serum creatine phosphokinase (CK or CPK) should be performed in wildland firefighters to ensure early diagnosis so that aggressive treatment can start as soon as possible. Urinary dipsticks to check for myoglobin in the absence of red blood cells are not an accurate screening tool for rhabdomyolysis. Only a serum CPK can confirm or exclude this diagnosis routine urine dip test is not sufficient. Treating physician should be presented with a copy of the NWCG Rhabdomyolysis in

Wildland Firefighters document (Appendix A) to ensure the provision of proper medical examination and care.

### **Supervisors and Managers**

- Ensure all personnel understand the necessity for hydration, nutrition and rest.
- During training exercises provide for sufficient water, electrolyte replacement, nutrition and shade.
- Monitor personnel for signs of heat stress.
- Ensure proper rest/ work cycle and adjust to environmental conditions.
- Encourage employees to report pain, injury, illness or unusual symptoms early and provide care as necessary.
- Discuss exercise habits and the need to maintain functional reserve for job performance.

### **INCIDENTAL ISSUES/LESSONS LEARNED**

- Drink lots of water during, and following, strenuous exercise / activity to assist in the prevention of rhabdomyolysis.
- If an employee experiences any abnormal symptoms or injury, it is imperative these are reported promptly to their immediate supervisor.
- When planning a workout routine, keep total activity in mind and consider work demands in addition to physical fitness activities.
- Clinicians should have a high index of suspicion for rhabdomyolysis in wildland firefighters who present for treatment for heat stress and dehydration, muscle pain, or exercise intolerance.
- Urinary dipsticks to check for myoglobin in the absence of red blood cells are not an accurate screening tool for rhabdomyolysis. Only a serum CPK can confirm or exclude this diagnosis routine urine dip test is not sufficient.

### **References**

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## Appendix A

### RHABDOMYOLYSIS IN WILDLAND FIREFIGHTERS

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Rhabdomyolysis can have deadly and debilitating consequences if not correctly identified in a timely manner. The symptoms of rhabdomyolysis can mimic those of heat stress and dehydration.

### SHARE THIS WITH YOUR HEALTHCARE PROVIDER

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Due to the prolonged exertion wildland firefighters may undergo during training and fire response activities, they are at increased risk for rhabdomyolysis. Carrying heavy loads (e.g., pack weights up to 110 lbs) across steep terrain, heat stress, and dehydration are exacerbating factors encountered by firefighters as they do their job. Recently, several cases of rhabdomyolysis have been diagnosed in wildland firefighters with some becoming permanently disabled.

Clinicians should have a high index of suspicion for rhabdomyolysis in wildland firefighters who present for treatment for heat stress and dehydration, muscle pain, or exercise intolerance. A serum creatine phosphokinase (CK or CPK) should be performed in wildland firefighters to ensure early diagnosis so that aggressive treatment can start as soon as possible. Urinary dipsticks to check for myoglobin in the absence of red blood cells are not an accurate screening tool for rhabdomyolysis. Only a serum CPK can confirm or exclude this diagnosis.

Help keep our wildland firefighters safe by asking all patients about their work. Have a high suspicion for rhabdomyolysis among those who are wildland firefighters.



Health Hazard  
Evaluation Program

