



# The Safety Corner

From the Marine Corps Center for Lessons Learned  
February 15, 2008



This issue of the Safety Corner highlights High Altitude Sickness.

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**From the Director:** No matter what the season, the weather changes quickly in the mountains; skies can go from sunny blue to dark and stormy in minutes. Whether you're getting ready for a ski trip to the Pocono's, or conducting operations in support of the Global War on Terrorism, Marines and Sailors must be prepared to adjust quickly to change.

At high altitudes, you must be able to perform your duties without excessive fatigue and often under cold and dangerous conditions. The lack of oxygen can cause debilitating effects on the body, fatigue, headaches, shortness of breath, loss of appetite, and nausea. Even the most physically fit can be affected by altitude sickness. Your fitness will enhance your ability to keep pace in the mountains, but it's how your body reacts to the thinner air that will determine your tolerance to high altitude.

There is not much you can do to prevent this problem, but there are ways to minimize the effects of operating in high elevations. Your knowledge, training, equipment, hydration, and physical condition will be your keys to success in high elevation operations. Prioritize safety and make sure you are knowledgeable on the symptoms of High Altitude Sickness.

You are welcome to pass on and post this newsletter for widest dissemination. Log on the [www.mccl.usmc.mil](http://www.mccl.usmc.mil) to download previous editions of the Marine Corps Center for Lessons Learned Safety Corner as well as our Monthly Newsletters. I look forward to your comments and feedback so we can raise awareness, reduce risk and maintain a high level of readiness. Use this information for awareness and training. Always seek competent medical care if you believe you or one of your Marines or Sailors is being affected by altitude sickness.

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## What is High Altitude

Source: <http://www.princeton.edu/~oa/safety/altitude.shtml>

### Altitude is defined on the following scale

**High:** 8,000 - 12,000 feet  
**Very High:** 12,000 - 18,000 feet  
**Extremely High:** 18,000+ feet

There are no specific factors such as age, sex, or physical condition that correlate with susceptibility to altitude sickness. Some people get it and some people don't, and some people are more susceptible than others. Most people can go up to 8,000 feet with minimal effect. If you haven't been to high altitudes before, it's important to be cautious. If you have been at higher altitudes before with no problem, you can probably return to that altitude without problems as long as you are properly acclimatized.

**Acute Altitude Sickness is believed to result from changes in the body's responses to lowered levels of oxygen and air pressure changes.**

## What Causes Altitude Illnesses

Source: <http://www.princeton.edu/~oa/safety/altitude.shtml>

The concentration of oxygen at sea level is about 21%, and the barometric pressure averages 760 mmHg. As altitude increases, the concentration remains the same but the number of oxygen molecules per breath is reduced (at 12,000 feet, there are roughly 40% fewer oxygen molecules per breath). In order to properly oxygenate the body, your breathing rate (even while at rest) has to increase. This extra ventilation increases the oxygen content in the blood, but not to sea level concentrations. Since the amount of oxygen required for activity is the same, the body must adjust to having less oxygen. In addition, for reasons not entirely understood, high altitude and lower air pressure causes fluid to leak from the capillaries which can cause fluid build-up in both the lungs and the brain. Continuing to even higher altitudes without proper acclimatization can lead to potentially serious, even life-threatening illnesses.

The observations and recommendations contained in The Marine Corps Center for Lessons Learned (MCCLL) Safety Corner represent the considered judgment of Marines who have identified safety issues in their units. The purpose of this newsletter is to apprise other Marines of these safety recommendations and to encourage them to enter their own lessons into the Marine Corps Lessons Management System (LMS).



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You never truly appreciate the ability to breathe until you can't. Breathing takes on a whole new importance at high altitude.

### Types of Altitude Illnesses

Source: <http://www.princeton.edu/~oa/safety/altitude.html>

#### Acute Mountain Sickness (AMS)



AMS is common at high altitudes. At elevations over 10,000 feet (3,048 meters), 75% of people will have mild symptoms. The occurrence of AMS is dependent upon the elevation, the rate of ascent, and individual susceptibility. Many people will experience mild AMS during the acclimatization process. Symptoms usually start 12-24 hours after arrival at altitude and begin to decrease in severity about the third day. The symptoms of mild AMS are headache, dizziness, fatigue, shortness of breath, loss of appetite, nausea, disturbed sleep, and a general feeling of malaise. Symptoms tend to be worse at night and when respiratory drive is decreased. Mild AMS does not interfere with normal activity and symptoms generally subside within 2-4 days as the body acclimatizes. As long as symptoms are mild and only a nuisance, ascent can continue at a moderate rate.

#### Basic Treatment of AMS

The only cure is either acclimatization or descent. Symptoms of mild AMS can be treated with pain medications for headache and with medicine available by prescription. Both help to reduce the severity of the symptoms, but remember, reducing the symptoms is not curing the problem.

#### Moderate AMS

Moderate AMS includes severe headache that is not relieved by medication, nausea and vomiting, increasing weakness and fatigue, shortness of breath, and decreased coordination (ataxia). Normal activity is difficult, although individuals may still be able to walk on their own. At this stage, only advanced medications or descent can reverse the problem. Descending even a few hundred feet may help, and definite improvement will be seen in descents of 1,000-2,000 feet (305-610 meters). Twenty-four hours at the lower altitude will result in significant improvements.

#### Severe AMS

Severe AMS results in an increase in the severity of the aforementioned symptoms, including shortness of breath at rest, inability to walk, decreasing mental status, and fluid buildup in the lungs. Severe AMS requires immediate descent to lower altitudes (2,000 - 4,000 feet).

**There are two other severe forms of altitude illness:** High Altitude Cerebral Edema (HACE) and High Altitude Pulmonary Edema (HAPE). Both of these happen less frequently, especially to those who are properly acclimatized. When they do occur, it is usually when people go too high, too fast, or go very high and stay there. The lack of oxygen results in leakage of fluid through the capillary walls into either the lungs or the brain.

#### High Altitude Pulmonary Edema (HAPE)

HAPE results from fluid buildup in the lungs. The fluid in the lungs prevents effective oxygen exchange. As the condition becomes more severe, the level of oxygen in the bloodstream decreases, and this can lead to cyanosis, impaired cerebral function, and death. Symptoms include shortness of breath even at rest, "tightness in the chest," marked fatigue, a feeling of impending suffocation at night, weakness, and a persistent productive cough bringing up white, watery, or frothy fluid. Confusion, and irrational behavior are signs that insufficient oxygen is reaching the brain. One method for testing yourself for HAPE is to check your recovery time after exertion.

#### High Altitude Cerebral Edema (HACE)

HACE is the result of swelling of brain tissue from fluid leakage. Symptoms can include headache, loss of coordination (ataxia), weakness, and decreasing levels of consciousness including disorientation, loss of memory, hallucinations, psychotic behavior, and coma. It generally occurs after a week or more at high altitude. Severe instances can lead to death if not treated quickly. Immediate descent is a necessary life-saving measure (2,000 - 4,000 feet).

**Antioxidant vitamins (A, C, and E) help reduce the effects of high altitudes.**



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### Operating in High Altitudes

#### Boost Your Aerobic Fitness

Since there's less oxygen in the air, you'll be a bit slower and more out of breath. Endurance training will enhance your ability to do more (hump farther, climb longer, carry your pack) with the reduced oxygen intake.

#### Hydration

The most important element. Start to increase your fluid intake about three weeks before your deployment, and continue to drink plenty of fluids throughout your deployment. Dehydration is the number one problem Marines and Sailors will suffer when they operate in mountains. Thinner air is typically drier air, and fluids are lost very quickly at higher elevations. This can lead to headaches, even in moderately high altitudes of 5000 feet. The lack of fluids will diminish your endurance, contribute to fatigue, and put you at risk for heat related illnesses.

#### Diet

Proper diet is very important in helping you maintain body weight, nutritional status, and mental and physical alertness. Eating enough food is the most important nutritional factor at altitude. Almost all persons going to altitude lose weight. This weight loss is a combination of body fat and lean tissue, and at very high altitudes the weight loss is incapacitating. The loss of insulating fat decreases tolerance to cold temperatures. Accompanying the weight loss are fatigue, loss of strength, and psychological changes such as decreased mental alertness and morale. All of these can contribute to accidents and failure to accomplish the mission.

#### Warmth

It gets colder at night at high altitude. Temperatures tend to be more extreme, with huge differences between day and night temperatures. Bring layers of clothing because the temperatures can fluctuate.

#### Sleep

People often have trouble sleeping at higher altitudes, and lack of sleep for a few nights will only add stress to your deployment; staying hydrated will help you sleep better. The more unnecessary factors you eliminate, the less chance you have that altitude will cause you sleepless nights.

#### Wind

Higher altitudes normally mean more wind. And there are fewer trees, or none at all, so shelter is not going to be easy to find if you need to get out of the wind for a while. Wind, combined with sun, or lowered temperatures, can be brutal. 60 MPH winds are commonplace. The wind chill factor is nothing to joke about. A high wind on a sunny day in midsummer can bring on hypothermia very quickly, and in winter, you develop frostbite very quickly.

#### Sun

The sun's rays are not filtered as much at high altitudes, so when they feel less intense, they are, in fact, more intense. Cool days, cloudy days, and even stormy days can still pose a high risk of sunburn. Bring lip moisturizer and sunscreen for exposed areas of skin if you are not used to high sun exposure. Bring along sunglasses also, especially if you are going to be around snow. Cloudy days at high altitude can actually be harder on your eyes than sunny days, because there is often more glare. Reflected light alone in the mountains can sunburn fair skin even when it is in the shade!

#### Breathing

Exertion can cause shortness of breath very rapidly even at moderately high altitudes. It can be aggravated by high winds, cold air, and rapid changes in elevation. So take it seriously. Usually when trouble starts, it goes from bad to worse very rapidly, so pay attention to the first warning signs and slow down, warm up, cover up, or drink up. Acting quickly at the first sign of trouble can avert a disaster.

**Physical fitness is no guarantee against developing altitude sickness; working out beforehand is a great preventative measure. While this doesn't guarantee an easier time in high elevations, it can enhance your lungs ability to cope with the challenges.**



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### Snow Blindness

Snow blindness is a potential problem whenever considerable amounts of snow remain on the ground. In the simplest of terms, snow blindness is sunburn of the epithelial layer (cornea) of the eye. Ultraviolet rays are present and threatening in any weather condition during the day. To protect against the damaging affects of the ultraviolet rays, it is essential to wear sunglasses at all times when traveling on snow. Even when cloudy and snowing, snow blindness can occur after only a few hours of unprotected exposure. Additionally, it is a good practice to wear sunglasses when hiking at higher elevations as there is significantly less atmosphere to filter the affects of dangerous ultraviolet rays. Snow blindness is extremely painful due to the eyelid moving over the inflamed cornea. Treatment is an eye patch over the affected eye(s) for a period of 24 - 48 hours. In most cases, the eyes heal quickly.



### Eating Do's AND Don'ts

Eat foods high in potassium: broccoli, bananas, avocado, cantaloupe, bran products, celery, greens, bran, chocolate, granola, dates, dried fruit, potatoes, tomatoes, etc.

<b>DO</b> eat 25-50% more calories than usually eaten in garrison	<b>DON'T</b> eat snow or ice for moisture.
<b>DO</b> heat food and beverages at every opportunity, prior to eating.	<b>DON'T</b> adopt bizarre dietary habits (such as eating only meat and butter) just because of being in the cold.
<b>DO</b> drink more than thirst dictates.	<b>DON'T</b> take multivitamin tablets or consume alcohol to "ward off cold" stress.
<b>DO</b> eat snacks between meals.	<b>DON'T</b> eat food cold because of being too busy to stop and heat MREs.
<b>DO</b> moderate coffee and caffeine consumption.	<b>DON'T</b> use field training exercises in cold weather as an opportunity to lose weight.



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Be a leader, follow safe procedures.  
Captured North Korean Major

### Fatality Summary as of 15 February 2008

