

Field Manual



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About this Manual

The VECO Polar Resources *Field Manual* is an online reference guide which highlights topics of common interest and concern for National Science Foundation supported fieldwork in the Arctic and sub-Arctic. This overview of field safety issues also provides alternate sources and links for more detailed information. This manual is not an all-inclusive guide to every aspect of field safety in the North. Use common sense when living and working in extreme conditions.

The primary audience for this Manual is individuals with a scientific background and little or no previous field experience in Arctic and sub-Arctic environments.

For simplicity within this Manual, the word Arctic will be used to refer to *both* Arctic and sub-Arctic regions.

Please contact jill@polarfield.com with comments and suggestions related to this Manual.

Introduction to the Arctic

Carrying out research in the Arctic is uniquely demanding. Remote locations, adverse weather, and curious animals can create additional challenges to conducting research. Every Arctic researcher must be well prepared, whether for a mechanical breakdown or a medical emergency, prior to heading into the Arctic.

Though seemingly inhospitable, the Arctic environment is also very fragile. Plant and animal life exists in a delicate balance. It is of paramount importance to minimize any adverse impacts to this environment.

The Arctic is also a peopled environment. As a guest in close-knit communities, researchers are often seen as emissaries of *all* researchers or scientists. Take care to respect private land and subsistence users. Know ahead of time whose land you'll be using for research, what the rules are for usage, and if permits are required.

Refer to the National Science Foundation Office of Polar Programs web site at <http://www.nsf.gov/od/opp/arctic/conduct.htm> for more information on the principles of conduct for Arctic research.

The Cold Environment

Spring arrives late in the Arctic, anywhere from mid-May to mid-June. Snow can begin in mid-August or earlier. *Any* month of the year you need to be prepared for snow, wind, and cold.

Do not underestimate the difficulties created by field work in cold weather climates. Tasks are more demanding and problems which would be routine in more hospitable climates can turn life threatening in the severe cold. Northern weather can change quite rapidly so when in the field consider bringing extra food and shelter. You must always carry adequate clothing.

Check the following sites for forecasts and weather information for Alaska

<http://www.arh.noaa.gov>

and Greenland http://weather.noaa.gov/weather/GL_cc.html.



Figure 1 A stunning Arctic sunset

Working in the Cold

When you are outside working in frigid temperatures, be aware that overdressing and overheating can be as bad as being cold. Moisture, such as perspiration, robs the body of warmth, and can lead to dehydration. Wear layers and adjust them as needed to maintain a comfortable body temperature.

Help yourself stay warm by following these simple guidelines. Nibble on high calorie snacks. Ensure you drink more water than the generally recommended eight glasses per day. Dehydration is common in the cold and dry conditions of the Arctic. Wear a hat and use neck protection to avoid losing as much as fifty percent of your body heat. Put loops or pulls on your jackets and tent zippers so you can wear mittens when using zippers. Use chemical heat packs to help keep your hands and feet warm.

Camping in the Cold

Dependable shelter is critical when you camp in the cold. Invest in a good quality four season tent. It's a must. Avoid camping in valleys where cold air pools.

Camp with a pad to drain cold air to the lower points of the pad. Raising up your sleeping area, if only by an inch, keeps you warmer in your shelter. Plan on bringing one or more full-length closed cell foam pads, such as Ensolite brand. An air mattress, such as a Therm-a-rest brand, is good for comfort but not insulation, especially if it pops.

Moisture control is critical to staying warm. A bivy sack over your sleeping bag can help, as can unzipping the tent door several inches near the top. Remember to air out the sleeping bag at every opportunity.

To sleep warm, go to bed warm. Before going to bed, move or exercise briskly. Then dress warmly including a hat, gloves, and socks. A water bottle filled with hot water, then wrapped in a sock, is an ideal sleeping bag companion. Nibble on high calorie snacks and sip warm water to help fight night time cold. Keep extra clothes at the bottom of your sleeping bag. Place battery powered items, such as a camera or flashlight, in your sleeping bag to extend their use.

Expect to use up to three times as much stove fuel as you would in the summer, especially if you're melting snow for water.

Traveling in the Cold

When in doubt about the weather, do not travel. Blowing snow, blizzards, and whiteouts can make navigating extremely difficult. When you combine these adverse weather conditions with zero visibility, travel can quickly escalate into a hazardous situation.

When you must travel in cold weather conditions, always carry at least a modest emergency pack with extra gloves and hat, extra warm clothing, and drinking water.

Ice

You must be extremely cautious when traveling over any ice. Changing Arctic weather and moving water in streams and lakes affects the thickness and strength of ice. Snow cover can act as a blanket that prevents ice from forming.

Without ice, it's probably not safe to cross that stream or lake. Layers of overflow water and ice may create thin ice layers that can be easy to break through.

Glaciers

It is your responsibility to ensure you have the proper knowledge and equipment when traveling in glaciated areas. Refer to the *Field Manual for the United States Antarctic Program* for an overview of glacier travel issues. Books such as Glacier Travel and Crevasse Rescue by Andrew Selters, training courses, the expertise of a professional mountaineer, and above all, practice are recommended when you are traveling or working on glaciers.

Avalanches

To reduce your chance of being caught in an avalanche, do not travel on or below steep terrain of 30 degrees or greater. Ensure you take avalanche safety courses before working in snowy, mountainous terrain. Snow Sense: A Guide to Evaluating Snow Avalanche Hazard, by Jill Fredston and Doug Fesler provides a good overview on the topic. The Avalanche Handbook by David McClung and Peter Schaerer is another informative reference.

Weather

Weather in the Arctic is characterized by extremes. Snow is not uncommon in July, and rains have been registered mid-winter. Take weather conditions into account when conducting Arctic field work.

Check the current Greenland weather forecast at http://weather.noaa.gov/weather/GL_cc.html. Find the current Alaska weather forecast at <http://www.arh.noaa.gov/>.

Weather Observations from the Field



Figure 2 Changing Arctic weather

Having a simple weather kit is a good idea for field work, particularly if you are expected to provide current weather information to a pilot. A meteorological kit might include a thermometer, an anemometer, an altimeter, and a cloud identification chart. Kestrel Weathermeter (<http://www.kestrelmeters.com/Kestrel-4000-Weather-Meter.pro>) is a good basic weather kit.

Field weather observations can include:

Wind direction - expressed as the compass direction from which the wind is originating.

Wind speed - expressed in knots per hour. A wind gust is a sudden change in wind speed characterized by a variation of 10 knots between peak and lull. Both the prevailing wind speed and wind gust, if applicable, are reported. An anemometer is used to determine wind speed and direction.

Visibility - given in miles. This is dependent upon the geographical features near camp. Mountains or other features at a known distance can help to determine surface visibility.

Cloud height - expressed in feet above ground level. Geographical features of known elevations can help to determine cloud height.

Cloud coverage - expressed in eighths of the sky. When reporting cloud layers, start at the ground and proceed upward. Cloud type, such as cumulus, stratus, cirrus and nimbus along with cloud appearance help determine the height of a cloud layer. For example:

- Clear - no clouds present
- Scattered - trace to 4/8ths of the sky covered
- Broken - more than 4/8ths, but not total sky coverage
- Overcast - total sky coverage

Temperature - given in degrees Celsius or Fahrenheit, depending upon location. Make sure that the thermometer is not directly exposed to sunlight. Protect the thermometer from the wind.

Pressure - expressed in millibars.

Altimeter setting - expressed in inches of mercury to the hundredths.

Aircraft

Field sites in the Arctic are typically accessed with aircraft, whether helicopter, bush plane, Twin Otter or C-130 Hercules. No matter the type of aircraft, make sure the pilot or loadmaster provides you with a safety overview of the aircraft. Know the location and operation of emergency exits and emergency gear.



Figure 3 C-130 Hercules aircraft

Inform the pilot if you are traveling with any hazardous

substances or bear repellent. When traveling with cargo, know its weight, size, and mass.

When inside any aircraft, remain seated with your seat belt fastened at all times. Wear a helmet, when provided. In the event of an emergency, remain in the aircraft until all motion has stopped. Always obey the pilot's orders.

If you are dropped off from the aircraft, even for just a few hours, carry a modest survival pack. Weather can change, preventing pick up. Suggested survival pack contents include:

- Trail bars or compact food
- 2 quarts of water, and iodine tablets or a water purification filter
- Emergency signal mirror
- Radio
- Space blanket
- Spare clothes
- First aid kit
- Bivouac or small tent

Travel with critical items such as clothing and important documents in sealed plastic bags as an additional precaution against water damage.

Helicopter Safety Guidelines

Following are a few simple rules to observe when traveling by helicopter. Never approach a helicopter until eye contact is made with the pilot and you are given a "go-ahead" signal. Never walk near the tail rotor. Always approach from the front of the helicopter. Carry long loads, such as shovels or survey rods, low and level to the ground.

Navigation

Global Positioning System (GPS) is, simply put, a satellite based navigation system which allows users to compute their position. Land navigation has



Figure 4 GPS satellite

undergone a dramatic change over the past several years due to the increased availability of GPS coverage and equipment. While a GPS is a valuable resource to field parties, it should not be relied upon as the sole method of navigation. Map reading skills and knowing how to use a compass provide Arctic researchers with a vital means of navigational backup.

GPS

There are a number of GPS units available on the market, some quite inexpensive. Be sure you know how to use your GPS unit well in advance of arriving in the field.

Satellite coverage is generally good in the Arctic so obtaining positions is typically not a problem. Keep the GPS unit in a jacket or other warm location for optimal battery life.

In addition to your GPS unit's user manual, books such as [GPS Made Easy: Using Global Positioning Systems in the Outdoors](#) by Lawrence Letham and [Wilderness Navigation: Finding your Way Using Map, Compass, Altimeter, and GPS](#) by Bob Burns, Mike Burns and Paul Hughes may be helpful general references.



Figure 5 Compass

Magnetic Compasses

For accurate compass navigation in the Arctic it is crucial to be aware of the deviation between geographical and magnetic north. The following National Geophysical Data Center site can help calculate declination

<http://web.ngdc.noaa.gov/cgi-bin/seg/gmag/flsntn1.pl>.

Navigation in the Arctic with a magnetic compass is difficult. Because of the proximity of the magnetic pole, the magnetic variation can change significantly over short distances.

Maps

Accurate maps for Greenland and Alaska can be obtained online. The Danish Polar Center has a listing of sources for Greenland maps, at <http://www.dpc.dk/Guide/Guide2.html>. Alaska information and topographic maps can be obtained from the United States Geological Survey site at <http://www.usgs.gov/>.

All-Terrain Vehicles

While all-terrain vehicles (ATVs) or “four wheelers” are not legal in Greenland they are the workhorse of rural Alaska. ATVs are an excellent tool for reaching field locations and hauling equipment.

These powerful machines must be used responsibly. Driving too fast, traveling over rough terrain, encountering unexpected obstacles, overloading, or combining alcohol or drugs with driving can make an ATV deadly.



Figure 6 An ATV

Be aware that ATVs will damage tundra. Use only on existing trails.

Operating Guidelines

First and foremost, remember it is both illegal and dangerous to use ATVs on public roads.

Please adhere to the following guidelines when operating an ATV. The machines will run longer and work can be done safely.

- Look the machine over carefully before driving. Check the oil and fuel levels and be sure the brakes are working. If something seems wrong with the ATV notify the camp staff immediately.
- Never allow anyone to ride on the front rack.
- Pack gear securely on the racks. Have good visibility at all four corners of the machine.
- Wear protective clothing. Helmets and goggles are strongly encouraged.
- Ride responsibly. Go slow where people or animals are present. Be courteous to neighbors. Consider whether an ATV is absolutely necessary for late evening work, when others are sleeping. Do not drive in roadless areas where tundra scars can be permanent.

Driving Tips

Follow these driving tips for safe operation of an ATV.

- To turn, keep body weight on the outside foot peg and lean upper body into the turn.
- When climbing hills, lean body weight forward to keep the front wheels on the ground. If stopped while going uphill, do not apply the rear brake. Get off the machine and turn it around to proceed down the hill. When driving downhill, keep the engine running and in gear. Use the rear brake and avoid sharp turns.
- Avoid driving along the side of a hill. When one side of the vehicle is higher than the other, the ATV could roll. When driving along the side of a hill is unavoidable, lean into the hill.

Snowmachines

Snow cover opens up the Arctic, allowing travel in areas inaccessible in the summer months. Snowmachines are an excellent tool for getting around in snow country. When arriving at a field camp location where snowmachines are available, attend a hands-on operation and safety course provided by the camp staff.

Carry emergency gear in case of a breakdown. Never consume alcohol or drugs before or during snowmachine operation. Dress appropriately with warm, wind-proof clothing. Always wear a helmet with goggles or a face shield.

Snowmachine Mechanics



Figure 7 Snowmachine operator in distress

Every person who operates a snowmachine is responsible for checking the machine before use. Check the suspension. Look for loose or broken idler wheels, located in the snowmachine track. Check the springs and shocks. Inspect the track's adjustment and tension. Confirm that the skis and track are not frozen to the snow or ice. Lifting the front ski will break a frozen ski free. If the track is frozen in, break it loose by standing on the machine and gently rocking it from side to side. Be aware of loose trailing straps

and ropes that can get entangled in the tracks and around axles.

Most snowmachines have two-cycle engines that require a gas and lubricating oil mixture. The machines owned by VECO Polar Resources vary as to how this oil is mixed. Always check either the oil level or confirm the correct pre-mixed fuel is being used before operating. Operating a snowmachine without lubricating oil will cause engine failure.

In Greenland, fuel must be mixed by hand at a ratio of 50:1 (12 ounces of oil to 5 gallons of gasoline).

The snowmachines in Alaska have an automatic oil injection system. Pre-mixing fuel is not necessary. An oil reservoir tank must be filled and the level maintained to provide continuous lubrication.

Gasoline is flammable and explosive under certain conditions. Always fuel in a well ventilated area. Do not smoke or allow open flames or sparks in the vicinity. If gasoline fumes are noticed while driving, determine the cause and immediately correct the problem.

When parking snowmachines, point the front into the prevailing wind. Always cover the machines to help prevent snow from accumulating under the engine cover.

Snowmachine Operation

Before starting the snowmachine, activate the throttle control lever several times to check for smooth operation. The throttle control lever must return to the idle position when released. Inspect fuel or gear oil reservoirs for leaks. Inspect brake operation.

Be easy on transmissions and shift gently. If gear(s) will not engage, turn off motor, shift gears, and restart. Abusing shifting can cause mechanical problems that are not repairable in the field. Never shift the transmission unless the snowmachine is stopped.

When operating a snowmachine always keep speed to a safe, responsible and manageable level. Longer stopping distances are needed on snow and ice surfaces. When traveling with two or more machines give adequate separation for unexpected stops or hazards.

Water Safety

The cold waters of the Arctic demand respect whether wading in a stream or crossing in a motor boat. Wide channels full of silt, fast moving rocky streams, and logs or overhanging brush all present safety challenges. These challenges are compounded by the remote Arctic location and the year-round risk of hypothermia.

There are many books available which address water rescue, including River Rescue: A Manual for Whitewater Safety by Les Bechdel and Slim Ray.

Rafting, Kayaking, and Wading

Do not launch a raft or kayak on a river that has not been researched. Make sure your ability is equal to the difficulty of the river.

Overhanging brush or fallen tree limbs can choke river banks or block a channel. Always scout ahead for a clear route. Avoid getting tangled in or being swept under obstacles in the river such as tree limbs or large debris that could drown you.



Figure 8 River kayaking

In some areas of the Arctic overflow ice can linger year-round. A river channel may dive beneath an ice ledge or end in a wall of ice. Watch for floating ice chunks. They are often much heavier than they look and can upset a raft, kayak, or boat.

Use extreme caution when crossing streams on foot. Always unbuckle your pack in case you fall into the water.

Boating

Travel by boat is one of the most effective ways to move people and gear during the Arctic summer. It can also be dangerous if you are unfamiliar with the boat, the river or boating rules. Remember that not all people can swim. Keep in mind that any assistance, whether mechanical or medical, can be hours if not days away.

Always remember to tell someone where you are going and when you will return.

Wear a life jacket. In the United States boats must carry a wearable life jacket for every person on board. Make sure all life jackets are in working order and accessible. On boats 16 feet or longer, one throwable personal flotation device, for example a life ring, is also required.

Confirm the boat is in top operating condition. Know how to use the boat. Make sure the boat is equipped with fuel, back-up fuel, a mooring line, and common spare parts.

Never overload a boat with passengers or cargo beyond its safe carrying capacity. Keep any cargo load low and distributed evenly fore and aft and from side to side. Keep passengers seated.

Watch for sudden wind shifts, darkening skies, and choppy water. If a storm is gathering, get off the water. Bring a radio and keep a close eye on the weather.

Bring emergency supplies such as maps, flares, and a first aid kit. Store them in a floating pouch. Store personal gear in waterproof bags. A trash bag lining is helpful in rain or heavy spray.

In closed cabins, always ventilate after refueling. Sniff for fumes before starting the engine and if you detect fumes, do not start the engine.

Never consume alcohol or drugs before or during boat operation.

Boating Safety Links

Check the United States Coast Guard's website <http://www.USCGBoating.org> for boating safety regulations and information. The United States Coast Guard also produces a brochure entitled "Federal Requirements and Safety Tips for Recreational Boats" that provides more safety details. Within the United States phone toll free 1-800-368-5647 to order the brochure.

The Alaska Department of Natural Resources Office of Boating Safety produces a comprehensive brochure "Alaska Boater's Handbook." Some of this information is available on their website <http://www.dnr.state.ak.us/parks/boating>.

The Marine Safety Office of Anchorage site at <http://www.uscg.mil/d17/msoank/msoank.htm> lists boating safety regulations.

Wildlife

Bears are one of the most well known inhabitants of the Arctic. However, all wild animals should be respected and given a safe distance.



Figure 9 Grazing Caribou

Walrus have been known to attack small boats. Musk oxen and caribou will charge. Moose, especially cows with calves, should not be approached. Trappings are not uncommon. Use caution when camping near ground squirrels as they can chew into equipment and storage bags.

Rabies is a danger, especially in the Arctic fox. Get immediate treatment for any scratch or bite.

In short, do not approach or bother *any* wild animal or bird.



Figure 10 Arctic fox

Insects

Mosquitoes, gnats, and black flies are not life threatening, but can make field work miserable. From June through August be prepared with repellent, a headnet, and a screened tent. Even if the weather is warm, long sleeve shirts and pants are helpful. Mesh bug jackets are also effective insect deterrents. Refer to <http://www.bugshirt.com/> for one brand of clothing designed to protect against biting insects.

Burnable coils and Buhach powder create a smoke that is relatively effective in keeping insects away. If allergic to bug bites, carry medication. Wasps are also active in the summer months in some areas of the Arctic.

Bear Country

When working in the field in Alaska and Greenland, you are in bear country.



Figure 11 Polar bear

Brown bears or grizzlies are found from the southern forests of Alaska through to the Arctic. Black bears live in the forested areas of Alaska. Polar bears frequent the pack ice and tundra of extreme circumpolar north.

Bears are curious, intelligent, and potentially dangerous animals. Fear of bears can endanger both bears and people. Many bears are killed every year by people who are unduly afraid of them. Having a healthy respect for bears is a wise safety precaution. It is also wise to

learn proper behavior in their territory so that neither you nor the bear will suffer needlessly from an encounter.

While grizzlies and black bears are generally dormant from November through April, mid-winter sightings are not uncommon. Polar bears are active year-round.

Polar Bears

Polar bears are predators and they do occasionally prey on people. If you are working in northern coastal areas, follow all bear safety protocol but be additionally wary. For more information on polar bears, refer to these websites: Danish Polar Center at <http://www.dpc.dk/Publications/Wildlife1.html>, Parks Canada at http://parkscanada.pch.gc.ca/library/nationalparks/polar/english/polar_e.htm and the Churchill Northern Studies Centre at <http://www.cancom.net/~cnsc/cnsc-pbsafety.html>.

Bears and People

Do not surprise a bear. Make your presence known by talking loudly, singing, or clapping. If possible, travel with a group. Groups are noisier and easier for bears to detect.

When hiking, camping, or working in the field avoid areas with thick brush. If that's not possible, walk with the wind at your back so your scent can warn bears of your presence.

Bears, like humans, use trails and roads. Don't set up camp close to a trail that a bear might use. Detour around areas where you see or smell fish or animal carcasses.

Cook away from your tent. Store all food away from the campsite. Hang food on a tree, out of a bear's reach. If no trees are available, store food in airtight or specially designed bear-proof containers.

Keep your camp clean and immediately wash dirty dishes. Avoid food with strong smells that might attract a bear's interest. Keep food smells off of your clothing. Burn garbage completely in a hot fire and pack out the remains. Dispose of fish entrails in a fast moving river.

Bear Close Encounters



Figure 12
Grizzly bear

If you see a bear, avoid it if at all possible and give the bear every opportunity to avoid you. If you do encounter a bear at close distance, remain calm. Identify yourself as a human by talking to the bear in a normal voice and waving your arms. Back away slowly from the bear. If the bear follows, stop and hold your ground. Do not run as it is not possible to outrun a bear.

Bears often make bluff charges, sometimes to within 10 feet. In case of a bluff charge, continue waving your arms and speaking in a normal voice. If the bear gets closer than 10 feet, raise your voice and be more aggressive. Make yourself look as large as possible. If you're in a group join hands and raise all of your arms upward.

Surrender immediately if a brown or black bear makes contact with your body. Fall to the ground and *play dead*. Either lie flat on your stomach or curl up in a ball, using your hands to protect your neck. Bears typically break off attack once the perceived threat has been eliminated. Continue to play dead by remaining motionless. If you move before the bear has moved away, it may return and renew its attack. Get up and retreat from the area only when you are sure the bear has gone.

While not common, an attacking brown or black bear may perceive a person as food. If a bear treats you as prey, or continues biting you long after you have assumed the play dead position, it is probably a predatory attack. In that case, fight back vigorously to save your life.

Protection

It is illegal to carry firearms in some of Alaska's national parks. Check the appropriate rules before going. Before bringing firearms into Greenland, your request must be approved by the Danish Commission for Scientific Research in Greenland. You must also file an application to transport firearms with the Chief of Police in Nuuk, Greenland.

If you must shoot at a bear, use a .300-magnum rifle or a 12-gauge shotgun with rifled slugs. Heavy handguns such as a .44 are not as effective.

Remember bluff charges are common with black and brown bears. Before ever encountering a bear, decide at what distance you would shoot at a bear. Close range shots have a greater chance of killing a bear.

If you absolutely must kill a bear, the first shot is the most important one. If the bear is broadside, aim for the low neck area. If the bear is facing you, shoot at the low center neck between the shoulders. To knock the bear down and disable it, aim for the bear's front shoulder area. Head shots generally will not kill a bear. When the bear goes down, continue shooting at its vital areas until it is still. Once the bear is completely still, check that it is dead.

Alaska state law allows a bear to be shot in self-defense if the attack was unprovoked and there was no alternative. The bear hide and skull must be salvaged and turned over to local authorities. The same is true in Greenland.

Defensive aerosol sprays containing capsicum extract are a moderately effective bear deterrent when sprayed at a range of 6-8 yards. Do not discharge the spray upwind or while in a moving vehicle as the spray can disable the user.

Be sure to inform a pilot if you are flying with bear spray in your possession. Pressure changes at altitude may cause a canister to leak.

For more information on brown and black bears, contact the Alaska Department of Fish and Game at <http://www.state.ak.us/local/akpages/FISH.GAME/wildlife/geninfo/game/bearfax.htm>.

The Alaska Audubon Society publishes an informative booklet "Living in Harmony with Bears." Within the United States, phone (907) 276-7034 to order the booklet.

Gun Safety

Guns must be handled carefully and used responsibly. Any person bringing a gun into the field should have previously taken a gun training course and be comfortable handling their own gun. Practice at a range regularly. It is the responsibility of the gun owner to know all the rules of firearm safety. Following are several important reminders.



Figure 13 Scientists cross ice, alert for polar bears

In Camp

Keep guns unloaded. Store ammunition and guns separately.

In the Field

Carry guns in a safe position where easily accessible. For a pistol this might be a shoulder

holster. For a shotgun this could be slinging it so the shotgun muzzle is never pointed at anyone else, even when stooped over or traveling in brush.

Always have the gun safety on, but don't rely upon it to work. Be aware that working in brush can cause a misfire.

Avoid Accidents

Treat every gun as though it is loaded. Point the muzzle away from people, even when empty. Do not point at anything you do not intend to shoot. Keep your finger off the trigger until ready to shoot.

Consider taking a hunter safety class, even if you're not a hunter. These classes provide basic information about gun safety, gun handling, gun laws and how guns work. Browse through the Alaska Department of Fish and Game's site at <http://www.state.ak.us/local/akpages/FISH.GAME/wildlife/geninfo/educate/huntered/huntered.htm> for information on classes or check your local state department.

Health and Safety

While in the field anywhere in the Arctic, be prepared to provide not only first aid but also follow-up long term care. Many places in the Arctic are remote and weather conditions can delay a rescue for days. Every field party member should have basic first aid and Cardiopulmonary Resuscitation (CPR) training. There are many courses offered in wilderness medicine focusing on techniques when help is more than one hour away. VECO Polar Resources, in partnership with Learn to Return <http://www.survivaltraining.com/>, a field safety training company located in Anchorage, Alaska, has developed a field safety training program for National Science Foundation Arctic Program participants. Courses will be offered every year and will include wilderness medical and field survival training. Please contact jill@polarfield.com for further information on the field safety training program. In addition, from the VECO Polar Resources web site at

<http://www.vecopolar.com/> follow the Safety link to the Field Safety and Medical Training section for upcoming training courses.

In addition to adequate training, always carry a well-stocked first aid kit. A reference manual is a key component of this kit. Several excellent books are available which address field care, including Medicine for Mountaineering and Other Wilderness Activities, by James Wilkerson and A Comprehensive Guide to Wilderness and Travel Medicine, by Eric A. Weiss.

Environmental Concerns

In addition to basic first aid awareness, individuals should work to avoid harm. Being safe and planning ahead can prevent many careless injuries. Help prevent situational health problems such as frostbite, hypothermia, carbon monoxide poisoning, altitude illness, snow blindness, and sunburn by knowing the warning signs of these conditions.

Frostbite

Frostbite is the freezing of body tissue. Superficial frostbite, often called frostnip, feels like a mild tingling or pain followed by numbness. Deep frostbite is a full or partial freezing of a body part which mainly affects the hands and feet. Suspect frostbite if a painfully cold body part suddenly stops hurting when that part is not actually getting warmer. The affected body part is cold, solid and wooden with pale, waxy skin.

Factors contributing to frostbite include inadequate insulation, wet clothing, fatigue, poor nutrition, alcohol and/or tobacco consumption, restricted peripheral circulation due to tight clothing or equipment, and contact with metal or hydrocarbon liquids such as gasoline.



Figure 14 Frost can form quickly on exposed skin

Hypothermia

Hypothermia is the lowering of body core temperature and can result from exposure to cold rain and wind, or from falling into cold water. Hypothermia, when not properly treated, can be fatal. Proper layering of clothing and adequate food and water consumption are key elements in avoiding hypothermia.

Carbon Monoxide Poisoning

Carbon monoxide is a colorless, odorless gas that is produced by incomplete combustion of substances containing carbon. When inhaled, carbon monoxide combines with the hemoglobin in red blood cells to render the cells incapable of carrying oxygen.

The signs and symptoms depend upon the amount of carbon monoxide inhaled. In mild cases, the patient may complain of dizziness, headache, and confusion. Fatigue, numbness, chest pains, heart palpitations, and visual disturbances may also be present. Severe cases can produce a deep coma. Recognizing this condition may be difficult if all members of the party are affected.

Treatment involves removing the victim from the fumes and administering oxygen, if available. Serious poisoning cases may take months to recover.

Carbon monoxide poisoning can be a significant hazard in the field, particularly when stoves are used in poorly ventilated shelters such as tents or snow caves. Prevention is easy in that all shelters must be well ventilated.

Altitude Illness

In Greenland much of the ice sheet is above 10,000 feet, making altitude sickness a very real concern. New arrivals may struggle for breath or grow easily tired. It is important for those just arriving at high elevations to take work slowly, avoid overexertion, and drink fluids with no diuretic effects, avoiding caffeine. Severe altitude sickness may require evacuation from the field.

Dehydration is a common problem not only at elevation, but also in many northern areas due to the dry climate. Drink at least 8 cups of water each day.

Snow Blindness



Figure 15 A researcher wears dark glasses while working outside

Snow blindness can occur when intense ultraviolet radiation reflects off the snow's surface. This condition can permanently damage eyesight. Always wear dark glasses when outside, even if you do not plan to be out very long. Snow blindness can occur on overcast days as well as clear days. Itching or pain in the eyes, scratchy eyelids, and headache are warning signs. Treatment involves keeping the eyes from light for a lengthy period.

Sunburn

The high intensity of radiation and reflection off Arctic snow can result in severe sunburn. Sunburned skin loses the ability to perspire and will reduce the body's ability to cool itself. Sunblock cream and lip balm will help prevent sunburn.

Hygiene

Do not be tempted to relax hygiene standards when working in the field. Poor diet, sanitation, and hygiene can adversely impact health and mental functioning. Use common sense and allow time for personal maintenance.

Be Field Ready

Prior to heading out in the field, review and test every piece of field equipment you plan on using. Consider a trial run weekend trip to ensure you are fully prepared for field camping. The spare stove part or sleeping pad that seems inconsequential back home may be crucial to a successful, or at least more comfortable, field season.

For any remote field camping, especially when dropped off by aircraft, always plan on staying longer than you intend. Delays in pick up are common so carry extra food and clothing.

Camping

Many northern rivers and lakes contain the waterborne parasite giardia. Treat all drinking water by boiling for one minute; or use chemicals or a purification filter to avoid this parasite.

Practice the minimum impact rules of camping. Whatever you take in to a site, take out. Dispose of trash properly. Prepackage food and equipment to avoid excess trash in the field. Camp and travel on durable ground surfaces such as established trails and campsites, rock, gravel, dry grasses or snow.

In popular outdoor areas pick a camp site in an already disturbed area, such as a campground or a dirt area with a fire circle. Do not create new camping damage. However, in pristine areas spread out camping use by changing campsites daily.

When in the field, properly dispose of waste you can't take out. Catholes are the most widely accepted way of disposing of human waste. Dig a hole 8 inches deep and at least 200 feet (70 adult steps) from water, trails and camp. Fish viscera should be left in a fast moving river or lake. Cleaning fish near camp is an invitation for bears. Minimize soap and food in waste water.

Minimize the use of fires. They are generally not necessary, except in emergencies.

More information on responsible outdoor use is available through the Leave No Trace program. Within the United States, call 1-800-332-4100 or visit their web site at <http://www.lnt.org/>.

Tents



Figure 16 Ice screws

Before heading out into the field, set up your tent. Make sure you have all tent parts and you know how to use them.

Consider the environmental conditions you'll encounter in the field. Bring a tent staking system appropriate to those conditions. In the snow, a deadman picket system or bamboo stakes may be best. Ice screws, pictured, are better staking tools for glaciers or sea ice.

Poles and fabric are brittle in

the cold so assemble the tent gently. If the shock cord in the poles does not have any spring, warm the poles in your parka. When the bungee warms up, the spring will return.

In wet areas, a ground cloth or tarp is helpful, as long as it does not extend beyond the fly and pool water under the tent. In snowy areas with strong winds, build a snow wall before erecting the tent. A snow wall can keep a tent from blowing away in gale force winds, decrease wind chill, and reduce tent flapping noise.

To minimize ice and frost build up, set up the tent with adequate ventilation in mind. Place the back end of the tent into the wind. Keep the downwind (front) door and fly ventilation holes slightly open to draw air through.

In windy conditions, stake out the tent's leading edge first, then insert poles and erect the tent. If the tent has snow flaps or a valance, weight the flaps with snow, ice blocks, or gear. Tighten all tent support lines. Use "slippery" knots that can be re-tightened and won't require a knife when it's time to take down the tent.

Because of the danger of carbon monoxide poisoning, do not cook in tents except in emergencies. If it is necessary to cook in the tent, preheat the stove outside the tent. Make sure there is fresh airflow into the tent that will not be blocked by falling snow or the tent fly.



Figure 17 Arctic Oven tent

The Arctic Oven Tent

The double-walled Arctic Oven tent, pictured, is one of the most common shelters used at the Greenland field camps.

For more information on the Arctic Oven, refer to Alaska Tent and Tarp's site at <http://www.ptialaska.net/~aktent/AO.htm>.

Maintenance

Carry a small tent repair kit, including adhesive nylon fabric tape to provide a temporary fix for tent holes or tears in mosquito netting, along with extra shock cord to revive a pole's spring.

Gear for the Field

Field researchers need to outfit themselves with the proper camping, survival, and personal gear along with clothing appropriate to their field environment. Doing so helps ensure a successful and comfortable field season.

Pack clothes and gear in sealable plastic bags to help prevent disaster. Line your pack or duffels with trash bags to help keep gear dry.

Camping Gear

Field researcher should have the following camping and field equipment:

- Tent and stakes
- Tent repair kit
- Sleeping bag with liner
- Full-length closed cell foam pad, such as Ensolite brand
- Inflatable sleeping pad, such as Thermarest brand
- Ground cloth
- Pack with pack cover or trash bags
- Stove and camp fuel
- Stove repair and cleaning kit
- Primer paste for warming up a portable camp stove, if cold weather
- Lighters and matches
- Pots, dishes, and silverware
- Insulated drinking mug
- Water bottles
- Water purification filter

- First aid kit; include a useful reference book such as Medicine for Mountaineering and Other Wilderness Activities, by James Wilkerson or A Comprehensive Guide to Wilderness and Travel Medicine by Eric A. Weiss; see books for kit content recommendations
- General repair kit with fabric repair tape, needle and thread, duct tape, safety pins, extra line and webbing

Survival Gear

Carry these survival gear items near you at all times, in a fanny pack or pocket:

- Sunscreen
- Water purification tablets
- Bug repellent spray
- Tarp or rain poncho
- Matches
- Flares
- Signal mirror
- Pocket knife
- Spare eyeglasses, if necessary
- Extra clothing and food

Clothing



Figure 18 Visiting TEArctic teacher learns how to measure snow depth and ice thickness

Science party participants are generally responsible for their own cold weather clothing. Fabrics to consider are Polar Plus Fleece, Polypropylene, Capalene, wool, and silk. Avoid cotton fabrics and jeans for remote field site use. Bring a cotton T-shirt or two for camp comfort wear.

- Bandanna
- Wool socks
- Synthetic long underwear
- Expedition weight thermal top/bottoms
- Rain/wind jacket and pants
- Pile/fleece jacket, vest, and pants
- Insulated parka with hood
- Insulated bibs, such as Carhartt brand
- Good quality rubber boots
- Good quality hiking boots
- Ball cap
- Pile, fleece, or wool hat
- Musher style hat with earflaps
- Pile/fleece neck gaiter
- Leather work gloves, insulated ski gloves, and expedition mittens

Personal Gear

Researchers should consider bringing these items for increased personal comfort:

- Headlamp and/or flashlight, including spare bulbs and batteries
- Toilet paper and towel
- Skin lotion
- Chapped lip protection
- Binoculars
- Camera
- Compass and maps
- GPS unit
- Bear repellent spray
- Gun with ammunition
- Insect repellent
- Earplugs
- Head net
- Sunglasses and goggles
- Leatherman-type utility knife

Stoves

In addition to a hot meal, portable stoves provide a source of heat, can treat water, and can make water from snow. Most models operate on the principle of preheating liquid gasoline or kerosene so that the fuel pressurizes and exits the jets as a vapor, where it is then ignited.

Safety Guidelines

Liquid fuel stoves are potentially hazardous due to the flammability of the fuels used and the toxicity of the carbon monoxide vapors produced. When using a stove in the field, make sure to follow the safety measures listed below.

- Do not cook in tents except in emergencies
- Provide for adequate ventilation
- Do not release fuel tank pressure near an open flame
- Use extreme caution when refueling; fuel has a lower freezing point than water so it can be in liquid form but still so cold that contact with skin can cause instant frostbite
- Release pressure in the fuel tank before packing or traveling
- Pack stoves and fuel away from food
- Test all stoves before going into the field, and carry common spare parts

Stove Troubleshooting

The five most common problems with portable camp stoves are:

1. Insufficient preheating
2. Clogged jet
3. Air leak in the system
4. Wrong jet
5. Contaminated fuel



Figure 19
Camp stove

Use the following troubleshooting guidelines to get your stove working:

Limited or no fuel:

- No pressure - pump up fuel tank
- No fuel - tank is empty, jet is clogged, fuel tube is clogged, and/or fuel is too cold

Fuel leakage:

- At fuel bottle - fuel cap (or pump) not on tight
- At connectors - seals or "O" rings damaged
- At pump - pump valve or seals are damaged
- At jet - control valve is stripped

Reduced performance through jet:

- Lack of fuel - check fuel level, pump up pressure-tank
- Obstructions - clean jet. Improper jet
- Too cold - improperly insulated from snow; warm fuel tank in sleeping bag; use primer paste

Erratic burning/surging:

- Pressure too great - control valve opened too far
- Improper jet - kerosene being burned in "G" gas jet
- Gas being burned in "K" kerosene or diesel jet - stove is cold; burner not adequately preheated

Pump won't work:

- Dry cup - oil the pump cup
- Dirty pump – clogged; check valve

When finished using a gasoline stove, do not purge it with kerosene as this will ruin the stove. Instead, drain and vent a gasoline stove. Do not leave a venting stove where blowing snow, sand, or dirt could contaminate the fuel tank.

Waste Handling

When planning your field season, consider carefully the waste your research may generate. In many areas of the Arctic, waste is flown out at a high cost. Recycling is usually very limited because of transportation costs. In most areas, additional waste can severely impact small local waste facilities. A general rule to follow is take everything out of the field that you took in.

Hazardous Waste

Fuel, oil, antifreeze, batteries, aerosol cans, and fluorescent light bulbs are all examples of hazardous wastes. Make every effort to dispose of these items at the appropriate local facility.

Waste Spill Guidelines

Be diligent about preventing hazardous spills. Any amount of hazardous material that does spill on the ground must be cleaned up. If feasible and safe, remove the spilled material using absorbents from a spill kit or, if the spill is on snow, shovel the snow up and place into plastic bags to be disposed of. Report larger spills to camp staff and local authorities.

Check all equipment for leaks prior to usage. If a leak is apparent, stop the job and get the problem repaired. If a leak cannot be repaired immediately use berms or surface liners to catch leaks and drips when equipment is in operation or when parked. Routinely check valves and connections to make sure they are left in the off position when equipment is not in use.

Always monitor fueling operations and avoid overfilling tanks. Remember, not all field pumps have an automatic shut-off.

Position equipment so that its valves, connections, and piping will not be damaged by contact with other vehicles or equipment.

Quick Reference to Useful Links

<i>If you want to</i>	<i>Click here</i>
Learn more about the code of conduct for Arctic research	http://www.nsf.gov/od/opp/arctic/conduct.htm
Check the current weather forecast for Alaska	http://www.arh.noaa.gov
Check the current weather forecast for Greenland	http://weather.noaa.gov/weather/GL_cc.html
Review glacier travel information from the <i>Field Manual for the United States Antarctic Program</i>	Select bookmark "Field Manual for the United States Antarctic Program"
Read about public lands in Alaska including links to national parks, national forests, wildlife refuges, state parks, rivers, and maps of area regions	http://www.nps.gov/aplic/center/
Contact the Alaska Department of Natural Resources for details on state parks and outdoor safety links	http://www.dnr.state.ak.us/
Contact the State of Alaska for current Alaskan news features	http://www.state.ak.us/
Contact the Danish Polar Center for information on field work in Greenland, and links to other Greenlandic information	http://www.dpc.dk/
Find topographic maps of the United States	http://www.usgs.gov/
Find a map of Greenland	http://www.dpc.dk/Guide/Guide2.html
Compute values of the Earth's magnetic field	http://web.ngdc.noaa.gov/cgi-bin/seg/gmag/fldsnth1.pl
Read about exercising responsible practices in the outdoors	http://www.treadlightly.org/ and http://www.lnt.org/
For more information on the Arctic Oven tent	http://www.ptialaska.net/~aktent/AO.htm
Learn more about polar bears	http://www.dpc.dk/Publications/Wildlife1.html and http://parkscanada.pch.gc.ca/library/nationalparks/polar/english/polar_e.htm and http://www.cancom.net/~cnsc/cnsc-pbsafety.html
Learn more about brown and black bears	http://www.state.ak.us/local/akpages/FISH.GAME/wildlife/geninfo/game/bearfax.htm

Quick Reference to Useful Links (continued)

<i>If you want to</i>	<i>Click here</i>
Read about hunter safety courses	http://www.state.ak.us/local/akpages/FISH.GAME/wildlife/geninfo/educate/huntered/huntered.htm
Learn more about boating safety in the United States	http://www.USCGBoating.org
Learn more about boating safety and regulations in Alaska	http://www.uscg.mil/d17/msoank/msoank.htm and http://www.dnr.state.ak.us/parks/boating
Contact us	jill@polarfield.com