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NGEE Arctic
Next-Generation Ecosystem Experiments

Project Field and Laboratory Safety Manual

U.S. DEPARTMENT OF ENERGY | Office of Science

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PROJECT FIELD AND LABORATORY SAFETY MANUAL
NEXT-GENERATION ECOSYSTEM EXPERIMENTS—NGEE ARCTIC

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Revision 2

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Applicability

This manual is required reading for all NGEE Arctic project participants before commencing any field or laboratory work on the Seward Peninsula or in Utqiaġvik, Alaska.

Review the References and Appendix. They contain supplemental information (e.g., planning, contacts, site instructions, emergency information) that will be useful to all NGEE Arctic project participants. The attachments also include controls pertaining to many other items, such as field clothing/personal protection equipment and first aid kits.

Revision Record

Rev. Number	Date	Description	Authorized By
0	1/16/2020	Initial Release This document is a combination of previous documents, • NGEE Arctic Project Field Safety Manual (IDMS 15906—archived) • NGEE Artic Project Laboratory Safety Manual (IDMS 15905—archived)	S. Wullschleger
1	5/14/2020	Creative Media updates for photos, graphics, format only	S. Wullschleger
2	9/14/2021	Updated hyperlinks and added section on Lithium Battery transport.	S. Wullschleger
END			

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Abbreviated Terms

AED	automated external defibrillator
ATV	all-terrain vehicle
DOE	US Department of Energy
DOT	US Department of Transportation
ESH&Q	environmental safety, health, and quality
GFCI	ground fault current interrupter
MOT	Materials of Trade
NGEE Arctic	Next-Generation Ecosystem Experiments
NRTL	nationally recognized testing laboratory
OOTD	Officer of the Day
ORNL	Oak Ridge National Laboratory
OSHA	Occupational Safety and Health Administration
PPE	personal protective equipment
SDS	safety data sheet
STL	Science Team Lead
TL	Task Lead
UAF	University of Alaska Fairbanks
UIC	Ukpeaġvik Iñupiat Corporation

Introduction

Overview

The Next-Generation Ecosystem Experiments (NGEE Arctic) project is a 10-year (2012–2022) research effort to reduce uncertainty in Earth system models through developing a predictive understanding of the carbon-rich Arctic system processes and feedbacks to climate. This project is achieved through experiments, observations, and syntheses of existing data sets that strategically inform and enhance the knowledge base required for model initialization, calibration, and evaluation.

As the lead institution for this project, Oak Ridge National Laboratory (ORNL) has established guidelines for field and laboratory work that all project participants must review and acknowledge. Each partner organization (US Department of Energy [DOE] national laboratories, universities, subcontractors, and collaborators) establishes institutional safety requirements for its staff. The NGEE Arctic leadership team promotes discussions of hazards and best practices for fieldwork and recommends personal protective equipment (PPE) that mitigates hazards. We expect that specific activities and equipment will require additional training and that such training will be provided on the site by subcontractors and qualified staff.

Safety at Arctic field sites is an integral component of the team's research planning and execution, and field research is a hallmark of the NGEE Arctic project. Current field research provides exciting new experiences that can shape the future of our students, staff, and faculty. Field research can also be challenging when people are uncertain about expectations and behavioral norms in an ever-changing and collaborative field setting. We are committed to creating a safe, secure, open, and inclusive project in which people are welcomed, valued, and respected for their talents.

Primary field locations for the project are at the Barrow Environmental Observatory situated on the coastal plain of the North Slope of Alaska near Utqiaġvik, Alaska, and a network of sites on the Seward Peninsula (Figure 1).

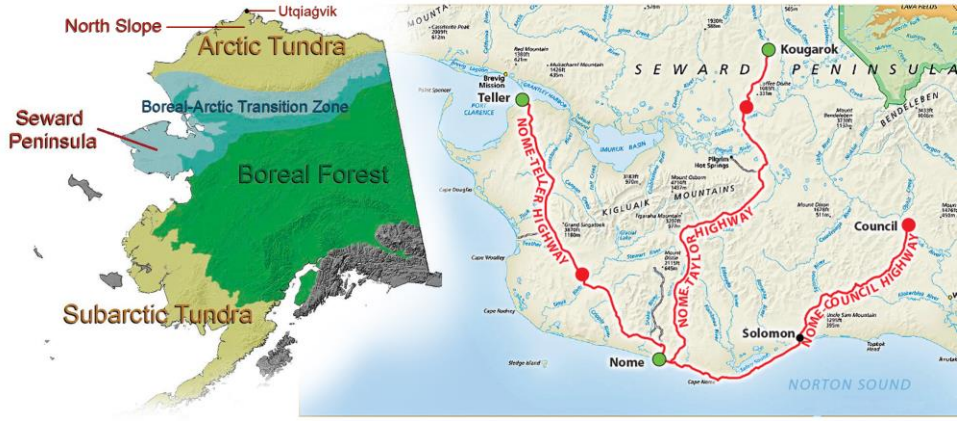


Figure 1. (left) Map of Alaska showing locations of the Seward Peninsula, North Slope, and Utqiaġvik. (right) Locations of field sites along the Teller, Kougarok, and Council Roads outside Nome, Alaska.

The safety culture within the project encourages each individual to be accountable. The project leaders and participants promote a work environment that is safe and harassment-free for all people. All participants are expected to act with integrity and build trust among colleagues, collaborators, and residents in the communities where we work.

The NGEE Arctic project fully supports a Stop Work Authority policy. Through this policy, all participants are empowered to initiate a Stop Work Action for conditions or behaviors that threaten or produce danger to person(s), equipment, or the environment without experiencing negative consequences or retaliation. Although this authority is rarely exercised, it is an essential component of safety plans that enlist individuals and teams to share the responsibility for safety. Individuals may also decide not to pursue approved activities based on physical condition or level of experience.

The NGEE Arctic project is committed to doing what is right—right for you, right for the environment, and right for those who own the land on which we conduct our project research. We are committed to making safe decisions for ourselves and others so that we enjoy our time in Alaska and work safely every day.

Project Safety Requirements

Project Roles, Responsibilities, and Authorities

To ensure the safety and health of all project participants and the environment, the fundamentals of safety management for the NGEE Arctic project begin with the participants.

Project safety management in the field begins with a clear definition of the scope of work to be performed. Each Science Team Lead (STL) is responsible for a scope of work as defined in the Phase 3 proposal presented to the DOE. Each STL is also responsible for defining tasks and selecting Task Leads (TLs) who are, in turn, responsible for developing a scope of work that defines the work to be performed, the participants working on the task, the hazards that will or may be encountered, and the controls to mitigate those hazards. Hazard identification must be thorough enough to identify all sources of injury or illness or damage to the environment, equipment, or property that could reasonably be encountered while performing work. The controls used by participants to avoid or mitigate hazards must be reviewed and approved for adequacy by the safety professionals at the TL's home institution.

Project Safety Requirements

- Ensure the safety and health of project participants and the environment
- Perform individual roles, responsibilities, and authorities
- Enforce and comply with Stop Work Authority
- Take annual safety training module refresher

TLs must ensure that the participants on their team are briefed on the hazards and controls of their work activities, including additional discussions when changes occur. After safety plan briefings, the TL and participants perform the scope of work using the identified controls.

All participants have the authority to stop work upon observing imminent danger; work must cease, and the danger must be reported to the project Officer of the Day (OOTD). Work must not resume until the threat from the hazard is mitigated or removed.

During the preparation and performance of work, all participants must be mindful of known hazards, use defined controls, and be observant of changing conditions. Participants who encounter a new hazard must request additional review before continuing work. The TL will collect lessons learned and suggestions for improving hazard controls; these lessons and suggestions must be considered for changes to the Work and Safety Plan and/or communication to other project task teams. Any changes to the Work and Safety Plan must be reviewed, approved, and communicated to team participants.

The table below describes the field and laboratory responsibilities and authorities of each project role.

Table 1. NGEE Arctic project roles, responsibilities, and authorities.

Role	Responsibilities	Authorities
Laboratory Research Director	• Provide overall leadership for the Next-Generation Ecosystem Experiments (NGEE Arctic) project • Act as the single contact point for the US Department of Energy (DOE) • Ensure project integration • Seek inputs from the Core Team • Direct capability development • Monitor deliverables	• Exercise full authority to manage all aspects of the project with DOE approval
Technical Project Manager	• Direct field campaign operations management and logistics • Generate regular reports • Monitor deliverables • Manage subcontractors • Provide financial management and reporting to the Laboratory Research Director • Hold responsibility for environmental safety, health, and quality	• Manage planning documents, including project timelines and work breakdown structure • Request project information from the Core Team and report to the Laboratory Research Director • Manage all procurements and subcontracts • Assess research safety and quality plans
Institutional Lead	• Establish the proper expectations for safety planning and implementation for all participants from their institutions • Advise the Laboratory Research Director • Assist with planning and reviews • Anticipate staffing issues and resolve performance concerns	• Monitor institutional deliverables across science areas • Plan adjustments to project plan and budget allocations as appropriate
Science Team Lead (STL)	• Develop work plans to integrate activities within and across project elements • Ensure that safety plans are properly developed, reviewed, and approved before field and laboratory work begins • Identify field and laboratory hazards and controls • Monitor deliverables and progress planned • Conduct periodic reviews of plans and adjust via the change control plan • Track budgets against tasks and deliverables • Mentor staff and facilitate collaboration	• Assess safety of team • Set objectives and deliverables for team's focus area • Develop multiyear plans and an annual scope of research to attain deliverables • Build and review budgets • Monitor progress and meet financial performance targets • Assess subcontractor performance
Task Lead (TL)	• Plan responsibilities to complete key tasks assigned by the STL • Execute key tasks • Maintain awareness and brief Field Team on hazards and controls	• Develop work plans, especially for fieldwork • Consult with institutional safety support when planning work with new hazards

Role	Responsibilities	Authorities
Officer of the Day (field operations)	• Ensure that the daily meeting occurs, everyone has a buddy, and return times are known • Gather weather information and bear reports • Serve as point of contact to Oak Ridge National Laboratory and other institutions in the event of an accident	• Halt fieldwork when weather or other hazards that could jeopardize participants arise • Ensure that information is gathered from witnesses to any accident involving an NGEE participant in field locations
All Participants	• Execute the scope of research consistent with the proposal plan • Investigators: collect, document, upload, and release data • Promote a work environment that is safe and harassment-free for all people • Act with integrity and build trust among colleagues, collaborators, and residents in the communities where work is conducted • Employ the buddy system for all work in the field and ensure each buddy team has a communication device	• Modify scope of work as appropriate in consultation with the TL and/or STL • Alert the appropriate STL or Laboratory Research Director when problems arise • Enforce Stop Work Authority for conditions or behaviors that threaten or produce danger to person(s), equipment, or the environment

Annual Safety Training

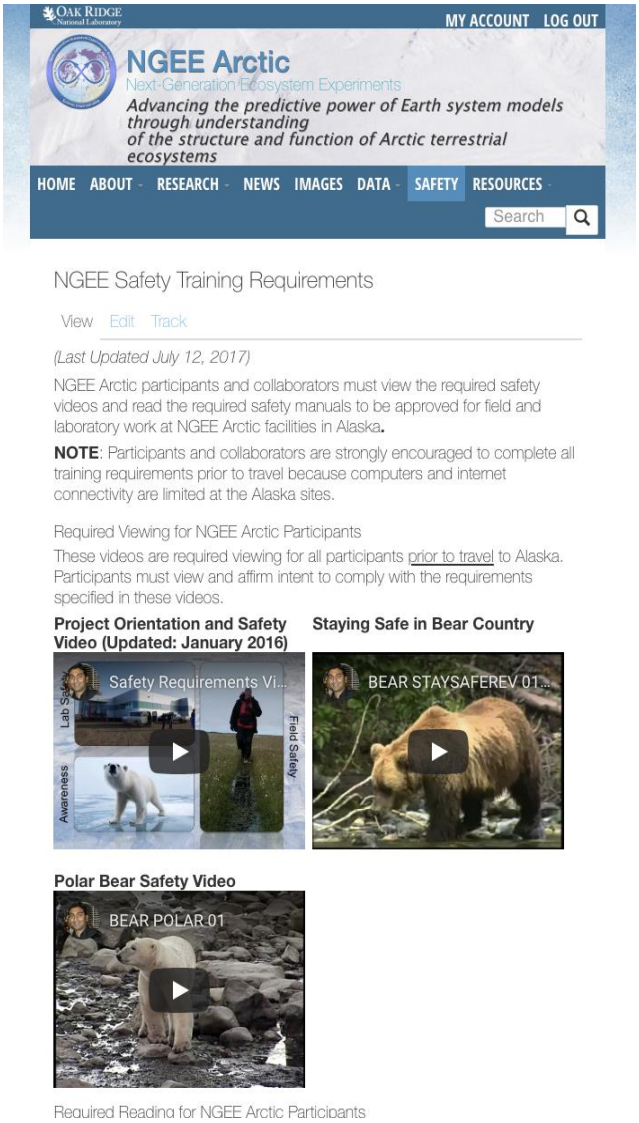
The Core Team of the NGEE Arctic Project has developed this *Project Field and Laboratory Safety Manual* to define the minimum safety expectations and requirements for participation in field and laboratory work in Alaska. All participants must comply with these minimum safety requirements. The hazards and controls contained within the manual do not need to be repeated in the Work and Safety Plan unless additional controls are required because of the work being performed.

The Annual Safety Training Module is located on the **NGEE Arctic website** under the Safety tab, and associated documents are located under the Resources: NGEE Team Files tab. They are reviewed annually for currency and applicability, and significant changes will be communicated to all participants.

A login account is required to access the safety training module and the following safety materials:

- Project Orientation and Safety Video
- Staying Safe in Bear Country Video
- Polar Bear Safety Video
- Project Field and Laboratory Safety Manual
- NGEE Arctic Work and Safety Plan Template

Plan to take the annual refresher before you leave for the field. Participants conducting field research for the project are required to refresh the safety training each year and acknowledge completion.



Field Safety

Field Work and Safety Plan

The STL or TL will prepare the Work and Safety Plan for the field campaign in conjunction with input from the Field Team, Institutional Lead, and Laboratory Research Director.

Send the Work and Safety Plan to your Institutional Lead, Laboratory Research Director, Technical Project Manager, and other related team members or STLs.

A sample NGEE Arctic Work and Safety Plan is available on the **NGEE Arctic website** under the Resources and Safety tabs. The Work and Safety Plan is organized by the following categories.

Planning

- Scientific rational and objectives as defined in the NGEE Arctic Phase 3 proposal presented to the DOE
  - Support to science questions and tasks
  - Support to integrated modeling tasks
  - Progress to data sets
  - Progress to publications
- Additional resources needed (equipment needed, field techniques, outside resources needed)
- Action items

Field Preparation

- TL and OOTD designations
- Location of work
- Trip summary (who, when, where, daily protocol, OOTD assignment, and external resources [helicopter, subcontractors, snow machines, project lodging, and so on])
- Overarching safety goals
- Team member roster, contact information, emergency contact information, and itineraries
- Permits
- Anticipated weather
- Communication plan
- Hazards and controls
- Specific training requirements in addition to the NGEE Arctic project safety training
- Risk assessment
- Previous lessons learned

Checklist

- Easy reference checklist before leaving for field research

References/Contacts

- NGEE Arctic leadership team contacts
- Field contacts

Preparing for Fieldwork

Before You Travel

Before you travel, collect as much information as possible about the work you will do and about the site where you will work. This information will help with planning.

Be aware that when you reach your destination, work conditions may be different from what you expected. If necessary, call your STL or your institutional representative for guidance to prepare properly. The resources of your institution still will be available to you (e.g., your supervisor, subject matter experts, and environmental, safety, and health support staff).

Prepare an emergency phone list to bring with you, including the contact information of your

- Supervisor
- Project colleagues
- Subject matter experts
- Local emergency services

Verify that your emergency contact information is current at your institution and that your supervisor has your contact information for the off-site location.

All participants should have basic first aid training and should carry a first aid kit. Consider any additional training you may need before arriving to the field such as driving in adverse conditions, handling materials, and shipping.

Review, understand, and talk about the Field Work and Safety Plan with your team and address all questions.

Stop Work Authority

EVERYONE has Stop Work Authority: If you are placed in an unsafe condition while working on the NGEE Arctic project, attempt to stop the work and resolve the concern. If that is not possible, you are responsible for removing yourself from the situation and not working until the issue is resolved. A Stop Work Action triggers an immediate review by knowledgeable personnel until the matter is settled. Furthermore, you may decide not to pursue approved activities based on your physical condition or level of experience.

The Buddy System

No one is permitted to work alone at any NGEE Arctic field site. Always have someone with you; you are not permitted to be at the field site alone at any time. Each buddy team must have some means of communication in case of emergency or for notification of changing conditions and hazards. Two-way radios are the preferred method. In Utqiaġvik, radios are available from the Ukpeaġvik Iñupiat Corporation (UIC). On the Seward Peninsula, each team will be responsible for obtaining its own communication device(s), such as a radio, satellite phones, or SPOT beacons.

Officer of the Day

The STL or TL will assign the role of OOTD to a participant every day that project work is performed in Alaska. The OOTD is responsible for

- Planning the daily meeting
- Gathering weather, bear, and other reports relevant to the day's activities
- Ensuring that all participants attend the meeting
- Ensuring that new participants have completed the required reading and acknowledgment

- Ensuring that someone is responsible for carrying the first aid kit, communication equipment, and/or other survival gear (e.g., compass/global positioning system device, whistle, map, emergency survival supplies, lighting, provisions for emergency shelter, fire-starting materials)
- Ensuring that all participants have a buddy and are in good physical health
- Ensuring that any known hazards for the day's work are discussed and that hazard controls are understood

The OOTD also has the authority to cancel field activities because of weather conditions, bear activities, and other unmanageable hazards. In an emergency, the OOTD is responsible and must act to ensure the safety of the participants.

In the event of an injury or illness, notify the OOTD. If an injury has occurred, the OOTD must ensure that any unsafe conditions are corrected or mitigated to prevent further injury, confirm that appropriate medical care has been received, and record that circumstances and actions leading to the injury. Before the close of business on the day of the injury or illness, the OOTD must report it to the injured or ill participant's institutional lead. Additional actions may be assigned after these notifications are made.

Daily Meeting

Each day, before starting any field or laboratory work in Alaska, the OOTD organizes and leads a meeting with project participants to discuss the day's activities and weather conditions. After assigning participants to job teams and work sites and after gathering expected return times for those performing fieldwork, the OOTD confirms that participants have reviewed the hazards and required PPE. The following questions can be helpful to ensure that new and known hazards are controlled:

- What can go wrong?
- What measures or controls are in place to prevent that from happening?
- How do (or which of) the most important controls depend on human actions or behavior?
- Where might an error or omission impair the effectiveness of an important control?
- What change has been made (e.g., to a process, equipment) that could inadvertently increase risk in another area?

Permits

All field sites fall under the jurisdiction of federal, state, or local/native corporate organizations. Native corporation permits are negotiated and signed by the Laboratory Research Director. Federal and state permitting is handled by the University of Alaska Fairbanks (UAF). You are responsible for adhering to local, state, and tribal permitting/requirements, and avoiding subsurface utilities or interferences. Contact the Laboratory Research Director, Stan Wullschleger, or the Technical Project Manager, Susan Heinz, for information about permits obtained for the project.

Weather

Check the weather forecast before leaving home and communicate to the team. Extremes in both high and low temperatures can occur at any time during the year; plan accordingly with protective clothing.

Communication

Plan for communication:

- Bring your emergency phone list with you.
- Make sure that you have some means of communication available in the field. In Barrow, our logistics provider typically provides two-way radios to the Field Teams. These work well because of proximity to the central base station.
- On the Seward Peninsula, each team working in the field needs to have a satellite telephone and a satellite location device such as a Garmin InReach device or a SPOT beacon (DeLorme) with communication capabilities.

- A communications plan will be outlined in the Field Work and Safety Plan. Best practices include using an emergency contact in Alaska as the primary recipient of your logistics and a secondary contact outside Alaska. Develop a strategy for emergency scenarios or no-contact scenarios (e.g., in the event of no contact by 9 p.m., begin escalation to locate the field participant).
- At the end of each day, OOTDs will communicate to account for each team and person.
- Communicate situational awareness to other in the field (weather, road status, bear sightings).

Specific Hazards

Consider special precautions necessary in unusual environments. Local work control processes and health and safety requirements must be followed when working at other facilities.

Review the Hazards and Controls section of this document. Additionally, use mosquito repellants and protective netting as seasonal conditions warrant.

Mandatory General Emergency Controls

This safety manual and applicable safety data sheets (SDSs) for chemicals used by participants must be maintained by personnel at the laboratory or field site.

1. When in the field, you will have access to, and know/learn how to operate, some means for getting timely emergency help (e.g., radio or phone and contact numbers). You must have the emergency services phone numbers for the location and the numbers for the site point of contact immediately available (see **NGEE Arctic Field Work and Safety Manual**).
2. The buddy system is required at all times. You are not ever permitted to be at the field site alone.
3. If you are involved in a work-related injury or illness, immediately seek the appropriate level of medical care required by the event. As soon as reasonably possible after the event, inform the OOTD for proper follow-up and reporting.
4. A first aid kit must be taken to or maintained at the field sites for basic first aid needs. The Red Cross First Aid course is recommended for all participants.
5. If you work in Barrow, you can maintain and be trained on the use of an automated external defibrillator (AED). UIC will provide an AED at the field site and/or a centralized location. An AED is also available for the Seward Peninsula sites. Contact the Laboratory Research Director or Technical Project Manager for access.
6. Because of the remote nature of this work, consider carrying emergency survival items (e.g., compass/global positioning system device, whistle, map, fire-starting materials) and be aware of the route from the worksite to the nearest medical facility and/or a method to summon emergency services to the site.

Working in the Arctic Climate

No matter when or where you travel to conduct field research in Alaska, weather is always a primary consideration. Extremes in both high and low temperatures can occur at any time during the year, and these extremes **vary with location in the state**. Therefore, appropriate clothing, equipment, and procedures are necessary to ensure outdoor safety under these conditions. The major danger occurs when working outdoors on the tundra or sea ice for sustained periods. Also, wind chill factors can easily drop to double digits below zero for anyone traveling on a snowmobile at 30 mph.

Protective Clothing

The appropriate protective clothing and equipment have been identified through published sources and lengthy conversations with local agencies, contractors, and native communities.

Appropriate Winter Clothing

The under layer—to keep your skin dry. The under layer of clothing should be made of fabrics with good moisture wicking ability, such as polypropylene, wool blends, or silk. Do not use cotton as an underlayer fabric because it has poor wicking and insulating properties when wet. Underlayer items include the following:

- Thermal underwear
- Sock and glove liners

The middle layer—to provide insulation from the cold. Polar fleece fabrics trap air in their fibers and are particularly well-suited for the middle clothing layer. Polar fleece is soft, absorbs little moisture, insulates when wet, and dries very quickly. Useful middle-layer garments include the following:

- Turtlenecks/sweaters
- Polar fleece or other insulating jackets/vests
- Polar fleece or other insulated pants
- Socks
- Hats
- Neck gaiters
- Gloves

The outer layer—to protect from rain, snow, and wind. The outer layer of clothing should be constructed of tightly woven fabrics to protect against the wind. Waterproof qualities are less important on the North Slope in the winter because liquid water is seldom present. Outer-layer garments include the following:

- Hooded parkas
- Wind pants
- Insulated boots
- Goggles
- Face masks
- Balaclavas

Appropriate Clothing for Other Times of the Year

Appropriate clothing is often a judgment call depending on the prevailing and forecast weather.

- Well-fitting rubber boots or waders
- Head nets and/or mosquito jackets (mosquitoes are particularly persistent and in ample supply during spring and summer months)
- Rain gear
- Warm cap and gloves, depending on the time of day of the fieldwork

Dehydration and Overheating

Ironically, overheating is a significant threat. Overheating caused by overexertion or by keeping outdoor clothing on for too long while indoors leads to perspiration, which in turn degrades the insulating value of clothing. Upon cessation of exertion, overheating easily turns to hypothermia. Consequently, exertion and protective clothing need to be balanced carefully and adjusted as needed to minimize or preferably prevent perspiration.

Frostbite

Frostbite is the major concern. Keep all skin warm, dry, and protected, and, to the extent possible, remain active. Follow the recommendations for wearing multiple layers of clothing provided in the Appropriate Winter Clothing list on the previous page. Head and facial coverage is also important in windy and frigid climates. At the first signs of numbness or severe chill, seek warmth and covering and initiate mild joint movements. Upon returning inside to warm shelter, treat mild frostbite or chills with additional coverings or with cool-progressing-to-warm water to alleviate discomfort. Lingering frostbite warrants medical treatment.

Bear Encounter Hazard

No matter how careful you are, the possibility always exists that you may encounter a bear while working in the field. A polar bear hazard is possible while working on the North Slope. Grizzly bears are common throughout many areas of Alaska.

The best defense against bears is staying in a group. Bears are extremely unlikely to attack a group of even two people, but it can happen if a bear is surprised. While you are in Utqiaġvik, UIC Science will provide bear guard support. Your work activities may dictate whether you need to have an armed escort for protection.

Under good visibility conditions, you may be able to spot bears at long range and take evasive action without the need for protection. However, under low visibility conditions (darkness, blowing snow), the addition of an armed escort is advised.

If you are planning to work indoors at a field building, you may choose to travel unarmed in a vehicle to the site. In that case, a close watch for bears during arrival and departure from the site may suffice.

For Seward Peninsula sites, no armed escort options are provided. Bear spray cannisters and holsters are available in the conex storage vans. Consider practicing dispensing a can in a safe area with your group for training purposes.

A protective positive sealed case will be used if transporting bear spray in a helicopter to protect against accidental discharge. Bear spray will be stored in a closed container in vehicles to mitigate accidental discharge.

> **The Law:** Polar bears are protected under the Marine Mammal Protection Act of 1972. The Act prohibits the “taking” of marine mammals. “Take” is defined to mean, “harass, hunt, capture, or kill, or attempt to harass, hunt, capture or kill any marine mammal.” Polar bears are considered marine mammals because they spend most of their lives hunting seals on Arctic Ocean sea ice. The use of force against polar bears in defense of human life, and even the use of deterrent devices such as cracker shells by unauthorized persons are both technically illegal under the Act.

Encountering Rough Terrain and Conditions

The terrain you will encounter in Alaska may be different from the terrain to which you are accustomed, and it changes from one region to another and by season in the permafrost.

Be alert while walking in the field because slippery and uneven surfaces could cause slips, trips, and falls. Always be aware of where your coworkers are and of other activities going on around you. Finally, scout carefully and consult with knowledgeable local personnel about current conditions.

Transportation Safety

Seasonal Weather Driving

Driving conditions in Alaska can become severe in a short amount of time. Hazards include snow- and ice-covered roads, which can limit visibility and affect the response of a vehicle.

Field environments may cause challenges in keeping visual contact with all vehicles traveling together as a team. A vehicle may become stranded and not be able to contact other team members for assistance.

Keep a safe distance from the vehicle in front of you to avoid rock contact with vehicle windshields that could affect driving visibility and require costly replacement.

Follow basic tips on planning and preparation when traveling in Alaska. Have the following systems on the vehicle routinely checked by a skilled mechanic:

- Battery
- Ignition system
- Heating and cooling systems
- Exhaust system
- Windshield wipers and washers
- Tires
- Tire chains

Also, maintain the following cold-weather equipment within the vehicle at all times:

- Flashlight
- Brush, broom, or snow scraper for snow removal
- Extra fuses for vehicle systems
- A rag for cleaning the headlights or windshield
- Chains for the tires
- Extra windshield washer fluid
- Insulated gloves
- Small snow shovel
- Small bag of sand or salt
- Blanket and extra heavy clothing for emergencies
- Booster cables or “boost box”
- Nonperishable food for emergencies

NOTE: For additional information, refer to **Winter Weather Driving Tips** from the Alaska Department of Transportation.

Snowmobiles and All-Terrain Vehicles

Utqiaġvik

Use of a snowmobile or an all-terrain vehicle (ATV) to access the site or to transport tools or equipment requires training and qualification before use. Two snowmobile and ATV training videos are required and will be available on-site.

Helmets approved by the US Department of Transportation (DOT) and eye protection (such as goggles or fixed face shield) must be worn at all times by anyone operating or riding on a snowmobile or ATV.

Refer to the work aids located under the Resources, NGEE Team Files, and Safety tabs on the NGEE website for additional information on snowmobile operation requirements.

- **ATV Safety**
- **Alaska Department of Transportation Snowmobile Safety, Laws, Rules and Regulations**

Seward Peninsula

Currently, there are no project resources or logistics for snowmobiles or ATVs, but vendors are available if a team requires their use. Contact the Laboratory Research Director or Technical Project Manager for information.

Helicopter

The NGEE Arctic project has contracted with Bering Air for limited helicopter services to gain access to remote research sites not accessible by vehicles, or to carry equipment to the site. Safety and etiquette guidelines are as follows:

- Use of the helicopter with NGEE Arctic project funds requires prior preparation and planning with the Laboratory Research Director and Technical Project Manager. A manifest that describes the mission with passenger emergency contact information will be prepared for DOE reporting. Additionally, each participant is responsible to adhere to their individual institutional requirements regarding charter travel.
- The aircraft pilot will provide a safety briefing and passengers must follow all instructions.
- Approach or leave in the pilot's field of vision, usually from the front of the aircraft.
- Approach or leave the helicopter in a crouching manner to stay below the main rotor.
- Stay away from the tail rotor.
- Approach or leave on the down-slope side.
- Carry tools horizontally and below waist level, never upright or over the shoulder.
- Fasten your seat belt after entering the helicopter and leave it buckled until the pilot signals you to get out.
- Never leave the helicopter while it is at a hover.
- Do not touch the bubble or any moving parts (e.g., tail rotor, exposed linkage).
- Do not slam the helicopter doors.
- Wear survival clothing in flight, up to the waist, in case of an emergency.
- Keep the heliport clear of loose articles (e.g., water bags, empty cans).
- Keep people away from the helicopter during takeoffs and landings.
- Keep cooking and heating fires well clear of the helicopter.
- Use specific closed containers for transporting bear spray.
- Sling loads will be directed by the air crew (Figure 2).

Helicopter Operations

Helicopter charters for DOE projects require prior planning, manifests, and post-briefings. Contact the Laboratory Research Director or Technical Project Manager for information.

Maintain situational awareness at all times. If something does not look right, tell your OOTD and the flight crew.

Figure 2. Helicopter sling load operation performed by pilot.

Equipment and Ergonomic Hazards

Excessive Noise

Some site locations or activities (e.g., heavy equipment operation) may produce excessive noise. If you use hearing protection devices (ear plugs and/or muffs), either on a mandatory or voluntary basis, you must understand why the PPE is required and must review the proper use and fit of hearing protection devices (refer to "Wearing Hearing Protection Properly," located on the **NGEE Arctic website** under the Resources, NGEE Team Files, and Safety tabs).

All individuals operating drilling equipment, and individuals assisting in operations that put them near any drilling equipment (such as the Big Beaver drill rig and/or the gas-powered hand auger), must wear hearing-protective devices.

If you are unsure whether activities exceed 85 dB noise levels and/or a noise survey is not possible, always err on the side of caution and use hearing protection.

Carrying Equipment

Drill rods, core barrels, augers, and other drilling accessories are heavy, and movement associated with drilling and sampling operations could present ergonomic hazards. Carrying, holding, and operating the gas-powered auger can be hazardous to the back, wrists, elbows, and shoulders. Carrying and handling heavy deep-cycle batteries could result in personnel injury if not done correctly.

Be aware of the need for a proper ergonomic layout of equipment and operations and make adjustments as appropriate.

To minimize the risk of injury, avoid awkward positions when possible during fieldwork and follow proper lifting and carrying techniques.

Tips for Lifting Heavy Items

Lifting is strenuous, and proper bending and lifting techniques are strongly encouraged to perform lifting safely. By bending at the knees (instead of at the waist) and lifting with the large, strong muscles of the

legs instead of the small muscles of the back, workers can prevent back injuries and reduce the potential for lower back pain.

For most workers, lifting loads weighing more than 20 kg (44 lb) can result in an increase in the number and severity of back injuries. Be cautious and use proper lifting techniques when lifting any load, especially those loads approaching 40 lb. A team lift is recommended for all loads weighing at or more than 40 lb. Seek assistance, even for lesser weights, depending on your personal capabilities and the bulkiness of the item.

Operating Equipment

Drilling Rig Operation

Some project participants may operate drilling equipment and/or work near drilling operations (e.g., during soil coring/sampling activities). Special authorization to operate heavy drilling equipment (such as the Big Beaver Power Mast) is required. ORNL has authorized Kenneth Lowe for this operation (Figure 3). Kenneth may choose to have other project participants assist during drilling operations but will not allow these individuals to operate the rig. Kenneth will use the PPE and controls guidance in *Drilling Operations in Support of Environmental Sciences Division* (ESD RSS 8532) when operating the rig. Additionally, instructions within the owner/operator manual for the **Big Beaver Power Mast** and for the **Little Beaver Hydraulic Power Unit** will be followed. The manufacturer pre-use maintenance and safety checklist must be filled out for the Big Beaver Power Mast before for each day's use.

Figure 3. Drill rig and operator Kenneth Lowe.

Operator manuals and a safety checklist are located on the **NGEE Arctic website** under the Resources, NGEE Team Files, and Safety tabs. Documentation can also be found on the **Little Beaver website**.

Other project participants will not be directly engaged in drilling activities; however, if they or any other observers are in the field when heavy equipment is operating, the responsible person on hazards and controls will perform a briefing. Potential topics are an exclusion zone, where observers may not enter around equipment, and hand signals for heavy equipment operators to communicate, if necessary, to the observers. Specific topics are up to the responsible individual, but they must convey the needed information to observers, who in turn are responsible for abiding by the restrictions.

Gas-Powered Handheld Augers

Gas-powered handheld augers will be used to make ground penetrations and take core samples. Any project participant may operate the gas-powered auger. Unless the available auger is a small, single-person unit, operation of a gas-powered auger must be a two-person operation. Individuals operating the auger should be physically fit to handle, move, and operate the device. Be aware that, should the auger bit bind, the power head/top of the auger may kick or attempt to spin freely. Follow all instructions within the referenced owner/operator manual for the specific auger used (**One-Man Auger** or **Two-Man Auger**), but additional considerations are as follows:

- Do not carry the auger between drilling sites/holes with the engine running.
- Keep hands, feet, hair, loose clothing, and lanyards away from moving parts on the engine and auger.
- Always wear safety glasses with side shields and hearing-protective devices (muffs or plugs) when operating the auger.
- Wear safety toe work boots or insulated boots with protective caps at all times when operating the auger.
- Avoid contact with the exhaust system or any other hot parts of the unit.
- Rotate crews or take breaks as needed to limit continuous actions by individuals under extended field sampling situations.
- Follow all instructions within the operator manuals for both types of augers (located on the **NGEE Arctic website** under the Resources, NGEE Team Files, and Safety tabs).

Only individuals who are physically capable of moving the device (team lifting at all times) and holding the device in place during operation (being able to withstand kickback should the bit bind) will be permitted to operate this equipment.

Gas-Powered Portable Generators

Gas-powered portable generators will be used to power various activities. Any project participant may ccccccccccoperate the portable generators.

Operator manuals and safety checklist are located on the **NGEE Arctic website** under the Resources, NGEE Team Files, and Safety tabs.

You can also find the documentation on the Honda EU2000i and EU3000i portable generators at **EU2000i** and **EU3000i**.

Electrical Hazards

The potential for electrical shock requires you to inspect equipment cords and battery cords before use for defects (e.g., loose parts; deformed or missing pins; pinched, cut, crushed, or deteriorated outer insulation). Cords must be removed from service if a defect or damage is observed.

Cords subject to pedestrian traffic must be protected to eliminate physical damage and to minimize tripping hazards.

All electrical equipment powered by alternating current (i.e., portable generators) that is used in the field must be protected by a ground fault current interrupter (GFCI), either by an in-line GFCI extension cord, built-in GFCI protection in the generator, or standalone GFCI circuit protector.

Electrical field equipment that stays outdoors unattended must be listed by a nationally recognized testing laboratory (NRTL; e.g., Underwriters' Laboratories, Inc. [UL]) for such use.

In Utqiaġvik, sealed LI-COR batteries must be charged in a designated area at the UIC garage. Batteries must not be charged when frozen because this increases the likelihood of fracturing the battery casing. Batteries that have visible signs of damage must not be connected to the charger and will be taken out of service for proper disposal.

There are no specific sites on the Seward Peninsula to charge batteries.

NOTE: You may charge deep-cycle batteries, but the manufacturer's instructions for charging/safety must be followed. Your home institution may require additional electrical safety training.

Needles and Sharps

Syringes with needles may be used in some field experiments and measurements (Figure 4). Do not directly recap needles using two-handed operations. Instead, use safer alternative methods (e.g., the foam block technique) to avoid the potential for puncture/needle sticks.

Ensure all needles are recapped before walking around in the fields. Dispose of all sharps in appropriate sharps containers.

Figure 4. A syringe is used to extract water samples from permafrost soils.

Hazardous Materials

Small amounts of hazardous materials (e.g., inorganic salt solutions, dilute sodium hypochlorite solutions, microsphere beads, acids) may be used in the field. All volumes of solutions taken to the field and/or made in the field must be minimized. Hard copies of the SDSs for all chemicals taken to the field must be available to the participants while in the field or in the laboratory.

If you work with hazardous chemicals in the field, you must have training on hazardous materials and must be familiar with the materials (e.g., have access to and be aware of the product SDSs). When preparing solutions in the field, you must wear nitrile gloves and safety glasses with side shields.

To meet the project hazardous compound labeling requirements, secondary chemical containers (not used/stored in laboratories) must be labeled with the identity of the hazardous chemical(s) and appropriate hazard warnings (via words or symbols), which provide at least general information regarding physical and health hazards. This labeling requirement applies unless the hazardous chemical is used only by the person transferring the chemical from the primary container, the person who performed the transfer has constant control of the container, and the chemical is used completely within the work shift.

Cryogenic

Use

Liquid nitrogen and/or dry ice may be used in the field for sample preservation.

For liquid nitrogen, at a minimum, safety glasses with side shields are required at any time cryogenic liquids, exposed to the atmosphere, are present. Goggles provide the best protection for the eyes. A full-face shield must be used when a cryogenic liquid is transferred to an open container when a bubbling potential exists.

Long sleeves or a laboratory coat are means for protecting exposed skin of the arms when working with liquid cryogenics in the field.

For hand protection, special gloves made for cryogenic work (i.e., Cryo-Gloves) or loose leather gloves without gauntlets that can be tossed off readily must be used.

Use tongs or other tools to lift objects out of the liquid or liquid baths. Only use containers specifically designed for holding cryogenic liquids when freezing samples with liquid nitrogen.

Never store dry ice in an airtight container; use loose-fitting lids to prevent pressure build-up.

Do not touch dry ice with your skin. Use tongs, insulated (thick) gloves, or an oven mitt and safety glasses with side shields when handling dry ice.

Use dry ice in a well-ventilated area and keep the material away from your face/breathing zone.

Transport

If you must prepare and ship samples and/or materials on dry ice for air transport from off-site locations, additional DOT function-specific training certifications are required to properly declare and placard the package(s). Authorized individuals must possess the “IATA Dry Ice by Air Shipper” role in LRN.

NOTE: Transport of dry ice by vehicle is not DOT-regulated, but be cautious if transporting dry ice inside vehicles compartments. Ensure adequate ventilation in the vehicle compartment and do not recirculate the air in the vehicle.

Regardless of transportation mode, keep dry ice in closed coolers or other containers, but not sealed airtight.

Flammable or Combustible

Use

A handheld auger and portable generators are powered by gasoline.

Gasoline carried to field locations is transported in containers approved for the purpose. Ignition sources are kept at a safe distance (recommend 25 feet) from storage containers and equipment during refueling.

Safety glasses with side shields must be worn during refueling.

NOTE: Approved metal or plastic safety cans may be used for handling and using flammable liquids in quantities up to 5 gallons. Safety cans must meet the following conditions:

- Be not more than 5 gallons in capacity
- Be listed by a NRTL such as UL or Factory Mutual
- Have a spring-closing lid that closes after filling or pouring
- Be leak-tight
- Have a flame arrestor screen
- Have a safety valve to relieve internal pressure

Transport

Transport of gasoline or compressed gases in Alaska falls under the DOT Materials of Trade (MOT) exception to the full DOT hazardous shipment requirements. You are only permitted to transport hazardous chemicals by vehicle if you have completed the MOT training. The controlling subject area procedure requires the containers to be physically secure and properly labeled.

NOTE: The MOT volume limits per container for gasoline (DOT Class 3 flammable liquid, Packing Group II) is 5 gallons or less. However, multiple safety cans may be transported at the same time.

Airline Pack Safe – Lithium Batteries

Use

Traveling to the field usually entails a variety of battery powered equipment such as Sat Phones, GPS devices, cell phones, rechargeable and non rechargeable lithium batteries, laptops, and power banks.

Transport

These items, containing lithium batteries, must be carried in carry-on-baggage only. The battery terminals must be protected from short circuit.

Size limits: Lithium metal (non-rechargeable) batteries are limited to 2 grams of lithium per battery. Lithium ion (rechargeable) batteries are limited to a rating of 100 watt hours (Wh) per battery. These limits allow for nearly all types of lithium batteries used by the average person in their electronic devices. With airline approval, passengers may also carry up to two spare larger lithium ion batteries (101–160 Wh) or Lithium metal batteries (2-8 grams). This size covers the larger after-market extended-life laptop computer batteries and some larger batteries used in professional audio/visual equipment.

Quantity limits: None for most batteries — but batteries must be for use by the passenger. Batteries carried for further sale or distribution (vendor samples, etc.) are prohibited. There is a limit of two spare batteries per person for the larger lithium ion batteries described above (101–160 watt hours per battery).

View this illustrated **quick reference guide and FAQ** from the Federal Aviation Administration.

Laboratory Safety

Overview and General Requirements

Laboratory activities are performed in a laboratory space that is shared with other organizations and projects both in Utqiaġvik and Nome. Our laboratory users need to maintain a vigilant awareness of the activities of others in the laboratory. PPE is required in the laboratory for project participants who handle chemicals. Minimum PPE includes safety glasses with side shields at all times and nitrile gloves when handling chemicals. You must comply at a minimum with your home institution's Chemical Hygiene Plan requirements when performing NGEE Arctic laboratory activities in Alaska.

No food, gum, cosmetics applications, sandals, open-toe shoes, or open-heel shoes are permitted in the laboratory at any time.

Work conditions at the site may be different from what you expected. Consult your institution's safety, health, or environmental professionals if you have questions. If necessary, ORNL resources will be available to you (e.g., your supervisor; subject matter experts; environment, safety, and health support staff; and the ORNL Laboratory Shift Superintendent).

Mandatory General Emergency Controls

Each identified hazard will be addressed before laboratory activities begin through work controls, training plans, checklists, safeguards, and PPE provisions. However, a mechanism to stop unsafe situations in the laboratory is essential. NGEE Arctic leadership is committed to a Stop Work Authority policy. EVERYONE has Stop Work Authority: If you are placed in an unsafe condition while working on the NGEE Arctic project, attempt to stop the work and resolve the concern. If that is not possible, you are responsible for removing yourself from the situation and not working until the issue is resolved. A Stop Work Action triggers an immediate review by knowledgeable personnel until the matter is settled. Although this authority is rarely exercised, it is an essential component of safety plans that enlist individuals and teams to share the responsibility for safety. Furthermore, you may decide not to pursue approved activities based on your physical condition or level of experience.

If you are involved in a work-related laboratory or injury or illness, immediately seek the appropriate level of medical care as required by the event. As soon as reasonably possible after the event, inform the OOTD for proper follow-up and reporting.

You must have the emergency services phone numbers for the location and the numbers for the site point of contact immediately available (see the **NGEE Arctic Contacts**). Review the NGEE Arctic Team Contact and Site Information for Utqiaġvik and the Seward Peninsula. The information is located in the NGEE Arctic Field Work Safety Plan on the **NGEE Arctic website** under the Resources, NGEE Team Files, and Safety tabs.

NOTE (Utqiaġvik-specific): The UIC Science 24-hour on-call duty manager can be reached at 907-229-6567.

The Red Cross First Aid course is recommended for all participants. A first aid kit will likely be present in each working laboratory; you must ensure that you have access to one.

The shared NGEE Arctic laboratory spaces will include safety shower and eyewash units. Information and instructions for use of the individual units should be discussed during site-specific training. In general, however, if a situation arises in which you need to use an eyewash unit, hold eyelids open so water can get under the lids, and roll the eye to expose it to a stream of water for at least 15 minutes. In the case of safety showers, remove contaminated clothing and shower for at least 15 minutes. Do not block the shower with equipment or materials.

If a snorkel vent is available, verify that the vent is operational before relying on it to exhaust gases.

Laboratory Infrastructure Controls

Chemical Fume Hood

The NGEE Arctic project Core Team ensures that fume hoods are inspected and certified annually. Confirm that the flow indication device is affixed to the fume hood and verify flow before use.

Verify that the hood is turned on and functional before relying on it for safe ventilation. To do this, use a tissue (or Kimwipe) taped to the sash to confirm airflow visually. Pull the sash down to maximize airflow and to provide maximal protection.

Each home institution is responsible for evaluating the specific chemicals its workers will use in the laboratory spaces. However, the minimum PPE for laboratory work includes safety glasses with side shields and nitrile gloves unless the worker's home institution documents exceptions. Laboratory coats are also recommended to meet chemical safety best practices to cover unprotected skin when working with hazardous chemicals.

Disposing of Chemicals

Consult with resident laboratory staff and/or the facility manager before disposing of any chemicals in the drains and/or for other waste labeling and handling instructions.

Disposing of Sharps

Dispose of all sharps in appropriate sharps biohazard containers. Sharps containers are generally located on the benchtop for the disposal of sharp blades and needles. Do not fill the container beyond the fill line.

Do not directly recap needles using two-handed operations. Instead, use safer alternative methods (e.g., direct disposal, foam block technique) to avoid the potential for punctures or needle sticks.

Be sure to follow

- Your home institution's chemical hygiene plan
- Your home institution's general hazard communication training
- OSHA laboratory standards training, including site-specific training

Laboratory Requirements

The NGEE Arctic project involves work conducted under the Occupational Safety and Health Administration (OSHA) Laboratory Standard.

Training

NGEE Arctic project participants working in the Barrow Arctic Research Center and/or the UAF Northwest Campus laboratory space will use some chemicals (such as soda lime and Drierite) and compressed gases.

The principal investigator or a delegate should conduct site-specific training concerning the use of laboratory spaces, which shall be conducted before laboratory use.

Chemical SDSs are available online at **www.msds.com**, through each chemical vendor's website or in printed form.

Site-specific environmental safety, health, and quality (ESH&Q) training includes

1. The physical and health hazards of chemicals in the work area, including signs and symptoms of exposure to hazardous chemicals
2. Methods and observations that may be used to detect the presence or release of hazardous chemicals
3. Measures employees can take to protect themselves from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and use of PPE

4. Location and availability of known reference materials on the hazards, safe handling, storage, and disposal of hazardous chemicals found in the laboratory (e.g., SDSs)

Chemical Classes such as Carcinogens, Flammables, and Caustics/Corrosives

Laboratory work may involve a variety of chemical classes including flammables, caustic/corrosives, toxic compounds, and more (e.g., the International Agency for Research on Cancer lists a component of Drierite as a suspected human carcinogen). Any chemical brought into the laboratory must be approved by the Laboratory Research Director. Each home institution's ESH&Q point of contact also must evaluate chemical use. Additional chemical safety PPE and exposure assessments may be required.

- More information on labeling is available in the **Labeling of Hazardous Chemical Containers** safety document.

Electrical Energy

Some instruments use rechargeable batteries or must be plugged in to power strips (sometimes called multi-strips), and batteries often need to be recharged.

The laboratory environment may have corded electrical equipment, flexible power cords, and/or power strips in use.

Sealed LI-COR batteries will be charged in a designated area. Batteries will not be charged when frozen because this increases the likelihood of fracturing the battery casing. Batteries that have visible signs of damage will not be connected to the charger and will be taken out of service for proper disposal.

Do NOT open an electrical panel or reset a circuit breaker unless you hold the appropriate training qualification. Also, keep areas in front of electrical panels and/or disconnects clear of any storage or equipment—OSHA requires that areas in front of electrical panels and/or disconnects be kept clear a minimum of 36 in. to the front and 30 in. on the sides.

Visually inspect electrical cords for defects (e.g., loose parts; deformed or missing pins; pinched, crushed, or deteriorated outer insulation) before initial use and periodically, such as when relocating plugged-in office equipment. Cords shall be removed from service if a defect or damage is observed. Only someone with the appropriate training qualification may repair or replace cords integral to the equipment.

Flexible cords, cables, and other off-the-shelf electrical equipment, such as electrical power strips, must be approved by an NRTL. The "UL listed" label is a common example of NRTL approval. For illustrations of NRTL marks and symbols, please review the US Department of Labor's **Current List of NTRLs**.

NOTE: Non-NRTL approved items shall not be used for laboratory activities. Contact your institution's safety professionals if you have questions regarding approved/unapproved equipment.

Flexible cords shall not be

- Permanently attached to building surfaces (e.g., stapled or zip-tied)
- Run through holes in or concealed in walls, ceilings, or floors
- Run through doorways, windows, or other pinch points unless adequately protected, or spliced, tapped, or modified, unless specifically permitted by the national electric code
- Used as a substitute for fixed wiring of a structure

Cords that can be stepped on by pedestrian traffic must be protected to eliminate physical damage and minimize tripping hazards.

Electrical multi-strips (power strips) shall not be plugged into one another, which is often referred to as "daisy chaining."

Compressed Gases

Both flammable and nonflammable gases used in the laboratory can exceed 100 psi. The cylinder valves must be closed when not in use.

Typically, compressed gases in large cylinders (such as methane in argon, hydrogen, purified air, or helium) and small lecture bottles (such as methane in air or CO_2, and N_2O in nitrogen) are used.

A cylinder user must read the cylinder label to verify the identity of the compressed gas and to ensure that the proper type and concentration of gas is used. The cylinders must be secured and stored in an appropriate area until needed.

Flammable gas cylinders cannot be stored with oxidizers. Users must determine to the best of their ability that cylinders are not defective or leaking. Knowledgeable personnel will place and inspect regulators.

Small packaged gas cylinders containing reference gases may be used. Cylinders of all sizes must be protected from falling or stem breakage during use and storage.

NOTE: All requirements and guidance on compressed gas cylinder use can be found in the **Compressed Gas Handling and Use** safety document.

Thermal Hazards

Hot

Drying ovens will be used and should be turned off when not in use. Protective thermal gloves and tongs must be used to remove, handle, or manipulate items/samples when the operating temperature is higher than 60°C.

Additionally, before workers can add or remove samples, the oven must be allowed to cool down to ~100°C.

Other safety considerations include identifying emergency cutoffs, guarding/shielding hot surfaces, and posting warnings on hot surfaces before commencing work. Prospective users of equipment that poses thermal hazards in the laboratory must review the **Heat-Producing Appliances Exhibit** for applicable controls.

If heat-producing appliances require modifications, the electrical and/or fire protection authority having jurisdiction must approve the modified appliance before its use.

NOTE: Turn off thermal devices when you leave the laboratory space or no longer need them.

Cold

Liquid nitrogen and low-temperature freezers will be used within the laboratory space. A walk-in cold room at 4°C and three walk-in freezers at −20°C, −40°C, and −80°C are available at the Barrow laboratory. Freezers are also available in the UAF laboratory space. Appropriate PPE must be worn to mitigate hazards.

Cryogenic liquid controls

At a minimum, safety glasses with side shields are required in the presence of cryogenic liquids any time such liquids are exposed to the atmosphere. Goggles provide the best protection for the eyes. A full-face shield must be used when a cryogenic liquid is being transferred to an open container where there is a potential for bubbling. Cryogen gloves (Cryo-Gloves) are also required when handling liquid nitrogen. These gloves are designed to protect the wearer from both the extreme cold of the cryogenic liquid and the contact hazard (frozen skin/flesh). Open-weave extreme-temperature gloves may not be used for this task.

Cryo-Gloves, other extreme-temperature gloves, or tongs are available and must be used when handling extremely cold (−40°C) freezer items.

Only containers specifically designed for holding cryogenic liquids will be used for freezing samples with liquid nitrogen.

Additional information can be found in the **Cryogenic Liquids and Related Components** document.

Freezer contact control

Avoid direct skin contact with objects stored in the cold and ultracold freezers or the inside structure of the freezers. Cryo/thermal gloves are available for use when extended handling time is required while inside the freezers or while removing items from the freezers. Gloves (cotton, leather, or other material) that eliminate direct contact and minimize temperature transfer between the objects being handled and the skin may be used when more dexterity is needed and handling time is minimal.

PPE for entering the cold room and freezers in addition to required safety glasses with side shields is as follows:

- Cold room—Wear appropriate clothing and watch for spilled materials that could cause slipping.
- −20°C freezer—Wear appropriate clothing and protective gloves.
- −40°C freezer—Wear appropriate clothing, protective gloves, and safety glasses with side shields.
- −80°C freezer—Wear appropriate clothing, protective gloves, and safety glasses with side shields.

Packaging, Transporting, or Shipping of Samples

Materials are ordered directly from the vendor and shipped to the site. Some items, such as plant and soil samples, may be shipped from the work location back to ORNL or another NGEE Arctic collaborating institution.

Plant and soil samples are collected under the related Field Safety Manual and processed within the laboratories. Samples to be sent to ORNL or other collaborating institutions will be shipped as luggage or separate air cargo (dry ice will not be used for sample preservation). Such samples must be nonhazardous and contain no hazardous preservatives.

If questions arise about transporting or shipping materials, research staff members must contact ORNL Transportation Management or the shipping department of their home institution.

Referenced Documents

All documents are archived under the Resources, NGEE Team Files, and Safety tabs on the NGEE Arctic website at **http://ngee-arctic.ornl.gov**.

Field Safety References

Documents and manuals are located on the internal NGEE Arctic website under the Resources: NGEE Team Files tab and are password protected. Current team members should use the Contact form to request access.

All-Terrain Utility Vehicle Controls: Training Documentation Owner's Manual—**https://ngee-arctic.ornl.gov/filebrowser/download/381**

ATV Safety—**http://www.atvsafety.org/**

Big Beaver Operator Parts Manual—**https://ngee-arctic.ornl.gov/filebrowser/download/1202**

Cold Stress Guide—**https://www.osha.gov/SLTC/emergencypreparedness/guides/cold.html**

Drill Rig Manual—**https://ngee-arctic.ornl.gov/filebrowser/download/393**

Honda EU2000i Companion Generator Owner's Manual—**https://ngee-arctic.ornl.gov/filebrowser/download/1204**

Honda EU3000i Handi Generator Owner's Manual—**https://ngee-arctic.ornl.gov/filebrowser/download/1205**

Little Beaver PS-18H/PS-19D/PS-20HA/PS-24H Hydraulic Power Unit Operator's Manual—**https://ngee-arctic.ornl.gov/filebrowser/download/1206**

Little Beaver Safety Checklist—**https://ngee-arctic.ornl.gov/filebrowser/download/1209**

Marine Auto ATV Battery Charging—**https://ngee-arctic.ornl.gov/filebrowser/download/377**

NRTL Marks and Symbols—**https://www.osha.gov/dts/otpca/nrtl/nrtllist.html**

One-Man Auger—**https://ngee-arctic.ornl.gov/filebrowser/download/388**

Snowmobile Safety, Laws, Rules, and Regulations—**http://www.dot.state.ak.us/stwdplng/hwysafety/assets/pdf/AK_Snowmobile_Laws_Rules_Regs_02-03.pdf**

Snowmobile Work Aid—**https://ngee-arctic.ornl.gov/filebrowser/download/384**

Two-Man Auger—**https://ngee-arctic.ornl.gov/filebrowser/download/390**

Wearing Hearing Protection Properly—**https://ngee-arctic.ornl.gov/filebrowser/download/382**

Winter Weather Driving Tips—**http://dot.alaska.gov/winter_driving_tips.shtml**

Work and Safety Plan

Laboratory Safety References

Compressed Gas Handling and Use—**https://ngee-arctic.ornl.gov/filebrowser/download/399**

Cryogenic Liquids and Related Components—**https://ngee-arctic.ornl.gov/filebrowser/download/374**

Field Safety Manual—**https://ngee-arctic.ornl.gov/filebrowser/download/392**

Guideline: Fire Protection for Ovens, Furnaces, and Environmental Chambers—**https://ngee-arctic.ornl.gov/filebrowser/download/380**

Heat Producing Appliances Exhibit—**https://ngee-arctic.ornl.gov/filebrowser/download/379**

Laboratory Safety Manual—**https://ngee-arctic.ornl.gov/filebrowser/download/1223**

NRTL Marks and Symbols—**https://www.osha.gov/dts/otpca/nrtl/nrtllist.html**

Recognized Industrial Practices for Activities Involving the Storage, Handling, and Use of Hazardous Chemicals—**https://ngee-arctic.ornl.gov/filebrowser/download/394**

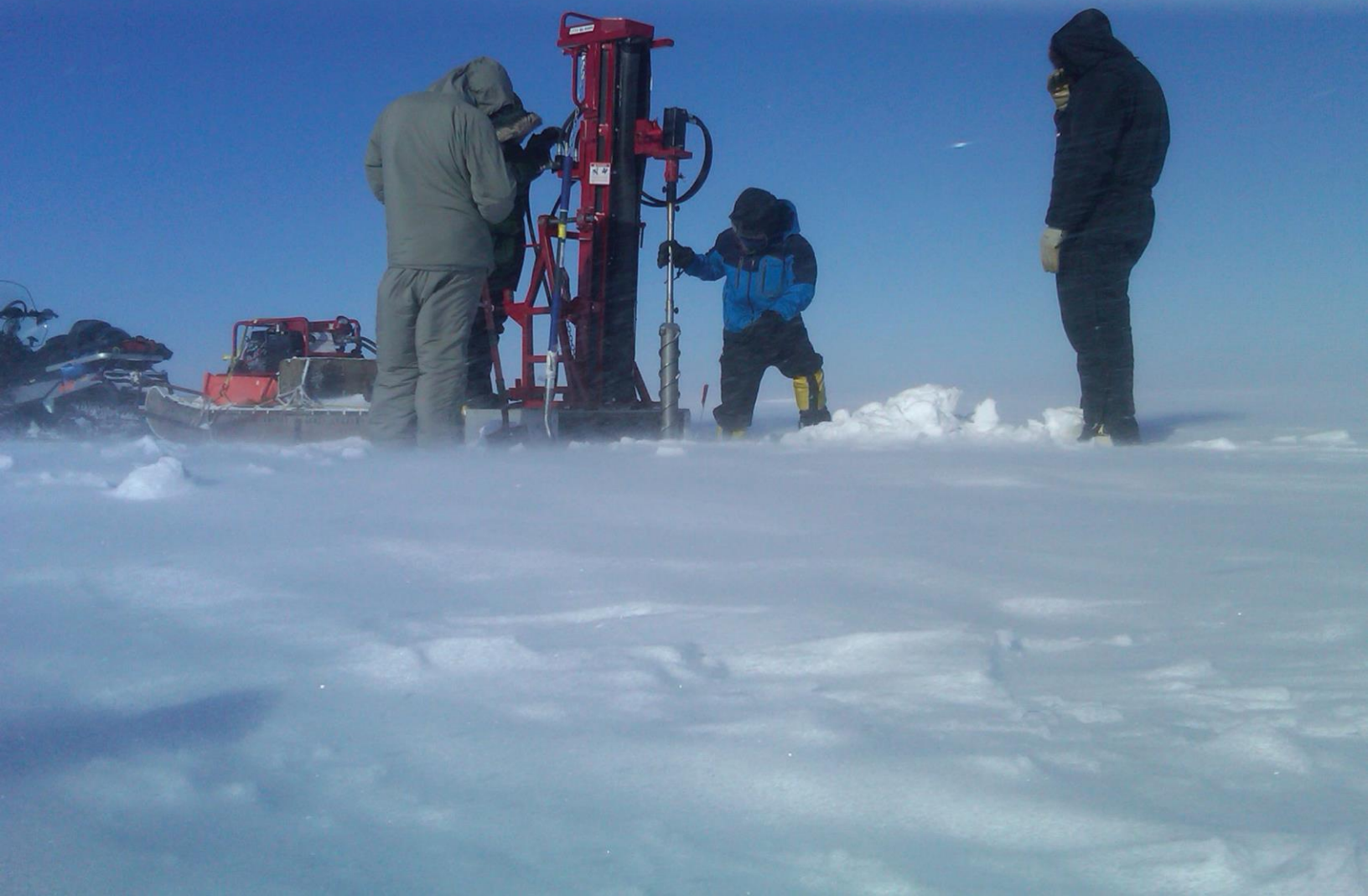
Literature Cited

Roberts, D. E., and M. P. Hamlet. 2001. “Prevention of cold injuries.” In *Medical Aspects of Harsh Environments*. D. E. Lounsbury, K. B. Pandolf, and R. E. Burr (eds.). Department of the Army, USA, pp. 411–427.

Contact Information

See the NGEE Arctic Team Contact and Site Information for quick reference numbers and addresses for Utqiaġvik and the Seward Peninsula. The information is located in the NGEE Arctic Field Work Safety Plan on the NGEE Arctic website at **http://ngee-arctic.ornl.gov** under the Resources, NGEE Team Files, and Safety tabs.

Appendix



Barrow Artic Research Center Photos and Information

Barrow Artic Research Center facility photos showing laboratory safety features (fume hood, fire extinguisher, emergency eyewash and safety shower, and more) and major pieces of equipment and infrastructure.







Bally

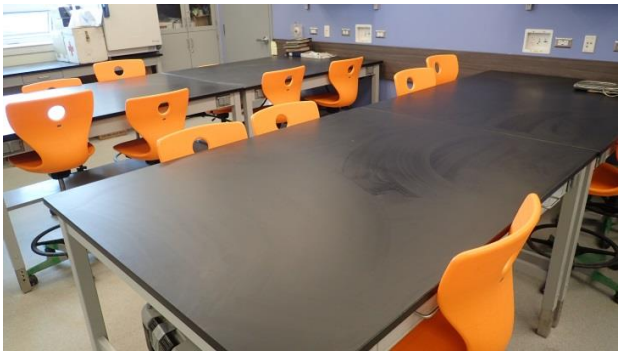
Bally

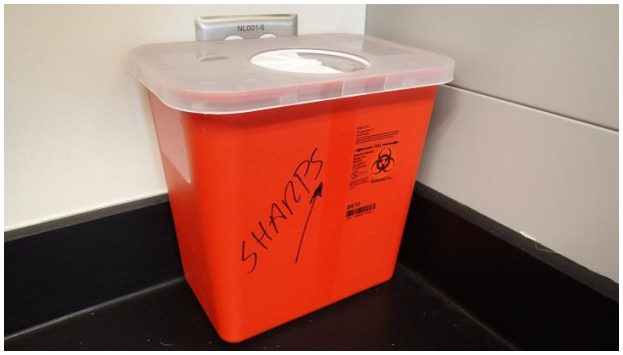


BlueM

University of Alaska Fairbanks Northwest Campus Photos and Information

UAF facility photos showing laboratory safety features (fume hood, fire extinguisher, emergency eyewash and safety shower, etc.) and major pieces of equipment and infrastructure.




SHARPS


FLAMMABLE
KEEP FIRE AWAY
CORROSIVES
CORROSIVES