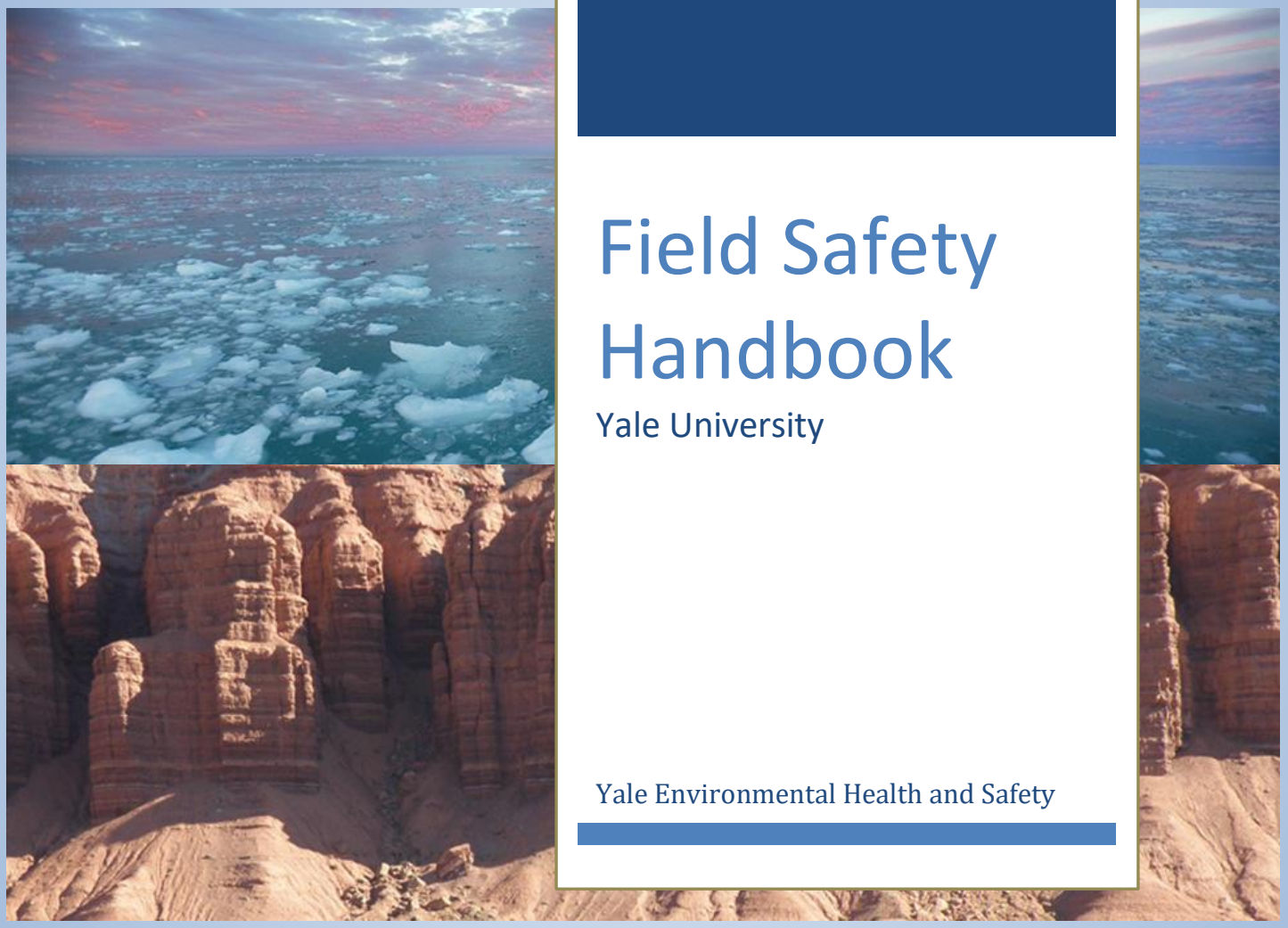

Field Safety Handbook

Yale University

Yale Environmental Health and Safety

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Introduction

1. Introduction

The faculty, students, and staff of Yale University conduct research studies anywhere in the world. Such studies, occurring outside traditional classroom environments and essential to the advancement of knowledge, may often take place in regions of the world where challenging and unusual hazards are present. This research is referred to as "field studies" or "field research". The purpose of this manual is to assist Yale researchers and staff with planning and preparation for field research.

The writer of the Yale Field Safety Handbook wishes to acknowledge the following essential references to which our Handbook is deeply indebted:

The University of California, "Field Operations Safety Manual"
The American Association of Petroleum Geologists,
"Field Safety in Uncontrolled Environments"
US Department of the Interior, USGS,
"Safety and Health for Field Operations, Handbook 445-3-H,

Definition of Field Research

Field research, or fieldwork, is the collection of information outside of a laboratory, library or workplace setting.

Roles and Responsibilities

The Department of Origin assists the participant with training and preparation and approves the Field Research plan.

The Sponsoring Agency is the organizational entity in charge of the field research site. The Sponsoring Agency is responsible for the safety of the participant at the field research site.

A Field Site Supervisor (FSS) is any person who directs, guides, or mentors the participant at the field research site. The FSS is in charge of the field research site and is responsible for safety of participants, risk assessments, and hazard remediation at the site.

The participant is the Yale-associated person who conducts research at the field site. The participant gathers information about hazards, prepares hazard risk assessments, and submits a Field Research Plan to the Yale Department Head or their designated representatives.

Yale Environmental Health and Safety (EHS) acts as a safety information resource and provides training and guidance to all parties at Yale.

Planning for Fieldwork

2. Planning for Fieldwork

The goal of planning is for the participant to gather information for the preparation of key documents to achieve a healthy and safe experience while engaged in Field Research--The Emergency Response Plan, and the Field Safety Plan

Emergency Response Planning

The Emergency Response Plan (ERP) is a document containing contact information and contingency plans to be used in emergencies. The plan remains with the participant at all times and it must be made available to the participant's Yale Department of Origin and the Sponsoring Agency at the field research site. The following items should be part of the ERP:

☐ The name(s) of the participant(s) and emergency contact information.

☐ Contact information for local police, fire, and/emergency rescue services*. If possible, the emergency services should be consulted to get their estimate on response times to the participant's field residence and the field research site.*

☐ Location of the medical facility with route plans from field site(s) and domicile(s).

☐ Contact information for local people who can assist in an emergency.

☐ Contact information for the US Consulate (as needed)

☐ Contact information for International SOS (as needed)

☐ Identification of allergies and location of emergency medications such as auto-injectors.

☐ Contingency plans for location-specific hazards such as sudden inclement weather, political unrest, etc.

☐ Verification of communications/check-in times.

☐ Special communication procedures in the event phone or internet are not functioning.

In the Yale University International Toolkit website, there is an example of an "Emergency Action Plan" under the "Study Abroad Student Handbook". This Emergency Action Plan can serve as a good starting point.
http://www.studentsabroad.com

Field Safety Plan Development

The field safety plan is a comprehensive list of hazards the participant expects to encounter in the field research environment along with a list of hazard control measures the participant will use to eliminate or reduce the chance of injury. The field safety plan should include all potential hazards for which the participant may reasonably be expected to encounter, and where the participant is untrained or has no significant experience. The participant should consider listing multiple control measures because some measures may not be available or feasible in the field environment. Hazard analysis and risk assessment must be accomplished for each hazard in order to complete the field safety plan.

Hazard Analysis

A hazard is a source of harm. Hazard analysis is the process of listing hazards from most serious to least serious, and listing control measures to protect the participant from each hazard. Hazards must be researched in order to comprehend their nature, to identify factors which amplify or mitigate the hazard, and to choose effective control measures. The Department of Origin and Yale EHS and will assist the participant in collecting hazard information and making hazard analysis. An example of hazard analysis is given below. A more comprehensive list can be found in Appendix B.

Hazard	Control Measures
Malaria Infection https://www.cdc.gov/parasites/malaria/index.html	▪ Use DEET or other insect repellents ▪ Use mosquito netting ▪ Use antimalarial/prophylaxis drugs
Chainsaw Injury https://www.osha.gov/OshDoc/data_Hurricane_Facts/chainsaws.pdf	▪ Get training ▪ Develop a pre-operations checklist ▪ Wear PPE--Helmet with faceshield, gloves, chaps, and hearing protection

https://www.ccohs.ca/oshanswers/hsprograms/hazard_risk.html
https://www.osha.gov/shpguidelines/hazard-prevention.html

Risk Assessment

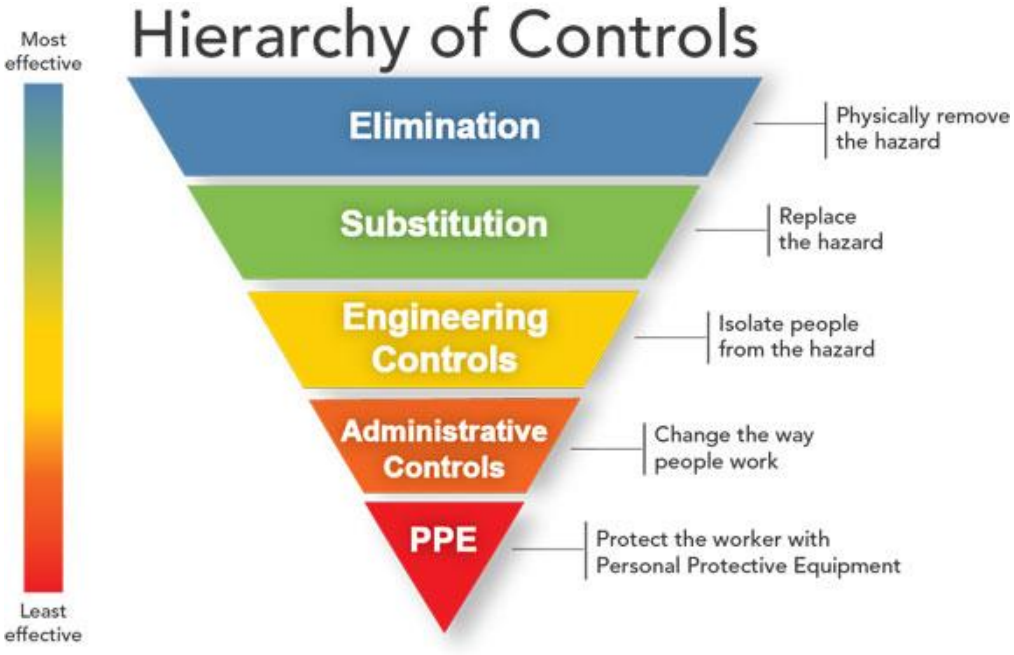
Risk is the chance that a known hazard will cause harm. Risk assessment is a process where the probability of an adverse event occurring (i.e. being injured by a hazard) is weighed against the severity of consequences for that adverse event. The application of effective hazard control measures will either decrease the probability of the adverse event or decrease the severity of consequences. In developing the field safety plan, the participant will assess their own risk to identified hazards, investigate control measures, and apply them to reduce the chance of injury. *Anyone involved in the process is strongly encouraged to seek assistance from Yale EHS and other safety organizations.* Other factors must be considered in the risk assessment:

- The frequency with which the hazard is encountered
- The number of people exposed to the hazard
- Where applicable, the risk assessment must include the possibility of significant changes in weather, terrain, or other conditions that may increase the nature of hazard

Appendix B lists a number of hazards and possible control measures to assist the candidate in selecting the best method(s) of hazard reduction. In situations where a hazard exists which is not addressed sufficiently in Appendix B, the participant will have to develop their own risk assessment by using online resources or printed materials along with consultations with their department of origin and Yale EHS.

Once hazards have been identified, controls must be selected to decrease the risk of incidents and injuries. There may be many options for control of a hazard but not all may be available or feasible. Some choices are better than others because they are more effective. To help understand the relative effectiveness and protection offered

by different control measures, please refer to the NIOSH Hierarchy of Controls diagram:



Controls which fall into the top of the diagram are more effective at controlling the hazard and offer more protection to workers.

Elimination and Substitution are generally the options that offer the most protection, but they are often difficult to achieve in an existing process. For example, a researcher using the hazardous solvent chloroform may not have the option of eliminating it from the experiment, or substituting with a less hazardous solvent, because chloroform is essential and gives the best results.

Engineering controls are often the best option for hazard control because they can be adapted or implemented in an existing process. An example of an engineering control is the machine guard on a table saw which prevents a worker's hand from contacting the saw blade. Some additional examples are:

- A soundproof housing, placed around a machine tool, or around the operator, to protect workers from high noise levels.
- A concrete wall to provide radiation shielding and physically prevent workers from approaching too close to a high radiation hazard.
- A fume hood to conduct harmful vapors, fumes, and mists away from workers and protect them from exposure.

- A needle box/sharps container for discarding used needles, razors, and scalpels.

Administrative controls are rules, policies, procedures, work practices, and training to inform workers and protect them from hazards. A warning sign is an example of an administrative control. Another example is a company policy limiting the number of hours a driver can operate a truck without a rest period. Administrative controls are used when engineering controls are not practical. They are less effective than Engineering Controls because they can be easily bypassed if workers forget or ignore them.

Personal Protective Equipment (PPE) is equipment worn or carried by workers to protect them from hazards. It is the last line of defense and should never be used as the sole method of hazard control. Before PPE can be used, the participant must be trained in hazard awareness and in care and proper use of the PPE.

Hazard controls reduce the risk of injury, but there will always be some residual risk unless the hazard can be eliminated.

https://www.cdc.gov/niosh/topics/hierarchy/default.html

Risk Assessment Matrix

A fast and simple way to assess the effectiveness of controls is to use a Risk Assessment Matrix (RAM). The matrix cross-references the level of potential harm from a hazard—the Severity, against the likelihood that injury will occur—the Probability. A caveat; the RAM is an oversimplification of a typically complex process. The value of the RAM lies in its ability to produce a quick estimate which is a good "first approximation" of risk reduction.

The matrix user performs an initial assessment of the risk before controls are applied. In order to do this, it is critically important that the user have an appropriate understanding of the nature of the hazard. References, resources, and experts must be consulted for guidance and knowledge before the initial assessment can be done. Otherwise, an inaccurate initial assessment may put people at greater risk.

First, the severity of a possible incident must be considered. The matrix included here has a four-point scale:

- **Catastrophic - 4** An incident arising from human error, environment, design deficiencies, element, subsystem or component failure, or procedural deficiencies may commonly cause death or major system loss.

- **Critical - 3** An incident arising from human error, environment, design deficiencies, element, subsystem or component failure or procedural deficiencies may commonly cause severe injury or illness or major system damage.

- **Marginal - 2** An incident may commonly cause minor injury or illness or minor systems damage such that human error, environment, design deficiencies, subsystem or component failure or procedural deficiencies can be counteracted or controlled without severe injury, illness or major system damage.

- **Negligible - 1** An incident caused by personnel error, environment, design deficiencies, subsystem or component failure or procedural deficiencies will result in no, or less than minor, illness, injury or system damage.

Next, the probability or likelihood of an incident is considered in the matrix. This matrix has a five-point scale:

- **Frequent - 5** Will occur often in the life of an item

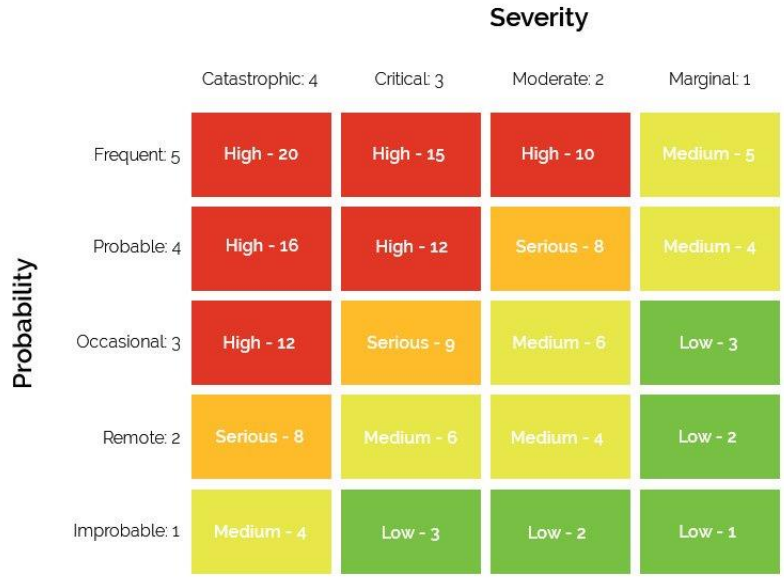
- **Probable - 4** Will occur several times in the life of an item

- **Occasional - 3** Likely to occur sometime in the life of an item.

- **Remote - 2** Unlikely but possible to occur in the life of an item.

- **Improbable - 1** So unlikely, it can be assumed occurrence may not be experienced.

Next, the initial risk score is achieved by multiplying the values for Severity and Probability as can be seen in the matrix:



A second risk assessment is made after controls are applied using the same process described above. The user must apply experience, knowledge, and/or judgement to decide if the controls will decrease hazard severity, hazard probability, or both.

Finally, the entire process must be approved by supervisory persons who have ample experience and knowledge of the hazards and risks.

An example of the process is as follows:

Clarisse will spend three months in Montana studying quaking aspen trees sponsored by the US Forestry Service. She will need to use a chainsaw, and she has no experience with them. As part of the planning process, she does some research online, and consults with her Principal Investigator, department administrator, a contact at the Sponsoring Agency, and Yale EHS. The Sponsoring Agency informs her that they will provide equipment-specific training for the chainsaw and PPE (chaps, gloves, and protective headgear). She knows the exact model of chainsaw, so she reads the manual. She decides to purchase a set of round files to sharpen the chainsaw blade, because she has learned equipment maintenance is part of a good safety plan and a dull chainsaw blade can cause fatigue for the operator.

Consulting the RAM, her initial assessment of severity and probability is “critical” and “occasional”. This gives her a risk assessment number of “Serious-9”. After application of controls, training and PPE, she takes stock of the situation. Clarisse has hazard controls and she has educated herself, but she knows she is still a novice. With this in mind, she consults the RAM again and begins the process of assessing risk after controls are applied. She feels justified in dropping the severity to

"Moderate" and the probability to "Remote". This yields the new risk assessment of "Medium-4". Clarisse submits the risk assessment to her supervisor.

The RAM process can be applied by supervisors dynamically to new hazards that suddenly appear, but this should only be done by someone who has a high degree of experience with the hazard.

https://www.industrysafe.com/blog/risk-matrix-calculations-severity-probability-and-risk-assessment/

https://www.osha.gov/shpguidelines/hazard-Identification.html
https://www.ccohs.ca/oshanswers/hsprograms/risk_assessment.html

Threat Analysis

Threat analysis refers to human elements—criminals and terrorists—who intend either direct harm to the participant or political unrest. The process of threat analysis begins in the planning phase and ends when the participant returns home.

The purpose of this section is to briefly remind the participant of their potential vulnerability in an unfamiliar locale and not to offer specific advice about personal safety measures. For personal safety recommendations, the participant is directed to consult with local law enforcement and emergency response organizations in the region of the field study.

Engaging in field research means the participant will travel some distance from their familiar surroundings where the culture and people are known to them. Even in the United States, a person traveling to a distant location is easily recognized as an outsider. The situation is more pronounced when a person leaves the USA for another country. This can make them a target for criminal acts or terrorism. They are also more vulnerable should a crisis ensue. The participant can take steps to protect themselves by reducing their target profile.

In the planning phase, the participant must investigate the culture and customs of the region before departing for the region or country where the field site is located. Do research on the political situation, local holidays, criminal activities, sensitive topics, and locations where extreme caution are advised. Read newspapers and other periodics published by people from the region. Investigate information sources such as the embassy or consulate, or the US Department of State publications; *Tips for Travelers*, *Background Notes,* and *Travel Advisories*.

Speak with someone who has recently been to the field site to learn about cultural do's and don'ts, appropriate clothing and clothing typically worn by someone of the participant's age and gender, and places to avoid. Identify trustworthy contacts in the foreign country and establish contact before departure.

http://www.roperinsurance.com/travel-safety-when-traveling-abroad/
https://www.ricksteves.com/travel-tips/theft-scams/outsmarting-pickpockets
https://travel.state.gov/content/travel/en/international-travel/before-you-go/crisis-abroad--be-ready.html

First Aid Training/First Aid Kit/CPR

The field research site may be some distance from adequate medical support facilities. Part of the safety considerations for the field site may be the need for a first aid training and a kit supplied with components sufficient to deal with the types of injuries that might occur at the field research site. The participant must consider the need for this and address it in the Field Safety Plan.

There is no perfect first aid kit, but here are some guidelines to help assemble one for the site:

- Have the first aid kit checked by a physician who is familiar with the hazards at the field research site
- First aid kits don't save lives, people do. All researchers at the site must be trained on how to use ALL components of the kit
- Commercial first aid kits are good starting points. Buy a good kit and add components to it
- Customize your kit for your destination, tasks, group size, and level of training
- Pack extra gloves
- Re-pack your first aid kit for each trip; replenish used or expired items
- Check for expiration dates on medications and sterile items; replace items that may have been torn open or damaged. Many vendors sell refill kits
- Leave an empty plastic bag in your kit for trash. Be strict with all users of the kit to use the trash bag.

If an injured person is not breathing, then they will need Cardiopulmonary Resuscitation (CPR). Classes for CPR are offered by EHS and elsewhere on campus, but may require scheduling weeks in advance. The participant should include CPR training in the planning phase if such training is necessary.

Survival Kits

A survival kit, also referred to as an emergency kit or "safety equipment", is any group of items that enable a person to temporarily persevere in adverse circumstances until they can reach a place of greater safety. For example, a simple survival kit for sightseeing in Rome, Italy might be as follows: cell phone, passport, laminated card with the address and phone number of the US Consular Office, power bar or other snack, bottle of water, pill container for a day's supply of medicine, and 100 Euro note tucked in a shoe. Kit components vary depending on the hazards and the environmental conditions. A survival/emergency kit for a cold weather environment will have a longer list of components.

https://en.wikipedia.org/wiki/Survival_kit
https://www.fieldandstream.com/three-things-to-consider-before-you-buy-survival-kit/
https://www.travelers.com/resources/weather/emergency-preparedness/how-to-build-an-emergency-preparedness-kit

Participants must consider where survival/emergency kits are necessary for their field studies and incorporate them into their Field Study Plan. First Aid kits are an essential sub-component of almost every survival/emergency kit.

For each kit, a checklist must be developed to ensure all items are present, functional, and have not passed expiration dates. Kits are stocked with desirable items that are often removed/pilfered and not replaced. For this reason, kits must be inspected at regular intervals depending on the nature of the hazards in the environment. A survival kit for a truck going into the Australian Outback might need to be inspected once a week, while a survival kit for SCUBA diving would require an inspection before and after each dive. Perishable kit components may require more frequent inspections than other components.

Take the time to learn how to use each kit component, or at the very least, make sure instructions are included in the survival/emergency kit checklist.

Accommodations/Domiciles/Residences

Will the Sponsoring Agency provide living quarters for the participant? If not, the participant will arrange for a residence with the assistance of the Department of Origin. Short-term rentals can be arranged through various websites:
https://www.airbnb.com/
https://www.homeaway.com/
https://homelink.org/en/
https://www.sabbaticalhomes.com/

Itinerary at the Field Site(s)

Participants must inform their Department of Origin concerning their travel itinerary from Yale to the region where the field study will occur. Once they arrive, participants must ensure a daily itinerary is recorded with the Sponsoring Agency at the field research site. The itinerary should include locations with GPS or map coordinates, travel times, communication (radio, cell phone, etc) plan with check-in times, and relevant emergency plans. The Participant must inform the Sponsoring Agency of changes as soon as possible.

Health and Medical Issues

It is likely that any pre-existing health and medical issues will be accentuated by travel, harsh climate, or the unfamiliar environment found at field research sites. For this reason, the participant should get a medical exam appropriate for the expected hazards and obtain necessary medical clearances 6-8 weeks prior to departure. Travel health appointments can be made by contacting Travel Health Services for Students (203-432-8148) or Passport Health (203-285-3485).

It is the participant's responsibility to inform the Department of Origination and the Sponsoring Agency of any medical condition which may affect the participant's ability to conduct field research. Some hazardous activities such as diving require special exams and clearances. Some medical conditions may require the participant to avoid or restrict activities such as working alone or working in cold environments.

The participant should bring all necessary medications and copies of prescriptions, and arrangements should be made for refill of prescriptions. The Sponsoring Agency should be notified if the participant has ever experienced life-threatening allergies causing anaphylaxis brought on by a bee stings, antibiotics, or foods. If appropriate, vaccinations can be acquired at this time.

The participant should be shown the written arrangements for medical treatment at the field study region and the medical emergency evacuation plan from the field study site. If possible, the local emergency services should be consulted for their estimate of response times to the participant's field residence and to the field research site. For participants outside the US, international SOS can assist with emergency medical evacuation to the nearest hospital meeting international standards of care and repatriation of mortal remains.
https://www.internationalsos.com/personal-travel

The Sponsoring Agency must notify the Yale Department of Origination if the participant incurs a serious injury or illness (amputation, disfigurement, blindness, overnight hospitalization) or fatality while the participant is in the field study area.

Insurance

The participant may need to research and acquire more than one type of insurance prior to departure.

- Automobile driver's insurance. What is adequate for the region?
- Medical insurance. How is coverage affected at the field site?
- International SOS https://www.internationalsos.com
- Travel Insurance
- Diving accident insurance https://www.diversalertnetwork.org/

Communication Plan

The communication plan must be robust. Each day at the field research site, prior to commencement of work, all members of the field research team should receive a safety briefing reviewing key items such as the emergency communication plan, communication check-in times, weather, active hazards, and changes that have a potential for affecting site safety. The field research site should have at least one reliable means of distant communication such as a cell phone, two-way radio, or satellite phone. If there is no single reliable method of communication, then a backup method should be provided. All communication systems must be tested and verified each day. Check-in times must be established for all field research teams at the site. All team members must know the emergency communication procedures at the site.

Exchange of Information

Strong lines of communication between all entities are critical to a safe and successful field research experience. Robust contact between the Department of Origination and the Sponsoring Agency must be maintained throughout the field research process in order to keep all entities informed. Exchange of information is critically important for the participant in the planning phase so the participant has access to information for their Field Study Plan.

Particular attention should be paid to items such as changes in the planned itinerary, changes in the hazard profile, a clear description of all research activities undertaken, costs that may be borne by the participant or the Department of Origination, and changes of areas of responsibility. Such information should be provided in a timely manner well in advance of the fieldwork to allow for consultation with Yale agencies above the Department of Origin, government

agencies, or subject matter experts. The participant will need time to arrange for informed consent, training, purchase of equipment, vaccinations, etc.

Working Alone

A person is considered as working alone when they cannot be seen or heard by another person. Not all circumstances of working alone are hazardous to the "lone worker". However, hazards in the workplace are more perilous for the lone worker because they are at greater risk for;

1. Verbal and physical abuse from other persons.
2. Accidents or emergencies due to hazards in the workplace or sudden illness.
3. Delays in treating or responding to these emergencies because no one is available to give first aid or assistance.
4. Inadequate monitoring of rest, personal hygiene and general welfare of the lone employee

Working alone increases the risk of injury. While at the field research site, the participant should work as a member of a two-person team as much as possible. Avoid working alone unless there is no alternative. For situations where working alone must occur, consider using a "Lone Worker" automated emergency communication system.

https://www.hsa.ie/eng/Topics/Hazards/Lone_Workers/
https://www.directsafetygroup.com/risks-hazards-of-working-alone

https://www.ccohs.ca/oshanswers/hsprograms/workingalone_offsite.html
https://www.safetyandhealthmagazine.com/articles/12628-lone-worker-safety

Personal Protective Equipment (PPE)

Personal protective equipment is any type of equipment, worn or carried, that protects the participant from injury in a hazardous environment. PPE is specific for certain hazards; there is no single PPE set for all possible hazards. As part of the control measures for hazard reduction, the participant will have to consider what PPE is necessary. *PPE will not protect from hazards if the user is not trained on the PPE or if the user fails to wear the PPE*.

In the planning phase prior to departure, there will need to be exchange of information between the Department of Origin and the Sponsoring Agency regarding who is responsible for providing the participant with PPE. The participant might need to acquire PPE from a Yale source or purchase it themselves. Yale EHS is an invaluable source of guidance for what PPE is required.

Permits, Licenses, Approvals, and Registrations

Transport of regulated items across state or international borders often requires a permit or license. Regulated items fall under what are known as Export Control Laws. Any attempt to transport such items without a permit or license may result in fines or penalties. The participant must determine if permits or licenses are necessary with sufficient time to acquire them prior to departure. The following items or goods may fall under a federal law requiring the need for a permit or license:

-Biohazards
-Computers
-Chemicals
-Defense Articles
-Electronics
-Microorganisms
-Space-Related Technologies
-Telecommunications

Transport of certain goods or items to countries under US embargo or sanction may be restricted. Additionally, cultural items may be protected by import/export laws, treaties, conventions, or policies. For an brief excellent summary of restricted activities and protected cultural items, the participant should visit the Yale International Toolkit https://world-toolkit.yale.edu/resources-topic/restricted-activities.

Research involving human subjects must be approved by the Yale University Institutional Review Board (IRB). Questions related to field studies involving human subjects should be referred to the Yale Human Research Protection Program, (HRPP) https://your.yale.edu/research-support/human-research/hrpp-about-us

Yale EHS can assist with guidance and training for shipment of chemicals, biological agents, and other hazardous materials. https://ehs.yale.edu/research-materials-shipping

Additionally, participants are advised that certain research activities occurring on state or federally owned lands within the US, or internationally, may require a permit.

Supervision, Monitoring, and Review

The Department of Origin and the Sponsoring Agency should exchange information regarding an appraisal of the supervision at the field site. The appraisal should satisfy the Department of Origin's requirements for competency of field study supervisors. Other factors to be addressed in the appraisal are the level of supervision and the density of supervisors to participants to verify adequate management of hazards and risks takes place at the field study site. As a minimum, supervision at the field study site should be described in the Field Safety Plan. Supervision can also be listed as a hazard control measure.

Monitoring and review is a continuous shared process between the Department of Origin and the Sponsoring Agency which begins in the planning phase and ends when the participant returns home. Both sides monitor the safety of the participant, take note of issues and problems, and conduct reviews to make adjustments and changes for future field studies.

Plan Approval

The participant assembles the information necessary for completion of the Field Study Plan and submits it to the Department of Origin for approval. If the participant is a member of a group or team of researchers, then the Department of Origin

should arrange for all members to be briefed about the contents of the plan. Yale EHS will review and approve the field study plan.

Training for The Fieldwork

3. Training for the Fieldwork

Many hazards require specific training and certification available only from experts. Yale University mandates such training be documented as part of various safety programs in order to protect participants and to remain in compliance with regulatory requirements, accrediting agencies, or funding agencies. Such documented training can be acquired from various sources:

- Yale EHS, online courses, or classroom
- Commercial sources
- Collaborative agreements with other educational institutions
- Departmental or Sponsoring Agency sources

The following list includes tasks and hazards where training is mandatory:

General Field Skills

Field First Aid

Field first aid training is essential where medical services are more than one hour distant. A basic first aid course will not be sufficient. Training programs for field first aid are available from many sources and are often referred to as "Advanced First Aid" or "Wilderness First Aid". The program should be vetted beforehand to ensure the curriculum covers the types of injuries experienced at the field study site. https://emergencycare.hsi.com/wilderness-first-aid

Outdoor Ethics

Participants should be taught the basics of minimizing their impact on outdoor field environments. Training in conservation and outdoor ethics will educate the participant to avoid damaging field research sites, which are often fragile, or causing undue harm to the environment or historical nature of the surroundings. https://lnt.org/get-involved/training-courses/

Leadership Skills

Yale participants who are instructors, guides, or facilitators for other researchers at the field research site are assuming a leadership role. As such, then need to be trained or certified for leadership tasks that are more than those normally found in the classroom environment. Leadership courses are available though sites such as NOLS, https://www.nols.edu/en/courses/ , and the NOLS Leadership Educator Notebook can also be ordered from their website. Another excellent resource published by the American Association of Petroleum Geologists is "Field Safety in Uncontrolled Environments". The Department of Origin and the Sponsoring Agency should have the credentials and an approval process for instructors, guides, and facilitators.

Basic Outdoor skills

It is recommended that participants get trained in outdoor skills if they will spend time at an isolated field research site. Learning a few essential skills can save lives and prevent injury should disaster or misfortune occur.

- Building a fire, and outdoor fire safety
- Sheltering techniques
- Location-specific/climate-specific training (cold weather, desert, etc)
- Map reading and use of a compass
- Water purification
- Knot tying
- Using hand tools; axe, hatchet, machete, knife, etc

There are schools nearby offering weekend classes to learn outdoor skills.
http://www.northcampsurvival.com/courses/
https://www.primalsurvivor.net/best-survival-schools-usa/

Specialized Field Skills

Underwater Diving

Underwater diving is a high-risk activity which requires mandatory certification. Participants must have a current physical fitness evaluation and complete a safety diving course offered by an appropriately certified professional--the Diving Safety Officer or (DSO). Yale University has an agreement with the University of Connecticut DSO to provide diving training through their Marine Sciences Department at Avery Point, CT. https://marinesciences.uconn.edu/mstc/diving/# A dive plan must be completed for each research dive. Diving accident insurance is offered through Divers Alert Network (DAN) https://www.diversalertnetwork.org/.
https://www.aaus.org/

Boating

Participants operating a motorized boat must complete a Motorboat Operator Certification Course (MOCC). Non-motorized boats (kayaks, canoes, rowboats, sailboats, etc) do not require MOCC, but the participant should complete a safety course in practical boating skills offering instruction in the following skills:

- Familiarity with boating terminology and types of boats
- Basic boat inspections
- Paddling techniques

- Weight distribution in a small boat
- Safety equipment such as personal floatation devices (PFD)
- Emergency procedures
- Weather and water conditions for safe boating
- Knots, lashings, and tiedowns
- Basic/survival swimming instructions
- Float plan

A float plan must be completed for each boating trip.

https://www.ct.gov/deep/lib/deep/boating/PrivateProviders.pdf
https://www.uscgboating.org/
https://sportsandrecreation.yale.edu/recreation-centers/mcnay-family-sailing-center/sailing-programs

Confined Spaces

Field researchers may encounter confined spaces in a number of guises; caves, caverns, tunnels, grottos, tanks, pipes, crawl spaces, manholes or chambers. OSHA defines a confined space as a space which;

- Is large enough for an employee to enter fully and perform assigned work;
- Is not designed for continuous occupancy by the employee; and
- Has a limited or restricted means of entry or exit.

Confined spaces must be considered "high-hazard" areas because it is difficult to extract people from them if they become injured or overcome by hazardous atmospheres.

In the US, confined spaces may be referred to as "permit required confined spaces" if they are known to contain hazards as defined in 29 CFR 1910.146. Entry into any space meeting this definition is forbidden unless specific training and safety requirements are met. OSHA requires training for three types of assigned duties should a permit required confined space need to be entered: Authorized Entrant, Attendant, and Entry Supervisor. Yale EHS can provide some of this training.

https://www.osha.gov/Publications/osha3138.html

https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=9797&p_table=STANDARDS

Fall Protection

Climbing or working at heights are a hazard that may be present at the field research site. This includes free climbing or work on scaffolds, ladders, structures, man lifts or cherry pickers, cliffs, and roofs. Accidents involving falls or falling objects are consistently among the highest sources of injury from year to year. Field research conducted at heights above 6 feet will require training in fall protection. Some aspects of this training are as follows:

- Fall hazard recognition
- Guardrail systems
- Personal Fall Arrest Systems (PFAS)
- Ladder safety
- Scaffolds
- Perimeter protection
- Falling object protection

Yale EHS can provide fall protection training. There are also online sources for fall protection training.
https://www.guardianfall.com/fall-protection-training/online-training-courses?gclid=EAIaIQobChMIzpzmtOX85QIVNRh9Ch0eYQROEAAYAiAAEgK0sfD_BwE

Operating Power Tools or Equipment

This section includes powered hand tools and powered equipment such as ATVs and snowmobiles. Please contact Yale EHS prior to using powered tools or equipment. Follow all instructions in the manufacturer's manuals and keep manuals nearby when operating the equipment. Use the manufacturer's guidance to develop a list of safe work practices for hazard mitigation. For some tools and equipment, it may be necessary for the participant to develop a Job Hazard Analysis.

Job Hazard Analysis (JHA) is a technique where a job (or a task) is broken down into its component steps followed by an evaluation of each step for hazards. A JHA can be done for any hazardous task, but it is particularly important if any of the following conditions exist:

- A job/task with a high injury or illness rate.
- A job/task with the potential to cause severe or disabling injuries or illness.
- A job/task where simple human error could lead to a severe accident or injury.
- Any job/task new to your operation or where changes have occurred in the process or procedures.
- Any job/task complex enough to require written instructions

Modified from: Safety and Health for Field Operations, Handbook 445-3-H,
US Department of the Interior, US Geological Survey, February 2014, p.1

Each hazard is mitigated by elimination, substitution, engineering controls, work practices, or PPE. Additional requirements for worker training, certification, authorization, etc., may be identified for the process or job. The final product is a concise document describing the standard of safe operation for a particular job or task.

Modified from: Field Operations Safety Manual, University of California, Office of the President, Risk Services, 2019, p.18.

Operating Machine Tools

Industrial machine tools—mills, presses, lathes, saws, planers, shapers, and shears--can be very hazardous without extensive training in safety and proper operation. Machinery can cause serious injuries such as lacerations, electrocution, and pinching. Additionally, machinery with combustion mechanisms can create hazardous atmospheres and may require special exhaust systems to protect the operator. The participant must contact Yale EHS if any machine tools are used in their field research. Machine tools can cause serious injuries by themselves, but they also generate additional hazards to the operator; noise, dusts and fumes, slippery surfaces, sharp objects from cuttings, electrical hazards, and hazards from stored energy. If use of a machine tool in unavoidable, then the participant must be completely familiar with the operating manual and conduct a JHA of their process.

https://smithy.com/machining-handbook/chapter-1/page/4
https://www.osha.gov/Publications/osha3170.pdf
https://www.osha.gov/SLTC/etools/machineguarding/generalrequirements.html

Excavating or Trenching

Excavating or trenching are hazardous because of the possibility of being trapped or buried if there is a collapse. In general, excavations of five deep or more require some type of protection for the entrant, safe access and egress, and a daily safety inspection by a competent person. Other hazards occur with excavations;

- Physical hazards from use of digging equipment.
- Respiratory hazards caused by disturbing soil that contains environmental contaminants
- Risk for trips/falls if the edge is not clearly flagged or protected.

Consult with Yale EHS for guidance and to establish safe work practices.
https://www.osha.gov/Publications/trench_excavation_fs.html

Clinical Work or Handling Biological Specimens

Any clinical work or research involving human body fluid or tissue samples carries with it the risk of infection from bloodborne pathogens and other agents. Participants who expect to work in a clinic, or in a laboratory where unfixed human body fluids and tissues are analyzed, must protect themselves with a combination of engineering controls, training, work practices, PPE, medical examinations, vaccinations, and post-exposure prophylaxis which may vary considerably depending on the nature of the hazards. Yale EHS Biosafety should be contacted to

assist the participant with hazard and risk assessments and to select appropriate control measures for any of the following:

- Tuberculosis and tuberculosis awareness training
- Any research involving recombinant DNA (rDNA) viruses or viral components
- Known human pathogens
- Known animal pathogens
- Biological toxins

The control measures must be integrated into the participant's Field Safety Plan as a subset termed the "Exposure Control Plan". Be advised that medical clearance, training, and vaccinations may take many months to complete.

Handling Hazardous Materials, Chemical, Radiological

Participants who expect to conduct field research using hazardous materials, hazardous chemical reagents, or radioactive isotopes must contact Yale EHS Chemical Safety Office or Yale EHS Radiation Safety Office for guidance and training. The safe use of such materials requires the proper combination of engineering controls, training, administrative controls, and PPE.

- Flammable chemicals
- Corrosive chemicals
- Toxic chemicals
- Strong oxidizers
- Explosive, pyrophoric, or water reactive chemicals
- Radiological isotopes of any type

Proper storage, use, and disposal of hazardous chemicals and radiological agents is governed by numerous US regulatory entities.

Handling Wildlife

Field research with wildlife presents many hazards to the participant; zoonotic diseases, vector diseases, attack or injury from the animal, and other physical hazards in the environment. The Sponsoring Agency is responsible for training the participant on hazards associated with wildlife at the field research site.

If possible, it is recommended that the Department of Origin and the participant consult with Yale Institutional Animal Care and Use Committee (IACUC) and Yale EHS regarding animal and wildlife protocols. IACUC can advise on best practices for darting, handling, or trapping wildlife. EHS can help assess additional field hazards to the participant—weather, terrain, hazardous plants, and hazardous animals and insects.

Bear in mind that animal procedures require hands-on demonstration and training; consult with the Yale Animal Resource Center (YARC) or Yale EHS Biosafety for guidance and never perform work that is not specifically approved in your Animal Use Protocol.

> Modified from: Field Operations Safety Manual, University of California, Office of the President, Risk Services, 2019, p.19

Shipping/Transporting Hazardous Materials or Biological Samples

Shipment of hazardous materials or biological samples is highly regulated. Participants desiring to ship these materials must contact Yale EHS and complete training on eShipglobal. https://your.yale.edu/work-yale/learn-and-grow/training/financial-training/express-shipping/faq-express-shipping

Driving Powered Industrial Trucks (Forklifts)

A number of utility vehicles fall under the general category of powered industrial trucks; fork trucks, tractors, platform lift trucks, motorized hand trucks, and other specialized industrial trucks powered by electric motors or internal combustion engines. Operators must meet the OSHA requirements for training to include formal and practical training, a performance evaluation, and determination of competency to operate the powered industrial truck safely. The training is composed of truck-related topics for the make and model of truck and workplace safety related topics as specified in OSHA regulations. 29 CFR 1910.178(l)(4). Classroom instruction is available from several online sources, but participants will need to acquire truck specific training and worksite specific training at the field work site.

Unmanned Aerial Systems-(UAS/Drone)

Yale university has a policy which applies to use of UASs all Yale staff, faculty and students operating UASs at any location (including international) as part of University activities or within the scope of their employment. https://ehs.yale.edu/sites/default/files/files/unmanned-aerial-systems-pollicy.pdf A flight request must be submitted to Yale EHS and Office of Emergency Management (OEM) at least ten days prior to UAS deployment. http://ehs.yale.edu/sites/default/files/files/unmanned-air-system-flight-request.pdf. All incidents and near misses must be reported to Yale EHS.

At the Field Site

4. At the Field Site

Acclimation

Travelling is hard on the body because it disrupts the body's normal rhythms. Jet-lag, sitting for long periods of time, uneven mealtimes, and insufficient hydration are all present during travel and take the body out of sync with its normal environment. This is true for a four-hour drive as it is for an eight-hour flight. Additionally, for international travel there is a process of adaptation and learning about the new culture.

Upon arrival in a new country, the participant should take time to allow their body to acclimate to the new surroundings. This can take up to a week depending on the distance travelled. The participant should rest, hydrate, and avoid drinking alcoholic beverages during the acclimation period. Avoid driving or operating hazardous equipment.

Many people experience a sense of being confused and overwhelmed by the unexpected and unfamiliar nature of their new surroundings. The process, labelled misleadingly as "culture shock", occurs most often during the first weeks after arrival in the new country. As mentioned previously in the planning section, some study before departure is helpful. After arrival in the country, one should try to take things at an easy pace. The participant will encounter some degree of adversity, discomfort, and disorientation. A good attitude to strive for is to be patient, humble, and open-minded while at the same time maintaining a sense of awareness of surroundings.

Personal Security

Blend in

When in a foreign country, learn a few basic phrases in the local language. Study the local social iconography; symbols, flags, sports teams, etc. Read newspapers and journal articles about the region, and read those from the region, if possible.

Stay Alert

The participant remains at risk for criminal activity as long as they stay in a foreign country. They are vulnerable because they don't speak the language, they don't know the local laws, and they are easily recognized as a foreigner. While in a foreign country, the participant should practice what is referred to as "situational awareness"; a heightened state of alert for changes in the nearby surroundings and an increased vigilance for escape routes away from trouble. An excellent description of situational awareness is found in chapter 3 of *The Field Researcher's Handbook* by David J. Danelo.

Again, patience is the key to attaining situational awareness. The participant should pace themselves in a new environment and study their surroundings. Pay attention to what people nearby are saying and what they are doing. There are "normal" patterns and rhythms in the manner people interact and conduct themselves day to day. Paying attention to the patterns allows one to notice when something is not normal. Stay away from crowds, disturbances, political meetings, or commotions. The participant should be alert to anyone following them or watching them.

Avoid Attracting Attention

The participant should try to avoid appearing like a tourist. The participant should avoid the following;

- Displaying money
- Taking out a map and studying it in public places
- Using ATMs in non-secure locations and failing to shield information while using an ATM
- Wearing expensive jewelry
- Fixating on cell phones and cell phone conversations while failing to keep focus on their surroundings
- Leaving baggage unattended
- Establishing patterns of movement and travel routines that do not vary
- Travelling alone and failing to take advantage of safety in numbers

Guard Your Personal Information

Avoid over-sharing with passing acquaintances. Criminals will use this information to plan an attack. Do not share details of travel itineraries. Keep personal and sensitive information in a room or other locked location.

Safety Briefings

There must be a safety briefing every day before starting any movement and a safety briefing before entering the research site. A driver's safety meeting is needed for vehicle travel. A water safety briefing is needed for water travel. Additional briefings can be done as needed. See appendix C for examples of safety briefing formats.

Emergency Procedures

Participants should be reminded of the emergency procedures often. A good practice is to review them at safety briefings. The emergency procedures must be rehearsed by all members of the group so that everyone knows each role and what is expected of them. *Conducting multiple rehearsals will help build the team, instill confidence in the participants, and cross-train group members.*

Communication Plan

The communication plan must be robust. Each day at the field research site, prior to commencement of work, all members of the field research team should receive a safety briefing reviewing the communication plan. The field research site should have at least one reliable means of distant communication such as a cell phone, two-way radio, or satellite phone. If there is no single reliable method of communication, then a backup method should be provided.

No communication system is 100% reliable and some are tricky to operate. It is often tempting to allow the unofficial assignment of "communications operator" to a small number of participants in the group who show aptitude with the communications gear, yet this is usually a bad idea. *Everyone in the group must be proficient with all communications equipment.* Communication systems must be tested and verified each day. Check-in times must be established for all field research teams at the site. All team members must know the emergency communication procedures and signals at the site.

Exchange of Information

Exchange of information is a continuous process while the field research is ongoing. Changes and problems will arise while the participant is at the field research site. This information should be shared with the Yale Department of Origin as soon as possible. The Department of Origin and the Sponsoring Agency should agree to a list of critical information requirements affecting the hazard profile at the field research site and the safety of the participant.

Accommodations/Domiciles/Residences

Once they have arrived "in country", the participant will acquire housing, possibly arranged by the Sponsoring Agency. The residence may be distant from the field research site. The participant should inspect the residence carefully for safety issues. There are three main areas of concern:

☐ **Is the structure habitable?** Are walls, foundations and roofs intact? Is there damage to internal structures from rot, mold or insects? Is there damage from animals, water, or fire?

☐ **Is the structure secure?** Can all doors and windows be locked or secured from intruders? Are there unsecured access points in the basement or attic/roof?

☐ **Can you escape quickly if there is a fire?** Use the Residence Checklist in Appendix C as a guide for inspecting your living quarters for fire hazards. Reaction to a fire emergency will vary depending on the type of domicile and its location in the world. It is recommended that the participant determine as soon as possible, from the Sponsoring Agency or the local EMS, the best sequence of steps to take in the event of a fire and then update the ERP.

The completed Residence Checklist and the updated ERP contain valuable safety information for the Department of Origin and Yale EHS. The participant should make every effort to return these completed documents.

Transportation

The purpose of this section is to address safe means of transportation in the country or region where the field research takes place and especially in and around the field research site. Transportation accidents "in-country", by aircraft, bus, car, taxi, train, boat, etc, are a major cause of injury to students abroad. The participant should take steps to make sure the mode of transportation and the travel route are safe.

Generally, the least hazardous form of mass transit throughout the world is by rail. The next best choice is by bus. Finally, if neither are available, feasible, or safe, the participant should consider a vehicle, but it may be best to let an experienced local contact be the driver.

Local contacts are invaluable sources of information with regard to transportation conditions and means. Check the Association for Safe International Road Travel (ASIRT) website for current reports and other valuable "in-country" travel information.
https://www.asirt.org

Accident, Incident, and Near-Miss Reporting

An incident is any event that has a impact on safety. An accident is an incident where there is injury or property damage. A near-miss is an incident where injury or property damage was narrowly averted.

All incidents should be recorded. "Reporting, whether formal or informal, is a means to identify the root cause of a deviation from safety planning and make recommendations that will inevitably lead to better problem solving and preparedness."* Ideally, the Department of Origin and the Sponsoring Agency should agree on a report format that satisfies both their needs. Comments should be

solicited from participants, supervisors, and other staff, ideally in an after-action review (AAR) setting, addressing the following concerns;

- How and why the incident occurred.
- How the incident have been prevented.
- What was done during and after the incident.
- What worked well and what went wrong.
- Review and/or modification of the ERP or other plans.

The responsible person for completing the report should be put in writing beforehand. For example, incidents at the field research site are the responsibility of the FSS, but incidents occurring at the participants living quarters are the responsibility of the Sponsoring Agency administrator.

After Completion of Fieldwork

5. After Completion of Field Work

Supervision, Monitoring, and Review

Once the participant has returned to Yale, an evaluation of the entire field study process should occur. A method should be developed for the Department of Origin and the Sponsoring Agency to appraise the participant's experience at the field site with focus on specific areas of interest;

- What was the quality of supervision?
- Were existing hazards dealt with effectively?
- Did new hazards arise, and how were they handled by the supervisory staff?
- Did failures occur in safety equipment or PPE?
- Were accommodations adequate and safe?
- Were there any accidents, close calls, near misses, or incidents?
- Do any procedures, protocols, or JHAs need to be revisited/revised due to information gleaned from AARs, accidents, close calls, near misses, or incidents?
- What was the quality of services rendered by third party providers?
- Did any safety issues arise with respect to communications or transportation?
- What issues detracted from the participant having a successful field study experience?
- What issues contributed to a positive field study experience?

Best Practices for Leaders and Instructors

6. Best Practices for Leaders and Instructors

Leaders and instructors are key members of the sponsoring agency. Their job is to lead groups of participants to and from the field research site. Leaders and instructors must have the appropriate level of experience and training to successfully accomplish the field research and keep all participants safe from hazards. They must possess the following traits:

- A depth of experience with the research subject matter at the field site
- Intimate knowledge of conditions at the field site through personal experience; climate, weather, hiking and driving conditions, wildlife and plant life
- The ability to effectively manage and oversee diverse groups of researchers such that all participants retain a focus on the group goals and safety
- Solid communication and leadership skills necessary to build a team where every participant internalizes the goals, jobs, and expectations for successful research done safely
- A composure displaying caring, fairness, and trustworthiness accessible and approachable to participant researchers
- First aid training. Field first aid training is the minimum if medical assistance for a serious injury is more than 1 hour distant
- Specialized training essential to the research
- Ability to assess risks, to mitigate hazards, and use of conservative judgement to protect participants from harm

The Importance of Team Integrity

Field research teams may have to conduct research in isolated locations for extended periods. Diverse groups of participants involved in field research must be blended into a cohesive group in a short period of time. Training activities should be designed to cross-train participants on research-critical and safety-critical tasks, but also to mold them into a team that can still function effectively when there are injuries or other emergencies.

The leader/instructor should use knowledge of group dynamics to create a team culture where all members are devoted to the research mission and keep a continuous focus on safety. A positive group dynamic is one where team members trust each other, they work towards a collective decision, and they hold each other accountable for proper performance. Good team integrity helps to foster an environment where the group can make safe decisions together.
https://pubs.iied.org/pdfs/G01718.pdf

Evaluate groups and individuals for unsafe/risky behavior and effective intervention

The leader must set the tone by explicitly expressing the group goals and expectations for each group member. A few suggested rules and policies should be established regarding the following:

- Personal safety—obey all safety rules such as wearing seat belts, wearing PPE, hiking, swimming, climbing, or other rules specific to the field research site

- Take care of yourself—If a participant is injured, not feeling well, or is uncomfortable with a task, then they should report this to an instructor. Additionally, participants must do all they can to be ready for the research; get plenty of rest, eat well, and drink ample amounts of water.

- Sexual harassment –clearly describe the university policy regarding sexual harassment and ensure all members understand that it will not be tolerated

- Disruptive or counterproductive behavior—inappropriate jokes, sarcasm, or insulting remarks are distracting to the group goals and group dynamic

- Aggression—threats or threatening motions suggesting intent to cause harm or intimidate others

- Language—Bad language should be avoided

- Policy on Alcohol consumption or other substances—This must be expressed clearly to the group because it affects safety, learning, group cohesiveness, and there are legal issues

- Policy on smoking—smoke free areas and designated smoking zones

- Cell phone use—explain when cell phone use is inappropriate such as during classroom activities, while driving, or during specific research activities

- Punctuality—participants must be ready for instruction at the assigned time and place. Team members must be able to depend on each other to complete assigned tasks in the allotted time.

- Take part in discussions—*It is vital that all members of the group speak up and are made to feel they can do so without embarrassment. The observations of any single participant can be critically important during safety briefings and After Action Reviews.*

- Consequences if rules are broken—corrective actions that may occur

- Removal from the field research site, or from the program—although this should not be made as a threat, it may be advantageous to give an example of a time when a person's actions caused instructors to remove them from the site.

Adapted from: Field Operations Safety Manual, University of California, Office of the President, Risk Services, 2019 pp 34-36

The instructor must teach the rules, provide a good example to follow, and hold group members to the rules. He has to establish effective communication with each member of the group. Group discussions are a good method for members to learn

about each other and for the group leader to instill group behavior norms. When a group member has a problem; when they become isolated from the group, engage in risky behavior, or commit unsafe acts, the leader must be able to identify the problem quickly and employ corrective measures that foster the group consciousness in the individual.

Field Team Organization

The field site supervisor (FSS), usually the senior member of the research group, is responsible for safe transport to and from the research site and overall safety while the group is working at the site. Optimally, the FSS will have additional Sponsoring Agency people assigned to assist with management.

- Assistant instructors—to help guide and mentor research teams and monitor safety of participants

- Logistics coordinator—the person responsible for arranging the logistics at the site to include food, lodging, and transportation.

- Safety watch—an experienced instructor with no research duties. This person is charged with safety oversight and first aid response at the site on a daily basis. This can be a rotating duty.

- Site staff—persons assigned to the site, or employees of the Sponsoring Agency, such as administrators, custodians, technicians, or medical staff, who may be temporarily assigned to the FSS.

The FSS should organize the research group into two-person "buddy teams", but teams of three or more persons are often better. One reference suggests teams of 4-10 people because they enable speedy accomplishment of routine and repetitious activities, foster exchange of ideas, and allow learning and sharing of skills and techniques. Ideally, team composition should be a balance of experience, expertise, and compatibility of team members*

Avoid situations where one person is working alone. Care should be taken to balance strengths and weaknesses in each team. A typical three-person team might consist of the following example;

1. a participant who is a good vehicle driver with poor map reading skills and a preexisting minor knee injury.
2. a healthy participant who is a good map reader.
3. an assistant instructor.

Adapted from: Oliveri, S and K. Bohacs, Field Safety in Uncontrolled Environments: A Process-Based Guidebook, The American Association of Petroleum Geologists, Tulsa, OK, 2005, Section 5 "Field Operations"

*Geomorphological Fieldwork, Developments in Earth Surface Processes Volume 18, Thornbush, MJ et al, Elsevier, Waltham, MA, 2014

The instructor to student ratio should be determined by the most current risk assessment for the work site.

Pre-departure inspections (PPE, Safety/survival kits, First Aid kits, Vehicle kits, etc)

There will be a number of kits used for the field research or emergencies. As part of their safety training, all participants should be shown every kit, the kit checklist, and how each component functions. Part of their responsibilities before every movement to the field research site must be to check each kit using the checklist, and ensure each component is present and functional. They should be taught to do this methodically item by item.

Participants should be required to inspect kits until it is second nature and they can do it quickly. If damaged or missing kit components are not replaced promptly, then participants will become disillusioned because the process is not taken seriously.

SOPs for driving and hiking

The probability of accidents and injuries increases while traveling by foot or vehicle. The field study group must develop Standard Operating Procedures to make sure all members and their equipment arrive safely to and from the research site. Consider the following items in the SOP:

- Footgear—wear appropriate footgear that give good support, traction, and are broken-in. The terrain and climate may dictate more than one pair of footgear is necessary. Bring extra pairs of clean dry socks.

- Backpacks—the style and capacity of the backpack is determined by the length of time in the field and the items carried. Initially, instructors must pay close attention to what participants are carrying in their packs, and it is a good idea for instructors to check pack weights before departure. In some settings, where the site is very remote or there are extraordinary hazards, instructors may conduct pack inspections.

- Hydration—water is the best thing for hydration. Exceptions to this must be approved by the FSS. Participants must be reminded to drink water. Instructors must monitor water consumption.

- Headcounts—when and where are headcounts taken, and how are they initiated?

- Go/NoGo Criteria—The Sponsoring Agency must have Go/NoGo criteria for each field research site to ensure the safety of participants visiting the site. Each site may have multiple criteria for:

    - weather changes
    - terrain issues
    - injuries or accidents
    - breakdowns, equipment failures, or training gaps
    - personnel requirements
    - research requirements
    - special equipment requirements
    - vehicle limitations
    - communication requirements

- Safety briefings—There must be a safety briefing before starting movement and a safety briefing before entering the research site. A driver's safety meeting is needed for vehicle travel. A water safety briefing is needed for water travel. Additional briefings can be done as needed.

- Emergency Procedures—Injured person, vehicle accident, hasty evacuation of the research site, etc. These must be fully briefed and rehearsed by all members of the group so that everyone knows their role and what is expected of them. *Conducting multiple rehearsals will help build the team, instill confidence in the participants, and cross-train group members.*

- Convoy/March Order—Where will instructors be located during travel by foot or vehicle? Where will Safety Watch/medical personnel be placed? Key equipment should be cross-loaded if possible. Under what circumstances of terrain or weather should follow distances between walking teams or vehicles be increased or decreased during travel? What is the travel route?

- Logistical Requirements and Support—How much food and water should be brought along? Where are rest halts/parking locations? When and where is food available? What is the maintenance support in the event of a vehicle or equipment breakdown?

- Medical Support—How far away is medical support? What is the medical evacuation method and/or route if there is a serious injury?

- Field Safety Resource Books—Consider placing a book in each vehicle containing the following items:

    - The ERP
    - Driver safety briefing format
    - Communication plan

- Travel route map
- Field research site map
- Vehicle emergency kit checklist
- Other kit checklists assigned to the vehicle

➢ After action review—The FSS should allot time at the end of the day for a brief after action review (AAR) of the day's events. All participants must be present. The AAR consists of a review of the timeline of events, what went right, what went wrong, and corrective actions to be taken in the future. The safety watch can help facilitate the AAR by keeping a running log of all unsafe acts observed during the day, *but all group members must be encouraged to take part in the discussion.*

Appendix A: Abbreviations

AAR – After Action Review
ASIRT – Association for Safe International Road Travel
ATV – All Terrain Vehicle
BSL – Biosafety Level
CPR – Cardio-Pulmonary Respiration
DAN – Diver's Alert Network
DSO – Diving Safety Officer
EHS – Yale Environmental Health and Safety
ERP – Emergency Response Plan
FSS – Field Safety Supervisor
HepA – Hepatitus A
HepB – Hepatitus B
IACUC – Yale Institutional Animal Care and Use Committee
IRB – Yale Institutional Review Board
JHA – Job Hazard Analysis
MOCC – Motorboat Operator Certification Course
NIOSH – National Institute of Occupational Safety and Health
NOLS – National Outdoor Leadership School
OEM – Yale Office of Emergency Management

OSHA – Occupational Safety and Health Administration
PFAS – Personal Fall Arrest System
PFD – Personal Floation Device
PPE – Personal Protective Equipment
RAM – Risk Assessment Matrix
rDNA – Recombinant DNA
SCUBA – Self-Contained Underwater Breathing Apparatus
SOP – Standard Operating Procedure
UAS – Unmanned Aerial System
YARC – Yale Animal Resource Center

Appendix B: Hazard Analysis List

Physical and Equipment Hazards

Hazard	Control Measures
All-Terrain Vehicles https://atvsafety.org/ http://www.snowmobilers.org/snowmobile-classes.aspx	▪ Training course ▪ Manufacturer's instructions ▪ JHA
Chainsaw https://www.osha.gov/OshDoc/data_Hurricane_Facts/chainsaws.pdf	▪ Get training ▪ Develop a pre-operations checklist ▪ Wear PPE--Helmet with faceshield, gloves, chaps, and hearing protection
Chemicals; toxic, flammable, corrosive, oxidizers https://ehs.yale.edu/trainings/laboratory-chemical-training https://ehs.yale.edu/trainings/laboratory-waste-disposal-training	▪ Engineering controls ▪ JHA ▪ PPE
Chemicals; explosive, pyrophoric, water reactive https://ehs.yale.edu/trainings/organolithium-compounds	▪ Engineering controls ▪ JHA ▪ Work practices ▪ PPE
Climbing, Rapelling, Rope Work https://www.rei.com/events/p/us-ma-boston/a/climbing http://www.nmgadventures.com/rock-climbing---rappelling.html	▪ Training
Compressed Gases https://www.osha.gov/SLTC/compressedgasequipment/ compressed gasses OSHA factsheet https://www.cdc.gov/niosh/docs/2004-101/chklists/r1n29c~1.htm	▪ Use NIOSH checklist
Confined Spaces https://www.cdc.gov/diseasesconditions/az/l.html https://www.cdc.gov/diseasesconditions/az/l.html https://www.cdc.gov/diseasesconditions/az/l.html	▪ Confined space recognition training ▪ "Authorized Entrant" training ▪ Chest or body harness training
Diving https://marinesciences.uconn.edu/mstc/diving/	▪ UConn Diving Training Course

Excavation, Trenching, Tunneling https://www.osha.gov/Publications/trench_excavation_fs.html https://www.osha.gov/Publications/osha2226.pdf	▪ Use protective systems such as trench shields ▪ Daily inspections by a competent person ▪ Vehicle barriers
Explosives https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.109 http://www.explosivesacademy.org/connecticut.htm http://aggregatesmineralsmarketplace.com/Listing/Company/365272	▪ Training course and certification
Fall Protection https://www.osha.gov/SLTC/fallprotection/ https://www.osha.gov/Publications/OSHA3146.pdf	▪ Training on fall hazards ▪ Training on fall protection systems
Firearms	▪ Firearms safety training course
Fire Extinguisher https://www.osha.gov/SLTC/etools/evacuation/portable_required.html	▪ Training
Hazardous Materials; shipping or transporting https://your.yale.edu/yale-link/eshipglobal-express-shipping https://your.yale.edu/policies-procedures/policies/1430-shipping https://www.faa.gov/hazmat/safecargo/how_to_ship/	▪ eShipglobal training ▪ Contact Yale EHS
Hazardous Energies https://bmsweb-h.yale.edu/ords/tms/tms_enrollments.offerings?p_crs_id=85 https://www.osha.gov/SLTC/controlhazardousenergy/index.html https://www.osha.gov/Publications/osha3120.pdf	▪ LOTO program (SOP) ▪ LOTO training
Ladders https://www.cdc.gov/diseasesconditions/az/l.html https://www.cdc.gov/diseasesconditions/az/l.html https://www.cdc.gov/diseasesconditions/az/l.html	▪ OSHA "QuickCard" or Factsheet ▪ Check for overhead powerlines or other electrical hazards
Lifting Devices and Hoists https://www.osha.gov/dts/maritime/sltc/ships/rigging/rigging_process.html https://www.osha.gov/cranes-derricks/	▪ Training
Machine Tools: Presses, Saws, Mills, Shapers, Grinders, Planers, etc https://www.osha.gov/SLTC/handpowertools/ https://www.osha.gov › fy14_sh-27638-sh4_Hand-and-Power-Tools-Safety	▪ Training ▪ Guards and other engineering controls ▪ JHA ▪ PPE
Noise Exposure Above 85 dBA https://www.osha.gov/Publications/3498noise-in-construction-pocket-guide.pdf https://www.osha.gov/SLTC/noisehearingconservation/	▪ Hearing protection ▪ Use noise barriers ▪ Limit time in the area of hazardous noise
Powered Industrial Trucks, (Forklifts, Tractors, Heavy Equipment) https://www.osha.gov/SLTC/etools/pit/index.html	▪ Training and certification required ▪ Start-up operator's checklist

Powered Water Craft, Other Water Craft https://www.ct.gov/deep/lib/deep/boating/PrivateProviders.pdf https://www.uscgboating.org/ https://sportsandrecreation.yale.edu/recreation-centers/mcnay-family-sailing-center/sailing-programs	▪ MOCC ▪ Boating Safety Course ▪ PFD
Radioactive isotopes in any form https://ehs.yale.edu/trainings/radiation-safety-basic-concepts	▪ Training ▪ Engineering controls and work practices to decrease exposure time, increase distance, or increase shielding ▪ PPE
Scaffolds https://www.cdc.gov/diseasesconditions/az/l.html https://www.cdc.gov/diseasesconditions/az/l.html https://www.cdc.gov/diseasesconditions/az/l.html	▪ OSHA safety training per CFR 1926.454(a) ▪ Fall protection training

Biological and Clinical Hazards

Hazard	Control Measures
Animal Blood, Tissue, or Fluids https://www.health.state.mn.us/diseases/animal/zoo/index.html https://www.cdc.gov/healthypets/diseases/index.html	▪ Keep hands clean ▪ Avoid bites and scratches ▪ Approved protocol ▪ Work practices
Animal or Plant Pathogenic Bacteria or Viruses (Non-Human Primates) https://ehs.yale.edu/human-pathogens https://ehs.yale.edu/human-materials-infection-control-patient-care https://www.nap.edu/read/10713/chapter/5	▪ Consider registration with Yale IBC ▪ Contact Yale EHS ▪ Protocol-specific risk assessment ▪ Appropriate containment (BSL) ▪ Training ▪ Work practices review ▪ Engineering controls ▪ PPE
Blood Parasites, (Leishmania, Chagas Disease, African Sleeping Sickness, etc) https://www.cdc.gov/diseasesconditions/az/l.html https://www.cdc.gov/dpdx/az.html https://www.cdc.gov/dpdx/diagnosticprocedures/blood/safety.html	▪ Universal precautions ▪ Cover cuts and abrasions ▪ Sharps safety
HIV/AIDS https://aidsinfo.nih.gov/understanding-hiv-aids/fact-sheets/20/48/the-basics-of-hiv-prevention https://www.cdc.gov/hiv/basics/prevention.html	▪ Use condoms ▪ Modify sexual practices ▪ Don't inject drugs ▪ Pre-exposure prophylaxis (PreEP) ▪ Post-exposure prophylaxis (PEP)
Human Blood, Tissue, or Fluids https://www.osha.gov/SLTC/bloodbornepathogens/ https://ehs.yale.edu/trainings/bloodborne-pathogen-training-clinical-personnel https://ehs.yale.edu/trainings/bloodborne-pathogen-training-laboratory-personnel	▪ Universal precautions ▪ Hepatitis B vaccination ▪ Training ▪ Exposure control plan ▪ Engineering controls ▪ Work practices ▪ PPE

Human Pathogens Research https://ehs.yale.edu/human-pathogens https://ehs.yale.edu/human-materials-infection-control-patient-care https://www.cdc.gov/labs/BMBL.html?CDC_AA_refVal= https%3A%2F%2Fwww.cdc.gov%2 Fbiosafety%2Fpublications%2Fbmbl5%2Findex.htm	▪ Consider registration with Yale IBC ▪ Contact Yale EHS ▪ Protocol-specific risk assessment ▪ Appropriate containment (BSL) ▪ Training ▪ Work practices review ▪ Engineering controls ▪ PPE
Legionaires Disease https://www.cdc.gov/legionella/about/index.html	▪ Maintain building water systems ▪ Awareness training
Malaria Infection https://www.cdc.gov/parasites/malaria/index.html	▪ Use DEET or other insect repellents ▪ Use mosquito netting ▪ Use antimalarial/prophylaxis drugs
Other Parasites (*Giardia*, River Blindness, Schistosomiasis, etc) https://www.cdc.gov/diseasesconditions/az/l.html https://www.cdc.gov/parasites/travelers.html	▪ Disease-specific training ▪ Job hazard analysis ▪ Exposure control plan ▪ Location-specific training
Recombinant DNA viruses, (Lentivirus, Adenovirus, Retrovirus) https://ehs.yale.edu/recombinant-dna https://ehs.yale.edu/sites/default/files/files/rdna-synthetic-nucleic-acid-molecules.pdf	▪ Consider registration with Yale IBC ▪ Contact Yale EHS ▪ Protocol-specific risk assessment ▪ Appropriate containment (BSL) ▪ Training ▪ Work practices review ▪ Engineering controls ▪ PPE
Sewage https://www.cdc.gov/healthywater/global/ sanitation/workers_handlingwaste.html	▪ Basic hygiene practices ▪ Training ▪ PPE ▪ Vaccinations: HepB, HepA, typhoid, polio, tetanus
Tuberculosis (TB) https://ehs.yale.edu/tuberculosis-resources https://www.cdc.gov/tb/default.htm	▪ Test for TB exposure ▪ Training ▪ Isolation protocol for infected persons ▪ Respirator fit testing

Hazards Due to Climate or Environment

Hazard	Control Measures
Hazardous Insects https://www.insectidentification.org/harmful-insects.asp https://www.cdc.gov/niosh/topics/insects/default.html https://www.complex.com/pop-culture/2013/10/most-deadly-insects-in-the-world/	▪ Training in recognition and avoidance ▪ Keep living areas and work areas clean—don't leave food out

Hazardous Plants https://www.proflowers.com/blog/poisonous-plants	▪ Training in recognition and avoidance
Hazardous Wildlife https://en.wikivoyage.org/wiki/Dangerous_animals	▪ Species awareness training and avoidance techniques ▪ Awareness of risk factors ▪ Avoid likely habitats
High Altitude https://www.princeton.edu/~oa/safety/altitude.html https://www.wildsafe.org/resources/outdoor-safety-101/altitude-safety-101/	▪ Training ▪ Acclimation ▪ Slow rate of ascent
Hiking https://www.nps.gov/articles/hiking-safety.htm https://www.self.com/story/hiking-safety-tips?verso=true https://www.wilderness.org/articles/article/tips-great-hiking	▪ Hiking safety/emergency plan ▪ Buddy system ▪ Location-specific training
Jungle or Rainforest https://vetmed.tamu.edu/macawproject/volunteer/health-and-safety-in-the-jungle/ https://dev927.wordpress.com/2009/08/05/jungle-safety-tips/	▪ Location-specific training
Snakes https://www.cdc.gov/niosh/topics/snakes/default.html https://en.wikipedia.org/wiki/List_of_dangerous_snakes	▪ Training in recognition and avoidance ▪ Caution around likely snake habitats ▪ Wear boots, long pants, and gloves when working outdoors
Sun Exposure https://www.osha.gov/Publications/OSHA3166/osha3166.html https://www.who.int/uv/sun_protection/en/	▪ Use shade ▪ Loose clothing to protect skin ▪ Wear a hat ▪ Sunscreen
Swimming, wading, and snorkeling https://wwwnc.cdc.gov/travel/page/safe-swimming-diving https://tripprep.com/library/marine-hazards/traveler-summary https://hioceansafety.com/snorkeling-safety/	▪ Buddy system ▪ Check water conditions ▪ Monitor body condition—avoid fatigue
Temperature Extremes--Cold https://www.cdc.gov/niosh/topics/coldstress/ https://medlineplus.gov/ency/patientinstructions/000866.htm	▪ Training ▪ Wear dry clothing in layers ▪ Warm-up areas ▪ Buddy system/buddy checks
Temperature Extremes—Hot https://www.cdc.gov/disasters/extremeheat/heattips.html https://www.webmd.com/fitness-exercise/heat-exhaustion#	▪ Hydration ▪ Shade ▪ Acclimation time ▪ Wear sunscreen
Working Alone https://www.ccohs.ca/oshanswers/hsprograms/workingalone.html	▪ Reduce “working alone time” to the minimum ▪ Verify training is adequate ▪ Reschedule high risk tasks ▪ “Lone Worker” communication devices ▪ Check-in procedures
Working in the Dark	▪ Reflective clothing ▪ Rest intervals ▪ Sleep plan

https://www.apa.org/monitor/2011/01/night-work https://gocontractor.com/blog/night-shift-safety-hazards/	▪ Vehicle traffic control plan ▪ Law enforcement presence ▪ Generator lights
Working on, near, or over the water https://www.osha.gov/laws-regs/regulations/standardnumber/1926/1926.106 https://www.msha.gov/news-media/announcements/2016/09/07/hazard-alert-best-practices-working-near-water	▪ Work in buddy teams ▪ Education on hypothermia ▪ Wear PFD ▪ Training ▪ Safety plan ▪ Use rescue teams/boats ▪ Identify specific hazards; currents, erosion,
	▪

Appendix C: Checklists and Suggested Report Formats

Emergency Response Plan

Suggested Format

Activity: _____ **Dates:** _____

Activate in case of:

	Illness
	Injury
	Hazardous Condition
	Other?

How to Activate: Notify others in the field by:

	Voice
	Whistle
	Radio
	Other?

Initial Emergency Action Steps:

1. **Approach injured/ill person safely**
2. **Prevent further harm–DO NOT MOVE injured**
3. **Identify urgent issues: unconsciousness, breathing, pulse, severe bleeding**

Roles:	**Primary**	**Alternate:**
In **Charge overall**	*Activity Coordinator (AC)*	*Assistant Instructor*
Check the patient	*Safety Watch (SW)*	*Assistant Instructor*
Call for assistance	*Safety Watch (SW)*	*Assistant Instructor*
Provide **Care**	*Safety Watch (SW)*	*Assistant Instructor*
Take charge of uninvolved persons	*Assistant Instructor (AI)*	*Selected participant*
Assist with care	*Selected participant (SP)*	*Selected participant*
Provides peripheral support	*Logistics Coordinator (LC)*	*Selected participant*

Emergency Plan: INJURED PARTICIPANT

Condition:	*Actions:*	*Follow-up:*
If Accident Occurs:	- Stop and Check for Injuries/Illness - Provide First Aid care as needed	> Record details in Safety Log
If NO Further Care Required:		
	- Proceed with planned activities - Check with medical services in town upon return *(interface with local ERP/organization medical resources?)*	Property Damage only: -Notify Supervisor -File Report upon return to office > Notify Supervisor in case of injury > File appropriate report ***(Consult your Organization Guidelines)***
If Further Care IS Required:		
If Patient IS ABLE to evacuate under own power or with help	**SW** assists patient out and drives to medical facility **AI** takes charge of remaining group **AC** and Staff initiate Change Management process to determine actions and communicate to remaining group ***(Activate Alternate Roles using pre-selected Participant)***	> Notify Supervisor as soon as practical > File appropriate report ***(Consult your Organization Guidelines)***

Format adapted from: Field Safety in Uncontrolled Environments: A Process-Based Guidebook, Stephen R Oliveri and Kevin Bohacs, (2005), American Association of Petroleum Geologists, pp 76-80

Field Research Plan – Suggested Format

Yale University **Field Research Plan**	
This form may be used by the Principal Investigator (PI), or Project Lead, to assist with the development of a Safety Plan. **The completed Safety Plan should be shared with all the members of the field research team and kept on file on campus.** Multiple trips to the same location can be covered by a single Safety Plan. The Safety Plan should be revised whenever a significant change to the location or scope of fieldwork occurs. EH&S is available to assist in completion or review of the Safety Plan (785-3550).	
Principal Investigator:	Department:
Phone Number:	Email Address:
Dates of Travel: *(List multiple dates if more than one trip is planned.)*	
Location of Field Research: Country: _____ Geographical Site: _____ Nearest City: _____ *(Name, Distance from Site)* Nearest Hospital: _____ *(Location, Distance from Site)*	
Field Research: (Please include a brief description of the field work.)	
University Contact _____ Name Phone	Local (Field) Contact _____ Name Phone
Emergency Procedures: (Please include detailed plans for field location, including evacuation and emergency communication.) *Include a separate sheet if necessary.*	
First Aid Training: (Please list any team members who are trained in first aid and the type of training received.)	

Pre-existing Medical Conditions: (Please describe any medical conditions which require special or exceptional accommodations.) *Include a separate sheet if necessary.*

Working alone: (Please describe situations where the participant is working alone. Indicate the circumstances, time intervals, and frequency this may occur.)

Physical Demands Due to the Environment or Climate

☐	Extreme Heat	☐	Sun Exposure	☐	Climbing
☐	Extreme Cold	☐	Working on, near, or over water	☐	Hiking
☐	High Altitude	☐	Jungle or Rainforest		
☐	Not Applicable				

Clothing and Personal Protective Equipment (PPE)

YES	NO	N/A	
☐	☐	☐	Is there a need for suitable clothing, footgear, and personal supplies? (boots, hat, cold weather gear, gloves, sunglasses, sunscreen, raingear, insect repellent)
☐	☐	☐	Is there a need for special personal protective gear (PPE)?

☐	Safety Glasses	☐	Flame/Heat Resistant Clothing
☐	Faceshield	☐	Knee/Shin Guards
☐	Gloves	☐	Waders

			☐	Safety Headgear	☐	Coveralls
			☐	Hearing Protection	☐	Protective Clothing
					☐	Other:_____ _____
☐	☐	☐	Is there a need for respiratory protection and training?			

Safe Use of Equipment and Work Processes:

☐	Chain Saws	☐	Fire Extinguisher
☐	Climbing, Rapelling, Rope Work	☐	Hazardous Materials
☐	Compressed Gases 	☐	Ladders
☐	Confined Spaces	☐	Lifting Devices and Hoists
☐	Diving	☐	All Terrain Vehicles
☐	Excavation, Trenching, Tunneling	☐	Powered Water Craft, Other Water Craft
☐	Explosives 	☐	Noise Exposure about 85 dBA
☐	Fall Protection	☐	Powered Saws, Grinders, Planers
☐	Firearms	☐	Scaffolds
☐	Powered Mobile Equipment (Fork Lift, Tractor, Heavy Equipment)		
☐	Other:		
☐			

Wildlife and Plant Hazards:

Yes	No	N/A		
☐	☐	☐	Is there need for instruction on techniques to avoid unexpected encounters with potentially dangerous wildlife?	
☐	☐	☐	Will drugs or anaesthetics be administered to animals, and has training been provided for this?	
☐	☐	☐	Has instruction been provided on the methods of zoototic disease transfer and recognition of the signs and symptoms of zoonosis in the region of study?	
☐	☐	☐	Has instruction been provided for the recognition of plant hazards and toxic plants in the region of study?	

Biological/Clinical Hazards:

☐	Human Blood, Tissue, or Fluids	☐	Biological Toxins, (Botulism, SEB, Cholera, Ricin, Diptheria, etc)
☐	Infected Human Tissue	☐	Recombinant DNA viruses, (Lentivirus, Adenovirus, Retrovirus)
☐	Animal Blood, Tissue, or Fluids	☐	Human Pathogenic Bacteria or Viruses
☐	Infected Animal Tissue	☐	Animal Pathogenic Bacteria or Viruses
☐	Tuberculosis	☐	HIV/AIDS
☐	Hepatitis B	☐	Antibiotic Resistant Organisms
☐	Legionnaires Disease	☐	Needlestick/Sharps Injuries
☐	Tick Borne Diseases (Lyme Disease, Rocky Mountain Spotted Fever, etc)	☐	Molds or Fungi
☐	Blood Parasites (Malaria, Leishmania, Chagas Disease, etc)	☐	Other Parasites (*Giardia*, River Blindness, Schistosomiasis, etc)
☐	Sewage	☐	Stinging Insects
☐	Harmful Plants	☐	Animal or Bird Droppings

Required Immunizations or Prophylaxis

☐	Tetanus/Diptheria/Pertussis (Tdap or Td)	☐	Hepatitis A
☐	Typhoid	☐	Hepatitis B
☐	Measles (MMR or MMRV)	☐	Rabies
☐	Yellow Fever	☐	Rubella
☐	Cholera	☐	Polio
☐	Japanese Encephalitis	☐	Meningococcal
☐	Other: (Please give details _____ _____ _____ _____		

Chemical or Radiological Hazardous Materials

Yes	No	N/A		Pictogram
☐	☐	☐	Are Safety Data Sheets (SDS) available for all hazardous materials?	
☐	☐	☐	Will corrosive chemicals be used or transported (acids, bases, oxidizers, chloroform, phenol, etc)?	
☐	☐	☐	Will flammable chemicals be used or transported (alcohols, organic solvents, fuels, etc)?	
☐	☐	☐	Will toxic chemicals be used or transported (formaldehyde, insecticides, compounds of mercury, cyanide, arsenic, others)?	
☐	☐	☐	Radioisotopes in any chemical form?	
☐	☐	☐	Will tissue samples (animal, human, or plant) be preserved/stored in hazardous solvents (formalin, ethanol, etc)?	

☐	☐	☐	Will solvents or preserved/stored tissue samples be transported across interstate (USA) or international boundaries? *	
☐	☐	☐	In the event of a spill of hazardous material, is there a spill kit available and does everyone understand how to use the kit components?	

* Contact Yale EHS for details on how to transport hazardous materials (HAZMAT) across interstate or international boundaries. Do not attempt to transport or ship HAZMAT without the appropriate training and shipping materials.

Equipment Checklist

Accident/Incident/Near-Miss Report
Suggested Format

Activity: _____ **Dates:** _____

Location(s): _____

Field Safety Other

Supervisor: _____ Staff Present: _____

Background Information. Describe the activity and events leading up to the incident.

Describe the incident

List the persons involved and indicate their status in the incident (injured, witnesses, supervisors, etc)

Briefly summarize the factors contributing to the incident

Indicate any other observations relevant to the incident

Staff Suggestions for Improving Safety on Future Activities

Safety Suggestions/Feedback from Participants

Format adapted from: Field Safety in Uncontrolled Environments: A Process-Based Guidebook, Stephen R Oliveri and Kevin Bohacs, (2005), American Association of Petroleum Geologists, p. 149

Driver Safety Briefing
Suggested Format

Driving Preparation/Vehicle Inspection Checklist:		
❑ Plan Your Route ■ Check Map ■ Review Plan ❑ Adjust: ■ Seat/Seat Belt ■ Steering Wheel ■ Mirrors	❑ Locate Controls for: ■ Lights ■ Wipers/washer ■ Heating/AC ■ Mirrors ■ Horn ■ Windows/Locks	❑ Note/Check Condition of: ■ Brakes ■ Steering ■ Tires ■ Lights ■ Wipers/Washers

Safety Reminders/Instructions:

- Check tires before re-entering highway from unpaved road.
- Do not use communications devices while driving—let the front seat passenger talk.
- Make sure all your passengers are in the vehicle.
- Lock all doors before leaving.
- Drive with headlights on.
- Be extra careful when backing, use a spotter as needed.
- Report problems to trip leader.
- **Buckle Up and Drive Safely.**

Convoy Protocol:

- Activity leaders in lead vehicle. Instructor or logistics coordinator in the last vehicle.
- Review route, intermediate stops/gathering points, final destination, and approx. arrival times before departing. Intermediate gathering points will be about 1 hour's drive apart.
- Maintain radio contact between vehicles. DO NOT act unsafely just to maintain visual contact on the highway or in city traffic!
- Drive at posted speed limit or slower if conditions dictate.
- Do not pass any other vehicles in the convoy unless directed to do so by Leader.
- Maintain safe distance between vehicles (at the very least 2-second rule).
- If your vehicle becomes separated from the group or develops mechanical problems find a safe place to pull off the road and contact leader.

Tire changing protocol:

- Only field trip leaders, or other designated persons, will change tires. Competent tire changers only.
- Tire changer and assistant should wear reflective vest if passing vehicles are a possibility.
- Park vehicle on firm level surface.
- Place traffic warning devices as necessary.
- Review safe work practices for operation.
- Block the wheels and set the parking brake before jacking vehicle.
- No one allowed in vehicle when on the jack.
- Tire changer and assistant use appropriate personal protective equipment.
- Use proper lifting techniques: use legs, not back.
- Use appropriate lug wrench tool (consider use of 4-way tire tool).
- Never place body under a vehicle supported by a jack.

Format adapted from: Field Safety in Uncontrolled Environments: A Process-Based Guidebook, Stephen R Oliveri and Kevin Bohacs, (2005), American Association of Petroleum Geologists, p 98

Detailed Itinerary Report
Suggested Format

Activity	Date:
Field Safety Supervisor	Additional Instructors/Staff

Communication Plan

Primary Method:	Secondary Method:

Itinerary Plan

Leg 1		
Destination_____ Travel Method_____ Route Description_____ _____ _____	TEAM	VEHICLE ASSN
Leg 2		
Destination_____ Travel Method_____ Route Description_____ _____ _____	TEAM	VEHICLE ASSN
Leg 3		
Destination_____ Travel Method_____ Route Description_____ _____ _____	TEAM	VEHICLE ASSN

Team Assignments			
Name	Team Number	Name	Team Number

Job Hazard Analysis
Suggested Format

Task/Job:	Approval Date:	Revision Date:
PPE:		Revision Number:
Basic Task/Job Steps or Sequence	**Potential Hazard**	**Hazard Controls**

Safety Briefing
Suggested Format

1. Task to be completed:

2. Current situation:
    a. -Weather
    b. -Known hazards
    c. -New hazards

3. Discuss method of travel (if applicable):

    a. -Assign Drivers (if applicable):
    b. -Notify Drivers and Assistant Drivers the time and location of Drivers/A-Drivers safety briefing

4. Assign groups/buddy pairs, and roles:

5. PPE Check:

6. Review communication plan:

    a. -Issue comms gear
    b. -Discuss primary and secondary means of comms
    c. -Emergency signals

7. Location of safety gear

    a. -Kits

8. Review Emergency Response Plan (ERP):

9. Review safety philosophy:
    a. -Everyone is a safety officer
    b. -Participation—speak up if you are not comfortable with an action or situation
    c. -Review SOPs

10. Question and observations from participants

Yale EHS
Residence/Domicile Safety Checklist

The following inspection checklist is for Yale-associated persons living in a residence not under Yale control. The checklist was created by Yale EHS to help students, faculty, and staff who are living in a temporary residence while engaged in field research and may be traveling to countries or regions that do no not have uniform or developed safety regulations. Thus, it is important to take own precautions and prepare for emergencies.
GENERAL CONDITION
☐ The building address is visible and clearly marked (for emergency responders).
☐ The building exterior and adjacent properties are clean and well maintained. The interior and exterior structure/walls/ceiling appears sound, with no obvious damage from water, fire, mold, insects, or animals.
☐ Doors swing freely, latches closed, and locks where applicable (no keys required to exit).
☐ Electrical receptacles (outlets and switches) are in good condition and without missing covers.
☐ Exterior exits, parking areas, hallways and common areas are well illuminated.
☐ All wall electrical switches work easily (not sparking or warm to touch); light fixtures work properly.
☐ Electrical outlets near sinks are GFCI outfitted.
☐ Appliances provided appear to be clean and in good working condition. Appliance electrical cords must be in good condition. Large and heat-producing appliances (toasters, coffeemakers, etc.) should be plugged directly into outlets (not through extension cords).
☐ Kitchen exhaust and surfaces are free of grease buildup.
☐ Plumbing is functional. Verify hot and cold water at sinks turns on and off without leaks. Check for adequate drain flow in sinks, toilets and showers/tubs. Check under sinks for signs of leakage.
FIRE AND LIFE SAFETY
☐ Smoke detectors or alarms are installed and working (minimum of one located within and adjacent to each sleeping area). If not, either contact your landlord about having one installed or installing one yourself. Test smoke alarms monthly if a testing button is present See Note 1. "Chirping" may indicate a low battery. See Note 2.
☐ Means or methods for summoning emergency personnel are known. Note that numbers for calling emergency responders varies between countries. Identify the locations for phones and pull stations if the building is so equipped (typically near exit discharge doors).
☐ Doors, walkways/access corridors leading to exits, stairs and fire escapes are unobstructed and in good condition. Verify exit doors are free of locking devices that may interfere with exiting (no keys required).
☐ There are two evacuation routes available in the event one exit is blocked or not safe. Develop an evacuation plan and practice it. When applicable, include any roommates on the development of the plan. See Note 3.
☐ Fire alarms, emergency lights and exit signs are visible if available?

Yale EHS
Residence/Domicile Safety Checklist

☐ Carbon monoxide detectors are installed and working when fuel burning appliances and equipment are used (for cooking and heating applications).
☐ Response options are identified for medical emergencies. Identify nearby walk-in clinics and hospitals, phone numbers, and transportation options. Consider obtaining a first aid kit and training.
☐ Dryers, chimneys, wood stoves and all home heating systems are maintained. Generally, annual service is recommended to include inspection and cleaning.
☐ All furniture, linens, and draperies are appropriately placed. See Note 4.
☐ No accumulation of flammable liquids stored in and around the building.

Yale EHS
Residence/Domicile Safety Checklist

Notes

1. For operation or testing of smoke alarms, please check first with your Sponsoring Agency or landlord/property owner.
2. Consider getting a smoke alarm with a long-life lithium battery (typically good for 10 years from the date of manufacture) and an escape light. There are two types of smoke alarms available; ionization and photoelectric. Both types provide adequate protection against fire. Combination models are also available. However, ionization smoke alarms are prohibited in some countries, and may be problematic with airport security due to the small amount of radiation they emit. Check which kind of smoke detector is most appropriate for your residence and pack it when you travel, or purchase it locally if traveling by air or outside the U.S.
3. Buildings with automatic fire suppression (i.e. sprinklers) are preferred. If you live above the first floor, make sure your residence has an accessible fire escape ladder or purchase a portable escape ladder. If floor selection is available, consider floors above the 1st floor (for security purposes) and below the 7th floor for improved access for emergency responders (fire ladder truck reach). If windows are part of the evacuation plan, verify the windows can be opened easily in the event of a fire. Keep the area clear. If the windows have security bars, check to see if there is an emergency release device.
4. Never smoke in bed, when drowsy, intoxicated or when using medication that can cause drowsiness. Always leave at least 3 feet of space between furniture and space heaters, fireplaces or wood stoves. Never place furniture close to an element that produces heat or has an open flame. Keep electrical cords, lamps and appliances away from upholstered furniture. Do not press upholstered furniture against electrical cords plugged into sockets as this could damage the cord and cause a fire. Make sure that open flames such as candles, are kept away from upholstered furniture, draperies and lampshades. This checklist covers some of the risks associated with fire safety. It does not cover risks associated with criminal activity, or issues resulting from other persons living in the residence. For more information on these hazards, please refer to the following website:
   https://your.yale.edu/community/public-safety/yale-police-department

Resources

https://www.nfpa.org/Public-Education
http://www.firesafetyfoundation.org/
https://ehs.yale.edu/sites/default/files/files/electrical-safety.pdf

Appendix D: Training Aids

Yale *Environmental Health & Safety*

Tick Safety Awareness Guide

This guide intends to:

- Increase **awareness of risks** involved with outdoor activities and tick research.
- Foster **best practices** when working with ticks and while working out in the field.
- Educate on **protection strategies** to reduce risk of exposure.
- Review **emergency response** methods to effectively handle incidents.

Welcome to Yale University.

We hope you **enjoy your time** in New Haven and the beautiful New England scenery, whether it be in fieldwork as part of your academic program or simply exploring the many **outdoor spaces** available to you.

Unfortunately, a necessary part of spending time outdoors in the area is **being aware of ticks. Connecticut** is among the leading states in the country in cases of confirmed **Lyme disease**.

As a Yale employee, faculty member, visiting scientist, or student you have been identified as having **potential exposure** to ticks or other vectors during field work for your job or as part of a course.

What are ticks, and why should I be concerned?

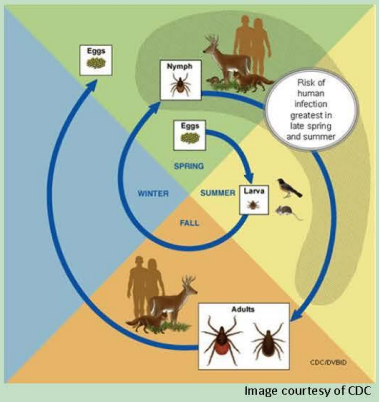


Image courtesy of CDC

Ticks are parasites that feed by latching on to a host, **embedding** their mouthparts into the host's **skin**, and sucking its **blood**. Tick bites commonly go **unnoticed** because **the bite does not hurt** and it is **not usually itchy**. This method of feeding makes ticks the perfect organisms to **transmit disease**, as they **harbor multiple pathogens**.

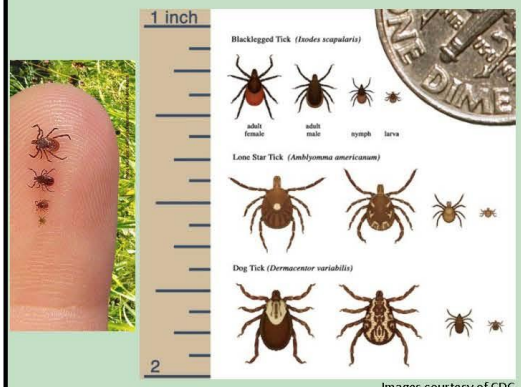
In Connecticut, ticks are most active in the **spring and summer**, as they are attracted to **warmer climates**, **deep brush**, and **moisture** rich areas. Ticks find their hosts by detecting carbon dioxide emitted from our sweat and heavy breathing. They also detect body odors, body heat, moisture, and vibration.

Ticks hold on to **leaves and grass** using their third and fourth pairs of legs. They use their first two sets of legs to **climb** onto a passing host. The tick's **saliva** contains **anesthetic** properties which causes the tick bite to go unnoticed. If a tick contains a pathogen, the organism may be **transmitted to the host** through the bite. Prompt removal of an attached tick will reduce the chance of infection.

Early detection and treatment is important.
Contact your healthcare provider immediately if you have been bitten by a tick or have any health concerns.

Yale University Environmental Health and Safety | 135 College Street, Suite 100, New Haven, CT 06510
Phone: 203-785-3550 | Hours: 8:30 a.m.—5:00 p.m. | https://ehs.yale.edu/ | document updated 05-2019

What types of ticks and risks are found in Connecticut?



Images courtesy of CDC

Ticks vary in size, color and shape.
The most common types of ticks found in Connecticut are:

- **Black-legged "deer" tick**
- **Lone star tick**
- **American dog tick**
- **Asian long horned tick** (latest U.S. discovery)

Rashes may develop within **minutes**, **days**, or a **month** after a bite. Common **symptoms** associated with tick bites:

- **Fever**
- **Chills**
- **Headache**
- **Fatigue**
- **Muscle aches**

	Associated Diseases	Symptoms
Black-legged tick ("deer tick")	Lyme disease (*most common in Connecticut*)	• Joint pain • Rash (bullseye shape)
	Babesiosis	• Dark urine • Nausea, vomiting, diarrhea
	Anaplasmosis	• Cough • Stiff neck • Confusion • Nausea, vomiting, diarrhea
Lone star tick	Ehrlichiosis	• Nausea, vomiting, diarrhea
	Tularemia ("rabbit fever")	• Ulcer at site of bite • Swelling of the lymph nodes
Dog tick	Rocky mountain spotted fever	• Rash on palms and soles of feet
	Tick Paralysis (*reverses when the tick is removed from the body*)	• Loss of coordination • Slurred speech • Shallow irregular breathing
Asian longhorned tick	*(Pending research in U.S.)*	• Severe illnesses

How can I protect myself from ticks?

- Wear **light colored clothing** when working with ticks or when out in the field.
- **Tuck** your pants into your socks, and wear **gloves** long enough to cuff over your **long sleeve shirt.**
- Wear **closed toe shoes**.
- **Stay on paths** while walking in the woods; **avoid tall grass** and vegetation.
- Wear an **insect repellent** following the directions and precautions on the label.
- Wear a **repellent** containing **20-30% DEET** (N,N-diethyl-3-methylbenzamide) on **exposed skin**, avoiding wounds and irritated skin; spray on cuffs, shoes, and sleeves (can damage some clothing materials); wash hands with soap and water after applying.
- Use **Permethrin** (ON **CLOTHING ONLY**) to treat boots, hats, hems, sleeves, shoes, and any items **low to the ground**. Follow the directions and precautions given on the repellent label; apply in a **well-ventilated area** outdoors protected from the wind; allow 2 hours for **drying before wearing**.
- Products containing **oil of lemon eucalyptus** (OLE) or PMD are recommended as an alternative to DEET and Permethrin.

Please note: **ticks do not jump**, fly, or drop from trees, but **grasp passing hosts** from various sources such as the leaf litter and tips of grass. **Ticks are usually picked up on the lower legs and then crawl up the body seeking a place to feed.**

*If working with ticks in a lab setting, please contact Yale EHS for additional procedures and best practices.

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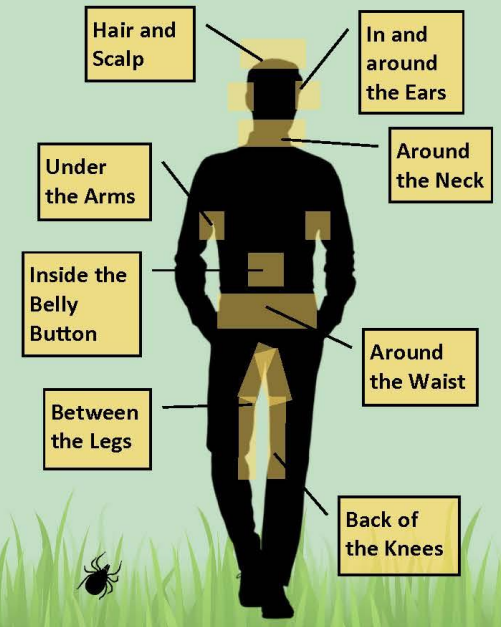
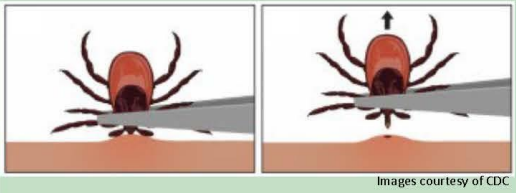
CHECK FOR TICKS OFTEN & When Returning Indoors.

- After leaving the field, and before entering transportation, **brush yourself off**, remove PPE, and **check for ticks**.
- At home, place dry **clothes in the dryer** on high for 10 minutes to kill any lingering ticks (longer for wet clothes). Then wash clothes using **hot water**.
- Carefully **inspect body** and **remove any ticks quickly**; check body, head/hair, ears, armpits, belly button, waist, behind knees, and in groin areas.
- Take a **shower within 2-hours** of returning indoors. Showering may help wash off unattached ticks and it is a good opportunity to do a self-check for ticks.
- Remember to **check your pets for ticks**. Contact your veterinarian with any concerns.

Use a mirror or a cell phone camera to perform a self-check in key places!



If you find a tick attached to your skin, there's no need to panic—the key is to **REMOVE THE TICK AS SOON AS POSSIBLE.**



Images courtesy of CDC

1. Use **fine-tipped tweezers** to grasp the tick as **close to the skin's surface** as possible.
2. **Pull upward** with steady, even pressure. Don't twist or jerk the tick; this can cause the mouth-parts to break off and remain in the skin. If this happens, **remove the mouth-parts** with tweezers. If you are unable to remove the mouth-part easily with clean tweezers, leave it alone and let the skin heal.
3. After removing the tick, thoroughly **clean the bite area** and your hands with rubbing alcohol or soap and water.

Never crush a tick with your fingers. Dispose of a live tick by putting it in alcohol, placing it in a sealed bag/container, wrapping it tightly in tape, or flushing it down the toilet.

Revisit your doctor if you develop a fever, rash, severe fatigue, facial paralysis, or joint pain within 30 days of being bitten by a tick or if you have any concerns.

Acute Care/Yale Health: 203-432-0123

Yale EHS: 203-785-3550 (M-F; 8:30am-5:00pm)
203-785-3555 EHS Emergency Line

Additional links and resources:

CDC:
https://www.cdc.gov/ticks/

Yale EHS—Arthropod and Tick Biosafety:
https://ehs.yale.edu/arthropod-tick-biosafety

CAES Tick Testing :
https://portal.ct.gov/CAES/Tick-Office/Tick-Office/Information-on-Submitting-Ticks

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Appendix E: List of Resources

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Geomorphological Fieldwork, Developments in Earth Surface Processes Volume 18, Chapter 3.2 "Field Safety: Principals, Practice, and Culture". Elsevier, Waltham, MA. Edited by MJ Thornbush, CD Allen, and FA Fitzpatrick.

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Field Operations Safety Manual, University of California, Office of the President, Risk Services, 2019 https://www.ucop.edu/safety-and-loss-prevention/environmental/program-resources/field-research-safety/index.html

Guidance on Health and Safety in Fieldwork, Universities Safety and Health Association (USHA) in association with the Universities and Colleges Employers Association (UCEA), 2011 https://www.gla.ac.uk/media/Media_575064_smxx.pdf

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Safety Guidelines for Field Researchers, The University of Texas at Austin Environmental Health & Safety, 2010. https://ehs.utexas.edu/programs/labsafety/documents/FieldResearchers-SafetyGuidelines.pdf

Safety Protocol and Information for Field Research, Michigan Technological University, School of Forest Resources and Environmental Science, 2018 https://www.mtu.edu/ehs/docs/field-safety-guide-school-of-forestry.pdf

Field Safety Guide, University of South Florida, Environmental Health and Safety, Tampa, FL, 2019 https://www.usf.edu/administrative-services/environmental-health-safety/documents/field-safety-guide.pdf

Fieldwork Safety Manual, Texas A&M University, 2009 https://ehs.tamu.edu/manuals/

Field Research Safety Guidelines, 1st Edition, Louisiana State University, Institutional Animal Care and Use Committee, Office of Environmental Health and Safety, 2013 https://www.lsu.edu/ehs/files/Field-Safety-Guidelines-POST-COPY-1.16.14.pdf

NAU Field Safety Program, Northern Arizona University, Environmental Health and Safety, https://nau.edu/wp-content/uploads/sites/74/2018/08/Field-Safety-Program.pdf

Laboratory and Field Safety Guidelines, South Dakota School of Mines and Technology Department of Geology and Geological Engineering, 2014-2015 https://www.sdsmt.edu/Academics/Departments/Geology-and-Geological-Engineering/Docs/2014-15-GGE-Lab-and-Field-Safety-Guidelines-manual/

Field Procedures and Safety Manual, UNBC Field Safety Committee, University of Northern British Columbia, https://www.unbc.ca/safety/field-safety