Safety Techniques, Safety Equipment, and First Aid procedures recommended for inclusion in BSA literature, Camp Guidance, and Training Courses.

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DEDICATION

I dedicate this thesis to “Safe Scouting”. Asking me to overlook your safety in Scouting would be to ask me to compromise my entire attitude towards the value of your life.

ACKNOWLEDGEMENT

I want to acknowledge the Naval Facilities Engineering Command (NAVFAC) and the Navy Crane Center (NCC) where I worked for 38 years (34 years as a Professional Engineer) honing my skills as a Construction Management Engineer and the last 14 years as a Safety Engineer. I also want to give my appreciation to the United States Canoe Association (USCA) for appointing me Safety Committee Chairman in 2005 and including the safety afloat standards I drafted into the *USCA Competition Rules*, and allowing me to maintain a safety page on the USCA website. I also want to thank the USCA for selecting me "Outstanding Paddler of the Year" in 2010 which gave me encouragement to continue to advocate safety in paddlesports. In addition, I want to acknowledge the Philadelphia Canoe Club (PCC), where I have been a member since 1974 and its Race Director since 1984, for allowing me to maintain a safety webpage on their website and to write safety articles for their *CaNews* newspaper; and for inviting me to speak on water related safety issues at their monthly General Meetings. And finally I want to thank the American Canoe Association, which I have been a Life Member since 1976, for allowing me to be on their Board where I learned the importance of being safe while enjoying both recreation and competition on the water.

PREFACE

Reason for writing this thesis:

BSA *Guide to Safe Scouting* emphasizes "BSA's Commitment to Safety". From the *Guide to Safe Scouting*: "We want you to know that the safety of our youth, volunteers, staff, and employees cannot be compromised. Health and safety must be integrated into everything we do to the point that no injuries are acceptable beyond those that are readily treatable by Scout-rendered first aid."

The BSA *Commissioner Fieldbook for Unit Service* says "Your Mission – As a commissioner, you provide units with meaningful service that delivers Scouting ideals to youth, brings about membership growth, and ensures on-time charter renewal. Your mission is to help unit succeed." A unit can only succeed if the unit conducts its activities in as safe of an environment as is possible. The *Commissioner Fieldbook* goes on to say that "A commissioner plays several roles, including being a friend, a representative, a unit 'doctor' or paramedic, a teacher, and a coach. The commissioner is a unit 'doctor' or a paramedic. In your role as 'doctor', you know that prevention is better than a cure, so you try to see that your units make good 'health practices' a way of life." While this is an implied comparison to Commissioners providing support to Unit leaders (i.e. when problems occur, act quickly, observe symptom, diagnose the real ailment, prescribe a remedy, and perform a follow up). There is a reason why this makes for a powerful metaphor is because of the importance of physical good health of the members of a Scout unit, both youth and adult members.

This thesis identifies life safety techniques, equipment, procedures, and physiological functions which are not currently contained or fully covered in BSA literature, but are recognized by safety and medical professionals and experts in the field to be the cutting edge of safety technology and practices. These safety recommendations are the result of scientific study, medical practice, and manufacturer innovations; and some are not common knowledge to many adult and youth Scouts. The *Guide to Safe Scouting* is a teaching tool and a guide, so it is imperative to be up-to-date on the latest safety and medical (First Aid) information.

It is hoped by putting these recognized safety measures and practices in a Commissioner's Doctoral thesis, it will be read by the Scout leaders at the BSA National Office and this will help get these items incorporated in the BSA *Guide to Safe Scouting*, E-Learning Course Management, National High Adventure Bases, Local Council High-Adventure Bases, Cub Scout Day Camps; Webelos Overnight Camps; Long-Term Resident Camps; Council and District Camporees; National Jamborees; and applicable BSA merit badges.

Safety topics in this thesis would make for excellent educational and informative articles for *Boys' Life*. I would be more than willing to work with the staff at the National Office to assist them on writing such articles and to update BSA training materials on these topics. Contained in this thesis are copy-ready handouts I prepared which contain descriptive verbiage in summary form, illustrations, and photographs. I have used several of these handouts in safety presentations I put on for Boy Scout and Cub Scout units, and at Roundtable meetings. If the safety information contained in this thesis is incorporated into BSA literature and this knowledge helps save a Scout's life or prevents a serious injury, then this thesis will have met my mission.

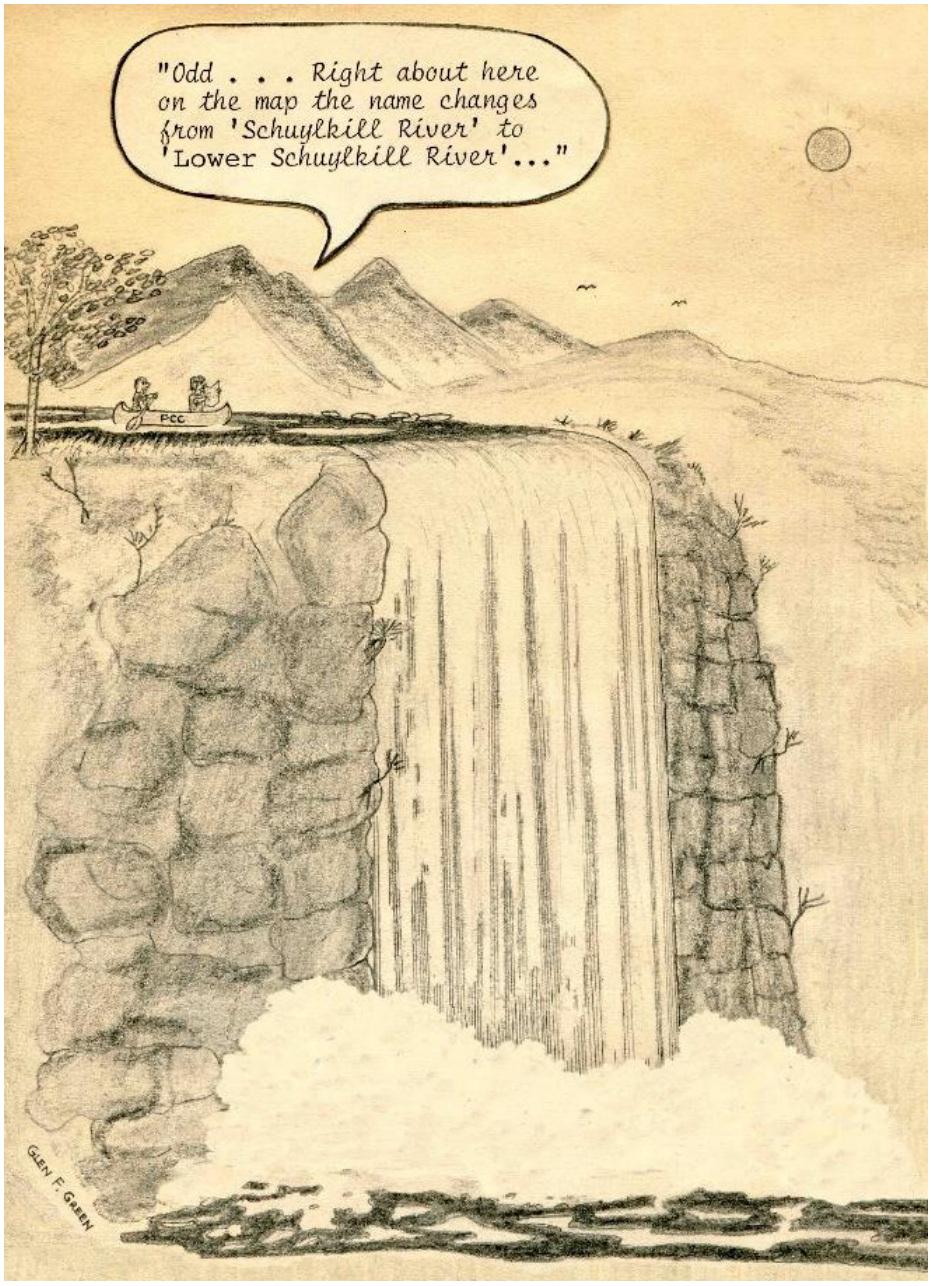
Groups that will benefit from reading this thesis:

This thesis is written on behalf of all adult and youth Scouts.

Scope of this thesis:

This thesis covers safety techniques, equipment, procedures, and physiological functions pertaining to Inflatable PFDs, Inflatable Belt Pack PFDs, Rescue Throw Bags, Rescue Throw Sticks, Sound Signaling, Light Signals (Navigation Lights/Visual Distress Signals), Lightning Safety on Water, Cold Water Inspiratory Gasp, Cold Shock Response, Lightning Detectors, Hypothermia, Hyperthermia, Hyponatremia, Hypernatremia, Drowning, Near Drowning, Laryngospasm, Post Rescue Collapse, Paradoxical Undressing, Wilderness First Aid Kit, Assisted Ice Rescue, Self Ice Rescue Techniques, and Lightning Protection of Scout Facilities.

SAFETY TRAINING AND PREPARATION IS THE BEST WAY TO AVOID AN ACCIDENT:



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CHAPTER 1

INTRODUCTION

The *Guide to Safe Scouting* states "In particular, Scout leaders are responsible for the physical and mental well- being of everyone under their supervision. Parents who entrust Scout leaders with their children justifiably expect them to return uninjured." "The purpose of the *Guide to Safe Scouting* is to prepare adult leaders to conduct Scouting activities in a safe and prudent manner. The policies and guidelines have been established because of the real need to protect members from known hazards that have been identified through over 100 years of experience."

The *Guide to Safe Scouting* goes on to say that "In situations not specifically covered in this guide, activity planners should evaluate the risk or potential risk of harm, and respond with action plans based on common sense, community standards, the Boy Scout motto, and safety policies and practices commonly prescribed for the activity by experienced providers and practitioners." The order that the safety information (i.e. Thesis Appendix Chapters) is presented in this thesis mirrors the order of the sections in of the *Guide to Safe Scouting* where this safety information would be incorporated.

<u>II. Aquatics Safety</u> – Inflatable PFDs, Inflatable Belt Pack PFDs, Rescue Throw Bags, Rescue Throw Sticks, Sound Signaling, Light Signaling (Navigation Lights/Visual Distress Signals), Cold Water Inspiratory Gasp, Cold Shock Response, Lightning Safety on Water.
<u>III. Camping</u> – Lightning Detectors.
<u>V. First Aid</u> – Hypothermia, Hyperthermia, Hypernatremia, Hyponatremia, Drowning, Near Drowning, Laryngospasm, Post Rescue Collapse, Paradoxical Undressing, Wilderness First Aid Kit.
<u>IX. Inspections</u> - Lightning Protection of Scout Facilities.
<u>XII. Winter Activities</u> – Assisted Ice Rescue Techniques, Self Ice Rescue Techniques.

This thesis identifies several life safety techniques, equipment, procedures, and First Aid guidance which are recognized by safety professionals and experts in the field as being the physiological functions that occur, equipment that is needed, and techniques and procedures to be followed to be safe during specified Scout activities. This thesis provides references to medical experts on recommended first aid procedures to be followed if a victim exhibits the aforementioned medical conditions. By including or enhancing these safety items in the *Guide to Safe Scouting* it becomes a teaching tool as well as a guide. These safety recommendations and first aid procedures are the result of scientific study, medical practice, and manufacturer innovations; and some are not common knowledge to many adult and youth Scouts.

It is hoped by putting these innovative safety measures and practices, and first aid procedures in a Commissioner's Doctoral thesis, it will be read by the Scout leaders at the BSA National Office which might help these items incorporated in the BSA *Guide to Safe Scouting* (Aquatics Safety, Camping, First Aid, Inspections, and Winter Activities).

Each of the chapters contains one or more handouts I prepared containing detailed information, illustrations, photos, and safety equipment currently on the market. These handouts are being offered for use in Scout literature or as part of Scout training. The photos in the handouts were converted from "color to "black-and-white" so that they can be reproduced more economically.

The information contained in this thesis will make the operations of the National High Adventure Bases safer. Activities at these adventure bases which would benefit from this enhanced safety information are described below:

- Northern Tier (the BSA's cold weather research center where members learn cold weather camping skills, such as dog sledding, cross country skiing, snowshoeing, snow shelter building, ice fishing, and other cold weather activities),
- Florida Sea Base (a variety of water activities including SCUBA, sailing, snorkeling, and fishing),
- Philmont Scout Ranch (over 30 staffed program camps that Scouts and Venturers take part in, including backpacking treks, horseback cavalcades, fly-fishing, and rock climbing),
- National High Adventure Base at the Summit (activities may include backpacking, canoeing, mountain biking, horse packing, mountain climbing, ski touring, rafting, kayaking, or a host of other outdoor adventures),
- Local Council High-Adventure Bases [including Sea Scout Base Galveston, Chief Seattle Council Sea Scout Fleet Base, Bayport Scout Reservation, Great Lakes Sailing Adventure, Tacoma Sea Scout Base] (activities include backpacking, canoeing, mountain climbing, ski touring, rafting, kayaking, swimming, scuba diving, power boating, sailing).

The safety information in this thesis, when incorporated into the safety procedures followed by these Scout camps, will make camping events safer:

- Cub Scout Day Camps and Twilight Camps,
- Webelos Overnight Campouts,
- Long-Term Resident Camps (includes Summer Camps),
- Council and District Camporees, and
- National Jamborees

Including the safety information in this thesis in the literature and requirements of applicable BSA merit badges including Climbing, Camping, First Aid, Fishing, Hiking, Kayaking, Lifesaving, Medicine, Motor Boating, Rowing, Skating, Small Boat Sailing, Snow Sports, Swimming, Water Sports, Weather, Whitewater; and the guidance followed by Lone Scouts (information for Lone Scout Counselors), the Scouts who earn these merit badges will have be imparted additional safety knowledge which will influence their behavior during these activities.

Some may feel that the information provided in this thesis is too technical to be include in BSA literature, Camp Guidance, and Training Courses. Having raised two Eagle Scout sons and currently a Bear Cub Scout son, I can say with some experience that we underestimate their ability to comprehend detailed information. I would like to suggest that imparting this information to all Scouts may have a rewarding payback. Teaching Scouts some of the rare symptoms of a medical emergencies in addition to the common ones may have a lifesaving outcome. For example, a Scout encountering a hypothermic victim with no observed breathing or pulse; rather than assuming that the person is dead, performs lifesaving procedures on that person, it may actually save that victim’s life. The safety of Scouts is the mission of this thesis.

CHAPTER 2

INFLATABLE PFDs / INFLATABLE BELT PACK PFDs

Scout literature and training courses do a good job explaining the different types of U.S. Coast Guard approved personal flotation devices: Type I – Offshore, Type II – Near Shore, Type III – Flotation Aid, Type IV – Throwable Device, Type – Special Use; *however*, the BSA doesn't teach about U.S. Coast Guard approved inflatable PFDs.

INFLATABLE PFDS: The following characteristics of inflatable PFDs and the regulations pertaining to them should be a part of Scout literature and included in Scout training:

- Inflatable PFDs do not meet the U.S. carriage requirements unless the inflatable PFD is actually being worn.
- Inflatable life jackets rely on inflatable chambers that provide buoyancy when inflated.
- Inflatables come in a variety of U.S. Coast Guard-defined performance types.
- Can be inflated manually pulling a lanyard which sets off a CO2 cylinder, inflation by blowing into a tube, automatic inflation by a dissolving-pill-in-a-bobbin when the pill is dissolved by water, and hydrostatic activation by being under 4 inches of water pressure.
- Uninflated inflatable life jackets are less bulky than inherently buoyant life jackets.
- Inflatable PFDs are designed for adults weighing over 80 lbs with a chest size of 30-52".
- An inflated over-the-shoulder inflatable PFD immobilizes the head area similar to a collar, so it would stabilize some neck injuries.
- The specific type of life jacket is determined by its characteristics, such as its amount of buoyancy. Most over-the-shoulder inflatable PFDs have more buoyancy (35 pounds) which would physically raise the person's body higher out of the water than most standard foam core life jackets (22 pounds buoyancy).
- Do not use inflatable PFDs below freezing—cold air is denser, so inflation amount is less.
- Currently there are no inflatable PFDs that are USCG approved for use by youth under 16 years of age.
- Difficult to swim to shore or to a boat wearing an inflated inflatable PFD.
- Not recommended for whitewater where sharp rocks could puncture the air bladder.
- Not for repeated capsizes—once inflated need to install a replacement CO2 cartridge
- Should not be used by non-swimmers in case inflation of the air bladder is needed by blowing into inflation tube.
- Air bladder must not be partially inflated when CO2 cartridge is activated or bladder may explode.
- Do not wear inflatable PFD under a jacket—could cause fatal pressure against chest when inflated.
- Discuss when, where, how, and who are allowed to wear a belt pack PFD.
- Some belt PFDs are just buoyancy aids since they only offer 16 pounds of buoyancy.

INFLATABLE BELT PACK PFDs are particularly useful in hot temperatures where wearing a foam filled life jacket might overheat the participant, and when unhindered upper-body rotation is needed (e.g. during a canoe or kayak race). Also, a belt pack PFD is particularly useful when paddling a standup paddle board (SUP). The USCG considers a SUP a vessel; therefore, a PFD must be carried or worn when paddling a SUP in locations outside of the surf zone or outside of swimming areas. A belt pack PFD must be worn and not just carried when in or on a vessel.

If an inflatable belt pack PFD is worn at the waist in the front, and the lanyard is pulled after the person falls into the water, the air bladder would inflate in the front; then the user pulls the inflated PFD over his/her head, and cinches the straps to the torso. Over-the-shoulder (horse collar) inflatable PFDs and Belt Pack PFDs, once inflated, are designed to turn wearers to a face-up position and keep the user's head and mouth above the water.

Many paddlers incorrectly wear inflatable belt pack PFDs. *U.S. Coast Guard regulations* require that an USCG approved inflatable PFD must be worn to be in compliance with the USCG carriage requirement, and that it must be worn in accordance with manufacturer's instructions which state that a belt-pack PFD must be worn in the front. When in the water, the user pulls the lanyard to inflate the air bladder (all belt-pack PFDs are manually inflated by either pulling a lanyard or blowing into the oral inflation tube). If a paddler were to be wearing the inflatable belt pack PFD on his waist in the back, and were to pull the lanyard to inflate the air bladder; it would inflate on the paddler's back pushing the paddler forward into the water and making it impossible to be pulled properly over the paddlers head without completely taking the inflated PFD off the back and trying to put it on over the head in the front while treading water.

The Boy Scouts of America has replaced the term "Personal Flotation Device (PFD)" with the term "Life Jacket" in the *Guide to Safe Scouting* II. Aquatics Safety Safe, Swim Defense and Aquatics Safety, Safety Afloat, and in the BSA "Safety Afloat©" training. This is not an accurate way of labeling *U.S. Coast Guard approved* personal flotation devices. Recommend that the BSA stick to terminology describing PFDs and life jackets that U.S. Coast Guard uses because:

- The Code of Federal Regulations (U.S. law) and U.S. Coast Guard Regulations use the term "PFD (Personal Flotation Device)", not the term "life jacket".
- Underwriter Laboratory (UL) which tests PFDs and other specific flotation devices to the applicable ANSI/UL, CAN/CGSB standards uses the term "Personal flotation devices (PFD)", not "life jackets".
- Type I and Type II PFDs are worn like a horse collar, not like a jacket.
- Type III and Type V PFDs are worn like a jacket.
- Most Type V inflatable PFDs are worn uninflated like a pair of suspenders, and when inflated worn like a horse collar.
- Some Type V inflatable PFDs are worn like a jacket, and when inflated worn like a horse collar.
- Type V belt-pack inflatable PFDs are worn uninflated around the waist and like a horse collar when inflated.
- A Type IV PFD is a throwable device, it is not worn; and it is not a jacket.
- Type V belt inflatable PFDs are worn uninflated around the waist, and gripped as a buoyancy aid when inflated. [See the photo of the "Belt manual inflatable buoyancy aid PFD" in the handout attached to this chapter.]
- For those who use human-powered boats in both the United States and Canada: *Transport Canada* (Canadian law) classifies Personal Lifesaving Appliances as follows: (1) SOLAS (Safety of Life at Sea) lifejackets; (2) Standard Type Lifejackets; (3) Small Vessel Lifejackets; (4) Personal Flotation Devices (PFD). Under Canadian law PFDs are different than Lifejackets. See: http://tinyurl.com/ptvyr4v .

Inflatable Personal Flotation Devices

Inflatable PFDs do not meet the U.S. carriage requirements unless the inflatable PFD is actually being worn. Inflatable PFDs are designed for adults weighing over 80 lbs with a chest size of 30-52". An inflated over-the-shoulder inflatable PFD immobilizes the head area similar to a collar, so it would actually stabilize some neck injuries. Most over-the-shoulder inflatable PFDs have more buoyancy (35 pounds) which would physically raise the person's body higher out of the water than most standard foam core life jackets (22 pounds buoyancy) .
Cons: Do not use below freezing. Currently there are no inflatable PFDs that are USCG approved for use by youth under 16 years of age. Hard to swim in an inflated PFD. Not recommended for whitewater where sharp rocks could puncture the air bladder. Not for repeated capsizes—once inflated need to install a replacement CO2 cartridge. Should not be used by non-swimmers in case inflation of the air bladder is needed by blowing into inflation tube. Air bladder must not be partially inflated when CO2 cartridge is activated or bladder may explode.

Over-the-shoulder hydrostatic activation inflatable PFD

Cons: water pressure activated inflation device may not inflate if a person is floating face down while wearing waterproof clothing under the PFD since it requires 4 inches water pressure to activate.

Over-the-shoulder PFD automatic inflatable dissolving-pill-in-a-bobbin.

Cons: can accidently inflate by splashing water or rain which may dissolve the pill.

Over-the-shoulder inflatable PFD (photo showing inflated)

Note: A Belt-Pack must be worn on the lap (not on the back), since once inflated it must be pulled over one's head.

Belt-Pack manual inflatable PFD

Belt-Pack inflatable PFD (inflated)

Cons: Belt-Pack PFDs requires the manual pulling of a lanyard tab to inflate (does not automatically inflate when immersed). Once inflated the air bladder must be pulled over your head & the straps connected.

Re-Arming Kit

Order the appropriate size CO2 cartridge
33 Gram / 24 gram / 16 gram cylinders

Belt manual inflatable buoyancy aid PFD

Cons: Buoyancy aids PFDs requires the manual pulling of a lanyard tab to inflate. Not recommended for non-swimmers or weak swimmers. Requires the conscious holding of the inflated air bladder.

Buoyancy aid PFD (inflated)

CHAPTER 3

RESCUE THROW BAGS / RESCUE THROW STICKS

A rescue throw bag has become synonymous with swiftwater rescue over the last 25 years; however, since rescue throw bags have become easier to reload the rope, more compact, and some sell for under $20; more and more people are carrying rescue throw bags in their vehicles as well as in their boats. Throw bags have been use to rescue people trapped in their cars during flash floods, and to rescue swimmers in lakes as well as in whitewater creeks; and are often carried in backpacks on winter hikes and cross country ski trips, and on snowmobiles for possible rescue of a person who has fallen through ice.

Rescue throw bags are only mentioned in passing in the Kayaking merit badge requiremenst: *"Review the importance of safety equipment such as a … throw bag"*, the Whitewater merit badge: *"Include in your explanation a discussion about throw ropes"*, and the Lifesaving merit badge: *"Demonstrate water rescue methods by … throwing lines and objects. Demonstrate 'throwing' rescues using various items such as … rescue bags."* However, rescue throw bags in these merit badges are only a "review", an "explanation", or a "such as"; not a requirement to demonstrate a Scout's proficiency in throwing the bag, and repacking the bag (important so the rope doesn't "bird's nest" during a throw). Using a throw bag is a perishable skill, throwing a rescue rope throw bag is a skill that must be learned and practiced. When learning how to throw a rope bag, youth and adult Scouts have sometimes tossed the bag straight up into the air, just have it fall back on them, and others thrown the bag while letting the rope go – the victim would get the bag, but how were they going to be pulled to shore?

Rescue throw bags need to be a part of the requirements of the Canoeing merit badge, Safety merit badge, Rowing Merit badge, Skating merit badge (rescuing a person who falls through the ice), Watersports merit badge, Swimming merit badge, and Scuba Diving merit badge (there are specific throw bags with shorter rope length designed to be carried and throw swimmer to swimmer). Also, recommend that rescue throw bags and the *Rescue Stick*™ be discussed in detail in *Safety Afloat* literature and training. Photos of throw bags and the *Rescue Stick*™ can be seen in the handout.

RECOMMENDATION: Scout leaders should consider taking a *rescue stick*, a *rescue throw bag*, and an *inflatable belt pack PFD,* put them into a waterproof sack and take it on Scout unit water related trips. These items can be purchase separately Rescue Stick™ $135 http://tinyurl.com/k4th2h3 + Kwik Tec Rescue Throw Bag $16 http://tinyurl.com/mxgf2jz + Onyx Inflatable Belt Pack PFD $73 http://tinyurl.com/kypxddk for one-half the cost of buying a preassembled MRK110 Water Rescue Kit http://tinyurl.com/qykd8vp. In this rescue kit are the following:

RESCUE THROW BAG. Toss the rope throw bag beyond the victim, pulling it back to allow the victim to reach the rope. Then pull the victim to shore or to the rescue boat.

RESCUE STICK™. Throw the Rescue Stick™ within reach of the victim. It will automatically inflate when it hits the water, and provides rapid flotation assistance allowing rescuers to quickly and easily stabilize the victim. A stabilized and calm victim can more confidently aid in self rescue.

INFLATABLE BELT PACK PFD. The basic requirement of water rescue is self-protection. Although the rescuer does not plan to enter the water, if the unexpected happens being prepared keeps the rescuer from becoming a victim.

Rescue Throw Bags

WRSI Hail Mary Throw Bag

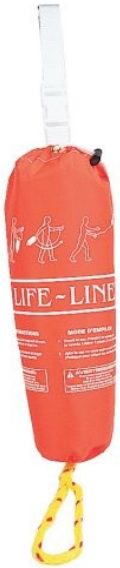
51' Polypropylene 1/4" Rope
Can be thrown like a football.

Astrol Throw Pouch

50' Poly/Spectra 3/8" Rope

Astrol Life Jacket

Slot behind front of PFD
to store throw pouch.



Twik Tek Throw Bag

50' Poly 1/"4 Rope
Cheapest at $17,
however difficult to
repack bag.

Liquidlogic Speed Loader Throw Bag

50' Polypropylene 5/16" rope bag opens flat for repacking.

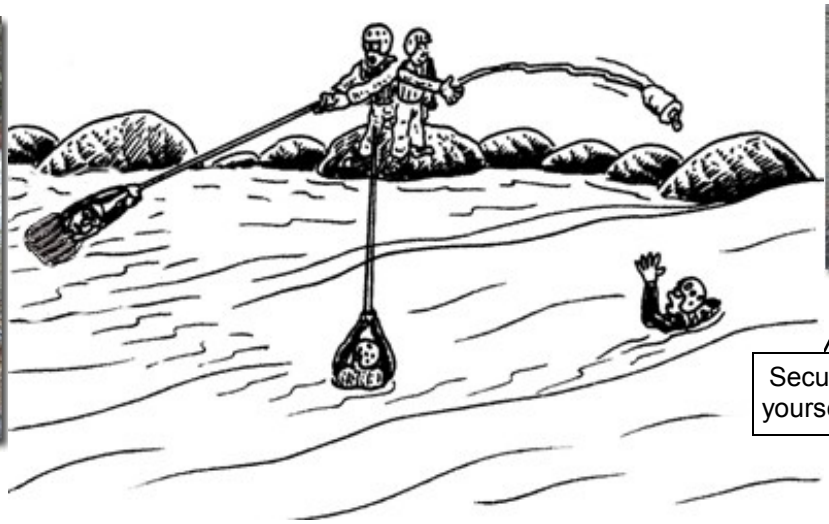
Survival Systems
Throw Rope.

56' Nylon 3/8" Rope.

Advantages & disadvantages of different types of rope:

- Nylon has good resistance to UV deterioration & abrasion, chemical resistant, coils easily, does not float.
- Polypropylene (poly) susceptible to UV deterioration, not as strong as nylon or polyester, floats.
- Spectra is a very high strength low weight cut resistant rope, resists UV deterioration and is expensive, floats.
- Polyester has excellent resistance to UV deterioration & abrasion, chemical resistant; however does not coil well or float, therefore is not used in a rescue throw bag.
- Solid-braid (not hollow braid) should be used for a throw rope. Manila rope is not used in a rescue throw bag.

Underhand toss



Secure
yourself

Re-packing bag

Tossing a rescue throw bag:

- Open bag just enough to pull some rope out. Hold the free end securely.
- Alert swimmer that you are ready to throw. NEVER TIE OFF THE END OF THE ROPE.
- Toss the bag to the swimmer. DO NOT let go of the end of the rope. Wear your PFD.
- Jude distance—try to thow the bag just over the swimmer, or just upstream if throwing over a moving stream.
- Choose a stance that will allow you to take the force of the swimmer on the end of the rope.
- Another person can hold onto the thrower or the shoulder straps of the thrower's life jacket for extra security.

CHAPTER 4

SOUND SIGNALING

Cub Scouts, Boy Scouts, Varsity Scouts, Venture Scouts, and adult Scout leaders are taught to always carry a whistle when canoeing or kayaking to signal for help in an emergency. This is for Scout safety. It also happens to be required by Federal law 33 CFR 83.37: "When a vessel *[e.g. canoe, kayak, rowboat, sailboat]* is in distress and requires assistance she shall use or exhibit signals described in Annex IV to the U.S. Coast Guard Navigation Rules *[e.g. loud whistle]*."

What also needs to be pointed out to both the youth and adult Scouts is that another Federal statute, 33 CFR 83.36, requires a sounding device be carried to attract the attention of an approaching boat: "If it is necessary to attract the attention of another vessel, any vessel *[e.g. canoe, kayak, rowboat, sailboat]*may make light or sound signals that cannot be mistake for any signal authorized elsewhere in the U.S. Coast Guard Navigation Rules *[e.g. loud whistle]*."

Scout literature and training courses should explain that other sounding devices can be used instead of a loud whistle, for example: a pressurized air horn. Some of these air horns are quite compact, weighing only 1.5 ounces and measuring only 4 ½ inches in height, and emit a 112 dB to 120 dB blast that can be heard ½ mile away *[see examples of portable air horns in the handout attached to this chapter]*. Air horns have a better chance of being heard over the engine noises of powerboats and jet skis, than a whistle, since the unique blast of an air horn which is used on most power boats and sailboats is universally recognizable by operators of vessels.

Many Scouts are under the impression that you only need to carry a sounding device *[e.g. loud whistle or portable air horn]* on well trafficked navigable waterways to warn approaching vessels, when in fact they are required by Federal Law to be carried in the boat and readily available for use on just about any waterway where you are paddling, canoeing or rowing.

Recently the number of waterways that the U.S. Coast Guard has jurisdiction over (U.S. Coast Guard Navigation Rules apply) has significantly increased. On June 5, 2007 the U.S. Environmental Protection Agency (EPA) and Army Corps of Engineers released a long-awaited interpretation of what constitutes "waters of the United States." The two agencies jointly issued a legal memorandum that interprets the June 19, 2006 Supreme Court decision in the consolidated cases *Rapanos v. U.S.* and *Carabell v. U.S.* (known as the "*Rapanos*" decision). The guidance was given to the Corps of Engineers and EPA field offices in an attempt to ensure nationwide consistency in identifying wetlands, streams and rivers subject to the Clean Water Act (CWA). A reaching effect of this Supreme Court decision is that U.S. Coast Guard regulations apply to more waterways than in the past as evidenced by the statement in the Code of Federal Regulations, Title 33, Part 2.36(i)(b) "…all waters within the U.S. tributary thereto." Title 33 is the portion of the Code of Federal Regulations that governs Navigation and Navigable Waters within the United States.

Scout literature does not emphasize the importance of a sound signal being heard at a distance, and that a standard sports whistle or a toy whistle doesn't put out the at least 110 dBs necessary to be heard for ½ mile over the water. Samples of loud whistles are in the attached handout.

Sound Signaling

The Law: U.S. Department of Homeland Security, United Sates Coast Guard:

NAVIGATION RULES: These rules apply to all vessels upon the inland waters of the United States, and to vessels of the U.S. on Canadian waters of the Great Lakes.

Part A - General: Rule 3. The word "**vessel**" incudes every description of water craft, including non-displacement craft and seaplanes. "**Inland Waters**" mean the navigable waters of the U.S. shoreward of the high seas, and includes rivers, other inland waters of the U.S. and the waters of the Great Lakes on the U.S. side

Part D - Sounds and Light Signals: Rule 32. The word "whistle" means any sound signaling appliance capable of producing the prescribed blasts and which complies with specifications in Annex III to these Rules [33 CFR 83.32(a)].

Part D: Rule 33. A vessel of less than 39.4 feet (12 meters) in length shall be provided with some means of making an efficient signal [33 CFR 83.33(b)].

Part D: Rule 36. If necessary to attract the attention of another vessel, any vessel may make light or sound signals that cannot be mistaken for any signal authorized elsewhere in these Rules [33 CFR 83.36].

ANNEX III to the USCG Navigation Rules: For inland waters a sound signal with audibility range of 1/2 nautical miles (0.58 miles) for a vessel of 39.4 feet in length but less than 66.6 feet. *[No listed sound signal intensity or range of audibility for vessels less than 39.4 feet].*

Code of Federal Regulations, Title 33, Part 2.36: **Navigable waters** of the United States mean: (1) Territorial seas of the United States; (2) Internal waters of the U.S that are subject to tidal influence; and (3) Internal waters of the U.S. not subject to tidal influence that: (i) Are or have been used, or are or have been susceptible for use, by themselves or in connection with other waters, as highways for substantial interstate or foreign commerce, notwithstanding natural or man-made obstructions that require portage; (ii)(b)...and all waters within the U.S. tributary thereto. Except where Congress has designated them not to be navigable waters of the U.S.

U.S. Coast Guard *"A Boater's Guide to the Federal Requirements for Recreational Boats"*: Recreational vessels are required to use sound signals during periods of reduced visibility and while at anchor [33 CFR 83.35(h)].

It is important that your sound signal can be heard at a distance of 1/2 mile.

Sound Level Calculations: A standard whistle produces sound less that 85 decibels (dB). You need a loud whistle or air horn that can produces a sound of at least 110 dBs. Assuming no wind and no noise from motor boats or thunderstorms, and no obstructions (such as trees, buildings, or hills) - if the sound level is 85 decibels at one meter from the whistle, the sound at 1/2 mile (805 meters) is 26.88 decibels (level of whisper). However, if the background noise is around 35 decibels, at 1/2 mile a person would not be able to hear a standard whistle being blown which only produces sound up to 85 decibels; therefore you would need a whistle that can produce at least 115 dB or more. See the 115 dB whistles below. *[Also, see dB calculator located at website http://www.sengpielaudio.com/calculator-distance.htm]*

Whistles: Sound Power > 115 dB

* *Whistles which contain a "pea" which whirls to produce a trilling sound.*


Fox 40 Classic


Fox 40 Sonic


Jetscream


Jetscream 2.0


Windstorm *


Storm *


REI Tri-Power *


Coghlans Survival Horn

Air Horns: Sound Power > 115 dB


Super Sound


Marco Gas Horn


Seasense Horn


Gas Horn

Ship's Bell: Sound Power ~ 110 dB

* *Many safety whistles for small boats are pealess, because a whistle can be rendered useless if the pea jams when the whistle fills with water from splashing water, rain, or if the boat were to capsize. Whistle chambers designed to self-clear when submerged in water Is desirable.*

Whistles: Sound Power ~ 110 dB


Fox 40 Mini


Fox 40 Micro


Seattle Sports

Standard Whistles: Sound Power < 85 dB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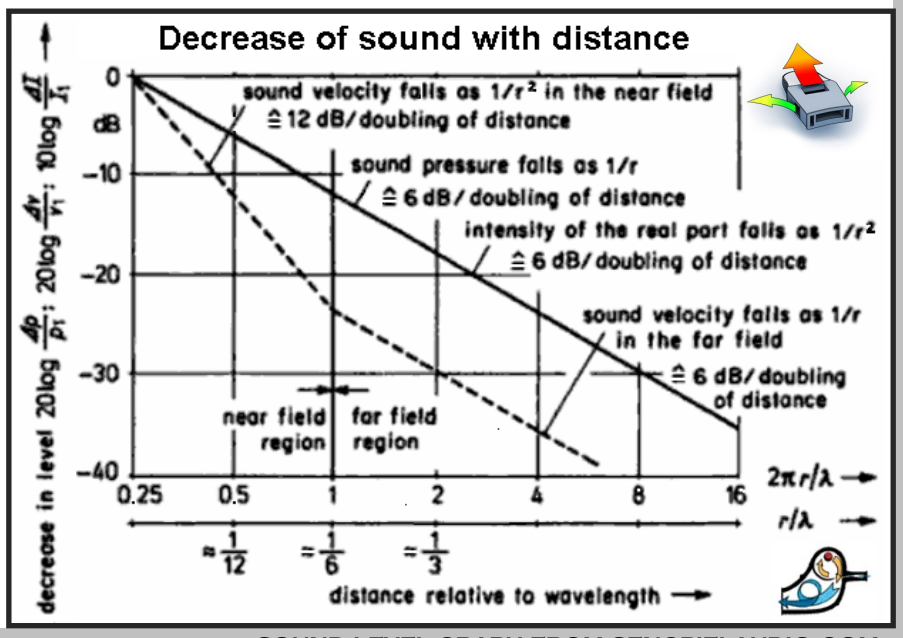
Decrease of sound with distance



HANDOUT PREPARED BY GLEN GREEN 2016

SOUND LEVEL GRAPH FROM SENGPIELAUDIO.COM
PHOTOS FOR THE MANUFACTURER'S WEBSITE

CHAPTER 5

LIGHT SIGNALING

NAVIGATION LIGHTS:

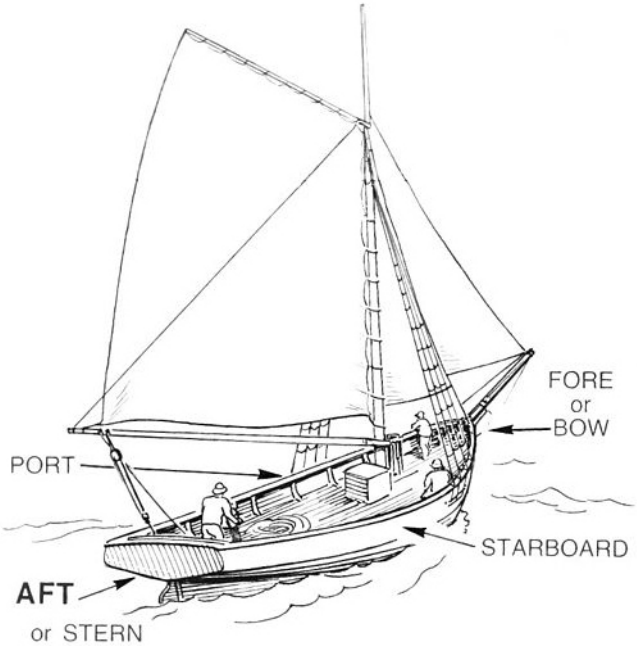
Due to a recent U.S. Supreme Court case ruling, the definition of "navigable waters" which U.S. Coast Guard has jurisdiction (U.S. Coast Guard Navigation Rules apply) has significantly expanded to encompass just about all waterways in the United States, including many lakes and streams, just about any waterway where you can paddle a canoe or kayak. This means that Scouts on any canoe or kayak trip needs to carry a light for navigation if happen to paddle after dusk (sunset to sunrise). For example, late getting to the planned take out spot or camp site.

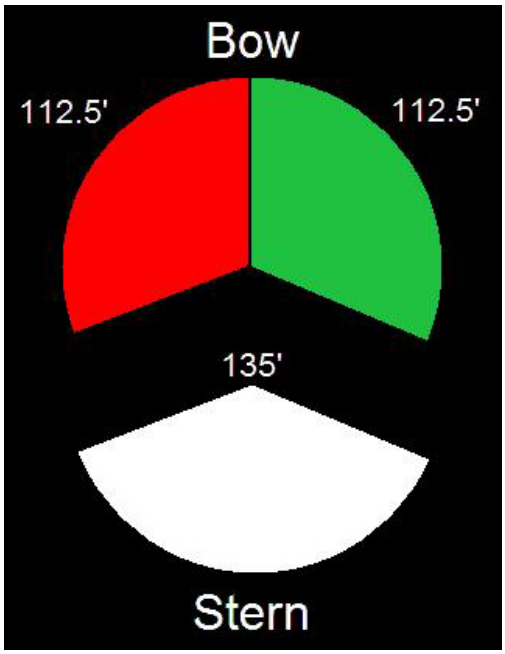
Scout literature recommends that a flashlight be carried in canoes and kayaks at night. While this meets U.S Coast Guard regulations which state that between sunset and sunrise "A vessel under oars she shall have ready at hand an elect torch showing a white light which shall be exhibited in sufficient time to prevent collision As per USCG Navigation Rules the word "vessel" incudes every description of water craft, including non-displacement craft and seaplanes. Technically, canoe and kayaks don't use oars, but many Federal and State compliance officers interpret that this rule to include canoes and kayaks.

While pointing a flashlight at an approaching vessel will to draw the attention of an approaching vessel that a manpowered craft is ahead of them or near them, putting down a paddle or letting go of the oars to hold up an electric torch or point a flashlight in the dark when there are waves in the lake or river from the weather or passing boat traffic, or even just strong winds; could put the occupants of manpowered craft in an unsafe situation which may lead to the boat capsizing. Many canoes and kayaks need to be moving in order to track straight; stopping paddling to point a flashlight could cause the manpowered craft to veer off course, and maybe into the path of an approaching vessel. Also, if the only light you have is a flashlight and it is pointing in the direction you are paddling, boats approaching form the rear may not see you.

A better way of attracting the attention of other boats is for the canoe or kayak to exhibit a red light on the left (port) and a green light on the right (starboard) on the bow, plus a white light on the stern. There are many acceptable red/green/white navigation lights currently on the market which are compact, lightweight, relatively inexpensive, and easy to attach to canoes and kayaks. Scouts using sailboats 23 feet and longer in length during darkness, must have facing fore (towards the front) a 112.5º red light on the left bow and a 112.5º green light on the right bow, and facing aft (towards the rear) a 135º white light mounted on the stern.

The Navigation Rules go on to say that if it is impracticable to exhibit one unblocked all-round light, then two all-round lights shall be used suitably positioned or screened so that the beams from these lights prevented from shining into the paddlers eyes which would compromise their night vision. For example a white 180º light on stern, another 180º light on bow. U.S. Coast Guard Navigation Rules specify that these lights have an intensity so as to be visible at 3 nautical miles (3.5 miles). Canoes, kayaks, surfskis, outrigger canoes, rowing shells, and sailboats under 23 feet in length may use an all all-round (360º) white lights as navigation lights on inland waters between sunset and sunrise.





Some States such as Texas have more restrictive regulations than the U.S. Coast Guard regulation which is acceptable under the Code of Federal Regulations, and require vessels of size including canoes and kayak to display between sunset and sunrise an all-round (360º) unbroken beam white light, or be subject to a fine by a compliance officer.

During my years of paddling at dusk and after dark, I have often observed human-powered boats including rowing shells using strobe lights and flashing lights of various colors to provide them with "higher visibility" which makes sense to them. However, as explained in the U.S. Coast Guard's, Navigation Rules, Frequently Asked Questions: "Displaying a strobe for visibility would confuse other vessels as to your navigational status." A high intensity white light flashing at regular intervals is a distress signal as spelled out in the U.S. Coast Guard regulations.

Recommend that the BSA Scout literature and training point out the Scouts need to carry more than just flashlight when they go on a canoe or kayak trip where there is a chance of paddling at dusk our at night when paddling on a river, lake, bay, or coastal waters where the is boat traffic besides other canoes and kayaks, including motor boats, jet skis, sail boats, and rowing shells; and describe the use of a portable red/green/white light, or an all-round (360º) white light affixed to their canoe or kayak.

Many people who own boats do know what the navigation rules say. A search of the Internet shows many interpretations of what is required for navigation lights and visual distress signals. The handout I prepared, and attached to this chapter, contain excerpts from the U.S. Coast Guard's NAVIGATION RULES so that Federal regulations can be read straight from the source. If this is taught to the Boy Scouts it will help them now and help them when they are adults and go boating. Also in the handout are photos of lightweight compact red and green bow lights, all-round white lights that can be easily mounted on canoes and kayaks; and U.S. Coast Guard compliant flashing lights distress signals; all of which are available for purchase on the Internet.

VISUAL DISTRESS SIGNALS

There are Venture and Boy Scout troops who take canoe and kayak trips and who sail or row on coastal (coastal waters are the Atlantic Ocean, Gulf of Mexico and all bays, sounds, harbors, rivers, inlets, etc., where any entrance is over two miles wide to the first point where the distance between shorelines narrows to two miles). U.S. Coast Guard regulations require vessels on coastal waters must be equipped with U.S.C.G. Approved visual distress signals. The following vessels are not required to carry day signals but must carry night signals when operating from sunset to sunrise: Recreational boats less than 16 feet in length; boats participating in organized events such as races, regattas, or marine parades; open sailboats less than 26 feet in length not equipped with propulsion machinery; and manually propelled boats.

USCG approved distress signals include: (a) gun fired at one minute intervals, (b) continuous sounding fog horn; (c) rockets or shells throwing red stars, (d) SOS signals, (f) International Code Signal, of distress, (g) square flag having a ball above or below, (h) flames on the vessel (as from burning oil barrel), (i) a rocket parachute flare or a hand flare showing a red light, (j) an orange-colored smoke signal, (k) slowly and repeatedly raising and lowering outstretched arms, (l) radiotelegraph alarm signal, (m) radiotelephone alarm signal, (n) signals transmitted by emergency position-indicating radio beacons, (n) signals transmitted by emergency position–indicating radio beacons, (o) signals transmitted by radio communication systems, (p) a high intensity white light flashing at regular intervals from 50 to 70 times per minute.

For example, in Pennsylvania, visual distress signal devices are required only for boats operating on Lake Erie. Boats less than 16 feet in length must carry distress signals suitable for use at night. Boats 16 feet and over in length must, at all times, carry devices suitable for day use and night use or devices suitable for use both day and night. Flares are approved for both day and night use. If flares are selected, a minimum of three must be carried. Three day/night signaling devices meet both requirements.

As far as using pyrotechnic style signals, it is not feasible to carry readily accessible flares in a kayak. Paddlers of these small human-powered boats often carry equipment, food, water, and spare clothes either behind a bulk head accessed by opening a hatch; or carry them in a dry bag in the storage area behind the seat under the kayak sprayskirt that seals the kayak from incoming waves. To complicate the accessing and deployment of a traditional pyrotechnic style signal paddlers would need to put down their paddle to deploy a flare. However to safely paddle a kayak or canoe after dark you should be continually holding onto the kayak paddle (or canoe paddle) so the paddle can be used for bracing (or prepared to brace) especially while paddling in windy choppy water at night since you cannot see a wave coming.

Pyrotechnics are universally recognized as excellent distress signals. However, there is potential for injury and property damage if not properly handled. These devices produce a very hot flame and the residue can cause burns and ignite flammable materials. Pistol launched and hand-held parachute flares and meteors have many characteristics of a firearm and must be handled with caution. In some states they are considered a firearm and prohibited from use. Young Scouts should not handle pyrotechnics. A visual distress signal used at night by Scouts should be a bright white electric flashing light.

Light Signaling

Researched by Glen F. Green, P.E., USCA Safety Committee Chairman, ACA NJ State Competition Director

The Law : U.S. Department of Homeland Security, United Sates Coast Guard *[some States may have stricter regulations]*:

NAVIGATION RULES: These rules apply to all vessels upon the inland waters of the United States, and to vessels of the U.S. on the Canadian waters of the Great Lakes.

Part A - General: Rule 3. The word "**vessel**" includes every description of water craft, including non-displacement craft and seaplanes. "**Inland Waters**" mean the navigable waters of the U.S. shoreward of the high seas, and includes rivers, other inland waters of the U.S. and the waters of the Great Lakes on the U.S. side of the Int'l Boundary.

Part C—Lights and Shapes: Rule 20. Application. The rules concerning lights shall be complied with from sunset to sunrise. Rule 22. Visibility of Lights. The lights prescribed in these Rules shall have an **intensity** as specified in Annex I *[i.e. 3 nautical miles = 12 candelas]* so as to be visible at the following minimum ranges:

(d) In **inconspicuous vessels**: a white all-round (360º) light, 3 miles. Rule 25. (d)(ii) A vessel under oars may exhibit the lights prescribed in this Rule for sailing vessels, but if she does not, she shall have ready at hand an elect torch or lighted lantern showing a white light which shall be exhibited in sufficient time to prevent collision. Rule 37. Distress Signals. When a vessel is in distress and requires assistance she shall use or exhibit the signals described in Annex IV.

Part D - Sounds and Light Signals: Rule 36. If necessary to attract the attention of another vessel, any vessel may make signals that cannot be mistaken for any signal authorized elsewhere in these Rules, or may direct a beam of light in the direction of the danger. Rule 37. When a vessel is in distress and requires assistance she shall use or exhibit the signals described in Annex IV to these Regulations *[this applies to inland waters of the United States and to International waters].*

ANNEX I to the USCG Navigation Rules: Positioning 33 CFR 84.17 (c) If it is impracticable to comply with paragraph (b) *[all-round light shall not be obscured]* of this section by exhibiting only one all-round light, two all-round lights shall be used suitably positioned or screened to appear, as far as practicable, as one light at a minimum distance of one nautical mile. *[e.g. a white 180º light on stern, another 180º light on bow.]*

ANNEX IV to the USCG Navigation Rules: **Distress Signals** - The following signals, used or exhibited either together or separately indicate distress and need of assistance: *[from sunset to sunrise]:* (c) rockets or shells, throwing red stars fired one at a time at short intervals; (i) a rocket parachute flare or a hand flare showing a red light; (p) *[inland waters only]* a high intensity white light flashing at regular intervals from 50 to 70 times per minute. The use or exhibition of any of the foregoing signals except for the purpose of indicting distress and need of assistance and the use of other signals which may be confused with any of the above signals is prohibited.

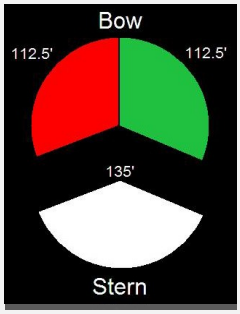
Code of Federal Regulations, Title 33, Part 2.36: **Navigable waters** of the United States mean: (1) Territorial seas of the United States; (2) Internal waters of the U.S that are subject to tidal influence; and (3) Internal waters of the United States not subject to tidal influence that: (i) Are or have been used, or are or have been susceptible for use, by themselves or in connection with other waters, as highways for substantial interstate or foreign commerce, notwithstanding natural or man-made obstructions that require portage; (ii)(b)...and all waters within the U.S. tributary thereto. Except where Congress has designated them not to be navigable waters of the United States.

USCG *"A Boater's Guide to the Federal Requirements for Recreational Boats"*: 33 CFR 175.105. All vessels used on coastal waters, the Great Lakes, territorial seas, and those waters connected directly to them, up to a point where a body of water is less than two miles wide must be equipped with U.S.C.G. approved visual distress signals. Vessels owned in the United States operating on the high seas must be equipped with U.S.C.G. Approved visual distress signals. The following vessels are not required to carry day signals, **but must carry night signals** when operating from sunset to sunrise: (1) Recreational boats less than 16 feet in length. (2) Boats participating in organized events such as races, regattas, or marine parades. (3) Manually propelled.

Navigation Lights

NAVIGATION RULES do not address canoes or kayaks per se, except in regards to **vessels under oar** which can be treated as a sailing vessel that must (sunset to sunrise) exhibit a red light on the left (port) and a green light on the right (starboard) on the bow, plus a white light on the stern; or treated as a sailing vessel under 65.6 feet where the red/green/white lights may be combined into an all-round (360º) white light carried near the top of the mast. If a portion of the all-round light is obstructed, a white light on the bow, plus a white light on the stern, with a screen blocking beams from these lights from shining into the operator's eyes is an alternative. Sailing vessels under 23 feet may instead display an electric white torch.

RED/GREEN BOW LIGHTS



Navilight Tri-Color 112.5º red

Attwood™ portable red/green bow LED

Need two: one for bow, one for stern -

Innovative™ portable LED red/green bow

ARCNAV System 4.0 red/green

Navlite red/green bow lights

A headlamp will allow you to keep your hands on your paddle or oars, but it may appear as a flashing light to other vessels as you turn your head around.

Nite-Row-Lites green light clipped onto an oar. *Closeup of silicone light dispersion end. Also comes in a red light.*

Waterproof Floating Flashlight: USCG regulations allow man-powered vessels to carry a flashlight showing a white light which can be exhibited in sufficient time to prevent collision, 33 CFR 83.25. *However, stopping just before a collision, letting go of your paddle or oars to grab a flashlight and turn it on, aiming it at the other vessel, in rough water or windy conditions is not particularly feasible.*

ALL- ROUND WHITE LIGHTS

Navilight 360º or 135º Navisafe™ LED dual steady-on or flashing

33 CFR 83.22

Attwood™ portable white stern LED

Perko Masthead & All-Round light

Kayalu Kayalite® submersible kayak deck stern LED light with diffusion lens to protect paddler's night vision.

Seattle Sports® Hydrostar™ multi-LED

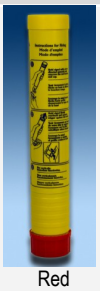
Visual Distress Signals

are required to be carried from sunset to sunrise on man-powered vessels on coastal waters, the Great Lakes, territorial seas, and those waters connected directly to them, up to a point where a body of water is less than two miles wide. **U.S.C.G. APPROVED SIGNALS *(night signals in bold):*** (a) gun fired at one minute intervals, (b) continuous sounding fog horn; **(c) rockets or shells throwing red stars,** (d) SOS signals, (f) International Code Signal, of distress, (g) square flag having a ball above or below, (h) flames on the vessel (as from burning oil barrel), **(i) a rocket parachute flare or a hand flare showing a red light,** (j) an orange-colored smoke signal, (k) slowly and repeatedly raising and lowering outstretched arms, (l) radiotelegraph alarm signal, (m) radiotelephone alarm signal, (n) signals transmitted by emergency position-indicating radio beacons, (n) signals transmitted by emergency position–indicating radio beacons, (o) signals transmitted by radio communication systems, **(p) a high intensity white light flashing at regular intervals from 50 to 70 times per minute.**

A minimum of 6 of any signals are required: 3 signals for day use, 3 signals for night use.

USCG COMPLIANT PYROTECHNICS

33 CFR 175.130



Red Parachute Signal Rocket SOLAS

Skyblazer II red aerial signals: Altitude 450 feet, burn time 7 seconds, brightness 16,000 candela

Pocket Rocket 4 aerial signal kit

Alerter Basic 4 12 guage launcher & aerial flares

Multiple flashes meets the 3 signals for night use

USCG COMPLIANT FLASHING LIGHTS

33 CFR 161.013

FireFly® "Waterbug" water activated/ manual LED rescue flashing light

Navilight 360º dual steady-on or flashing

SEE-ME™ "Select" water activated/manual LED rescue flashing

SEE-ME™ marine LED rescue flashing light

CHAPTER 6

COLD WATER INSPIRATORY GASP / COLD SHOCK RESPONSE

BSA literature describes possible hypothermia from falling into cold water, but it does not describe an initial cold water gasp and cold shock response. This needs to be discussed in the BSA literature and in training courses. If a Scout understands what happening to them when cold water hits their face, they can make an effort to remain calm and try to concentrate on controlling their breathing and not to panic. There is nothing in the BSA *Safety Afloat* or in the rest of the *Guide to Safe Scouting* which talks about cold water inspiratory gasp or the cold shock response which is experienced by everyone, young or old if their face is immersed in cold water. There was an article in *The Oregonian* on June 8, 2008 that reported on the death of an 11-year-old Boy Scout who capsized on a canoe trip with his Troop and fell into 43ºF water. Despite this boy being on the school swim team and wearing a life jacket, he drowned. Cold water shock probably was a factor in this boy's death because if you are unable to hold your breath even for a few seconds when you are sucked underwater after cold water hits your face, you can inhale water during a cold water gasp. The following is what a person experiences when their face is suddenly immersed in cold water:

COLD WATER GASP

Cold water gasp, also known as the gasp reflex, torso reflex, or cold water inspiratory gasp, occurs when there is a sudden immersion of a person's face in cold water which causes an automatic gasp to breath in a large volume of air. This is a part of an artifact of human evolution called the mammalian diving reflex exhibited in aquatic mammals (seals, otters, dolphins, wales) which optimizes respiration to allow staying underwater for extended periods of times. Diving birds such as penguins and cormorants have a similar diving reflex. Every animal's diving reflex is triggered specifically by cold water contacting the face of a mammal. Water that is warmer than 70ºF does not cause the reflex, and neither does submersion of other body parts.

If this sudden gasp for air happens when you are submerged (boat capsizing or a fall through thin ice) or when you get doused by a large wave of cold water, you will inhale water, not air. This is why wearing a PFD is critical, because if you do inhale some water the PFD will bring you to the surface and keep you on the surface as you are gasping or choking. It only takes an inhalation of about five ounces (150 ml) of water to cause drowning. Drowning is a combination of cardiac arrest and suffocation. Water in the lungs compromises your ability to exchange oxygen, and because respiratory movements may occur for up to five minutes when underwater, water can continue to be drawn into your lungs. Once your brain has been deprived of oxygen for a period of 4-5 minutes you will become unconscious and with continued lack of oxygen your heart will eventually stop beating. The longer your brain is deprived of oxygen the less chance you have of returning to normal function even if the heart keeps beating.

Practice helps—triathletes & swimmers who practice getting into cold water, and whitewater kayakers & canoers who roll their boats in cold water, experience the changes the body makes. They know what's coming, they know it will settle out, and they know they can make the adjustments to hold their breath or control their breathing. If you are planning on swimming in

cold water, try breast stroking a few times to start the process. When you're ready, put your entire face in knowing that it will take a bit for your body to settle out and adjust

COLD SHOCK RESPONSE

Cold water inspiratory gasp is the initial response to being submersed in cold water. A second component of the Cold Shock Response involves hyperventilation. Like the gasp reflex, this is a natural reaction to the cold. Although this physiological response will subside, panic can cause a psychological continuance of hyperventilation. Prolonged hyperventilation can lead to fainting, so the key thing is to concentrate on controlling your breathing. Hyperventilation can be exacerbated by panicking. If the body has a staged immersion (gradual immersion to the waist followed by full immersion to neck level), it can attenuate (lessen) the hyperventilation response; therefore, the probability of sudden drowning. If experiencing hyperventilation, the tendency is to want to take deeper breaths. You have to fight this desire as best you can, and slow down your breathing dramatically. Hyperventilation literally translates to "over-breathing". Contrary to popular belief, it is not the act of getting too little air; rather, it's the act of breathing out carbon dioxide too quickly, causing too much oxygen to enter the lungs. Take breaths that last as long as 12 seconds. Breathe in through your nose slowly for 5 seconds; hold for 3 seconds; breathe out through pursed lips for 7 seconds. Doing this will help your body balance its carbon dioxide levels again and should prevent you from further hyperventilating.

Cold receptors are not in your body or limbs, but in your nasal cavity and other facial areas that relay information to your brain. Once triggered by cold, the automatic nervous system then takes control to make changes in your body. This includes slowing your heart rate down and restricting blood flow to the limbs and organs to conserve oxygen for the heart and brain. One minute in 60°F water will result in the skin turning black on infrared viewing--meaning the skin is cold and surface circulation has been eliminated. See the section on hypothermia for further details on what cold water leads to even in the absence of inhaling water. The length of time in cold water before a fatal outcome depends on temperature of the water, protective gear and the health of the person.

Attached to this chapter is a handout containing a description and photos on Cold Water Gasp and Cold Shock Response. On this hand out is a photo of Jimmy Fallon participating in a plunge into Lake Michigan on March 2, 2014 in 32ºF water as part of a fund raising event for the Special Olympic Chicago. You can see from the expression on his face that he had just experienced a cold water gasp from cold water hitting his face – luckily he remained on his feet and was able to regain breathing normally in relatively short time. On the *Tonight Show* the next day he said it was the most uncomfortable experience of his life. Practice helps—triathletes & swimmers who practice getting into cold water, and whitewater kayakers & canoers who roll their boats in cold water, experience the changes the body makes. They know what's coming, they know it will settle out, and they know they can make the adjustments to hold their breath or control their breathing. If you are planning on swimming in cold water, try breast stroking a few times to start the process. When you're ready, put your entire face in knowing that it will take a bit for your body to settle out and adjust. Warming one's body core temperature by drinking a hot beverage or exercising before the plunge helps.

Cold Water Gasp

In the photo in the upper right hand corner you can see the gasp by Jimmy Fallon (man in the suit) from 36.5°F cold water hitting his face. Practice helps—triathletes & swimmers who practice getting into cold water, and whitewater kayakers & canoers who roll their boats in cold water, experience the changes the body makes. They know what's coming, they know it will settle out, and they know they can make the adjustments to hold their breath or control their breathing. If you are planning on swimming in cold water, try breast stroking a few times to start the process. When you're ready, put your entire face in knowing that it will take a bit for your body to settle out and adjust.

Cold water gasp, also known as the **gasp reflex**, **torso reflex**, or **cold water inspiratory gasp,** occurs when there is a sudden immersion of a person's face in cold water which causes an automatic gasp to breath in a large volume of air. This is a part of an artifact of human evolution called the *mammalian diving reflex* exhibited in aquatic mammals (seals, otters, dolphins, wales) which optimizes respiration to allow staying underwater for extended periods of times. Diving birds such as penguins and cormorants have a similar diving reflex. Every animal's diving reflex is triggered specifically by cold water contacting the face of a mammal. Water that is warmer than 70ºF does not cause the reflex, and neither does submersion of other body parts.

If this sudden gasp for air happens when you are submerged (boat capsizing or a fall through thin ice) or when you get doused by a large wave of cold water, you will inhale water, not air. This is why wearing a PFD is critical, because if you do inhale some water the PFD will bring you to the surface and keep you on the surface as you are gasping or choking. It only takes an inhalation of about five ounces (150 ml) of water to cause drowning. Drowning is a combination of cardiac arrest and suffocation. Water in the lungs compromises your ability to exchange oxygen, and because respiratory movements may occur for up to five minutes when underwater, water can continue to be drawn into your lungs. Once your brain has been deprived of oxygen for a period of 4-5 minutes you will become unconscious and with continued lack of oxygen the less chance you have of returning to normal function even if the heart keeps beating.

Cold Shock Response

Cold water inspiratory gasp is the initial response to being submersed in cold water. A second component of the **Cold Shock Response** involves *hyperventilation*. Like the gasp reflex, this is a natural reaction to the cold. Although this physiological response will subside, panic can cause a psychological continuance of hyperventilation. Prolonged hyperventilation can lead to fainting, so the key thing is to concentrate on controlling your breathing. Hyperventilation can be exacerbated by panicking. If the body has a staged immersion (gradual immersion to the waist followed by full immersion to neck level), it can attenuate (lessen) the hyperventilation response; therefore, lessen the probability of sudden drowning. If experiencing hyperventilation, the tendency is to want to take deeper breaths. You have to fight this desire as best you can, and slow down your breathing dramatically. Hyperventilation literally translates to "over-breathing". Contrary to popular belief, it is not the act of getting too little air; rather, it's the act of breathing out carbon dioxide too quickly. This changes the chemistry of the blood by raising the pH affecting the central nervous system and chemical functions. The result can be muscle cramps, disorientation, confusion and loss of control. Take breaths that last as long as 12 seconds. Breathe in through your nose slowly for 5 seconds; hold for 3 seconds; breathe out through pursed lips for 7 seconds. Doing this will help your body balance its carbon dioxide levels again and should prevent you from further hyperventilating.

Cold receptors are not in your body or limbs, but in your nasal cavity and other facial areas that relay information to your brain. Once triggered by cold, the automatic nervous system then takes control to make changes in your body. This includes slowing your heart rate down and restricting blood flow to the limbs and organs to conserve oxygen for the heart and brain. One minute in 60°F water will result in the skin turning black on infrared viewing--meaning the skin is cold and surface circulation has been eliminated. See the handout on hypothermiafor further details on what cold water leads to even in the absence of inhaling water. The length of time in cold water before a fatal outcome depends on the temperature of the water, protective gear, and the health of the person.

FOUR PHOTOS FROM COLD WATER BOOT CAMP

HANDOUT PREPARED BY GLEN GREEN 2016

CHICAGO'S "POLAR PLUNGE" – HUFFINGTON POST 03-02-2014

CANOE PHOTO FROM AMERICAN CANOE ASSOCIATION 2005

HANDOUT REVIEWED BY ROBERT McNAMARA, MD, FAAEM 2014

CHAPTER 7

LIGHTNING SAFETY ON WATER

Lightning safety is a risk management procedure. Early recognition of the lightning hazard, with an awareness of defensive options, will provide high levels of safety. BSA *E-learning* "Weather Hazards", *Weather merit badge* (requirement 5 "… how lightning and hail are formed"), and *Guide to Safe Scouting* "Lightning Risk Reduction" cover the basics for lightning safety, such as:

- It is importance to consider weather when planning an outdoors trip.
- A paddler must pay attention to the weather and check the forecast before getting on the water.
- A paddler must be willing to turn around; yield to weather conditions; react before weather changes; not afterwards (better to be late in this world than early in the next).
- A immediately get off the water and seek a safe shelter, such as a lightning protected building or steel bodied vehicle – there is no safe place outside in a thunderstorm.
- If there are no lightning protected buildings or steel bodied vehicles, find a low spot under short brush or in a wooded area of trees of even height (never under an isolated tree); crouch in a ditch or depression, ravine, or foot of a hill (do not go to picnic shelters); if in an open field squat low to the ground on the balls of your feet.
- Keep moving; don't stop – the chances of being struck decrease the more you move.
- Being struck by lightning is often preceded by a sensation of all your hair standing on end, along your arms & the back of your neck–you are probably going to be struck in the next few seconds. If you have this feeling, immediately couch, or if on the water paddle as fast as you can or dive into the water (action of last resort).
- Wait a minimum of 30 minutes from the last observed lightning or thunder before resuming activities

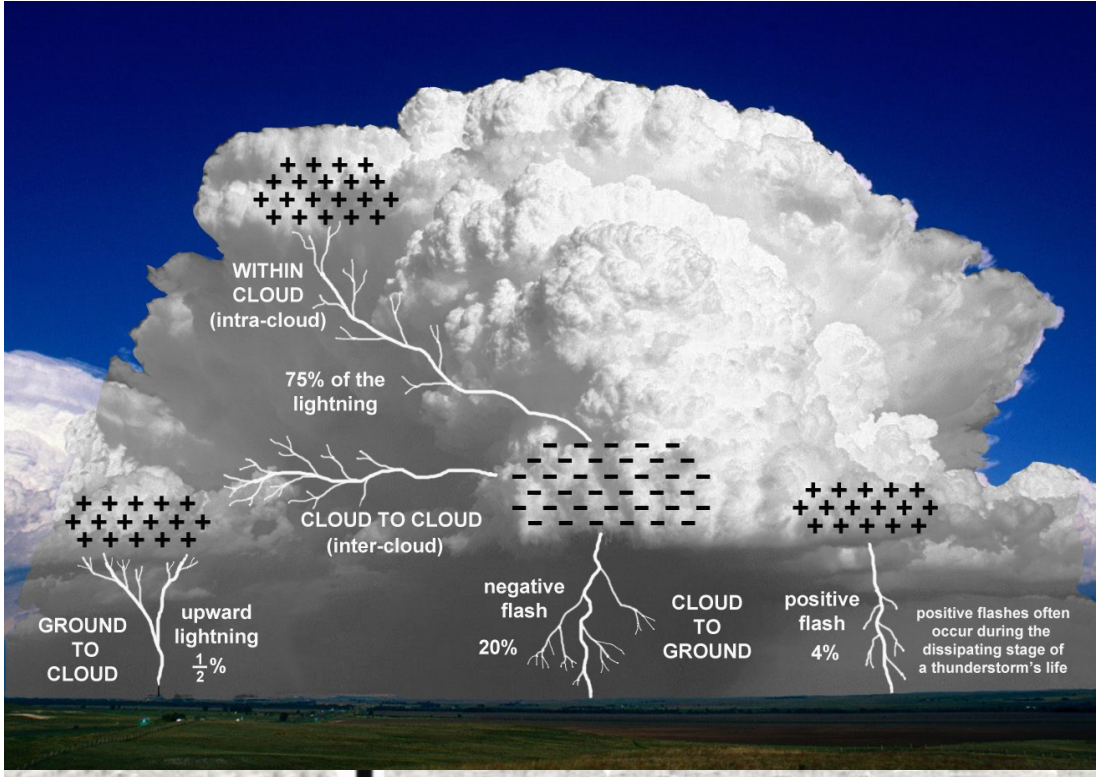
U.S. Service Project Scout "Health and Safety" website http://www.usscouts.org/safety/safe-lightning.asp on "Be Lightning Wise" has many lightning safety tips; however, BSA literature and training does not teach what to do if a paddler is caught in a thunderstorm and it is not possible to immediately get off the water due to high or muddy banks, or thick brush.

There is no such thing as lightning-proof boats, only lightning-protected boats. All-metal ships are rarely damaged, and since passengers and crew are normally inside of steel rooms, injuries or deaths are uncommon. These ships are frequently struck, but the high conductivity of the large quantities of metal, with hundreds of square yards of hull in direct contact with the water, causes rapid dissipation of the electrical charge.

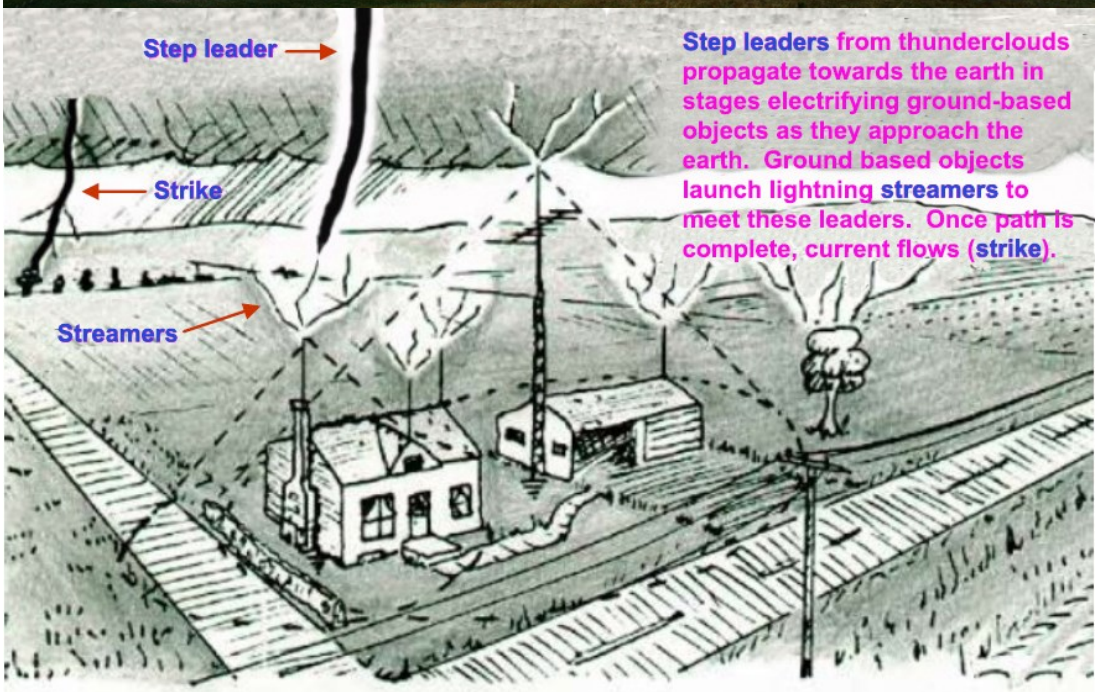
Canoes, kayaks, rowboats, and especially small sailboats without a cabin are particularly vulnerable to lightning strikes since any projection above the flat surface of the water acts as a potential lightning rod. Also when lightning strikes a small boat, the electrical current is searching any route to ground and the human body is an excellent conductor of electricity!

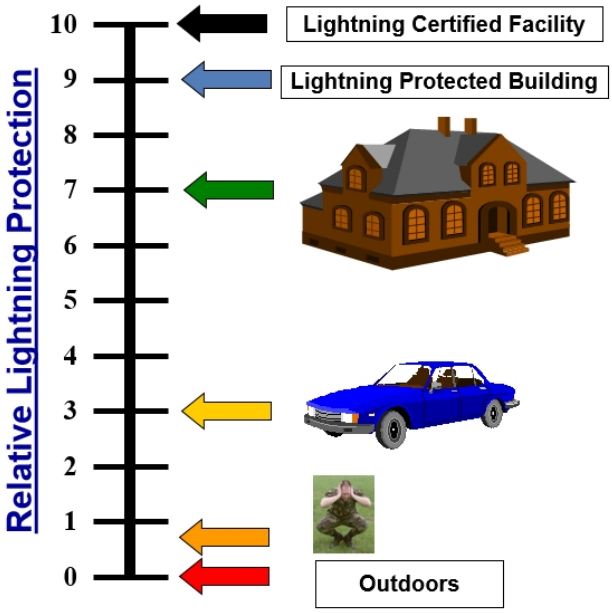
As a Navy Safety Engineer I researched lightning safety. Scientists believe in a concept they call the "Cone of Protection" where if you go inside an imaginary cone drawn at a 45 degree angle from the highest object near you down to ground, lightning will strike the highest object and not an object or person inside the cone. However, calling this a "Cone of Protection" is a misnomer since this imaginary cone does not offer protection, it is, however, a location where the probability of being struck by lightning is less inside this imaginary cone than outside of the cone. If paddlers understand that this concept, then as a last resort, if a paddler cannot get off the water immediately during a thunderstorm then he/she should paddle into this zone. I coined the phrase calling this a "Zone of Lesser Probability". An illustration of this "Zone of Lesser Probability" which I sketched is contained in the attached handout to this chapter.

As the ice particles within a cloud grow and interact, they collide, fracture and break apart. Smaller particles tend to acquire positive charge, while the larger particles acquire more negative charge. These particles tend to separate under the influences of updrafts and gravity until the upper portion of the cloud becomes negatively charges. This separation of charge produces enormous electrical potential both within the cloud and between the cloud and ground. This can amount to millions of volts, and eventually the electrical resistance in the air breaks down and a flash begins. Lightning is an electrical discharge between positive and negative regions of a thunderstorm.



If you can't find proper shelter, squat low to the ground on balls of your feet. Have your heals touch. Place your hands over your ears, eyes closed. Hold your breath if you anticipate an immediate close strike to prevent breathing super-heated air.





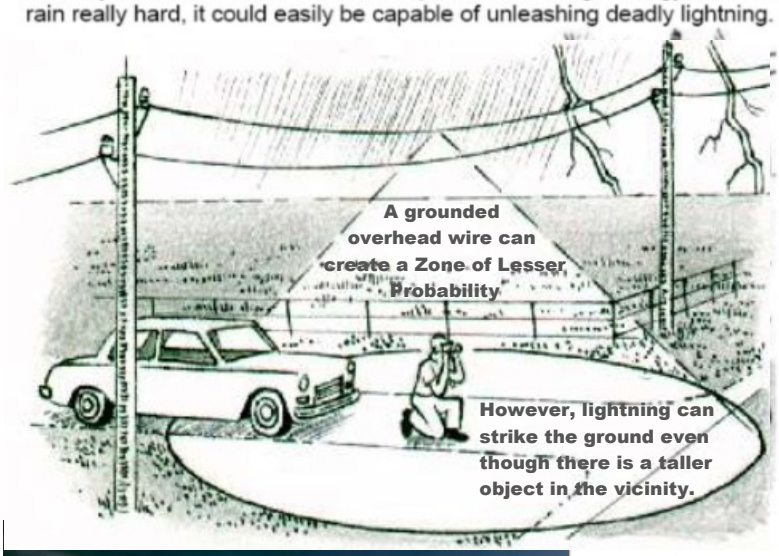
No place outside is safe near a thunderstorm.

1. Pay attention to forecast of local weather conditions.
2. If lightning is seen, count the time until you hear thunder. If the time is 30 seconds (6 miles) or less; or if you don't see the lightning, but hear loud thunder; seek proper shelter.
3. A lightning certified or lighting protected building is the safest. Inside a metal bodied car with windows rolled up is relatively safe.
4. If caught outdoors find a low spot away from poles and lone trees. Stay low (crouch) in a ditch or depression, or a low area, ravine or foot of a hill. Do not go to picnic shelters. Avoid shallow caves.
5. In the woods, find a low spot under short brush or a small tree among several large ones. Stay at least 6 feet away from the tree trunk to minimize a side strike or ground current from a tree strike.
6. Keep moving, don't stop—the chances of being hit decrease the more you move. Stay sheltered for 30 minutes after last lightning.
7. Avoid water and metallic objects. Avoid close proximity to other people--spread out 15 ft. apart. Avoid contact with dissimilar objects (water & land; boat & land; rock & ground; tree & ground).

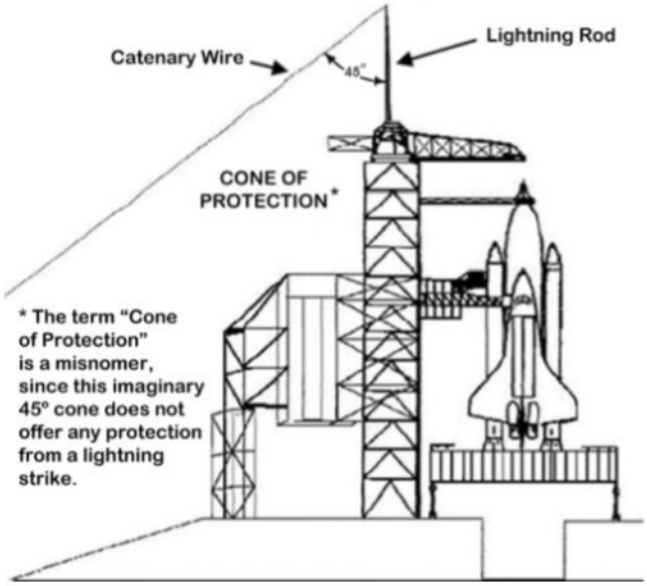
WHAT TO DO IF YOU CAN'T GET OFF THE WATER SAFELY IN A THUNDERSTORM: "Cone of protection" is an imaginary 45º cone around a tall isolated object with the assumption that lightning won't strike within this cone since lightning should strike the taller object first. Many lightning experts and safety organizations like the *National Lightning Safety Institute* consider the so-called "cone of protection" to be fallacious. They are correct, there is no guaranteed protection since lightning can easily strike inside the "cone of protection"; and even if lightning strikes the taller object, persons close to the tall object are in danger as a lightning strike dissipates along the ground or side flash. The streamer that the step leader reaches is not necessarily the closest streamer to the cloud. It's very common for lightning to strike the ground even though there is a tall object in the vicinity. Lightning streamers rise from both the tops of tall objects as well as from the ground and from the surface of the water. However, the probability is greater that a step leader from a cloud will reach the highest step leader off the ground which would be the top of the cone made by a tall object, which is why lightning rods are placed on the tallest parts of a building. "Cone of Protection" is a misnomer, it would be more appropriate to call it a "Zone of Lesser Probability" of a lighting strike. Lightning is a capricious and random event. It cannot be predicted with any accuracy. It cannot be prevented. Advanced planning is the best defense. Immediate evasive action could save a life. If it is impossible to find proper shelter during a thunderstorm and you are out in the open, and there is a nearby grounded tall object like an antenna tower or a group of taller objects (not a lone tall tree or a single pole); play-the-odds, and go inside the "Zone of Lesser Probability".

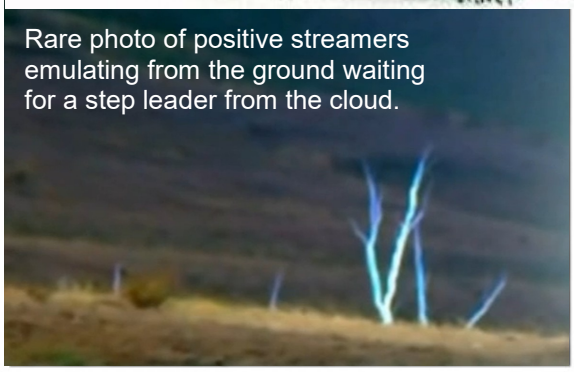
No place outside is safe in a thunderstorm.

If it is raining especially hard, lightning may not be readily visible and thunder may be drowned out. If the atmosphere has enough energy to make it rain really hard, it could easily be capable of unleashing deadly lightning.



ROCKET SCIENTISTS BELIEVE IN THE CONCEPT CALLED THE "CONE OF PROTECTION"





As the step leaders approach the earth, objects on the surface begin responding to the strong electric field. The objects reach out to the cloud by "growing" positive streamers—once produced they do not continue to grow but wait patiently as the step leaders approach. When a step leader and a streamer meet—current flows (strike).

Lightning Safety:

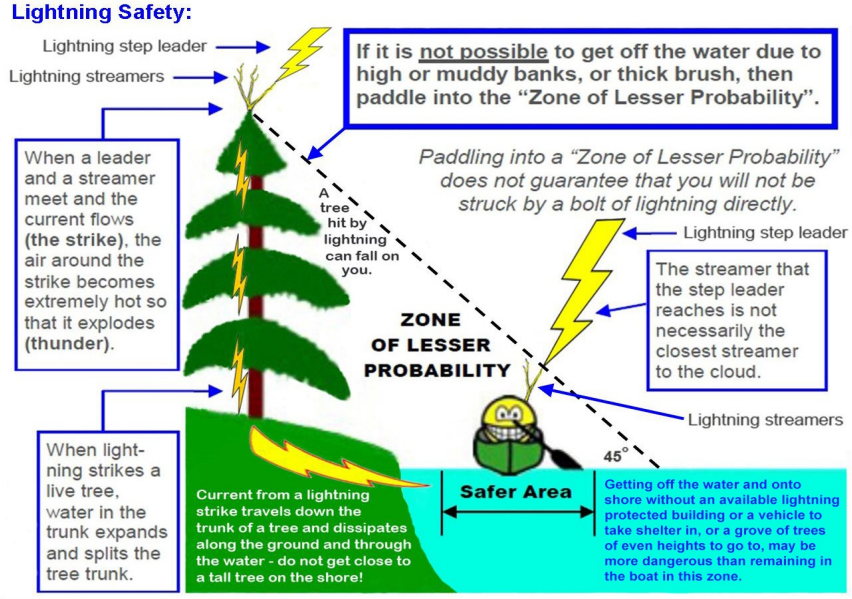


ILLUSTRATION BY GLEN GREEN

CHAPTER 8

LIGHTNING DETECTION / LIGHTNING DETECTORS

LIGHTNING DETECTION

There can be as many as 40,000 thunderstorms each day around the world. They are the most common in the U.S., where they can produce tornadoes, floods, lightning and damaging winds. Lightning is the second highest cause of weather-related deaths in the United States annually, and produces considerable damage by initiating fires and disrupting communications and power transmission systems. Remote sensing technology is becoming increasingly important in the detection of lightning-producing convective storms.

Lightning can be anticipated with an approaching thunderstorm, but cannot be predicted with accuracy. A lightning strike cannot be prevented. The Flash-to-Bang-Method most people rely on is only sometimes accurate. The primary reason is because thunder can typically only be heard when the lightning strike is 2 to 4 miles away. You are in danger of being struck by lightning when the leading or trailing edge of the storm cell is 8 miles away. That's why 60% of people struck by lightning have no prior visual or audible warning. 90% of people struck are struck under blue skies. 30% are struck before the storm is overhead. 60% are struck after they think the storm has passed and it's safe to go back outside.

Lightning can travel sideways for up to 10 miles, so it is possible for a, "bolt from the blue", on the edge of a storm. At least 10% of lightning occurs without visible clouds in the sky. If you can hear thunder, lightning is close enough that it could strike your location at any moment. Go to a safe shelter immediately. If you wait until you see lightning, it may be already too late to take action. Most people struck by lightning are not in the rain! Your best bet is an early warning system (e.g. lightning detectors) that will allow time for you to seek proper shelter.

Early recognition that lightning is approaching provides the best defense. Relying solely on personal observation of lightning is not adequate. Additional information including detecting actual lightning strikes and monitoring the range at which they're occurring is required to ensure consistent, accurate, and adequate advance warning.

LIGHTNING DETECTORS

A lightning detector is a device that detects lightning produced by thunderstorms. There are three primary types of detectors: ground-based systems using multiple antennas, mobile systems using a direction and a sense antenna in the same location (often aboard an aircraft), and space-based systems. Lightning detectors and weather radar are used together to detect storms. Lightning detectors indicate electrical activity, while weather radar indicates precipitation. Both phenomena are associated with thunderstorms and can help indicate storm strength.

Personal handheld lightning detectors function by detecting the electromagnetic pulse emitted by a lightning strike. By measuring the strength of the detected EMP, the device can then estimate how far away the detected strike was. It is possible for a lightning detector to miss a strike if it is in the presence of interference, if it is processing a strike while another strike occurs, or if the

strike is a cloud-to-cloud strike. The careful user will use a lightning detector as a trending device - knowing what range of distance the storm is in, watching to see if the storm is approaching, and seeking shelter when the storm is within 6 miles.

There are reasonably priced lightning detectors on the market, recommend that all Troops, Huddles, and Crews; and all Scout camps, High Adventure Bases, Camporees, and Jamborees have one or more of these detectors – could save a life!

Below is a list of some of portable personal handheld lightning detectors currently on the market. The StrikeAlert II is the size of a pager and is under $60 on Amazon.com. You can put the Strike Alert II in a soft clear plastic waterproof pouch used to carry mobile phones and you can take the StrikeAlert II on canoe and kayak trips. You can still clearly hear the warning beeps and see the flashing lights which indicates lightning strikes and their approximate distance away right through the waterproof pouch. The advantage of the StrikeAlert II over using the "WeatherBug App" on a smart phone is that you sometimes lose a phone signal when hiking in hilly or mountainous terrain, or if you are in a remote area away from cell tower range; whereas all you need to use the StrikeAlert is a two AA batteries that still have a charge:

- "ThunderBolt" Detector, 75 mile range, immediate response to a strike, calculates approach speed & expected arrival time on LCD display, Water Resistant. $560.

- "StrikeAlert HD" Lightning Detector, immediate response to a strike, 40 mile range, 360° tracking, 1 hour storm trend, 80 hours operation, 2 AA batteries, audible & vibrate warnings $200.

- "Strike Alert II" Lightning Detector, 40 mile range, immediate response, LED lights & audible alarm at each strike, 100 hours operation, 2 AAA batteries, automatic shutoff when strikes stop, small clip on pager size. $60.

- "StrikeAlert HD" Lightning Detector, immediate response to a strike, 40 mile range, 360° tracking, 1 hour storm trend, 80 hours operation, 2 AA batteries, audible & vibrate warnings $200.

- Smart Phone "WeatherBug" App (refreshes every 60 seconds). However, needs a cell tower signal - not good in remote areas or mountainous terrain. Cost: Price of phone + phone carrier charges.

Photos of these detectors can be seen in the attached handout to this chapter.

Lightning Detection

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Lightning Detectors

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The careful user will use a lightning detector as a trending device - knowing what range of distance the storm is in, watching to see if the storm is approaching, and seeking shelter when the storm is within 6 miles.

"ThunderBolt" Detector, 75 mile range, immediate response to a strike, calculates approach speed & expected arrival time on LCD display, Water Resistant. $560.

http://tinyurl.com/n5nx9xc

http://www.youtube.com/watch?v=-hOwiC5VOME

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Smart Phone **"WeatherBug"** App (refreshes every 60 seconds). However, needs a cell tower signal - not good in remote areas or mountainous terrain. Cost: Price of phone + phone carrier charges.

http://weather.weatherbug.com/spark-alert.html

CHAPTER 9

HYPOTHERMIA / HYPERTHERMIA

The *Guide to Safe Scouting* states under XII. Winter Activities, Winter Camping Safety, "Having Scouts paired aids in monitoring each other's physical conditions and observation of surroundings and circumstances"; and the *Guide to Safe Scouting* states under Winter Activities, Winter Sports Safety, "Participants should be aware of the potential hazards of any winter sport before engaging in it. Leaders should emphasize preventing accidents through adherence to safety measures and proper technique." A Scout being outside in the cold is inherent to winter camping and winter sports, yet there is no discussion on hypothermia.

The *Guide to Safe Scouting* states under VIII. Sports and Activities, "The supervisor should adjust all supervision, discipline, and protection to anticipate potential risks associated with individual health conditions." Sometimes sports and activities take part on hot days, yet there is no discussion on hyperthermia.

It is true that everything can't be covered in the *Guide to Safe Scouting*, but if important life safety information which pertains to Scouts is not contained in the *Guide to Safe Scouting*, then this document should at least direct Scout leaders as to where to go to become trained on recognizing symptoms for hypothermia and hyperthermia, and where to go to receive first aid training on them.

Symptoms and first aid for hypothermia and hyperthermia are mentioned in the *Backpacking, Cycling, Climbing, First Aid, Fishing, Fly Fishing, Gardening, Geocaching, Golf, Hiking, Kayaking, Lifesaving, Motor Boating, Orienteering, Pioneering, Rowing, Skating, Scuba Diving, Search and Rescue, Small Boat Sailing, Snow Sports, Sports, Surveying, Swimming, Water Sports, Whitewater,* and *Wilderness Survival* merit badges; but they could be covered in a little more detail. The goal is not to train Scouts to be EMT first responders; but Scouts are often the first responders in hypothermia/hyperthermia situations, and if they are in the wilderness what they do is even more critical if a victim recover successfully.

The *Los Angeles Times* reported from 2005 to 2010 that 32 Boy Scouts and adult leaders have died in outdoor activities. The list was compiled from news accounts, law enforcement reports, lawsuits and other public records. It excludes other deaths that involved occupational accidents, heart failures that occurred during non-strenuous activities and transportation accidents. Of these two died from hypothermia and one died of heatstoke (hyperthermia).

Recognizing the symptoms of hypothermia needs to be covered in *Safe Swim Defense* and *Safety Afloat*. Under *BSA Aquatics Safety* "Distance and Competitive Swimming in Open Water" it mentions "Long-distance swimming races are not approved for Cub Scouts or Boy Scouts, but Varsity Scouts and Venturers may participate in triathlon training and competitive events." Long immersions in water as high as 70ºF by a swimmer not wearing some sort of a wet suit may result in hypothermia.

Attached to this chapter are three handouts on hypothermia and one handout on hyperthermia to aid in teaching Scouts and Scout leaders.

HYPOTHERMIA

Core body temperatures of 95ºF and lower is considered hypothermic can cause the heart and nervous system to begin to malfunction and can, in many instances, lead to severe heart, respiratory and other problems that can result in organ damage and death.

First aid for hypothermia:

- Call 911 or emergency medical assistance. While waiting for help to arrive, monitor the person's breathing. If breathing stops or seems dangerously slow or shallow, begin CPR immediately.
- Move the person out of the cold. If going indoors isn't possible, protect the person from the wind, cover the head, and insulate the individual from the cold ground.
- Remove wet clothing. Replace wet things with a warm, dry covering.
- Don't apply direct heat. Don't use hot water, a heating pad or a heating lamp to warm the person. Instead, apply warm compresses to the center of the body (head, neck, chest & groin). Don't apply heat to the arms and legs – that forces cold blood back toward the heart, lungs and brain, causing the core body temperature to drop. This can be fatal. Most patients who die during active rewarming die from cardiac arrest.
- Don't give the person alcohol. Offer warm nonalcoholic drinks, unless the person is vomiting.
- Don't massage or rub the person. Handle people with hypothermia gently because their skin may be frostbitten, and rubbing frostbitten tissue can cause severe damage.
- Rewarming of the severe hypothermia patient is best carried out in a Hospital's Emergency Room using a pre-defined protocol.

HYPERTHERMIA

Hyperthermia is elevated body temperature when a body produces or absorbs more heat than it dissipates. Hyperthermia is defined as a temperature greater than 99.5°F to 100.9°F depending on the person. The normal human body temperature in health can be as high as 99.9°F. Hyperthermia requires an elevation from the temperature that would otherwise be expected. Body temperatures of 104.0 to 106.7°F are classified as Hyperpyrexia and is life threatening.

First aid for hyperthermia:

- Remove the underlying cause.
- Mild hyperthemia caused by exertion on a hot day may be adequately treated through self-care measures, such as increased water consumption and resting in a cool place. Fever-reducing drugs such as paracetamol and aspirin have value in treating hyperthermia.
- When body temperature is significantly elevated, mechanical cooling methods are used to remove heat and to restore the body's ability to regulate its own temperatures.
  - Passive cooling techniques, such as resting in a cool, shady area and removing clothing can be applied immediately.
  - Active cooling methods, such as sponging the head, neck, and trunk with cool water, remove heat from the body and thereby speed the body's return to normal temperatures.
- When the body temperature reaches about 104°F, or if the affected person is unconscious or showing signs of confusion, hyperthermia is considered a medical emergency that requires treatment in a proper medical facility. In a hospital, more aggressive cooling measures are available, including intravenous hydration, gastric lavage with iced saline, and even hemodialysis to cool the blood.

Normothemic

Means normal body temperature. Normal body core temperature ranges from 99.7ºF to 99.5ºF. A fever is a body temperature of 99.5 to 100.9ºF and above. Humans are warm-blooded mammals who maintain a constant body temperature (euthermia). Temperature regulation is controlled by the hypothalamus in the base of the brain. The hypothalamus functions as a thermostat for the body. Temperature receptors (thermoreceptors) are located in the skin, certain mucous membranes, and in the deeper tissues of the body. When an increase in body temperature is detected, the hypothalamus shuts off body mechanisms that generate heat (for example, shivering). When a decrease in body temperature is detected, the hypothalamus shuts off body mechanisms designed to cool the body (for example, sweating). The body continuously adjusts the metabolic rate in order to maintain a constant CORE temperature.

Hypothermia

Core body temperatures of 95ºF and lower is considered hypothermic can cause the heart and nervous system to begin to malfunction and can, in many instances, lead to severe heart, respiratory and other problems that can result in organ damage and death.Hannibal lost nearly half of his troops while crossing the Pyrenees Alps in 218 B.C. from hypothermia; and only 4,000 of Napoleon Bonaparte's 100,000 men survived the march back from Russia in the winter of 1812 - most dying of starvation and hypothermia. During the sinking of the Titanic most people who entered the 28°F water died within 15–30 minutes.

Symptoms:

Mild hypothermia: As the body temperature drops below 97°F there is shivering, hypertension (high blood pressure), tachycardia (rapid beating heart), tachypnea (rapid breathing), and vasoconstriction (contraction of blood vessels). These are all physiological responses to preserve heat.

Moderate hypothermia: As body temperature drops below 95°F shivering becoming more violent. Muscle mis-coordination becomes apparent. Movements are slow and labored, accompanied by a stumbling pace and mild confusion, although the person may appear alert. Surface blood vessels contract further as the body focuses its remaining resources on keeping the vital organs warm. The subject becomes pale. Lips, ears, fingers and toes may become blue.

Severe hypothermia: As the temperature decreases, further physiological systems falter and heart rate, respiratory rate, and blood pressure all decrease. This results in an expected heart rate in the 30s at a temperature of 82°F. Difficulty in speaking, sluggish thinking, and amnesia start to appear; inability to use hands and stumbling is also usually present. Below 86°F, the exposed skin becomes blue and puffy, muscle coordination becomes very poor, walking becomes almost impossible, and the person exhibits incoherent/irrational behavior including terminal burrowing or even a stupor. Pulse and respiration rates decrease significantly, but fast heart rates (ventricular tachycardia, atrial fibrillation) can occur. Major organs fail. Clinical death occurs.

First Aid :

Call 911 or emergency medical assistance. While waiting for help to arrive, monitor the person's breathing. If breathing stops or seems dangerously slow or shallow, begin CPR immediately.

Move the person out of the cold. If going indoors isn't possible, protect the person from the wind, cover the head, and insulate the individual from the cold ground.

Remove wet clothing. Replace wet things with a warm, dry covering.

Don't apply direct heat. Don't use hot water, a heating pad or a heating lamp to warm the person. Instead, apply warm compresses to the center of the body (head, neck, chest & groin). Don't attempt to warm the arms and legs. Heat applied to the arms and legs forces cold blood back toward the heart, lungs and brain, causing the core body temperature to drop. This can be fatal. Most patients who die during active rewarming die from cardiac arrest.

Don't give the person alcohol. Offer warm nonalcoholic drinks, unless the person is vomiting.

Don't massage or rub the person. Handle people with hypothermia gently because their skin may be frostbitten, and rubbing frostbitten tissue can cause severe damage.

Rewarming of the severe hypothermia patient is best carried out in a Hospital's Emergency Room using a pre-defined protocol.

Hyperthermia

Hyperthermia is elevated body temperature when a body produces or absorbs more heat than it dissipates. Hyperthermia is defined as a temperature greater than 99.5°F to 100.9°F depending on the person. The normal human body temperature in health can be as high as 99.9°F in the late afternoon. Hyperthermia requires an elevation from the temperature that would otherwise be expected. Body temperatures of 104.0 to 106.7°F are classified as Hyperpyrexia and is life threatening.

Symptoms

Heat stress: Strain is placed on the body as a result of hot weather.

Heat fatigue: A feeling of weakness brought on by high outdoor temperature. Symptoms include cool, moist skin and a weakened pulse.

Heat syncope: A sudden dizziness experienced after exercising in the heat. Skin appears pale and sweaty but is generally moist and cool. Pulse is weakened and the heart rate is usually rapid. Body temperature is normal.

Heat cramps: Painful muscle spasms in the abdomen, arms or legs following strenuous activity caused by a lack of salt in the body.

Heat exhaustion: Person may be thirsty, giddy, weak, uncoordinated, nauseated and sweating profusely. Body temperature is normal and the pulse is normal or raised. The skin is cold and clammy.

Heat stroke: A body temperature above 104°F. Confusion, combativeness, bizarre behavior, faintness, staggering, strong and rapid pulse, possible delirium or coma, and maybe irreversible brain damage.

First Aid

The underlying cause must be removed. Mild hyperthemia caused by exertion on a hot day may be adequately treated through self-care measures, such as increased water consumption and resting in a cool place. Fever-reducing drugs such as paracetamol and aspirin have value in treating hyperthermia.

When body temperature is significantly elevated, mechanical cooling methods are used to remove heat and to restore the body's ability to regulate its own temperatures. Passive cooling techniques, such as resting in a cool, shady area and removing clothing can be applied immediately. Active cooling methods, such as sponging the head, neck, and trunk with cool water, remove heat from the body and thereby speed the body's return to normal temperatures.

When the body temperature reaches about 104°F, or if the affected person is unconscious or showing signs of confusion, hyperthermia is considered a medical emergency that requires treatment in a proper medical facility. In a hospital, more aggressive cooling measures are available, including intravenous hydration, gastric lavage with iced saline, and even hemodialysis to cool the blood.

TREATMENT IN THE FIELD FOR HYPOTHERMIA

BODY SIGNS/SYMPTOMS TEMP. (rectal)	
98.8 NORMAL	
97 FEEL COLD **96 SHIVERING**	Seek dry shelter, replace wet clothing with dry including socks, gloves, hat, cover neck, insulate whole body including HEAD from cold. Exercise but avoid sweating. External warmth (bath, fire) ONLY if CORE TEMP. above 35°C. Warm sweet drinks and food (high calories).
BODY CORE TEMPERATURE BELOW 35°C = HYPOTHERMIA = HOSPITAL	
CLUMSY **93 IRRATIONAL** **CONFUSED** **(may appear drunk)** **92 MUSCLE STIFFNESS**	**NO EXERCISE, HANDLE GENTLY, REST.** **NO EXTERNAL WARMTH** (except to chest, trunk, eg. Hiebler Jacket). Warm sweet drinks and calories. Internal warming via warm moist air (exhaled air, steam) or warm moist oxygen (40 - 42°C at mask). Monitor pulse, breathing. Restrict all activity, lie down with feet slightly raised.
90 SHIVERING STOPS, COLLAPSE. TRANSFER TO HOSPITAL. URGENT.	
88 SEMI CONSCIOUS **UNCONSCIOUS** **86 No response to painful stimuli**	Nothing by mouth. Check airway remains open. May tolerate plastic airway, put in recovery position, check airway, turn every 2 hours to protect skin, monitor pulse and breathing.
84 SLOW PULSE AND BREATHING	Slow mouth-to-mouth breathing, at victim's own rate (may be very slow).
82 CARDIAC ARREST **No obvious pulse or breathing** **Pupils dilated**	Check airway. CPR, with mouth-to-mouth breathing. Aim for normal CPR rates of 12-15 breaths/min. and 80-100 compressions/min. but slower rates of 6-12 breaths/min. and 40-60 compressions/min. may be adequate. Continue for as long as you can.
BELOW	**NO VITAL SIGNS, COLD. DO NOT GIVE UP TREATMENT.**

NOTE: NOT DEAD UNTIL WARM AND DEAD!
Avoid rapid rewarming and **HANDLE GENTLY AT ALL TIMES.**
Core temperature may lag behind skin temperature and continue to drop, so keep monitoring.

TREATMENT IN HOSPITAL FOR HYPOTHERMIA

CAUTION

No re-exposure to cold
Exercise to generate body heat but no sweating.
Warm bath.
Warm sweet drinks, calories
Keep warm for several hours.
Watch for drop in temperature.

DO NOT massage cold limbs.

DO NOT give alcohol or coffee.

CHECK FOR OTHER INJURIES. MINIMUM STAY – 48 HOURS

Watch out for late cardiac arrhythmia.
Warm only trunk, chest.
Give warm, sweet drinks.
Warm moist air or warm moist oxygen, 40-42°C at mask.
e.g. Warm IV fluids e.g. Dextrose/Saline 5% at 37°C, 50% Dextrose, 20ml.
Monitor pulse, respiration, ECG.

NO exercise.
NO external warmth except Hiebler warm water type jacket to trunk and chest.
NO cold air, oxygen.
NO cold drinks.
DO NOT overload with IV fluids.

JOLTING DURING TRANSPORT MAY CAUSE CARDIAC ARREST.

Nil by mouth except glucose jelly.
Check airway, recovery position.
Turn every 2 hours to protect skin.
Oropharyngeal airway
Slow synchronous mouth-to-mouth or mask. Defibrillate if necessary. Intubate if unable to maintain airway. Ventilate with 50% humidified oxygen at 42°C, CPR at 6-12 ventilations/min. and 40-80 compressions/min. Warm peritoneal lavage (standard dialysate as fast as it will flow), or Arterio-venous by-pass warming.

NO food or drink

Endotracheal intubation may precipitate ventricular fibrillation.
NO drugs unless CORE temp. above 32°C. e.g. Lignocaine.

CONTINUE TO TREAT

Monitor Core temp.
Monitor biochemistry (potassium, sugar, acidity) and correct cautiously.

DO NOT GIVE UP

DO NOT defibrillate until CORE temp. above 30°C.

NOTE: CORE temp. lags behind skin temp, watch out for after-drop. Other complications may arise during rewarming (e.g. cardiac, fluid balance).

CHAPTER 10

HYPERNATREMIA / HYPONATREMIA

Being able to recognize dehydration and the first aid for it is covered in the *Backpacking, Camping, Canoeing, Climbing, Cycling, First Aid, Fishing, Fly Fishing, Gardening, Geocaching, Golf, Hiking, Kayaking, Lifesaving, Motor Boating, Orienteering, Pioneering, Rowing, Search and Rescue Scuba Diving, Small Boat Sailing, Snow Sports, Sports, Surveying, Swimming, Water Sports, Whitewater,* and *Wilderness Survival* merit badges; however, dehydration is only one of the causes of hypernatremia (too little water). Also, in these merit badges there are no requirements to recognize the symptoms of hyponatremia (too much water), or knowing the first aid to treat it.

There is no mention of fluid intake in the requirements for the *Personal Fitness merit badge,* despite the fact that this merit badge asks the Scouts to train for and perform the aerobic fitness, and muscular strength tests, where the drinking of fluids before and after training is important; nor is there any mention of fluid intake in the requirements for the *Athletics merit badge* when there are requirements for a Scout to start a personal training program compete in four of the following groups: sprinting, long-distance running, long or high jump, swimming, pull-ups and push-ups, baseball throw, basketball shooting, football or soccer kick, or weight training; all of which can be strenuous activities involving sweating and the loss of fluids. Also the intake of fluids in not mentioned in the requirement for the *Skating merit badge*, even though roller skating and in-line skating can cause fluid loss if done for long periods of time, or under the sun, or on hot asphalt; plus you must also consider fluid intake during ice skating, since exercise even in cold weather causes sweating.

The following is an explanation of hypernatremia and hyponatremia:

HYPERNATREMIA (too little water)

Hypernatremia is the medical term for high levels of sodium in the blood and is a very common electrolyte disorder. The most common cause of hypernatremia is dehydration. When there is too little water in the body, sodium levels increase and can affect many different organ systems. High sodium results in cellular dehydration, and the symptoms can be as wide ranging as dizziness to vomiting to death in severe cases. There are three main causes of hypernatremia, according to "The New England Journal of Medicine." The 1st is when there is fluid loss from the body because of sweating, inadequate hydration or diarrhea. The 2nd cause is inadequate production of the hormone arginine vasopressin by the pituitary gland, resulting in excess water loss from the kidneys in the disease diabetes insipidus. The 3rd cause is if large amounts of a liquid are consumed that contain higher sodium concentrations than those in the body, such as sea water.

Hypernatremia affects the central nervous system most prominently, which has cascading consequences on the rest of the body. The development of hyperosmolality (increase in concentration of body fluids and urine) from the water loss can lead to neuronal cell shrinkage and resultant brain injury. Loss of volume can lead to circulatory problems. Rapid free-water replacement can cause cerebral (brain) edema (fluid in the tissues between the body’s cells).

Dehydration is a state of hypernatremia. Dehydration (hypohydration) occurs when you use or lose more fluid than you take in, and your body doesn't have enough water and other fluids to carry out its normal functions. If you don't replace lost fluids, you will get dehydrated.

Common causes of dehydration include vigorous exercise, especially in hot weather; intense diarrhea; vomiting; fever or excessive sweating. Not drinking enough water during exercise or in hot weather even if you're not exercising also may cause dehydration. Anyone may become dehydrated, but young children, older adults and people with chronic illnesses are most at risk. You can usually reverse mild to moderate dehydration by drinking more fluids, but severe dehydration needs immediate medical treatment. The safest approach is preventing dehydration in the first place. Keep an eye on how much fluid you lose during hot weather, illness or exercise, and drink enough liquids to replace what you've lost.

Children have an increased chance of becoming dehydrated because: a greater portion of their bodies is made of water; they have a high metabolic rate, so their bodies use more water; their kidneys do not conserve water as well as an adult's kidneys; a child's natural defense system that helps fight infection (immune system) is not fully developed, which increases the chance of getting an illness that causes vomiting and diarrhea; and children often will not drink or eat when they are not feeling well.

- Symptoms:
  Initial symptoms of hypernatremia include: loss of appetite, nausea, vomiting, generalized weakness, excessive fatigue, faintness, excessive thirst, and irritability. Symptoms of worsening hypernatremia include: muscle spasms, muscle tremors, swelling, irritability, excessive sleepiness, confusion, seizures, coma. Hypernatremia may occur in people with diabetes insipidus, a disease that causes excessive urine production. (It is not the same disease as diabetes mellitus, a disease resulting from impaired insulin production.)

- First Aid:
  For individuals who have a mild case of hypernatremia, just drinking plain water when thirsty may be all the treatment that is needed. Those who appear ill or have confusion need hospital treatment. In severe cases of hypernatremia, call 911 or get the person to a hospital so that the serum sodium in the blood can be tested and fluid can be provided intravenously with close monitoring of the concentration of sodium in the blood to ensure controlled rehydration along with possible administration of vasopressin which is an anti-diuretic hormone that causes the body to retain water and constrict blood vessels.

HYONATREMIA (too much water)

Sometimes called water intoxication, overhydration, or hyperhydration is the imbalance of water to salt in the body. Hyponatremia is a condition in which the amount of sodium (salt) in the blood is lower than normal. Sodium is found mostly in the body fluids outside the cells. It is very important for maintaining blood pressure. Sodium is also needed for nerves, muscles, and other body tissues to work properly. Drinking too much water causes the sodium in your body to become diluted. When the amount of sodium in fluids outside cells drops, water moves into the

cells to balance the levels. This causes the cells to swell with too much water. Brain cells are especially sensitive to swelling, and this causes many of the symptoms of hyponatremia. In particular hypotonic hyponatremia is caused from excess water intake, including excessive tap water in infant feed resulting, drinking too much water during athletic training/competition, and binge drinking of dilute alcoholic drinks (potomania). Medical studies have shown that you don't get hyponatremia from ingesting water during a drowning or near drowning incident.

Beer potomania is from massive consumption of beer which is poor in solutes and electolytes. Hyperhydration, rather than dehydration, may pose a greater health risk to athletes, according to two articles in a British Medical Journal written by Tim Noakes, MD. Of the University of Cape Town in South Africa. Heat-induced dehydration rarely causes athletes to collapse during workouts or competition. In most cases, the culprit is exercise-associated postural hypotension (a drop in blood pressure). Misperceptions about dehydration have been driven in large part by marketing of sports drinks. People have been misled ... to believe that they need to drink to stay 'ahead of thirst' to be optimally hydrated. In fact, relatively small increases in total body water can be fatal. A 2% increase in total body water leads to generalized edema that can impair physical and mental performance.

Healthy athletes face barely any risk of dehydration during competition in an endurance event. Serious health risks — including inhibition of voluntary motor activity and paralysis — occur only when total body water decreases by 15% or more, which would require 48 hours in the desert with no water. On June 11, 2012, a 30 year old paddler competing in the 260-mile 50th Annual Texas Water Safari race died from hypontremia from drinking too much water during the competition despite being admitted to the San Antonio Military Medical Center after being stricken.

- Symptoms:
  Symptoms of hyponatremia include dizziness, muscular weakness, neurological impairment, nausea, vomiting, headache, confusion, lethargy, fatigue, loss of appetite, slurring of speech, restlessness, irritability, spasms or cramps, paralysis seizures, and decreased consciousness or coma inhibition — if not reversed— death by respiratory arrest. Body temperature is usually normal in hyponatremia, which differentiates this condition from heat stroke or heat exhaustion.

- First Aid:
  The first step in the approach and evaluation of hypotonic hyponatremia is to determine whether emergency therapy is warranted. Guide treatment by the size of the victim, the duration of the overhydration, and the degree and severity of the symptoms. If the victim is conscious, generally nothing needs to be done other than to allow the body to catch up and excrete the excess water through urination. Most electrolyte drinks are still lower in salt than the blood stream and they generally do not help. If the symptoms are more than minor, call 911 or get the person to a hospital for intravenous therapy & medicine.

Hyponatremia

Sometimes called **water intoxication**, **overhydration**, or **hyperhydration** is the imbalance of water to salt in the body. Hyponatremia is a condition in which the amount of sodium (salt) in the blood is lower than normal. Sodium is found mostly in the body fluids outside the cells. It is very important for maintaining blood pressure. Sodium is also needed for nerves, muscles, and other body tissues to work properly. Drinking too much water causes the sodium in your body to become diluted. When the amount of sodium in fluids outside cells drops, water moves into the cells to balance the levels. This causes the cells to swell with too much water. Brain cells are especially sensitive to swelling, and this causes many of the symptoms of hyponatremia. In particular hypotonic hyponatremia is caused from excess water intake, including excessive tap water in infant feed resulting, excessive water ingestion during swimming or a near drowning incident, drinking too much water during athletic training/competition, and binge drinking of dilute alcoholic drinks (potomania). Beer potomania is from massive consumption of beer which is poor in solutes and electolytes. Hyperhydration, rather than dehydration, may pose a greater health risk to athletes, according to two articles in a British Medical Journal written by Tim Noakes, MD. Of the University of Cape Town in South Africa. Heat-induced dehydration rarely causes athletes to collapse during workouts or competition. In most cases, the culprit is exercise-associated postural hypotension (a drop in blood pressure). Misperceptions about dehydration have been driven in large part by marketing of sports drinks. People have been misled ... to believe that they need to drink to stay 'ahead of thirst' to be optimally hydrated. In fact, relatively small increases in total body water can be fatal. A 2% increase in total body water leads to generalized edema that can impair physical and mental performance. Healthy athletes face barely any risk of dehydration during competition in an endurance event. Serious health risks — including inhibition of voluntary motor activity and paralysis — occur only when total body water decreases by 15% or more, which would require 48 hours in the desert with no water. On June 11, 2012, a 30 year old paddler competing in the 260-mile 50th Annual Texas Water Safari race died from hypontremia from drinking too much water during the competition despite being admitted to the San Antonio Military Medical Center after being stricken.

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First Aid The first step in the approach and evaluation of hypotonic hyponatremia is to determine whether emergency therapy is warranted. Guide treatment by the size of the victim, the duration of the overhydration, and the degree and severity of the symptoms. If the symptoms are mild, loosen all clothing, attempt to reduce the person's body temperature by rubbing ice cubes on the soles of the person's fee and the palms of his hands, and apply a towel dipped in cold water to the persons forehead. If conscious help the person drink orange juice or a drink containing electrolytes. If the symptoms are severe, call 911 or get the person to a hospital for intravenous therapy & medicine.

Hypernatremia

Hypernatremia is the medical term for high levels of sodium in the blood and is a very common electrolyte disorder. The most common cause of hypernatremia is dehydration. When there is too little water in the body, sodium levels increase and can affect many different organ systems. High sodium results in cellular dehydration, and the symptoms can be as wide ranging as dizziness to vomiting to death in severe cases. There are three main causes of hypernatremia, according to "The New England Journal of Medicine." The 1st is when there is fluid loss from the body because of sweating, inadequate hydration or diarrhea. The 2nd cause is inadequate production of the hormone arginine vasopressin by the pituitary gland, resulting in excess water loss from the kidneys in the disease diabetes insipidus. The 3rd cause is if large amounts of a liquid are consumed that contain higher sodium concentrations than those in the body, such as sea water. Hypernatremia affects the central nervous system most prominently, which has cascading consequences on the rest of the body. The development of hyperosmolality (increase in concentration of body fluids and urine) from the water loss can lead to neuronal cell shrinkage and resultant brain injury. Loss of volume can lead to circulatory problems. Rapid free-water replacement can cause cerebral (brain) edema (fluid in the tissues between the body's cells). **Dehydration** is a state of **hypernatremia.** Dehydration (hypohydration) occurs when you use or lose more fluid than you take in, and your body doesn't have enough water and other fluids to carry out its normal functions. If you don't replace lost fluids, you will get dehydrated. Common causes of dehydration include vigorous exercise, especially in hot weather; intense diarrhea; vomiting; fever or excessive sweating. Not drinking enough water during exercise or in hot weather even if you're not exercising also may cause dehydration. Anyone may become dehydrated, but young children, older adults and people with chronic illnesses are most at risk. You can usually reverse mild to moderate dehydration by drinking more fluids, but severe dehydration needs immediate medical treatment. The safest approach is preventing dehydration in the first place. Keep an eye on how much fluid you lose during hot weather, illness or exercise, and drink enough liquids to replace what you've lost. Children have an increased chance of becoming dehydrated because: a greater portion of their bodies is made of water; they have a high metabolic rate, so their bodies use more water; their kidneys do not conserve water as well as an adult's kidneys; a child's natural defense system that helps fight infection (immune system) is not fully developed, which increases the chance of getting an illness that causes vomiting and diarrhea; and children often will not drink or eat when they are not feeling well.

Symptoms Initial symptoms of hypernatremia include: loss of appetite, nausea, vomiting, generalized weakness, excessive fatigue, faintness, excessive thirst, and irritability. Symptoms of worsening hypernatremia include: muscle spasms, muscle tremors, swelling, irritability, excessive sleepiness, confusion, seizures, coma. Hypernatremia may occur in people with diabetes insipidus, a disease that causes excessive urine production. (It is not the same disease as diabetes mellitus, a disease resulting from impaired insulin production.)

First Aid For individuals who have a mild case of hypernatremia, just drinking plain water when thirsty may be all the treatment that is needed. In severe cases of hypernatremia, call 911 or get the person to a hospital so that the serum sodium in the blood can be tested and fluid can be provided intravenously with close monitoring of the concentration of sodium in the blood to ensure controlled rehydration along with possible administration of vasopressin which is an anti-diuretic hormone that causes the body to retain water and constrict blood vessels.

CHAPTER 11

POST RESCUE COLLAPSE / PARADOXICAL UNDRESSING

Knowing the symptoms and first aid for hypothermia victims is covered in the *Backpacking, Cycling, Climbing, First Aid, Fishing, Fly Fishing, Gardening, Geocaching, Golf, Hiking, Kayaking, Lifesaving, Motor Boating, Orienteering, Pioneering, Rowing, Skating, Scuba Diving, Search and Rescue, Small Boat Sailing, Snow Sports, Sports, Surveying, Swimming, Water Sports, Whitewater,* and *Wilderness Survival* merit badges; but these merit badges don't cover severe cases of hypothermia, and what to do to stabilize the victim until emergency responders arrive on the scene; or what to do if in the wilderness and it will be a while before you can get the victim to a hospital. Most Scout and most adult Scout leaders probably have never heard of post rescue collapse, paradoxical undressing, or terminal burrowing. Boy Scouts and adult Scout leaders need to know what to do if they encounter someone who is experiencing severe hypothermia. If the incorrect first aid is performed, it could have fatal results. Recommend including this information in Scout literature and Scout training, even if briefly, it might save a life. The following is a description of the physiological responses due to severe hypothermia, and what to do if they are seen:

POST RESCUE COLLAPSE

Also known as Circum-rescue Collapse, or Afterdrop. 20% of immersion deaths occur during extraction from cold water, or within hours after rescue. During World War II the Germans and Allies noted that ditched aircrew who had been conscious in the water and aided in their own rescue, became unconscious and died shortly afterwards. Sixteen Norwegian fishermen pulled alive from the North Atlantic, all 16 died shortly afterwards, possibly as a result of exercise (moving/walking) induced core temperature afterdrop. When a body gets chilled the arteries on the extremities which first encounter the cold constrict [narrow] (vasoconstriction) forcing blood to instead circulate around the core of the body keeping the heat around the vital organs to keep them working. If a person is at this stage of hypothermia where the blood has been diverted to keep the vital organs warm; and the victim's arms or legs are stimulated or rewarmed, causing the peripheral vessels in the arms and legs to dilate, sending the very cold, stagnate blood from the periphery to the core further decreasing core temperature which can lead to death. In addition, this blood is very acetic which may lead to cardiac dysrhythmia (also known as arrhythmia or irregular heartbeat) and can cause cardiac arrest (heart attack).

<u>First Aid (Severe Hypothermia)</u>:

- Hypothermia Wrap - the idea is to provide a shell of total insulation for the patient. No matter how cold, patients need to be warmed from the inside, not rewarming the periphery. Make sure the patient is dry and protected from any moisture in the environment. Use multiple sleeping bags, wool blankets, wool clothing, to wrap the patient, and Ensolite pads between the patient and the ground. If someone is severely hypothermic, do not put him/her naked in a sleeping bag with another person. Do not touch or stimulate the victims arms or legs in any way. Keep the victim in a horizontal position at all times.

- Warm Sugar Water - for people in severe hypothermia, the stomach has shut down and will not digest solid food but can absorb water and sugars. Give a dilute mixture of warm water with sugar every 15 minutes. Dilute Jello™ works best since it is part sugar and part protein. This will be absorbed directly into the blood stream providing the necessary calories to allow the person to rewarm themselves.

- Urination - people will have to urinate from cold diuresis. Vasoconstriction creates greater volume pressure in the blood stream. The kidneys pull off excess fluid to reduce the pressure. A full bladder results in body heat being used to keep urine warm rather than vital organs. Once the person has urinated, it precious body heat will be used to maintain the temperature of vital organs.

- Rescue breathing - can increase oxygen and provide internal heat. Respiratory heat loss accounts for 10% to 30% of the body's heat loss. This is particularly important in rescue situations where the ambient air is cold (cooling of the core through respiration). Upon ambulance arrival EMTs need to provide heat directly to the head, neck, and thoracic core through inhalation of warm, water-saturated air at (107 - 122°F). This method also warms the pothalemus (temperature regulation, respiratory, cardiac center) at the base of the brainstem and improves the level of consciousness.

- Handle victim gently - a cold heart is susceptible. Some victims may suffer fatal ventriculation when jolted about, during initial handling or transportation.

- Stabilize before transportation to the hospital - preventing respiratory heat loss and progressive cooling of the heart through the tissues is essential. This cooling if not arrested, can lead to ventricular fibrillation of the heart. Patients who are unconscious, with a body temperature below 80°F may not respond to defibrillation. Thermally stabilizing a patient is necessary, before transportation and en route to the hospital to prevent cardiac complications.

- Get the patient to the Emergency Room. The core needs to be warmed as rapidly as possible, using internal methods such as warm steam inhalation/ventilation, peritoneal lavage, warm gastric/bladder lavage, warm IV's, chest lavage via chest tubes, and preferably cardiopulmonary bypass, if available.

PARADOXICAL UNDRESSING

20% to 50% percent of hypothermia deaths are associated with paradoxical undressing. When a body gets chilled the arteries on the extremities which first encounter the cold constrict [narrow] (vasoconstriction) forcing blood to instead circulate around the core of the body keeping the heat around the vital organs to keep them working. The extremities of the fingers and the toes lose their heat. As the body continues to chill further, eventually the muscles around the blood vessels on the extremities get tired and relax (plus cold-induced paralysis of the nerves in the vessel walls) and the blood vessels open up (vasolidation) allowing the blood in the core of the body to be pumped back into the extremities. This now allows the warm core-blood to re-perfuse the

skin, causing a sensation of warmth; so the victim feeling overheated begins to shed layers of clothes. The victim's core temperature begins to plummet which accelerates the process of complete body shutdown and hence, death from hypothermia.

- Symptoms (Severe Hypothermia):
  A person in an advanced stage of hypothermia may take all their clothes of despite it being cold outside. Paradoxical Undressing often precedes Terminal Burrowing and it represents the last effort of the victim and is followed almost immediately by unconsciousness and death.

- First Aid (Severe Hypothermia):
  If the victim's clothes aren't wet, try to keep the clothes on the victim, or wrap the victim in a blanket. Follow the First Aid described for Terminal Burrowing below. If emergency responders cannot get to the scene within a few minutes, try to get the victim to the Emergency Room of a Hospital immediately.

TERMINAL BURROWING

An apparent self-protective behavior known as terminal burrowing, or hide-and-die syndrome, occurs in the final stages of hypothermia. The afflicted will enter small, enclosed spaces, such as underneath beds or behind wardrobes. It is often associated with paradoxical undressing. Researchers in Germany claim this is "obviously an autonomous process of the brain stem, which is triggered in the final state of hypothermia and produces a primitive and burrowing-like behavior of protection, as seen in hibernating animals." This happens mostly in cases where temperature drops slowly.

- Symptoms (Severe Hypothermia):
  At 90°F body temperature the body tries to move into hibernation, shutting down all peripheral blood flow and reducing breathing rate and heart rate. Shivering stops, exposed skin blue of puffy, inability to walk, confusion, incoherent, and irrational. At 86°F muscle rigidity, semiconscious, possible heart fibrillation. The person may be curled up in a fetal position. Try to open their arm up, if it curls back up, the person is alive. Dead muscles won't contract only live muscles.

- First Aid (Severe Hypothermia):
  During severe hypothermia the heart is hyperexcitable and mechanical stimulation (such as CPR, moving them or Afterdrop) may result in fibrillation leading to death. As a result CPR may be contraindicated for severe hypothermia situations. Do not to attempt to provide care. Do not touch or stimulate her arms or legs in any way. Keep them in a horizontal position. Moving them into a vertical position could cause blood leave the body core. Gingerly place them on a rescue stretcher and get them to the Emergency Room of a Hospital immediately.

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Also known as **Circum-rescue Collapse**, or **Afterdrop**. 20% of immersion deaths occur during extraction from cold water, or within hours after rescue. During World War II the Germans and Allies noted that ditched aircrew who had been conscious in the water and aided in their own rescue, became unconscious and died shortly afterwards. Sixteen Norwegian fishermen pulled alive from the North Atlantic, all 16 died shortly afterwards, possibly as a result of exercise (moving/walking) induced core temperature afterdrop. When a body gets chilled the arteries on the extremities which first encounter the cold constrict [narrow] (vasoconstriction) forcing blood to instead circulate around the core of the body keeping the heat around the vital organs to keep them working. If a person is at this stage of hypothermia where the blood has been diverted to keep the vital organs warm; and the victim's arms or legs are stimulated or rewarmed, causing the peripheral vessels in the arms and legs to dilate, sending the very cold, stagnate blood from the periphery to the core further decreasing core temperature which can lead to death. In addition, this blood is very acetic which may lead to cardiac dysrhythmia (also known as arrhythmia or irregular heartbeat) and can cause cardiac arrest (heart attack).

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CHAPTER 12

DROWNING / NEAR DROWNING / LARYNGOSPASM

Scout Literature and training describes rescuing a drowning victim (i.e. *Lifesaving merit badge*), but it doesn't cover laryngospasm, and near drowning symptoms; and first aid for these types of drowning. Though not common, these are real possibilities, and they need to be addressed in Scout first aid training, both in recognizing the symptoms and how to stabilize the patient until emergency responders arrive on the scene. For example the *First Aid merit badge* requires a Scout to "*describe the symptoms, proper first aid procedures, and possible prevention measures for a heart attack, stroke, severe cut on the leg and wrist, bee sting, heatstroke, hypothermia, convulsions/seizures, frostbite, dehydration, bruises/strains/sprains, burns, abdominal pain, broke/chipped/loosened tooth, knocked out tooth, and muscle cramps*; but there is no mention of drowning or recognizing drowning related symptom, and what to do help and stabilize the victim until EMTs arrive.

DROWNING

Drowning is the process of experiencing respiratory impairment from submersion/immersion in liquid including inhaled water, or blockage or muscular contract of the trachea which prevents the individual from breathing oxygen. Drowning outcomes are classified as: death, morbidity (abnormal condition), and no morbidity. There was also consensus among medical professionals that the terms wet, dry, active, passive, silent, and secondary drowning should no longer be used. However, whether-or-not these defining terms of wet, dry, active, passive, silent, and secondary drowning are used or not used, they do describe the different physiological functions that are called "drowning".

NEAR DROWNING

Near-drowning is a term used to describe almost dying from suffocating under water. It is the last stage before actual drowning, which often results in death. Near-drowning occurs when you are unable to breathe under water for a significant period of time. During near-drowning, oxygen intake decreases and major body systems shut down from the lack of oxygen flow. Near-drowning victims require medical attention to prevent related health complications.

- Symptoms: Can differ from person to person depending in part on how long the individual has been submerged, the person's age, and the temperature of the water. Upon rescue, some victims are alert but agitated or disoriented, while others are comatose; breathing and heartbeat may have stopped, or the victim may be gasping for breath; bluish lips and ears, cold skin, pale appearance, coughing, vomiting, and frothy pink sputum. Rapid breathing and a rapid heart rate are common during the first few hours after rescue.

- First Aid: 1st priority is to ensure an open airway and that the person is breathing. Open the airway by tilting the head, checking the mouth, and lifting the chin. Check for breathing for up to 10 seconds. If the person's breathing has stopped, begin rescue breathing as soon as you can. This often means starting the breathing process while still in the water. Continue to breathe for the person every few seconds while moving him or her to dry land. Once on land, give CPR chest compressions as needed. Call 911. A major high-risk group comprises young children who almost drowned and whom spontaneous respiration has not occurred for

at least 5 to 10 minutes after rescue, but appear to improve rapidly thereafter. These victims must be admitted to hospital for observation, irrespective of their apparent wellbeing within several hours after rescue. Rescuers and clinicians should expect primary lung function to deteriorate within four hours of rescue in about one in 20 survivors of drowning accidents. If the syndrome is anticipated, recognized, and hospital treatment provided, prognosis is optimistic.

LARYNGOSPASM

Laryngospasm (Dry Drowning) - In 10 to 20% of the cases, people who are submersed in cold water, instead of gasping, experience a laryngospasm which can occur if the trachea below the vocal cords detects the entry of water, resulting in an uncontrolled / involuntary muscular contraction (spasm) of the laryngeal cords which causes a partial blocking of breathing in. There is some correlation to the Mammalian Dive Reflex in that all mammals may experience this involuntary reflex where the larynx closes the throat. This is not the same as having one's breath knocked out from force, or swallowing wrong and choking, nor is it related to the shock of falling into cold water and having it "take your breath away".

Symptoms: Persistent coughing which continues for an extensive amount of time, or often long after water has been taken in. Abruptness of breath and chest pain. Having trouble breathing freely, even after out of the water. Confusion and sluggishness, difficulty in realizing verbal instructions, or has trouble in expressing thoughts following inadvertent water consumption. Difficulty speaking.

First Aid: If laryngospasm does not abate in 30 to 60 seconds seek medical assistance immediately. It is very important to undergo treatment at a hospital, which includes removing water from lungs and resupplying oxygen as early as possible. Oxygen is usually supplied with a ventilator or respirator, while the lungs are allowed to heal from any damage sustained due to water inhalation.

SECONDARY DROWNING (obsolete term)

Secondary Drowning was previously thought to be a condition where an acute respiratory distress syndrome developed after a latent period of one to 48 hours of relative respiratory well-being. This type of drowning was tragically described in a news article dated June 5, 2008: “The death of a South Carolina boy is being blamed on a phenomenon called secondary drowning – lung damage that is caused by ingesting water but that is not fatal right away. The 10-year-old swallowed water while swimming at a pool in Goose Creek, S.C., over the weekend. He complained that he couldn't breathe and was tired after getting out of the pool. The boy drowned while taking a nap in his bed, authorities said.

The current thinking is that there is no latent period and that these cases previously described as secondary drowning are just a progression of existing damage from the event. The important point is that anyone with symptoms after a near drowning should have a thorough medical examination by a professional.

Drowning

The following definition was accepted by the **World Congress on Drowning** in 2002 and subsequently by the **World Health Organization** in 2005: "Drowning is the process of experiencing respiratory impairment from submersion/immersion in liquid" including inhaled water, or blockage or muscular contract of the trachea which prevents the individual from breathing oxygen. This definition does not imply fatality, or even the necessity for medical treatment after removal of the cause, nor that any fluid necessarily enters the lungs. The World Health Organization further recommended "Drowning outcomes should be classified as: **death, morbidity** (abnormal condition), and **no morbidity**." There was also consensus that the terms **wet**, **dry**, **active**, **passive**, **silent**, and **secondary drowning** should no longer be used.

Whether-or-not these defining terms are used or not used, *they do describe the different physiological functions that are considered "drowning".* When a person is drowning, the air passages close to prevent water from entering the lungs. This also prevents air from entering the lungs, thus depriving the victim of oxygen and eventually leading to unconsciousness and death. Usually, only if the victim has been unconscious in the water for some time do the lungs fill up with water. More commonly, the water goes into the stomach. Drowning itself is quick and silent, although it may be preceded by distress which is more visible. A person drowning is unable to shout or call for help, as they cannot obtain enough air. The instinctive drowning response is the final set of autonomic reactions in the 20 – 60 seconds before sinking underwater, and to the untrained eye can look similar to calm safe behavior.

Near Drowning

Near-drowning is a term used to describe almost dying from suffocating under water. It is the last stage before actual drowning, which often results in death. Near-drowning occurs when you are unable to breathe under water for a significant period of time. During near-drowning, oxygen intake decreases and major body systems shut down from the lack of oxygen flow. Near-drowning victims require medical attention to prevent related health complications. Recovery is directly related to the amount of time the body was without adequate oxygen (hypoxia). Brain damage is the major long-term concern in the treatment of near-drowning victims. Patients who arrive at an emergency department awake and alert usually survive with brain function intact, although they may initially have respiratory complications. **Pneumonia** is common following near drowning and often develops within the first 24 hours.

Symptoms They can differ from person to person depending in part on how long the individual has been submerged, the person's age, and the temperature of the water. Upon rescue, some victims are alert but agitated or disoriented, while others are comatose; breathing and heartbeat may have stopped, or the victim may be gasping for breath; bluish lips and ears, cold skin, pale appearance, coughing, vomiting, and frothy pink sputum. Rapid breathing and a rapid heart rate are common during the first few hours after rescue.

First Aid 1st priority is to ensure an open airway and that the person is breathing. Open the airway by tilting the head, checking the mouth, and lifting the chin. Check for breathing for up to 10 seconds. If the person's breathing has stopped, begin rescue breathing as soon as you can. This often means starting the breathing process while still in the water. Continue to breathe for the person every few seconds while moving him or her to dry land. Once on land, give CPR chest compressions as needed. Call 911. A major high-risk group comprises young children who almost drowned and whom spontaneous respiration has not occurred for at least 5 to 10 minutes after rescue, but appear to improve rapidly thereafter. These victims must be admitted to hospital for observation, irrespective of their apparent wellbeing within several hours after rescue. Rescuers and clinicians should expect primary lung function to deteriorate within four hours of rescue in about one in 20 survivors of drowning accidents. If the syndrome is anticipated, recognized, and hospital treatment provided, prognosis is optimistic.

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Symptoms Persistent coughing which continues for an extensive amount of time, or often long after water has been taken in. Abruptness of breath and chest pain. Having trouble breathing freely, even after out of the water. Confusion and sluggishness, difficulty in realizing verbal instructions, or has trouble in expressing thoughts following inadvertent water consumption. Difficulty speaking.

First Aid If laryngospasm does not abate in 30 to 60 seconds seek medical assistance immediately. It is very important to undergo treatment at a hospital, which includes removing water from lungs and resupplying oxygen as early as possible. Oxygen is usually supplied with a ventilator or respirator, while the lungs are allowed to heal from any damage sustained due to the inhalation of water.

CHAPTER 13

WILDERNESS FIRST AID KIT

Guide to Safe Scouting describes on page 25 the recommended contents for a "Personal First-Aid Kit" and a "Home or Patrol/Troop First-Aid Kit"; however, when a Scout trip is to a remote area the kits needs to be customized since it's hard to estimate when further help will arrive to the scene of an accident or serious injury. In the wilderness there are a numerous amount of ailments which can occur from a variety of situations.

When preparing for an outdoor adventure, consider the activity you will be doing. Your activity, whether it is hiking, mountain climbing, or canoeing carry very different associated risks. They will require different safety precautions, emergency equipment, and first aid items. Adventure-specific first aid training is highly advisable for multi-day and remote trips. A member of the Troop or Crew needs to be assigned to carry the Troop/Crew first aid on the unit's trip, and this kit must be available for access by the members of the unit on the trip.

Each Scout needs to carry his/her own personal first aid kit with minor supplies. The kit needs to be revisited before EVERY outing. The kit needs to contains items applicable to the trip you are taking, expiry dates checked, examined for any damage to contents from previous trips, and the Scout should re-acquaint himself/herself with what is in their personal kit and what items are contained in the Patrol/Troop/Crew first aid kit. The *Guide to Safe Scouting* in paragraph VIII. "Sports and Activities" states:

First-Aid Resources. "The supervisor should determine what first-aid supplies to include among the activity equipment. The level of first-aid training and skill appropriate for the activity should also be considered. An extended trek over remote terrain obviously may require more first-aid resources and capabilities than an afternoon activity in a local community. Whatever is determined to be needed should be available."

However, there is no guidance in the *Guide to Safe Scouting* or anywhere else on the BSA website as to what is recommended to be included in a Wilderness First-Aid Kit over what is contained in a traditional first-aid kit, including having an instruction booklet specific to the items in the kit carried in the kit. This first-aid instruction booklet may be quite useful for those who aren't familiar with the items in the kit or if the Scout can't remember specifically what to do during the immediate crisis of an injury to themselves or a fellow Scout.

Requirement #5 of the *Wilderness Survival merit badge* says "Put together survival kit and explain how each item in in could be useful." Recommend that the items in the attached handouts to this chapter, after tailoring for the trip, be included in this survival kit. Also recommend that the requirement for assembling a first aid kit along with suggested items to be included in this kit be include in the requirements for the *First Aid merit badge*.

It is also recommended that a discussion on first-aid kits be included in the *Backpacking, Cycling, Climbing, First Aid, Geocaching, Golf, Hiking, Kayaking, Lifesaving, Motor Boating, Orienteering, Pioneering, Rowing, Scuba Diving, Search and Rescue, Small Boat Sailing, Snow Sports, Whitewater,* and *Wilderness* merit badges.

TEN ESSENTIALS

'Be prepared'! Just like every Scout every camper should be equipped with these ten essentials on any camping trip:

Contingency & First Aid Kit 1

"Contingencies" (someone forgot a flashlight, wet weather makes fire building difficult, etc.) are more common than emergencies. A first-aid kit supplemented with a spare flashlight, spare whistle, trail food, matches, and fire starters is your 'air bag' – essential but you hope, (like the air bag in your car), you'll never need it.

First Aid Kit Bag
+
Spare Whistle
+
Spare Flashlight
+
Trail Food
+
Matches and Fire Starters

Flashlight 2

A sturdy headlamp is better than a hand-held flashlight. LED lights (one with a brightness of 35 lumens is more than adequate) use less power and batteries last longer.

Trail Food 3

Carry a few granola bars, protein bars, trail mix, or other compact, high-energy, high nutrition food (avoid sugar -based snacks). Carry a couple of additional nutrition bars in the Contingency & First Aid Kit.

Matches & Fire Starters 4

There are any number of fire starter alternatives; many can be made at home.
If you need to get a fire going in difficult circumstances, you want a proved fire starter and matches in a waterproof container.

Sun Protection 5

In direct sun in hot weather sunburn and some level of heat exhaustion are common. Staying hydrated, using sunscreen and wearing a broad-brimmed hat are important.

Whistle 6

If you become lost or separated stay put and use a whistle. Signal by blowing three blasts (a well-known emergency signal).

Spend a little more on one designed to signal over distances; cheap insurance should you need it.

Rain Gear 7

Staying warm is crucial, and it's hard to stay warm if you are wet.

Rain pants and a rain jacket are essential, Ponchos restrict movement and don't trap warmth near your body.

Water 8

An adequately sized (32 ounces), wide-mouthed rugged water bottle. In dry or hot climates carry two. Include some simple way to purify water, tablets or other chemical treatments don't take up much space.

Map & Compass 9

A simple base-plate compass is best.

Buy a reliable brand rather than a cheap knock-off, it's worth spending a bit more for an accurate compass.

Pocket Knife 10

A sturdy, well-made simple combination knife is ideal for camping.

SCOUTMASTERCG.com

hero in a backpack

From sunburn to snakebite to scalding, the risks of outdoor expeditions are endless, but so is your capacity to plan, adapt and improvise. *Outdoor* walks you through the equipment to carry every time you go bush.

REMEMBER
Prepare for the worst and plan to be at your best when disaster strikes

Lightweight Mat
In the case of a serious injury, you will likely be dealing with a patient on the ground. Remove the risk of further complications from cold ground with insulation. Also good for a comfy lunch break

Sun Protection
A hat, sunglasses, sunscreen, lip-balm and plenty of water are staple ingredients for surviving the Australian bush

Extra Food
Regardless of the length of your excursion, pack an extra 24-hours'-worth of survival food (think chocolate, muesli bars, dried fruits etc.)

Trekking Pole
Not only great for preventing ankle and knee injuries or for crossing creeks, also handy for leg-splints, stretchers and improvised shelters

Communications
Always carry some form of communication device, and know where it has coverage in your area. Whether it be a mobile phone, radio or sat phone, know how to use your device, know its limits, ensure it is in good working condition and inform someone else of its details. Carry emergency numbers including National Parks, and remember 112 as a last resort

Rain Layer
Highly efficient, compact, lightweight rain jackets are all over the outdoor market. Even if it stays stuffed in the bottom of your pack, it is an investment well worth making

Water & Purification
Carry more water than you need, plan for additional water access en route, and pack a solution to treat the water when you get to it with a filter, purifier, tablets or drops

Matches
You should always carry the capacity to create warmth for yourself. Wrap matches in a couple of seal-top plastic bags and never leave home without them

Hygiene
Many illnesses suffered in the bush could be easily prevented with solid hygiene practices. Carry anti-bacterial gel, and use it often. Be particular about toileting, cooking and cleaning procedures

Insect Repellent
Their brains are smaller than the hairs of your neck amongst which they hitch lifts, yet they still cause havoc! Arm yourself for battle and prevent this evolutionary anomaly

Map and Compass
Even if it is a colour brochure given out at a gift-shop, carry a map of your proposed journey, as well as a compass. Be familiar with the basic principles of navigation

Whistle and Mirror
If you have lost your bearings, lost a group member, or need to alert others to an emergency, a whistle may save your life. A mirror for signalling will send a message hundreds of metres and requires no battery

Extra Insulation
Pack a spare set of thermals, even in summer. They weigh nothing, can be used as slings and bandages, and can save lives in cases of exposure or immersion. Carry all clothing in a dry-bag

Small Tarp or Fly
Invaluable shelter from sun, wind and rain, a tarp will also make a handy hypothermia wrap (a kind of human burrito). It may seem excessive to carry shelter on a day walk, but try to manage a patient in pouring rain without it. If you carry no mat, be sure to carry a tarp as ground insulation

Wilderness First Aid Kit

how to | FIRST AID & SAFETY

Nothing says I love you like a snakebite compression bandage, fracture splint or dressing for a head-wound

Your first aid kit may be the least used item in your pack, but it should be the most familiar. Revisit your kit before EVERY outing. Ensure that it contains most of the items shown on this page, check expiry dates, any damage to contents from previous trips, and re-acquaint yourself with your tools. *Outdoor* has assembled a minimalist general-purpose kit as an example of a personal wilderness kit. Tailor your own toolbox to suit your activity, terrain, group and first aid skills.

Elasticised roller bandage (heavy weight)
For support and/or to control the swelling of a knee on ankle. Also used in the treatment of snakebites

Sterile gauze pads and/or sterile gauze rolls
To compress bleeding wounds, retain dressings and to support hand, arm or thumb injuries

Athletic tape and/or duct tape
For particular use with muscle, tendon and ligament injury. Some people may be allergic to these kinds of tape, so monitor for redness and itching, and never apply to the face

Micropore or similar adhesive tape
A hypoallergenic tape used to secure eye pads and light dressings. Painless to remove, it is also safe for use on the face

Emergency thermal blanket
For the treatment of hypothermia, a "space" blanket is a handy back-up device to be used in conjunction with other insulative measures

Microthin waterproof film dressings, such as Tegaderm
For minor lacerations and non-oozing wounds

Triangular bandage
Use as a sling, a bandage to support an injury or to retain a dressing. A triangular bandage *could* be adapted from a shirt or similar, but is a lightweight item, and is highly versatile in itself

Prepared wound dressing such as Cutiplast
An absorbent, but also breathable pad with adhesive edges for larger lacerations

Large trauma dressings
Individually wrapped sanitary napkins also make for good trauma dressings, and are arguably more versatile

Antiseptic solution, towlettes and/or alcohol wipes
In the form of drops or wipes, antiseptic is used to clean wounds and the skin around wounds. If you can find it, a chlorhexidine-based product is a preferable choice to iodine-based (eg. Betadine) due to its hypoallergenic properties

Skin ointment
Papaw ointment is a wise choice for the neutralisation of venom from insect and marine stings, and to reduce inflammation

Wound closure strips
For the closure of wounds such as lacerations, avulsions, and punctures. Use to close **clean** wounds only

Energy food
Additional to your spare food, this is a bar/gel/goo that lives permanently in your kit. It is only consumed in the case of hypoglycemia (low blood sugar) or starvation. Also carry a sachet of honey or sugar to rub onto gums in the case of unconsciousness

Short length of string or cord

Back-up light source
The Petzl E-lite is a 28g waterproof wonder with flashing red and white strobes designed for travel or signalling

First aid manual
Write and laminate your own key action points from training, books and research or buy a published mini-guide. It is surprising how much knowledge can leave the brain when it is under stress

Pad and pencil
Making regular notes of a medical incident is crucial to monitoring a patient and diagnosing deterioration or improvement. Details such as time of incident are vital

Tweezers

Backup fire lighter

Knife or scissors

Plastic bags
For the containment of potentially hazardous waste such as bloody dressings, and for water protection of wounds and dressings if required

Blister padding
Adhesive foam from which to cut blister "donuts" for ankles

Eyepads
To protect eye from further injury, light or contamination

Burn dressing and gel wound coverings
Burn dressings such as Burnaid for immediate burn application, and moist burn pad for dressing

Saline solution and irrigation syringe
For washing-out wounds and eyes. Also carry plain salt if you are carrying a stove, in the case that more saline solution is required. (Boil water, wait to cool, and add 1/2 tsp of salt to 500ml water)

Splint
Be aware of the items in your pack that could multitask as splints. Lightweight, pre-made malleable "SAM" splints are a product worth exploring for extended trips

Adhesive strips
For minor lacerations. Hypoallergenic (non-allergy) brands are available

Rubber gloves and CPR mouth shield
Protecting yourself should be your first priority. Look for Latex-free gloves to reduce potential allergy risks

Waterproofing for your kit
Invest in a quality dry-bag or box for your kit so that it is sure to survive complete immersion. In addition, keep your kit out of direct sunlight and extreme heat

BASIC MEDS

Basic Medications to Consider:

- **Analgesics (painkillers)**
  Paracetamol is a basic option, though the WMI recommends only ibuprofen. Soluble forms will be more quickly absorbed than tablets, but do require fluids to take
- **Antihistamines (for allergies)**
  Take note of potential drowsiness and dosages for children
- **Anti-diarrheals**
- **Anti-emetics (anti-nausea and anti-vomit)**
  These are optional and should be ordered through a physician
- **Antacids**
- **Laxatives**
- **Throat lozenges**
- **Rehydration salts**
  For the replacement of fluid and electrolytes in the case of diarrhoea, vomiting, bad burns or hyperthermia/dehydration

All medications should be accompanied by a Drug Information Card (small and laminated) with information including: drug names, a description, dosages for adults and children, reasons to dispense, reasons not to dispense, possible side effects and what not to mix it with. For extended trips (more than 10-days) consult your doctor regarding any drugs suitable for severe allergic reactions (including anaphylaxis) and infections. Any prescription medications carried in your kit should be kept separate and well labelled.

CHAPTER 14

LIGHTNING PROTECTION OF SCOUT FACILITIES

June 26, 2013: Gilmanton, New Hampshire. Two dozen Boy Scouts out camping were burned when lightning struck a 100 foot pine tree at Camp Bell, part of the Griswold Hidden Valley Scout Reservation in Gilmanton. "When that bolt hit it shook the ground," said Boyle who was under another tarp nearby. "Another 25 feet and it would have been a whole different story." With about a 15-minute warning from their base camp, the Boy Scouts and their counselors hurriedly gathered under a tarp tied to trees to wait out the approaching storm. The torrential downpour hit first – just before 6 P.M. Monday – then a nearby flash of lightning. Minutes later spider-web like marks appeared on the arms and legs of a half dozen Scouts – ages 13-17. By night's end, 23 had been transported to area hospitals for treatment and observation. Six were held overnight.

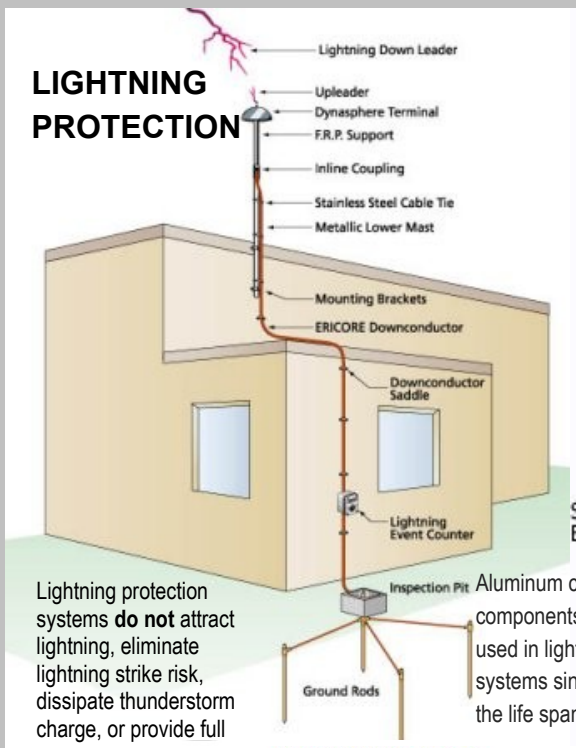
July 14, 2011: Provo, Utah. Lightning struck two Boy Scouts Wednesday morning at the Scofield Scout Camp in Carbon County, Utah. David Rayborn, 12, died as he was being airlifted to a hospital. Sean Smith, 12, was take to Utah Valley Regional Medical Center with burns. He is listed in fair condition.

August 3, 2005: Uinta Mountains of Utah. A bolt of lightning killed a 15-year-old Eagle Scout and injured three others as they slept in a log shelter during a violent storm in Utah's Uinta Mountains. "There was a big flash and a big boom," said Dr. Stephen Morris, a trauma surgeon at the University of Utah's burn unit who was with the troop. "Somebody came running down the trails saying, 'Help, we need help.'" Morris said he tried in vain for 90 minutes to revive the boy after Tuesday night's lightning strike. Two of the injured boys were flown to the University of Utah burn unit. A third boy, Matthew Edwards, 13, was released Wednesday after being treated for minor burns to his legs, feet and neck. "From what we can tell, it appears the lightning hit a tree next to us, came down and came out of the tree and just into some nails that were driven into the cabin to hold the logs together," said elder Edwards, Troop leader.

July 30, 2005: Fresno, California. A Scout troop from St. Helena was just two days away from finishing the trip along the John Muir Trail – a 210 mile high-country route from Yosemite Valley to Mt. Whitney. In a wide, grassy meadow near Mt. Whitney, the five adults and seven teenagers set up two tarps, keeping away from granite outcroppings to stay as safe as they could from the lightning flashing across the sky. Then a bolt of lightning hit one of the tarps the Scouts had set up in a meadow in the Sequoia National Park, killing the troop leader instantly and claiming the life of a 13-year-old Boy Scout. Six others were injured. At least one of the injured in the lightning strike was kept alive only because the troop Scouts administer CPR for an hour.

While you can't protect Scouts from being struck by lightning in a wilderness setting, you can minimize their chance of getting struck by teaching them to follow lighting safety procedures. Also, installing a lightning protection system on buildings, log shelters, dining tents, and picnic shelters (where the Cub Scouts and Boy Scouts sometimes take shelter during a thunderstorm), and around swimming pools (a lightning bolt can strike "out of the blue" from an approaching thunderstorm 10 miles away) is relatively inexpensive and easy to install. Included in this thesis is a handout showing the installation of lightning protection systems and where to buy the materials for these systems.

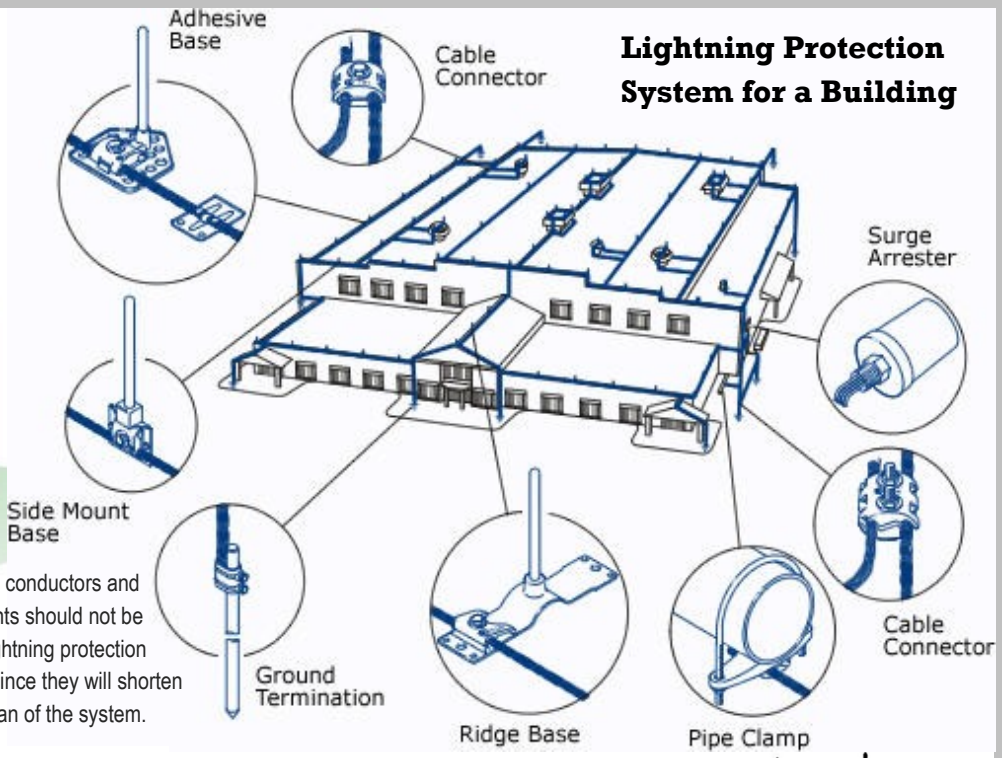
LIGHTNING PROTECTION



Lightning protection systems **do not** attract lightning, eliminate lightning strike risk, dissipate thunderstorm charge, or provide full

Aluminum conductors and components should not be used in lightning protection systems since they will shorten the life span of the system.

Lightning Protection System for a Building



LIGHTNING RODS

Ridge Strap Lightning Rod and Mount

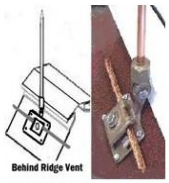
With 12" Solid Rod.
Copper or aluminum strap mount with cable clamp for use on ridge, flat or sloping roof's.—Shipped flat but may be easily formed to fit any roof slope.

Copper:
Catalog #C-4-12 with 12" Rod $27.00
With 18" Rod #C-4-18 $33.00

Aluminum:
#A-4-12 with 12" Rod $18.00
With 18" Rod #A-4-18 $21.00
Longer length rods add $1.00 per inch

Swivel Lightning Rod with clamp base

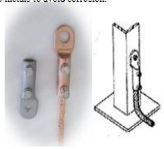
With 12" solid Rod. **Great for installing behind Ridge Vent**
Heavy cast copper or aluminum.
For use on back side of roof to hide mount from view.



Copper:
Catalog #C-16-12
with 12" Rod $34.50
With 18" Rod #C-16-18 $40.50
Aluminum:
Catalog #A-16-12
with 12" Rod $24.50
With 18" Rod #A-16-18 $27.50
Longer length rods add $1.00 per inch

Deluxe Bolted Metal Bonding Lug

Heavy cast copper or aluminum lug with stainless steel bolts for connecting to metal objects.
Note: If connecting copper to aluminum, a stainless steel washer can be inserted between the two metals to avoid corrosion.



Copper: # C-20 $ 8.00

Aluminum: # A-20 $ 6.25

Bolted connectors allow for Easy removal when re-roofing.

Lightning Conductor Cable's

Class 1—Standard of the industry for buildings under 75' high (Other sizes available).

Copper Conductor Cable:
Catalog #C-1 Copper **$2.35 per ft.**
Braided approx., 7/16" diameter Copper Cable in smooth Basket weave configuration.

Economy Crimp Double Cable Splicer

Fingers are crimped over the cable with pliers or hammered over the cable.
(For a better bolted splicer see #10-Z at right)

Copper: Catalog # C-6 $2.90

Aluminum: #A-6 $1.90

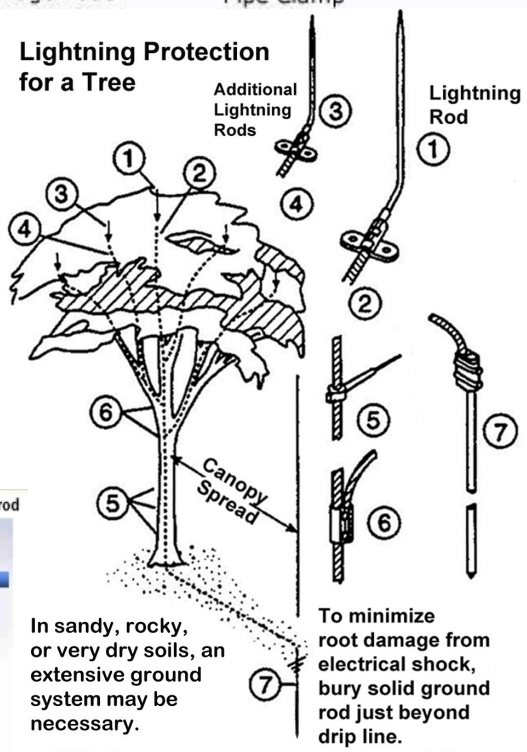
Economy Crimp TEE Splicer

Fingers are crimped over the cable with pliers or hammered over the cable.
(For a better bolted splicer, see #19 at right)

Copper: Catalog # C-8 $2.90

Aluminum: #A-8 $1.90

Lightning Protection for a Tree



In sandy, rocky, or very dry soils, an extensive ground system may be necessary.

To minimize root damage from electrical shock, bury solid ground rod just beyond drip line.

GROUNDING RODS

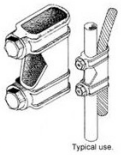
Ground Rods and Ground Rod Clamps

LEFT: Ground Rod is 1/2" x 8' long made of copper clad hardened steel. Long life corrosion resistant. **Note:** Never connect aluminum underground.

8' Ground Rod (Left) #22 $19.00 (Note: Additional shipping due to high shipping costs, ground rods may be available locally at less cost).

Copper Ground Clamp (Right) # C-23-A for 1/2" or 5/8" ground rods $11.00

 # C-23-B for 3/4" ground rods $12.00



Used for connecting copper cable to ground rod. Will fit 1/2" - 5/8" - 3/4" ground rods. Two stainless steel bolts with 2" contact length along axis of the grounding rod.

Copper Ground Plate with Clamp

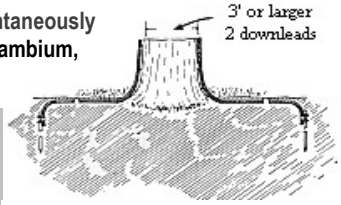
2 square foot x 0.032 thick copper flat plate.
Comes complete with attached clamp for ground cable.

Copper: # C-24 $ 62.00

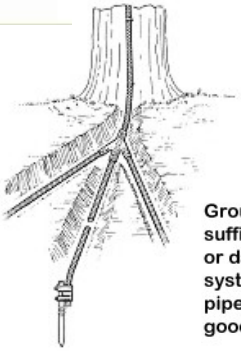
Use in place of Ground Rods where shallow top soil is encountered -
For soil depths of 1 to 2 ft.

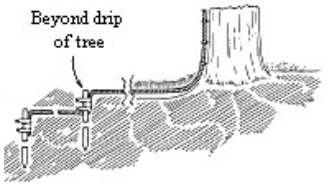
External Protection with Early Streamer (ESE) lightning rod

When a tree is struck by lightning, water within the tree is instantaneously Vaporized. Steam is created usually in the outer sapwood and cambium, resulting in an explosion which strips off bark from the tree.



Large trees with trunks measuring 3 feet or more in diameter should have 2 ground cables extending beyond spread of branches and connecting to prope ground system.





Ground cable should be buried to a sufficient depth to avoid displacement or damage. Underground sprinkler system, water pipes and other metal pipes and other metal objects are very good grounds.

Installing a Lightning Protection System in a building provides a path of least resistance to ground and diverts most of the current from a strike away from electrical, plumbing, and structural systems which reduces the risk of fire, shock wave damage, side flash injuries, and minimizes electrical appliance and electronic destruction.

Tall trees do not protect. As a matter of fact, they could actually make things worse. Lightning usually jumps from the tree to the house because of all the grounded metal items inside and outside the house. Metal is a much better conductor of electricity than a tree. Consider installing lightning protection in tall trees next to a house.

CHAPTER 15

ASSISTED ICE RESCUE TECHNIQUES / SELF RESCUE TECHNIQUE

Under "Winter Sports Safety" on the BSA website and in the *Guide to Safe Scouting* it mentions "cold-weather activities present challenges to the Scout and leader, such as crosscountry skiing, ice skating, sledding, snowmobiling, ice fishing, and snowshoeing." All these activities might result in a Scout falling through the ice, yet there is no discussion on ice safety or ice rescue under "Winter Sports Safety"? *Guide to Safe Scouting* on page 35 has a paragraph titled "Skating Safety" which talks about ice skating, skateboarding, and in-line skating (rollerblading); but there is no discussion on ice safety or ice rescue? There is a very real possibility that a Scout may fall though thin ice if they happen to be skating on a pond or lake, or ice fishing. Teaching Scouts, including adult Scout leaders, how to rescue someone who has fallen through the ice, and how to self-rescue if you are alone and happen to fall through the ice, cold save a life.

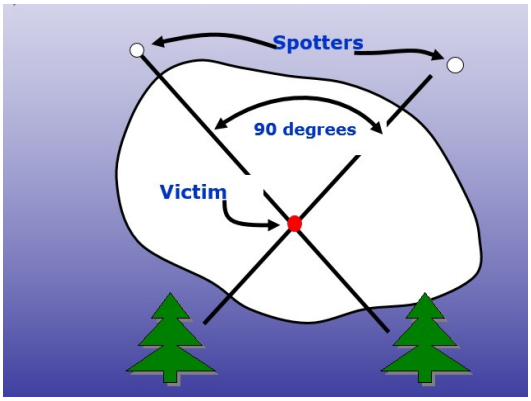
The *Skating merit badge* (ice skating option) requirement #1 says "Discuss preparations that must be taken when skating outdoors on natural ice." Knowing about ice rescue is not a requirement in the *Snow Sports merit badge* even though cross-country (Nordic) skiing is sometimes done on frozen lakes during the winter; or the *Wilderness merit badge* where there are sometimes "cold and snow" treks passing lake and along river banks. The only location in Scout literature and training that I have been able to find that addresses ice rescue is a website link at the very bottom of the BSA Ice Safety website which directs you to an *Ohio State University* article on ice safety*.

**Ohio State University Extension, Ice Safety, Rescue Procedures*. *"What If You Fall into the Water? The most important thing is to stay calm and always look and work your way toward the shore (remember the weakest ice is in the center of the water body). Call out for help to others if they are close by. Place your hands up on the unbroken ice. This is why ice claws or ice picks are excellent safety devices to carry with you. Try to swim onto the ice by pulling with your hands and ice claws, and by kicking your legs. If the ice breaks, keep trying. Once upon the ice, do not stand up. Distribute your weight out over a larger area by crawling, sliding, or rolling toward shore following your tracks made going out on the ice as you know the ice was safe to the point where you fell in."* http://ohioline.osu.edu/aex-fact/pdf/0392.pdf

There have been news articles on Scouts rescuing someone who has fallen through the ice, including an article about five Scouts rescuing a fellow Scout who fell through the ice on White Bear Lake http://www.northernstarbsa.org/News.aspx?articleID=1367. Another article as recently as January 17, 2014 talks about a 14-year-old Illinois Boy Scout saving a 9-year-old who had fallen through the ice. He said that his Boy Scout training prepared him for the emergency http://www.cbsnews.com/news/illinois-boy-scout-saves-kid-who-falls-through-ice/. One year ago a man who was ice fishing suffered hypothermia after falling through the ice on Wolverine Lake at the Owasippe Scout Camp http://tinyurl.com/nyyaum5.

The following handouts to this chapter are on assisted ice rescue techniques and self-rescue techniques, including if you have fallen through the ice: "swim onto the ice", which is not known by many Scouts or Scout leaders. These handouts contain photos and illustrations. Pictures are worth a thousand words. The following is a video link showing a person falling through the water and self-rescuing himself: http://www.youtube.com/watch?v=Wz3gy5XyaBo. BSA literature (e.g. BSA website, *Guide to Safe Scouting*, and *Skating merit badge*) does not contain pictures or videos on ice rescue techniques). This needs to be done.

Assisted Ice Rescue Techniques



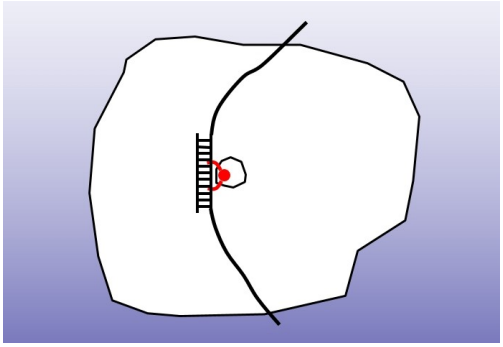
Visually mark the victim's location utilizing shore objects (such as trees or larger rocks) in case the victim submerges.

Someone has fallen through the ice. Your first instinct may be to run to the person's rescue, this can lead to both of you falling into the ice and being just as helpless. You should avoid approaching the hole in the ice unless the victim is unconscious or in imminent danger of slipping into the water and drowning, either from weakness or an inability to swim.

Lay flat on the ice to spread out your weight if you have to crawl out on the ice to get closer to the victim**.** Extend anything (e.g. board, stick) towards the victim (if possible extend from the

Using a ladder to rescue someone. If a lifejacket is available toss it to the victim and see if they are able to put it on. If there is another lifejacket available, put one on yourself.

Crawl to the victim. As a last resort, if you do have to approach the hole, then you should still not run or walk, but crawl, to minimize the impact of the weight. Tell the victim to remain calm. Let them know that as long as they stay afloat, they have time to be rescued. Advise them to take deep, slow breaths.



A Ladder and ropes can be used to reach extended distances without leaving the shore.

Toss the victim a rescue throw bag. Tell the victim to hold onto the rope kick with their legs as if swimming as you try to pull them out of the water and onto the ice. Your own clothes could serve as a line if all else fails: Yes, it means you'll have to tolerate the bitter cold for a few minutes, for the sake of saving the person in distress. If you wear a sweater, or some other item not as bulky as overcoat, attempt to use it first. Tie a knot at the end of each sleeve, hold on to one and throw the other to the victim.

Use a boat to get to out to the victim. A boat can be pushed across the ice and paddled or rowed if it breaks though the ice.

Pictures from http://www.isur.org

HANDOUT PREPARED BY GLEN GREEN 2016

Sketches from http://www.montgomerycountymd.gov

NEBULUS EMERGENCY FLOTATION DEVICE

Is a compact, portable lifesaving tool engineered for use in ice and water rescue situations. Pull lanyard to inflate. Flotation buoyancy 1000 lbs. Weight 17 lbs. Two 440g CO2 cylinders. $525.00

HANDOUT PREPARED BY GLEN GREEN 2016

PHOTOS FROM HTTP://NEBULUSFLOTATION.COM

Self Ice Rescue Techniques

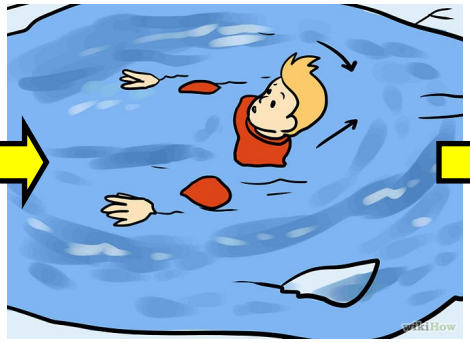
Video of a self rescue: http://www.youtube.com/watch?v=Wz3gy5XyaBo

Be prepared. Carry safety spikes (nail in one-inch-dowels), waterproof matches, dry clothes in a waterproof bag, food, water.

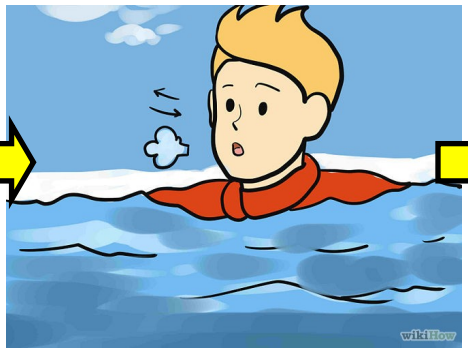
Flare your arms out to the side to keep them above the ice. Hold your breath and lean back a little to help avoid submersion..

Keep calm. The body will react by a "cold shock". Do not panic, you've got 2 to 5 minutes before you lose strength and coordination.

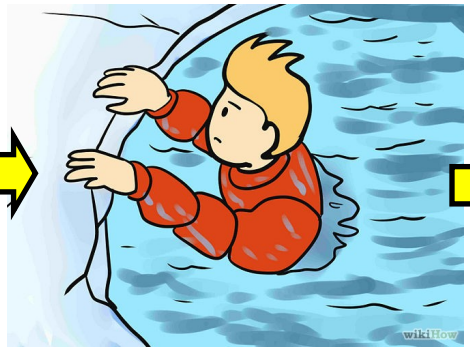
Find the hole. If ice is covered with snow — hole will be darker. Ice without snow — hole will be lighter. Look for contrasting color.



Stay afloat. Tread water. Don't worry about getting out right away. In the first minute you should just concentrate on keeping afloat.



Control your breathing. Concentrate on slowing your breathing. Hyperventilating & gasping from cold shock can last up to 4

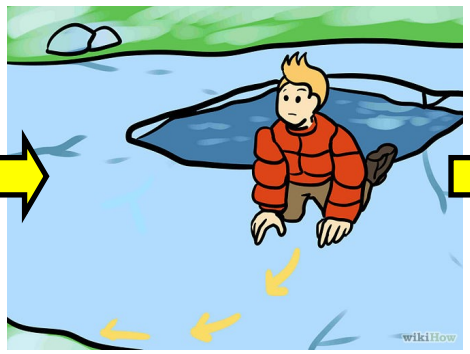


Face the strongest part of the ice. Generally, the strongest ice will be that you were on just before you fell through. Place your arms on ice.

Do <u>not</u> try to push yourself up with your arms on the edge of the ice. That would be concentrating your weight and break the ice.

Swim yourself back onto the ice. Get your body as horizontal as possible, lean forward and kick your feet as if you were swimming.

Roll away from the hole or crawl on your belly until you are several feet from the hole, then crawl on your hands and knees.

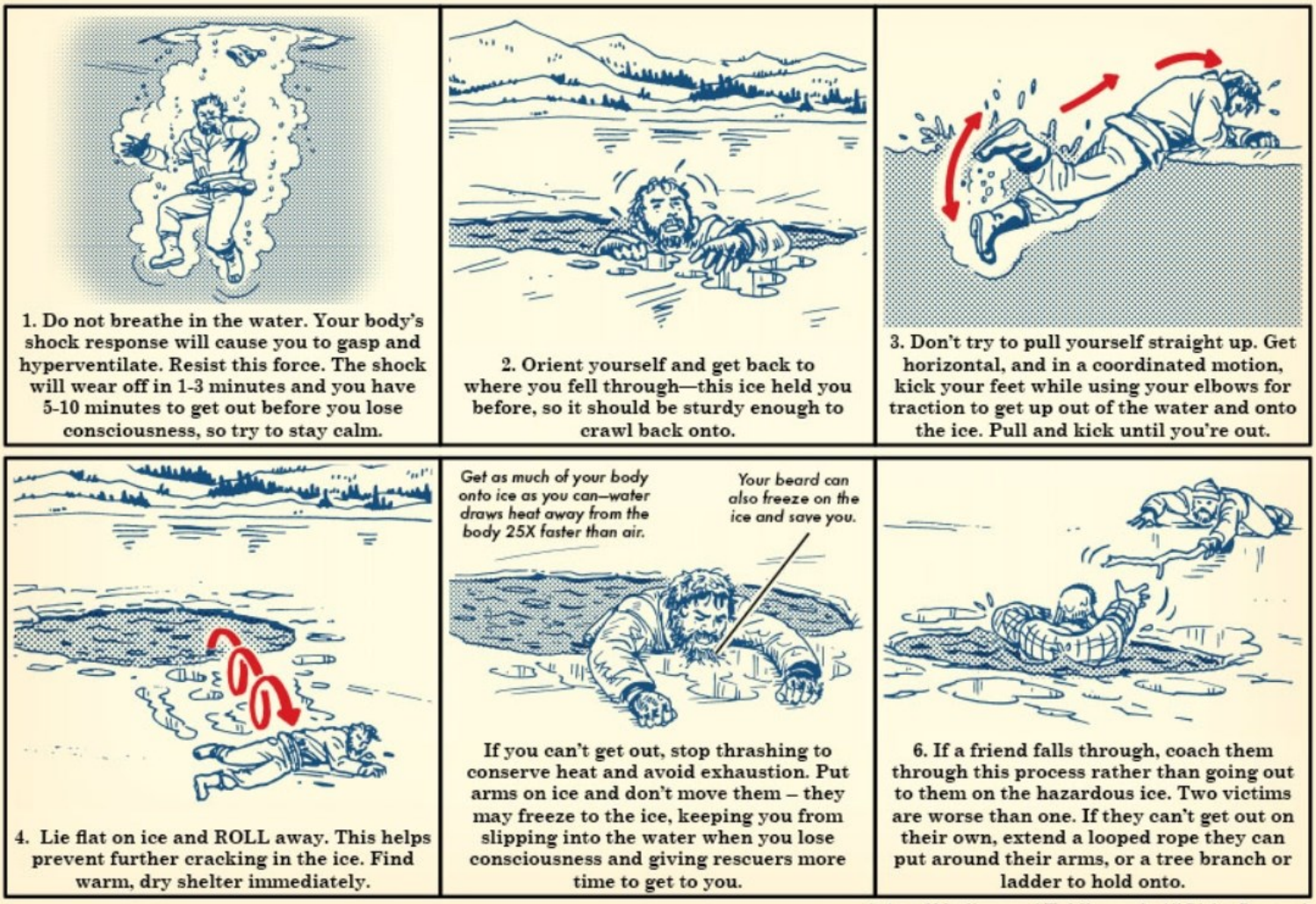


Retrace your footsteps back to shore as the ice you crossed earlier held up under your weight until the breaking point.

Warm up and get help. If you are in the wilderness, start a fire. Warm up your core from the inside—get some hot liquids in your

What To Do If You Fall Through the Ice

The Art of MANLINESS



Don't hyperventilate. As you hit the water, a physiological reaction known as *torso reflex* will cause you to gasp for air. Force yourself to take slow, deep breaths. You'll begin to shiver violently & feel intense pain; try to remember that these are natural responses & not life-threatening.

Break your fall. As the ice breaks, extend your arms to the side. Depending on how the ice breaks your arms may find enough solid ice to keep part of your torso out of the water. That will make a significant difference in the initial shock you experience.

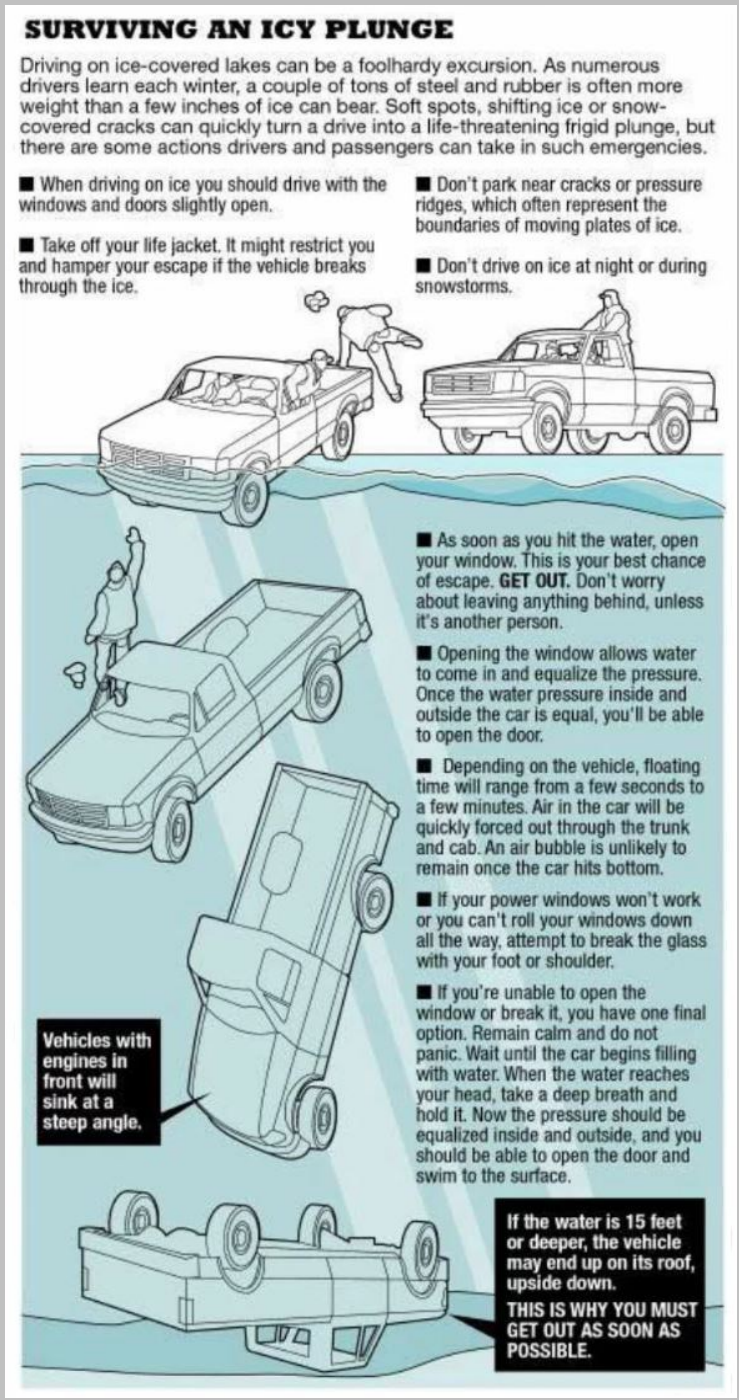
Orient yourself. As you bob in the opening you fell through, turn and face the direction you came from. The ice there was strong enough to hold you until this point, so it should be able to support you as you maneuver out. You don't have time to take a chance on other escape routes.

Lift and kick. Stretch your arms over the ice and shimmy your body up until most of your torso is resting on the ledge. (This way, if you lose consciousness before you're free, you won't slip back under and drown.) Now, as you pull with your arms, kick your legs dolphin-style to propel yourself out.

Recover. Once out, logroll to shore. Resist the urge to rub your arms and legs (which would send the cool blood from your extremities straight to your core) or gulp hot liquids (which would trigger a rush of blood to your skin). Strip, wrap your torso in blankets, and sip a tepid decaf beverage.

SCKETCHES BY TED SLAMPYAK
ILLUSTRATIONS BY JASON LEE
VERBIAGE BY MATHEW HONANA

HANDOUT PREPARED BY GLEN GREEN 2014



FACEBOOK POST BY DAVID SMITH

ARTWORK BY GLEN GREEN

H.E.L.P. HEAT ESCAPE LESSENING POSTURES

CONSERVE BODY HEAT IN COLD WATER – HUDDLE TOGETHER

https://www.boat-ed.com/

GRAPHICS BY GLEN GREEN

PHOTO BY XAVIER MACIA

CHAPTER 16

SUMMARY

As mentioned in the Preface to this thesis - BSA *Guide to Safe Scouting* emphasizes "BSA's Commitment to Safety". From the *Guide to Safe Scouting*: "We want you to know that the safety of our youth, volunteers, staff, and employees cannot be compromised. Health and safety must be integrated into everything we do to the point that no injuries are acceptable beyond those that are readily treatable by Scout-rendered first aid." This thesis identified life safety techniques, equipment, procedures, and physiological functions which are not currently contained or fully covered in BSA literature, but are recognized by safety and medical professionals and experts in the field to be the cutting edge of safety technology and practices. These safety recommendations are the result of scientific study, medical practice, and manufacturer innovations; and some are not common knowledge to many adult and youth Scouts. It is hoped by putting these recognized safety measures and practices in a Commissioner's Doctoral thesis, it will be read by the Scout leaders at the BSA National Office and this will help get these items incorporated in BSA literature and training courses.

CONCLUSIONS

Following the safety recommendations in this thesis will make for a safer environment for the Scouts to learn and play. While some may feel that some of this information is too technical and contains too much detail – but don't sell Scouts short. Many of these young Scouts have learned technological information in this age of smart phones, I-pads, computers, and the Internet that astound many adults. The more that youth know about how to be safe, the odds are the safer they will be.

RECOMMENDATIONS

<u>Recommendation 1</u>: That the life safety techniques, equipment, procedures, and physiological functions identified in this thesis, after review by appropriate BSA committees and Scout leaders, will be incorporated at the National level into the BSA *Guide to Safe Scouting*, BSA E-Learning Course Management System (Safe Swim Defense, Safety Afloat, Weather Hazards)[formally known as the BSA Online Learning Center (BSA OLC)]; National High Adventure Bases, Local Council High-Adventure Bases, Cub Scout Day Camps and Twilight Camps; Long-Term Resident Camps (e.g. Summer Camps); the *Athletics, Backpacking, Cycling, Climbing, First Aid, Fishing, Fly Fishing, Gardening, Geocaching, Golf, Hiking, Kayaking, Lifesaving, Motor Boating, Orienteering, Personal Fitness, Pioneering, Rowing, Skating, Scuba Diving, Search and Rescue, Small Boat Sailing, Snow Sports, Sports, Surveying, Swimming, Water Sports, Whitewater,* and *Wilderness Survival* merit badges, and activities followed by Lone Scouts (and their Counselors).

<u>Recommendation 2</u>: That an "advocate" be assigned to the BSA National staff whose sole duty is to continually research the Internet, seek out published scientific studies, review medical journals, and to talk to with Scout leaders in the field to discover innovations, new ideas, technology advances, and current and updated safety and medical practices to be incorporated in the BSA *Guide to Safe Scouting*, E-Learning Course Management, National High Adventure Bases, Local Council High-Adventure Bases, Cub Scout Day Camps and Twilight Camps; Long-Term Resident Camps (e.g. Summer Camps); Lone Scouts (& their Counselors); and applicable BSA merit badges.

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CHAPTER 15 – ASSISTED ICE RESCUE / SELF RESCUE TECHNIQUES

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Vindy.com Cub Scouts learning ice rescue http://tinyurl.com/n3s9vuw
wikiHow http://www.wikihow.com/Survive-a-Fall-Through-Ice

CHAPTER 16 – SUMMARY / CONCLUSIONS / RECOMMENDATIONS

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