

# WINTER STORMS

## THE DECEPTIVE KILLERS



### A PREPAREDNESS GUIDE

U.S. DEPARTMENT OF COMMERCE  
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION  
NATIONAL WEATHER SERVICE

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# WINTER STORMS

## THE DECEPTIVE KILLERS

This preparedness guide explains the dangers of winter weather and suggests life-saving action **YOU** can take. With this information, **YOU** can recognize winter weather threats, develop an action plan and be ready when severe winter weather threatens. Remember...your safety is up to **YOU**.

### WHY TALK ABOUT WINTER WEATHER?

- Each year, dozens of Americans die due to exposure to cold. Add to that number, vehicle accidents and fatalities, fires due to dangerous use of heaters and other winter weather fatalities and you have a significant threat.
- Threats, such as hypothermia and frostbite, can lead to loss of fingers and toes or cause permanent kidney, pancreas and liver injury and even death. You must prepare properly to avoid these extreme dangers. You also need to know what to do if you see symptoms of these threats.
- A major winter storm can last for several days and be accompanied by high winds, freezing rain or sleet, heavy snowfall and cold temperatures.
- People can become trapped at home or in a car, without utilities or other assistance.
- Attempting to walk for help in a winter storm can be a deadly decision.
- The aftermath of a winter storm can have an impact on a community or region for days, weeks or even months.
- Extremely cold temperatures, heavy snow and coastal flooding can cause hazardous conditions and hidden problems.



James Wiesmueller

### FOR MORE INFORMATION

Contact your local National Weather Service (NWS) office, American Red Cross chapter or local emergency management agency for more weather-related brochures.

You can find more information on flash flooding in the *Flash Floods and Floods...The Awesome Power* brochure. Contact your local Red Cross chapter or NWS office for copies. You can download a copy at the NWS Web site below. To find additional materials on winter safety, try the following Web sites:

**NWS:** [www.nws.noaa.gov](http://www.nws.noaa.gov)

**FEMA:** [www.fema.gov](http://www.fema.gov)

**Red Cross:** [www.redcross.org](http://www.redcross.org)





# HEAVY SNOW

Heavy snow can immobilize a region and paralyze a city, stranding commuters, closing airports, stopping the flow of supplies, and disrupting emergency and medical services. Accumulations of snow can cause roofs to collapse and knock down trees and power lines. Homes and farms may be isolated for days and unprotected livestock may be lost. In the mountains, heavy snow can lead to avalanches. The cost of snow removal, repairing damages, and the loss of business can have severe economic impacts on cities and towns.



*Before and after photo at Mt. Baker, WA, Ski Summit. Early June snow depth in 1999 measured 228 inches. The world record seasonal snowfall of 1,141 inches was recorded at Mt. Baker that year. Photos courtesy of Mt. Baker Ski Area.*



**BLIZZARD:** Winds of 35 mph or more with snow and blowing snow reducing visibility to less than ¼ mile for at least 3 hours.

**BLOWING SNOW:** Wind-driven snow that reduces visibility. Blowing snow may be falling snow and/or snow on the ground picked up by the wind.

**SNOW SQUALLS:** Brief, intense snow showers accompanied by strong, gusty winds. Accumulation may be significant.

**SNOW SHOWERS:** Snow falling at varying intensities for brief periods of time. Some accumulation is possible.

**SNOW FLURRIES:** Light snow falling for short durations with little or no accumulation.

## Injuries Due To Ice and Snow

- About 70% result from vehicle accidents
- About 25% occur in people caught out in a storm
- Most happen to males over 40 years old

An avalanche is a mass of tumbling snow. More than 80 percent of midwinter avalanches are triggered by a rapid accumulation of snow, and 90 percent of those occur within 24 hours of snowfall. An avalanche may reach a mass of a million tons and travel at speeds up to 200 mph.



# ICE

Heavy accumulations of ice can bring down trees and topple utility poles and communication towers. Ice can disrupt communications and power for days while utility companies repair extensive damage. Even small accumulations of ice can be extremely dangerous to motorists and pedestrians. Bridges and overpasses are particularly dangerous because they freeze before other surfaces.



# WINTER FLOODING

Winter storms can generate coastal flooding, ice jams and snow melt, resulting in significant damage and loss of life.

**COASTAL FLOODS:** Winds generated from intense winter storms can cause widespread tidal flooding and severe beach erosion along coastal areas.

**ICE JAMS:** Long cold spells can cause rivers and lakes to freeze. A rise in the water level or a thaw breaks the ice into large chunks which become jammed at man made and natural obstructions. Ice jams can act as a dam, resulting in severe flooding.

**SNOW MELT:** Sudden thaw of a heavy snow pack often leads to flooding.



*Large wave action in Marquette Harbor, MI/Jack Pellet*



*Ship survey of ice in shipping channels/NOAA*





## Wind Chill Chart

Wind (mph)	Temperature (°F)																			
	Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63	-68	-72
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-71	-77	-81
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77	-83	-89
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81	-87	-93
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84	-91	-97
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87	-93	-99
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89	-95	-101
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91	-97	-104
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-92	-99	-106
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-94	-101	-108
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-95	-102	-109
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-83	-90	-96	-103	-110

Frostbite Times: 30 minutes (light blue), 10 minutes (medium blue), 5 minutes (dark blue)

Wind Chill (°F) =  $35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$   
 Where, T = Air Temperature (°F) V = Wind Speed (mph) Effective 11/01/07

NOAA

Exposure to cold can cause frostbite or hypothermia and become life-threatening. Infants and elderly people are most susceptible. What constitutes extreme cold varies in different parts of the country. In the South, near freezing temperatures are considered extreme cold. Freezing temperatures can cause severe damage to citrus fruit crops and other vegetation. Pipes may freeze and burst in homes that are poorly insulated or without heat. In the North, extreme cold means temperatures well below zero.

**Wind Chill** is not the actual temperature but rather how wind and cold feel on exposed skin. As the wind increases, heat is carried away from the body at an accelerated rate, driving down the body temperature. Animals are also affected by wind chill; however, cars, plants and other objects are not.

### Injuries Related to Cold

- 50% happen to people over 60 years old
- More than 75% happen to males
- About 20% occur in the home

**Frostbite** is damage to body tissue caused by extreme cold. A wind chill of -20° Fahrenheit (F) will cause frostbite in just 30 minutes. Frostbite causes a loss of feeling and a white or pale appearance in extremities, such as fingers, toes, ear lobes or the tip of the nose. If symptoms are detected, get medical help immediately! If you must wait for help, slowly rewarm affected areas. However, if the person is also showing signs of hypothermia, warm the body core before the extremities.

**Hypothermia** is a condition brought on when the body temperature drops to less than 95°F. It can kill. For those who survive, there are likely to be lasting kidney, liver and pancreas problems. Warning signs include uncontrollable shivering, memory loss, disorientation, incoherence, slurred speech, drowsiness and apparent exhaustion. Take the person's temperature. If below 95°F, seek medical care immediately!

**If Medical Care is Not Available,** warm the person slowly, starting with the body core. Warming the arms and legs first drives cold blood toward the heart and can lead to heart failure. If necessary, use your body heat to help. Get the person into dry clothing and wrap in a warm blanket covering the head and neck. Do not give the person alcohol, drugs, coffee or any hot beverage or food. Warm broth is the first food to offer.



Hypothermia occurs when the extremities are excessively cold (blue)



Improperly warming the body will drive cold blood from the extremities to the heart, leading to heart failure

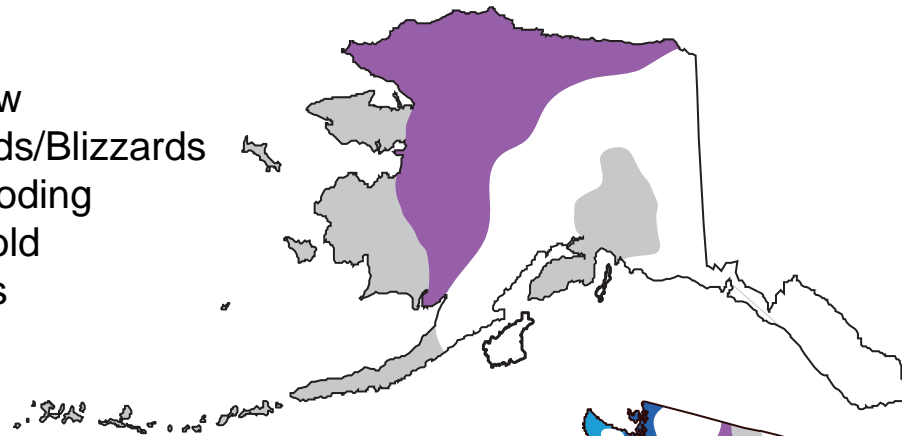


# WINTER STORM HAZARDS IN THE U.S.

## ANNUAL MEAN SNOWFALL

### Alaska

- Heavy snow
- Strong winds/Blizzards
- Coastal flooding
- Extreme cold
- Avalanches
- Ice jams
- Ice fog



### The West Coast

- Heavy precipitation
- High winds
- Coastal flooding
- Beach erosion

### Midwest and Plains

- Heavy snow
- Strong winds/Blizzards
- Extreme wind chill
- Lake-effect snow
- Ice storms

### Mid-Atlantic to New England

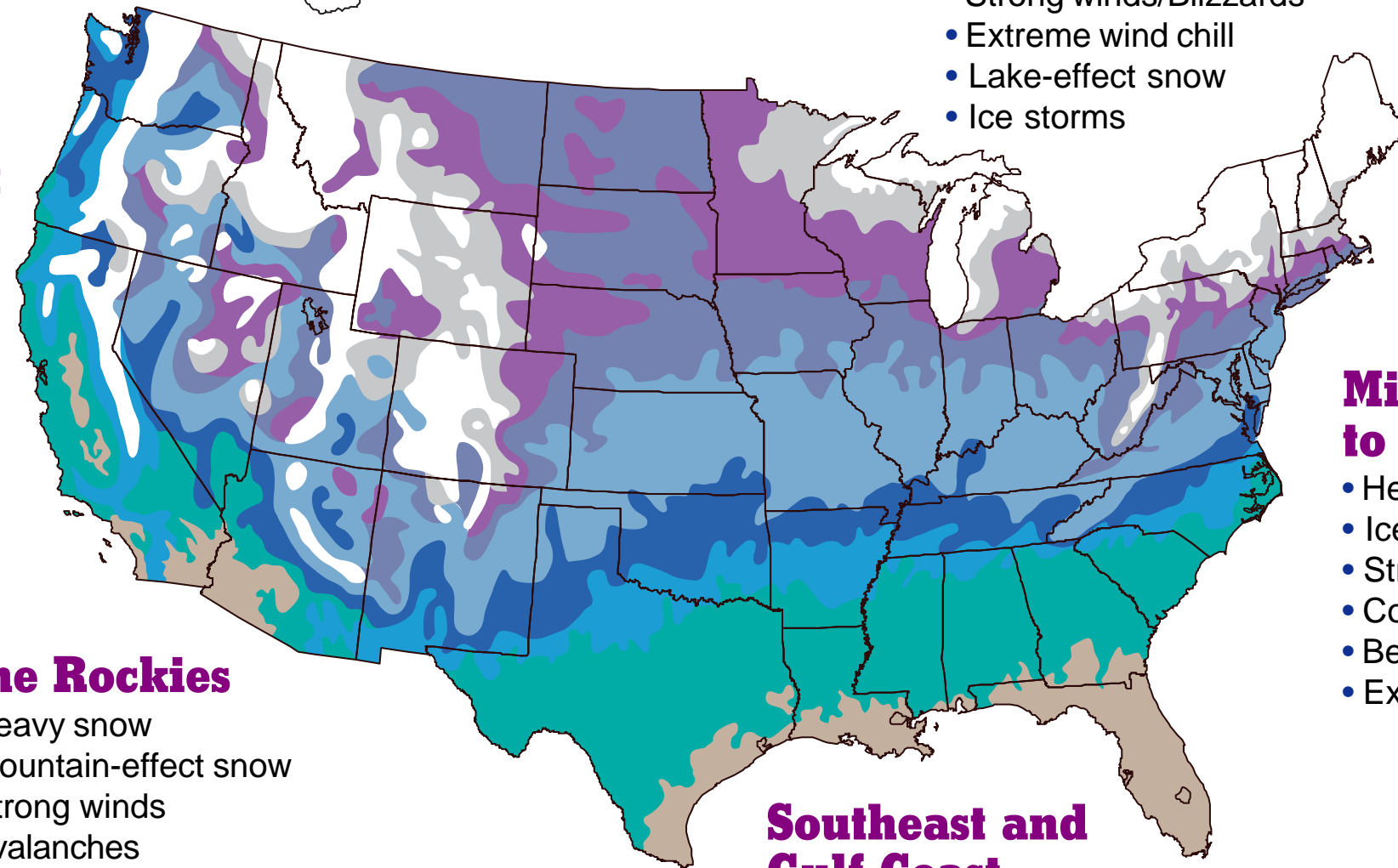
- Heavy snow
- Ice storms
- Strong winds
- Coastal flooding
- Beach erosion
- Extreme cold

### The Rockies

- Heavy snow
- Mountain-effect snow
- Strong winds
- Avalanches
- Extreme cold
- Blizzards

### Southeast and Gulf Coast

- Ice storms
- Crop-killing freezes
- Occasional snow



### Inches

0.0
0.1 - 3.0
3.1 - 6.0
6.1 - 12.0
12.1 - 24.0
24.1 - 36.0
36.1 - 48.0
48.1 - 72.0
> 72.0



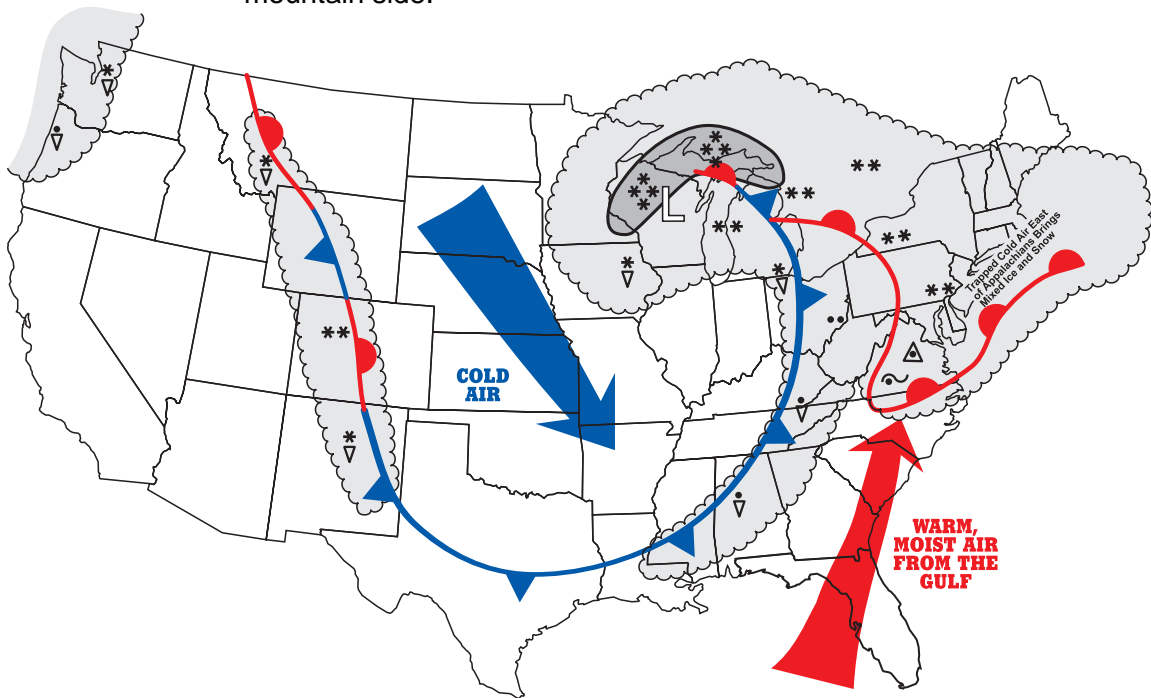
# HOW WINTER STORMS FORM

There are many ways for winter storms to form; however, all have three key components.

**COLD AIR:** For snow and ice to form, the temperature must be below freezing in the clouds and near the ground.

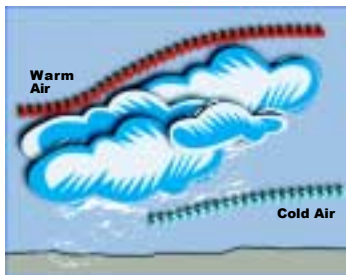
**MOISTURE:** Water evaporating from bodies of water, such as a large lake or the ocean, is an excellent source of moisture.

**LIFT:** Lift causes moisture to rise and form clouds and precipitation. An example of lift is warm air colliding with cold air and being forced to rise. Another example of lift is air flowing up a mountain side.

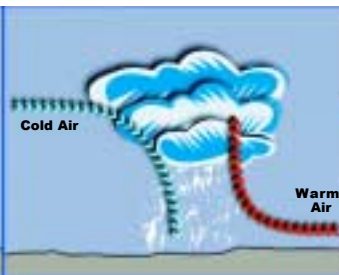


- |                    |                 |                  |
|--------------------|-----------------|------------------|
| *<br>▽ Snow Shower | ~ Freezing Rain | Cold Front       |
| ▽ Rain Shower      | △ Sleet         | Warm Front       |
| ** Light Snow      | ** Heavy Snow   | Stationary Front |
| •• Light Rain      |                 |                  |

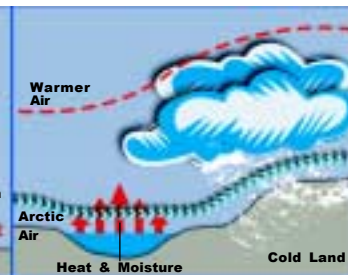
## Warm Front



## Cold Front



## Lake Effect



## Mountain Effect





# STAY INFORMED!

**KEEP AHEAD  
OF THE STORM**  
by listening to  
**NOAA Weather Radio,  
commercial radio  
and television for the  
latest winter storm  
warnings, watches  
and advisories**



*Electronic equipment available to receive weather information/NOAA  
(Weather Radio, Radio, TV, Pager, Cell Phone, Two-Way Radio)*

**NOAA Weather Radio is the best means to receive warnings from the National Weather Service.** The National Weather Service continuously broadcasts warnings and forecasts that can be received by NOAA Weather Radios, which are sold in many stores. The average range is 40 miles, depending on topography. Purchase a radio that has a battery back-up and a Specific Area Message Encoder feature, which automatically alerts you when a watch or warning is issued for your county or parish.

## WHAT TO LISTEN FOR

The National Weather Service issues outlooks, watches, warnings and advisories for all winter weather hazards. Here's what they mean and what to do. Use the information below to make an informed decision on your risk and what actions should be taken. Remember to listen to your local officials' recommendations and to NOAA Weather Radio for the latest winter storm information.

**OUTLOOK:** Winter storm conditions are possible in the next 2-5 days.  
Stay tuned to local media for updates.

**WATCH:** Winter storm conditions are possible within the next 36-48 hours.  
Prepare now!

**WARNING:** Life-threatening severe winter conditions have begun or will begin within 24 hours. Act now!

**ADVISORY:** Winter weather conditions are expected to cause significant inconveniences and may be hazardous. If you are cautious, these situations should not be life threatening.





# BE PREPARED!

## BEFORE THE STORM STRIKES

### At Home and Work

Primary concerns are loss of heat, power and telephone service and a shortage of supplies if storm conditions continue for more than a day.

Have available:

**Flashlight and extra batteries.**

**Battery-powered NOAA Weather Radio** and portable radio to receive emergency information. These may be your only links to the outside.

**Extra food and water.** Have high energy food, such as dried fruit, nuts and granola bars, and food requiring no cooking or refrigeration.

**Extra medicine and baby items.**

**First-aid supplies.**

**Heating fuel.** Refuel before you are empty. Fuel carriers may not reach you for days after a winter storm.

**Emergency heat source:** fireplace, wood stove, space heater.

- Use properly to prevent a fire.
- Ventilate properly.

**Fire extinguisher, smoke alarm.**

- Test smoke alarms once a month to ensure they work properly.

**Make sure pets have plenty of food, water and shelter.**

### In Vehicles

Plan your travel and check the latest weather reports to avoid the storm!

**Fully check and winterize** your vehicle before the winter season begins.

**Carry a WINTER STORM SURVIVAL KIT:**

- Mobile phone, charger, batteries
- Blankets/sleeping bags
- Flashlight with extra batteries
- First-aid kit
- Knife
- High-calorie, non-perishable food
- Extra clothing to keep dry
- Large empty can to use as emergency toilet. Tissues and paper towels for sanitary purposes
- Small can and waterproof matches to melt snow for drinking water
- Sack of sand or cat litter for traction
- Shovel
- Windshield scraper and brush
- Tool kit
- Tow rope
- Battery booster cables
- Water container
- Compass and road maps.

**Keep your gas tank near full** to avoid ice in the tank and fuel lines.

**Avoid traveling alone.**

**Let someone know your timetable** and primary and alternate routes.

### On the Farm/Pets

**Move animals to sheltered areas.**

Shelter belts, properly laid out and oriented, are better protection for cattle than confining shelters, such as sheds.

**Haul extra feed to nearby feeding areas.**

**Have water available.** Most animals die from dehydration in winter storms.

**Make sure pets have plenty of food, water and shelter.**



Glenn Field/NOAA



NOAA

### Dress for the Season

Wear loose, lightweight, warm clothes in layers. Trapped air insulates. Remove layers to avoid perspiration and subsequent chill. Outer garments should be tightly woven, water repellent, and hooded. Wear a hat. Half your body heat loss can be from the head. Cover your mouth to protect your lungs from extreme cold. Mittens, snug at the wrist, are better than gloves. Try to stay dry.



# WHEN CAUGHT IN A WINTER STORM



Courtesy of American Red Cross



Courtesy of American Red Cross



NOAA

## Outside

### Find shelter:

- Try to stay dry.
- Cover all exposed body parts.

### No shelter:

- Build a lean-to, windbreak or snow cave for protection from the wind.
- Build a fire for heat and to attract attention.
- Place rocks around the fire to absorb and reflect heat.

### Melt snow for drinking water:

- Eating snow will lower your body temperature.

## In a Vehicle

### Stay in vehicle:

- You will become quickly disoriented in wind-driven snow and cold.
- Run the motor about 10 minutes each hour for heat.
- Open the window a little for fresh air to avoid carbon monoxide poisoning.
- Make sure the exhaust pipe is not blocked.

### Be visible to rescuers:

- Turn on the dome light at night when running the engine.
- Tie a colored cloth, preferably red, to your antenna or door.
- After snow stops falling, raise the hood to indicate you need help.

### Exercise:

- From time to time, move arms, legs, fingers and toes vigorously to keep blood circulating and to keep warm.

## Inside

### Stay inside:

- When using alternate heat from a fireplace, wood stove, space heater, etc., use fire safeguards and properly ventilate.

### No heat:

- Close off unneeded rooms.
- Stuff towels or rags in cracks under doors.
- Cover windows at night.
- Eat and drink. Food provides the body with energy for producing its own heat. Keep the body replenished with fluids to prevent dehydration.
- Wear layers of loose-fitting, lightweight, warm clothing. Remove layers to avoid overheating, perspiration and subsequent chill.

**AVOID OVEREXERTION**, such as shoveling heavy snow, pushing a car or walking in deep snow. The strain from the cold and the hard labor may cause a heart attack. Sweating could lead to a chill and hypothermia. Take Red Cross Cardiopulmonary Rescue (CPR) and Automated External Defibrillator (AED) training so you can respond quickly to an emergency.





# FAMILY DISASTER PLAN

Prepare for hazards that affect your area with a Family Disaster Plan. Where will your family be when disaster strikes? They could be anywhere at work, at school or in the car. How will you find each other? Will you know if your children are safe? Disasters may force you to evacuate your neighborhood or confine you to your home. What would you do if basic services – water, gas, electricity or telephones – were cut off?

## Steps to Take

**I Gather information about hazards.** Contact your local National Weather Service office, emergency management office, and American Red Cross chapter. Find out what type of disasters could occur and how you should respond. Learn your community's warning signals and evacuation plans. Assess your risks and identify ways to make your home and property more secure.

**II Meet with your family to create a plan.** Discuss your plan with your family. Pick two places to meet: a spot outside your home for an emergency, such as fire, and a place away from your neighborhood in case you can't return home. Choose an out-of-state friend as your "family check-in contact" for everyone to call if the family gets separated. Discuss what you would do if advised to evacuate.

### Implement your plan.

- III**
1. Post emergency telephone numbers by the phone.
  2. Install safety features in your home, such as smoke alarms and fire extinguishers.
  3. Inspect your home for potential hazards (items that can move, fall, break or catch fire) and correct them.
  4. Have your family learn basic safety measures, such as CPR, AED and first aid; how to use a fire extinguisher; and how and when to turn off water, gas and electricity in your home.
  5. Teach children how and when to call 911 or your local Emergency Medical Services number.
  6. Keep enough supplies in your home for at least 3 days. Assemble a disaster supplies kit. Store these supplies in sturdy, easy-to-carry containers, such as backpacks or duffle bags. Keep important documents in a waterproof container. Keep a smaller disaster supplies kit in the trunk of your car.

### A Disaster Supplies Kit Should Include:

- A 3-day supply of water (one gallon per person, per day)
- Food that won't spoil
- One change of clothing and shoes per person
- One blanket or sleeping bag per person
- First-aid kit
- Prescription medicines
- Emergency tools
- Battery-powered NWR
- Portable radio
- Flashlight with extra batteries
- Extra set of car keys
- Cash and a credit card
- Special items for infant, elderly or disabled family members.

**IV Practice and maintain your plan.** Ensure your family knows meeting places, phone numbers and safety rules.

Conduct drills. Test your smoke alarms monthly and change the batteries at least once each year. Test and recharge your fire extinguisher(s) according to manufacturer's instructions. Replace stored water and food every 6 months. Contact your local National Weather Service office, American Red Cross chapter or emergency management office for a copy of "Your Family Disaster Plan" (L-191/ARC4466).

## Local Sponsorship: