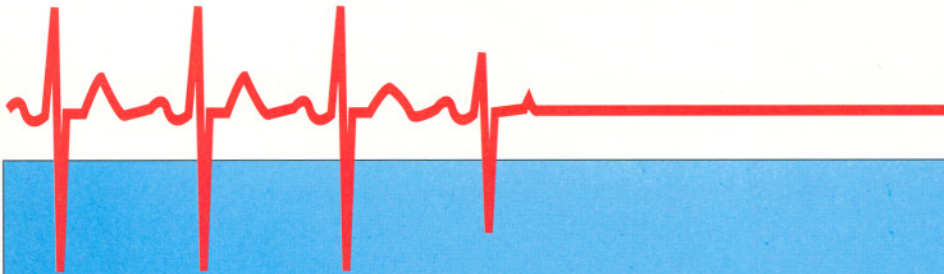


winter storms...

the Deceptive Killers



A GUIDE TO SURVIVAL

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Weather Service
Warning and Forecast Branch
November 1991



STORMS WITH STRONG WINDS

Sometimes winter storms are accompanied by strong winds creating blizzard conditions with blinding wind-driven snow, severe drifting, and dangerous wind chill. Strong winds with these intense storms and cold fronts can knock down trees, utility poles, and power lines. Storms near the coast can cause coastal flooding and beach erosion as well as sink ships at sea. In the West and Alaska, winds descending off the mountains can gust to 100 mph or more damaging roofs and other structures.



EXTREME COLD

Extreme cold often accompanies a winter storm or is left in its wake. Prolonged exposure to the cold can cause frostbite or hypothermia and become life-threatening. Infants and elderly people are most susceptible. What constitutes extreme cold and its effect varies across different areas of the United States. In areas unaccustomed to winter weather, 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, below zero temperatures may be considered as "extreme cold." Long cold spells can cause rivers to freeze, disrupting shipping. Ice jams may form and lead to flooding.

Winter's **IMPACT**



ICE STORMS

Heavy accumulations of ice can bring down trees, electrical wires, telephone poles and lines, and communication towers. Communications and power can be disrupted for days while utility companies work to repair the extensive damage. Even small accumulations of ice may cause extreme hazards to motorists and pedestrians.

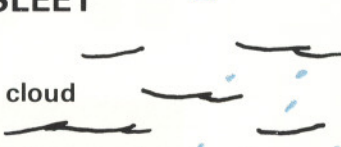


HEAVY SNOW STORMS

Heavy snow can immobilize a region and paralyze a city, stranding commuters, stopping the flow of supplies, and disrupting emergency and medical services. Accumulations of snow can collapse buildings and knock down trees and power lines. In rural areas, 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 loss of business can have large economic impacts on cities and towns.

Winter Precipitation



SNOW  cloud	28° 29°	SLEET  cloud	34° 33° 32°	FREEZING RAIN  cloud	36° 35° 34°
	30° 31° 31° 30°		31° 30° 30° 30°		33° 32° 31°
Cloud temperature is cold enough for snow to form; air above the ground does not melt it.	30°	Rain freezes to ice pellets which do not stick to surfaces, but accumulate on the ground.	30°	Glaze of ice forms over surfaces.	30°

Snow

FLURRIES - Light snow falling for short durations. No accumulation or light dusting is all that is expected.

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

SQUALLS - Brief, intense snow showers accompanied by strong, gusty winds. Accumulation may be significant. Snow squalls are best known in the Great Lakes region.

BLOWING SNOW - Wind-driven snow that reduces visibility and causes significant drifting. Blowing snow may be snow that is falling and/or loose snow on the ground picked up by the wind.

BLIZZARD - Winds over 35 mph with snow and blowing snow reducing visibility to near zero.

Sleet

Rain drops that freeze into ice pellets before reaching the ground. Sleet usually bounces when hitting a surface and does not stick to objects. However, it can accumulate like snow and cause a hazard to motorists.

Freezing Rain

Rain that falls onto a surface with a temperature below freezing. This causes it to freeze to surfaces, such as trees, cars, and roads, forming a coating or glaze of ice. Even small accumulations of ice can cause a significant hazard.



Winter Regions

From the Mid-Atlantic Coast to New England... The classic storm is called a *Nor'easter*. A low pressure area off the Carolina coast strengthens and moves north. Wind-driven waves batter the coast from Virginia to Maine, causing flooding and severe beach erosion. The storm taps the Atlantic's moisture-supply and dumps heavy snow over a densely populated region. The snow and wind may combine into blizzard conditions and form deep drifts paralyzing the region. Ice storms are also a problem. Mountains, such as the Appalachians, act as a barrier to cold air trapping it in the valleys and adjacent low elevations. Warm air and moisture moves over the cold, trapped air. Rain falls from the warm layer onto a cold surface below becoming ice.

Along the Gulf Coast and Southeast... This region is generally unaccustomed to snow, ice, and freezing temperatures. Once in a while, cold air penetrates south across Texas and Florida, into the Gulf of Mexico. Temperatures fall below freezing killing tender vegetation, such as flowering plants and the citrus fruit crop. Wet snow and ice rapidly accumulate on trees with leaves, causing the branches to snap under the load. Motorists are generally unaccustomed to driving on slick roads and traffic accidents increase. Some buildings are poorly insulated or lack heat altogether. Local municipalities may not have available snow removal equipment or treatments, such as sand or salt, for icy roads.

In the Midwest and Plains... Storms tend to develop over southeast Colorado in the lee of the Rockies. These storms move east or northeast and use both the southward plunge of cold air from Canada and the northward flow of moisture from the Gulf of Mexico to produce heavy snow and sometimes blizzard conditions. Other storms affecting the Midwest and Plains intensify in the lee of the Canadian Rockies and move southeast. Arctic air is drawn from the north and moves south across the Plains and Great Lakes. Wind



Courtesy of James Wiesmueller

and cold sometimes combine to cause wind chill temperatures as low as 70°F below zero. The wind crosses the lakes, tapping its moisture and forming snow squalls and narrow heavy snow bands. This is called "lake-effect snow."

From the Rockies to the West Coast... Strong storms crossing the North Pacific sometimes slam into the coast from California to Washington. The vast Pacific provides an unlimited source of moisture for the storm. If cold enough,

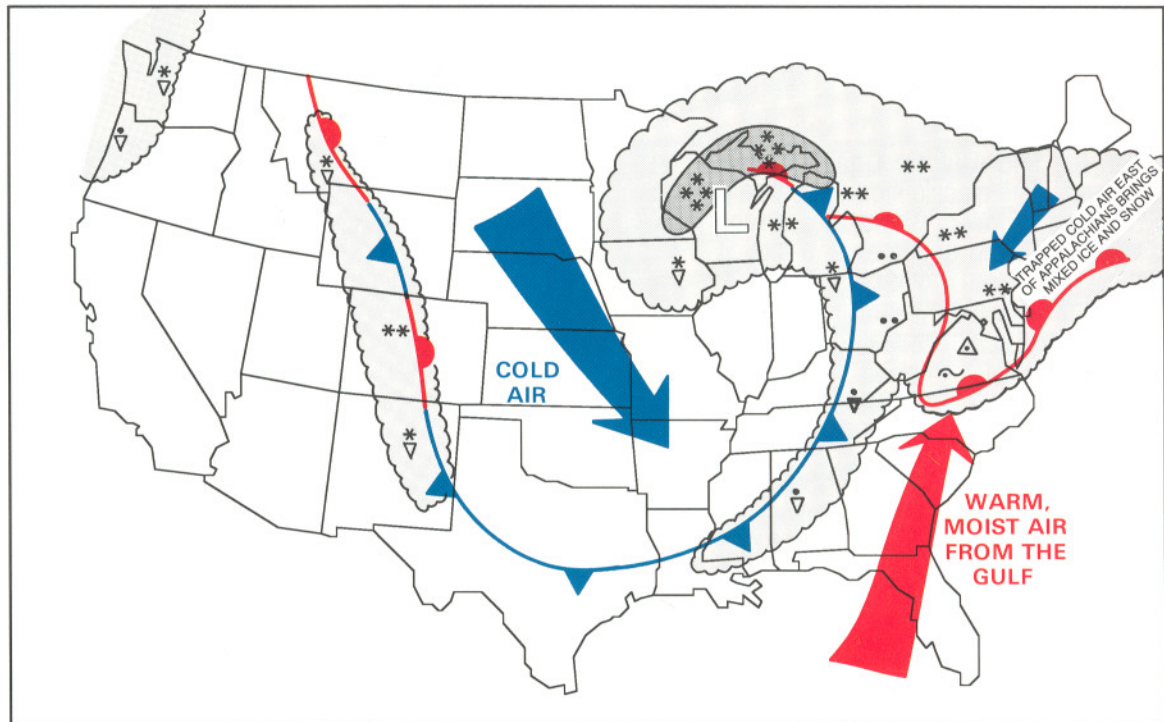
snow falls over Washington and Oregon and sometimes even in California. As the moisture rises into the mountains, heavy snow closes the mountain passes and can cause avalanches. The cold air from the north has to filter through mountain canyons into the basins and valleys to the south. If the cold air is deep enough, it can spill over the mountain ridge. As the air funnels through canyons and over ridges, wind speeds can reach 100 mph, damaging roofs and taking down power and telephone lines. Combining these winds with snow results in a blizzard.

In Alaska... Wind-driven waves from intense storms crossing the Bering Sea produce coastal flooding and can drive large chunks of sea ice inland destroying buildings near the shore. High winds, especially across Alaska's Arctic coast, can combine with loose snow to produce a blinding blizzard and wind chill temperatures to 90°F below zero! Extreme cold (-40°F to -60°F) and ice fog may last a week at a time. Heavy snow can impact the interior and is common along the southern coast. With only brief glimpses of the winter sun across the southern horizon, the snow accumulates through the winter months. In the mountains, it builds glaciers, but the heavy snow accumulations can also cause avalanches or collapse roofs of buildings. A quick thaw means certain flooding. Ice jams on rivers can also cause substantial flooding.



Courtesy of the American Red Cross

Winter Storm



*
▽ SNOW SHOWER
 *
▽ RAIN SHOWER
 ** LIGHT SNOW
 •• LIGHT RAIN

~ FREEZING RAIN
 △ SLEET
 *** HEAVY SNOW

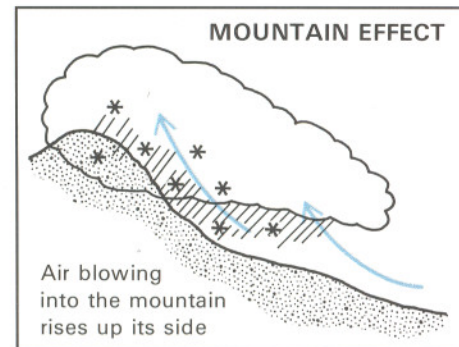
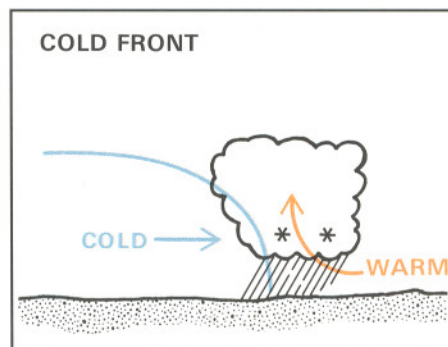
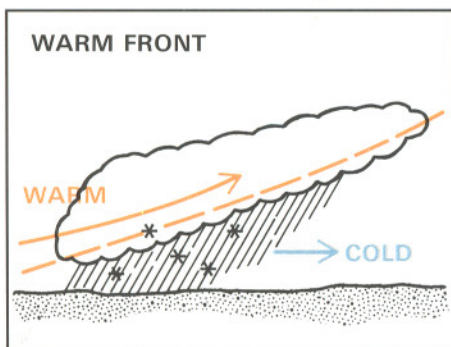
▲ COLD FRONT
 ◐ WARM FRONT
 ◐ STATIONARY FRONT

What Makes a Winter Storm?

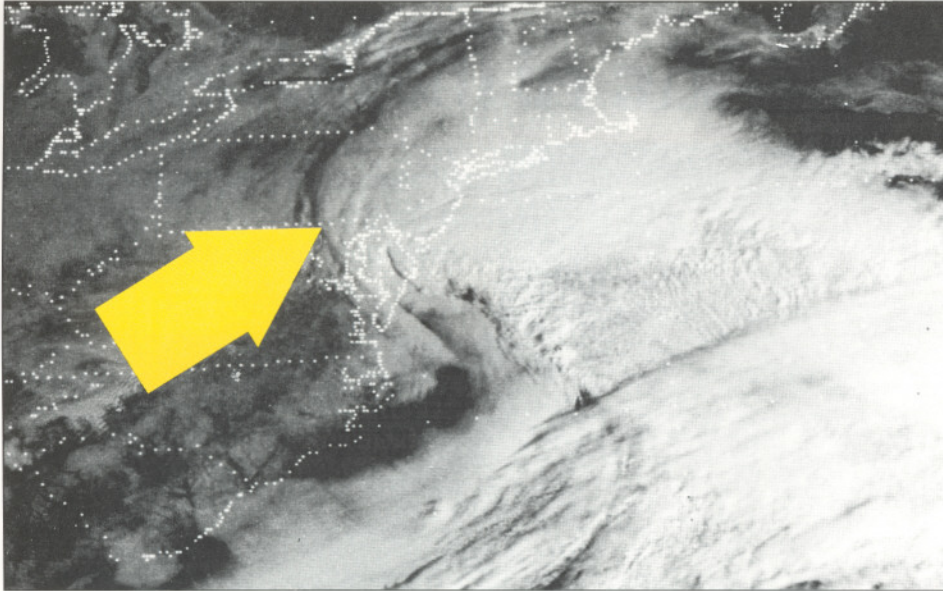
COLD AIR:
below freezing temperatures in the clouds and near the ground are necessary to make snow and/or ice.

LIFT:
something to raise the moist air to form the clouds and cause precipitation. An example of lift is warm air colliding with cold air and being forced to rise over the cold dome. The boundary between the warm and cold air masses is called a front. Another example of lift is air flowing up a mountain side. See examples of lift below.

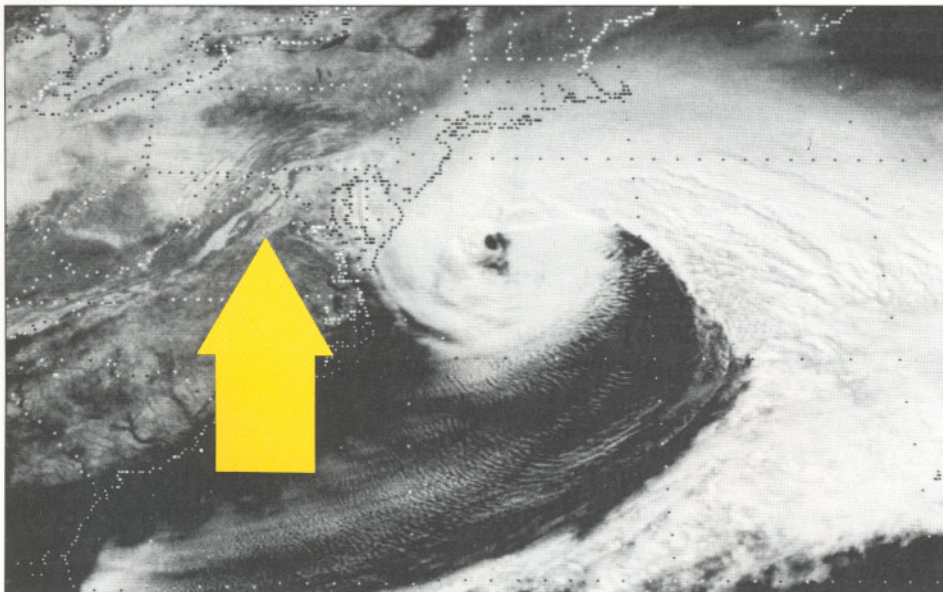
MOISTURE:
to form clouds and precipitation. Air blowing across a body of water, such as a large lake or the ocean, is an excellent source of moisture.



Facts:



President's Day Storm of February 1979. The area of heaviest snow associated with winter storms is usually only a 50-mile wide band.



Five hours later the storm has intensified off the coast. Snow can be seen covering the ground in the Mid-Atlantic states.

WINTER STORMS ARE CONSIDERED DECEPTIVE KILLERS BECAUSE MOST DEATHS ARE INDIRECTLY RELATED TO THE STORM

- People die in traffic accidents on icy roads.
- People die of heart attacks while shoveling snow.
- People die of hypothermia from prolonged exposure to cold.

Winter Deaths

Everyone is potentially at risk during winter storms. The actual threat to you depends on your specific situation. Recent observations indicate the following:

Related to ice and snow:

- About 70% occur in automobiles.
- About 25% are people caught out in the storm.
- Majority are males over 40 years old.

Related to exposure to cold:

- 50% are people over 60 years old.
- Over 75% are males.
- About 20% occur in the home.

COLD

FROSTBITE

Frostbite is damage to body tissue caused by that tissue being frozen. 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: LOW BODY TEMPERATURE

Warning signs - uncontrollable shivering, memory loss, disorientation, incoherence, slurred speech, drowsiness, and apparent exhaustion.

Detection - Take the person's temperature. If below 95°F (35°C), immediately seek medical care!

If medical care is not available, begin warming the person *slowly*. Warm the body core first. If needed, use your own body heat to help. Get the person into dry clothing, and wrap them 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 better. Do not warm extremities (arms and legs) first! This drives the cold blood toward the heart and can lead to heart failure.

WIND CHILL

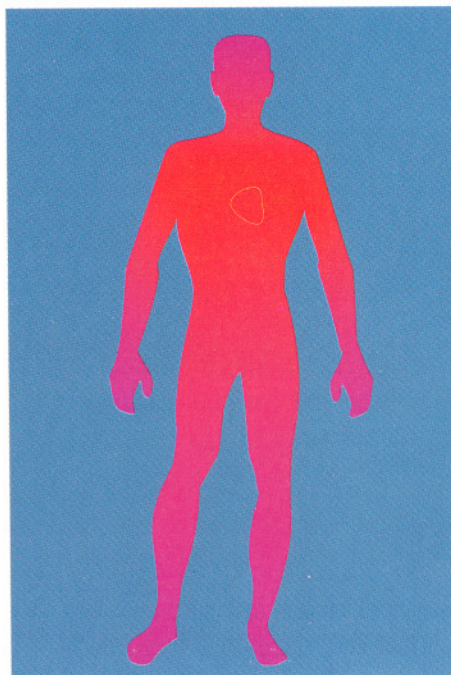
The wind chill is based on the rate of heat loss from exposed skin caused by combined effects of wind and cold. As the wind increases, heat is carried away from the body at an accelerated rate, driving down the body temperature. Animals are also affected by wind chill.

Equivalent Temperature (°F)

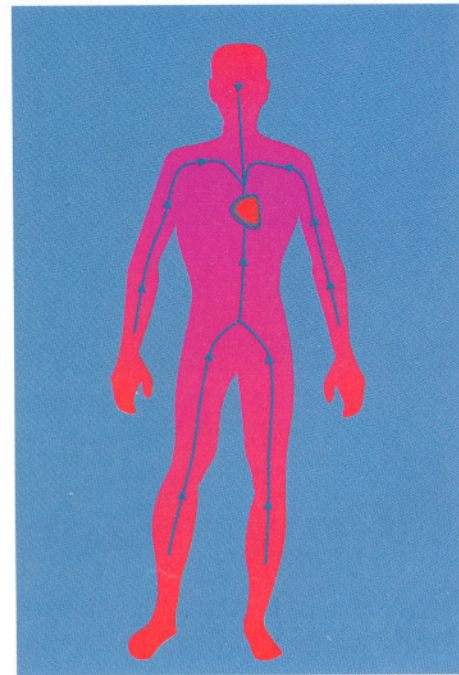
Calm	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	32	27	22	16	11	6	0	-5	-10	-15	-21	-26	-31	-36	-42	-47	-52
10	22	16	10	3	-3	-9	-15	-22	-27	-34	-40	-46	-52	-58	-64	-71	-77
15	16	9	2	-5	-11	-18	-25	-31	-38	-45	-51	-58	-65	-72	-78	-85	-92
20	12	4	-3	-10	-17	-24	-31	-39	-46	-53	-60	-67	-74	-81	-88	-95	-103
25	8	1	-7	-15	-22	-29	-36	-44	-51	-59	-66	-74	-81	-88	-96	-103	-110
30	6	-2	-10	-18	-25	-33	-41	-49	-56	-64	-71	-79	-86	-93	-101	-109	-116
35	4	-4	-12	-20	-27	-35	-43	-52	-58	-67	-74	-82	-89	-97	-105	-113	-120
40	3	-5	-13	-21	-29	-37	-45	-53	-60	-69	-76	-84	-92	-100	-107	-115	-123
45	2	-6	-14	-22	-30	-38	-46	-54	-62	-70	-78	-85	-93	-102	-109	-117	-125

WIND CHILL CHART

Read right and down from calm-air line. For example, a temperature of zero degrees Fahrenheit (0°F) combined with a wind of 20 miles per hour has an equivalent cooling effect of -39°F.



When a person is suffering from hypothermia, the extremities are cold (blue).



Improperly warming the body will drive cold blood from the extremities to the heart which can lead to heart failure.

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.

When **CAUGHT** in a Winter Storm...



OUTSIDE

Find shelter:

- try to stay dry.
- cover all exposed parts of the body.

No shelter:

- prepare a lean-to, wind-break, 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.

Do not eat snow. It will lower your body temperature. Melt it first.



IN A CAR OR TRUCK

Stay in your car or truck. Disorientation occurs quickly in wind-driven snow and cold.

Run the motor about ten 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.

Make yourself visible to rescuers:

- turn on the dome light at night when running engine.
- tie a colored cloth (preferably red) to your antenna or door.
- raise the hood indicating trouble after snow stops falling.

Exercise from time to time by vigorously moving arms, legs, fingers, and toes to keep blood circulating and to keep warm.



AT HOME OR IN A BUILDING

Stay inside. When using **ALTERNATIVE HEAT** from a fireplace, wood stove, space heater, etc.:

- use fire safeguards.
- 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.

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



What to Listen For...

WINTER STORM WATCH:

Severe winter conditions, such as heavy snow and/or ice, are possible within the next day or two. Prepare now!

WINTER STORM WARNING:

Severe winter conditions have begun or are about to begin in your area. Stay indoors!

BLIZZARD WARNING:

Snow and strong winds will combine to produce a blinding snow (near zero visibility), deep drifts, and life-threatening wind chill. Seek refuge immediately!

WINTER WEATHER ADVISORY:

Winter weather conditions are expected to cause significant inconveniences and may be hazardous. If caution is exercised, these situations should not become life-threatening. The greatest hazard is often to motorists.

FROST/FREEZE WARNING:

Below freezing temperatures are expected and may cause significant damage to plants, crops, or fruit trees. In areas unaccustomed to freezing temperatures, people who have homes without heat need to take added precautions.

BE PREPARED...

Before the Storm Strikes

At home and at work...

Primary concerns are the potential loss of heat, power, 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.** High energy food, such as dried fruit or candy, and food requiring no cooking or refrigeration is best.
- **Extra medicine and baby items.**
- **First-aid supplies.**
- **Heating fuel.** Fuel carriers may not reach you for days after a severe winter storm.
- **Emergency heating source**, such as a fireplace, wood stove, space heater, etc.
 - Learn to use properly to prevent a fire.
 - Have proper ventilation.
- **Fire extinguisher and smoke detector.**
 - Test units regularly to ensure they are working properly.

On the farm...

- **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 a water supply available.** Most animal deaths in winter storms are from dehydration.

In cars and trucks...

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:**
 - blankets/sleeping bags; flashlight with extra batteries; first-aid kit; knife; high-calorie, non-perishable food; extra clothing to keep dry; a large empty can and plastic cover with tissues and paper towels for sanitary purposes; a smaller can and water-proof matches to melt snow for drinking water; sack of sand (or cat litter); shovel; windshield scraper and brush; tool kit; tow rope; booster cables; water container; compass and road maps.
- **Keep your gas tank near full** to avoid ice in the tank and fuel lines.
- **Try not to travel alone.**
- **Let someone know** your timetable and primary and alternate routes.

Example of winter storm survival kit.



DRESS TO FIT THE SEASON. Wear loose-fitting, light-weight, warm clothing in several layers. Trapped air insulates. Layers can be removed 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.

FAMILY DISASTER PLAN

Families should be prepared for all hazards that affect their area and themselves. NOAA's National Weather Service, the Federal Emergency Management Agency, and the American Red Cross urge each family to develop 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?

Follow these basic steps to develop a family disaster plan...

Gather information about hazards. Contact your local National Weather Service office, emergency management office or civil defense 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.

Meet with your family to create a plan. Discuss the information you have gathered. Pick two places to meet: a spot right 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. (1) Post emergency telephone numbers by phones; (2) Install safety features in your house, such as smoke detectors and fire extinguishers; (3) Inspect your home for potential hazards (such as items that can move, fall, break, or catch fire) and correct them; (4) Have your family learn basic safety measures, such as CPR 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 to meet your needs for at least three days. Assemble a disaster supplies kit with items you may need in case of an evacuation. Store these supplies in sturdy, easy-to-carry containers, such as backpacks or duffle bags. Keep important family 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) and food that won't spoil • one change of clothing and footwear per person • one blanket or sleeping bag per person • a first-aid kit, including prescription medicines • emergency tools, including a battery-powered NOAA Weather Radio and a portable radio, flashlight, and plenty of extra batteries • an extra set of car keys and cash • special items for infant, elderly, or disabled family member.

Practice and maintain your plan. Ask questions to make sure your family remembers meeting places, phone numbers, and safety rules. Conduct drills. Test your smoke detectors monthly and change the batteries at least once a year. Test and recharge your fire extinguisher(s) according to manufacturer's instructions. Replace stored water and food every six months.