

FWS/ARW-RF1

OCT 7 1987

Memorandum

To: Refuge Manager, Tamarac NWR
From: Regional Refuge Supervisor, RF1
Subject: Safety Plan

Attached is an approved copy of the station's Safety Plan. Your plan is well written and thorough. Your efforts are appreciated. Also, the Poison Control Center Procedures (Attachment 1) was a novel idea.

Please review Mr. Markwell's comments (attached) and file with the plan.

/s/ John W. Ellis

John W. Ellis

Attachments

cc:SSA

RF1:TLarson:mm:10/6/87:x3701



United States Department of the Interior

FISH AND WILDLIFE SERVICE
FEDERAL BUILDING, FORT SNELLING
TWIN CITIES, MINNESOTA 55111



IN REPLY REFER TO:

FWS/ABA-SSA

June 23, 1987

MEMORANDUM

TO: Refuge Manager, Tamarac National Wildlife Refuge

THROUGH: Regional Refuge Supervisor, Division 1

FROM: Safety and Occupational Health Manager, Region 3

SUBJECT: Safety Management Plan

Subject Plan has been reviewed by the Division of Safety and the following comments/observations are listed below for your action, as appropriate.

Reference

Comment

Page 7, IX.D.1.

Personnel must be medically certified to wear respirators (see 24 AM 3, Exhibit 6, item 10) for assignments such as spray painting or spraying chemicals.

Page 7, X.B.4.

See 24 AM 3, Exhibit 1, regarding required personal protective equipment for Welding.

Page 8, XI.B.5.

See 24 AM 3, Exhibit 1, regarding required personal protective equipment for Tree felling and thinning using a chainsaw.

Subject Plan is very well written. Your station has incorporated many portions of the Regional Director's various Notices on safety procedures and concerns for employee safety.


Earl Markwell

SAFETY MANAGEMENT PLAN

Tamarac National Wildlife Refuge
Rochert, Minnesota 56578

June 2, 1987

Submitted by: Harold J. Waller Date: 6/2/87
Refuge Manager

Reviewed by: Earl Spivey Date: 6/23/87
Regional Safety Officer

Concurrence: Thomas J. Liron Date: 10/1/87
Regional Supervisor

Approval: _____ Date: _____
Refuge Manager

TABLE OF CONTENTS

	<u>Page</u>
I. PLAN OBJECTIVES.....	1
II. EMERGENCY INFORMATION.....	1
A. Emergency Telephone Numbers.....	1
1. Medical Facilities.....	1
2. Fire and Police Agencies.....	1
3. Poison Control Centers.....	1
4. Chemical Referral Center.....	1
B. Employee Information.....	2
C. Severe Weather Procedures.....	2
III. EMERGENCY TRAINING/EQUIPMENT.....	2
A. Training.....	2
1. Emergency Supplies and Training.....	2
2. Emergency Equipment.....	2
a. Vehicles.....	2
b. Heavy Equipment.....	3
c. Boats.....	3
d. Radios.....	3
IV. SAFETY ORGANIZATION.....	3
A. Safety Committee.....	3
B. Safety Meetings.....	3
V. FIRE SUPPRESSION.....	3
a. Fire Equipment Maintenance.....	3
b. Fire Equipment Operation.....	4
c. Buildings.....	4
VI. VEHICLE MAINTENANCE AND OPERATION.....	4
A. Maintenance.....	4
B. Operation.....	5
VII. HEAVY AND FARM EQUIPMENT.....	5
VIII. WATERCRAFT MAINTENANCE AND OPERATION.....	5
IX. HAZARDOUS MATERIALS.....	6
A. Pesticides and Poisonous Chemicals.....	6
B. Storage and Handling of Explosives.....	6
C. Creosoted or Penta-treated Wood Products.....	7
D. Respirators.....	7
X. SHOP WORK AND TOOLS.....	7
A. Power Tools.....	7
B. Welding.....	7
XI. HAZARDOUS WORKING CONDITIONS.....	7
A. Lifting.....	7
B. Forest Work.....	7
C. Working On Ice.....	8

	<u>Page</u>
XII. GUN HANDLING.....	8
XIII. VISITING PUBLIC-RECREATION.....	8
A. Public Hunting.....	8
B. Boating and Fishing.....	8
C. Office/Visitor Center.....	9
ATTACHMENT 1----Procedure For Contacting National Poison Control Center	
ATTACHMENT 2----Severe Weather Procedures	
ATTACHMENT 3----Safety Training	
ATTACHMENT 4----Annual Review Form	
ATTACHMENT 5----Danger! Thin Ice-DNR Pamphlet	

I. PLAN OBJECTIVES

- a. Provide an occupationally safe and healthful environment for all personnel and the visiting public.
- b. Minimize unsafe acts and work-related illnesses.
- c. Identify and correct hazardous conditions.
- d. Minimize accidental property damage or loss.
- e. To make safety and environmental health an integral part of every task.
- f. Provide a ready reference for emergencies.

II. EMERGENCY INFORMATION

- A. The following emergency telephone numbers shall be prominently posted on the station safety bulletin board.

1. Medical Facilities

Ambulance--Detroit Lakes Ambulance Service	847-5422
Hospital--St. Mary's Hospital	847-5611
Clinic's--Dakota Clinic LTD	847-3166
--Community Medical Clinic	847-1641

2. Fire and Police Agencies

Detroit Lakes Fire Department	847-4555
Callaway Fire Department	375-3333
Frazee Fire Department	847-1842
Becker County Sheriff	847-2661
Minnesota Highway Patrol	847-1550
Detroit Lakes Police Department	847-4222

3. Poison Control Centers

National Poison Control Center	800/222-1222
Community Medical Clinic	847-1641
Dakota Clinic LTD	847-3166
Fergus Falls Lake Region Hospital	736-5475
	(Ext. 222)

See Attachment 1 for procedures when contacting the National Poison Control Center.

4. Chemical Referral Center (CRC)

For emergency (spills, leaks, accidents) information on chemicals, call Chemtrec. Toll free 800/424-9300

For non-emergencies the toll free numbers for specific areas are listed below:

Continental United States and Hawaii	800/262-8200
Alaska and outside Continental United states	Call collect- 202/887-1315

The CRC is open from 8:00 AM to 9:00 PM, EST, Monday through Friday.

- B. The following information for each employee will be maintained in his/her station personnel folder:

Name and residence address
Home telephone number
Employee's doctor and telephone number
Who to notify in case of accident
Medical information

- C. Procedures to follow in case of severe weather is posted on the bulletin board in the office/visitor center and maintenance office (See Attachment 2).

III. EMERGENCY TRAINING/EQUIPMENT

A. Training

For first-aid and other safety related training see Attachment 3.

1. Emergency Supplies and Training

First-aid kits are centrally located in the office/visitor center and maintenance office. All vehicles carry first-aid kits and fire extinguishers. The office/visitor center has nine mounted fire extinguishers. The maintenance office and shop has eight mounted fire extinguishers and several extras stored in the shop. First-aid training can be obtained from the Detroit Lakes Area Vocational Institute and St. Mary's Hospital.

2. Emergency Equipment

The following equipment is available for emergency situations:

a. Vehicles

Dodge Pickup 4X4 (1)
Chevy Pickup (1)
Dodge 1/2 ton (1)
Dodge 1 ton (1)
Dodge 3/4 ton (1)
AMC Jeep (1)
AMC Concord (1)
Ford Ranger (1)
Chevy Luv (1)
Honda 3-wheeler
Ferret 4-wheeler

b. Heavy Equipment

Caterpillar Road Grader
John Deer Forklift
Caterpillar Tractor D-2
Caterpillar Tractor D-4
Farm Tractors:
 John Deere (2)
 Ford (1)
International Dump Truck (2)
Dodge Firewagon with 200 Gallon Water Tank

c. Boats

Grumman Canoe (1)
Alumacraft Boat (1)
Mercury Outboard 4 HP
Evinrude Outboard 9.9 HP

d. Radios

Motorola Base (Fixed)
Mobile Radios (12)
Portable Radios (3)

IV. SAFETY ORGANIZATION

A. Safety Committee

The station safety committee shall be comprised of the Assistant Manager, Forester, Park Ranger and Heavy Equipment Operator. The Assistant Manager will serve as chairman for the committee.

B. Safety Meetings

Monthly staff safety meetings shall be held once a month. Safety committee meetings shall be held quarterly and/or when deemed necessary by the chairman. The secretary shall prepare a record of staff safety meetings on Form R3-SA. The station safety plan will be the subject of one monthly safety meeting each year and reviewed by all employees (See Attachment 4).

V. FIRE SUPPRESSION

Primary responsibility for this section rests with the Refuge Forester. The Fire Boss shall be as specified in the Refuge Fire Management Plan (page 8.9 and Table 8.3).

a. Fire Equipment Maintenance

1. Fire trucks, pickups and other motorized equipment used in fire suppression activities will have engines started once a week during primary spring and fall fire seasons and receive a weekly testing to ensure trouble free operation.

2. All tools on fire trucks will be maintained in excellent condition. Pumper units will be properly secured to prevent shifting and possible injury to operators.
3. First-aid kits and hand tools shall be inspected at the onset of each fire season and maintained in excellent condition.
4. Refresher training shall be provided at the onset of each spring fire season and the step test taken and passed.
5. Employees involved in fire suppression and prescribed burning activities will be required to complete fire training course S-130 and S-190.
6. Personal protective equipment (i.e. hard hats, gloves, fire proof clothing, etc.) shall be carried in fire trucks.
7. Portable radios shall be kept fully charged throughout the fire seasons and other communication equipment regularly inspected to ensure trouble free operation.

b. Fire Equipment Operation

1. Drivers of fire suppression vehicles will not exceed legal speed limits and will drive at speeds appropriate to road conditions.
2. Only permanent staff will be permitted to operate motorized fire fighting equipment.
3. Fire control operations will be coordinated by two-way radio on all fires.

c. Buildings

1. Ladders should be available and properly stored for easy and safe removal in case of fire.
2. All buildings will be equipped with adequate fire extinguishers which will be inspected every six months.
3. Chimneys shall be inspected at the onset of each heating season.
4. Smoke detectors/alarms in refuge buildings shall be checked quarterly.

VI. VEHICLE MAINTENANCE AND OPERATION

A. Maintenance

1. Annual safety checks will be completed on each vehicle.
2. Each operator is responsible for daily checks of his/her vehicle.

B. Operation

1. Defensive driving courses and refresher training will be required of all personnel.
2. All operators must hold a valid operator card (SF-46) for the vehicle being operated. Completed training on ATV's must be indicated on the reverse of the SF-46.
3. Policy for the use of ATV's is contained in the following sources:
 - a. SA-24 AM 4, Regional Release 24-74, dated September 27, 1983, Subject: Motorcycles, Motor Scooters and Three Wheeled Cycles.
 - b. U.S. FWS All Terrain Vehicle Training Guide (green cover) 1985.
4. Operators and passengers of refuge vehicles will be required to wear safety belts at all times.
5. All vehicles will be equipped with a first-aid kit, a fire extinguisher, emergency flashers and flashlights.

VII. HEAVY AND FARM EQUIPMENT

- A. This category includes crawler tractors, road graders, scrapers, tractor trailers, dump trucks and farm equipment.
 1. All equipment in this category will be operated and maintained in accordance with 24 AM 4.
 2. Only experienced operators will operate equipment on slopes, road grades, excavations or other situations where unavoidable hazards exist.
 3. All equipment shall be equipped with roll bars and safety belts. Equipment operated on forested terrain shall be equipped with cabs or canopies to protect the operator.
 4. Back up alarms shall be installed and maintained on all refuge heavy equipment. Slow moving vehicle signs shall be displayed on slow moving equipment.
 5. Only experienced operators shall load and transport heavy equipment.
 6. Operators are responsible for maintaining machines in safe operating condition.

VIII. WATERCRAFT MAINTENANCE AND OPERATION

1. All watercraft shall be operated in accordance with 24 AM 2.
2. All personnel who operate boats and motors should be given training in water safety prior to operation. Safety meetings at

the start of the watercraft season will refresh permanent employees in the principles of water safety and also serve as training for new or temporary summer personnel.

3. Approved life jackets will be worn at all times when engaged in work on the water.
4. Safety equipment required in the boat will be life jacket, fire extinguisher and a distress signaling device (mirror, etc.).

IX. HAZARDOUS MATERIALS

A. Pesticides and Poisonous Chemicals

1. All staff members handling and applying pesticides/herbicides shall receive appropriate training from the Minnesota Department of Agriculture.
2. Handling of poisonous chemicals is restricted to personnel licensed to handle these substances.
3. Personnel handling toxic substances will read the label and follow instructions. Emergency measures in case of accident should also be noted.
4. Protective equipment necessary to handle and apply pesticides will be provided by the refuge.
5. Personnel should avoid inhaling fumes and avoid pesticide contact with exposed skin.
6. Disposal of empty pesticide containers shall follow instructions in the booklet "Apply Pesticides Correctly."
7. Material Data Sheets will be on file for all hazardous materials.

B. Storage and Handling of Explosives

1. Storage, handling, use and disposal of explosives will be done in accordance with 24 AM 5. See Safety Notice, 7/18/75, "Potential Safety Hazards" for additional guidance on storage of explosives.
2. Explosives used are kinepak and rocket net charges.
3. Only personnel with training and experience will be permitted to handle and use explosives.
4. No blasting will be done during hunting seasons. When blasting is necessary near roads or trails, refuge personnel will be stationed at least 250 yards either side of the blast site to stop all vehicles until detonation.

C. Creosoted or Penta-treated Wood Products

1. Personnel will be warned of burn hazards from skin contact from treated materials. Gloves and protective clothing will be worn when working with treated products.

D. Respirators

1. Respirator masks will be provided and worn when working in dusty conditions, when spraying paint or spraying chemicals.

X. SHOP WORK AND TOOLS

A. Power Tools

1. Personal protective equipment for power tools shall be obtained, used and maintained in accordance with 24 AM 3.
2. Power saws, grinders, etc. will be equipped with safety guards that are kept aligned and stable.
3. All electrical equipment shall be properly grounded or double insulated. Power cords will be of three wire type connected to grounded circuits.
4. Inexperienced personnel will be given instruction by qualified personnel before operating power tools.

B. Welding

1. See Regional Instruction 55 24 AM 5, Regional Release 24-29, 8/14/75 for inspection of arc welding helmets.
2. Untrained personnel will not be allowed to operate welders or cutting torches.
3. Adequate ventilation will be provided in welding areas.
4. Proper clothing shall be worn at all times when welding (i.e. gauntlet gloves, coveralls, helmets and faceguards).

XI. HAZARDOUS WORKING CONDITIONS

A. Lifting

1. Personnel will be periodically reminded of proper lifting techniques through personal discussion, booklets or training films.

B. Forest Work

1. See Regional Instruction 55 24 AM 5, Regional Release 24-28, dated 1/13/75 for chainsaw operations.
2. Saws and axes will be kept sharp.

3. Chainsaws will not be operated by untrained personnel.
4. Employees shall be continually aware of nearby workers when preparing to fell a tree and shall give a loud verbal warning when a tree is about to be dropped.
5. Timber workers will wear hard hats and safety chaps while operating chainsaws.

C. Working On Ice

1. Extreme caution is advised when working or walking on ice surfaces. (See attached DNR pamphlet--Danger! Thin Ice).
2. Employees shall wear non-slip creepers when walking on bare ice.

XII. GUN HANDLING SAFETY

1. The firing of enforcement weapons will be allowed only during instances described in Section 11.4 of the Law Enforcement Handbook.
2. Personnel will treat every firearm as though it were loaded at all times.
3. Refuge firearms will be periodically inspected and cleaned. Refuge officers are responsible for the maintenance and security of service weapons assigned to them.

XIII. VISITING PUBLIC-RECREATION

A. Public Hunting

1. Hunter safety will be stressed in planning refuge hunting programs.
2. Hunters will be reminded of unsafe actions observed by refuge employees.
3. Firearm safety regulations (uncased/loaded gun in vehicle or boat with motor) will be enforced.

B. Boating and Fishing

1. State regulations regarding boating safety will be enforced on refuge lakes.
2. The ice fishing public will be warned of unsafe ice conditions by newsreleases and personal contact. When necessary, proper unsafe ice signs will be posted at the specific sites.
3. No private motor vehicles are allowed on ice covered lakes. Use of snowmobiles by special permit may be allowed to remove ice fishing structures.

C. Office/Visitor Center

1. Office and center entrances will have non-skid rugs or carpeting in place to prevent slipping and falls.
2. Step lights will remain on at all times when people are present in the auditorium.
3. Hand rails along the auditorium steps will be periodically inspected and maintained.
4. No smoking will be allowed in the visitor center in accordance with the Minnesota Clean Indoor Air Act.

ATTACHMENT 1

PROCEDURE FOR CONTACTING NATIONAL POISON CONTROL CENTER (800/222-1222):

1. What exactly were they exposed to?
Have the label/container available if possible.
2. What was the mode of exposure?
i.e. mouth, eyes, through the skin, etc.
3. Symptoms experienced by the victim?
i.e. nausea, vomiting, difficulty breathing, etc.
4. Know the weight of the victim.
5. Does the victim have allergies?
Is the victim wearing a medical alert I.D. bracelet?

ATTACHMENT 2

SEVERE WEATHER PROCEDURES:

1. Weather alert radio will be set on alert mode for early warning.
2. All employees in the field will be alerted on the refuge radio that there is a tornado watch or warning in the area.
3. If tornado is sighted, employees and visiting public are to proceed directly to the auditorium.
4. Maintenance personnel are to proceed to either the visitor center auditorium or the basement in the refuge residence, whichever is closest.
5. Personnel in refuge vehicles should move away from the tornado's path at a right angle. If there is no time to escape, lie flat in the nearest depression, such as a ditch or ravine and protect your head. Do not stay in your car.

ATTACHMENT 3

SAFETY TRAINING:

<u>Employees</u>	<u>Course Title</u>	<u>Dates</u>
Walls, Darold T. Refuge Manager	Defensive Driving S-130 & S-190 Multi-Media First Aid LE Refresher ATV Refresher Training	2/4-5/86 1984 3/4/86 2/23-27/87 6/2/87
Ondler, Theodore D. Assistant Manager	Regional Pesticide Applicator Defensive Driving S-130 & S-190 LE Refresher Multi-Media First Aid ATV Training	4/1-2/87 2/4-5/86 5/12-16/80 2/23-27/87 3/4/86 6/2/87
Brock, Cyrus G. Forester	Regional Pesticide Applicator Defensive Driving Fire & Resource Management S-130 & S-190 Multi-Media First Aid* ATV Training	4/1-2/87 2/4-5/86 1/16-27/84 2/27-3/3/78 11/17/78 6/2/87
Deede, Lowell C. Wildlife Biologist	Defensive Driving S-130 & S-190 LE Refresher Multi-Media First Aid ATV Refresher Training	2/4-5/86 7/13-16/81 2/23-27/87 3/4/87 6/2/87
Winter, Darrell L. Heavy Equipment Operator	Blasting Seminar Heavy Equipment Training Multi-Media First Aid* Hydro-Ax Training Regional Pesticide Applicator Defensive Driving S-130 & S-190 ATV Refresher Training	8/6-7/86 9/17-21/84 6/21/83 1/8-9/85 1/16/85 2/4-5/86 2/27-3/3/78 6/2/87
French, John D. Maintenance Worker	Defensive Driving S-130 & S-190 Blasting Seminar Heavy Equipment Training Multi-Media First Aid* ATV Refresher Training	2/4-5/86 4/17-18/84 8/6-7/86 9/17-21/84 6/19/84 6/2/87
Bartosch, Renee F. Secretary	Defensive Driving Nurses Aid Training-Multi-Media First Aid*	2/4-5/86 12/77-10/78
Beneke, Elizabeth A. Park Ranger	Multi-Media First Aid* Defensive Driving	New Employee 1985

*Training is being scheduled for this year.

ANNUAL REVIEW

Employee Name

Signature and Date

[illegible]

cracks refrozen, cross the cracks at right angles and avoid parking near them.

6. If you drive on ice, remember, it is only a film across a water surface. Weight moving across this film causes it to bend up and down in the form of long waves which roll out and away from a vehicle as it moves across the ice. U.S. Army researchers discovered that wave action may crack the ice if the vehicle is moving at a "critical speed" (see table).

Speeds above or below this critical speed substantially reduce the danger of cracking. Higher speeds are usually not recommended for other reasons, except over very shallow water. So drive slowly. Following closely behind other cars is not recommended, since you may interrupt their wave action with your own, causing a break in what would otherwise be safe ice.

7. Often cars will establish roads from shore to the current fishing "hotspot." After repeated use, these roads may cause the ice to weaken. Therefore, they may not be the safest route.

8. If you're on a snowmobile or driving a vehicle, be especially cautious at night or when it's snowing. The falling snow or darkness obscures thin ice or open holes.

9. Should you break through the ice, proper clothing can increase your chances of survival. An ordinary nylon snowmobile suit, if it is zipped-up, can trap air and slow the body's heat loss. Snowmobile suits are available with inflatable flotation elements. You can also use one of the newer vest-type, foam, personal flotation devices (PFD or life preserver) from your boat. One of these devices worn under your outer clothing will keep you warm (like an insulated vest), help conserve body heat, and keep you afloat. (Caution: Don't wear a PFD if you are inside a car or truck traveling on the ice. If your vehicle submerges, the PFD could hamper your escape.)

10. Carry a couple of large nails and a length of light nylon rope in your pocket. The nails can help you pull yourself out of the water and onto the slippery ice. Use the line to rescue someone else.

Critical Velocity of Moving Loads on Ice

Water Depth (feet)	4	6	8	10	15	20	30
Critical Velocity (mph)	9	11	12	14	17	19	22

dow out of its frame pressing against the corner of the window with feet or shoulder.

Once the car starts to sink, the amount of time and air left to work with is greatly reduced. Water will rapidly displace the remaining air which will escape through the cab and trunk.

An air bubble can remain in a submerged vehicle, but it is unlikely that such a bubble would remain after the car reaches bottom. Thus, escape chances have greatly diminished.

Once the car is filled with water the doors will be a little easier to open. But the time you need to remove children or injured persons is no longer available. This underscores the importance of beginning escape procedures through the windows while the car is still afloat.

Even if you escape (with no more harm than a cold bath), your problems aren't over. According to salvage experts, it will cost you from \$300 to \$2,000 or more to get the vehicle out of the water and refurbish it. Sometimes a tow truck can't do the job and a helicopter is required. That really can be expensive!

Remember, common sense is your greatest ally in preventing ice accidents. Assess ice conditions calmly and prepare yourself before venturing out on a lake or stream. Five minutes of checking ice from shore, as well as systematic checks while on the ice, can make the difference between an enjoyable outdoor experience and a tragedy.

FILMS

The DNR also has two films for free loan which review ice safety procedures: *Ice Safety* and *Water the Timeless Compound*. Also available is *By Nature's Rules*, an excellent film on hypothermia. For information on borrowing these films, contact the DNR film library at the address below.



Boat and Water Safety
Minnesota Department
of Natural Resources
500 Lafayette Road
St. Paul, MN 55146

Written by Kim Elverum, MN DNR Boat and Water Safety Coordinator.

Design, layout, and photography by Tim Smalley, MN DNR Boating Safety Specialist.

Tom Borchardt, Steve Hallin, Marcia Milbrath, and Dave Marquart, provided valuable assistance in the preparation of this pamphlet.

Front cover: Sign erected near many aeration systems, culverts, and other thin ice areas. Diamond shape signifies danger.

9/85-50M

DANGER!



ATTACHMENT 5



Insurance company staged this breakthrough for water safety film. Car sank within 45 seconds, turned over, and settled on top.

When is ice safe? There is no sure answer. Ice is tricky, and just because a lake or stream is frozen doesn't mean the ice is safe.

To understand the factors involved in the strength of ice, it's necessary to understand how ice forms on lakes and streams and a few of its physical properties. Here are points to consider, some based on research by the U.S. Army Cold Regions Research and Engineering Laboratory in New Hampshire.

You can't tell the strength of ice just by its appearance, the daily temperature, thickness, or whether the ice is or isn't covered with snow. Strength of ice, in fact, is based upon all four factors — plus the depth of water under the ice, size of water body, water chemistry, distribution of the load of the ice, and local climatic factors.

Generally speaking, new ice is much stronger than old ice. Direct freezing of lake or stream water will be stronger than ice formed by melting snow, re-frozen ice, or ice made by water bubbling up through cracks and freezing on the surface. Several inches of new ice may be strong enough to support you, while a foot or more of old, "rotten" ice may not.

Ice seldom freezes or thaws at a uniform rate. It can be a foot thick in one spot while, 10 feet away, only an inch thick.

A layer of snow insulates ice, slowing down the ice-forming process. In addition, the weight of snow can decrease the bearing capacity of the ice.

Ice near shore is weaker. The buckling action of the lake or stream over the winter breaks and refreezes ice continually along the shore.

If you hear ice "singing" or cracking on cold days or still evenings, it doesn't necessarily mean the ice is dangerous, merely that it's changing shape as the temperature changes.

Ice formed over flowing water can be dangerous near shore, around inflowing or outflowing streams, or on lakes containing large numbers of springs. River ice is generally about 15 percent weaker than ice on lakes. Straight, smooth-flowing stretches are safer than river bends. River mouths are dangerous because the current undermines the ice and creates unsafe pockets. A potential danger spot on lakes is an open portion completely surrounded by ice. Winds will force exposed water beneath the ice and rot it from below.

Other factors which weaken ice are water level fluctuations and the actions of birds and fish. As an example, schools of carp create thin ice spots or even open water by congregating in one location while circulating the water with their fins.

ICE TIPS

Once you understand the physical properties and problems with ice, you can understand why ice is so unpredictable and why the only absolute safety factor on ice is to stay off. If you are an ice fisherman, cross-country skier, ice skater, snowmobiler, or ice boater, however, staying off the ice is going to crimp your winter fun. So, for those who venture onto the ice, whether on foot or in a vehicle, here are some tips to lessen your chances of a breakthrough:

1. Clear, solid ice at least two inches thick is usually sufficient to hold a single person walking on foot. Ice fishing requires at least four inches, and a snowmobile five inches. Automobiles and light trucks require at least eight inches to a foot of ice. (Remember, however, these are merely guidelines; the factors mentioned previously must be considered!)

2. Before you head onto ice, check with a local bait shop operator, resort owner, or angler for known thin ice areas, or aeration operations which have created open water.



Two short lengths of broom handle with nails sharpened on both ends and joined with piece of string can be carried easily in pocket. In case of emergency, and while kicking, drive nails into ice ahead and pull yourself to safety.

3. Refrain from driving on the ice with your car or truck whenever possible. Travel in a vehicle, especially early or late in the season, is simply a matter of an accident looking for a place to happen.

4. If you must drive a vehicle, be prepared to leave it in a hurry. Unbuckle your seat belt and have a simple plan of action in case you break through. Some safety experts recommend the doors be left open and windows down for an easy exit.

5. Parking a vehicle in one spot tends to weaken ice. When ice thickness is marginal, prolonged parking is not recommended. Vehicles should be moved

from time to time so the ice can resume its "normal" position and shape.

A car parked on ice one-foot thick will depress the ice an inch within a diameter of 200 feet. Cars parked close together may increase the load beyond the bending limit, causing the ice to break.

Bending, however, gives added buoyancy since the ice becomes somewhat boat-shaped as it rests on the water underneath. But if the ice cracks, the added buoyancy is lost. A car surrounded by ice cracks has only the buoyancy of that single piece to support it. In any case, when driving across ice which has