AVALANCHE NEWS NO. 20

FEBRUARY 1986

EDITORIAL NOTE

The intention of AVALANCHE NEWS is to assist communication between persons and organizations engaged in snow avalanche work in Canada. Short articles cover reports of accidents, upcoming and past events, new techniques and equipment, publications, personal news, activities or organizations concerned with avalanche safety, education and research. Contributions are expected from the readers.

AVALANCHE NEWS is issued three times per year, usually in February, June and October. There is no subscription fee. Requests for copies and notifications of changes of address should be sent to the publisher.


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AVALANCHE NEWS

Canadian Avalanche Association, 3904 West 4th Ave., Vancouver, B.C., V6R 1P5

FEBRUARY 1986 NO. 20

# AVALANCHE HAZARD FORECASTING IN BACKCOUNTRY GUIDING

Submission by Peter Schaerer, Ed LaChapelle,
Chris Stethem, Hans Gmoser and Jeff Boyd

In Avalanche News No. 19 (November 1985), Peter Schaerer discussed the court decision of a trial in which a skiing company and a guide were found negligent in causing an avalanche accident. The objective was to draw the attention of avalanche workers to possible outcomes of legal actions after an accident, but the report in Avalanche News might lead to wrong conclusions. The authors of this contribution wish to clarify a few points because the report in Avalanche News No. 19 might be interpreted erroneously with respect to the way avalanche hazards are forecasted in ski guiding as well as to the need and frequency of making snow profile observations.

Avalanche hazard forecasting is carried out by collecting and analyzing numerous observations. Some of them are standardized and must be recorded in a recommended format, for example weather and snowpack observations on a study plot, but the majority and most significant ones are made on an "as you go" basis in the field and to an extent which is dictated by the terrain, previous knowledge of the snow conditions, and the type of application concerned. While terrain analysis and the selection of routes are the primary concern, the evaluation of snow stability uses the following information:

a) Avalanche activity rated according to elevation and exposure and indicating the slopes where unstable snow has been removed;

b) Previous slope use producing compaction and ski stabilization;

c) Current weather including field observations of the direction and magnitude of the wind, air temperature and radiation;

d) Snowpack distribution assessed from visual observations, probing and test profiles during travel;

e) Critical layering, identified in snow profiles and by probing, and snow temperatures;

f) Slope tests through skiing, feeling the reaction of the snow under the skis, and shovel shear tests at critical locations for identification of shear planes.

Snow profiles, while useful in assessing snow stability, are not the key ingredient as it might appear by reading Avalanche News No. 19. In fact, past experience has shown that placing too much emphasis on snow profiles alone could lead to fatal conclusions. While periodic snow profiles at carefully selected study plots give a good indication of the general developments in the snowpack mainly with respect to deep instabilities, snow profiles at higher elevations and at randomly selected sites usually give readings useful only for very small areas.

Selecting sites, then digging and observing snow profiles on each run and every day becomes an impossible task in large areas such as are covered in helicopter skiing as well as in ski and mountain guiding. Therefore, one digs only a few profiles at carefully selected spots for a check of the conditions that were determined from knowledge of the past weather and snowpack evaluations. There is no rule how frequently snow profiles must be observed; the amount of previous knowledge of the weather and the snowpack, the terrain and the type of operation would determine the need for information. The authors wish to make it clear also that snowpit observations give an indication of the stability of a given slope, but they do not indicate whether or not a slope would slide under ski loading.

In well defined areas where avalanche hazards are evaluated continuously, such as in ski areas and highway operations, the information is analyzed in a formal way by examining critical factors, plotting storm profiles, and referring to similar situations in the past. In ski guiding, much similar information is also analyzed but on a less formal basis while travelling by adding to and improving previous conclusions. Personal experience plays an important role in the analysis of the numerous clues. Avalanche hazard forecasting in guiding requires experience in recognizing hazardous terrain and the ability to evaluate the conditions of the snowpack from snow, weather and avalanche observations. This process in fact has a sound scientific basis but cannot be reduced to an arbitrary set of rules.

## AVALANCHE ACCIDENTS IN CANADA

Submission by Peter Schaerer

### Number of Accidents

The Avalanche Centre of the National Research Council of Canada is collecting information about avalanche accidents and incidents in Canada. Two publications describing accidents before 1979 are available (see references) and a third one containing the accidents from 1979 to 1984 is in the process of being copy-edited and printed. The Avalanche Centre has complete information regarding all accidents which have resulted in death or significant property damage since 1969, and information regarding major accidents before 1969. Information concerning both fatal accidents and persons or property involved in avalanches has been collected since 1979.

The enclosed table is a summary of the number of fatal accidents and the amount of property damage which occurred between 1969 and 1985, stratified according to the activities of the persons killed in avalanches. The fatalities near ski areas concern skiers who skied close to but outside maintained and controlled ski runs. Backcountry skiers include people who were cross country skiing, ski mountaineering or reached the top of a mountain by helicopter or snowcat. Mountain climbers refer to all those who climbed or hiked on foot in the winter and in the summer. The category "other recreation" contains operators of snowmobiles, people with toboggans and on snowshoes.

On the average there are seven fatalities per year, and as can be seen from the table, over the years a shift has occurred from fatalities occurring in buildings, on roads, and at work to fatalities occurring during recreational activities.

Property damage includes destroyed and damaged buildings, bridges, tramways, chair lifts, electric transmission lines, machinery, railway equipment and road vehicles. The total actual value of damage is greater than shown in the table because small damage usually goes unreported and additional losses occur when the service on roads, railways, powerlines and mines is interrupted. Often the value of lost service is greater than the cost of replacing destroyed structures and equipment but this can be difficult to estimate. A fair estimate of the average property damage would be about one million dollars per year when all unreported avalanche events and losses from the interruption of services were included.

NUMBER OF FATAL ACCIDENTS AND REPORTED PROPERTY DAMAGE
1969-1985

| Year | Number Fatal Accidents | Number of Persons Killed | | | | | | | Property Damage | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | In Buildings | On Roads | Near Ski Areas | Back Country Skiers | Mountain Climbers | Other Recreation | Total | Number Cases | Estimated Value ($) |
| 1969-70 | 1 | | | 1 | | | | 1 | 1 | 520,000 |
| 1970-71 | 2 | | | | | 4 | | 4 | 2 | 280,000 |
| 1971-72 | 8 | | 6 | 5 | 1 | 4 | 2 | 18 | 4 | 700,000 |
| 1972-73 | 1 | | | | | | 1 | 1 | 3 | 800,000 |
| 1973-74 | 4 | 7 | | 1 | 2 | | | 10 | 3 | 900,000 |
| 1974-75 | 0 | | | | | | | 0 | 0 | 0 |
| 1975-76 | 3 | | 3 | | 1 | | 1 | 5 | 1 | 20,000 |
| 1976-77 | 9 | | | 2 | 6 | 4 | 1 | 13 | 0 | 0 |
| 1977-78 | 3 | | | | | 5 | 1 | 6 | 0 | 0 |
| 1978-79 | 7 | | | 1 | 11 | 1 | 1 | 14 | 6 | 1,300,000 |
| 1979-80 | 3 | | | | 1 | 2 | | 3 | 1 | 150,000 |
| 1980-81 | 6 | | | | 8 | 2 | | 10 | 1 | 20,000 |
| 1981-82 | 8 | | 1 | 1 | 2 | 7 | | 11 | 2 | 10,000 |
| 1982-83 | 6 | | | 1 | 1 | 3 | 1 | 6 | 1 | 20,000 |
| 1983-84 | 3 | | | | | | 4 | 4 | 1 | 200,000 |
| 1984-85 | 4 | | | | 5 | | 1 | 6 | 3 | 700,000 |
| TOTAL 16 YEARS | 68 | 7 | 10 | 12 | 38 | 32 | 13 | 112 | 29 | 5,620,000 |
| PERCENT | | 6 | 9 | 11 | 34 | 28 | 12 | 100 | | |

## Most Frequent Mistakes

Accidents occur when either the terrain or the snow stability was judged safe and was not, or when people made errors in their actions after recognizing unsafe conditions. The accident case histories collected by the National Research Council of Canada Avalanche Centre show that mistakes were made repeatedly by failing to recognize the following:

Deposition of wind-transported snow;

Possibility of avalanches releasing above a travel route;

Terrain traps;

Steep slopes, trees, rocks, crevasses below a travel route;

Unstable layers and weak bonding deep in the snowpack;

Decrease of snow stability owing to a high air temperature or solar radiation;

Possibility of a second avalanche in the same path when one avalanche had occurred;

Danger of concentration of people in an avalanche path;

Need to wear transceivers and to carry shovels;

Importance of a search for clues on the surface after a burial.

## Errors in Terrain Analysis

Many backcountry travellers do not seem to have the skill needed to recognize the subtle variations of the terrain that cause depositions of drifting snow. Accidents have occurred when snow slabs fractured at the lee side of small ridges running in the fall line of long slopes, in shallow cirques where one side was more subject to deposition of wind-transported snow than the other, and below rolls of terrain.

Avalanches from above caught numerous skiers and snowmobilers who crossed slopes not steep enough to slide. The weight and motion of the travellers, however, produced a local failure which propagated to steeper slopes above. Other skiers were deeply buried in avalanches from short slopes in narrow valleys. The avalanches might have been harmless if the snow had not piled up so deeply. Obstacles such as rocks, trees and crevasses below a travel route were the cause of injuries when people were swept away even by small avalanches. Collisions with rocks and burials in crevasses were the most frequent causes of death for mountain climbers caught in avalanches. The lesson that can be drawn is that steep and rough terrain or a narrow valley below a travel route strongly increases the risk. One should always consider the consequences of being swept down by even a small avalanche.

## Errors in Snow Stability Evaluation

Errors in snow stability evaluation can be traced to failures in recognizing deep slab instabilities and influences of weather changes. Weaknesses deep in the snowpack were the most frequent cause of accidents to skiers and snowmobilers. Often the snow at the surface was well consolidated giving an appearance of stability which hid snow of a low cohesion below. Layers of surface hoar were more frequent failure planes and lubricating layers for avalanches than crusts and depth hoar. Fractures in depth hoar at the ground surface were common in December, but later in the winter the snow usually failed initially near the surface and broke into the depth hoar after it was in motion.

Snowfall, wind, high temperatures or a combination of these on the day of the accident or the day before was responsible for the poor snowpack stability in 55 percent of the accident cases between 1979 and 1984. Snowfall usually could be recognized readily as a cause of avalanche hazard, but people sometimes failed to recognize the significance of high temperatures and high wind. Accidents have occurred when a rapidly rising air temperature or sun produced unstable snow before climbing parties could retreat to safety, or when a high air temperature during the night prevented the snow from cooling and gaining strength in the early morning hours.

## Action of People

The accident cases again have demonstrated the importance of the safety measures recommended in the avalanche handbooks and pamphlets. Measures that have contributed significantly to the survival of people caught in avalanches include:

a) wearing transceivers and carrying shovels;

b) being mentally alert and prepared for an encounter with avalanches;

c) fighting to remain at the surface when carried down by the avalanche;

d) sticking a hand to the surface when the avalanche stopped (this produces a vent for air as well as aiding the hasty search);

e) quick action by eyewitnesses who often located the buried persons from objects on the surface faster than by a transceiver search.

Unfortunately, the following old errors were repeated:

a) cars stopped in avalanche paths;

b) maintenance crews removed snow in avalanche paths without observing safety measures and were hit by a second avalanche;

c) skiers and hikers travelled alone, and were found too late after burial in an avalanche;

d) parties crossed avalanche paths with insufficient spacing between individuals;

e) transceivers were not worn;

f) parties had an insufficient number of shovels;

g) hands were in ski pole wrist loops and safety straps were attached to skis and boots;

h) survivors panicked and walked away rather than making a hasty search.

Hazard to Snowmobile Operators

To run a machine up a steep slope as far as its power allows and then make a quick turn seems to be one of the pleasures derived from snowmobiling. Unfortunately, steep slopes are also likely avalanche paths and the weight and vibrations of the machine provide triggers for avalanches. Eight snowmobilers have lost their lives in avalanches between 1973 and 1985.

Snowmobilers usually travel in groups. Lives could have been saved if all party members had worn transceivers or had at least been equipped with probes and shovels and started probing and shovelling close to the last seen point or a partially buried machine. In four of the eight cases a part of the snowmobile was visible at the surface and the operator was found later by a rescue party within a five metre distance of his machine. The victims could have been found more quickly through transceiver search and probing by the survivors.

There appears to be a need for education of snowmobile operators in recognizing hazardous terrain, the use of safety equipment, and the action to take once an accident has occurred.

References

Stethem, C.J. and Schaerer, P.A.

a) Avalanche Accidents in Canada I: A Selection of Case Histories of Accidents, 1955 to 1976; Publication NRCC 17292 ($1.50).

b) Avalanche Accidents in Canada II: A Selection of Case Histories of Accidents, 1943-1978; Publication NCC 18525 ($3.50).

Both books are available from Publication Sales, National Research Council, Ottawa, Ontario, K1A OR6.

## REVIEW OF OBSERVATION GUIDELINES

As reported in Avalanche News #19, a Committee has been formed to re-examine the Guidelines for Weather, Snowpack, and Avalanche Observations. The Committee shall consider concerns arising from:

a) omissions;

b) ambiguities;

c) significant discrepancies in terms with those used by other agencies;

d) new techniques for accepted observations;

e) new observations which become accepted for standard use.

Proposals for changes to the guidelines should be addressed to the Canadian Avalanche Association, 3904 West 4th Avenue, Vancouver, B.C., V6R 1P5, or may be transmitted by word of mouth to one of the Committee members: Walter Schleiss, Jeff Boyd, Janice Johnson or Peter Schaerer before April 1986.

## CANADIAN AVALANCHE ASSOCIATION

### Business of the Directors

The Directors of the Canadian Avalanche Association met on September 25, 1985, in Vancouver and on November 23, 1985 in Creston. Following are the highlights of their business.

Amendments to the by-laws concerning membership, specifically the creation of categories of inactive and honorary members were discussed. The new by-laws will be proposed as a special resolution to the members at the next general meeting.

Brian Leighton had crests made for hats, shirts and jackets. Each active member shall receive a free crest. Additional crests, as well as hats, toques and shirts with a crest will be sold at cost to members.

The Association wrote to the Minister of Environment Canada requesting improvements to the mountain weather forecast and to the Chief Coroner of British Columbia offering the services of the members for the investigation of avalanche accidents.

The Directors resolved not to continue the reporting of all serious accidents immediately after the event as was initiated in the 1984-1985 winter because the communication system was inadequate and there appeared to be no strong need.

The Directors passed a motion that members must only state their membership with the Canadian Avalanche Association when they advertise their services, but must not imply that the membership is a qualification for avalanche hazard forecasting. The motion will be presented at the Annual General Meeting.

New active members are: Jack Bennetto, Tom Van Alstine, Ruedi Beglinger, Kris Newman, Bryan Keefer.

Annual General Meeting

The Annual General Meeting, exchange of technical information and social gathering, will be held on May 15-16, 1986, in Kelowna, B.C. The members of the Association will be notified by mail regarding the location, time and agenda. The Directors invite the active and associate members to propose items for discussion in the technical and business meetings. At the business meeting the active members will be asked to vote on amendments to the by-laws concerning the formation of inactive and honorary membership.

It should be noted that the meetings are open only to active members, a limited number of representatives of associate members of the Canadian Avalanche Association and specially invited guests.

Membership Cards

Active members who have paid their 1985 annual dues have received by mail their membership card. Those who have not received the card may be in arrears with the Association and will be issued a card when they have paid their dues. The Directors plan to develop and issue membership certificates for associate members.

## TRAINING AVALANCHE DOGS

Submission by Michael Morris,
RR 1, Site 9, Comp. 1,
Golden, B.C., V0A 1H0

The Canadian Avalanche Rescue Dog Association (CARDA) represents amateur dog handlers in British Columbia and Alberta who are actively training themselves and their dogs.

A non-profit, volunteer organization, CARDA runs training courses for persons interested in developing avalanche rescue dogs, and hopes eventually, to establish a network of avalanche rescue dog and master teams in western Canada. Training standards are the same as those adopted by the R.C.M.P. and the Parks Canada Warden Service.

Before search training can begin, the dog must be obedient to basic commands such as sit, stay, heel, come and fetch. Introductory training courses show dog handlers what skills and experiences are needed, and participants practice search techniques used to locate avalanche victims. Dog and master are also familiarized with travel on chair lifts, snow machines and helicopters, which are often used in real emergencies.

Interested persons should be competent in winter backcountry travel and the dog must be sufficiently robust to handle working in deep snow and cold weather. The most popular breeds so far are the German Shepherd and the Golden and Labrador Retrievers, though any dog with a strong instinct to search can be considered.

For more information, contact CARDA Chairman Rod Pendlebury at: Box 364, Fernie, B.C., V0B 1M0 (telephone: 604-423-7932).

The dates of the forthcoming course in Fernie have been changed to March 20-23, 1986.

## COMPUTERS

In response to a request in Avalanche News #19, the following information was received from organizations that use computers for avalanche hazard forecasting.

1. British Columbia Ministry of Transportation and Highways

   Computer Hardware and Software Used by the Snow Avalanche Section as of October 3, 1985:

   Hardware
   - Wang micro-computers
   - IBM micro-computers
   - Compaq micro-computers
   - Hayes Smartmodems
   - Epson FX-100 printers
   - Hewlett-Packard Thinkjet printers
   - Digital Decwriter Correspondent (portable terminal)

   Software
   - Crosstalk (Communications)
   - Wylbur
   - Lotus 1-2-3 (Spreadsheet)
   - Wang word processing

2. Banff National Park

The computer in use at the Sunshine office is part of a weather telemetry system which gathers data from four remote stations. The computer receives data from these stations, stores it on floppy disks, displays it on a printer and terminal and transmits it by phone lines to printers at the Banff and Norquay Warden offices.

The computer equipment consists of:

- Northstar Horizon II micro-computer with 32K RAM and 2-5 1/4" disk drives
- three Centronics Model 730-3 impact serial printers
- one Lear Siegler ADM-3A terminal
- three General DataComm 108-3 modems

This equipment is only able to run the telemetry system and cannot be expanded to perform additional tasks. We have submitted funding requests for a computer system which would have the capability to store and interrogate the historical data collected by the Lake Louise, Norquay and Sunshine avalanche control programs.

## PUBLICATIONS

LaChapelle, E.R., 1985

The ABC of Avalanche Safety. The Mountaineers, 306 Second Avenue West, Seattle, Washington, 98119; and Douglas & McIntyre Ltd., 1615 Venables Street, Vancouver, B.C., V5L 2H1; 112 p. Price $3.95 U.S.

Ed LaChapelle has completely rewritten and updated this popular pocketbook on avalanche safety. Starting with the properties of the snow cover, the text analyzes the different types of avalanches and the terrain subject to avalanche formation. The author then presents practical guidelines for determining stability of snow slopes, rules for travelling in avalanche terrain, and how to react when caught in an avalanche. The section on rescue includes a discussion of technical aids for locating a victim. Several case histories of avalanche accidents are described and analyzed.

The booklet is addressed to a wide range of readers from the beginner to the experienced avalanche hazard forecaster. Of special interest to the latter is the discussion of avalanche hazard forecasting where Ed LaChapelle has summarized in plain language the results of his studies about approaches to snow stability evaluation. This information is not available in similar form anywhere else.

International Glaciological Society, 1985

Annals of Glaciology, Vol. 6. Proceedings of the Symposium on Snow and Ice Processes at the Earth's Surface; held in Sapporo, Japan, September 2-7, 1984. International Glaciological Society, Lensfield Road, Cambridge CB2 1ER, England, U.K.; 329 p. Price £45.00.

The publication contains 92 papers presented at the conference. The subjects include avalanche dynamics; metamorphism, thermodynamics and measures of properties of snow; blowing snow, ice, mass and heat exchange at the snow/ice surface. The following 8 papers deal with avalanches:

E. Hestnes. A contribution to the prediction of slush avalanches. (Description of the terrain features and weather conditions that have produced slush avalanches in Norway).

L. J. Onesti. Meteorological conditions that initiate slush flows in the Central Brooks Range, Alaska. (Study of weather conditions linked with slush flows).

T. E. Lang, T. Nakamura, J. D. Dent, M. Martinelli, Jr. Avalanche flow dynamics with material locking. (Flow equations for avalanches at a slow motion in the runout zone).

T. Nakamura, O. Abe, N. Numano, T. E. Lang. Computer study of snow avalanche startup dynamics (Comparison of computer models for the motion in the initial phase of avalanches).

D. M. McClung, P. A. Schaerer. Characteristics of flowing snow and avalanche impact pressures. (Results of speed and impact pressure observations at Rogers Pass. Peak and average pressures on small and large loading plates are discussed for dry and wet avalanches).

H. Norem, T. Kvisteroy, B. D. Evensen. Measurement of avalanche speeds and forces: instrumentation and preliminary results of the Ryggfonn project. (Observations of speeds and impact pressures of avalanches on a steel mast, a concrete structure and a transmission line at the experimental site in Norway).

B. Salm, H. Gubler. Measurement and analysis of the motion of dense flow avalanches. (Observation of avalanche speeds and flow depth by radar in Switzerland. Analysis of the mode of flow either as sliding, partly fluidized or fully fluidized).

Y. Endo. Release mechanisms of an avalanche on a slope covered with bamboo bushes. (Investigation of the glide speed and stresses in the snow cover).

# INTERNATIONAL SNOW SCIENCE WORKSHOP

October 22-25, 1986
Lake Tahoe, California, U.S.A.

## Objectives

The theme of the conference is "a merging of theory and practice". Following in the tradition of the workshops in Banff, Vancouver, Bozeman and Aspen, this workshop will provide an opportunity for the mutual exchange of new information and ideas between those engaged in the study of theoretical, professional and recreational aspects of snow.

## Topics

The workshop will be concerned with all aspects of snow science, with particular emphasis on the following topics:

1. Snowpack stability evaluation and avalanche forecasting;
2. Avalanche control techniques;
3. Avalanche protection and liability (engineering and design, zoning, public education, public warning systems);
4. Avalanche dynamics;
5. Physical and chemical properties of snow;
6. Snow formation and mountain meteorology;
7. The effect of wind on snow deposition, distribution and structure (theory, measurement and effect on stability);
8. Instrumentation and methodology;
9. Snow management (recreation, safety and water resources);
10. Avalanche and winter search and rescue techniques;
11. Other relevant topics.

The conference committee would like to make it clear that they are encouraging presentations involving descriptive narratives and/or case histories of successful field methods, as well as quantitative analysis of specific scientific topics.

Attendance will be limited by space to 300 participants. Based on the attendance at previous workshops, we can expect the Tahoe Workshop to fill early. If you plan to attend, please send in your registration form and fee as soon as possible.

The workshop will be four days in length, with October 22, 23 and 25 (Wednesday, Thursday and Saturday) devoted to papers and poster sessions, Friday, October 24 for the field session, and a concluding banquet on Saturday evening, October 25.

We encourage all persons interested in giving a presentation on any of the suggested topics to submit an extended abstract (500-1000 words) to the conference committee immediately. These extended abstracts will not be published, but for accepted papers, a shortened abstract (50-250 words) and a written paper, both in camera ready form, will be requested for publication in the conference proceedings. The short abstracts will be printed for distribution at the workshop.

Registration Fees

| | |
|---|---|
| Before March 1, 1986 | $45.00 |
| After March 1, 1986 | $55.00 |

Remember, we are limited by space to 300 participants, so register early!

Address for Registration and Information

ISSW Conference Committee
P.O. Box 567
Homewood, California, 95718 U.S.A.

## SNOW ENGINEERING COURSE

A post-graduate short course is intended for engineering and scientific personnel who are increasingly having to find solutions to snow problems with limited knowledge of the required fundamentals. The course covers properties of the snow cover, measurement and interpretation of snow cover data, snow drifting, snow melt and transmission.

Date: April 21-25, 1986

Location: The Banff Centre
Banff, Alberta

Fee: Regular $690; Students $230

Registration: Division of Extension and Community Relations
University of Saskatchewan
Saskatoon, Saskatchewan
S7N OWO
Telephone: (306) 966-5539

AVALANCHE RESOURCE AGENCIES

JANUARY 1986

1) AVALANCHE CONDITIONS, SEARCH AND RESCUE

The following agencies and individuals maintain continuous observations of the snow stability and avalanche hazards in their areas. They are also equipped for search and rescue work.

National Parks

Banff National Park:

Correspondence:

The Chief Warden
Banff National Park
P.O. Box 900
BANFF, ALBERTA TOL 0C0

Information concerning avalanche conditions:

Taped message on telephone 403-762-3600
Banff Wardens' office (open 24 hours per day)
Lake Louise Wardens' office 403-522-3866

Avalanche control offices at:

| | | |
|---|---|---|
| Sunshine Village | Telephone: | 403-762-2693 |
| Lake Louise | Telephone: | 403-522-3982 |
| Mt. Norquay | Telephone: | 403-762-2640 |

Emergency telephone: 403-762-4506

Jasper National Park:

The Chief Warden
Jasper National Park
P.O. Box 10
JASPER, ALBERTA TOE 1E0

| | | |
|---|---|---|
| Warden Office (during office hours) | Telephone: | 403-852-6156/6157 |
| (24 hours) | Telephone: | 403-852-6161 |

Glacier and Mount Revelstoke National Parks:

Correspondence:

The Superintendent
Glacier and Mount Revelstoke National Parks
P.O. Box 350
REVELSTOKE, B.C. V0E 2S0

Information concerning avalanche conditions:

| | | |
|---|---|---|
| Parks office at Revelstoke | Telephone: | 604-837-5155 |
| Information office at Rogers Pass | Telephone: | 604-837-6274 |

Search and rescue:

| | | |
|---|---|---|
| The Chief Warden, Revelstoke | Telephone: | 604-837-5155 |
| Wardens' office, Rogers Pass | Telephone: | 604-837-6274 |

Yoho National Park
Box 99
FIELD, B.C. V0A 1G0 Telephone: 604-343-6467

Attention: Chief Park Warden

Kootenay National Park
Box 220
RADIUM HOT SPRINGS, B.C. V0A 1M0 Telephone: 604-347-9615

Attention: Chief Park Warden

Waterton Lakes National Park
WATERTON, ALBERTA T0K 2M0 Telephone: 403-859-2352

Attention: Chief Park Warden

Kluane National Park
Haines Junction
YUKON Telephone: 403-634-2251

Attention: Chief Park Warden

British Columbia Ministry of Transportation
and Highways

Geoff Freer, Head
Snow Avalanche Section
940 Blanshard Street
VICTORIA, B.C. V8W 3E6 Telephone: 604-387-6361

Janice Johnson
Snow Avalanche Section
940 Blanshard Street
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Jim Bay
Snow Avalanche Section
940 Blanshard Street
VICTORIA, B.C. V8W 3E6 Telephone: 604-387-6361

District Avalanche Technicians:

Gordon Bonwick
1690 Main Street
NORTH VANCOUVER, B.C. V7J 1E3 Telephone: 604-987-9311

Ed Campbell
Box 579
HOPE, B.C. V0X 1L0 Telephone: 604-869-2401

Jack Bennetto
Bag 4500
MERRITT, B.C. V0K 2B0 Telephone: 604-378-9359

Scott Aitken
Box 460
LILLOOET, B.C. V0K 1V0 Telephone: 604-256-4255

John Tweedy
238-10th Avenue
CRESTON, B.C. V0B 1G0 Telephone: 604-428-3242

Bruce Allen
1100 West 2nd Street Telephone: 604-837-7646
REVELSTOKE, B.C. V0E 2S0 or 604-837-7685

Allan Dennis
P.O. Box 490
STEWART, B.C. V0T 1W0 Telephone: 604-636-2294

Mike Zylicz
#300-4546 Park Avenue
TERRACE, B.C. V8G 1V4 Telephone: 604-638-3324

The Ministry of Transportation and Highways have trained personnel and rescue equipment on all mountain highways with avalanche problems.

Parks Branch of British Columbia Ministry of Lands, Parks and Housing

Parks & Outdoor Recreation Division
East Kootenay District
Box 118
WASA, B.C. V0B 2K0 Telephone: 604-422-3212

Parks Branch
(Kokanee Creek)
NELSON, B.C. Telephone: 604-825-4421

Parks Branch
(Alice Lake)
BRACKENDALE, B.C. V0N 1H0 Telephone: 604-898-3678

Alberta Recreation and Parks

Kananaskis Country Region
Box 280
CANMORE, ALBERTA T0L 0M0

| | | |
|---|---|---|
| Lloyd Gallagher - Alpine Specialist, Public Safety Co-ordinator | Telephone: | 403-678-5508 |
| George Field - Alpine Specialist | Telephone: | 403-678-5508 |
| Jock Richardson - Snow Study Observer | Telephone: | 403-678-5508 |
| Gavin More - Resource Specialist | Telephone: | 403-678-5508 |
| Kananaskis Provincial Park (7 days a week - 0800-1630) | Telephone: | 403-591-7222 |
| Bow Valley Provincial Park (Monday to Friday - 0800-1630, weekends on call) | Telephone: | 403-673-3663 |
| Elbow District (Monday to Friday - 0800-1630, weekends on call) | Telephone: | 403-949-3754 |

Mining Companies

Crows Nest Resources Ltd.
Line Creek Mine (Upper Elk Valley)
P.O. Box 2003 Telephone: 604-425-2555
SPARWOOD, B.C. V0B 2G0 (24 hours)

Attention: Greg F. Allen

## Ski Areas

Whistler Mountain
Whistler Mountain Ski Corporation
Box 67
WHISTLER, B.C. V0N 1B0 Telephone: 604-932-3434
Attention: Brian Leighton

Red Mountain Ski Area
Box 939
ROSSLAND, B.C. V0G 1Y0 Telephone: 604-362-7384
Attention: Simon Walker

Fernie Snow Valley Ski Ltd.
Box 788
FERNIE, B.C. V0B 1M0 Telephone: 604-423-9221
Attention: Dave Aikens

Mt. Washington Ski Resort Ltd.
P.O. Box 217
CAMPBELL RIVER, B.C. V9W 5B1 Telephone: 604-338-1386
Attention: Rob Orvig

Whitewater Ski Society
Box 60 Telephone: 604-354-4944
NELSON, B.C. V1L 5P7 (Nelson)
Attention: T. Van Alstine

Blackcomb Mountain
P.O. Box 98
WHISTLER, B.C. V0N 1B0 Telephone: 604-932-3141
Attention: Ken Newington

## Heli-Ski Operators

Hans Gmoser, Mark Kingsbury, Jeff Boyd, Kobi Wyss
Canadian Mountain Holidays
Box 1660
BANFF, ALBERTA T0L 0C0 Telephone: 403-762-4531

Ernst Buehler
Canadian Mountain Holidays, Cariboos
Box 1660 Prince George Mobile N699377
BANFF, ALBERTA T0L 0C0 "Cariboo Lodge"

Klaus Fux
Canadian Mountain Holidays, Valemount
VALEMOUNT, B.C. V0E 2Z0 Telephone: 604-566-4487

Dominic Neuhaus
Canadian Mountain Holidays, Monashees
MICA CREEK, B.C. V0E 2L0 Telephone: 604-834-7223

Buck Corrigan
Canadian Mountain Holidays, Revelstoke
REVELSTOKE, B.C. V0E 2S0 Telephone: 604-837-2107

Colani Bezzola
Canadian Mountain Holidays,
Bobbie Burns
Box 827
GOLDEN, B.C. V0A 1H0 Telephone: 604-346-3366

Walter Bruns
Canadian Mountain Holidays, Bugaboos
BANFF, ALBERTA T0L 0C0 Telephone: 604-346-3366

Ernst Salzgeber
Panorama Heli-Skiing
Box 937
INVERMERE, B.C. V0A 1K0 Telephone: 604-342-6941

Rudi Gertsch
Purcell Helicopter Skiing
GOLDEN, B.C. V0A 1H0 Telephone: 604-344-5410

Peter Schlunegger
Selkirk-Tangiers Heli-Skiing
REVELSTOKE, B.C. V0E 2S0 Telephone: 604-837-5271

Allan Drury
Selkirk Wilderness Skiing
MEADOW CREEK, B.C. V0G 1N0 Telephone: 604-366-4424

Mike Wiegele
Wiegele Helicopter Skiing
BLUE RIVER, B.C. V0E 1J0 Telephone: 604-673-8344
BANFF, ALBERTA T0L 0C0 Telephone: 403-762-5548

2) SEARCH AND RESCUE

The following agencies and individuals can assist in search and rescue work.

Dogs for Avalanche Search - Parks Canada

Alphie Burstrom
Jasper National Park — Telephone: 403-852-4401 (Bus)
JASPER, ALBERTA TOE 1EO — 403-852-3555 (Res)

Gordon Peyto
Glacier National Park — Telephone: 604-837-6274 (Bus)
REVELSTOKE, B.C. V0E 2S0 — 604-344-5041 (Res)

Dale Portman
Banff National Park — Telephone: 403-522-3866 (Bus)
LAKE LOUISE, ALBERTA TOL 1EO — 403-522-3628 (Res)

Scott Ward
Banff National Park — Telephone: 403-762-4506 (Bus)
BANFF, ALBERTA — 403-762-2488 (Res)

Dogs for Avalanche Search - R.C.M.P.

The followings dogs and their masters have received special avalanche training:

Chilliwack Sub/Division

Cpl. Terry Barter — Telephone: 604-792-4611

Cranbrook Detachment

Cpl. Gordon Burns — Telephone: 604-489-3471

Calgary, Alberta Sub/Division

Cpl. Gary McCormick — Telephone: 403-230-6434

Courtenay Sub/Division

Cpl. Ron Flack — Telephone: 604-338-7421

Kamloops Sub/Division

Cpl. Wayne Murphy — Telephone: 604-372-3111

Nanaimo Detachment

Cpl. Dale Marino — Telephone: 604-754-2345

Nelson Detachment

Cpl. Claude Millard — Telephone: 604-354-4104
(until May 1986)

Penticton Detachment

Cpl. Jim Brewin — Telephone: 604-492-4300

Prince George Detachment

Cpl. Gary Gillette
Cst. Al Soneff — Telephone: 604-562-3371

Terrace Detachment

Cpl. Lothar Bretfeld — Telephone: 604-638-0333

Vernon Detachment

Cpl. Tim Boal — Telephone: 604-545-7171

For contacts ask for the R.C.M.P. Radio Room where the location of the dog handlers will be known.

The following detachments will take information and pass it on to the Alberta Provincial Parks:

R.C.M.P., Kananaskis Provincial Park — Telephone: 403-591-7707

R.C.M.P., Canmore — Telephone: 403-678-5516

R.C.M.P., Banff — Telephone: 403-762-2226

Provincial Emergency Program

The British Columbia Provincial Emergency Program co-ordinates most local search and rescue groups in the Province. Enquiries can be directed to:

R.E. Neale, Director
Provincial Emergency Program
3287 Oak Street
VICTORIA, B.C. V8X 1P8 — Telephone: 604-387-5956

B. Thorshaug, Search & Rescue Co-ordinator
Provincial Emergency Program
3287 Oak Street
VICTORIA, B.C. V8X 1P8 — Telephone: 604-387-5956

Regional co-ordinators are located at:

Vancouver Island Region

| | | | |
|---|---|---|---|
| | Mr. W.C. Dalley (Claude) | Telephone: | 604-758-3951 |
| (Bus) | 2569 Kenworth Road | | 604-387-5956 |
| | NANAIMO, B.C. V9T 4P7 | | (after hours-Victoria) |
| (Res) | 7946 North Wind Drive | | |
| | LANTZVILLE, B.C. V0R 2H0 | Telephone: | 604-390-4546 |

Lower Mainland Region

| | | | |
|---|---|---|---|
| | Mr. F.G. Clegg (Frank) | Telephone: | 604-584-6366 or |
| (Bus) | 10334 152nd A Street | | 604-584-8822 |
| | SURREY, B.C. V3R 7P8 | | (24 hours) |
| (Res) | 6892 Centennial Drive | | |
| | SARDIS, B.C. V0X 1Y0 | Telephone: | 604-858-9980 |

Northern Region

| | | | |
|---|---|---|---|
| | B.C.E. Akehurst (Barry) | Telephone: | 604-565-6395 |
| (Bus) | 1011 4th Avenue | | 604-565-6130 |
| | PRINCE GEORGE, B.C. V2L 3H9 | | (after hours) |
| (Res) | 753 Faulkner Crescent | | |
| | PRINCE GEORGE, B.C. V2M 5E1 | Telephone: | 604-563-5531 |

Kootenay Region

| | | | |
|---|---|---|---|
| | G. Hartley | Telephone: | 604-354-6395 |
| (Bus) | 310 Ward Street | | 604-354-6399 |
| | NELSON, B.C. V1L 5S4 | | (24 hours) |
| (Res) | #44 Boneventure Mobile Home Park | | |
| | RR #1, Box 503 | | |
| | NELSON, B.C. V1L 5R3 | Telephone: | 604-825-9458 |

Invermere

| | | | |
|---|---|---|---|
| | Columbia Mountain Rescue Group | | |
| | A. Larson (Arnor), Co-ord. | Telephone: | 604-342-6042 (Res) |
| | J. Hetherington, Deputy Co-ord. | | 604-342-9741 (Res) |
| | Box 399 | | |
| | INVERMERE, B.C. V0A 1K0 | | |

Southern Interior Region

M.E. Dyer (Murray) — Telephone: 604-374-9717
(Bus) 1259 Dalhousie Place — 604-372-3213
KAMLOOPS, B.C. V2C 5Z5 — (24 hours)

(Res) 2478 Young Street
KAMLOOPS, B.C. V2B 4M8 — Telephone: 604-376-3453

First Aid Ski Patrol

P.O. Box 2651
VANCOUVER, B.C. V6B 3W8

West Kootenay Rescue Group

Box 764
NELSON, B.C. V1L 5R4

To activate, call:

Nelson R.C.M.P. — Telephone: 604-352-3511

3) EDUCATION

Avalanche Centre, National Research Council

P. Schaerer
3904 West 4th Avenue — Telephone: 604-666-6741 (Bus)
VANCOUVER, B.C. V6R 1P5 — 604-987-3716 (Res)

Technical Information.

British Columbia Institute of Technology

P. O'Reilly
3700 Willingdon Avenue
BURNABY, B.C. V5G 3H2 — Telephone: 604-432-8582 (Bus)

Courses for professional staff.

Outdoor Recreation Council of British Columbia

Suite 100, 1200 Hornby Street
VANCOUVER, B.C. V6Z 2E2 — Telephone: 604-687-3333

Safety brochures and slide packages.

Federation of Mountain Clubs of British Columbia

1200 Hornby Street
VANCOUVER, B.C. V6Z 2E2 Telephone: 604-687-3333

Two day awareness courses.

Canadian Ski Patrol System

T. Simper
National Avalanche Training Officer
14 Knowles Place, Box 1117
OKOTOKS, ALBERTA TOL 1T0 Telephone: 403-938-2131

Brian Weightman
Avalanche Officer
C.S.P.S. Calgary Zone
2108 Home Road N.W.
CALGARY, ALBERTA T3B 1H7 Telephone: 403-286-7245

George Evanoff
Pacific North Division-Avalanche Officer
1960 Garden Drive
PRINCE GEORGE, B.C. V2M 2V8 Telephone: 604-564-7814

Awareness courses.

Avalanche Films

"Avalanche" - 50 minutes

Industrial Services Section
Ministry of Health
500 Lougheed Highway Telephone: 604-521-1911
PORT COQUITLAM, B.C. V3C 1J0 (Loc. 281)

"The Snow War" - 25 minutes

National Film Board
811 Wharf Street
VICTORIA, B.C. V8W 1T2 Telephone: 604-388-3868

National Film Board
1161 West Georgia Street Telephone: 604-666-0716 or
VANCOUVER, B.C. V6E 3C4 604-666-0718

National Film Board
545 Quebec Street
PRINCE GEORGE, B.C. V2L 1W6 Telephone: 604-564-5657

Backcountry Avalanche Institute

Box 1050
CANMORE, ALBERTA  TOL 0M0

Telephone: 403-678-4102

Awareness courses.

Ptarmigan Tours

Box 11
KIMBERLEY, B.C.  V1A 2Y5

Telephone: 604-427-2838
604-422-3270 (eve)

Awareness courses.

5) WEATHER OFFICES

Atmospheric Environment Service

Correspondence and equipment:

Dr. O. K. Dawson
Regional Director
1200 West 73rd Avenue
VANCOUVER, B.C.  V6P 6H9

Telephone: 604-666-6399

G.E. Wells
Officer in Charge
Pacific Weather Centre
1200 West 73rd Avenue
VANCOUVER, B.C.  V6P 6H9

Telephone: 604-666-0523

N. Penny
Climate Information
1200 West 73rd Avenue
VANCOUVER, B.C.  V6P 6H9

Telephone: 604-666-2980

Alberta Weather Office
Edmonton International Airport
EDMONTON, ALBERTA  T5J 2T2

Telephone: 403-437-1250

## LIST OF WEATHER OFFICES IN BRITISH COLUMBIA

| OFFICE | TELEPHONE | OPEN HOURS (local time) |
|---|---|---|
| CASTLEGAR | 604-365-3131 | 0615-1615 |
| KAMLOOPS | 604-376-2160 | 0700-1700 |
| KELOWNA | 604-765-6598 | 0445-0015 |
| PENTICTON | 604-492-0539 | 0700-1700 |
| PORT HARDY | 604-949-6559 | 0700-1700 |
| PRINCE GEORGE | 604-963-7552 | 0445-2115 |
| REVELSTOKE | 604-837-4164 | 0400-2200 |
| TERRACE | 604-635-3224 | 0710-1710 |
| VANCOUVER | 604-276-6109 | 24 HOURS |
| VICTORIA | 604-656-3131 | 24 HOURS |
| PACIFIC WEATHER CENTRE | 604-666-2728 | 24 HOURS |

(The Pacific Weather Centre is the main contact during hours when the local weather offices are closed).

| | | |
|---|---|---|
| BANFF, ALBERTA | 403-762-2088 | 0600-1700 |
| WHITEHORSE, YUKON | 403-668-2293 | 24 HOURS |
| ALBERTA WEATHER OFFICE | 403-468-7931 | 24 HOURS |

### CHANGES

Changes, additions, or deletions to this list should be reported to the Snow Avalanche Section, British Columbia Ministry of Transportation and Highways.