

Evaluation of the **P**erception
of **W**indchill and the
Receptiveness to **C**hange

Final Report

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1.0 EXECUTIVE SUMMARY

Use of and Interest in Weather Information

Overall, almost all of the participants indicated they were at least somewhat interested in the weather, weather information and forecasts.

Most participants consult some form of meteorological information on a daily basis; others only consult the weather the night before a special activity, such as skiing or travel. A minority of participants in each group state that weather information is of no interest to them.

Those who seek out weather information every day like to know what to expect from the standpoint of what to wear, how to dress their children, how long, or if, they will be able to work outside that day, how quickly they must get ready in the morning and whether or not weather will affect traffic.

Compared to those in central and eastern Canada, participants in the western groups were more likely to express interest in the long-range weather forecasts as well. They indicated that these forecasts helped them plan travel and other activities.

Type of Information Sought

For the majority of participants, temperature and precipitation are the most important weather information they seek. Cloud cover and windchill are also considered essential information.

Windchill seems to be of greater concern to those living on the prairies, especially Winnipeg and Regina, although members of the Moncton groups, and to a lesser extent the Quebec City groups, consider windchill to be an integral part of the temperature as well.

Sources of Information

Participants obtain their weather information from a variety of sources, predominantly television (for the most part, The Weather Network or their local news) and radio, and also from newspapers. A few participants call Environment Canada directly for specific and up-to-the-minute information (this behaviour is even more pronounced among those from the prairie groups).

The Internet is cited by a small minority of respondents.

Most participants consult more than one source of weather information throughout the day.

Overall Awareness of Windchill

Of the three prairie cities assessed, participants from the Winnipeg groups, followed by those in Regina and Edmonton, seemed most conversant with windchill. In the east, knowledge about windchill was stronger in Moncton than in Quebec City or Ottawa.

In the western groups, most participants had a good understanding of the concept of windchill. Within each of the western groups, there was at least one respondent who could provide what the Environment Canada observers deemed to be an almost textbook definition of windchill.

Most participants in the six eastern groups were unable to give an exact definition of windchill. For most members of these groups, windchill expresses a reduction in ambient temperature, caused by the wind. Only a few participants gave the correct definition of windchill, including the notion that windchill only affects the human body.

Relative Importance of Windchill

For the eastern groups, windchill information served strictly as a guide to determine how they will dress. On weekends, however, high windchills may result in the postponement of outdoor activities.

The participants in Edmonton, Regina and Winnipeg held a pragmatic view of windchill. They seemed to take much of the discussion of windchill and the impact of windchill on their lives in stride. Even though windchill may not have been the top-of-mind, most important piece of weather information, participants in the prairie groups indicated that windchill information was very important to them.

For many of the western participants, their interest in windchill varied according to what they were doing or planning to do over the course of a few days.

Dangers of Windchill

The vast majority of participants were conversant with the dangers and hazards posed by windchill including frostbite, exposure, hypothermia and death. In addition, a number of respondents reported health conditions that were made worse by the cold including asthma, bronchitis and arthritis.

Participants in the eastern groups were less likely to express the more severe dangers caused by windchill than were their counterparts in the west.

Satisfaction with Information Provided on Windchill

Generally speaking, all participants expressed satisfaction with the amount and quality of the information they received on windchill. This finding was not as pronounced among the western groups.

Windchill Expressed as Equivalent Temperature

All of the participants were familiar with the notion of expressing windchill as equivalent temperatures. In most instances however, participants did not refer to it by the title equivalent temperature, instead preferring “-xx degrees, with windchill -xx” or “feels like -xx”.

While among the eastern groups, the vast majority of participants look for this information in their weather forecasts and know how to apply it to their daily lives, few were able to define it. Several thought that the ambient temperature actually decreases when windchill is present.

This confusion was much less pronounced among the prairie groups. Among these participants, recall of equivalent temperatures and how they should be interpreted was high.

Threshold values

Participants in the eastern groups did not immediately volunteer any responses as to which temperatures were the most likely to elicit changes in their behaviour. However, after more in-depth probing, participants eventually described two levels of threshold values that

may trigger such changes; -20C would cause more of a psychological change rather than a behavioural one in participants at -35C to -40C, participants will postpone outdoor activities such as hockey or skiing.

Conversely, participants in the six prairie groups readily provided responses and indicated equivalent temperatures at which their behaviour and activities would change.

Participants in the three western cities were much more likely to say their activities and behaviours would change only when the windchill rate was high. In most cases, an equivalent windchill of -20C was not sufficient to elicit any real change in their activities. At a windchill of -30C, some participants indicated they would change their behaviour – add more clothes, allow the car to warm up longer. Real changes in behaviour were noted when the windchill reached an equivalent temperature of -35C to -40C.

Windchill Expressed as a Cooling Rate

In Ottawa, Moncton and Quebec City, only a few individuals had heard of a different way to express windchill other than as equivalent temperature. Most could not describe it.

For the majority of eastern participants, the term ‘watts per square metre’ implied a notion of electrical current, perhaps the electricity contained in a square metre of wind. Very few participants related this term to a loss of energy, and fewer still understood that it relates to the area of exposed human skin.

In general, most members of the groups considered this unit of measure very scientific and complicated.

Among the three prairie cities assessed, there was more variation in participants’ reactions to windchills as cooling rates than was the case in the eastern groups. By far those most conversant with the cooling rates were respondents in Winnipeg, followed by those in Regina and then participants in Edmonton.

In Winnipeg, where windchills have been expressed as a cooling rate for some time, familiarity with cooling rates was the highest. Nevertheless, even in these two

groups, most of the participants were not clear on the units. A few indicated it was "...something about watts".

Among the three prairie cities, awareness of and familiarity with cooling rates was second highest among the participants in Regina.

Comprehension of cooling rates in Edmonton was the lowest of the three prairie cities. Very few understood this rating and there was very low awareness of watts per square metre.

Expressing Windchill as an Index

In the eastern groups, expressing windchill as an index between one and ten was seen by most participants as a simpler way to provide windchill information. Because it does not contain a unit of measure, it is believed to be easier to understand.

Reaction to this index in the three prairie cities was not particularly positive, although people did draw parallels between it and both the UV Index and the Richter Scale. Many participants said that this was just another scale that we would have to learn. In both of the Winnipeg groups, at least one person said there was nothing wrong with the current method of providing windchill information.

Participants also perceived problems with consistency based on a one to ten scale. In particular, they indicated that a rating of, for example, seven in the west would be very different than a rating of seven in Ontario.

Expressing Windchill Verbally

Among the eastern respondents, a few were able to recall a limited number of other methods of expressing windchill:

"I've heard windchill expressed using words, but I don't remember which ones."

"They say, with windchill, you get frostbite in five minutes."

"It means that flesh freezes in three minutes."

"They sometimes say 'risk of frostbite'."

"I've heard 'bitterly cold' before."

Most participants felt that using subjective terms (such as 'bitterly cold') is less useful than objective expressions (such as 'skin will freeze in five minutes'). If used, the latter should follow the actual temperature reading in weather reports, according to these participants.

The French-speaking groups also used various terms as synonyms for windchill including *facteur vent*, *facteur éolien* and *facteur de refroidissement*.

In the western groups, participants were tested with verbal scales such as cold, very cold and bitterly cold, and high, very high and extreme windchills. Overall, verbal scales like these were viewed as too subjective and not precise enough.

Windchill Expressed as a More Accurate Equivalent Temperature

In the six eastern groups, participants' opinions were divided on the benefits of a more accurate method of expressing windchill as equivalent temperature. Approximately half the participants felt that a more accurate calculation of equivalent temperature would be beneficial. The other half believed that the actual number expressing windchill does not matter; what matters to them is how they feel outside.

A change to this more precise equivalent temperature would only be worthwhile if the added precision makes an appreciable difference, probably of five degrees or more. Should the change be worthwhile, these participants would be willing to learn a new system.

Importance of Education

Participants agreed almost unanimously that an education process is essential, should a change in windchill system occur. Only those who were uninterested in windchill information in general did not attach any importance to public education.

While respondents in the west fully appreciated the need for education should windchill change, many were sceptical as to why the change would be made. In each of the Winnipeg and Regina groups participants reiterated "if it isn't broken, don't fix it". Among the prairie groups a number of participants indicated that they

could live with what we had now and that the money should be spent elsewhere.

Method of Education

The vast majority of participants strongly believed that a transition period, where both the current and the new systems were provided, was essential. This would help people get accustomed to the new system and make the appropriate decisions.

Participants mentioned several ways of communicating a change in windchill system, but most predominant was the suggestion that any modification be publicized in the places where people typically look for weather information. This would entail providing information in newspapers, on the radio and on television, in conjunction with regular weather forecasts.

In the east, participants mentioned the use of a brochure that could be distributed to every home. This brochure could be similar to the Year 2000 (Y2K) pamphlet published recently by the Government of Canada. Those in the west expressed strong opposition to the use of pamphlets and other mail-outs which they referred to as “garbage”.

Several participants felt that some form of education should be done in schools, to sensitize children to the new system.

Across all of the groups, several members suggested that a conversion chart be provided, perhaps in the form of a fridge magnet, in order that they could consult it for however long they feel they need to.

Finally, information sessions seem to be of little efficacy as a way of educating the population about the change in system. Most participants indicated that they would not attend such sessions.

Timing

According to the participants, the transition period, during which windchill information should be presented in both the current format and the new way, should last anywhere from several months to a few years.

Most participants feel that early fall (September-October) would be the ideal time to start informing the public about the change.

National Standard

In general, participants were very supportive of Canada adopting one, standard method of providing windchill measures across the country. In many instances, respondents indicated that it would be beneficial to people who travel to have the same system employed nationally.

Reaction to Change in Windchill Measurement and Provision

Overall, participants adopted a pretty pragmatic reaction to change. As many of them said, “you may not like the change, but ultimately there isn’t much you can do about it”. Others said that they were comfortable with the current system, but that if it was changed then that was the “prerogative” of Environment Canada or as one participant indicated:

“Everyone wants progress, no one wants change.”

Conclusions

In the majority of instances, participants use the current windchill units or figures as relative measures. By that we mean, even though a respondent may not understand what a cooling rate of 1800 is actually measuring, those who live in areas where this system is used, and has been used for some time, understand what these readings mean. As such, they are able to change their behaviour appropriately whether it is dressing in more layers, staying indoors or limiting car travel. In this way it seems to matter little to them that they do not know that the units are watts per square metre, nor do they seem particularly interested in learning more about the measure. As one participant in the Winnipeg groups stated:

“I wouldn't care if the scale was based on colours (yellow meant something, red something else and blue something else which was worse). It's just the person's relative reaction that counts the most. You change your behaviour accordingly.”

The same finding holds for equivalent temperatures. While very few respondents could provide a definition of a degree Celsius, most of them are clear on what it means to have a windchill expressed in an equivalent temperature of -30C. As was the case for the cooling rates, their response to these figures and this information becomes behaviour based, that is, they know what to do as a result of hearing a number of this magnitude. So while they may not understand the precise science behind the number (nor do they seem particularly interested in it) they are fairly clear on what actions they need to take to ensure their safety and their family's safety. This explanation goes some distance to explaining their rather ambivalent answers to discussions that focussed on current inaccuracies with equivalent temperatures. Since participants use these figures as a relative indicator only, it matters less to them that the

science behind it is precise. Through experience, they have come to learn what to do at windchills of -30 or -40, the fact that these equivalent temperatures are not accurate becomes immaterial to participants since they use them as relative figures only.

Overall, if the purpose of providing windchill figures is to allow Canadians to make sensible decisions for themselves, their families and their co-workers during winter then the results of these groups seem to indicate that this is succeeding regardless of how Canadians currently receive windchill information.

Still these results indicate that there is some room to move and change the system if that decision is made. In particular, while participants seem to favour the status quo for most of the communities assessed (many have become comfortable with a system which at its introduction probably seemed complex and difficult), positioning a standardized, national windchill delivery system or product appears to have its merits. If this is done, it will be important to explain why it is being undertaken, educate people on the system/product, provide both measures in communities that are getting the new delivery system/product and do all of it without appearing to be frivolous with money.

The reaction of participants indicates that while they may not necessarily like change, they view it pragmatically. If a new system is introduced, it is possible to gain acceptance and understanding of it.

Whatever decision is made, it may be important to keep in mind the current windchill preferences per city:

- Ottawa, Moncton and Quebec City – equivalent temperatures
- Edmonton – equivalent temperatures
- Regina – equivalent temperatures
- Winnipeg – cooling rate

2.0 INTRODUCTION

Environics Research Group is pleased to present to The Policy and Corporate Affairs Directorate of Environment Canada the results of a series of focus groups undertaken among Canadians from across the country. The focus groups were held to assess a number of issues related to the provision of information on windchill. Specific objectives of the research included:

- An assessment of how interested participants are in weather information and forecasts;
- Current usage and frequency of usage of weather information and forecasts;
- Awareness and understanding of windchill and the units that measure windchill including equivalent temperatures and cooling rates;
- Impact of windchill on personal behaviour;
- Overall reaction towards possible changes in the way in which windchill information is provided; and
- Assessment of these changes.

A total of twelve focus groups in six cities (two groups per evening per city) were convened. In each city, the groups were held at 6 p.m. and 8 p.m. The scheduling and composition of the groups is shown in the table below.

CITY	LANGUAGE
Ottawa - March 15, 1999	English and French
Winnipeg - March 16, 1999	English
Edmonton - March 17, 1999	English
Quebec City - March 17, 1999	French
Moncton - March 22, 1999	English and French
Regina - March 22, 1999	English

The groups in Winnipeg, Edmonton and Regina were moderated by Graham Loughton, Senior Associate, Environics Research Group, while the groups in Ottawa, Quebec City and Moncton were moderated by Anne Marie David, Senior Consultant at CROP. Anne Marie David is fluently bilingual and was able to moderate both the French and English groups.

In each centre, 12 participants, per group, were recruited. The actual number of participants attending each session and the total number of participants considered in this research is shown in the table below.

Participant Tally

CITY	6 P.M.	8 P.M.	TOTAL
Ottawa	10	10	20
Winnipeg	11	9	20
Edmonton	11	6	17
Quebec City	10	10	20
Moncton	10	10	20
Regina	12	12	24
Total	64	57	121

Within each group, at least one participant worked out of doors and another had children who were 12 years of age or younger. Each of the groups was audio and video taped. All of the respondents were provided with a \$40 cash incentive at the conclusion of the group. The focus group proceedings followed the discussion guide which is appended to the end of this report.

3.0 RESEARCH FINDINGS

3.1 Use of and Interest in Weather Information

To begin the discussions, participants were asked some general questions related to their interest in the weather and weather forecasts. Overall, almost all of the participants indicated they were at least somewhat interested in the weather, weather information and forecasts.

Most participants consult some form of meteorological information on a daily basis; others only consult the weather the night before a special activity, such as skiing or travel. A minority of participants in each group stated that weather information is of no interest to them, preferring to rely solely on their own observations.

“I stick my head outside and if it’s cold, I go back inside and get another layer or a toque.”

Those who seek out weather information every day like to know what to expect from the standpoint of what to wear, how to dress their children, how long, or if, they will be able to work outside that day, how quickly they must get ready in the morning and whether or not weather will affect traffic.

“I pay a lot of attention to weather, so I can plan my life accordingly.”

“I take the bus to work and I need to know what the weather is like so I can dress accordingly while I wait for the bus.”

Some participants also consult weather information for school closings since it affects their morning routine with their children. In most of the groups, at least one participant indicated they were interested in weather because it makes for an interesting topic of conversation when meeting people.

“I live in Winnipeg, so of course I’m interested in the weather.”

Compared to those in central and eastern Canada, participants in the western groups were more likely to express interest in the long-range weather forecasts as well. They indicated that these forecasts helped them plan travel and other activities.

3.2 Type of Information Sought

For the majority of participants, temperature and precipitation are the most important weather information they seek. Cloud cover and windchill are also considered essential information. Overall, windchill seems to be of greater concern to those living on the prairies, especially Winnipeg and Regina, although members of the Moncton groups, and to a lesser extent the Quebec City groups, consider windchill to be an integral part of the temperature as well. Participants are also interested in road conditions, low and high pressure systems, wind speed and direction, long-term forecasts, school closings, Humidex, UV index and international weather. Participants from the prairies are more likely to report they are interested in weather extremes – storms, high windchills, tornadoes, etc.

3.3 Sources of Information

Participants obtain their weather information from a variety of sources, predominantly television (for the most part, The Weather Network or their local news) and radio, and also from newspapers. A few participants call Environment Canada directly for specific and up-to-the-minute information (this behaviour is even more pronounced among those from the prairie groups).

The groups in the west also showed a strong reliance on the Weather Network and the local cable stations, which feature scrolling temperatures and other weather information provided by Environment Canada. In a number of instances, participants expressed frustration with the emphasis placed by the Weather Network on information for Ontario and Quebec.

The Internet is cited by a small minority of respondents.

Most participants consult more than one source of weather information throughout the day. Some might for example listen to the radio in the morning or on the way to work, and watch The Weather Channel in the evening; others may consult newspapers and their local televised news broadcast on a given day.

4.0 INTRODUCTION TO WINDCHILL

4.1 Overall Awareness

To further refine the discussion, participants were asked to indicate their level of awareness of windchill and provide a basic definition.

Overall, while all of the participants in all of the groups were aware of windchill, as one participant in the Winnipeg group reported – “If you live in Manitoba you know windchill,” there were some variations in the level of familiarity with and knowledge about windchill across the country.

Of the three prairie cities assessed, participants from the Winnipeg groups, followed by those in Regina and Edmonton, seemed most conversant with windchill. In the east, knowledge about windchill was stronger in Moncton than in Quebec City or Ottawa.

In the western groups, most participants had a good understanding of the concept of windchill as a combination of wind and temperature making it feel colder than it would in the absence of wind. A number of respondents further understood windchill in terms of a cooling rate, with some saying it was a measurement of time for exposed flesh to freeze. Within each of the western groups, there was at least one respondent who could provide what the Environment Canada observers deemed to be an almost textbook definition of windchill.

Although very comfortable with the significance of windchill in their daily lives, when prompted further, most participants in the six eastern groups were unable to give an exact definition of windchill.

For most members of these groups, windchill expresses a reduction in ambient temperature, caused by the wind. These people disregard the ambient reading and rely on windchill as the true temperature:

“Windchill is the actual temperature as opposed to the degree of temperature.”

Some participants define windchill simply as a measure of wind speed. For them, a high windchill factor means that there is a high likelihood of blowing snow and black ice.

“Windchill is a cooling factor that increases dangers in winter; it creates blowing snow and causes more accidents on the roads.”

Only a few participants gave the correct definition of windchill, including the notion that windchill only affects the human body.

“Windchill is an index of how cold it will feel on people’s skin; it could cause frostbite.”

However, others thought that windchill also affects inanimate objects such as cars. Indeed, some individuals rely on windchill information to determine when to plug in their car’s block heater, without regard to the actual ambient temperature.

4.2 Relative Importance of Windchill

For the eastern groups, windchill information served strictly as a guide to determine how they will dress, given that they still have to go to work regardless of the windchill. On weekends, however, high windchills may result in the postponement of outdoor activities.

“It’s important to know what’s going to happen. If it’s -10, but with the windchill it’s -30, it’s important to know that. We’ll still go out, but we’ll take the necessary precautions.”

A few participants brought up the fact that windchill can be dangerous, posing the risk of frostbite, especially for young children, and that windchill may be hard on vehicles and cause black ice on the roads.

Overall, the participants in Edmonton, Regina and Winnipeg held a relatively pragmatic view of windchill. As residents of the prairies and accustomed to harsh winter weather, they seemed to take much of the discussion of windchill and the impact of windchill on their lives very much in stride. Even though windchill may not have been the top-of-mind, most important piece of weather information, participants in the prairie groups indicated that windchill information was very important to them. As one of the Edmonton participants indicated, windchill in the west is a fact of life.

It was also apparent that for many of the western participants, their interest in windchill varied according to what they were doing or planning to do over the course of a few days. In particular, this related to travelling or activities where their children may be out of doors. In this way, windchill was viewed as having a significant impact on their lives and something that could be dangerous to their health.

Within each of the western groups, at least one person reported that windchill was irrelevant to them.

4.3 Dangers of Windchill

The vast majority of participants were conversant with the dangers and hazards posed by windchill including frostbite, exposure, hypothermia and death. In addition, a number of respondents reported health conditions that were made worse by the cold including asthma, bronchitis and arthritis.

Generally speaking, participants in the eastern groups were less likely to express the more severe dangers caused by windchill than were their counterparts in the west. It seems logical that these differences in perception are based on the different types of weather and windchill experienced in each region. Participants in the west, who face more severe winters, lower temperatures and high windchills, are more likely to cite dangers like frostbite exposure, hypothermia and death because they face this type of weather more often than those in Ottawa, Moncton or Quebec City. This should

not be construed as an indication however that those in Ottawa, Moncton or Quebec City are unaware of the dangers posed by windchill, it is just less of a direct impact on their lives than is the case in Western Canada.

Aside from the impact of windchill on people, a number of participants indicated that pets should be brought indoors during periods of high windchill. In the Regina groups, one person, who was a farmer, mentioned the importance of monitoring windchill if cattle are outside.

4.4 Satisfaction with Information Provided on Windchill

Generally speaking, all participants expressed satisfaction with the amount and quality of the information they received on windchill. This finding was not as pronounced among the western groups, some of whom indicated they would like more information and especially information that was more accurate. Still others said that if someone wanted more information, it was easily attainable.

"I find the real thing that is missing is a lack of accuracy in the windchill numbers."

Within the prairie groups, some also indicated that they would like to have information on the actual wind speed and wind direction.

5.0 WINDCHILL EXPRESSED AS EQUIVALENT TEMPERATURE

Following the more general discussions of windchill and information on windchill, participants were asked a series of questions related to how windchill figures are expressed. The first to be discussed was equivalent temperatures.

Overall, all of the participants were familiar with the notion of expressing windchill as equivalent temperatures. In most instances however, participants did not refer to it by the title equivalent temperature, instead preferring “-xx degrees, with windchill -xx” or “feels like -xx.”

While among the eastern groups, the vast majority of participants look for this information in their weather forecasts and know how to apply it to their daily lives, few were able to define it. Several thought that the ambient temperature actually decreases when windchill is present. Alternately, some believed that the lower temperature would only be felt if one was standing in a particularly windy place:

“If you’re in a sheltered place, it’s -10, but if you get out into the wind, it’s -37.”

This confusion was much less pronounced among the prairie groups. Among these participants, recall of equivalent temperatures and how they should be interpreted was high. Many people indicated that the equivalent temperature provided a measure as to what it would actually feel like outside when both the air temperature and the wind were taken into account. They also said that a person would cool off faster during a cold day where there was a substantial wind.

To prompt the discussion further, participants in each city were presented with weather scenarios for two days and asked a series of questions about each.

Ottawa and Moncton

Day 1: The temperature is -5C, blustery day and the wind gusting to make the equivalent temperature feel like it is -15C.

Day 2: Clear blue skies and there is no wind. The ambient (air) temperature is -15C.

Quebec City

Day 1: The temperature is -10C, blustery day and the wind gusting to make the equivalent temperature feel like it is -20C.

Day 2: Clear blue skies and there is no wind. The ambient (air) temperature is -20C.

Western Canada

Day 1: The temperature is -15C, blustery day and the wind gusting to make the equivalent temperature feel like it is -25C.

Day 2: Clear blue skies and there is no wind. The ambient (air) temperature is -25C.

In the case of the eastern cities, the vast majority of participants reported that day one would seem colder, as the wind and snow would cool them down, whereas on the second day, the sun would warm their skin.

In the French Moncton group, a few participants mentioned that, on a windy day, the wind whisks the humidity from the skin, thus drying it and making it feel colder. This led one member of this group to wonder:

“Does windchill take the humidity in the air into account? It can really make a big difference.”

However, most participants also agreed that, if a thermometer were left outside on both days, the reading would indicate -5C on day one, and -15C on day two (using the temperatures of the Ottawa and Moncton scenarios) a view which was unanimously held by those in the Moncton groups.

“If the thermometer were to give the same reading on both days, why would there even be a concept of windchill?”

In the Ottawa and Quebec City groups, a few participants believed that, on day one, the thermometer would not indicate -5C, but rather a reading between -5C and -15C. As well, a few participants in these groups stated that the thermometer would read -15C on both days.

The apparent contradiction between participants’ evaluation of the scenarios and their impressions of the thermometer readings seems to demonstrate the confusion over the real meaning of windchill. This

confusion notwithstanding, participants seem to draw from it the meaning they require, and apply it to their daily lives without further question.

In the prairie groups, there was less confusion as to what the two scenarios meant. Overwhelmingly, respondents were of the opinion that the weather conditions described in day one would make this day feel much colder than those in day two. As a number of respondents remarked:

“I can still work and do things when the air temperature is -25C. But the wind will go right through you and make you feel a lot colder.”

As one participant in Regina indicated:

“You can handle the cold, but not the wind. People only complain when it is the wind too.”

And;

“I find the wind very draining, it really takes it out of you.”

However, at least one person in every group reported that there would be no difference in the way each of the two days “felt” since there was no difference between the two temperatures as they were reported.

To gain a little more insight into people’s impressions of the scenarios, those in the prairie groups were also asked to indicate what a thermometer would read during each day. When asked, most participants correctly reported that it would read -15C in day one, but that objects or living creatures would just cool off more rapidly than -15C with no wind. For day two, a thermometer would read -25C. However, at least one individual in each group thought the thermometer reading would actually be influenced by the wind and would therefore register some temperature lower than the ambient temperature (this varied from a few degrees lower to exactly equal to the equivalent temperature).

As was the case in the eastern groups, some discussion about humidity and how humidity was included in windchill calculation also transpired. Some respond-

ents indicated that humidity was part of the calculation or equivalent temperatures and was therefore taken into account. A number of participants said they did not know whether humidity was considered or not. Most perceived that the cold damp weather in eastern Canada was in some way colder than the same temperature on the dry Prairies.

5.1 Threshold Values

To delve into the issues surrounding windchill and equivalent temperatures in more depth, participants were asked to identify which temperatures were the most likely to elicit changes in their behaviour. Participants in the eastern groups did not immediately volunteer any responses, indicating that they did not consciously modify their behaviour based on pre-determined temperatures. However, after more in-depth probing, participants eventually described two levels of threshold values that may trigger such changes. Conversely, participants in the six prairie groups readily provided responses and indicated equivalent temperatures at which their behaviour and activities would change.

In the eastern groups, participants indicated that a windchill equivalent of -20C would cause more of a psychological change rather than a behavioural one in participants. Indeed, they will recognize the fact that it is very cold outside, but will not alter their behaviour very much and they will still go to work or go outside. They may at most put on an extra sweater or scarf, or dress their children more warmly. At this level, some participants will start plugging in their car’s block heater.

The second level, however, causes more appreciable changes in behaviour. When the temperature reaches -35C to -40C, participants will postpone outdoor activities such as hockey or skiing. In fact, several participants will avoid going outside altogether, while others will avoid straying too far from home.

In general, thresholds for Ottawa participants are situated at a slightly warmer temperature than in the Quebec City and Moncton groups.

Overall, participants in the three western cities were much more likely to say their activities and behaviours would change only when the windchill rate was high. In most cases, an equivalent windchill of -20C was not sufficient to elicit any real change in their activities. At a windchill of -30C, some participants indicated they would change their behaviour – add more clothes, allow the car to warm up longer. Real changes in behaviour were noted when the windchill reached an equivalent temperature of -35C to -40C. At this level, respondents indicated they would stay indoors and keep their children indoors. Among those participants who worked outdoors, most said they would either not work on a day like this or significantly limit their time outside.

As a final discussion point among the six prairie groups, participants were polled to see at what equivalent temperature most of their activities would stop. While there was some variation in the range of the temperatures provided, at times bordering on bravado, it was interesting to note that the men would in most cases provide an equivalent temperature which was more severe than that expressed by women.

6.0 WINDCHILL EXPRESSED AS A COOLING RATE

Following the discussion of windchill expressed as equivalent temperatures, the proceedings moved to a discussion of providing windchill as a cooling rate. In this section, pronounced differences are present between the groups undertaken in the east and those in the west.

In Ottawa, Moncton and Quebec City, only a few individuals had heard of a different way to express windchill other than as equivalent temperature. Most could not describe it.

For the majority of eastern participants, the term 'watts per square metre' implied a notion of electrical current, perhaps the electricity contained in a square metre of wind. Very few participants related this term to a loss of energy, and fewer still understood that it relates to the area of exposed human skin. Of the latter, some wondered how many square metres of skin they had on their body. Finally, this term evoked notions ranging from temperature to power for some, as well as absolutely nothing for a few participants.

"It's too abstract, it doesn't mean anything to me."

In general, most members of the groups considered this unit of measure very scientific and complicated. They understood that this new method would be more accurate, and thus help them make a better decision as to how to dress. Participants believed that this would be particularly advantageous for people who work outdoors. In spite of these benefits, however, they did not feel comfortable with what they saw as a complex unit of measure.

"It's too scientific; people would find it too technical."

"Just the name of it will scare a lot of people. Let's stay realistic and stick with -20 or -30 degrees. Who's going to have a metre of skin exposed anyway?"

According to these participants, expressing windchill solely with a four digit number (e.g. 1600) without the unit of measure would simplify the system, as long as they were informed as to the meaning of these numbers. However, they believe that they would have a very strong tendency to look for a degree Celsius equivalent.

"We would need a chart to convert it into degrees."

"As long as we know how to calculate it, and as long as the calculation is not too complicated, we could convert it into what we have now ..."

Most participants admitted they would be reluctant to accept a change in the system. However, if necessary, most were willing to take the time to learn a new system if this system is proven to be beneficial. These participants stated very clearly that they would accept any changes much more readily if they were properly justified.

"There has to be a reason to change."

Most participants need to know how windchill will affect them in order to be able to determine how to dress, regardless of the terms or measures used to express it. Should the system change, they would in time determine which values are important to them, and act accordingly. The added precision of the cooling rate method, therefore, does not constitute a valid reason to modify the system.

"I need to know how it affects me. I have to find out if I'm comfortable, regardless of the numbers. I would just find out what numbers are important to me."

On the other hand, some participants were more optimistic about this method. They believed that a new and presumably more accurate system would enable them to learn more about the weather and understand how it affects their lives.

Among the three prairie cities assessed, there was more variation in participants' reactions to windchills as cooling rates than was the case in the eastern groups. By far those most conversant with the cooling rates were respondents in Winnipeg, followed by those in Regina and then participants in Edmonton.

In Winnipeg, where windchills have been expressed as a cooling rate for some time, familiarity with cooling rates was the highest. Nevertheless, even in these two groups, most of the participants were not clear on the units. A few indicated it was "...something about watts". Even after the units (watts/square metre) were

written on a flip chart, only a few expressed any familiarity with them. Still as many respondents indicated:

“We really don’t care what the units are, we just want to know the value and its impacts.”

While the Winnipeg groups were not familiar with the units for cooling rates, they were very aware of what certain ratings meant to them, particularly as this related to the way they dressed and the activities they could undertake.

“I understand what the number means from experience, but the units are of little concern.”

At 1250 participants reported it is beginning to get uncomfortable. At 1600, add some extra clothing. Eighteen hundred is still manageable, “getting up there”, but reduce some outdoor activities (outdoor recess is stopped in some schools). At a cooling rate of 2000, outdoor activity is reduced or halted and skin freezes in less than one minute. At 2400, participants said, “stop everything”. While not all respondents participated in this breakdown, well over half were agreeable to the values and their meaning.

Among the three prairie cities, awareness of and familiarity with cooling rates was second highest among the participants in Regina. As was the case in Winnipeg, a very small minority of participants could recall the actual units for cooling rates. Even when watts per square metre was written on a flip chart, few were able to decipher what it meant or how it related to the human body. As one respondent indicated:

“I can’t relate to how long I can do something before my fingers freeze.”

Another person said:

“It doesn’t mean a thing to me.”

Even though participants did not understand the units, there was some comprehension of various cooling rates. In particular, respondents recognized that when windchill got to 1800, outdoor activity was getting “iffy” and that above 2000 it was hazardous. However there was a great affinity to also quoting the equivalent temperature “the windchill is 2000 which feels like ...”. Most people also agreed that the description about exposed flesh freezing in a given period was helpful when the windchill got to dangerous levels. Despite a relatively good understanding of the windchill thresholds (participants indicated that they had heard it expressed in this manner for a long time), both groups were almost unanimous in wanting windchill in equivalent temperature. Some people wanted both.

Comprehension of cooling rates in Edmonton was the lowest of the three prairie cities. Very few understood this rating and there was very low awareness of watts per square metre. One respondent expressed some familiarity with cooling rates indicating she had heard windchills expressed as -2000 degrees. Even after watts per square metre was written on a flip chart, neither comprehension nor understanding increased markedly. As one participant indicated:

“This sounds like an academic measure, I have no reference points for it.”

As a result, participants in Edmonton were unable to provide much insight on threshold values for windchill when expressed as cooling rates. There was some recognition that the windchill must be worse when the number gets higher but there was little differentiation between 1600, 1800, 2000 or 2200 and little understanding of what to do when confronted with windchills of these magnitudes.

7.0 OTHER METHODS OF EXPRESSING WINDCHILL

Following the discussions of equivalent temperatures and cooling rates, the examination was broadened to include a number of other ways of expressing windchill. The first to be assessed was a windchill index.

7.1 Expressing Windchill as an Index

In the eastern groups, expressing windchill as an index between one and ten was seen by most participants as a simpler way to provide windchill information. Because it does not contain a unit of measure, it is believed to be easier to understand. Further, people are already used to this type of numbering, from their exposure to the UV index. As well, some people feel that windchill information provided in this manner would be easier to discern quickly while listening inattentively to the weather forecast on the radio or on television.

"I look at the weather very quickly, so I just want pertinent information. I don't want to have to analyze the information. It has to be simple."

Although an index is viewed as a simple system to express windchill, some participants feel that such a scale would lose all the precision of the cooling rate method.

"It loses precision, but a scale of one to ten is a lot simpler."

However, most participants who work indoors believe that precision is only important for people who work outdoors:

"It doesn't bother me if it's not precise, because I work in an office; it's not the same environment as someone who works outdoors."

Further, some participants in the eastern groups brought up the fact that using large numbers, as in the watts per square metre method, would be more effective in conveying the importance of bundling up.

"'1800' would scare you more than '7'."

Participants in these groups indicated that regardless of the system used, any change would force them to learn something new, something they seemed reluctant but resigned to do.

Considerably less time was spent discussing a one to ten, windchill index in the three prairie cities. Overall, reaction to this index was not particularly positive across the six groups, although people did draw parallels between it and both the UV Index and the Richter Scale. Many participants said that this was just another scale that we would have to learn. In both of the Winnipeg groups, at least one person said there was nothing wrong with the current method of providing windchill information.

"If it ain't broke, don't fix it."

In Regina some of the participants questioned the cost of re-educating everyone to know what the new scale meant.

Participants also perceived problems with consistency based on a one to ten scale. In particular, they indicated that a rating of, for example, seven in the west would be very different than a rating of seven in Ontario. They added that if the scale was consistent, weather conditions in Ontario may never get to a rating of seven or eight and as a result, residents in this area may under-estimate the dangers posed by windchill.

7.2 Expressing Windchill Verbally

Respondents were also asked about the appropriateness of providing windchill readings using a verbal rather than a numeric scale.

Among the eastern respondents, a few were able to recall a limited number of other methods of expressing windchill:

"I've heard windchill expressed using words, but I don't remember which ones."

"They say, with windchill, you get frostbite in five minutes."

"It means that flesh freezes in three minutes."

"They sometimes say 'risk of frostbite'."

"I've heard 'bitterly cold' before."

Most participants felt that using subjective terms (such as 'bitterly cold') is less useful than objective expressions (such as 'skin will freeze in five minutes'). If used,

the latter should follow the actual temperature reading in weather reports, according to these participants.

The French-speaking groups also used various terms as synonyms for windchill including *facteur vent*, *facteur éolien* and *facteur de refroidissement*.

In the western groups, participants were tested with verbal scales such as cold, very cold and bitterly cold, and high, very high and extreme windchills. Overall, verbal scales like these were viewed as too subjective. As one participant indicated;

“What is cold in Florida isn’t cold in Alberta.”

In addition, participants indicated there would be a lack of consistency across the country with the use of verbal measures.

“A measure like that is subjective and would not be applicable across the country ... what one person considers cold, another person might not.”

In addition to these problems, a number of participants in the west indicated that verbal scales of this sort do not allow for a precise measure, provide vague information and are not comprehensive enough. A number of participants were supportive of the verbal descriptors but only if they were used in combination with some other measure (equivalent temperature or cooling rate).

7.3 Windchill Expressed as a More Accurate Equivalent Temperature

In the six eastern groups, participants were informed that one of the problems with using equivalent temperatures stems from the way in which the temperatures were originally calculated. Over time, this calculation was found to be incorrect meaning that the equivalent temperatures provided to the public are frequently over-stated (i.e. it will not feel as cold as reported). Participants were then asked whether a more accurate way of calculating windchills should be employed.

Participants’ opinions were divided on the benefits of a more accurate method of expressing windchill as equivalent temperature. Approximately half the participants felt that a more accurate calculation of equivalent temperature would be beneficial, as it would help in making better decisions as to how to dress. For these participants, keeping the same unit of measure, with which they are comfortable, would minimize their resistance to change.

However, a change to this more precise equivalent temperature would only be worthwhile if the added precision makes an appreciable difference, probably of five degrees or more. Should the change be worthwhile, these participants would be willing to learn a new system.

The other half believed that the actual number expressing windchill does not matter; what does matter to them is how they feel outside.

“As long as I know it’s really cold it doesn’t matter to me the exact temperature.”

In fact, they indicated that people would not even notice a change in the precision of this system. These participants, unconvinced of the new system’s benefits and satisfied with the current one, did not consider it worthwhile to have to learn something new.

“We all understand the current system, so why change it?”

Finally, one person brought up the fact that introducing a more accurate equivalent temperature would imply that Environment Canada had been providing erroneous information for years. This would undermine his confidence in all other weather information.

This topic was not addressed in the Winnipeg groups, because these respondents were so well versed in cooling rates. It was also omitted in Regina and Edmonton on the advice of Environment Canada observers who indicated that the premise of the questioning (equivalent temperatures are not accurate) was not entirely true.

8.0 METHODS OF PROVIDING INFORMATION ON WINDCHILL

The final section of the discussion assessed participants' opinions on the importance of education if there was a change in the way in which windchill information was provided.

8.1 Importance of Education

Participants agreed virtually unanimously that an education process is essential, should a change in windchill system occur. Only those who were uninterested in windchill information in general did not attach any importance to public education.

In the east, respondents did not seem surprised to learn that the cooling rate system introduced in other parts of Canada had met with fairly strong resistance. They believed that people in those regions were comfortable with the existing system, and did not receive adequate information about the new method. The population therefore did not understand the benefits of the new system, hence their resistance to change. Participants believed that proper education over a somewhat lengthy transition period would prevent such problems.

"It was perhaps introduced overnight. Did they warn people?"

While respondents in the west fully appreciated the need for education should windchill change, many were sceptical as to why the change would be made. In each of the Winnipeg and Regina groups participants reiterated "if it isn't broken, don't fix it". Among the prairie groups a number of participants indicated that they could live with what we had now and that the money should be spent elsewhere.

"Don't waste the taxpayers' money."

8.2 Method of Education

The vast majority of participants strongly believed that a transition period, where both the current and the new systems were provided, was essential. This would help people get accustomed to the new system and make the appropriate decisions.

Participants mentioned several ways of communicating a change in windchill system, but most predominant was the suggestion that any modification be publicized in the places where people typically look for weather information. This would entail providing information in newspapers, on the radio and on television, in conjunction with regular weather forecasts.

In the east, participants mentioned the use of a brochure that could be distributed to every home. This brochure could be similar to the Year 2000 (Y2K) pamphlet published recently by the Government of Canada. Those in the west expressed strong opposition to the use of pamphlets and other mail-outs which they referred to as "garbage".

Several participants felt that some form of education should be done in schools, to sensitize children to the new system. Indeed, some of the older participants felt that they would learn the new system through their children.

In the eastern groups, participants also suggested inserting a notice along with heating bills, or with income tax correspondence from Revenue Canada (this idea was rejected in the western groups). However, others countered that people are likely to look only at their bill, and throw away the remaining contents of the envelope. Further, the participants who did not see any benefit in changing the way windchill is expressed disagreed with the option of including a notice with correspondence from Revenue Canada. They felt people would immediately make the connection between their tax dollars and a seemingly frivolous change in the way weather information is provided.

"It makes you think that you owe money; it could be dangerous."

Across all of the groups, several members suggested that a conversion chart be provided, perhaps in the form of a fridge magnet, in order that they could consult it for however long they feel they need to.

Finally, information sessions seem to be of little efficacy as a way of educating the population about the change in system. Most participants indicated that they would not attend such sessions.

8.3 Timing

According to the participants, the transition period, during which windchill information should be presented in both the current format and the new way, should last anywhere from several months to a few years.

Since most participants agree that a change would initially cause confusion, they believe that the education process should be initiated early enough to allow people to accustom themselves to the new system before the winter season. Therefore, most participants feel that early fall (September-October) would be the ideal time to start informing the public about the change. Some members of the groups would even prefer to see this process started as early as August, while others believe that starting in November would be adequate.

8.4 National Standard

In the Edmonton, Regina and Winnipeg groups, participants were informed that, at the present time, the way in which windchill information is provided to the public varies across the country. Some people get cooling rates, some get equivalent temperatures, some get verbal scales and others get a combination of some or all of these. Participants were then asked how important they believed it was that windchill should be expressed in the same way across the country.

In general, participants were very supportive of Canada adopting one, standard method of providing windchill measures across the country. In many instances, respondents indicated that it would be beneficial to people who travel to have the same system employed nationally. If any decision is made to change the way in which windchill figures are provided, the issue of national standardization should be incorporated into any messages provided to the public (this is assuming that the changes would be to one system across the country).

If standardization did take place, a number of participants indicated that there would be significant variation in the important thresholds.

8.5 Reaction to Change in Windchill Measurement and Provision

Overall, participants adopted a pretty pragmatic reaction to change. As many of them said, “you may not like the change, but ultimately there isn’t much you can do about it”. Others said that they were comfortable with the current system, but that if it was changed then that was the “prerogative” of Environment Canada or as one participant indicated:

“Everyone wants progress, no one wants change.”

9.0 CONCLUSIONS

In the majority of instances, participants use the current windchill units or figures as relative measures. By that we mean, even though a respondent may not understand what a cooling rate of 1800 is actually measuring, those who live in areas where this system is used, and has been used for some time, understand what these readings mean. As such, they are able to change their behaviour appropriately whether it is dressing in more layers, staying indoors or limiting car travel. In this way it seems to matter little to them that they do not know that the units are watts per square metre, nor do they seem particularly interested in learning more about the measure. As one participant in the Winnipeg groups stated:

“I wouldn’t care if the scale was based on colours (yellow meant something, red something else and blue something else which was worse). It’s just the person’s relative reaction that counts the most. You change your behaviour accordingly.”

The same finding holds for equivalent temperatures. While very few respondents could provide a definition of a degree Celsius, most of them are clear on what it means to have a windchill expressed in an equivalent temperature of -30C. As was the case for the cooling rates, their response to these figures and this information becomes behaviour based, that is, they know what to do as a result of hearing a number of this magnitude. So while they may not understand the precise science behind the number (nor do they seem particularly interested in it) they are fairly clear on what actions they need to take to ensure their safety and their family’s safety. This explanation goes some distance to explaining their rather ambivalent answers to discussions that focussed on current inaccuracies with equivalent temperatures. Since participants use these figures as a relative indicator only, it matters less to them that the science behind it is precise. Through experience, they have come to learn what to do at windchills of -30 or -40. The fact that these equivalent temperatures are not accurate becomes immaterial to participants since they use them as relative figures only.

Overall, if the purpose of providing windchill figures is to allow Canadians to make sensible decisions for themselves, their families and their co-workers during winter then the results of these groups seem to indicate that this is succeeding regardless of how Canadians currently receive windchill information.

Still these results indicate that there is some room to move and change the system if that decision is made. In particular, while participants seem to favour the status quo for most of the communities assessed (many have become comfortable with a system which at its introduction probably seemed complex and difficult), positioning a standardized, national windchill delivery system or product appears to have its merits. If this is done, it will be important to explain why it is being undertaken, educate people on the system/product, provide both measures in communities that are getting the new delivery system/product and do all of it without appearing to be frivolous with money.

The reaction of participants indicates that while they may not necessarily like change, they view it pragmatically. If a new system is introduced, it is possible to gain acceptance and understanding of it.

Whatever decision is made, it may be important to keep in mind the current windchill preferences per city:

Ottawa, Moncton and Quebec City

- equivalent temperatures

Edmonton

- equivalent temperatures

Regina

- equivalent temperatures

Winnipeg

- cooling rate

10.0 DISCUSSION GUIDE
