



AIR QUALITY POLICY FOR ORIENTEERING EVENTS

2024

Modification dates:

- Approved June 17th, 2024.

1.0 Reason for this Policy

When air quality is compromised by contaminants in the air a person's health can be adversely affected. Smoke from forest fires and emissions from other sources can have a profound impact on air quality.

The Alberta Orienteering Association (AOA) recognizes the potential short- and long-term health effects of engaging in physical activity outdoors when the air quality is poor. The AOA is fully committed to reducing the risk posed to orienteers from poor air quality.

2.0 Purpose and Scope

The purpose of this policy is to provide Alberta orienteering officials (coaches and event organizers) with guidelines that aim to reduce the health-related risk of poor air quality on people attending, helping at, and organizing orienteering events in Alberta.

This policy is available on the AOA website.

3.0 Background on Air Quality Impacts on Outdoor Sports

There are many resources from which one can learn about air quality, the air quality health index (AQHI), and poor air quality as it impacts outdoor sports. Examples are given below.

- Learn about the AQHI from an Alberta government website¹
- The Sport Information Resource Centre (SIRC), Health Canada, and the Coaching Association of Canada (CAC) developed an e-learning module on air quality impacts on outdoor sports, accessible for free from the internet². They have also provided a summary of air quality impacts on outdoor sport participation³;
- Health Canada has developed guidelines for sport groups that they can use in creating their own air quality guidelines⁴;
- The Environment and Climate Change Canada weather app 'WeatherCAN'⁵ has an AQHI section. The app is available for both Android and iOS smart phones; a user can set up alerts.

The following table is commonly used to describe the AQHI, and what people should do given a reported AQHI value. The most important thing to remember from an orienteering official's perspective is that, according to SIRC and Health Canada, **anyone participating in an outdoor sport is considered to be part of the at-risk population**⁶.

¹ <https://www.alberta.ca/about-the-air-quality-health-index>

² *Air Pollution and Sport Safety*. <https://sirc.ca/air-quality-and-sport>

³ <https://sirc.ca/blog/clearing-the-air-around-air-quality-and-outdoor-sport-safety/>

⁴ *Air Quality and Outdoor Sport Safety*. <chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://sirc.ca/wp-content/uploads/2023/02/Air-Quality-Policy-Guide-FINAL-EN.pdf>

⁵ *WeatherCAN*. <https://www.canada.ca/en/environment-climate-change/services/weather-general-tools-resources/weathercan.html>

⁶ <https://sirc.ca/blog/clearing-the-air-around-air-quality-and-outdoor-sport-safety/>

Health Risk	Air Quality Health Index	Health Messages	
		At Risk Population	General Population
Low Risk	1 – 3	Enjoy your usual outdoor activities.	Ideal air quality for outdoor activities.
Moderate Risk	4 – 6	Consider reducing or rescheduling strenuous activities outdoors if you are experiencing symptoms.	No need to modify your usual outdoor activities unless you experience symptoms such as coughing and throat irritation.
High Risk	7 – 10	Reduce or reschedule strenuous activities outdoors. Children and the elderly should also take it easy.	Consider reducing or rescheduling strenuous activities outdoors if you experience symptoms such as coughing and throat irritation.
Very High Risk	10+ ^a	Avoid strenuous activities outdoors. Children and the elderly should also avoid outdoor physical exertion.	Reduce or reschedule strenuous activities outdoors, especially if you experience symptoms such as coughing and throat irritation.

^a '10+' means that the AQHI reading is greater than 10.

Air quality can change rapidly and the AQHI can also be quite different depending on one's location – even adjoining neighborhoods can have differing values. This makes it difficult to determine “rules” regarding the management of orienteering events, and so in this policy, some discretion is being given to the orienteering officials in charge of an event.

4.0 Recommendations for Orienteering Events with Regard to Air Quality

4.1 Factors that affect the impact of air quality on an orienteering event

Possible accommodations to an adverse AQHI will depend on several factors:

- The type of event:
 - Training
 - Competition (C-, B-, or Canada Cup event);
- Ability to determine the local AQHI: While the WeatherCAN app provides the AQHI for cities, towns, and villages, an orienteering B- or Canada Cup-event is not often close to one of these centers;
- Duration of the event: An orienteering event often runs through a whole day: placement of controls, vetting, the competition window, which can be at least 4-h long, and subsequent take-down. During this time the AQHI could vary; some competitors could race during an AQHI < 4, while others could experience an AQHI > 7. Officials and volunteers are often present for the whole day. A consideration is that air quality can deteriorate rapidly, but usually only improves slowly.
- Intensity of competition (e.g. sprint vs. long vs. recreational)

4.2 Recommendations

1. The officials in charge of an event or training session will check the AQHI for a location as close to the site as possible, as well as the forecast maximums. These AQHI values should be used to adjust participants' potential exposure to poor air quality.
2. An orienteering event will be cancelled if the AQHI, or PM_{2.5} equivalent, is greater than 10 (i.e. 10+).

If, during an event, the AQHI (or PM_{2.5} equivalent) goes above 10, no further starts will be allowed. As well, any competitor observed, who is still on the course (e.g. passing through an arena), will be told to stop their race. Note that it is likely that the event was already modified (AQHI was likely above 7).



3. When the AQHI reaches 4 or above, all participants should be informed of the risks, (e.g. using information flyers at registration). This information is especially important for those with pre-existing medical conditions. Specific recommendations follow.
4. If the AQHI is not available, measurement of PM_{2.5} can be used (Appendix A – Approximating the AQHI Air quality using PM_{2.5} Measurement).
 - a. At orienteering sites that are distant from centers that report AQHI values, it is often the case that there is a site that measures PM_{2.5} that is closer to the orienteering event site.
 - b. PM_{2.5} monitoring sites often report values every few minutes, whereas the AQHI is usually only updated hourly.

Given these two factors, a PM_{2.5} monitoring site may often provide more relevant data on the air quality at the orienteering site. For this reason, in this policy we have included values for the US EPA PM_{2.5} air quality index (AQI) values that can be used in conjunction with the Canadian AQHI values.

4.2.1 Recommendations for Training or Learn-to-Orienteer Events

Decisions regarding whether to modify or reschedule training or learning events will be based on the AQHI value and will be made by the head coach or program leader. We recommend that the CAC guidelines be used:

AQHI value	Recommendation	US EPA AQI for PM _{2.5} ^a
1 – 3	Carry on as usual.	0 - 50
4 – 6	Reduce intensity and/or duration of the event; <ul style="list-style-type: none"> • The coach or leader should be aware of any pre-existing medical conditions of the participants; • Monitor all participants. 	51-200
7 – 10	If possible, move the event indoors, or, if not, re-schedule or cancel.	201-300
10+	The event is cancelled.	300+

^a This is a modification of the US EPA guidelines. The full table of US EPA PM_{2.5} guidelines is given in Appendix A.

4.2.2 Recommendations for C Events

Decisions regarding whether to modify or cancel a C-event will be based on the AQHI value and will be made by the event organizer(s). As these are local club events, often held within the city, or a minimal distance away, the recommendations are:

AQHI value	Recommendation	US EPA AQI for PM _{2.5}
1 – 3	Carry on as usual.	0 - 50
4 – 6	At registration notify participants of AQHI value and advise caution.	51-200
7 – 10	At registration notify participants of AQHI value, advise caution, and notify that all competitive aspects of the event (e.g. club “points”) are removed.	201-300
10+	The event is cancelled. Notification should be made on the club website.	300+

Whether to cancel or not will be determined on the day of the event in order that a cancellation notice can be communicated in as timely a manner as possible.

A possible option in the event of a cancellation is to create a MapRun event, and advise members they could run the course at their convenience.



4.2.3 Recommendations for B- and Canada Cup-events

For B- and Canada Cup events, a committee of at least three people (e.g. course planner, event director, controller, jury members) should meet at least three hours before the start time of the event to discuss potential cancellation or other mitigating changes to the event.

Based on the forecast and/or actual AQHI value:

AQHI value	Recommendation	US EPA AQI for PM _{2.5}
1 – 3	Carry on as usual.	0 - 50
4 – 6	Notify participants of AQHI value and advise caution.	51-200
7 – 10	Notify participants of AQHI value, advise caution, and let all participants know that all competitive aspects of the event (e.g. posted results, medals) are removed.	201-300
10+	The event is cancelled.	300+

If the air quality has been on an improving trend, the committee has the option to postpone starts for two hours (as long as competitors can still finish during daylight hours).

For B-events, the committee can consider rescheduling the event. This should be determined well ahead of the actual event, including the new date, if the event has to be re-scheduled. This information, whether the event would be rescheduled (with date), or cancelled outright, in the event of poor air quality, must be posted on the event web-page, and included in the registration form, for competitors to acknowledge. The time when organizers will post to all websites as to a decision regarding cancellation or re-scheduling must also be included in all event information.

It is recommended that the host club also post information as to whether refunds will be offered if the event is re-scheduled, or cancelled outright.

5.0 General Recommendations when Organizing an Orienteering Event When Poor Air Quality is Possible

Many of the following are common sense.

- An advisory must be placed on club and event-specific websites, and in other communications such as registration information, competitor newsletters, or information bulletins, that events could be cancelled, re-scheduled, or modified, in the event of poor air quality. The time that a cancellation notice will be posted on all pertinent websites, must also be included.
- Changes to an event must be communicated as effectively and as timely as possible (e.g. club web-site for C- or B-events, to both web-site and direct e-mail to registered participants (if technologically feasible) for B- and Canada Cup events.
- Impacts on health of poor air quality must be posted to club and event-specific web sites (the AQHI table should be posted, at a minimum).
- The course planner or event director should identify the air quality monitoring sites closest to the event location (N, S, E, and W of the site) on the WeatherCAN app or the Alberta AQHI site⁷, and monitor the values the day before, and four hours before the start of the event, when air quality could be an issue. When air quality is changing, the AQHI should be monitored every two hours during the event, and results posted for the competitors. PM_{2.5} monitoring sites should also be identified and monitored.

⁷ <https://airquality.alberta.ca/map>



- In the event that there is no internet access at the site of the event, and so officials cannot monitor the AQHI, they should arrange for someone who will have internet access to update the on-site officials.
- If there is no cell coverage either, an option would be to buy a PM_{2.5} monitor to be used on site (see Appendix A).
- If there are no other sources of air quality data, visibility could be used, but research has shown it to be somewhat problematic. The Nevada Division of Environmental Protection has published a guideline relating visibility and air quality (see Appendix B – Nevada Division of Environmental Protection: Visibility Range as a Tool for Estimating Air Quality)
- Course planners and other volunteers should modify their field work when the AQHI is 7 or above: either go another time or wear a well-fitting mask that can block PM_{2.5} particles (e.g. N95 or N99 masks).

In summary, orienteering officials should always keep the welfare of participants in mind, and provide information to participants on air quality.



6.0 Appendix A – Approximating the AQHI Air quality using PM_{2.5} Measurement

When there are no AQHI monitoring stations nearby, or if the local conditions are obviously different, a measure of the PM_{2.5} value can serve as a broad guide.

There are sensors one can purchase such as the Purple Air PA-II air quality sensor that is used by Alberta Environment^{8, 9}, as well as access to on-line monitoring sites. These include that of the World Air Quality Index organization¹⁰, IQAir¹¹, which includes a map showing wind direction with air quality i.e. is there a chance the smoke will clear) or Purple Air¹²

You have to be careful interpreting values you find on websites e.g. are they raw data, or have they been converted to the (usually) US EPA AQI value?

- A calculator can be found here <https://www.airnow.gov/aqi/aqi-calculator-concentration/> to convert between the two values;
- The US EPA AQI categories for PM_{2.5} are given in the table below.

US EPA AQI categories¹³:

AQI	Air Pollution Level	Health Implications	Cautionary Statement (for PM _{2.5})
0 - 50	Good	Air quality is considered satisfactory, and air pollution poses little or no risk	None
51 -100	Moderate	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.	Active children and adults, and people with respiratory disease, such as asthma, should limit prolonged outdoor exertion.
101-150	Unhealthy for Sensitive Groups	Members of sensitive groups may experience health effects. The general public is not likely to be affected.	Active children and adults, and people with respiratory disease, such as asthma, should limit prolonged outdoor exertion.
151-200	Unhealthy	Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects	Active children and adults, and people with respiratory disease, such as asthma, should avoid prolonged outdoor exertion; everyone else, especially children, should limit prolonged outdoor exertion
201-300	Very Unhealthy	Health warnings of emergency conditions. The entire population is more likely to be affected.	Active children and adults, and people with respiratory disease, such as asthma, should avoid all outdoor exertion; everyone else, especially children, should limit outdoor exertion.
300+	Hazardous	Health alert: everyone may experience more serious health effects	Everyone should avoid all outdoor exertion

⁸ <https://www.alberta.ca/provincial-air-quality-management>

⁹ Cost ranges from \$229 to \$299.

¹⁰ <https://aqicn.org/here/>

¹¹ <https://www.iqair.com/ca/canada/alberta>






¹² <https://map.purpleair.com/1/mAQI/a10/p604800/cc0#9.22/52.3384/-113.6231>

¹³ <https://aqicn.org/calculator/>

7.0 Appendix B – Nevada Division of Environmental Protection: Visibility Range as a Tool for Estimating Air Quality¹⁴

To use the table:

- Face away from the sun;
- Determine the limit of your visibility range by looking at something at a known distance (miles). The visibility range is the point at which even high-contrast objects (e.g. a dark mountain against the sky at noon) totally disappear;
- After determining the visibility in miles, use the table to identify the level of health concern and the associated protective actions recommended.

Visibility (AQI)	Local Landmark	Level of Health Concern	Visibility Example
Visibility >10 miles Good = 0-50	Slide Mountain	Air quality is considered satisfactory, and air pollution poses little or no risk.	
Visibility 6 to 10 miles Moderate = 51-100	Snow Valley Peak	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.	
Visibility 3 to 5 miles Unhealthy for Sensitive Groups = 101-150	Prison Hill	Members of sensitive groups may experience health effects. The general public is not likely to be affected.	
Visibility 1.5 to 2.75 miles Unhealthy 151-200	Mouth of Ash Canyon	Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects.	
Visibility 1 to 1.25 miles Very Unhealthy 201-300	C Hill	Health alert: everyone may experience more serious health effects.	
Visibility <1 mile Hazardous 301-500	No visible landmarks	Health warnings of emergency conditions. The entire population is more likely to be affected.	

¹⁴ chrome-extension://efaidnbnmnibpcjpcglclefindmkaj/https://ndep.nv.gov/uploads/air-aqm-docs/AQI_Estimator_General_Public.pdf

8.0 Appendix C – How to Calculate the AQHI

The AQHI is calculated from measured concentrations of nitrogen dioxide, ground-level ozone, and particulate matter less than 2.5 μ ($PM_{2.5}$)¹⁵. The formula is given in Stieb et al.¹⁶, which depends on 3-h average concentrations of the three components.

$$AQHI = \left(\frac{10}{10.4}\right) \times 100 \times [(e^{0.000537 \times O_3} - 1) + (e^{0.000871 \times NO_2} - 1) + (e^{0.000487 \times PM_{2.5}} - 1)]$$

where O_3 and NO_2 concentrations are in ppb and $PM_{2.5}$ is in $\mu g/m^3$.

A possibly more straight-forward approach are the absolute thresholds of specified parameters that Alberta sometimes uses in its Ambient Air Quality Objectives¹⁷.

One review of devices to measure indoor air quality is provided by BreathSafeAir¹⁸. An important consideration they mention is that monitors lose their calibration after only a few months, and so will have to be regularly maintained. One supplier of outdoor monitors (this is not an endorsement) is Aeroqual¹⁹, which supplies monitors that can measure all three parameters used in the calculation of the AQHI (AQS series). But they are not cheap, ranging from \$1K up to \$6K. However, sensors that just determine $PM_{2.5}$ concentrations are much less expensive.

It would be straightforward to calculate the AQHI using a spreadsheet, if the data were available.

¹⁵ *Air Quality Index (Canada)*. Retrieved from [https://en.wikipedia.org/wiki/Air_Quality_Health_Index_\(Canada\)#:~:text=heat%20or%20humidity,Calculation,billion%20\(ppb\)%20while%20PM2](https://en.wikipedia.org/wiki/Air_Quality_Health_Index_(Canada)#:~:text=heat%20or%20humidity,Calculation,billion%20(ppb)%20while%20PM2)

¹⁶ Stieb, D. M. (2012). A New Multipollutant, No-Threshold Air Quality Index ... *Journal of the Air & Waste Management Association*, 58(3), 435-450.

¹⁷ <https://www.alberta.ca/ambient-air-quality-objectives>

¹⁸ *Air Quality Monitors - What you need to know*. Retrieved from <https://breathesafeair.com/air-quality-monitors/>

¹⁹ <https://www.aeroqual.com/products>