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A Scan of Municipal Heat/Health Watch Warning Systems and Hot Weather Response Plans

Prepared on behalf of and with the support of the
Greater Toronto Area Clean Air Council

GTA CleanAir COUNCIL

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About the Clean Air Partnership
The Clean Air Partnership (CAP) is a registered charity that works in partnership to promote and coordinate actions to improve local air quality and reduce greenhouse gases for healthy communities. Our applied research on municipal policies strives to broaden and improve access to public policy debate on air pollution and climate change issues. Our social marketing programs focus on energy conservation activities that motivate individuals, government, schools, utilities, businesses and communities to take action to clean the air.

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EXECUTIVE SUMMARY

Heat is the deadliest of all atmospheric phenomena. As southern Ontario continues to warm, heat will become more and more of a public health concern in the Greater Toronto Area (GTA). Heat watch-warning systems combined with intervention strategies have been shown to save lives.

There are a variety of heat alert triggers used around the world, but the most common in Canada is Environment Canada's Humidex Index. Alerts are issued when the Humidex reaches 36°C or 40°C for an extended period of time. However, this system does not account for variability in human responses to heat, acclimatization over the summer months or the effects of several consecutive days of high heat and warm nights. As a result, a number of municipalities in the world, including Toronto and Peel Region, have adopted a more holistic approach known as the "spatial synoptic classification system". This method is location-specific and works by identifying air masses or weather types historically associated with increases in mortality. Alerts are issued when the likelihood of excessive mortality is predicted to exceed 65% (Heat Alert) or 95% (Extreme Heat Alert).

Across the GTA, government response to extreme heat is inconsistent. Public health and thus the issuing of heat alerts is the responsibility of upper- or single-tier municipalities. However, not all upper- or single-tier municipalities issue heat alerts and among those that do the trigger and type of response varies.

The response to extreme heat is also hampered by a lack of funding. Despite the fact that responsibility for heat intervention strategies tends to rest with lower-tier municipalities, very few lower-tier municipalities in the GTA have official hot weather response plans, and none receive funding from upper-tier municipalities to support their interventions. Nor have the upper-tier municipalities received funding from either the province or the federal government to develop heat alert systems.

Furthermore, no instances of common messaging for heat and smog alerts were found, despite the potential of these messages to conflict.

More research is needed to determine an appropriate heat alert trigger for Canadian cities, what effective mitigation strategies are, and the identity and location of the most vulnerable populations. As extreme heat events become more frequent, more Public Health Units will want to develop heat watch-warning systems. Direction and funding from the federal and provincial governments would streamline this development and eliminate duplication of efforts.

1. INTRODUCTION

Extreme heat events have a significant impact on public health, causing on average 120 deaths in the City of Toronto alone per year[1]. In the Toronto-Niagara region it is predicted that the number of heat-related premature deaths among the elderly alone could reach 144-447 annually by the mid 2020s[2] . In response to growing scientific understanding of heat-related mortality, heat watch-warning systems and response plans are being developed and implemented around the world and across the Greater Toronto Area (GTA).

This scan is an attempt to document the scope of hot weather responses in the GTA from all levels of municipal government. A total of twenty-six jurisdictions in the GTA and beyond were contacted to provide information about their community-focused[3] heat health watch-warning systems, hot weather response plans and intervention strategies. A secondary objective of this scan was to identify and document efforts to develop common messaging between heat alerts and smog alerts. High heat and poor air quality are related and often coincide, however messaging related to both has the potential to conflict.

The results of a survey sent to municipal staff in March, 2007, and subsequent follow-up telephone calls are presented in tabular form in section two of this report. The final three sections outline different heat watch-warning systems, provide an overview of selected hot weather response plans, including evaluations where available, and discuss the issue of common messaging between smog and heat alerts.

[1] Cheng, CS, Campbell, M et al. 2005 'Differential and Combined Impacts of Winter and Summer Weather and Air Pollution Due to Global Warming on Human Mortality in South Central Canada'. Technical Report submitted to Health Policy Research Program. Health Canada. http://www.toronto.ca/health/hphe/weather_air_pollution_research.htm

[2] Chiotti Q, Morton I, Maarouf A. Towards an adaptation plan: Climate change and health in the Toronto-Niagara region: Summary for Policy Makers. Adapting health infrastructures to cope with the health effects of climate change. A case study in the Toronto-Niagara region. 2002. Pollution Probe.

[3] As employers, governments are required to make provisions for their employees during heat events, however cataloguing these measures was not part of this scan.

2. SCAN RESULTS

Table 1 – Result of Municipal scan of heat alert and response systems in the GTA

Jurisdiction	Heat Alert / Response Plan Status	Development Partners/ Stakeholders	Heat Intervention Strategies	Trigger	Challenges/ Barriers	Contact
2.1 The City of Toronto						
City of Toronto	Heat Watch Warning System developed in 2000. Hot weather response plan updated annually.	• Toronto Public Health • Canadian Red Cross • Community Information Toronto • Regent Park Community Health Centre • Toronto Community Care Access Centres • Toronto Emergency Medical Services • Toronto Housing Corporation • Toronto Parks Forestry and Recreation • Toronto Public Library • Toronto Office of Emergency Management • Toronto Police Services • Toronto Shelter, Support Housing Administration • Toronto West Seniors Network • Toronto Office of Emergency Management • Community Care Access Centres • Ontario Community Support Administration • Environment Canada • Kent State University	There are over 800 agencies involved in coordinating Toronto's hot weather response strategy. Intervention strategies include: • Opening cooling centres in administrative buildings • Issuing media alerts to advise public of extreme heat alerts and necessary precautions • Supplying TTC tokens to the homeless so they can reach cooling centres • Distributing Hot Weather Protection Plan packages to boarding, lodging and group homes and developing on-site extreme heat contingency plans these facility operators • Operating a public information line • Delivering bottled water to agencies that work with vulnerable populations • Extending pool operating hours • *For a more detailed summary see Section 3, below	Based on the synoptic classification of air masses – a Heat Alert is called when an oppressive air mass is forecast and the likelihood of excess mortality related to the weather exceeds 65% (Heat Alert) and 90% (Extreme Heat Alert) (See section 3.1 for a complete description of the synoptic classification system)	According to updates of Toronto's Hot Weather Response Plan prepared in 2005 and 2006: • Fans do not work above the third floor because municipal by-laws prevent windows from being opened more than 4 inches • A/C units were offered but refused by rooming homes and boarding houses because of associated costs • Isolated and at-risk individuals are reluctant to go to cooling centres • Providing adequate services to vulnerable populations during off-hours is a challenge for staff and strains resources	Marco Vittiglio Manager Emergency Planning & Preparedness Unit 416-338-8187 mvittig@toronto.ca

Jurisdiction	Heat Alert / Response Plan Status	Development Partners/ Stakeholders	Heat Intervention Strategies	Trigger	Challenges/ Barriers	Contact
2.2 Halton Region						
Halton Region	Hot Weather Response Plan approved in 2003	Heat Alert notifications are sent to approximately 180 agencies including child care centres, long term care facilities/ hospitals, local shelter sites and regional employees. Notice is also provided to the media and local municipalities, school boards, hydro utilities and Conservation Halton.	At this time there are no official response strategies in place at the Regional level. It is up to individual lower-tier municipalities in the Region to determine the response that best suits their population.	Staff monitors Environment Canada site between May 15th -Sept. 30th and receives notifications of 5-day forecast and any Humidex Advisory warnings. • Environment Canada issues humidex advisories when the maximum daily humidex is expected to: exceed 40°Celsius (104°F) and/or exceed 36 degrees Celsius for an extended period (3 or more days) • If a humidex advisory is issued, then Halton Region Health Department will issue a Heat Alert.	• Halton does not have a 'visible homeless population. Often those that require assistance on extreme heat days are members of at-risk groups that are difficult to identify	Beckie Jas Environmental Health Specialist 905-825-6000 x 7678 Beckie.Jas@halton.ca
Town of Oakville	Town of Oakville Heat Alert Protocol developed in 2006, and finalized in 2007. Protocol supports the Halton Region's Hot Weather Response Plan	Heat alert strategy was developed by Halton Region. Town of Oakville developed internal protocol. Oakville's Recreation and Culture Department, Library, Environmental Policy and Policy, Strategy and Corporate Communications are involved in the municipal response.	• Community Centres, Town Hall and Libraries are available to the public as cooling centres. • Outdoor pools are open until dusk and extended hours established for indoor pools.	When Halton Region calls a heat alert, a notification is forwarded from the Region through the Halton Partners for Clean Air e-mail network. See Region of Halton (above) for Heat Alert trigger	None cited	Nina deVaal Director, Recreation and Culture 905-845-6601 x 3112 ndevaal@oakville.ca
City of Burlington	Burlington is covered by Halton Region's Hot Weather Response Plan	Heat alert strategy was developed by the Region. Burlington Parks and Recreation are responsible for the municipal program.	• Outdoor pools are kept open later, sunlight permitting • During the blackout, in 2003, the city kept facilities open later in the evening as cooling centres but there was little demand	When Halton Region calls a heat alert, a notification is forwarded from the Region through the Halton Partners for Clean Air e-mail network. See Halton Region for specific trigger.	• Strategy was developed by the region however recreation facilities are owned and managed by the lower tier municipalities. This presents communications challenges	Denise Beard, Supervisor of Programs, Parks and Recreation 905-639-2315 Beardd@burlington.ca

Jurisdiction	Heat Alert/ Response Plan Status	Development Partners/ Stakeholders	Heat Intervention Strategies	Trigger	Challenges/ Barriers	Contact
2.3 Peel Region						
Peel Region	Heat Watch Warning System and hot weather response plan implemented in 2006	• Workplace Health and Safety (Peel) • Ambulance and Emergency Programs (Peel) • Children's Services (Peel) • Fire and Emergency Services (Caledon) • Chronic Disease and Injury Prevention (Peel) • Environmental Health (Peel) • Communication Services (Peel) • Long-Term Care (Peel) • Management Services (Brampton) • Medical Officer of Health • Housing and Property (Peel) • Emergency Management (Brampton) • Ontario Works (Peel) • Business and Information Services (Peel) • Associate Medical Officer of Health (Peel) • Parks and Recreation (Mississauga)	Intervention strategies are specific to development partners and stakeholders. Contact Peel Region or individual partners/ stakeholders for more information.	Based on the synoptic classification of air masses – an alert is called when an oppressive air mass is forecast and the likelihood of excess mortality related to the weather exceeds 65% (Heat Alert) and 90% (Extreme Heat Alert) Synoptic systems are custom-made for individual urban areas based on specific meteorology, urban structure and demographics. When the data was examined from Peel Region, it was determined that mortality rates associated with certain air masses were statistically different (17%-20%) in Mississauga than in Caledon and Brampton. Based on these results a two-tiered Heat/Health Watch Warning System was developed for Peel Region. Under this two-tiered system climate conditions that trigger an alert in Mississauga do not necessarily trigger one in Brampton or Caledon.	• Various stakeholder priorities • Limited Resources • Keeping the Stakeholder contact list up to date	Lori Greco Supervisor, Chronic Disease and Injury Prevention Division 905-791-7800 x 2117 Lori.Greco@peelregion.ca
Town of Caledon	Included in Peel Region Heat Watch Warning System. No municipal hot weather response plan.	• Region of Peel	No municipal intervention strategies	See Peel Region for specific trigger.	n/a	Peter Malkowski Health and Safety Coordinator 905-584-2272 peter.malkowski@caledon.ca

Jurisdiction	Heat Alert/ Response Plan Status	Development Partners/ Stakeholders	Heat Intervention Strategies	Trigger	Challenges/ Barriers	Contact
City of Brampton	Included in Peel Region Heat Health Warning System. Municipal Heat Alert and Extreme Heat Alert protocol in place.	• Region of Peel • Emergency Measures and Corporate Security, Brampton	In a Heat Alert, the protocol is to monitor more closely the health and welfare of outside workers and children in day-camps. If a heat wave lasts more than three days then Brampton reverts to the Extreme Heat Alert protocol. In an Extreme Heat Alert, the protocol calls for: • extended pool hours • offering the use of recreation centres as cooling centre Brampton has considered obtaining bottled water from Peel Region Water Services but doesn't have the resources to distribute it.	Peel Region will call a Heat Alert or Extreme Heat Alert. See Peel Region for specific triggers.	• Limited staff and financial resources	Alain Normand Emergency Measures Manager 905-874-3360 alain.normand@brampton.ca
City of Mississauga	Included in Peel Region Heat Health Warning System. No municipal hot weather response plan.	Region of Peel, City of Mississauga Parks and Recreation Department	No municipal intervention strategies. Most community centres are open from 7:00 am to at least 10:00 pm in the summer and residents have access to every municipal lobby if they need shelter from the heat. IT staff post Regional alerts on the employee Intranet and the City website. An HR staff person forwards alert to all City Health & Safety Specialists, who then forward it to department supervisors	See Peel Region for specific trigger.	• Parks and Recreation has decided not to use community centres as cooling centres based on reports from other municipalities of limited uptake and the limitation of their impact on high-risk residents unless they are brought to the centres. • Mississauga has extended outdoor swimming pool hours in the past with limited use. Again, it has been found that high-risk individuals need to be brought to the pools to take advantage of extended hours	Jim Wynne Manager, Meadowvale Community Centre 905-615-4710 x 2564 jim.wynne@mississauga.ca

Jurisdiction	Heat Alert / Response Plan Status	Development Partners/ Stakeholders	Heat Intervention Strategies	Trigger	Challenges/ Barriers	Contact
2.4 York Region						
York Region	Considering Developing Heat Watch Warning System. Using the Region of Peel as an example.	n/a	York Region does not presently have a Heat Alert System but does provide information to residents to increase awareness of the health impacts of extreme temperature events.	n/a	n/a	Helen Doyle Manager of Environmental Health 1-877-352-1698 x 4500 Helen.doyle@region.york.on.ca
Township of King	No official hot weather response plan	Township of King, Department of Parks and Recreation	• Cooling centres opened in arenas and community centres • Fees waived for public pools	No official trigger, however Environment Canada Humidex Advisories, issued when the maximum daily humidex is expected to exceed 40°C and/or exceed 36°C for an extended period (3 or more days), have been used in the past.	None cited	Catherine Purcell Director of Parks and Recreation 905-859-0056 cpurcell@king.ca
Town of Newmarket	No official hot weather response plan	Central York Fire Services, Newmarket Parks and Recreation Department	• Cooling centres have been opened in the past	n/a	None cited	John Molyneaux, Fire Chief 905-895-9222 jmolyneaux@newmarket.ca
City of Vaughan	No official hot weather response plan	n/a	• The City posts on its website the location and operating hours of air conditioned places – malls, libraries, Canada's Wonderland, etc. The population is affluent and mobile so people tend to seek out cool places independently	n/a	• No identifiable vulnerable populations • No direction from Region with respect to parameters for calling heat alerts • Disagreements as to what level of government is responsible for funding intervention strategies	Sharon Walker Manager of Emergency Planning 905-832-8585 ext. 8301 sharon.walker@vaughan.ca

Jurisdiction	Heat Alert / Response Plan Status	Development Partners/ Stakeholders	Heat Intervention Strategies	Trigger	Challenges/ Barriers	Contact
Town of Richmond Hill	No official hot weather response plan	Parks and Recreation	• Town operates cooling centres during extreme heat events. See: http://www.richmondhill.ca/sub-page.asp?doctype=&pageid=news_releases_7_27_2006_cooling&startpos=0&pagenum=0	No official trigger. Staff will monitor weather and other environmental conditions and make a decision based on these factors. If the City of Toronto issues an alert it will also be taken into consideration.	• The Region limits hours that outdoor spray pads can operate reducing their usefulness as cooling centres	Lynton Friedburg Commissioner of Parks, Recreation & Culture 905-771-2422 lfriedberg@richmondhill.ca
Town of Markham	Heat alert plan in place	This policy was driven by the Emergency Management Committee and the executive branch of the municipality. The Recreation and Culture department was enlisted to develop facilities programs. Programs in other communities were observed and emulated.	• Cooling centres are opened by the municipality • Pools may be opened and hours may be extended • Public is notified of a heat alert through media releases • Water play areas may be opened • Water and conservation measures are encouraged	No real criteria. Markham generally goes by advice from Environment Canada and typically follows Toronto's lead.	• Establishing appropriate triggers and termination factors is a challenge. • Direction is needed on when to invoke the plan and when to call a heat alert off. • Existing information and the determining factors on whether to invoke a heat alert, or not, was found to be sparse and unclear	Shayne Mintz Deputy Fire Chief City of Markham 905-477-7000 x 5960 smintz@markham.ca

Jurisdiction	Heat Alert/ Response Plan Status	Development Partners/ Stakeholders	Heat Intervention Strategies	Trigger	Challenges/ Barriers	Contact
2.5 Durham Region						
Durham Region	No official hot weather response plan - not currently being considered	n/a	No regional intervention strategies	n/a	• The Region does not own any buildings it considers suitable for cooling centres or other interventions • Other barriers include lack of resources, costs, and liability issues • Medical Officer of Health has referred the heat alert file to the Region's Social Services Department as he feels that it is the appropriate department to respond to extreme heat	Laura Freeland Senior Public Health Inspector 905-723-3818 x 2289 Laura.freeland@region.durham.on.ca
City of Pickering	No official hot weather response plan although warnings are issues to staff	• Operations and Emergency Services • Parks and Recreation	• Cooling centres and pools have been opened in the past during extreme heat events	Daily weather reports are monitored, including Environment Canada's website. The elements of temperature, humidity and smog are all considered as well as their combined effects. A general heat precaution or a precaution to limit or cancel vigorous outdoor activity, depending on the severity of the environmental warnings and actual work conditions, may be issued to staff. There is no official procedure for issuing alerts to the public. The conditions have not yet been sufficient to declare a heat emergency.	None cited	Everett Buntsma Director of Operations and Emergency Services 1-866-683-2760 Ebuntsma@city.pickering.on.ca Susan Kamin Coordinator Health & Safety 905-420-4645 skamin@city.pickering.on.ca
Town of Ajax	Plan is under consideration due to more frequent and extended periods of extreme heat.	Recreation Service, Operations & Fire Departments	• Air conditioned community centres are kept open for longer periods • Operating hours of municipal pools are extended	The criteria are informal at present, based on temperature and common sense. However, consideration will be given to formalizing thresholds as "triggers".	None at this time	Linda Cork Director of Recreation Services 905-619-2529 x 7256 Cork@townofajax.co

Jurisdiction	Heat Alert/ Response Plan Status	Development Partners/ Stakeholders	Heat Intervention Strategies	Trigger	Challenges/ Barriers	Contact
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Town of Whitby	No official hot weather response plan	n/a	No municipal intervention strategies	n/a	n/a	Donna Windborne Corporate services 905-668-5803x 2226 winbornd@whitby.ca
City of Oshawa	No official hot weather response plan	n/a	No municipal intervention strategies	n/a	• Waiting for direction from the Region	Steve Meringer Fire Chief 905-436-3899 smer-inger@oshawa.ca
Municipality of Clarington	No official hot weather response plan but there is an informal procedure in place that has been tested over a number of summers	Clarington Community Services	• Free drinking water at all recreational facilities • Free swimming during public swimming sessions • Pool hours are extended into the evening	Hot weather response procedure is triggered when the temperature goes above 30°C or when there is a Humidex value of 40°C or greater.	• Increased programming costs • Limited resources	Joe Caruana Director of Community Services 905-623-3379 jcaruana@clarington.net

Jurisdiction	Heat Alert/ Response Plan Status	Development Partners/ Stakeholders	Heat Intervention Strategies	Trigger	Challenges/ Barriers	Contact
2.6 Single and Upper-tier Municipalities outside the GTA						
City of Hamilton	Hot weather response plan drafted in 2003 - serves as a working document.	Heat Alert Planning Committee (2002): • Aboriginal Health Centre • Canadian Mental Health Association • Canadian Red Cross • City of Hamilton • C.O.A.S.T. • Good Shepherd Centre • Housing Help Centre Outreach • Mental Health Rights Coalition • Mental Health Services for Adults with Developmental Handicaps • Mission Services of Hamilton • Out of the Cold Program • Roxborough Centre • Salvation Army • S.I.S.O. • Public Health and Community Services • St. Joseph's Hospital • St. Matthews House • Wellington Psychiatric Outreach Program • Wesley Urban Ministries • Women's Detox Centre	No intervention strategies	In the past heat alerts were considered when Toronto considered calling an alert. However, this year Public Health is looking at a Humidex value of 40°C to call a heat alert and a Humidex value of 45°C to declare a heat emergency	• Public Health is not comfortable calling a heat alert when there is no coordinated response plan in place and no targets • Most community intervention strategies are aimed at homeless population and don't address the housed elderly who are the most vulnerable • Low level of interest from community partners • Lack of capacity for after-hours service • Need for coherent messaging between heat, smog and West Nile virus. Public is advised to go outside in the cooler hours of the day, which coincide with mosquito feeding times.	Steve Walsh Public Health and Social Services 905-546-2424 x 5900 swalsh@hamilton.ca
Kingston, Frontenac and Lennox & Addington (KFL&A)	Heat alert strategy in place http://www.cityofkingston.ca/residents/environment/extrem	• KFL&A Public Health (lead role) • The City of Kingston Department of Community Services • Red Cross • North Kingston Community Health Centre	(City of Kingston) • Residents are reminded to take steps to avoid physical exertion, to drink plenty of fluids, and to recognize the symptoms for heat exhaustion.	(City of Kingston) System has 3 thresholds, each with different variables that cause a threshold to be reached: • Level 1 Alert - temperatures of 36° C or humidex for at least two consecutive days with no	No challenges. Across the board acceptance. The thresholds for extreme heat are well defined and adhered to when issuing heat advisories. By having a clear set of actions at each threshold level, implementation was	Justin Chenier, Communications Officer, jchenier@healthunit.on.ca 1-800-267-7875

Jurisdiction	Heat Alert/ Response Plan Status	Development Partners/ Stakeholders	Heat Intervention Strategies	Trigger	Challenges/ Barriers	Contact
	e/heatlevels.asp	• Senior's Association	• Air conditioned public locations are promoted for heat relief. • Cooling Lounges are opened for seniors, people with certain chronic medical conditions, and infants and preschool children • Some public pools are open free-of-charge • Public skating sessions are provided free-of-charge	SMOG alert • Level 2 Alert - 36° C or humidex for at least two consecutive days with SMOG alert or 40° C on humidex for at least two consecutive days with no SMOG alert • Level 3 Alert - 36° C or humidex and above with other contributing factors (i.e. power outage) or 40° C or humidex with SMOG alert or 45° C or humidex for at least two consecutive days with no SMOG alert	easily established.	
Middlesex-London Health Unit (MLHU)	Extreme Temperature Protocol written in 2005	Members of the Extreme Temperature Network include: • Canada Post • The Canadian Red Cross • Community Care Access Centre of ML • Community Health Centre • EMS • Hospitals • Hydro One • London Hydro • ML Housing Corporation • London Animal Control/ Humane Society • London and Middlesex Fire Services • London Ontario Works • London Intercommunity Health Centre • London Police Service • OPP • Strathroy-Caradoc Police • London Transit • Public Libraries • ML Health Unit	• MLHU opens cooling centres, operates information line • Community Health Centre staff distribute educational information to vulnerable populations • ML Housing Corporation encourages 'check your neighbour' campaign developed by MLHU • Community Services coordinates outreach to homeless populations • Other community partners provide extreme temperature information to vulnerable clients	Heat Alerts are issued when one or more of the following criteria are met: • The forecast shows a humidex of 40 degrees Celsius or more • A humidex of 36 degrees is combined with a Smog Alert • Environment Canada issues a humidex warning for outdoor activity for people in the Middlesex-London area • High temperatures without a humidex reading equal to 38 degrees or above	• Some delays in getting fax notifications out to the broader agencies. MLHU relies more on using emails, coupled with media interactions to reach the broadest number of public in the area	Jim Reffle Director of Environmental Health and Chronic Disease Prevention Services 519-663-5317 x 2424 jim.reffle@mlhu.on.ca Patricia Simone Manager, Emergency Planning 519-663-5317 x 2371 pat.simone@mlhu.on.ca

Jurisdiction	Heat Alert/ Response Plan Status	Development Partners/ Stakeholders	Heat Intervention Strategies	Trigger	Challenges/ Barriers	Contact
		• Parks and Recreation and Conservation Authorities • St. John Ambulance • Seniors Network • Women's Community House • Youth Action Centre				
The City of Montreal	Heat Health Warning System designed in 2004	• Organisation de sécurité civile de l'agglomération de Montréal • Direction de santé publique de Montréal • Emergency Preparedness Centre • Centre de sécurité civile	Montreal's intervention plan includes the following: • Opening of air-conditioned cooling shelters (community centers, libraries, arenas, schools, etc.); • Longer opening hours for public swimming and wading pools and water games; • Supplying of water bottles, juice, popsicles, etc to those who need them. • Transportation of citizens to rest-stops • Communication tools to inform citizens • Door-to-door Protocol aimed at the identification of vulnerable people who could need transportation to the cooling shelters	• An **Alert Level** is signaled when the weather forecast predicts an average maximum temperature ≥ 33°C and an average minimum temperatures ≥ 20°C over a three day period • An **Intervention Level** is triggered by extreme heat indicators that reach the predicted levels specified above (alert level) or by excess numbers of death or emergency room consultations shown by daily surveillance data during this period.	• When there is a boundary situation and conditions are just at, but do not fully meet warning or alert criteria, it is unclear whether an Intervention Level should be triggered	Éliane Raymond Ville de Montréal, Centre de sécurité civile 514-280-4039 eliane-lraymond@ville.montreal.qc.ca Tom Kosatsky Direction de la santé publique de Montréal 514-528-2400 x 3285 tkosatsk@santepub-mtl.qc.ca
Simcoe Muskoka District Health Unit	No hot weather response plan though it is under consideration.	n/a	n/a	n/a	n/a	Marina Whelan Manager, Health Protection Service 705-721-7330x7345 marina.whelan@smdhu.org

Jurisdiction	Heat Alert/ Response Plan Status	Development Partners/ Stakeholders	Heat Intervention Strategies	Trigger	Challenges/ Barriers	Contact
Region of Waterloo	No current hot weather response plan though it is under considera-tion. The information presented in this table describes a now defunct hot weather response plan, and has been included as it may influ-ence future plans.	• Social Services and EMS departments • University of Waterloo • Area municipalities • Media • Shelters and other commu-nity-based agencies such as the Salvation Army and Red Cross. Extreme weather is mentioned in the Emergency Response Plan however no intervention strate-gies are identified.	No intervention strategies at the Regional level	Heat Alerts were issued following Environment Canada's Humidex Advisories, which are issued when the maximum daily humidex is expected to exceed 40°C or to exceed 36°C for an extended pe-riod (3 or more days).	• Maintaining active partner-ship with community stakeholders • Inaccurate forecasts for extreme heat • No budget • No intervention programs (e.g. cooling centres)	David Roewade Public Health Planner 519-883-2008 x 5620 rdavid@region.water loo.on.ca

3. HEAT/HEALTH WATCH WARNING SYSTEMS

Heat/Health Watch-Warning Systems anticipate weather conditions that are likely to be harmful to human health and may result in increased mortality rates. Systems are based on a predetermined meteorological threshold, which when crossed, triggers an alert. Thresholds vary from system to system. Some are based solely on temperature and humidity levels while others, like the spatial synoptic classification system[a], are based on a sophisticated combination of variables. Typically, heat watch-warning systems are operated in parallel to heat intervention strategies, such as opening cooling centres, or extending operating hours of municipal facilities.

In Ontario, public health is the responsibility of upper-tier and large single tier-municipalities. As a result, the development of watch-warning systems falls to the regions and large cities. In the GTA and southern Ontario, watch-warning systems are currently based on one of two triggers: 1) the spatial synoptic classification system, and 2) the Humidex index.

3.1 The Spatial Synoptic Classification System - *Peel Region, City of Toronto*

The heat watch-warning systems for both the City of Toronto and Peel Region are based on the spatial synoptic classification system. Synoptic systems are custom-made for individual urban areas based on the specific meteorology, urban structure and demographics of these areas. The meteorological variables considered include air mass type, dew point, cloud cover, wind speed and direction[4]. Unlike other watch-warning systems, this method takes into account the negative impact of several consecutive days of oppressive weather, as well as the fact that heat waves earlier in the year are more dangerous that those late in summer[5]. Alerts are issued when oppressive weather is forecast and the likelihood of excess mortality is determined to exceed 65% (Heat Alert) or 90% (Extreme Heat Alert).

Twice a day, at 3:00 am and 3:00 pm, Environment Canada sends meteorological information to the University of Delaware where the system is housed. There the data is processed and forecasts for the upcoming day as well as the next two are sent to a password-protected Web site[6]. This information can then be accessed by public health staff who will make the ultimate decision about whether or not to issue an alert.

Prior to 2006, the practice in Peel Region was to issue heat alerts to coincide with those called in Toronto. However, after examining 14 years of data, it was determined that mortality rates in Peel Region were significantly different (15%) during hot weather events, than those in Toronto. Furthermore, due to the diversity in urban form, geography and popula-

[a] The Spatial Synoptic Classification System was developed by Dr. Larry Kalkstein and Dr. Scott Sheridan of the University of Delaware

tion within Peel Region, a 17-20% difference in mortality rates between Mississauga and Brampton/Caledon was found. As a result, Peel developed its own two-tiered synoptic heat alert system with two different thresholds for issuing heat alerts - one specific for Brampton and Caledon and one for Mississauga[7]. As a result, a heat alert may be called for Brampton but not Mississauga, even if temperatures are identical.

One possible weakness of the spatial synoptic classification system is its complexity. The synoptic method relies on a large amount of data and is not as easily calculated or interpreted by lay people. In addition, there is concern that a synoptic system results in alerts and warnings being called too often[8]. Furthermore, there are challenges with implementing the system in areas that have weak heat-health relationships - in smaller jurisdictions, for example. The smallest metropolitan area for which a synoptic classification system has been developed is approximately 500,000 people[9].

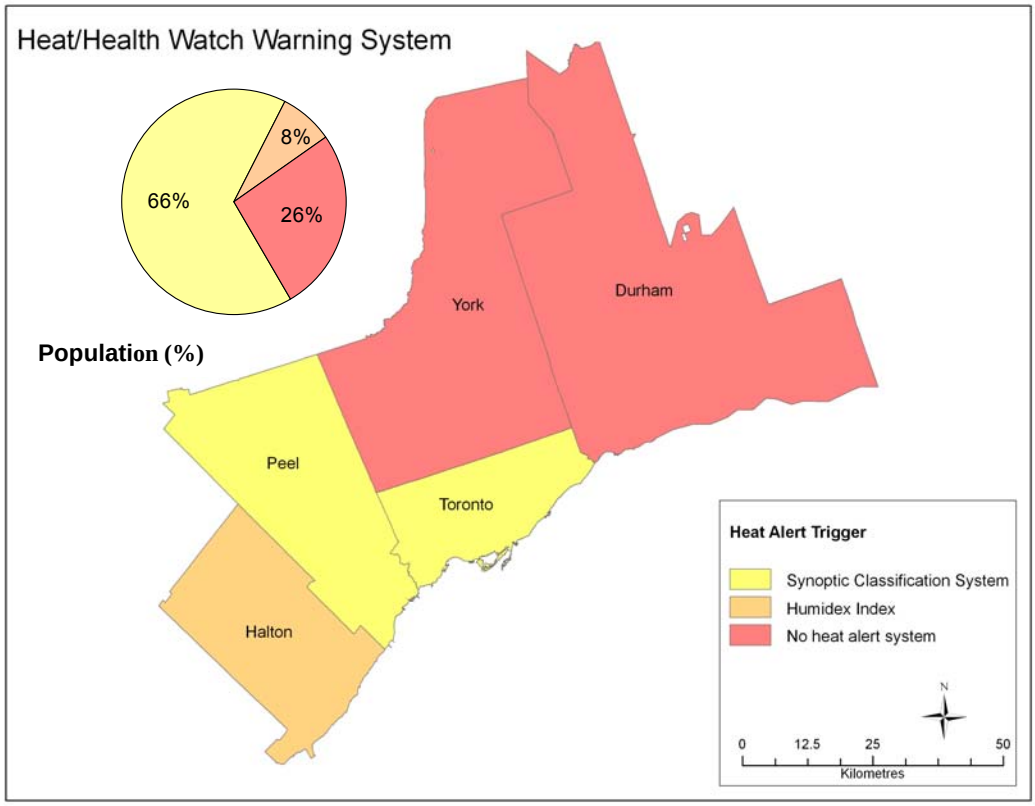

Figure 1[b]- Distribution of Heat Health Watch-Warning Systems in the Greater Toronto Area

Other cities that have implemented spatial synoptic classification systems include Philadelphia (the world's first), Rome, Shanghai, Cincinnati, Dayton and Columbus. Toronto's watch-warning system was the first in the world to issue alerts based on the likelihood of excess deaths, rather than forecasting actual numbers of predicted excess deaths.

[b] Cartographic boundary file provided by DMTI Spatial Inc. Mapping Software used - ESRI - ArcView 9.2

3.2 The Humidex Index – *Halton, Hamilton, Waterloo, Middlesex-London and KFL&A*

The Region of Halton, the City of Hamilton, the Region of Waterloo (in the past), the Middlesex-London Health Unit, and the Kingston, Frontenac and Lennox & Addington (KFL&A) Public Health Unit all issue heat alerts based on Environment Canada's Humidex Index. Alerts are typically issued when the maximum daily Humidex value is expected to exceed 40°C, or when Humidex values are expected to exceed 36°C for an extended period of time (3 days). However, Smoyer (2001)[1] has shown that increases in heat-related mortality in Toronto occur at temperatures as low as at 30-35° C.

A number of lower-tier municipalities in the GTA also reported using the Humidex Index as a guide for initiating heat response activities although this was not generally formalized in official plans (see Table 1).

Unlike the spatial synoptic classification system, which considers several weather-related variables, the Humidex Index considers only temperature and humidity, which are combined into a single value to reflect perceived temperature. Heat thresholds based on the Humidex Index are not targeted to specific populations but assume that temperature affects all people equally, regardless of the time of year, geographic location or heat wave duration.

3.3 Apparent Temperature – *National Weather Service (USA)*

In the United States, the National Weather Service (NWS) issues excessive heat advisories, watches and warnings based on the Apparent Temperature (AT) Index. AT is a measure of relative discomfort from combined heat and high humidity that is based on physiological studies of evaporative skin cooling[10].

Both the AT and Humidex indices are absolute, as they have predetermined health impacts associated with various ranges on the index. For example, temperatures <30 degrees C on the Humidex index are assumed to present no discomfort for all, while those >45 degrees C are considered to be dangerous for all[1]. A NWS Heat Wave Warning is triggered when a daytime AT greater than 40.6°C is predicted with night time lows greater than or equal to 26.7°C are forecast for two consecutive days[4].

Like the Humidex, AT assumes that people respond to a combination of only two main meteorological variables - temperature and humidity. Similarly, it does not account for acclimatization to high temperatures as a result of geographic location, or changing impacts on mortality after several days of high heat.

3.4 Minimum and Maximum Temperature Thresholds – *France, Montreal*

France and the City of Montreal have implemented heat watch warning systems with triggers based on maximum and minimum temperature thresholds. In Montreal a heat alert is triggered by a forecast of three consecutive days with lows of 20°C or greater and highs of 33°C or greater. Therefore, a three day weather forecast is required for this system to be activated[11]. When threshold temperatures are predicted the Montreal Public Health Department issues an alert to its various partners asking them to prepare to intervene if forecasted temperatures materialize.

In France a National Heat Alert System was developed in response to the catastrophic heat wave of 2003 that resulted in over 15,000 deaths. Alerts are triggered when maximum and minimum temperature thresholds are predicted. Thresholds are geographically specific and take into consideration regional characteristics. In Paris, the minimum temperature threshold is 21°C and the maximum temperature threshold 31°C. If temperatures are predicted to be clearly above the thresholds, an alert is issued. If temperatures are close to the thresholds, additional criteria, such as duration of the heat wave, humidity and air pollution are considered. A level 1 alert is continuously active from June 1st to September 30th, a level 2 alert is issued when the thresholds will be reached within 3 days, a level 3 alert is called when threshold levels are reached, and a level 4 alert is called when thresholds are reached and a prolonged heat wave or exceptional conditions (e.g. drought, blackout) are predicted or occur[12].

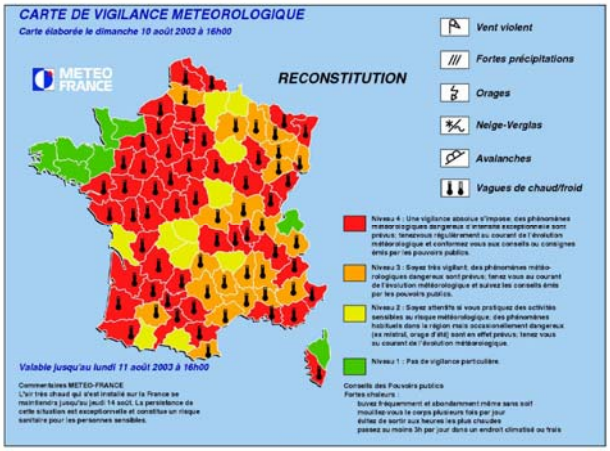

***Figure 2 – An example of the Heat Alert maps produced daily by METEO France. See also*: http://www.meteo.fr/meteonet/vigilance/**

4. HOT WEATHER RESPONSE PLANS

In Ontario upper- and single-tier municipalities are responsible for issuing heat alerts and developing heat-related messaging. Intervening and responding to hot weather, on the other hand, is often the responsibility of lower-tier municipalities. This is primarily because the majority of facilities appropriate for cooling centres, or cooling recreation are owned by lower-tier municipalities. The exceptions in the GTA are Toronto and Peel, which both operate multi-stakeholder intervention plans at the regional and upper-tier level.

Hot weather response plans vary in scope, detail and precision, but typically consist of one or more of the following components:

- Procedures for alerting municipal staff, community agencies and the public to the occurrence of extreme heat;
- Procedures to communicate to the public and organizations that work with at –risk groups the health risks associated with extreme heat and heat-safety information; and
- Procedures for rolling out public health intervention activities typically including, but not limited to, opening cooling centres and extending the operating hours of municipal facilities.

The following section summarizes the hot weather response programs of the City of Toronto and upper-tier municipalities in the GTA. Where available, results of evaluations of these programs have been included. Links to the Hot Weather Response Plans of lower-tier municipalities, where available, have been included in Section 2. However, responses at this level were typically found to be informal or ad hoc, and very little in the way of written protocols or plans is available.

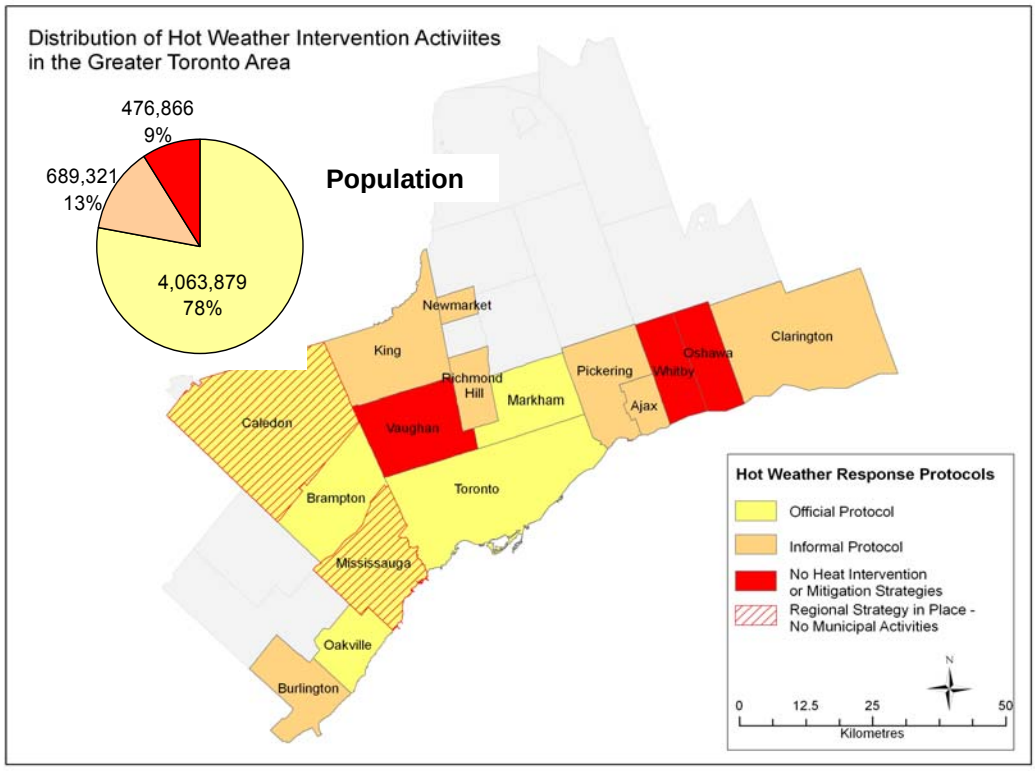

Figure 3[c]- Hot weather response protocols in the Greater Toronto Area

[c] Cartographic boundary file was provided by DMTI Spatial Inc. Mapping software used -s ESRI - ArcView 9.2

4.1 City of Toronto

Since 2000, Toronto Public Health has coordinated its response to extreme heat events through the Hot Weather Response Plan[13], which outlines strategic considerations, communications, and notification procedures as well as the roles and responsibilities of supporting City services, agencies and organizations.

a) Intervention Strategies

There are over 800 partner agencies involved in The City of Toronto's hot weather response strategy, including:

- **Toronto Public Health** - Responsible for contacting community agencies working with vulnerable populations to advise them of extra precautions to take during a heat alert; supplying Toronto Transit Commission tokens to the homeless through community agencies so they can reach cooling centres; issuing media releases to advise the public of heat alerts and precautions to take during hot weather; providing targeted education and training sessions for landlords and tenants, including the distribution of Hot Weather Protection Plan packages to boarding, lodging and group homes.
- **Public Health staff** - Responsible for visiting rooming houses/ lodging homes/ group homes and any other residential premises of concern prior to the hot weather season to encourage development of site-specific extreme heat contingency plans.
- **The Canadian Red Cross Society** – Responsible for operating an information line from 9 a.m. to 9 p.m. to answer heat-related inquires from the public; responding to requests to check on seniors who are at risk for heat related illnesses; and, coordinating the delivery of bottled water to agencies that work with vulnerable populations.
- **Shelter, Support and Housing Administration** – Responsible for requesting that all hostels make adjustments to permit clients to occupy air-conditioned space in common areas; providing outreach to people who are homeless through the Streets to Homes Team; extending hours at selected drop-in centres; and, managing the City's five cooling centres.
- **Community Information Toronto –** Responsible for phoning or faxing area hostels, seniors' agencies (such as Community Care Access Centres) and other community groups working with vulnerable populations during heat and extreme heat alerts.
- **Public Libraries** – Responsible for displaying key health messages about hot weather and heat related illness throughout the warm weather months.
- **Parks, Forestry and Recreation** – responsible for coordinating "Parks Ambassadors" who are responsible for visiting City parks to distribute information about the locations of cooling centres and other cool places; extending operating hours of nine City pools during Extreme Heat Alerts; and, opening recreation centres as cool public locations. Currently, facilities that lack air conditioning are being refurbished under an ongoing capital improvement project.

The City of Toronto has also created brochures with strategies for coping with and protecting oneself from the heat (see Appendix I). Topics include: *How to Beat the Heat*; *Hot Weather Plan for Landlords*; *Child and Car Safety in Hot Weather*; *Fan Facts*; *Heat, Drugs, and Alcohol*; *Help Pets Beat the Heat*; *Medications and Heat–Related Illness*; and *Outdoor Exercise During Heat and Smog Alerts*

b) Program Evaluation

In 2006, a graduate student at the University of Toronto evaluated the City's heat health watch warning system and hot weather response plan[14]. The purpose of this evaluation was to determine if Toronto's heat alert system and response strategy are effective at reducing heat-related mortality and morbidity. While indications are that Toronto's system uses appropriate threshold levels, concerns were raised surrounding the ability of intervention measures to protect vulnerable populations. The study concluded the following[15]:

- Significantly more heat alerts are called with the City of Toronto's spatial synoptic classification system compared to the previous system Humidex system.
- Most individuals involved in running Toronto's Heat Watch Warning System and those working with vulnerable populations were comfortable with the number of alerts that Toronto calls.
- Most city residents know about heat alerts, but not everybody. This missing group is mainly the vulnerable elderly and socially isolated who require targeted intervention measures during heat waves to help protect their health.
- Cooling centres are believed to be a very important component of Toronto's hot weather response plan by both those involved in running the system as well as those working with vulnerable populations. However, limitations include the accessibility of cooling centres and the fact that they are only open during Extreme Heat Alerts (and not during Heat Alerts).
- The direct costs involved in running Toronto's Heat Watch Warning System are low, however it was found that indirect costs are not well accounted for.
- The time commitment for many individuals involved in running Toronto's Heat Watch Warning System is minimal. In some cases, community partners reported not always fulfilling or completing their designated responses during heat alerts. This may leave some vulnerable individuals without the required attention needed during extreme heat events.

The effects of Toronto's heat alert system and hot weather response plan on morbidity and mortality has not yet been evaluated. However, Toronto Public Health (TPH) reports to City Council annually on the implementation of the Hot Weather Response Plan and makes recommendations for revisions in the upcoming year. In 2005[16], TPH reported that "the most effective way to reach vulnerable populations is to use a number of strategies simultaneously". It was also found that people tended to make good use of existing air condi-

tioned public spaces such as libraries, shopping centres and community centres, but that in Extreme Heat Alert situations, it is important that accessible cool spaces be available 24 hours a day, especially for those people who live in marginal housing.

Recommendations from 2005 and 2006[17] to improve Toronto's hot weather response plan included:

- Toronto Public Health should work with Toronto Hydro and other stakeholders to determine the feasibility of establishing a subsidy program for low-income vulnerable people to own and operate air-conditioners (2005);
- The Medical Officer of Health should set as a guideline a Maximum Indoor Temperature Threshold of 32°C that would act as a bench mark for a range of protective measures at times of Extreme Heat Alerts (2005);
- Toronto Public Health should request that a 5th cooling centre in east Toronto be opened at the Scarborough Civic Centre (2006);
- Shelter, Support and Housing Administration should be authorized to allocate up to $200,000 to implement the summer hours drop-in program (2006).

4.2 Peel Region

a) Intervention Strategies

Peel Public Health developed and administers the regional watch-warning system[18]. When alerts are called, a notice goes out by fax and e-mail to all stakeholders indicating both the current weather status and the prediction for the following day. A website was created to communicate heat-related messaging to the public with information and guidelines targeted to 8 different audiences (see Appendix II for examples): recreational facilities; indoor / outdoor workers; child care centres; the general public; agencies serving elderly/persons with disabilities; homeless shelters / outreach programs; and schools. The guidelines include general information about what to do differently during heat and extreme heat alerts. They provide information on the signs of heat over-exposure and on treatment for heat ailments. A 24-hour information line is available, including an after-hours message that links to Tele-health Ontario for heat health information.

At the local level there are many intervention strategies coordinated through Peel Region stakeholders and development partners (see Table 1 for stakeholder list). In addition to these initiatives, the City of Brampton coordinates its own intervention strategies, including opening cooling centres and keeping pools open later in the evenings (see Table 1). Neither the municipalities of Caledon nor Mississauga are involved in responding to heat events beyond posting the alert on their websites.

b) Program Evaluation

To evaluate the first year of Peel Region's Heat Watch Warning System questionnaires were administered to over 500 Peel residents and stakeholders to determine their knowledge and perception of the new system. Results indicated that 70% of Peel residents were aware that a heat alert had been called the previous summer. Television (48%) and radio (35%) were the most common media through which people reported hearing about heat alerts.

Messages about staying inside were recalled by 61% of people (compared to 62% in Toronto reported in a similar survey[19]), while only 36% of people remember being told to keep hydrated (versus 38% in Toronto). Only 45% of respondents reported changing their behaviour as a result of a heat alert (versus 57% in Toronto). The majority of these (66%) chose to stay inside or turn on air conditioning. Surprisingly, more than 20% of people who reported owning air conditioners did not turn them on during the heat alert and this was not necessarily due to the cost of electricity.

The survey revealed some opportunities for public messaging in the future. For example, of respondents who reported using the air conditioner, more than 60% had the thermostat set below the recommended temperature of 24-25°C. More seriously, 30% of residents in Peel reported using a fan with the windows closed a dangerous practice that can actually increase room temperatures and lead to dehydration.

4.3 Halton Region

Halton Regional Council endorsed a Hot Weather Notification System for the region in 2003[20]. The purpose of the System is to inform agencies and volunteers, in a coordinated manner, of extreme weather conditions to ensure that vulnerable people are protected. Alerts are based on Environment Canada's Humidex Index and are triggered when the maximum daily humidex is expected to exceed 40°Celsius (104°F) and/or exceed 36 degrees Celsius for an extended period (3 or more days).

a) Intervention Strategies

When threshold temperatures are predicted, the Halton Region Health Department alerts media and community stakeholders through a fax notification system (Appendix II). At this time, there are no intervention strategies in place at the regional level; these are the responsibility of lower-tier municipalities in the Region (see Table 1).

Since the Hot Weather Notification System was implemented in 2003, the Region has issued a total of 16 alerts spanning a total of 46 days (these numbers do not include figures for 2007).

b) Program Evaluation

In September 2006, a survey was conducted to determine the level of awareness of the Hot Weather Notification System as well as key messages promoted during these alerts[21]. A total of 182 surveys were faxed to organizations who receive these alerts of which 121 were returned.

Of those who completed the survey, 55% indicated that they had received Heat Alerts from the Health Department during the summer of 2006 and 48% indicated that they had used information from these alerts to modify activities on Heat Alert days. Long-term care homes were more likely to indicate that they received Heat Alerts (89%) than schools/school boards (56%) or daycare centres (40%). The report concluded that lower levels of awareness within daycares may be a result of the process for notification currently being used by the Health Department. Daycare centres often use one phone line for both fax and phone, resulting frequently in a "busy" line.

Survey respondents were asked if they received information about Heat Alerts from anywhere else. Forty-eight percent indicated that they received information from somewhere other than the Health Department. When asked how their organization would prefer to be kept informed about Heat Alerts, 72% indicated fax, while 58% identified e-mail. Only 4% indicated that they were not interested in receiving this information. The evaluators concluded that consideration should be given to alternative methods of communication, especially for facilities that are not receiving information effectively.

As part of the Health Department's action plan for 2007, staff will continue to do the following:

1. Issue heat alerts as appropriate;
2. Provide on-going support to agencies that serve vulnerable populations (i.e. educational materials and information on prevention strategies);
3. Provide guidance and direction to such agencies in terms of how to prevent heat and cold related illness; and
4. Focus on communication and resource dissemination opportunities.

4.4 Other Jurisdictions in Ontario

Hamilton[22], Middlesex-London[23] and Kingston, Frontenac and Lennox & Addington (KFL&A)[24] have developed heat alert protocols, which involve the following activities:

Table 2 – Common Hot Weather Response Protocols

Activity	Response
Monitoring	Health department staff monitor weather information from the Environment Canada web-site, which includes information on heat and smog episodes.
Notification	Health department staff receive an advance 5-day weather forecast from Environment Canada (via e-mail), and a specific message (via e-mail/fax) when there is a Humidex Advisory issued for the region.
Consultation	Health department staff will consult with the local weather office to discuss region-specific forecasts when necessary
Decision	Based on the weather conditions described above, the Medical Officer of Health (MOH), or a delegate, will determine if a heat alert will be issued to the community.
Activation	If a heat alert is declared by the MOH, health department staff will send notification to the media and community stakeholders that may be affected by extreme temperatures. Each agency is then responsible for internal notification of its staff. In addition, heat alert information is sent to the internal communications website contact for posting on the regional health unit website.
Public Education	Typically, the public are encouraged to "look in on" vulnerable neighbours and are given information on how to provide support for hot weather illness. People without shelter and those without air conditioning are encouraged to go to air-conditioned facilities such as malls and libraries. Public education will occur in a variety of ways: • Information can be obtained by calling the regional health unit and visiting the web. • Agencies can post information on bulletin boards and be prepared to answer questions. • Reports can be made in the media as hot weather is approaching. • Supplementary education is delivered when an alert is called and when the media interview staff.
Agency Staff Education	Vulnerable populations are, most often already being served by an agency, for example Shelter Support or Public Housing. Agency staff may require education on the prevention and treatment of heat-induced illness. Health units provide this information to those agencies in the form of fact sheets and referrals to additional support centres.
Termination	Once the decision has been made that hot weather is no longer a health threat, the MOH (or a delegate) will terminate the heat alert by notifying the media and participating agencies. Individual agencies will be responsible for notifying their staff that the alert has been terminated.

4.5 Other Canadian Municipalities

University of Toronto researchers and stakeholders are currently looking to summarize the kinds of public health heat interventions used across Canada and provide evidence on the effectiveness of these interventions. They are examining pros and cons of each intervention strategy and the literature that links these to public health practice. A complete report of the findings will be available in the fall of 2007[25].

4.6 The City of Philadelphia

The City of Philadelphia's hot weather response program is often viewed as a benchmark for integrated urban extreme heat event programs[26]. Developed in 1993 as a direct result of a July heat wave that claimed over 100 lives, the Philadelphia system combines an alert system, based on the spatial synoptic classification method, with a number of integrated response options.

a) Intervention Strategies

Philadelphia's hot weather response plan guides the implementation of a combination of the following activities depending on the severity of the predicted heat event: media announcements; a buddy system (5000 block captains checking on local residents); telephone '*Heatline'* activation; home visits by public health staff; halts to service shutoffs; increased emergency medical service staffing; increased outreach to homeless; cooling shelters; and public outreach.

b) Evaluation

An evaluation of the performance of Philadelphia's watch-warning system between 1995 and 1998[4] concluded that, on average, 2.6 lives per day were saved during extreme heat events for a total of 177 lives over the three year period. Based on a value of statistical life (VSL) measurement of 4 million dollars per life saved, and system costs of approximately $10,000 per day to implement intervention strategies, the evaluators concluded that the costs of running the system were so far below the benefits (in terms of of lives saved) as to render the costs of the system essentially irrelevant.

4.7 Other American Cities

In 2004, researchers from Johns Hopkins University and the US Centres for Disease Control and Prevention contacted 18 American cities considered at risk for heat-related mortality to evaluate their heat response plans[27]. They found that only 10 of these cities had stand-alone heat response plans and some of those – like many in Ontario - were very cursory.

Two cities had collected the names of at-risk individuals to be contacted during a heat emergency; four cities asked neighbourhood organizations or mail or utility workers to check on at-risk individuals; and several cities publicly urged people to check in with elderly individuals.

Although people with chronic mental or physical illness form a significant proportion of the victims of recent heat waves, only one plan emphasized reaching out to disabled persons. Two plans addressed the shelter and water needs of the homeless. Five cities reported fan distribution programs, despite evidence that fans do not reduce mortality risk during heat waves and can increase heat stress if used improperly[28]. In three cities, residential water

service could not be shut off during extreme heat events, and several cities took steps to prevent illegal use of fire hydrants.

Hot weather responses were coordinated by public safety or emergency management offices in most of the American programs that were reviewed.

In 2006 the Environmental Protection Agency released the *Excessive Heat Events Guidebook*[22] developed to assist communities in preparing for and responding to excessive heat events. The Guidebook highlights the health effects and risk sources of extreme heat, summarizes current notification and response plans, presents case studies from Philadelphia, Phoenix and Toronto and provides recommendations for identifying and responding to extreme heat.

5. THE CUMULATIVE EFFECTS OF SMOG AND EXTREME HEAT AND THE NEED FOR COMMON MESSAGING

As they are integrally related, extreme heat and smog often occur on the same summer days. However, the relationship between heat and smog is complicated as not all heat events coincide with poor air quality and poor air quality does not necessarily imply hot conditions. While there is sound scientific evidence on the independent association of smog episodes and extreme heat with premature mortality, there is less information on the synergistic effects of extreme weather events and pollution episodes.

In June 2005, Toronto Public Health and Environment Canada released a major study on the combined effects of extreme heat and air pollution on mortality in four Canadian cities, including Toronto[29]. Based on a historical analysis of data over 46 years (1954 – 2000), Toronto experienced an average of 120 heat-related deaths and 822 air pollution-related deaths per year. On those days with extreme heat, the average daily mortality was approximately twice as high as for comfortable days, taking into account air pollution levels. Heat-related mortality was significantly higher for the elderly and those with cardiovascular illness. A major recommendation stemming from this report was for the development of a national heat-health warning system, which takes into account the combined impacts of air pollution and heat.

In 2007 Environment Canada and Health Canada will pilot the new Air Quality Health Index (AQHI) in various locations across Canada, including the City of Toronto. The AQHI is based on epidemiological data from across Canada and considers multiple pollutants simultaneously. This data is linked to a health end-point and then normalized into an index. Adding temperature and/or humidity parameters to the AQHI[30] may assist municipal staff plan and prepare for simultaneous extreme heat and high pollution events. However, developing public messaging could be problematic as messaging associated with smog and

high heat has the potential to conflict and be confusing for the public. In the GTA, common messaging for heat and smog has not been developed although three jurisdictions have indicated an interest in doing so.

Some hot weather response plans address both air quality and heat, although not the cumulative effects of exposure. In the Region of Waterloo, when hot weather and poor air quality coincide, the public health unit issues a combined alert to the community (See Appendix I). This alert details information on both smog and heat threats, and includes suggested health precautions and actions to take. Similarly, in Middlesex-London, public health messaging always includes information about smog, heat and a high UV index although the messages are not combined.

Unique to this scan, the City of Kingston considers air quality in its decision to trigger a heat alert. According to Kingston's heat alert system, a level 1 alert is issued when temperatures of 36°C are predicted for at least two consecutive days and there is no smog alert. A level 2 alert is called when temperatures are predicted to reach 40°C for two consecutive days with no smog alert OR 36°C for two consecutive days with a smog alert. A level 3 alert, the highest, is triggered by temperatures of 45°C for at least two days with no smog alert, 40°C with a smog alert, or 36°C with extenuating circumstances (i.e. a power outage).

For the purposes of this scan, researchers involved in both the World Meteorological Organization (WMO) Showcase Cities Project and the European Commission PHEWE[31] Project were asked to comment on the need for common messaging between heat and smog alerts and to provide examples of any known to exist.

According to Dr. Larry Kalkstein, the creator of the spatial synoptic classification system, who was involved in the development of both the Peel and Toronto watch-warning systems and is the leader of the WMO's expert team on operational heat/health warnings, there are no international examples of common messaging for smog and heat events that he is aware of[32]. However, Dr. Kalkstein feels that the need for such messaging is real. It has been hypothesized that the owners of air conditioners in Peel Region who did not have them turned on during heat alerts may have kept them off in response to a simultaneous smog alert. Smog alerts have been called in Peel Region for several years and it is reasonable to assume that the public is more familiar with messaging related to smog, which advises reduced energy use.

According to Dr. Anna Paldy, from the National Centre of Public Health in Hungary and a member of the PHEWE team, the combined effects of heat and air pollution were not addressed by the PHEWE project but were the focus of the EuroHeat project[33], which aims to improve public health responses to weather extremes. EuroHeat had its final meeting in March 2007 and recommendations are expected in the fall of 2007. For more information

contact Dr. Bettina Menne WHO/Europe, Global Change and Health Program (Appendix III).

In Shanghai, where smog alerts in the winter and fall are common, researchers looking at the combined effects of air quality and extreme heat found that mortality was strongly associated with the duration of the heat wave. However, air pollution levels for two heat waves studied were similar and could not fully explain the observed differences in human mortality.

6. CONCLUSION

Public health officials across Canada must be prepared to respond to extreme heat events. Heat is the deadliest of all atmospheric phenomena (as 35,000 heat-related deaths in Europe in 2003 attest) and will continue to be so as climate change and the Urban Heat Island effect combine to heat cities. To protect the population against heat, health officials must first understand the meteorological conditions that lead to adverse health responses and then implement a mitigation plan that protects the most vulnerable. Research in Philadelphia, Rome and Shanghai has shown that heat/health watch-warning systems combined with targeted intervention strategies save lives.

As human response to extreme heat varies spatially, this variation can only be captured by a location-specific alert, such as the spatial synoptic classification system. However, these systems are more expensive to design, can be complex to understand and are not ideal for smaller regions (<500,000) where statistically there is less of a relationship between heat and excess mortality. Research in Toronto has indicated that the spatial synoptic classification system results in more heat alerts than would otherwise be called with the Humidex index as a trigger[12]. However, it is not known how this translates into reduced morbidity and mortality. Evaluations of heat-watch warning systems are difficult undertakings as it is difficult to predict the quantity of lives that were *not* lost and official mortality statistics are not generally available until 3-5 years after an extreme heat event[33].

Once oppressive weather conditions have been identified, the challenge for decision-makers becomes mitigating the effects of these conditions. Heat intervention strategies across the GTA and southern Ontario are highly variable. While Toronto and Peel have extensive networks of partner organizations that coordinate intervention strategies at the local level, other regions rely solely on municipalities to determine the response that best suits their population. Despite this reliance, very few lower-tier municipalities surveyed have what could be considered official hot weather response plans. Rather, intervention strategies are typically executed informally often without the benefit of a consistent trigger. As a result, it is very difficult to evaluate the impact of these intervention strategies and justify the allocation of funds.

A further challenge is for municipalities is identifying and targeting vulnerable populations. Although the homeless are often considered to be the most at-risk population by decision-makers, the elderly, those living alone, certain types of drug users, and those without access to air conditioning are also at a high risk. In fact, studies in the U.S. have indicated that homeless persons are likely to be at *lower* risk than those in older housing lacking (or not using) air conditioning[2]. Currently, municipal decision-makers in the GTA do not have the data, tools and/or expertise to incorporate information about housing-stock or population demographics into their decision-making processes.

Municipal decision-makers need more information about when to trigger heat alerts, effective intervention strategies and the identity and location of vulnerable populations. Funding to design heat alert systems and response plans needs to be identified. The Federal Government, through a grant from Natural Resources Canada Climate Change Action Fund, provided the money to develop Toronto's synoptic heat watch-warning system as a pilot project, while the Region of Peel paid for its own system. Federal government agencies and to a lesser extent utility companies have covered the majority of these costs in the United States[31].

In the past there have been calls for the Federal Government to develop a National Heat Alert System similar to those in France, Germany and the United States (in development). Dr. David McKeown, Toronto Medical Officer of Health, in a 2005 Report to the Board of Health, stated that: "Given the widespread interest and health benefit of having warning systems and heat response protocols in place, it is timely to develop a national system". He recommended that: "(T)he federal Minister of the Environment, in collaboration with the federal Minister of Health, develop a national heat-health warning system that would enable major urban centres to implement appropriate heat response protocols to protect vulnerable populations during extreme heat events, and additionally taking into account the combined impacts of air pollution."[1]

This report endorses that recommendation and further recommends that:

- A comparative analysis of the costs and benefits of various heat health watch warning systems should be completed. Several municipalities contacted for this scan indicated that they are currently investigating heat/health watch warning systems. These jurisdictions need a basis for which to evaluate existing systems and choose the most appropriate.
- A model Hot Weather Response Protocol should be drafted for lower-tier municipalities to use as a guiding document – similar to the Smog Alert Response Plan template developed by the Ontario Ministry of Environment (MOE) and currently

housed on their website[d]. This will ensure a minimum standard of response across the GTA, while allowing municipalities flexibility in designing their own interventions.

- Systematic evaluations of heat intervention strategies should be encouraged and evaluation methods and techniques built into emerging heat intervention protocols.
- Data concerning the location and identity of vulnerable populations should be compiled in a centralized, easily-accessible location to be used by municipal decision-makers to develop intervention strategies. This data includes but is not limited to housing stock; building use; population demographics; population habits and behaviours; and access to air conditioning.
- The benefits and challenges of developing common messaging for episodes of extreme heat and smog should be explored with the objective of creating clear and concise messaging that eliminates confusion resulting from conflicting messages.

[d] The Smog Alert Response Plan template was developed by MOE in response to a scan done by the Clean Air Partnership of smog alert responses in the GTA

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[15] For more information please contact the author, Joanna Angus at jo.angus@utoronto.ca.

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Appendix I - Examples of Messaging:

WATERLOO REGION

MEDIA RELEASE: HEAT ALERT -- URGENT!!

A **Humidex Advisory** has been issued by Environment Canada for Waterloo Region for …….
This alert is due to the combination of heat, humidity and/or other weather conditions that can be dangerous to the public. People at greatest risk include the elderly, infants and young children, the chronically ill, and those taking medications.

Health risks may increase during high heat levels (this also applies to high smog levels), particularly to those who play sports or exercise outdoors, cyclists, and/or those who are active outside (eg. gardeners). Parents, coaches and others supervising children should also be aware of the risks during a smog or heat alert. When you exercise or do hard physical work, you breathe harder than normal, bringing dirty air deeper into your lungs. You also breathe mostly through your mouth, bypassing the filtering action of the nose. For those who have lung or heart conditions, exercising outdoor during a heat or smog alert could worsen their conditions.

People exercising outdoors during a heat alert may:
• get heat cramps - muscle pains in the legs, arms or abdomen
• have a very high body temperature that could damage vital organs
• suffer from headache, nausea, dizziness, confusion, weakness due to heart-related illness

You can protect your health during a heat and/or smog alert by:
• stay out of the blazing sun or heat
• where possible, go to air conditioned sites (eg. malls)
• avoid strenuous physical activity outdoors
• rescheduling sports practices, jogging times etc.
• work out indoors in an air conditioned area
• plan ahead by asking for policies to reschedule sports events during alerts
• drink lots of water and natural fruit juices
• wear loose-fitting clothes that allow for evaporation of sweat
• wear a hat and use sunscreen (at least SPF 15)
• never leave children or pets unattended in a car
• call/visit friends and neighbours who are at risk of suffering health consequences because of hot weather

In Case of:
Heat Cramps - muscle spasms, possible heavy sweating, extreme thirst, nausea, cold and clammy skin. Move victim to cool, shaded area to rest and apply pressure to cramping muscles. Give victim two glasses of salty water at a 10-15 min interval (5 ml of salt to 1 L of water).

Heat Exhaustion - sweating, weakness, cold and clammy skin, low blood pressure, disorientation and possible vomiting. Move victim to cool area to rest, provide salty water, and cover person if shivering. Victim should rest in bed until recovered. Seek medical help.

Heat Stroke - weakness, headache, hot and dry skin, dilated pupils, offensive body odour, sharply rising temperature, pulse bounding and full, elevated blood pressure, delirium or coma common. Skin may be flushed at first, later purplish. Take victim to hospital immediately. If waiting medical attention, move victim to cool, shaded area and sponge body with cool water, letting water evaporate to reduce body temperature.

For further information about extreme heat, contact the Health Department at 883-2008, or visit the Region's website at: http://www.region.waterloo.on.ca.

City of Toronto

If you are taking any of the medications listed below, you are at higher risk for heat-related illness, especially if you are doing lots of exercise or heavy work and are not drinking enough water. This is even more true if you are taking two or more medications.

Some drugs have different brand names, so check with your doctor, nurse or pharmacist to be sure.

Psychiatric drugs such as[1]:

5. chlorpromazine (Thorazine, Largactil)*
6. thioridazine (Mellaril)*
7. perphenazine (Trilafon)*
8. fluphenazine (Modecate, Moditen)*
9. thiothixene (Navane)*
10. trifluoperazine (Stelazine)
11. prochloperazine (Stemetil)
12. haloperidol (Haldol)
13. clozapine (Clozaril)
14. risperidone (Risperdal)
15. loxapine (Loxapac, Loxitane)
16. fluspirilene (IMAP)
17. pimozide (Orap)
18. olanzapine
19. flupenthixol (Fluanxol)
20. zuclopenthixol (Clopixol)
21. reserpine (Serpasil, Serpalan)
22. Lithium (heavy exercise or heavy sweating in hot weather may change lithium levels, so that you may have too much in your system)

[1]This list is based in part on information from the Office of the Chief Coroner. Please note it is not complete.

*These medicines may make it easier for your skin to burn. Many other medicines may also cause your skin to burn more easily.

To be sure, ask your doctor, nurse or pharmacist. Try to stay out of the sun. If you can't, try to get sunscreen and wear a hat and long sleeves.

Anti-parkinson drugs such as:

- benztropine (Cogentin)
- biperiden (Akineton)
- ethopropazine (Parsitan, Parisdol)
- procyclidine (Kemadrin, Procyclid)
- trihexyphenidyl (Artane, Trihexane)
- levodopa (Dopar)
- selegiline (Eldepryl)

- amantadine (Symmetrel, Symadine)

Antidepressant drugs such as:

- amitriptyline
- doxepine (Sinequan)
- clomipramine (Anafranil)
- protriptyline (Vivactil)
- imipramine (Tofranil)
- desipramine (Norpramin)
- nortriptyline (Pamelor)
- fluoxetine (Prozac)
- fluvoxamine (Luvox)
- sertraline (Zoloft)
- paroxetine (Paxil)
- fluoxetine (Sarafem)

If you also take the medicines below, you further increase your risk for heat-illness:

- some antihistamines (e.g. Benadryl, Chlortripolon)
- over-the-counter sleeping pills (e.g. Nytol)
- anti-diarrhea pills (e.g. Lomotil)

If you are taking any medications regularly, ask your doctor, nurse or pharmacist if you need to be extra careful during hot weather.

WATERLOO REGION

Protecting your health during smog alerts & summer heat

Reschedule sports practices, jogging times, etc. if possible, to another time when the smog or heat alert is over. Or you could be active indoors in an air conditioned non-smoking area. Plan ahead by asking for rules about rescheduling sports events during smog and heat alerts.

If you're going to be active outdoors:

- drink plenty of fluids (e.g. water) before, during and after activity (during activity, drink fluids every 15 - 20 minutes)
- wear loose-fitting clothes
- wear a wide brimmed hat
- use sunscreen with SPF 15 or higher
- take lots of rest breaks in the shade or an air conditioned non-smoking area
- exercise or play sports in shaded areas
- if jogging or cycling, avoid busy streets, especially during rush hours
- reduce activity level if you begin to cough, wheeze, feel chest tightness and/or have trouble breathing
- try not to spend long periods of time outdoors between 11 a.m. - 6 p.m.

For more information

Region of Waterloo Public Health
www.region.waterloo.on.ca/ph
Environmental Health & Lifestyle Resources
519-883-2008

Ministry of the Environment
www.airqualityontario.com
Air Quality Index (AQI) forecast
1-800-387-7768

Being active outdoors during a smog or heat alert?

High smog and heat levels can be dangerous. It is estimated every year hundreds of people die earlier than expected and thousands of hospital visits are linked to heart or lung diseases, as a result of air pollution.

An Air Quality Advisory (smog alert) is issued by the Ontario Ministry of Environment when smog conditions reach dangerous levels (i.e. Air Quality Index reaches or exceeds 50). Most of Waterloo region's smog (a mixture of air pollutants on hot summer days), comes from the burning of fuels to run motor vehicles and generate electricity.

A Humidex Advisory (heat alert) is issued by Environment Canada when heat, humidity and other weather conditions together can be very dangerous.

Health risks may increase during high smog or heat levels for:

- those who play sports or exercise outdoors
- people riding bicycles
- people working outdoors
- children and the elderly
- people who have lung or heart conditions like asthma or angina

Parents, coaches and others taking care of children should also be aware of the health risks during a smog or heat alert.

How air pollution and heat affect your body

When you exercise or do hard physical work, you breathe harder than normal, bringing dirty air deeper into your lungs. You also breathe mostly through your mouth, instead of using the filter action of the nose.

If you are active when it is very hot, your body temperature can get very high and your body has to work extra hard to keep cool.

When working or being active outdoors during a smog alert, even healthy people may:

- cough and/or wheeze
- feel scratchy in their throat
- have trouble breathing
- damage lungs cells (short and long term)
- reduce the body's ability to fight off lung infections
- have difficulty performing their best (the lungs can't work at their normal levels)
- affect their long-term health

People working or being active outdoors during a heat alert may:

- get heat cramps – muscle pains in the legs, arms or abdomen
- have a very high body temperature that could damage their body inside
- suffer from headache, feeling sick, dizziness, confusion and/or weakness due to heat-related illness

For people who have lung or heart conditions, like asthma or angina, working or being active outdoors during a smog or heat alert could worsen their conditions.

Being overcome by smog and/or heat while being active can be serious.

Stop activity and seek medical help as soon as possible if you or someone else has the following symptoms:

- difficulty breathing
- weakness or fainting
- feeling more tired than usual
- feeling sick
- headache
- confusion

Help a sick person by:

- calling for medical help
- moving the person to a shaded area or indoors to a non-smoking cooler place
- giving the person sips of cool water (not ice cold water) or a sports drink

HALTON REGION

URGENT NOTICE!
HEAT ALERT

Heat Alert for Halton Region
A **Humidex Advisory** has been issued by Environment Canada for _____.
This alert is due to the combination of high heat, high humidity and/or other weather conditions that can be hazardous to people's health.

Risk Groups

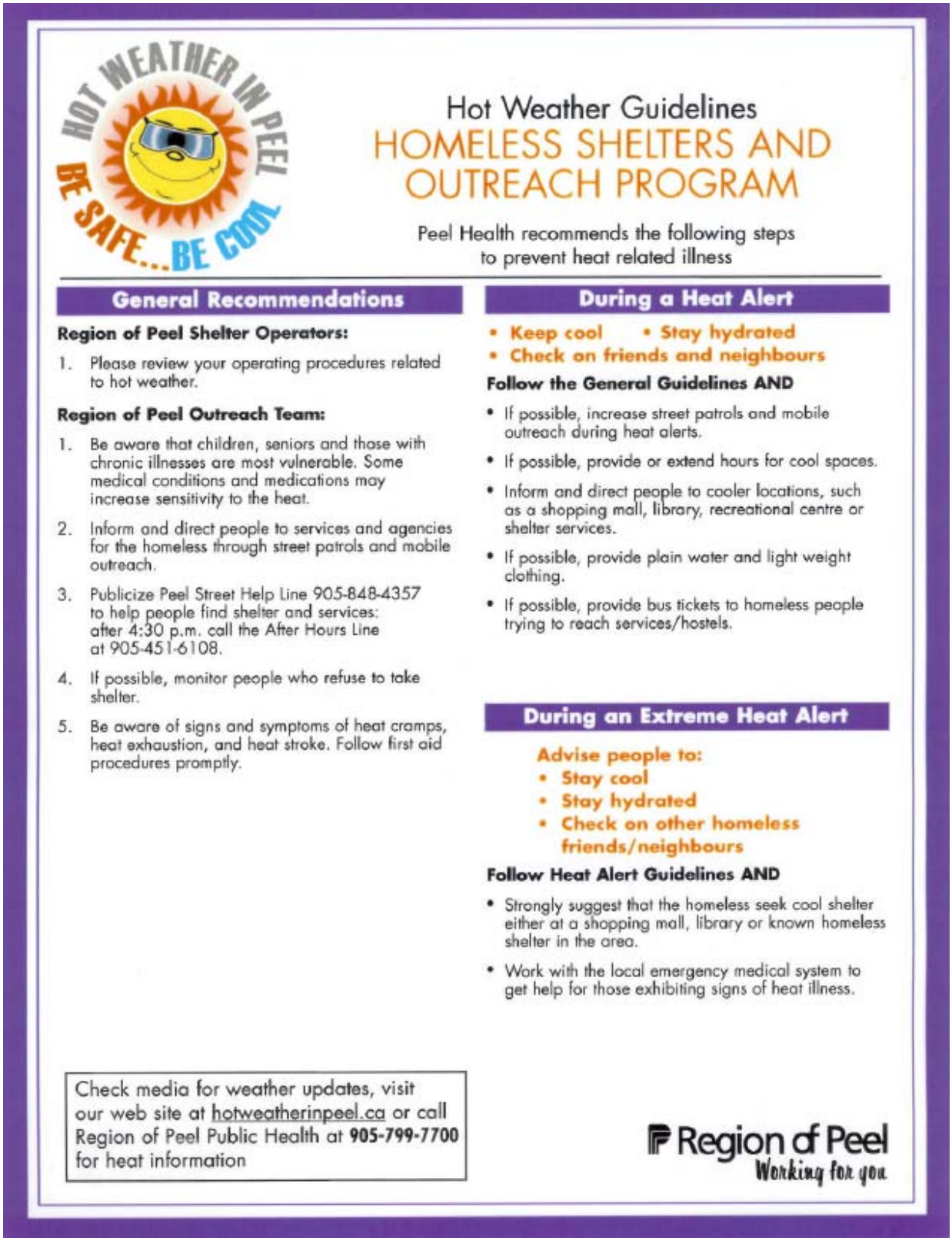
- Those especially at risk during heat and smog related weather conditions include:
- Older adults >65 yrs
- Infants and young children
- Those with chronic heart or lung disease, including asthma
- People taking certain medications (consult your doctor or pharmacist)
- People who exercise vigorously outdoors (play sports, cyclists, gardeners)
- Outdoor workers (depending upon length or time and exertion levels)
- Other risk factors: obesity, fever, dehydration, poor circulation, and sunburn
- Parents, coaches and others supervising children should be aware of the health risks during a heat or smog alert.

Protect Your Health

- You can avoid heat related illness by doing the following:
- Stay out of the hot sun or heat
- Where possible, go to air conditioned sites (e.g. malls, community centres)
- If you don't have air conditioning, keep shades drawn and blinds closed
- Avoid strenuous outdoor physical activity
- Reschedule sports practices and jogging times
- Drink lots of water and natural fruit juices (avoid alcohol, coffee, cola)
- Wear loose-fitting clothing that allows for evaporation of sweat
- Wear a hat and use sunscreen (of at least SPF 15)
- Never leave children or pets unattended in a car
- Call or visit friends/neighbours who are at risk (2-3 times daily)
- Take it easy and rest as much as possible

Listen to the forecast for current readings via the Weather Channel, local newspapers, television and radio.
Also, weather info can be obtained from the Environment Canada website -- special weather statements, including information on heat (and smog) episodes is posted throughout the day.
For weather and heat alert information: http://weatheroffice.ec.gc.ca/forecast/canada/on_e.html.
For air quality and smog alert information: http://www.airqualityontario.com/.

PEEL REGION


HOT WEATHER IN PEEL
BE SAFE...BE COOL
Hot Weather Guidelines
HOMELESS SHELTERS AND OUTREACH PROGRAM
Peel Health recommends the following steps to prevent heat related illness
General Recommendations
Region of Peel Shelter Operators:
1. Please review your operating procedures related to hot weather.
Region of Peel Outreach Team:
1. Be aware that children, seniors and those with chronic illnesses are most vulnerable. Some medical conditions and medications may increase sensitivity to the heat.
2. Inform and direct people to services and agencies for the homeless through street patrols and mobile outreach.
3. Publicize Peel Street Help Line 905-848-4357 to help people find shelter and services: after 4:30 p.m. call the After Hours Line at 905-451-6108.
4. If possible, monitor people who refuse to take shelter.
5. Be aware of signs and symptoms of heat cramps, heat exhaustion, and heat stroke. Follow first aid procedures promptly.
During a Heat Alert
• Keep cool • Stay hydrated
• Check on friends and neighbours
Follow the General Guidelines AND
• If possible, increase street patrols and mobile outreach during heat alerts.
• If possible, provide or extend hours for cool spaces.
• Inform and direct people to cooler locations, such as a shopping mall, library, recreational centre or shelter services.
• If possible, provide plain water and light weight clothing.
• If possible, provide bus tickets to homeless people trying to reach services/hostels.
During an Extreme Heat Alert
Advise people to:
• Stay cool
• Stay hydrated
• Check on other homeless friends/neighbours
Follow Heat Alert Guidelines AND
• Strongly suggest that the homeless seek cool shelter either at a shopping mall, library or known homeless shelter in the area.
• Work with the local emergency medical system to get help for those exhibiting signs of heat illness.
Check media for weather updates, visit our web site at hotweatherinpeel.ca or call Region of Peel Public Health at 905-799-7700 for heat information
Region of Peel
Working for you

Hot Weather Guidelines
SCHOOLS

Peel Health recommends the following steps to prevent heat related illness

General Recommendations

1. Establish a policy and plan to deal with extreme temperatures.
2. When outdoors, stay in the shade whenever possible (natural or artificial structures). Especially limit time outdoors when temperatures and UV radiation are most intense, between 11 a.m. and 4 p.m.
3. Monitor daily heat advisories and adjust outdoor activity schedules if possible.
4. When in the sun, wear a wide brimmed hat, UV protective sunglasses, and loose-fitting long shirts and pants.
5. As much as possible, ensure indoor temperatures are comfortable.
6. Ensure children are well hydrated. Plain water is the liquid of choice, diluted fruit juice is okay.
7. Monitor children in wheelchairs and check the temperature of metal and vinyl parts.
8. Check the temperature of metal and plastic playground equipment.
9. Staff should be aware of signs and symptoms of heat cramps, heat exhaustion, and heat stroke. Follow first aid procedures promptly.
10. Staff should role model appropriate heat and sun safety behaviours.
11. Apply sunscreen (SPF 15 or higher), 20-30 minutes before going outside to ensure absorption.
12. When using DEET insect repellent, apply 20-30 minutes after sunscreen has been applied.
13. **NEVER** leave children in a closed parked vehicle.

During a Heat Alert

- **Keep cool** • **Stay hydrated**
- **Check on children and other colleagues**

Follow the General Guidelines AND

- Activate your policy or plan for extreme temperatures.
- Limit strenuous activity outdoors.
- Provide or encourage frequent drinks to ensure adequate hydration. Plain water is the liquid of choice, diluted fruit juice is okay.
- Check regularly on young children and those children who are physically challenged or in wheelchairs and who have chronic illnesses such as asthma.

During an Extreme Heat Alert

- **Keep cool** • **Stay hydrated**
- **Check on children and other colleagues**

Follow Heat Alert Guidelines AND

- Cancel outdoor sports events if possible. Participation in strenuous outdoor activities during extreme heat advisories is dangerous.
- If possible, move outdoor activities indoors to an air conditioned facility.

Check media for weather updates, visit our web site at hotweatherinpeel.ca or call Region of Peel Public Health at **905-799-7700** for heat information

Region of Peel
Working for you

Appendix II - International Contact Information

The following international experts are at the forefront in field of heat response and management, most of whom are associated with PHEWE and/or the WMO. For the purposed of this scan all were contacted to provide information on combined messaging for heat and smog.

Prof. Ross Anderson
Department of Public Health Sciences St. George's Hospital Medical School (University of London)
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SW17ORE London, United Kingdom
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Email: randerso@sghms.ac.uk

Prof. Annibale Biggeri
Università di Firenze, Dipartimento di Statistica "G. Parenti"
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Tel. 0039-055-4237252 Fax 0039-055-4223560
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Dr. Krzysztof Blazejczyk
Institute of Geography and Spatial Organization, Department of Climatology
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00-818 Warszawa, Poland
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Email: k.blaz@twarda.pan.pl

Prof. Laurence S. Kalkstein
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University of Delaware
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