

Reducing Electromagnetic Field Exposure from Hydro Corridors

Date:	June 18, 2008
To:	Board of Health
From:	Medical Officer of Health
Wards:	All
Reference Number:	

SUMMARY

The use and transmission of electricity creates electromagnetic fields (EMF). Common sources in urban areas include electric appliances, building wiring, and electricity transmission lines. Background levels of EMF in urban areas are usually less than 1 milligauss (mG). However, overall levels of EMF in and right next to hydro corridors can be higher than those usually found both indoors and outdoors elsewhere in Toronto.

The International Agency for Research on Cancer (IARC) classifies the magnetic component of EMF as a possible carcinogen because of the association between exposures to EMF magnetic fields in the home and childhood leukemia. Given the possible link between the exposure to EMF and an increase in the risk of leukemia in children, taking practical low or no-cost actions to reduce exposures to young children is prudent.

This report proposes that the City continue with a policy of prudent avoidance and take simple steps that would minimise exposures to EMF from hydro corridors for young children. It recognizes that recreational, trail and park uses of hydro corridors have health benefits for children and adults who use them which outweigh any potential risk from EMF exposure.

The proposed policy would require City divisions to design new recreational, trail and park uses in hydro corridors so as to minimize childhood exposure to EMF. For new developments of residential, schools and day nursery uses next to a hydro corridor, the applicant would be requested to do an EMF management plan that includes low or no-cost solutions in the design and layout of the building and property to reduce childhood exposures to EMF. When new or upgraded transmission lines are proposed within Toronto, the City would request the proponent do a health impact assessment and an

EMF management plan that outlines the measures that can be taken to minimize any increase in exposure to EMF in Toronto.

RECOMMENDATIONS

The Medical Officer of Health recommends that:

1. City Council adopt the following policy of prudent avoidance to reduce childhood exposure to electromagnetic fields (EMF) in and adjacent to hydro corridors with transmission lines such that:
 - a. when the City plans new multi-use trails, garden allotment, recreational or parkland uses in or abutting a hydro corridor, the appropriate division undertake an EMF management plan and design the layout to minimize the increase in yearly average exposure to EMF for young children;
 - b. when applications are received for official plan and zoning bylaw amendments or plan of subdivisions for residential, school or day nursery uses on property that abuts a hydro corridor, the Chief Planner request the applicant to undertake an EMF management plan which outlines low or no-cost measures to minimize the increase in yearly average exposure to EMF for young children;
2. City Council request Toronto Hydro to report to the Board of Health on current and potential measures to reduce EMF emissions when new equipment used in the distribution of electricity is installed or existing equipment is modified;
3. City Council request the provincial Minister of Energy to direct Hydro One to continue to incorporate practical low-cost measures to reduce EMF emissions when new equipment used in the transmission of electricity is installed or existing equipment is modified;
4. when new high-voltage transmission lines or increases in the capacity of existing transmission lines are proposed within the City of Toronto, the Chief Planner, in consultation with the Medical Officer of Health, request the proponent to undertake a health impact assessment to evaluate options available to minimise any increase to the yearly average exposure to EMF in Toronto; and
5. the Board of Health forward this report to Health Canada, the Ontario Ministry of the Environment, Ministry of Health and Long-Term Care, other Boards of Health in Ontario, Toronto District School Board, Toronto Catholic District School Board, Conseil scolaire de district du Centre-Sud-Ouest, Conseil scolaire de district catholique Centre-Sud, Waterfront Secretariat, Toronto Hydro, Hydro One, Canadian Electricity Association, Canadian Standards Association, Ontario College of Family Physicians, and the Ontario Medical Association.

Implementation Points

The General Manager, Parks, Forestry and Recreation, in collaboration with the Medical Officer of Health, will develop procedures to require preparation of an EMF management plan for proposed parks and recreational activities in or next to a hydro corridor.

The General Manager, Transportation Services, in collaboration with the Medical Officer of Health, will develop procedures to require preparation of an EMF management plan for multi-use trails or bicycle paths in or next to a hydro corridor.

The Chief Planner, in collaboration with the Medical Officer of Health, will incorporate procedures to request preparation of an EMF management plan as part of the development application review process for new development of potentially sensitive land uses on properties next to a hydro corridor.

Financial Impact

There are no financial implications from the adoption of this report.

DECISION HISTORY

In May 2005, City Council adopted Planning and Transportation Committee Report 4, Clause 7, [Proposed Public Uses in Hydro Corridors](#), which identified municipal interests in secondary uses of hydro corridors, including parks and recreation. The report indicated that Toronto Public Health would report to the Board of Health on its review of the 1993 Policy of Prudent Avoidance and its application to hydro corridors.

In addition, in May 2007, because of concerns about a proposal for a new transmission line in Toronto, the Board of Health asked the Medical Officer of Health to request the Minister of Energy and the Minister of the Environment to direct the Ontario Power Authority (OPA) to conduct a full environmental assessment regarding the proposed transmission lines including a health impact assessment (HIA), including funding to Toronto Public Health to provide the necessary oversight of the HIA (see [Board of Health May 14, 2007 Minutes](#)).

ISSUE BACKGROUND

The potential health impact of electromagnetic fields (EMF) from power lines came to public attention in the late 1970s, when a study found a possible association between childhood leukemia and proximity to transmission lines. In 1993, based on the evidence then available, the former City of Toronto adopted a policy of prudent avoidance, which encouraged limiting exposure to EMF in public spaces where practical and feasible at

little or no cost. The 1993 policy was implemented on a case-by-case approach, and included recommendations such as:

- requesting that utilities use technology to mitigate magnetic fields
- locating playgrounds, day care centres and schools away from power lines and transformers, and
- ensuring that new residential units are as far away from power lines as possible and at least as far as other residences in the same area.

Requests for certain uses such as community gardens were permitted, since food security benefits were considered to outweigh any potential risk.

In 2002, the International Agency for Research on Cancer (IARC) published its review on the potential for EMF to cause cancer. This review found that there is some evidence suggesting an increased risk of leukemia among children exposed to higher levels of extremely-low frequency magnetic fields, one of the components of EMF from power lines. Based on this review IARC classified extremely-low frequency magnetic fields as a possible carcinogen.

At present the City has agreements for 22 soccer fields, 5 playgrounds, 5 cricket pitches, 7 baseball diamonds, approximately 6000 metres of trails and 10 garden allotments in hydro corridors. The City also has stormwater retention ponds located in hydro corridors. The City has identified additional areas within hydro corridors as suitable for potential new park and recreational uses. If all such areas were made available, this would double the amount of space devoted to such uses in hydro corridors.

Given the potential expansion of these uses and the existence of a prudent avoidance policy from the former City of Toronto, Toronto Public Health reviewed the health evidence that has accumulated since 1993 to evaluate whether there was a need to update its policy.

During the preparation of this report, Toronto Public Health consulted with City Planning, Legal Services, Parks, Forestry and Recreation, and Transportation Services divisions, Toronto Hydro, Hydro One, Toronto District School Board, Toronto Catholic District School Board, and le Conseil scolaire de district du Centre-Sud-Ouest.

COMMENTS

Electromagnetic fields, or EMF, are a type of energy that occurs naturally and that are also created through the use of appliances and equipment. Radiowaves, microwaves, visible light, ultra-violet light and X-rays are all forms of electromagnetic energy. These fields are described using different aspects such as frequency, wavelength, direction, and field strength. The frequency describes the number of cycles, or oscillations per second, and the wavelength is the distance between a peak on the wave to the next peak – the higher the frequency, the shorter the wavelength.

The properties of these fields depend on the frequency at which they occur. The transmission and use of electricity is the most common source of EMF in the built environment. In North America this produces fields at a frequency of 60 Hertz. These are known as power frequency or extremely-low frequency fields. In this report, when the term EMF is used, it refers to electromagnetic fields related to the use and transmission of electricity.

Daily Exposure to EMF

Studies that look at EMF in the environment usually report the strength of the magnetic field. In North America, it is usually measured in milligauss (mG). Outdoor background levels of EMF in urban areas in North America are usually less than 1 mG. Studies in the U.S. and Canada have shown that while individual exposures differ, most people (about 85 percent) are exposed to magnetic fields that average less than 2 mG in a day. Exposures are typically higher at work than at home. High-voltage power lines are not the most common source of magnetic fields, even in locations near power lines. Building wiring and electrical appliances are also important sources of total exposure.

Magnetic fields generated by appliances vary greatly by distance from the appliance and type of appliance. Generally, microwave ovens, toaster ovens, and refrigerators generate the highest fields. The contribution of these fields to overall personal exposure depends on a number of factors including how close appliances are to the area where a person spends time, how often a person uses the appliance and the model of the appliance. Overall, people who live in multi-family units, smaller homes, older homes, homes with metal water pipes or homes in urban areas tend to have higher exposures to EMF.

Exposure to EMF in Hydro Corridors

EMF levels in hydro corridors are higher than levels found in the general environment in the city. In February and March 2005, Toronto Public Health measured levels of EMF in 36 parks (18 parks inside hydro corridors and 18 parks outside of hydro corridors). Levels of magnetic fields taken in parks located in hydro corridors varied widely. Levels were usually highest directly underneath the high-voltage lines at midspan and decreased with increased distance from the lines (Table 1).

Magnetic field levels in park sites tested outside hydro corridors were lower. The levels were above 2 mG only when measurements were taken directly underneath the local distribution lines; the highest level measured was 16 mG (compared to 102 mG in the hydro corridor). The median of measurements taken in parks outside hydro corridors was 0.4 mG, which is similar to background level.

Table 1: Magnetic Field Levels in Parks

Location	Median (mG)	Range (mG)
In hydro corridors at mid-span ¹	37	4-102
In hydro corridors, 10 metres from the closest power line	17	4-72
Furthest point from power lines, at edge of hydro corridor ²	6	1-16
Parks outside the corridor	0.4	n.d. to 16 mG
¹ Midspan is the point at which the power line dips closest to the ground. These measurements were taken along a transect at right angles to the power lines. ² Hydro corridors are of varying dimensions. The furthest point from the power lines varies considerably. Therefore, these measurements were not taken at a constant distance. n.d. = not detected		

Health Effects of EMF

Studies have looked at a wide-range of potential health effects of EMF, including miscarriages, neurodegenerative conditions, and behavioural effects. While some studies have shown adverse effects, overall, the results do not show a consistent link between these effects and exposure at levels of EMF typical of everyday exposures. Current data indicate that EMF are not a cause of cardiovascular disease or breast cancer. Some authors have suggested that the foetus and young children may be more susceptible to the effects of EMF.

The one health effect for which results of studies have been more consistent is cancer. In 2002 the International Agency for Research on Cancer (IARC) published the findings of its review of the evidence. It found an association between childhood leukemia and higher exposures to extremely-low-frequency (ELF) magnetic fields in the home. Based on these studies, IARC has classified extremely-low frequency magnetic fields as a possible carcinogen.

In 2007 the World Health Organization published a review on EMF. It did not recommend a change in the IARC classification. For exposure to EMF and childhood leukemia it concluded that “on balance, the evidence is not strong enough to be considered causal, but sufficiently strong to remain a concern.” Areas of uncertainty include: understanding how EMF could cause cancer; the type of exposure that might be important (short periods of exposure to high levels or long periods of exposure to low levels); and lack of supporting evidence in experimental animals.

More details on health effects of EMF can be found in “An Assessment of Health Implications Associated with Exposures to Electromagnetic Fields in and next to Hydro Corridors in the City of Toronto” on Toronto Public Health’s website (<http://www.toronto.ca/health>).

Risks from Exposures to EMF in Toronto

The evidence available does not suggest that exposure to EMF at levels normally found in Canadian living and working environments is harmful. However, as noted above, studies have shown an increased rate of leukemia in children who are exposed to higher average levels of magnetic fields. Leukemia is a rare disease among children: about 25 cases of leukemia are diagnosed among children in Toronto a year. Based on the information available, if there is an increased risk, exposure to EMF might explain 1 to 3 of the leukemia cases in Toronto each year or might increase the life-time risk of childhood leukemia by about 16 in 1 million for every increase in average exposure of 1.0 mG. Increases in risk of cancer of more than 1 in 1 million over a lifetime are often considered sufficient for action.

EMF Regulations in Canada and Other Countries

Canada does not have any guidelines or standards for exposures to EMF. Canada, like many countries, uses the international guidelines which are based on the protection from the acute (short-term) effects of EMF. A few countries, states and local authorities have adopted precautionary measures. These limits generally address uses next to the hydro corridor and consider what is technologically achievable. The more strict guidelines (2-10 mG) that have been adopted in some jurisdictions elsewhere would greatly restrict the use of hydro corridors for parks and recreational activities in Toronto and prevent the health benefits of these uses.

Ways to Reduce Exposures

There are many ways to reduce EMF exposures. The most obvious is to reduce the creation of EMF at the source by increasing the heights of transmission towers, placing wires underground, or using a split-phase design for the transmission line. Toronto Hydro and Hydro One should be encouraged to continue to incorporate measures to reduce EMF emitted from both new and existing equipment used in the transmission of electricity through urban areas and particularly in Toronto.

Education and awareness of sources of EMF in daily life can help people who are concerned about exposures to take actions that will reduce their exposures. Examples of such actions include orientation of furniture in the home or staying away from appliances that emit high levels of EMF. Improved wiring practices to reduce ground current and changes to the design of appliances can also help reduce exposures. Land-use planning measures, such as setback distances or right-of-way widths for power lines next to residential areas, have also been used in some countries, states and municipalities.

Benefits of the Park and Recreational uses of Hydro Corridors

The [2001 Parkland Acquisition Strategic Directions Report](#) identified hydro corridors as an important open space resource for the City. The spatial characteristics of hydro corridors provide a unique opportunity to augment recreational facilities requiring large areas, such as cycling/walking trails and sports fields. There are many requests for additional sports facilities and community gardens.

Physical activity is essential to health and yet more than 40 percent of people in Toronto report their level of activity as low or none. The promotion of physical activity is important in the prevention of chronic disease and in stemming the increase in overweight and obesity among people living in Toronto. Park and recreational uses of hydro corridors provide opportunities for physical activity, including in at-risk neighbourhoods.

Participation in sports, recreational activities and community gardening contributes to the quality of life in the community. It also has many social benefits such as helping people of different backgrounds to get along and building community engagement. Current evidence indicates that the benefits of physical activity in hydro corridors likely outweigh risks from exposures to EMF.

Prudent Avoidance

Prudent avoidance is an application of the precautionary principle. It encourages actions which can increase protection or reduce exposures at little or no additional cost when there is uncertainty about possible risks. Given the possible link between the exposure to EMF and leukemia in children, taking practical actions that can reduce exposures to children is prudent.

If people are exposed to relatively high levels of EMF for a short period of time this will increase their overall average exposure by a small amount. For example:

- Crossing a hydro corridor twice a day (about 1 hour a week for 12 months of the year) where the levels of EMF are 170 mG would result in an increase in total average exposure by about 1 mG
- Playing on a sports field for about 3 hours in a week during 8 months of the year where the levels of EMF are 85 mG would result in an increase in total exposure by about 1 mG
- Playing on and around a play structure for 10 hours per week during 10 months of the year where EMF levels are 20 mG would result in an increase in total average exposure by about 1 mG

This suggests that spending some time in hydro corridors will not greatly increase the average exposure of most people using them. However, taking some care about where amenities are placed can minimize any such increase in exposure.

EMF management plans

An EMF management plan outlines what can be done to reduce exposures to EMF. For example, a plan for a new park in a hydro corridor can identify the best location for play equipment or other amenities where children are likely to spend time. A plan for a proposed development next to a hydro corridor could indicate low or no-cost measures to minimize the increase in yearly average exposure to EMF for young children. For example, it could identify areas in and outside the building where EMF are highest and determine the best place to locate the building or children's play areas.

Recreational uses in and adjacent to hydro corridors

To minimize the increase in exposure to EMF in or right next to hydro corridors that would occur from the use of new multi-use trails, allotment gardens, recreational or parkland uses are planned, and when new or replacement play structures (for example swing sets, slides, teeter totters, climbing equipment) are proposed, then the appropriate City division should do an EMF management plan. This would include an exposure assessment that would be used as one factor to guide the layout of the site so that exposures to EMF would be kept to a minimum.

New development adjacent to hydro corridors

Levels of EMF right next to hydro corridors are often higher than levels found further away. An EMF management plan for new development adjacent to hydro corridors would outline ways to reduce exposure to EMF where children would spend more than an average of four hours a day (for example in residences, schools, daycares). Many developers may not be aware of the low cost measures that can be taken to reduce exposure to EMF. For that reason, it is recommended that the Chief Planner request an EMF management plan as part of the development application review process for official plan and zoning bylaw amendments or plans of subdivisions for new residential, school or day nursery uses on properties that abut a hydro corridor.

New and upgraded transmission lines

The installation of new high-voltage transmission lines and the upgrade of existing transmission lines may result in an increase in the level of EMF on properties along the lines. The Ministry of the Environment has replied to the Medical Officer of Health indicating that new transmission lines would be subject to the requirements of the regulations under the Environmental Assessment Act. Where applicable, the environmental assessment process provides an opportunity for the public and agencies to voice their concerns. The City can and should participate in this process when new and upgraded transmission lines are proposed within the City. In such cases, and when new transmission lines do not require an environmental assessment, the City should request a health impact assessment and an EMF management plan that outlines the measures that can be taken to ensure that the lines minimise any increase in exposures in Toronto.

If adopted, the simple measures outlined in the proposed policy would help minimize exposures to EMF while allowing the benefits of the use of the land in and next to hydro corridors to be maintained.

CONTACT

Ronald Macfarlane
Supervisor,
Environmental Health Assessment and Policy
Toronto Public Health
Tel: 416-338 8097
Email: rmacfar3@toronto.ca

Monica Campbell
Manager,
Environmental Protection Office
Toronto Public Health
Tel: 416-338-8-91
Email: mcampbe2@toronto.ca

Carol Timmings
Interim Director, Planning & Policy
Toronto Public Health
Tel: 416-392-7463
Email: ctimming@toronto.ca

SIGNATURE

Dr. David McKeown
Medical Officer of Health