Sudbury to Hudson Reliability Project - EMF Position Paper

Protect Sudbury
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The plans that Eversource has established for the integration of a high voltage transmission line and recreational trail could expose recreational users to unsafe levels of EMF, in excess of EFSB guidelines, for prolonged periods of time and should be rejected. As the Exponent Report in Eversource's Petition indicates, the magnetic field above the transmission line could be as high as 88 mG and 99 mG during peak load periods, and 24mG – 28 mG during average load periods. [1] Though the Study provides lower EMF exposure at distances of 25 feet from centerline,[2] the proposed recreational path would either be directly above the transmission line, or adjacent to it with a 1 to 2-foot offset.[3] It is reasonable to assume that users of the recreational path would be exposed to the maximum EMF levels produced by the transmission line for the entire duration of the time spent on the recreational path. That exposure could last upwards of hours each time the trail is accessed. Further, since the recreational path will be in use during peak electric hours during the day, it is reasonable to assume that recreational users will be exposed to peak loadings on the line.

The Siting Board has established a guideline of 85 mG of magnetic field at the edge of the ROW in its Decision in Massachusetts Electric Company/New England Power Company, 13 DOMSC 119, at 228-242 (1985), and has used this guideline in successive cases to determine whether anticipated magnetic field levels were "unusually high". [4] This guideline is widely recognized as an upper limit for acceptable prolonged exposure to EMF in Massachusetts. Indeed, Eversource has listed this standard in its response to Protect Sudbury data requests in Attachment Protect-50(1).

Though, the Siting Board has not held this guideline out to be an upper limit, it is clear through the reasoning in its Decisions that its intent is that prolonged exposure to the public should remain at levels below 85 mG. For example, in EFSB 00-3, the Siting Board determined that EMF levels were acceptable as they dropped below 85 mG at the edge of the ROW:

> Because the proposed transmission line would lie almost entirely in city streets, there is no well-defined edge-of-ROW for the project;

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[1] Eversource Petition EFSB17-02, Appendix 5-10, Exponent, Sudbury to Hudson Transmission Line Reliability Project, Electric Field and Magnetic Field Assessment (March 27, 2017) Table 3, at page 15.

[2] EMF falls off to between 12 mG to 16 mG during peak periods at a distance of 25 feet, and 3.4 mG to 4.4 mG at 25 feet during periods of average loading.

[3] Eversource Petition EFSB-17-02, Section 5, at 5-13 and 5-14, indicating that the 4-foot wide duct banks that house the transmission line, will be offset from the 14 foot multi-use access road (bike path) by 2 feet (also shown at Exhibit 5-16 with an offset of only 1 foot, and proposed splice vaults will be partially under the multi-use access road, and the transmission line will traverse directly under bridges. Also see Exhibit EV-18, Appendix 2-1, at 15.

[4] EFSB Decision 00-3; D.T.E. 00-103, Cambridge Electric Light Company, at 37.

> however, the record shows that the street and sidewalk areas provide an "effective ROW" of at least 10 feet in width. Outside this effective ROW, magnetic fields associated with the transmission line would drop below 85 mG. Thus, although the Company has not specifically designated a ROW for its proposed transmission line, the magnetic field levels associated with the proposed project appear to be consistent with levels approved in the 1985 MECo/NEPCo Decision."[5]

Also, in EFSB 08-1, the Siting Board found that ROW levels would remain below the guideline.

> Here, the record shows that outside the facility site, electric field would be essentially unchanged by the project, and edge-of-ROW levels for both fields would remain below levels previously accepted by the Siting Board."[6]

The EFSB Tentative Decision in this (Sudbury to Hudson Reliability Project) case, listed EMF metrics at *average* loadings at distances of 5 and 10 feet from the transmission line, and found that exposure levels were acceptable.[7] First, as indicated above, the multi-use path will either be at a 1 to 2-foot offset from the duct bank, or will be either partially or fully above the transmission line, e.g., in the cases of splice vaults and bridges. According to Eversource's response to interrogatories by the Sudbury Conservation Commission, 33 percent of the transmission line in Sudbury will run down the center of the ROW (the center of the proposed multi-use path). The bridges will literally house the transmission line, with zero offset. Second, it is unclear why the Siting Board would disregard the peak loadings at 88 to 99 mG in its Decision, which are clearly in excess of the Siting Board's 85 mG safety guideline. Unless it is known what the loading durations of the line will be, it cannot be assumed that the line would not violate the Siting Board's safety guideline or consistently operate at average loading while the multi-use path is in use. This is particularly important because the recreational path will be most heavily used during the day when electric consumption is at its peak. For this reason, it is prudent to assume peak loading. The information presented by Eversource to the EFSB ignores the fact that users of the recreational path will receive continuous exposure to levels of EMF beyond acknowledged safety guidelines.

It is important to note that the EFSB's application of its safety guideline mentioned above do not pertain to siting of transmission lines adjacent to or underneath public recreational trails. The Siting Board's decisions imply that exposure to EMF would be measured in seconds, not hours. Because this transmission line will be integrated with a recreational path, the general public will spend many hours on the ROW. Some may use it for hours every day, perhaps pushing an infant in a baby stroller. The EMF that will be emitted from the multi-use path in one hour would exceed levels that many states and countries consider acceptable. For example, Sweden and Switzerland limit EMF exposure to 1.0 mG and 2.5 mG, respectively, averaged over a 24-hour period; and

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[5] Ibid.

[6] EFSB Decision EFSB 08-1, at 37.

[7] EFSB Tentative Decision EFSB 17-02, at pp. 154-155.

California limits EMF levels in schools to 1.2 mG and some American cities limit indoor residential levels (e.g. Brentwood, TN and Irvine, CA) to 4mG.[8] That is, one should not be exposed to greater than those levels averaged over a 24-hour period. It is possible that one hour spent on the multi-use path at peak loading, in itself, would cause a violation to the above referenced safety thresholds.

Though the science on the potential health effects of EMFs is generally considered inconclusive, there have been a multitude of epidemiological studies conducted that clearly identify an association between EMFs and certain forms of cancer, particularly leukemia in children, neurodegenerative disorders, and brain cancer in adults. The inconclusive aspect of these studies is that they have failed to pinpoint a clear causal factor in high voltage transmission lines that results in the associated greater incidence of cancer and neurological impacts. However, the results of the epidemiological studies have consistently found an association between leukemia, brain cancer and neurodegenerative disorders associated with EMF exposure. Below is a summary of epidemiological studies on the impacts of EMF, chronicled by Dr. David Carpenter, a Professor in the Department of Environmental Health Sciences at the University of Albany, in his testimony before the New Jersey Board of Public Utilities:[9]

- U.S. National Academy of Science (1997) found that relationship between power line wire-code rating and childhood leukemia "is statistically significant (unlikely to have arisen from chance) and is robust."
- National Institute of Environmental Health Sciences EMF-RAPID program (1999) found "strongest evidence for health effects comes from associations observed in human populations with two forms of cancer: childhood leukemia and chronic lymphocytic leukemia in occupational exposed adults. While the support from individual studies is weak, the epidemiological studies demonstrate, for some methods of measuring exposure, a fairly consistent pattern of a small, increased risk with increasing exposure that is somewhat weaker for chronic lymphocytic leukemia than for childhood leukemia."
- World Health Association (2007) found that epidemiological data "show an association between ELF magnetic field exposure and an increased risk of childhood leukemia."
- Wattenberg (1998) concluded that "the observed results identify a consistent risk that cannot be explained by random variations."
- Greenland et al. (2000) reported a significantly elevated risk of 1.68 (68% increase in childhood leukemia).
- Ahlbom et al. (2000) found an elevated risk of 2.0 (doubling of incidence) of childhood leukemia from exposures equal or greater than 4 mG as compared with less than 1 mG.
- Draper et al. (2005) found a dose-dependent relationship, with relative risk of leukemia in children being 1.69 (69% increase) for children living within 200 meters from the line, and the relative risk being 1.23 (23% increase) for children living from 200 to 600 meters from

[8] Data re.: EMF exposure limits can be found at EMF & RF Safety Levels – A Comparative Guide, www.scantech7.com.

[9] Reply Testimony of David O. Carpenter, in the Monmouth County Reliability Project Docket PUC-12098-16, Exhibit RAGE-2 [not all studies were listed due to redundancy or lack of relevance].

the line, as compared to those more than 600 meters away. The trend of increased risk based on closeness to the power line was statistically significant ($p<.01$).

- Foliart et al. (2006) examined the relation between magnetic field exposure and the survival of children with acute lymphoblastic leukemia and found a hazard ratio of 4.5 times the risk for children exposed to greater than 3 mG magnetic fields as compared to less than 1 mG.
- Svendsen et al. (2007) found a hazard ratio of 2.6 times the risk for the survival of children with acute lymphoblastic leukemia exposed to 2 mG during recovery as compared to those exposed to less than 1 mG.
- Lowenthal et al. (2007) found an increased risk of 3.23 times of adult lympho-proliferative and myeloproliferative cancers for adults who lived within 300 meters of a high-voltage power line during the first 15 years of life; and rose to 4.74 times for those who lived within 300 meters of a power line in the first 5 years of life.
- Infante-Rivard and Deadman (2003) found that maternal exposure during pregnancy increased the risk of children 0-9 years of age of developing leukemia by a risk factor of 2.5 times for children of mothers in the highest 10% of exposure.
- Li et al. (2009) found that maternal occupational exposure to ELF-EMF resulted in a 2.3 times, statistically significant risk of offspring developing brain cancer.
- Savitz and Ahlbom (1994) reported elevated leukemia mortality among Swiss railway employees exposed to magnetic fields.
- Kehifets et al. (1995) performed a meta-analysis of 29 reports of brain cancer and found statistically significant elevations for electrical engineers, welders, and power station workers with high occupational EMF exposure.
- Zhao et al. (2014) reported a statistically significant 1.25 times elevated risk of breast cancer in post-menopausal women for women that were occupationally exposed to elevated magnetic fields.
- Soffritti et al. (2016) found that ELF-EMF increased risks of breast cancer, malignant schwannomas and lymphoma/leukemia in a dose dependent fashion in rats; and the ELF-EMF promotes carcinogenic effects of ionizing radiation.
- Reif et al. (1995) found that pet dogs living in homes characterized by high or very high wire codes have increased rates of lymphoma at a level that is statistically significant.
- Qiu et al. (2004), Feychting et al. (2003) and Hakansson et al. (2003) found a statically significant elevated risk for Alzheimer's disease with ELF-EMF exposure, approximately two or three times the incidence in a control population.
- Lichtenstein et al. (2000) found that environmental factors were the initiating event in the majority of cancers.
- Yang et al. (2008) found that children who live within 100 meters of a power line or transformer and have a certain gene (the XRCC! Ex9 + 16A allele of a DNA repair gene) have an increased risk 4.31 times greater (400+ increase) of developing leukemia than children with the same exposure that did not have this gene.
- Leszczynski et al. (2002,2004), Olivares-Banuelos et al. (2004), Lupke et al. (2006), Zhao et al. (2007) all found that EMFs alter cell physiology and function and that EMF inhibit differentiation of an erythroleukemia cell line, affect gene transcription, induce the synthesis of stress proteins (Goodman and Blank, 2002; Tokalov and Gutzeit, 2004), and cause breakage of DNA (Svedenstal et al., 1999; Invanscits et al., 2003), probably through the generation of reactive oxygen species (Lai and Singh, 1995, 2004).

The World Health Organization takes a clear stand on the risks presented by EMF, in its Report it states:

> "New human, animal, and in vitro studies published since the 2002 IARC Monograph, 2002 [*sic*] do not change the overall classification of ELF (EMF) as a possible human carcinogen." [10]

The epidemiological studies' findings are consistent and clear. There is an increased dose-related risk of cancer and neurodegenerative disorders, due to elevated EMF exposure above 4 mG in children, adults, fetuses and animals. Though there have been studies that have reported dissimilar or weaker findings, this does not forestall the findings of peer-reviewed studies that have proven statistical associations between EMF and cancers and neurodegenerative diseases. As a result, there is a need to continue to study; and policy makers must exercise caution so as not to put the public at risk. The answers are undoubtedly complex. Cancer and Alzheimer's disease are complicated diseases that are likely to be caused by many combinations of factors. However, the clear association that study after study finds between increased EMF exposure and disease cannot be ignored.

Until there is a better understanding of the health effects of EMF, it is incumbent on our public officials to err on the side of caution to protect the public safety and place transmission lines at a safe distance from residences and public access ways, where children are likely to be playing. A recreational path that poses a potential health risk to the citizens of Sudbury, particularly its children, could never be in the public interest. This project as proposed will expose users of the recreational path to unsafe levels of EMF (as high as 99 mG in one hour) – well in excess of the daily dosages generally considered safe of between 2 mG and 4 mG averaged over a 24-hour period, and above the level that the EFSB has generally accepted to be safe (85 mG). Co-locating a rail trail with a transmission line could, under the appropriate circumstances, provide a unique and beneficial solution to both electric reliability and community enhancement, without endangering the community. But in this case, the ROW is too narrow, the recreational path too close to the transmission line, the surrounding area too environmentally, historically, and culturally sensitive, and the EMF exposure too high. This Sudbury to Hudson Reliability transmission line that is proposed to traverse beneath or adjacent to a Sudbury recreational path, as currently planned, must be rejected on the basis of elevated EMF exposure levels, in the context of the intended use of the path, and the resulting potential risk to public safety.

[10] WHO 2007, at 347.