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Mr. Darren Smith
446 Bevan Way
Tooele, UT 84074-2817

Dear Mr. Smith,

Thank you for your inquiry regarding the affects of the 60-Hertz (Hz) electrical distribution system on your daughter's Medtronic model KDR901 pacemaker. You were most interested in how the electromagnetic fields associated with electrical distribution system might affect her pacemaker, specifically, participating in normal everyday activities in your neighborhood such as using hiking paths in the area around the transmission lines.

Medtronic pacemakers are very immune to most types of electromagnetic interference. Our pacemakers are designed to be resistant to both conducted and radiated electrical interference. Minimum levels of susceptibility to these interference sources have been established (see page four of the second attachment). Medtronic pacemakers perform normally up to these levels.

Above these levels our pacemakers are designed to classify detected electromagnetic fields or conducted currents as being cardiac or non-cardiac in nature. Electromagnetic fields or conducted currents that vary with rates of less than approximately 5Hz (300 pulses per minute) are classified as cardiac. The pacemakers respond to these slower rates by withholding the pacemaker output resulting in the pacemakers being placed in a "Stand-by" condition for as long as these fields or currents are detected by the device.

Electromagnetic fields or conducted currents that vary with rates of greater than approximately 5Hz (300 pulses per minute) are classified as non-cardiac. The pacemakers respond to these faster rates by delivering a continuous train of stimuli to the heart at a normal low rate for as long as the fields or currents are detected by the device. The 60Hz power frequency is, of course, classified as non-cardiac.

If, however, the 60Hz electromagnetic field surrounding the line were significantly modulated by current surges at rates below 5Hz, the pacemaker may recognize these slower variations in the electromagnetic field as cardiac. In this situation the pacemaker would withhold the pacemaker output. Fluctuations in the electromagnetic field like this might occur when working on downed power lines or any other conditions that could cause transients on the power line.

At the 60Hz power frequency Medtronic pacemakers will operate normally in an electric field of up to 6000 volts per meter and a magnetic field of up to one gauss. These field intensities are determined with the pacemaker set to the most sensitive setting and the

lead configured for maximum coupling. Pacemakers programmed to more nominal values would provide greater immunity to these electromagnetic fields.

Mr. Smith, you asked me over the phone to commit to you in writing that the energy fields associated with the power distribution system have absolutely no risk of causing interference with your daughter's pacemaker. I will not commit that to you because there are too many variables to consider for me to say that there is "no risk". I will tell you the risk is very low, but I would never say "no risk" when dealing with this type of question.

If the pacemaker were affected by the electromagnetic field associated with a power distribution system, the affect may or may not pose a risk to an individual in a particular situation. The risk to the individual being treated with cardiac pacemaker therapy may vary widely depending on the medical condition of the individual. If the nature of the work environment is varied and at times unpredictable, this generally adds to the overall risk level for the individual. You may want to talk with her physician about the possible consequences of these affects in her particular situation.

Sincerely,

Rob Bakeberg
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