

**The Performance of Medtronic's Pacemakers and Cardiac Devices  
In the Vicinity of the Mona – Oquirrh Transmission Line Project**

With respect to the February 3 public hearing, concern was raised about potential interference with the pacemaker of Darin Smith's daughter. Mr. Smith reported that information from his daughter's pacemaker manufacturer, Medtronic, warns wearer's of possible interference from transmission lines and he expressed concern that exposures from the proposed transmission line could be potentially fatal to his daughter. As a result, Rocky Mountain Power contacted Medtronic to find out what the thresholds are for interference with their pacemakers.

In a February 2010 email, Medtronic sent us their most recent information containing the interference thresholds for their cardiac medical devices including pacemakers. They report the minimum thresholds for interference is 1 Gauss (1,000 mG) for magnetic fields and 6 kV/m for electric fields. Medtronic's threshold is much higher than the public magnetic field exposures expected from the proposed transmission line, either on the right-of-way or off of the right-of-way of the entire Mona to Oquirrh transmission line, and this is reason pacemaker interference from public exposure to transmission lines is primarily an electric field issue.

The Smith's residence is located approximately 2100 feet from the proposed double-circuit 345 kV transmission line, the line section between Tooele (or the future Limber substation) and Oquirrh. The maximum electric field from the transmission line will only be about 3.4 kV/m directly under the transmission line wires at the lowest conductor height. This is substantially below the minimum threshold for interference stated by Medtronic and Mr. Smith's daughter's pacemaker will be not be affected by the transmission line electric field in this section of the line, based on Medtronic's specifications, whether she is hiking on the proposed right-of-way directly under the wires or adjacent to the right-of-way in this line section between Tooele and Oquirrh.

Since the electric field decreases quickly with distance, the electric field at the edge of the right-of-way, 75 feet from centerline, will only be 0.3 kV/m. At the Smith's residence, any power frequency electric or magnetic fields will be due to electricity use in the home or from local electrical distribution facilities.

The electric field, however, will be higher associated with the single-circuit line section from Mona to Tooele (or the future Limber substation). The maximum electric field on the right-of-way will be 5.2 kV/m for 345 kV operation and about 8.0 kV/m when the line voltage is increased to 500 kV operation in the future. At the edge of the right-of-way, 125 feet from the centerline of the transmission line, the electric field will be below 1 kV/m for both 345 and 500 kV line voltages. Thus, there should be no interference with a Medtronic pacemaker off of the

right-of-way; however the minimum threshold for interference will be exceeded on the right-of-way when the line is operated at 500 kV. When the line is energized at 500 kV, Mr. Smith's daughter should avoid being on the transmission line right-of-way of the single-circuit line section when it is energized at 500 kV. Transmission line electric fields are, however, easily shielded by houses, trees, overhead distribution lines, etc. Thus, the fields will be shielded by an automobile's roof so there will be no interference when driving under the single circuit portion of transmission line in a car when it is energized at 500 kV.

It is not uncommon for pacemaker wearer's to have to take some precautions since other sources of interference are more common than transmission lines and wearers have to learn to take appropriate measures to reduce these interference risks. A quick search on the internet will show that pacemakers can malfunction in close proximity to many common electrical devices. Besides concerns from electric power facilities and lines, common sources of electric and magnetic field interference include iPods and other personal MP3 players, cell phones, wireless phones, microwaves, electric pencil sharpeners, power tools, anti-theft and security devices (in stores, libraries and airports), video games, ordinary magnets (i.e. on refrigerators or kitchen cabinets); escalators, electric vehicle ignition and motors, etc. If pacemaker wearers, however, avoid close proximity to these devices, then their pacemakers or defibrillators will not be susceptible to interference from electric and magnetic fields. Generally, this can be done with only minimal impact on a person's quality of life.

Magnetic fields from distribution line sources can in some circumstances be high enough to interfere with a pacemaker. For instance, interference could occur if a wearer puts his or her chest within a few inches of an ordinary pad mounted transformer that is used in residential areas with underground distribution service. These pad mounted transformers are used to lower the voltage on underground distribution cables to 110 volts for household use. As long as pacemaker wearers keep their pacemakers a few inches away from these transformers, the magnetic fields will be too low to be a concern.

With respect to electric power facilities, it has been our experience that interference with pacemakers and other types of medical implant devices is very rare. In my 25 years of experience handling electric and magnetic field issues for Rocky Mountain Power, I heard of no instances where interference with implantable medical devices actually occurred due to public exposures from electric or magnetic fields from Rocky Mountain Power facilities. On a few occasions over these years, I have worked with pacemaker wearers who were concerned about potential interference and these situations were satisfactorily resolved by taking simple precautions that did not have a detrimental impact on their quality of life.