



Public Service Commission of Wisconsin

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May 7, 2003

To the Person Addressed:

Re: Wisconsin Electrical System Grounding

Several questions and concerns have recently come to the attention of Public Service Commission of Wisconsin (PSCW) staff. These mainly regard the proper and acceptable interpretation of electrical system grounding. They also address the consequences of implementing a multigrounded electrical system, as well as covering some of the repercussions of a hypothetical ungrounded electrical system versus a grounded electrical system. The enclosed paper, "History and Interpretation of Electrical Grounding in Wisconsin" outlines the development of the multigrounded neutral distribution system in this state, why it is an absolute necessity from both code and safety perspectives, the benefits of a well-grounded system, the unavoidable consequences of having such a system instituted and the legal basis for the laws and rules that govern its existence and operation.

There have recently been some suggestions made by certain individuals throughout this state that it may be possible for utilities to establish some kind of "ungrounded" electrical distribution system to either replace or add on to the present system. The paper addresses this issue through multiple examples and code language citations. Wis. Admin. Code ch. PSC 114 (essentially the National Electric Safety Code - NESC) as adopted and in this state with suitable additions, modifications, and deletions) is referred to as the Wisconsin State Electrical Code Vol. 1. This code sets forth the minimum safety standards regarding all aspects of the construction, installation, and operation of utility electrical distribution systems. This includes the subject of grounding. The code is neither a design manual nor an instruction manual, but is a set of legal requirements with which utilities must comply. All public utilities are required to abide by PSCW rules and are held strictly accountable for their collective conduct as set forth in Wis. Stat. §196.44(1) where the PSCW "shall inquire into the neglect or violation of the laws of this state by public utilities or by their officers, agents or employees..." Suggesting that utilities undertake the construction of such a system would put them in the untenable position of premeditated violation of the Wisconsin State Electrical Code.

To further expand on this matter, some private individuals in this state have taken it upon themselves to offer and expound interpretations of certain provisions of the State Electrical Code Volume 1. They assert that some primary distribution systems must be "built as ungrounded

systems.” This declaration is deficient and unworkable in many ways. It lacks persuasive and documented proof of an effective and feasible design. It shows a deficiency in the understanding of even the most basic electrical principles and it has no credible endorsement as to either the merit of such an about-face change to the safety code or a truthful depiction of the ‘shocking’ impact this would have upon Wisconsin’s citizenry. As set forth in the paper, a wholly ungrounded system cannot be practically or safely built. It is a fiction that can only exist on paper or as a verbal or mental concept. In suggesting otherwise, such offerings contradict the authority having jurisdiction (the PSCW) and ignore the fact that an electrical configuration designed without benefit of grounding is known to be extremely hazardous and illegal to attempt under Wisconsin law. Members of the PSCW staff, being a part of the authority having jurisdiction over system design and safety, would never condone utility actions that eliminate proper grounding on specific parts of their electric distribution system in Wisconsin. Any attempt to install an ungrounded primary system in this state would be unconscionable and without question result in someone, private citizen or utility lineman, being killed or seriously injured by contact or being in close proximity with any part of that system.

These same individuals, as well as others, have suggested several unsolicited NESC and NEC code interpretations. One is that any electrical current found on a utility grounding system that is not wholly confined to flow in a physical wire is somehow “objectionable.” Their suggestions seem to be based solely on their own personal interpretations of code for ‘objectionable’ currents flowing on grounding and grounded structures that are part of the utility’s electrical distribution system. They proffer support in the form of pseudoscientific interpretations of the laws of electrical theory that are contrary to well-established and accepted laws and theories. They offer anecdotal testimony based on limited experiences that fly in the face of many documented counterexamples. They also offer “proof” in the form of data recorded with a variety of sophisticated instruments using non-standard measurement protocols. The data interpretation is obviously not based on a solid scientific understanding of the nature of electrical phenomena or proper data acquisition techniques. Certain electrical current flow conditions may exist that are recognized by industry as causing “specific” concerns to some, however they do not meet the definition of “objectionable” just because some private individual expresses a desire for their eradication. In addition, this certainly does not justify massive modifications to the electrical infrastructure of our state at an unknown, but certainly considerable, financial investment that would be passed on to the citizens of this state in the form of a substantial rate increase.

Specifically, PSCW staff does not consider the nominal current flowing on any particular grounding or grounded structures or in the earth to be an “objectionable” current. The paper

provides specific conditions and examples of what may constitute “objectionable” currents. The one exception is animal contact currents arising from elevated neutral-to-earth voltage sources that are known contributors to the phenomenon called “stray voltage.” That subject is well-studied and completely documented. There exists as a normal part of nature induction, coupling, interference, and noise effects explained by basic physics as well as low-level conducted currents that are an inescapable consequence of the act of grounding an active electrical distribution system. They are not and can never be subject to human constraints that wish them to disappear. They are not per se “objectionable” just by their mere existence. In the levels that normally exist, not only in this state but also throughout the entire world, they pose no documented adverse consequence whatsoever.

Some individuals have taken it upon themselves to provide a “remedy” for ground currents in the form of severing grounding conductor connections on both primary and secondary electrical systems. This act of sabotage is extremely dangerous for anyone in the immediate area of that electrical system. It serves no known beneficial purpose. Reasons offered for these actions by those individuals are strictly based on the faulty precepts of pseudoscience. The act is nothing short of criminal damage to property and will someday surely result in an electrocution death. As the paper plainly intones, the benefits of multigrounded electrical systems clearly outweigh any support for a lack of grounding.

Another issue some individuals have raised is the idea that currents found normally in the earth including those that are system return currents from the utility are able to somehow ‘trespass’ onto private property as if they had a will of their own and could eventually obey some future law forbidding this ‘invasion’ of property rights. Electricity follows the laws of physics, set up at the time of the creation of the universe. Electrical energy does not have a ‘soul’ or ‘intelligent will’ of its own and does not ‘trespass’ onto private property as was alleged in a recent lawsuit.¹ The physical laws of nature dictate its actions and all the consequences of those actions. In a legal decision rendered, it was found that electricity is not a thing, but is “wholly intangible” akin to noise, odors and light. It is therefore inappropriate to think of electricity as being able to ‘trespass’ under Wisconsin law.

We conclude that patently unsafe wiring conditions and configurations, as recommended by certain untrained entrepreneurs, pose a significant and substantial threat to the well-being of the citizens of Wisconsin. We all live in a technologically competent and well-informed society in this state. We cannot sanction any such recommendations. We will not allow them to become

¹ Circuit Court Branch VI, Brown Co, WI; *Allen vs. Wis. Public Service Corp.* case 00-CV-1441, Jan. 8, 2003.

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manifest. PSCW staff will never condone non-code compliant activities. To that end, staff offers this document as both a history and an interpretation of appurtenant codes and rules regarding many aspects of electrical grounding as is required in Wisconsin.

Sincerely,

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Rural Electric Power Services

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Enclosure