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December 10, 2015

Ms. Patricia Van Gerpen, Executive Director
South Dakota Public Utilities Commission
State Capitol Building
500 East Capitol Avenue
Pierre, South Dakota 57501-5070

Re: Docket Number RM15-001 - In the Matter of Rules Regarding Stray Electrical Current and Voltage Remediation

Dear Ms. Van Gerpen:

Xcel Energy appreciates this opportunity to offer the following comments regarding the rule making and development of standards implementing South Dakota law around Stray Voltage.

Following are thoughts as to what, why and how the proposed rules may be modified to accommodate the Company's suggestions:

- 1) Xcel Energy believes that the appropriate measurement method for determining the effects of prospective Stray Voltages is to exclusively utilize Voltage measurements. The Company believes that utilizing current to measure Stray Voltage is unreliable as available current meters do not provide reliable measurements at the low current levels typically found in cow contact circuits. We believe that Voltage is the only adequate and appropriate measurement to characterize electrical values at cow contact.

To implement this suggestion, the Company proposes to modify three proposed rules or sections of proposed rules that describe means of measurement of current.

a) The Company proposes to strike proposed rule 20:10:39:01(2) Cow contact current. As follows proposed rule 20:10:39:01(2) would be stricken as shown here ~~(2) "Cow contact current" or "Ice," the alternating current, 60 Hertz, root mean square, steady-state current measured through the shunt resistor;~~

b) We also propose to strike the part of proposed rule 20:10:39:28 that reads "or current through the shunt resistor." Modified as follows: 20:10:39:28. Conducting the cow contact test. The selection of cow contact points to be tested shall include a

sufficient number of locations reasonably likely to demonstrate the presence of stray voltage or current, if any. The voltage across the shunt resistor ~~or current through the shunt resistor~~ is measured between cow contact points. The source resistance is calculated during analysis for all cow contact points.

c) We would propose to strike the entire proposed rule 20:10:39:30 as follows:
~~20:10:39:30. Use of a milliammeter to conduct the cow contact test. When using an in-line milliammeter or a clamp-around milliammeter to measure current between contact points and one of those points is the floor surface or earth, the metal plate must make a high-quality conductive contact with the floor surface or earth, using the procedures described in § 20:10:39:31.~~

- 2) Xcel Energy also is concerned about the formula in proposed rule 20:10:39:57 for determining utility contribution to stray voltage. The proposed formula uses the maximum primary neutral to earth Voltage measured over a 48 hour recording period. We believe that a more appropriate method would be that the formula for utility contribution should use Cow Contact Voltage values from a “load box” test with the farm off.

To implement this suggestion, the Company proposes the following ideas:

a) Add the term “Vshunted” to proposed rule 20:10:39:01(9) as follows: "Open circuit voltage" or "Voc," the difference of electrical potential between two terminals when disconnected from any Vshunted circuit;

b) Clarify the cow contact voltage definition in proposed rule 20:10:39:28 as follows:
20:10:39:28. Conducting the cow contact test. The selection of cow contact points to be tested shall include a sufficient number of locations reasonably likely to demonstrate the presence of stray voltage or current, if any. The voltage across the shunt resistor ~~or current through the shunt resistor~~ is measured between cow contact points as defined in 20:10:39:01 (3). The source resistance is calculated during analysis for all cow contact points.

c) In addition, we would suggest the following additions to proposed rules 20:10:39:51 and 20:10:39:57:
20:10:39:51. Calculating the K factor for the load box test. The K factor is a calculated ratio of cow contact voltage/secondary neutral to reference voltage. This test should be conducted with the farm off during load box testing. The K factor should be less than one because cow contact voltage should be less than secondary neutral to reference voltage. If the K factor is greater than one, then there is contribution to cow contact voltage from sources other than secondary neutral to reference voltage or there are basic measurent errors.

20:10:39:57. Determination of any contributions to stray current or voltage for single phase dairies. The utility contribution to cow contact voltage ~~or cow contact current~~ is determined using the load box test with the farm off.

d) We also propose striking the formulas in proposed rule 20:10:39:57 as we believe that this formula fails in the field test. Our experience is that Voltage measurements of the utility supply with the farm connected to the supplying power system will be impacted by phase angle differences, load size and neutral isolation with each factor introducing error in the utility stray Voltage contribution calculation. We propose to strike as follows:

20:10:39:57.

~~Following formulas:~~

~~(1) Utility contribution to cow contact voltage = $((V_{p48} - V_{p\ Half}) / (V_{p\ Full} - V_{p\ Half})) \times (V_{ee\ Full} - V_{ee\ Half}) + V_{ee\ HALF}$; or~~

~~(2) Utility contribution to cow contact current = $((V_{p48} - V_{p\ HALF}) / (V_{p\ FULL} - V_{p\ HALF})) \times (I_{ee\ FULL} - I_{ee\ HALF}) + I_{ee\ HALF}$.~~

~~The values determined are compared to the preventive action level.~~

- 3.) We also propose striking the word “moist” in 20:10:39:22 as testing will sometimes be performed in frozen and dry conditions and the check for remoteness in the second paragraph will ensure “correct” placement of the rod.

20:10:39:22. Use of remote reference grounding electrodes. Remote reference electrodes are established by installing ground rods. In preparation for testing, each ground rod must be installed and penetrate ~~moist~~ soil to a depth of approximately 30 inches. When practicable, each remote reference electrode is installed at least 25 feet away from the nearest underground conductive electrical equipment of any type or at a distance equal to three to four times the buried depth of any metallic structure connected to the service entrance neutral. Each remote reference electrode must be located no closer than 25 feet from the centerline of a primary electrical conductor right-of-way and no closer than 100 feet from the edge of a transmission line right-of-way.

The Company looks forward to having the opportunity to further explain these suggestions and participating in a hearing in this proceeding.

If anyone has any questions, please call me at 339-8350.

Sincerely,



Jim Wilcox