

**Comments for the State of Iowa
Stray Electric Current and Agriculture Study Committee**

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Thank you for the opportunity to address you on the subject of standards for stray voltage and in particular, the Wisconsin experience. I have had the opportunity over the last 30 years to work in the area of stray voltage and dairy cows in Wisconsin, Iowa and elsewhere around the country on behalf of rural electric cooperatives and utilities. Stray voltage is an area where there has been a great deal of controversy over the years. There has also been significant progress with respect to improved understanding of the subject matter on the part of both utilities and farmers. I would also hope there is now greater cooperation in resolving concerns short of litigation. Establishing standards can bring the opportunity for more progress in both areas to Iowa.

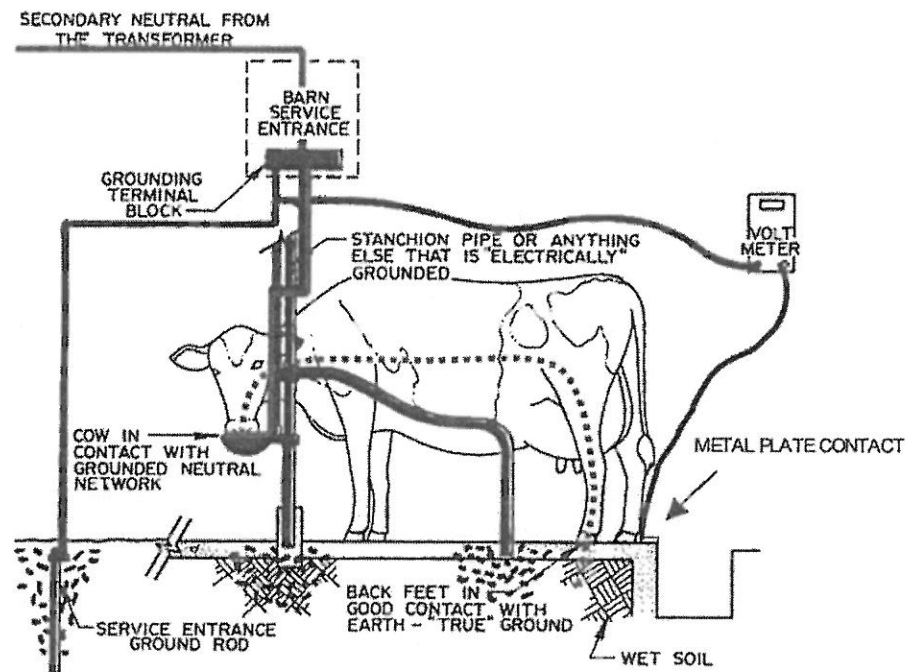
I respectfully submit that standards can help reduce areas of misunderstanding between utilities and farmers, encourage more efficient and practical resolutions of concerns, and allow resources to be channeled in the most useful way by both producers and power suppliers. Dairy farms are often some of the larger loads for rural electric cooperatives, and it is in everyone's interest for producers to prosper with their REC as partners. Standards for stray voltage can promote those interests.

I will leave it to others—the agricultural engineers, electrical engineers, dairy scientists and veterinarians—to suggest what *specific* standards may be appropriate for Iowa. I will also

try to avoid highly technical discussions of existing standards in deference to the expertise of the scientists and engineers. Rather, I will try to limit my comments to the more general nature of the standards that Wisconsin and other jurisdictions have developed, the process used to develop them, and the benefits of having standards.

The key elements of a useful standard are the science based establishment of a cow contact point measurement level and the establishment of science based procedures for measuring that level. A cow contact point measurement is a measurement made between two points that a cow may simultaneously touch—such as a water tank and the earth at her feet, or potentially from front hooves to rear hooves—through which current may be able to flow through her body.

EXAMPLE OF COW CONTACT POINT MEASUREMENT--WATER CUP TO FLOOR



These cow contact point standards are variously called “Levels of Concern”, “Preventative Action Levels” (PAL’s) or “Action Levels”. All share the attribute of being scientifically based thresholds aimed at keeping cow contact point exposures below a level where harm can be expected to occur. Thus, if a reliably measured level is below the standard, no harm would be expected. And, even where the level is exceeded, a margin for error is built in before harm would be likely to occur. Cow contact point level standards generally represent the amount of potential current flow that might affect a cow regardless of whether the source or cause of the current flow is the utility system, the farm wiring, or both. I would respectfully submit that setting standards in this area is an achievable goal.

Wisconsin’s experience with adopting stray voltage standards begin in the late 1980’s. We certainly know more now on the subject than we did then, and efforts to establish regulatory standards have evolved over time. Since Wisconsin established its first standards in early 1989, other states and jurisdictions have also adopted standards in various ways, often with very systematically documented investigation procedures. My experience with standards is, of course, mostly based on work in Wisconsin. While I do not offer the Wisconsin experience as perfect, I respectfully submit there is much to learn from it. Wisconsin has been a leader for many years in the dairy industry and in addressing this issue.

Stray voltage standards also require adoption of standardized methods of testing. Without that component, there is a serious risk of confusion or worse for all concerned. Measurement based cow contact point standards involve highly technical considerations. Science based procedures for testing and measurement prepared with the appropriate engineering expertise and input is critical to making standards useful, whatever level they may be. Without standardized

measurement and testing procedures, the reliability of any cow contact level standard can be called into question, and the risk for misinformation being introduced into an investigation process is increased. No one—not the farmer or the utility or the electrician—benefits when that occurs.

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WI PSC Docket 05-EI-106¹

In 1987 the Wisconsin Public Service Commission (PSC) opened a proceeding called a “docket” for the purpose of investigating and gathering information on stray voltage. The docket was technically called 05-EI-06 but the proceedings and orders that followed have become known simply as ‘Docket 106’. The Findings and Orders from Docket 106 and subsequent related docket proceedings have become important benchmarks and guidelines for utilities and farmers around the country.

The Docket 106 proceedings began with a preliminary technical conference and later a series of public hearings around the state. In fact, fourteen separate hearings were held in various towns in 1987 with testimony from farmers, electricians, utilities and others. Information was also gathered through questionnaires. Hearings were held with expert witness testimony in 1988 in Madison. Stakeholder representatives had a full opportunity for participation. The Findings and Order from Docket 106 can be seen as an early iteration of standards compared to where we are today. However, the procedure used to develop Docket 106 represents an example of a reasonable process that can be used to prepare a standard.

¹ Docket 106 is no longer available online. A copy can be provided.

The PSC issued its Findings of Fact, Conclusion of Law and Order in early 1989, supplemented by Amended Findings, Conclusions of Law and Orders in 1990.

Topics outlined in the Findings and Order included:

- A Level of Concern for cow contact points identifying how much utility contribution measured at cow contact points would trigger mitigation by a utility.
- The desirability of standardized screening and diagnostic measurements and equipment
- Prevention steps
- Neutral Isolation (the separation of the utility neutral system from the farm neutral system) and other mitigation techniques.

The Findings of Fact included the following:

- That stray voltages are low-level voltages present across points (for example, drinking cup to rear hooves) in which a current flow is produced when an animal simultaneously comes into contact with them.
- That stray voltages can cause stress and behavioral problems in confined livestock that can result in production losses as well as physical and manageability problems.
- That stray voltages can be caused by sources either on or off-farm.
- That a level of concern above which corrective or mitigation action should be taken if production and behavioral problems exist is 1 milliampere in the "cow contact" areas. (This correlates to a half a volt measured at cow contact points using standardized procedures and equipment).
- That non-electrical causes must be evaluated when stray voltage is a concern.
- That most stray voltage problems can be detected and corrected or mitigated if proper screening and diagnostic tests and equipment are used, including the use of resistors to simulate the resistance of the path through the animal.

- That the best means to avoid stray voltage problems is the proper planning, installation, operation and maintenance of both the electric utility's and the farmer's electrical systems and equipment.
- That accurate information, education and financial assistance to construct and maintain proper electrical systems is a good means to ensure that stray voltage problems are prevented, minimized or resolved.
- That more research is needed in various areas.

Docket 106 also included various “Orders” directed at regulated utilities. These included technical information, guidelines and directives that certain steps and procedures be used by regulated utilities to address stray voltage, the construction and maintenance of lines, how to conduct investigations and mitigation procedures.

Docket 106 represented a first effort in developing regulatory standards for stray voltage. It was however just a first step, and the substantive levels, guidelines and directives have in many ways been superseded by subsequent research as well as changes in both farming and utility practices. Docket 106 nonetheless provided useful guidance to stakeholders.

Because the PSC has no jurisdiction over farmers, in a sense it could offer little more than encouragement to producers to take steps to reduce the risk that they might experience a stray voltage problem. However by establishing a cow contact level of concern/action level, Docket 106 provided both farmers and utilities an objective standard—imperfect as each might think it to be—that each could look to to assess whether they were meeting their relative obligations and whether they could reasonably expect a stray voltage related problem to be present. Both parties could then make rational, scientifically based judgments on what steps might make sense to take, what costs might be worthwhile or necessary to incur, and thus how to best use their resources to good purpose. In addition, an articulated standard would better provide the opportunity for working together towards a common and measureable goal than

would be the case when both parties were completely free to establish their own personal or idiosyncratic targets without any objective guidance.

WI PSC Docket 05-EI-108²

April, 1990 the PSC opened an investigation into the effects of electromagnetic fields (EMF), direct currents (DC) and ground currents on dairy livestock. An advisory committee was formed that included dairy operators, electric utilities and cooperatives. The committee reviewed research and potential future studies. A draft Request for Proposal was finalized December, 1992. However a consensus could not be reached and PSC staff recommended that hearings be held. A technical conference was held in July 1993 to determine the scope of the issues and hearings were held in early 1995 in Madison. Findings of Fact, Conclusion of Law, Certificate and Order were filed in the middle of 1995. These indicated that while testimony showed that some farmers were describing problems operating their dairy farms, the cause of these problems was unclear. As there was conflicting evidence and a lack of firm data, the PSC determined it was unreasonable to adopt or order implementation of any of the proposed solutions.

The PSC did however conclude that it should coordinate with, and monitor, scientific research then being conducted under the auspices of the Minnesota Public Utilities Commission on these subjects. Accordingly, no standards or substantive orders were promulgated under Docket 108.

However, the research conducted by Minnesota was ultimately concluded. As set forth in the conclusions of the Report of the Minnesota Science Advisors:³

² Docket 108 is no longer available online. A copy can be provided.

³ Final Report of the Science Advisors to the Minnesota Public Utilities Commission:
http://www.puc.state.mn.us/portal/groups/public/documents/pdf_files/000670.pdf at page 38.

1. *We have not found credible scientific evidence to verify the specific claim that currents in the earth or associated electrical parameters such as voltages, magnetic and electric fields, are causes of poor health and milk production in dairy herds.*

2. *At the present time, there is no basis for altering the PUC-approved standards by which electric utilities distribute power onto or in the vicinity of individual dairy farms.*

WI PSC Docket 05-EI-115⁴

In 1995, the Wisconsin PSC opened Docket 115. A purpose of Docket 115 was to evaluate the results of stray voltage research that had been completed since 1989 and to update the original Docket 106. Twelve public hearings were held throughout the state. Five days of technical hearings with expert testimony were held in Madison in 1996.

Findings of Fact, Conclusion of Law and Order were filed in the middle of 1996.

Findings of Fact included the following:

- A scientific consensus existed about the effects of stray voltage.
- The major work published on the subject was the USDA Handbook 696 (often referred to as “The Redbook”). Long-term and on-farm experiments published after USDA 696 have confirmed its conclusions.
- 1 milliamp (1mA) was determined to be the lowest threshold at which the most sensitive cows perceive the presence of electricity.

⁴ <http://psc.wi.gov/utilityInfo/electric/documents/strayVoltage/strayvol.pdf>

- Research was found to confirm that stray voltage did not directly create health problems for a cow. The direct response is behavior change and cows can acclimate to current and voltage levels.
- The “Level of Concern” from Docket 106 was found to be extremely conservative and reasonable regulation would set a stray voltage level at a conservative level below where moderate avoidance behavior is likely to occur.

The PSC updated its level of action at cow contact points to 2 milliamps AC RMS 60 Hz, steady state, (or 1.0 volts when using standardized testing procedures) with the utility’s obligation to mitigate triggered at a contribution level of half this amount or 1 milliamp (.5 volts).

Docket 115 thus reflects a refinement of the standards set in Docket 106. It updated the threshold for action based on cow contact point measurements to reflect technical developments and updated scientific research that occurred in the years after Docket 106.

Whatever criticisms there may be of Docket 115, it is respectfully submitted that it is based on reliable scientific principles and research. As with Docket 106, the real value in having stray voltage standards remains the same: stakeholders have an objective target to provide guidance in conducting investigations and evaluating testing data.

The existence of the standards of Docket 106 and 115 has by no means meant the end of stray voltage litigation in Wisconsin. For example, the Wisconsin Supreme Court has ruled that meeting the PSC standard at cow contact points does not mean that no claim for damages can be

brought for stray voltage injury based on the evidence presented in the case.⁵ Arguments are made in courtrooms and elsewhere that the Dockets cover “traditional” stray voltage whereas injury is caused by “non-traditional” stray voltage variously described as ground currents, transients or by other terms. Whether such terms or distinctions are meaningful to a discussion of stray voltage and its effects on dairy cows is best left to others with appropriate expertise and to another day.⁶ Nonetheless, the existence of the standards in Docket 106 and Docket 115 has been useful in providing all concerned with benchmarks against which to evaluate information and guide their actions.

Other Jurisdictions:

Moreover, since Docket 115 was adopted, other states have adopted similar standards. They have, in general, built upon the cow contact point standards incorporated into Docket 115 but with some variations and with more detailed and documented standardized testing procedures. Each has its own nuances and specifications and each was adopted in the context of the particular jurisdiction’s overall regulatory structure. All have something to offer for consideration.

Idaho:

For example, in 2005 Idaho legislatively adopted a set of cow contact based standards, and in 2006, the Idaho Public Utilities Commission promulgated a comprehensive and

⁵ *Hoffmann v. Wisconsin Electric Power Company*, State of Wisconsin Court of Appeals No. 00-2703, Review of the Decision of the Court of Appeals Reported at 255 Wis.2d 831, 646 N.W. 2d 854.

⁶ In Michigan, administrative proceedings rejected a variety of claims regarding currents in the earth as cause for concern. See http://www.mrec.org/documents/svit/other/mi_proposal_for_decision_ground_currents.pdf

instructive set of regulations detailing testing procedures.⁷ Of particular note is a training and certification protocol for persons performing stray voltage testing. This has the benefit of minimizing the chance that unqualified personnel will be introducing unreliable information into an investigation process.

Michigan:

In 2007, Michigan adopted a detailed standard for cow contact point levels, again using the basic standards used in Docket 115. As in the case of Idaho, Michigan also documented a detailed and systematic set of protocols for standardized testing.⁸ Of particular interest is the manner in which Michigan approaches identifying the relative contribution of the utility to the cow contact point measurement. While best addressed by engineers, the approach differs from that used by Wisconsin and Idaho.

Ontario:

The Province of Ontario has also been involved in stray voltage evaluation for a number of years. In the course of that work, in 2008 it commissioned a report on the varying approaches taken in the United States and Canada on regulating stray voltage which provides a summary of different methods used.⁹ In 2009, Ontario ultimately adopted a detailed set of procedures for

⁷ Idaho Statutes re Stray Current and Voltage Remediation Act :
<http://legislature.idaho.gov/idstat/Title61/T61CH8.htm>

Rules for the Measurement of Stray Current or Voltage (The Stray Voltage Rules):
<http://adminrules.idaho.gov/rules/current/31/6101.pdf>

⁸ http://www7.dleg.state.mi.us/WebORRGSA/108_10_AdminCode.pdf

⁹ Ontario-Regulatory Approaches to Addressing the Impact of Stray Voltage on Farm Operations":
http://www.ontarioenergyboard.ca/OEB/Documents/EB-2007-0709/report_BDR_20080530.pdf

testing and measuring, again based in large part on the level of concern incorporated into Docket 115.¹⁰

Conclusion:

No standard will satisfy every stakeholder in every respect. However, a process that allows all concerned the opportunity to present their point of view, and the subsequent promulgation of reasonable and science based standards will likely assist in the resolution of concerns about stray voltage in an efficient and more productive way than can be achieved without such standards. Utilizing Wisconsin standards would be a good starting point for the development of science based standards in the State of Iowa.

¹⁰ Ontario-Farm Stray Voltage Distributor Investigation Procedure (Appendix H):

[http://www.ontarioenergyboard.ca/OEB/Documents/Regulatory/Distribution System Code AppH.pdf](http://www.ontarioenergyboard.ca/OEB/Documents/Regulatory/Distribution%20System%20Code%20AppH.pdf)

General documents related to OEB's Stray Voltage rules:

[http://www.ontarioenergyboard.ca/OEB/Industry/Regulatory%20Proceedings/Policy%20Initiatives%20and%20Consultations/Farm%20Stray%20Voltage%20\(EB-2007-0709\)](http://www.ontarioenergyboard.ca/OEB/Industry/Regulatory%20Proceedings/Policy%20Initiatives%20and%20Consultations/Farm%20Stray%20Voltage%20(EB-2007-0709))