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My name is Aaron Rendahl. I am an Assistant Professor of Statistics and Informatics in the Department of Veterinary and Biomedical Sciences of the College of Veterinary Medicine, University of Minnesota. I received my PhD in Statistics in 2008 from the School of Statistics, University of Minnesota, and was previously employed as the Manager of the Statistical Consulting Center there. In these two roles I have been co-author on over fifty peer-reviewed publications, as listed in my Curriculum Vitae attached hereto as Exhibit A.

A listing of the documents I have reviewed in this matter is attached hereto as Exhibit B. I have not testified in any court matter in the last four years.

I have been asked to review the statistical aspects of a number of documents and studies to assess the appropriateness of the analyses and conclusions, as follows.

1. USDA Handbook 696 Figure 3-4

In this section, I have evaluated the statistical evidence supporting Figure 3-4 (p. 3-22, reprinted as Figure 7-2, p. 7-9) from the USDA Handbook 696 (otherwise known as the “Red Book”), with a focus on the evidence for 500 ohms and 1000 ohms as worst-case and more realistic circuit impedance values, and find that these values are significantly larger than what the evidence supports.

On page 7-5 of Red Book, Figure 7-1, the overall circuit impedance is defined as the sum of the source, path, contacts, and cow impedances. As described in page 7-6, the worst-case circuit impedance is defined as the sum of the animal and the contact impedances; this is estimated in Table 7-2 as 500 ohms, which the total impedance is estimated as 1000 ohms and includes an additional 500 ohms for path and source impedance.

The evidence for the 500 ohm animal impedance is said to be from “experimental tests and field experience,” however, none of the published papers given as reference support this claim. The evidence for the impedance value for an animal is from eight published articles, as presented in Table 3-1 (p. 3-6, reprinted as Table 7-1, p. 7-6), which reports the mean impedance and range for each electrical path that was studied in each article. There is no evidence given for the reported 500 ohm path and source impedance, and none of the articles either measure or report on

this impedance, though some of the methods used include some of this impedance as part of the reported animal impedance.

Before describing the evidence in these eight articles, I will examine Table 3-1 on its own as evidence for the claim of 500 ohms as a “worst-case” circuit impedance. There are 18 pathway/study combinations reported on, and one-third (6) have mean resistance values of less than the supposed “worst-case” of 500 ohms. Additionally, of the 16 with reported ranges, 69% (11) have lower bounds less than 500 ohms. Therefore, the value of 500 ohms is not supported by this table, even without investigating the articles more fully.

However, there is also an important question that is left unaddressed by this report, which is what the “worst-case” value is meant to represent. As seen in the ranges in the table, there is notable variability in resistance from animal to animal and from pathway to pathway. If we use the mean value as “worst-case,” as is one possibility suggested by Table 3-1, then half or more of the individuals would have values less than the “worst-case,” assuming the distribution is right-skewed, as is suggested by the relationship between the mean and range. Instead, “worst-case” should refer to the animals in the herd with the least resistance, at the low end of the range, but the important issue of where the cutoff should be it is not discussed or even considered.

I now examine the evidence in each of the eight articles specifically.

1. Philips et al. 1963

This is the earliest study referenced, and reports just a single number: “the resistance of the cow was of the order of 1,000 ohms”. It is not specified how many cows these measurements were made on, or any indication given of how variable the value might be. This lack of information makes it impossible to evaluate the statistical value of the estimate. Additionally, this value includes at least some of the path impedance, as it was measured from the teat of the cow to a wet piece of cloth placed on the floor; the cow impedance would therefore be less.

2. Craine et al. 1970

This study reports a “total resistance” of 324 to 393 ohms, over 70 cows. This total resistance includes the “mouth contact, the animal, and its grounding resistance,” so again, the impedance due only to the cow would be less. Therefore, this study indicates the “worst-case” circuit impedance for a cow should be less than the reported 500 ohms.

3. Woolford 1972

This study reports numbers for two conditions, first, between “the wetted flank and a conducting floor,” they report the impedance to be “on the order of 1000 ohms,” and second, with “wet skin and ... the presence of urine,” they report a range of 200 to 400 ohms. However, contrary to the interest in a “worst-case” circuit impedance, Table 3-1 reports only the first. Instead, from this study, a

“worst-case” value of the reported minimum of 200 ohms would be more appropriate.

4. Whittlestone et al. 1975

This study reports actual numbers for the seven included cows, however, there are discrepancies in the numbers that call into question the accuracy of the measurements. Specifically, of the four cows that were able to be measured both on all four teats together and on a single teat, three were reported to have higher impedance on all four teats together. This is physically impossible, as adding additional pathways for current will always decrease the impedance. Either the measurements were made in an improper way, or there is substantial measurement error which is not explored or quantified.

5. Lefcourt, 1982

This study measured five cows, and had a range of 250 to 405 ohms. This was measured from the front leg to the rear leg, which is different than in practice where one of the current paths is instead to the floor. Additionally, although the author describes these as probable minimums because the resistance of the entry paths was minimized, without data on what that additional resistance would be, a reasonable estimate of the “worst-case” from this study would have to be the reported minimum value of 250 ohms.

6. Norell et al. 1983

This is the most complete of the eight studies, with eight different pathways measured. A primary result, as included in the abstract, is that 75% of the population had a impedance of 441 ohms or less between mouth and all hooves. This directly contradicts the estimated “worst-case” of 500 ohms.

7. Henke Drenkard et al. 1985

The data reported in Table 3-1 about this study is incorrect. It had six cows, not twelve, and the reported mean resistance was 630 ohms, with a range of 510 to 980 ohms, not a mean of 1700 and a range of 650 to 3000.

8. Lefcourt et al. 1985

This study used the same measurement techniques of the Lefcourt, 1982 study, between the front leg to the rear leg, and reports a total range over 13 cows of 302 to 412 ohms, again less than the supposed “worst-case” of 500 ohms.

2. Reinemann/Sheffield studies of immune response

In this section, I evaluate statistical analyses and conclusions from two studies of immune function responses to electrical exposures, as follows:

1. Reinemann, D. J., L.G. Sheffield, S. D. Lemire, M. D. Rasmussen, M. C. Wiltbank, 1999. Dairy Cow Response to Electrical Environment, Final Report, Part III. Immune Function Response to Low Level Electrical Current Exposure. Report to the Minnesota Public Utilities Commission, June 30, 1999.
2. Sheffield, L.G. Impact of Low AC Currents on Immune Function of Dairy Cattle, undated.

In the first study, three groups of eight cows were studied for three weeks each. During the second and third weeks, four of each group of eight were exposed to 1 mA of current flow from their front to rear hooves. Blood samples were taken from all cows twice each week, and eleven immune function responses were measured.

The statistical analysis used in this report was to take the difference between the final measurement and the average of the measurements during the first week for each cow. The treated and control cows were then compared by performing an independent t-test on these differences. Unfortunately, this choice of analysis suffers from two problems, both of which have the effect of making any potential differences between the treated and control cows more difficult to detect.

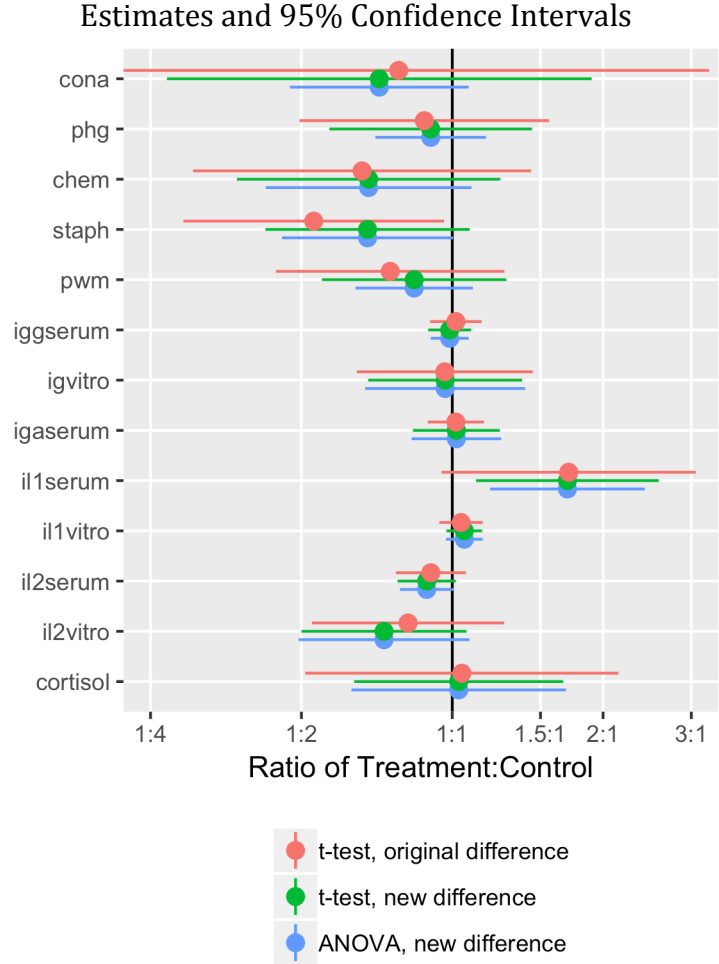
The first problem is that only the last measurement was used. Any measurement of a physical characteristic has some innate variability to it, and the more variable the characteristic is, the harder it is to statistically detect a difference. However, by averaging over multiple measurements, this variability can be reduced, leading to more precision in the results and more ability to detect differences. In this study, this technique was used for the first week, but not for the last week; by averaging the last two measurements as well, the analysis would be much stronger.

The second problem is more fundamental. Any analysis of data should account for all aspects of the experimental design, in particular, accounting for any groupings of the units under study that were imposed by the experimenter. In this study, the units are the twenty-four cows, and they were grouped into sets of eight, which were all under study at the same time. This grouping, or "blocking," is not accounted for in this analysis, and so any variation between the blocks is not accounted for, again leading to more variability in the analysis, less precision in the results, and less ability to detect differences.

To correct these problems, I have reanalyzed this data, using the difference between the average of the last two measurements and the first two measurements, and fitting an ANOVA model with a block effect for the three groups of cows. The

p-values for the ANOVA model are shown below. Also shown are the estimated treatment effects with 95% confidence intervals, using the original t-test method, a t-test on the new difference, and the ANOVA using both the new difference and blocking for the group.

ANOVA p-values	
cona	0.104
phg	0.427
chem	0.105
staph	0.0522
pwm	0.191
iggserum	0.782
igvitro	0.855
igaserum	0.850
il1serum	0.00558
il1vitro	0.187
il2serum	0.0603
il2vitro	0.111
cortisol	0.901



We now see that there is strong evidence for an effect of il1serum, with a p-value of 0.00558, which is statistically significant at the usual 0.05 level. We also see the effect of these two adjustments to the precision of our estimates in the shorter confidence intervals; on average, using the average of the last two measurements reduces the variance by 23.6%, and blocking for the group with an ANOVA reduces the variance by an additional 14.3%.

Using this ANOVA model, the best estimate for the treatment is that it increases il1serum by 1.70 times relative to the control, with 95% confidence that the increase is between 1.19 times and 2.42 times.

I have also reviewed the analysis of Dr. Frank Martin of this data; his analysis also includes a “crossed,” or “interaction,” term between the treatment and the group effect. This choice has little effect on the results.

Any one study, however, should not be taken as absolute proof of an effect, especially when the analyses were chosen afterwards, no matter how much more appropriate those analyses might seem. For stronger evidence, further studies with new data and new analyses should be performed to confirm any results.

Thankfully, additional research into this area was performed, as reported in the second study under consideration.

In this study, twenty cows were studied; ten received no current (control) and ten received a current of 1 mA, applied this time using electrodes that were glued to the upper part of each leg.

For this study, the two sample t-test is appropriate, for several reasons. First, according to Sheffield’s deposition of May 30, 2014, only one blood sample, from after the treatment period, was available to be analyzed for each animal. Secondly, all cows were in the same group, so there was no additional blocking. The precision of the estimates in this study could have been improved at the design stage by taking more measurements both before and after to allow us to again average over multiple measures and compute differences over time; however, not doing so does not invalidate any results, it just makes it harder to detect any differences between the treatment and control groups. The only change I would make to this analysis is to perform it on the log scale, as was done in the first study, but for the variables I have looked at, this change has little effect.

The results from this study confirms the result from the first study, that there is strong evidence for an effect of current on IL1a levels. The evidence is even stronger in this study, with a reported p-value of 0.00000874 (8.74e-06). The reported estimated ratio of treatment to control is 1.655, and if there really were no difference, this small a p-value means that the chance we would only see a ratio this large or larger by chance is only about 9 times in a million.

Re-analysing the data on the log scale provides a similarly small p-value of 6.52e-06, and an estimated ratio of 1.65; this analysis additionally allows us to report a 95% confidence interval for this ratio of 1.40 to 1.95.

Additionally, this second study provides statistically significant evidence for changes in other immune system responses as well, namely, decreases in IgJ (p=8.21e-05), IgAHC (p=0.00321), and IL10 (p=2.93e-05), and increases in IL1b (p=2.55e-06) and IL2 (p=4.98e-06).

Taken together, these two studies provide strong statistical evidence for an effect of current on the immune system.

3. Gorewit/Aneshansley studies of lactating Holsteins

I have also reviewed the statistical evidence in the following paper:

AC Voltages on Water Bowls: Effects on Lactating Holsteins. Gorewit, Aneshansley, Ludington, Pellerin, Zhao, 1989 J Dairy Science, 72:2814-2192.

Results from this paper also appeared in three ASAE reports, as follows:

- a. Effects of Neutral-to-Earth Voltage on Behavior, Production, and Water Intake in Dairy Cattle. Aneshansley, Gorewit, Ludington, Pellerin, Xin, 1987. ASAE 87-3034.
- b. Effects of Neutral-to-Earth Voltage on Animal Health and Reproduction in Cattle. Gorewit, Zhao, Aneshansley, Ludington, Pellerin, 1987. ASAE 87-3035.
- c. Delays in Drinking Due to AC Voltages. Gorewit, Aneshansley, Ludington, Pellerin, 1998. ASAE 88-3524.

I will focus my remarks on the milk production results from Trial 1, which has several serious errors in analysis and reporting. In this study, 30 animals (15 heifers and 15 cows) were assigned to 5 treatments, so 6 per treatment. The treatments were to receive 0, 0.5, 1, 2, or 4 V between the water bowl and a floor mat under the rear hooves. Water intake, milk yield, feed consumption, and milk composition were measured over 10.5 days before the treatment (pretest), during 21 days of treatment, and over 10.5 days after the treatment (posttest). These cows were on average at 71 days in milk at the start of the experiment, a time at which milk production is expected to decline over time.

The first error in this paper is in their choice of response; to analyze this data for the Journal of Dairy Science paper, the before and after data were averaged for each cow to get a single “control” value, which was then compared to the average over the treatment period. This choice is inappropriate because it does not truly characterize the effect due to the treatment, and in fact, minimizes any change in the rate of decline of milk production due to the treatment. That is, if the treatment causes the milk production to be less than it would have been even in the posttest period, then averaging the posttest and the pretest includes some of the treatment effect, so the “control” period is not truly a control, but instead a mixture of the control and the treatment.


In fact, the ASAE report 87-3034, which contains more detailed results, shows exactly this pattern in Fig 11, which shows changes relative to week 2, the second pretest week. We see a stronger decline over time for higher voltages both for weeks 3-5, the treatment weeks, and continuing into weeks 6-7, the post-test weeks, suggesting strongly that the effect of the treatment persists and so averaging the posttest and the pretest hides any possible effect. This visual pattern of stronger effects for higher voltages is called a dose-response relationship, and is evidence that the decline in milk production is caused by the voltage.

Furthermore, the ASAE paper notes concern about the effects of the higher voltages being due to mastitis in some of those animals. This concern is misguided and is opposite of the well-accepted principle of "intent-to-treat" which states that subjects should be analyzed as part of the treatment group that they were initially randomized to, regardless of whether they are able to stay with that treatment or have other complicating side effects. To remove them from the analysis can bias the results; in this case, it is possible that the voltage was a contributing factor to the mastitis, which then resulted in lower yield. If so, these subjects are strong evidence for an effect of voltage on milk production, not the opposite.

A final error in these papers is in their language about the results. In the conclusion of the JDS paper, they state there was "no change in production variables;" this is not a correct claim. A non-significant p-value never allows one to claim that there is no difference between two groups. Instead, one can claim only from the result we "fail to reject" the hypothesis of no difference; we never "accept" this hypothesis. Indeed, the language from the conclusion of the ASAE report is much more appropriate: the "number of animals were too small and the variation in milk production too large to find significant differences."

In conclusion, this paper not only incorrectly states that there was no change in milk production, but fails to analyze the data in a way that would have been able to find such a difference, a difference that is strongly suggested by the dose-response relationship observed in the data.

Dated: 14 Nov 2018


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Curriculum Vitae, November 2018

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295L Animal Science/Veterinary Medicine

Education

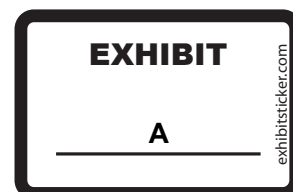
- Ph.D. Statistics August 2008
University of Minnesota
Thesis: Graphical Methods for Determining Predictor Importance and Effect
Sanford Weisberg, Advisor
- B.A. Mathematics
B.S. Physics May 2000
Bethel University, St. Paul, MN
Graduated cum laude. Minor in Computer Science.

Employment

- Assistant Professor of Statistics and Informatics June 2017–
College of Veterinary Medicine, University of Minnesota
I collaborate with researchers throughout the college on their research and teach graduate level courses on statistical practice.
- Statistical Consulting Manager July 2008–June 2017
School of Statistics, University of Minnesota
I managed the Statistical Consulting Center, including scheduling and oversight of graduate students, consulting with clients, and general administration of the clinic. I also managed the summer internship program for statistics graduate students and taught classes as necessary.

Teaching

- VMED/CMB 5915: Essential Statistics for Life Sciences Fall, 2018–
A broad overview of the principles and methods of statistical analysis used in life sciences research, including biological, veterinary, and translational research. Provides the background needed to understand and apply commonly used statistical methods.
- VMED/CMB 8910: Statistical Principles of Research Design Spring, 2018–
An overview of the principles and techniques of research design and methods used in veterinary and translational research. Provides the background a new researcher needs to understand the literature and make good decisions about what is appropriate for their research.
- STAT8801: Statistical Consulting Spring, 2009–2017
An introduction to skills needed to collaborate effectively and responsibly with non-statisticians to answer their subject matter questions. Includes written and verbal communication, professional practice and ethics, and various technical tools.



- STAT4893W: Consultation and Communication for Statisticians Spring and Fall, 2016
A capstone course for undergraduate statistics majors, including an in-depth consulting project and extensive written work.
- EPSY8282: Longitudinal Data Spring 2011
An introduction to longitudinal data analysis using mixed models.
- STAT4101-2: Theory of Statistics (Undergraduate Level) 2 times, 2006-2008
A calculus-based introduction to statistical theory and concepts, assuming no previous experience. Topics included probability, distributions, generating functions, likelihood, hypothesis testing, and Bayesian methods, with application to categorical data, analysis of variance, and regression.

Professional Memberships

American Statistical Association

Papers

2018 publication dates

1. Characterization of canine coagulopathies using the turbidometric ACL-TOP 300 CTS analyzer. R Richardson, J Todd, L Sharkey, R Washabau, K Williams, K Little, A Rendahl. *Journal of Veterinary Emergency and Critical Care*, Epub 15 Oct 2018. doi:10.1111/vec.12775
2. Assessment of eosinophils in canine gastrointestinal inflammatory disease. I Bastan, A Rendahl, D Seelig, M Day, E Hall, S Rao, R Washabau, P Sriramarao. *Veterinary Internal Medicine*, Epub 7 Oct 2018. doi:10.1111/jvim.15310
3. Using a model board examination and a case study assessing clinical reasoning to evaluate curricular change. M Root Kustritz, A Rendahl, L Molgaard, E Malone. *Education in the Health Professions*, Epub 1 Oct 2018. doi:10.4103/BHPHEHP_2_18
4. The effects of zinc amino acid complex supplementation on the porcine host response to *Lawsonia intracellularis* infection. F Leite, E Vasquez, F Vannucci, C Gebhart, A Rendahl, J Torrinson, A Mueller, N Winkelman, Z Rambo, R Isaacson. *Veterinary Research*, Epub 10 Sep 2018. doi:10.1186/s13567-018-0581-3
5. Retrospective evaluation of canine palpebral masses treated with debulking and cryotherapy: 46 cases. A Zibura, M Henriksen, A Rendahl, C Lim, C Reilly. *Veterinary Ophthalmology*, Epub 27 July 2018. doi:10.1111/vop.12585
6. Modifying school meal entrées to improve child legume intake. M Reicks, A Rendahl, et. al. *Health Behavior and Policy Review*, 2018;5(4):22-29. doi:10.14485/HBPR.5.4.3
7. Performance characteristics of the turbidometric ACL-TOP CTS 300 coagulation analyzer in dogs and cats. L Sharkey, K Little, K Williams, J Todd, R Richardson, A Gwynn, A Rendahl. *Journal of Veterinary Emergency and Critical Care*, Epub 14 June 2018. doi:10.1111/vec.12727
8. Detection of influenza A virus in aerosols of vaccinated and non-vaccinated pigs in a warm environment. V Neira, M Allerson, C Corzo, M Culhane, A Rendahl, M Torremorell. *PLOS ONE*, Epub 21 May 2018. doi:10.1371/journal.pone.0197600

9. Identification of conserved, primary sequence motifs that direct retrovirus RNA fate. G Singh, B Rife, B Seufzer, M Salemi, A Rendahl, K Boris-Lawrie. *Nucleic Acids Research*, Epub 26 May 2018. doi:10.1093/nar/gky369
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11. Metabolic perturbations in Welsh Ponies with insulin dysregulation, obesity and laminitis. S Jacob, K Murray, A Rendahl, R Geor, N Schultz, M McCue. *Journal of Veterinary Internal Medicine*, Epub 23 Mar 2018. doi:10.1111/jvim.15095

2017 publication dates

12. Positive Impacts of a Vegetable Cooking Skills Program among Low Income Parents and Children. F Overcash, A Ritter, T Mann, E Mykerezi, J Redden, A Rendahl, Z Vickers, M Reicks. *Journal of Nutrition Education and Behavior*, Epub 12 Dec 2017. doi:10.1016/j.jneb.2017.10.016
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14. Subcutaneous administration of ciclosporin in 11 allergic cats – A pilot open-label uncontrolled clinical trial. S Koch, S Torres, S Diaz, S Gilbert, A Rendahl. *Veterinary Dermatology*, Epub 25 Oct 2017. doi:10.1111/vde.12505
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17. The basal translation rate of authentic HIV-1 RNA is regulated by 5'UTR nt-pairings at junction of R and U5. I Boeras, B Seufzer, S Brady A Rendahl, X Heng, K Boris-Lawrie. *Scientific Reports* 7:6902, Epub 31 Jul 2017. doi:10.1038/s41598-017-06883-9
18. Examining the feasibility of implementing behavioral economics strategies that encourage home dinner vegetable consumption among low-income children. T Leak, A Swenson, A Rendahl, Z Vickers, E Mykerezi, J Redden, T Mann, M Reicks. *Public Health Nutrition*, 2017 20:8, 1388–1392, Epub 15 Mar 2017. doi:10.1017/S1368980017000131
19. DNM1 mutation status, sex, and sterilization status of a cohort of Labrador retrievers with and without cranial cruciate ligament rupture. K Ekenstedt, K Minor, A Rendahl, M Conzemius. *Canine Genetics and Epidemiology*, 2017 4:2, Epub 2 Feb 2017. doi:10.1186/s40575-017-0041-9
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21. Serotypes and antimicrobial resistance in *Salmonella enterica* recovered from clinical samples from cattle and swine in Minnesota, 2006 to 2015. S Hong, A Rovira, P Davies, C Ahlstrom, P Muellner, A Rendahl, K Olsen, J Bender, S Wells, A Perez, J Alvarez. **PLOS ONE**, Epub 9 Dec 2016. doi:10.1371/journal.pone.0168016
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24. Identifying base temperature for alfalfa germination: Implications for frost seeding. J Jungers, M Brakker, A Rendahl, C Sheaffer. **Crop Science**, Epub 24 Jun 2016. doi:10.2135/cropsci2016.02.0109
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26. Serum Beta Hydroxybutyrate in cats with chronic kidney disease, hyperthyroidism, and hepatic lipidosis. L Gorman, LC Sharkey, PJ Armstrong, K Little, A Rendahl. **Journal of Veterinary Internal Medicine**, Epub 15 Jan 2016. doi:10.1111/jvim.13826
27. Proteome scale-protein turnover analysis using high resolution mass spectrometric data from stable-isotope labeled plants. K Fan, A Rendahl, W Chen, D Freund, W Gray, J Cohen, A Hegeman. **Journal of Proteome Research**, Epub 11 Jan 2016. doi:10.1021/acs.jproteome.5b00772
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2015 publication dates

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31. Blood and Cerebrospinal Fluid α -Tocopherol and Selenium Concentrations in Neonatal Foals with Neuroaxonal Dystrophy. Finno, C.J., Estell, K.E., Katzman, S., Winfield, L., Rendahl, A., Textor, J., Bannasch, D.L. and Puschner, B. **Journal of Veterinary Internal Medicine**. Epub 22 Sep 2015. doi:10.1111/jvim.13618
32. Estimation of actual and ideal bodyweight using morphometric measurements and owner guessed bodyweight of adult draft and warmblood horses. Devan Catalano, Robert J Coleman,

Marcia R Hathaway, Molly E McCue, Aaron K Rendahl. *Journal of Equine Veterinary Science*, 39:38–43. Epub 9 Sep 2015. doi:10.1016/j.jevs.2015.09.002

33. Testing the Effectiveness of In-Home Behavioral Economics Strategies to Increase Vegetable Intake, Liking, and Variety Among Children Residing in Households That Receive Food Assistance. Tashara M Leak, Alison Swenson, Zata Vickers, Traci Mann, Elton Mykerezzi, Joseph P Redden, Aaron Rendahl, Marla Reicks. *Journal of Nutrition Education and Behavior* March–April 2015; 47(2):e1–e9. Epub 6 Mar 2015. doi:10.1016/j.jneb.2014.12.006

2014 publication dates

34. Field evaluation of a quantitative polymerase chain reaction assay for *Mycoplasma hyorhinis*. Maria J. Clavijo, Simone Oliveira, Jeffrey Zimmerman, Aaron Rendahl, Albert Rovira. *Journal of Veterinary Diagnostic Investigation*, 2014 26: 755–760. Epub 15 Oct 2014. doi:10.1177/1040638714555175
35. Associations between eating occasion characteristics and age, gender, presence of children and BMI among U.S. adults. Marla Reicks, Dennis Degeneffe, Aaron Rendahl, et.al. *Journal of the American College of Nutrition*, 2014;33(4):315–27. Epub 20 Aug 2014. doi:10.1080/07315724.2014.887485
36. A longitudinal comparison of two salt reduction strategies: acceptability of a low sodium food depends on the consumer. Nuala Bobowski, Aaron Rendahl, Zata Vickers. *Food Quality & Preference*, Mar 2015; 40B:270–278. Epub 12 Aug 2014. doi:10.1016/j.foodqual.2014.07.019
37. Preference for salt in a food may be alterable without a low sodium diet. Nuala Bobowski, Aaron Rendahl, Zata Vickers. *Food Quality & Preference*, Jan 2015; 39:40–45. Epub 20 June 2014. doi:10.1016/j.foodqual.2014.06.005
38. Intra-farm risk factors for *Mycoplasma hyopneumoniae* colonization at weaning age. M Pieters, GS Cline, BJ Payne, C Prado, JR Ertl, AK Rendahl. *Veterinary Microbiology*, 27 Aug 2014;172(3-4):575-80. Epub 4 Jun 2014. doi:10.1016/j.vetmic.2014.05.027
39. Estimation of body weight and development of a body weight score for adult equids using morphometric measurements. KL Martinson, RC Coleman, AK Rendahl, Z Fang, ME McCue. *Journal of Animal Science*, May 2014;92(5):2230–38. Epub 18 Mar 2014. doi:10.2527/jas.2013-6689
40. Genetic risk factors for insidious equine recurrent uveitis in Appaloosa horses. KL Fritz, HJ Kaese, SJ Valberg, JA Hendrickson, AK Rendahl, RR Bellone, KM Dynes, ML Wagner, MA Lucio, FM Cuomo, CL Brinkmeyer-Langford, LC Skow, JR Mickelson, MS Rutherford, and ME McCue. *Animal Genetics*, 45:392–399. Epub 28 Jan 2014. doi:10.1111/age.12129
41. Platelet count and plateletcrit in Cavalier King Charles Spaniels and Greyhounds using the Advia 120/2120. Jessica Kelley, Leslie C Sharkey, Pete W Christopherson, Aaron Rendahl. *Veterinary Clinical Pathology*, Mar 2014;43(1):43–49. Epub 21 Jan 2014. doi:10.1111/vcp.12116

2013 publication dates

42. Metabolomics Reveals the Origins of Antimicrobial Plant Resins Collected by Honey Bees. Michael B. Wilson, Marla Spivak, Adrian D. Hegeman, Aaron Rendahl, Jerry D. Cohen. *PLoS ONE* 8(10): e77512. Epub 18 Oct 2013. doi:10.1371/journal.pone.0077512

43. Coat Color Genotypes and Risk and Severity of Melanoma in Gray Quarter Horses. RBC Teixeira, AK Rendahl, SM Anderson, JR Mickelson, D Sigler, BR Buchanan, RJ Coleman, ME McCue. *Journal of Veterinary Internal Medicine*, Sep/Oct 2014;27(5):1201-1208. Epub 22 Jul 2013. doi:10.1111/jvim.12133
44. Equine developmental orthopaedic diseases — a genome-wide association study of first phalanx plantar osteochondral fragments in Standardbred trotters. S Lykkjen, NI Dolvik, ME McCue, AK Rendahl, JR Mickelson, KH Røed. *Animal Genetics*, Epub 7 Jun 2013. doi:10.1111/age.12064
45. Genome-wide analysis reveals selection for important traits in domestic horse breeds. Jessica L Petersen, James R Mickelson, Aaron K Rendahl, Stephanie J Valberg, Molly E McCue, et al. *PLOS Genetics* 9(1), 17 Jan 2013. doi:10.1371/journal.pgen.1003211

2012 and previous publication dates

46. Genome-Wide Association Study Identifies Testis-Sperm Specific *FKBP6* as a Susceptibility Locus for Impaired Acrosome Reaction in Stallions. Raudsepp, T, McCue, ME, Das, PJ, Dobson, L, Vishnoi M, Fritz, KL, Schaefer, R, Rendahl, AK, Derr, JN, Love, CC, Varner, DD, Chowdhary, BP. *PLOS Genetics*, 20 Dec 2012. doi:10.1371/journal.pgen.1003139
47. Genetic mapping of recurrent exertional rhabdomyolysis in a population of North American Thoroughbreds. Fritz KL, McCue ME, Valberg SJ, Rendahl AK, Mickelson JR. *Animal Genetics*, 23 Mar 2012. doi:10.1111/j.1365-2052.2012.02351.x
48. Frequency of urinary tract infection in dogs with inflammatory skin disorders treated with ciclosporin alone or in combination with glucocorticoid therapy: A retrospective study. Andrea L. Peterson; Sheila M.F. Torres; Aaron Rendahl; Sandra N. Koch. *Veterinary Dermatology* 2012; 23(3):201-e43, 12 Mar 2012. doi:10.1111/j.1365-3164.2012.01044.x
49. Comparison of Student Self-Assessment with Faculty Assessment of Clinical Competence. Margaret V. Root Kustritz, Laura K. Molgaard, Aaron Rendahl. *Journal of Veterinary Medical Education*, Summer 2011, 38(2):163–170. doi:10.3138/jvme.38.2.163
50. Genome-wide association analysis of osteochondrosis of the tibotarsal joint in Norwegian Standardbred trotters. S. Lykkjen, N.I. Dolvik, M.E. McCue, A.K. Rendahl, J.R. Mickelson, K.H. Roed. *Animal Genetics*, December 2010, 41 Suppl 2: 111–120. doi:10.1111/j.1365-2052.2010.02117.x
51. Responses of Spring Wheat and Soybean to Subsurface Drainage in Northwest Minnesota. Wiersma, J.J., Sands, G.R., Kandel, H.J., Rendahl, A.K., Jin, C.X., Hansen, B.J. *Agronomy Journal*, September 2010, 102(5):1399–1406. doi:10.2134/agronj2010.0055
52. Comparative studies on bull and stallion seminal DNase activity and interaction with semen extender and spermatozoa. Abdorrahman S. Alghamdi, Bethany J. Funnell, Scott L. Bird, G. Cliff Lamb, Aaron K. Rendahl, Patrick C. Taube and Douglas N. Foster. *Animal Reproduction Science*, September 2010, 121(3–4):249–258. doi:10.1016/j.anireprosci.2010.06.003
53. Measuring the turnover rates of Arabidopsis proteins using deuterium oxide: an auxin signaling case study. Yang, X.-Y., Chen, W.-P., Rendahl, A.K., Hegeman, A.D., Gray, W.M. and Cohen, J.D. *The Plant Journal*, August 2010, 63(4):680–695. doi:10.1111/j.1365-313X.2010.04266.x

54. Species specific interaction of seminal plasma on sperm-neutrophil binding. Abdorrahman S. Alghamdi, Bethany J. Lovaas, Scott L. Bird, G. Cliff Lamb, Aaron K. Rendahl, Patrick C. Taube, Douglas N. Foster. *Animal Reproduction Science*, September 2009, 114(4):331–344.
doi:10.1016/j.anireprosci.2008.10.015
55. Experimental Support for *Multiple-Locus* Complementary Sex Determination in the Parasitoid *Cotesia vestalis*. Jetske G. de Boer, Paul J. Ode, Aaron K. Rendahl, Louise E.M. Vet, James B. Whitfield, & George E. Heimpel. *Genetics*, November 2008, 180(3):1525–1535.
doi:10.1534/genetics.107.083907

Additional Publications, Talks, and Posters

- Using the Common Language Effect Size in Sample Size Conversations. Aaron Rendahl. *The Statistical Consultant*, newsletter of the ASA Section on Statistical Consulting. Summer 2015, Vol. 31, No. 1. Available at <http://community.amstat.org/cnsl/documents/newsletters>.
- Stories and Lessons from a University Statistical Consulting Center. Aaron Rendahl. *Invited Talk, Twin Cities American Statistical Association Fall Conference*, 3 Oct 2016.
- Training and Evaluating New Student Consultants at a University Consulting Center. *Conference for Statistical Practice*. Feb 19–21, 2015, New Orleans, LA, Poster PS1(5).

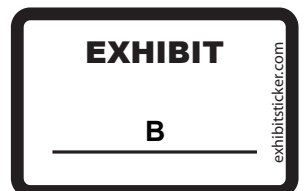
Advisees

Masters Students

Yi Liu, May 2018	Yuting Sun, August 2014
Yin-Ting Chou, May 2017	Nirui Kang, May 2014
Pu Ke, January 2016	Lian Hortensius, May 2014
Kedong Chen, November 2015	Lijun (Terence) Qin, February 2014
Menglin Cui, August 2015	Monica Patrin, December 2013
Lei Shi, August 2015	Yufeng Chang, October 2013
Logan Sullivan, May 2015	Jennifer Carolan, September 2013
Yu Wang, May 2015	Tianbi Men, June 2013
Chaitali Phadke, April 2015	Xiaoqian Zhao, May 2013
Yihan Yang, December 2014	Xinling Xu, May 2013
Xiao Zhong, October 2014	Ange Pang, December 2012
Yangfan Qin, September 2014	Zhou Fang, December 2012
Jieun Lee, September 2014	Yingliang Zheng, July 2012
Qi Shi, August 2014	Jing Yang, August 2011

DOCUMENTS REVIEWED

1. *USDA Handbook No. 696 – Effects of Electrical Voltage/Current on Farm Animals*;
2. Deposition of Lewis G. Sheffield, PhD, Vols. I-III, taken between March 14, 2014 and May 30, 2014 in *Paul Halderson, et al. v. Star Blends, LLC, et al.*, Trempealeau County Circuit Court Case No. 12-CV-74;
3. Marked exhibits nos. 249-301 to the deposition of Lewis G. Sheffield, PhD, Vols. I-III, taken between March 14, 2014 and May 30, 2014 in *Paul Halderson, et al. v. Star Blends, LLC, et al.*, Trempealeau County Circuit Court Case No. 12-CV-74;
4. Expert witness disclosure of Frank Martin, PhD dated March 7, 2014 in *Norman v. Crow Wing Cooperative Power & Light Company*, Cass County District Court Case No. 11-CV-12-1670, which includes the following reports of Dr. Martin:
 - a) June 15, 2007;
 - b) July 10, 2007;
 - c) October 27, 2007;
 - d) September 4, 2008;
 - e) A Re-Analysis of the University of Wisconsin 1mA Cow Exposure Data;
5. Transcript of the October 10, 2014 trial testimony of Frank Martin, PhD in *Norman v. Crow Wing Cooperative Power & Light Company*, Cass County District Court Case No. 11-CV-12-1670;
6. Trial exhibits marked nos. 132-184 in *Norman v. Crow Wing Cooperative Power & Light Company*, Cass County District Court Case No. 11-CV-12-1670;
7. January 2016 letter by Christopher Chase, DVM, PhD, to Doug Busselman of the Minnesota Farm Bureau;
8. Spreadsheet developed by Christopher Chase, DVM, PhD analyzing research performed by Lewis Sheffield at the University of Wisconsin-Madison;
9. Stray voltage research papers as listed on the attached index.



Stray Voltage Research Paper Index

Date	Author(s)	Title	Publication Infor.
1946_00_00	Samuels, M.M.	Specific Engineering Problems in Rural Electrification and Electroagriculture	AIEE Trans. 65:1065-1073, 1182-1184
1948_01_00	Churchward, R.E.	A Note on the Occurrence of Electric Shocks from Milking Machines and Their Possible Effect on Development of Mastitis	Aust. Vet. J. 24:150
1950_00_00	Buchanan, W.B.	Electrical Hazards to Farm Stock	AIEE Trans.
1950_00_00	Waghorne, J.H.	Rural Neutral Potentials	AIEE Trans. 69:660-663
1950_00_00	Schirmer, A.H.	Protective Grounding of Electrical Installations on Customer's Premises	AIEE Trans. 69:657-659
1950_00_00	Dalziel, Charles Mansfield, Thomas	Effect of Frequency on Perception Currents	AIEE Trans. 69:1162-1168
1955_01_21	Hammond, E. Robson, T.D.	Comparison of Electrical Properties of Various Cements and Concretes	The Engineer 199:78-80
1958_10_00	AIEE Committee Report	Voltage Gradients Through the Ground Under Fault Conditions	
1960_00_00	Armstrong, H.R. Simpkin, L.J.	Grounding Electrode Potential Gradients from Model Tests	AIEE Trans.
1961_00_00	Kinyon, A.L.	Earth Resistivity Measurements for Grounding Grids	AIEE Trans. PAS-80:795-800
1962_00_00	Phillips, D.S.M.	Production of Cows May Be Affected by Small Electrical Shocks from Milking Plants	N.Z.J. Agric. 105:221
1963_00_00	Phillips, D.S.M. Parkinson, R.D.J.	The Effects of Small Voltages on Milking Plants: Their Detection and Elimination	Dairy Farming Annu. pp. 79-90
1967_00_00	Salisbury, R.M. Williams, F.M.	The Effect on Herd Production of "Free" Electricity on Milking Plant	N.Z.J. 15:206-210
1968_00_00	Overmier, J.D.	Differential Pavlovian Fear Conditioning as a Function of the Qualitative Nature of the UCS: Constant vs Pulsating Shock	Cond. Reflex. 3:175
1968_05_00	Monfore, G.E.	The Electrical Resistivity of Concrete	J. Portland Cem. Assoc. Res. and Dev. Lab. 10:35-48
1969_00_00	Phillips, D.S.M.	Production Losses from Milking Plant Voltage	N.Z.J. Agric. 119(2):45-47
1969_11_00	Phillips, D.S.M.	Motorised Gates and Electric Pumps Can Put Voltage on Milking Machines	N.Z.J. Agric. 119(5):46-47
1969_12_00	Craine, Lloyd Ehlers, Melvin Nelson, D.K.	Effects of Distribution System Ground Voltages Appearing on Domestic Water Systems	ASAE Paper No. 69-814
1970_07_00	Craine, Lloyd Ehlers, Melvin Nelson, D.K.	Electric Potentials and Domestic Water Supplies	Agricultural Engineering 51:415-417
1971_00_00	Fink, D.G. Beaty, H.W.	Standard Handbook for Electrical Engineers - excerpts	McGraw Hill
1971_00_00	Woolford, M.W.	Recording Transient Voltage Pulses in Milking Plants	N.Z.J. Agric. Res. 14:248-251
1972_00_00	Woolford, M.W.	Small Voltage in Milking Plants	In Proceedings of the 2d Seminar on Farm Machinery and Equipment, Publication 645 pp. 41-47
1975_00_00	Craine, Lloyd	Effects on Mammals of Grounded Neutral Voltages from Distribution Power Lines	Rural Electrification Council Conference; IEEE Paper No. 75-303-3-IA
1975_00_00	Whittlestone, W.G. Mullord, M.M. Kilgour, R. Cate, L.R.	Electric Shocks During Machine Milking	N.Z. Vet. J. 23:105-108
1977_09_25	Fairbank, W.C.	Stray Electrical Currents Can Cut Production	Hoard's Dairyman 122:1093
1978_05_00	Kaune, William Phillips, Richard Hjeresen, Dennis Richardson, Richard Beamer, James	A Method for the Exposure of Miniature Swine to Vertical 60 Hz Electric Fields	IEEE Trans. Bio. Eng. BME-25:276-283
1978_05_00	Williams, G.F.	Stray Currents Reduce Production	Dairy Herd Management 15:34-37
1978_07_10	Jarrett, J.A.	Cows Wouldn't Let Down Milk; They Has Mastitis	Hoard's Dairyman 123:828-829
1979_00_00	Heppe, Robert	Step Potentials and Body Currents Near Grounds In Two-Layer Earth	IEEE Trans. On Power Appar. Sys. PAS-98:45-59
1979_00_00	Stetson, L.E. Beccard, A.D. DeShaser, J.A.	Stray Voltages in a Swine Farrowing Unit - A Case Study	ASAE Paper No. 79-3502
1980_00_00	Appleman, Robert Cloud, Harold	How to determine if you have a stray voltage problem	Hoard's Dairyman 125:748-749, 754-755
1980_00_00	Cloud, H.A. Appleman, R.D. Gustafson, R.J.	Stray Voltage Problems with Dairy Cows	N. Central Reg. Publ. 125, University of Minnesota
1980_00_00	McClermon, Patrick Gustafson, Robert Cloud, Harold	A Neutral-to-Earth Demonstration Unit	ASAE Paper No. 80-3566
1980_00_00	Gustafson, R.J. Drache, D.B. Cloud, H.A.	Neutral-to-Earth Voltages in Dairy Facilities - 2 Case Studies	ASAE Paper No. NCR 80-305

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Date	Author(s)	Title	Publication Infor.
1980_00_00	Jones, G.M.	The Impact of Stray Electrical Voltage on Dairy Herds	Northeast Reg. Agric. Eng. Ser. NRAES-12
1980_00_00	Lillmars, Luke Surbrook, Truman	Stray Voltage Problems and Solutions in Michigan	ASAE Paper No. 80-3504
1980_00_00	Lillmars, Luke Surbrook, Truman	Procedures for Investigating Stray Voltage Problems on Farms	ASAE Paper No. 80-3004
1980_00_00	Szelich, Jr., W.J. Maddox, T.E.	Neutral Potentials and Currents	ASAE Paper No. 80-3503
1980_00_00	Paulson, C.	The Invisible Irritant	Butterfat Mag. 58:28-31
1980_00_00	Seeling, R.S.	Stray Voltage on the Dairy Farm	Rural Electric Power Conference, IEEE Paper No. 80CH1532-1-IA-C3
1980_00_00	Stetson, L.E. Soderholm, L.H. Shull, H.	Investigations of Stray Voltages	ASAE Paper No. 80-3505
1980_00_00	Szelich, Jr., W.J.	Ground Potentials and Currents	Rural Electrification Council Conference, IEEE Paper No. 80CH1532-1-1
1980_01_00	Britten, Allan	Insulate Your Cows From Stray Voltage	Dairy Herd Management 17:67-70
1980_05_10	Jarrett, J.A.	From 6 to 8 Volts Were Passing Through Herringbone Stalls	Hoard's Dairyman 125:722
1980_12_00	Craine, Lloyd	Nationwide Occurrences of Electrical Neutral-to-Earth Voltages on Dairy Farms	ASAE Paper No. 80-3502
1981_00_00	Cloud, H.A. Appleman, R.D.	What Next If You Suspect Stray Voltage	Dairy Herd Management 18:54-58
1981_00_00	Gustafson, R.J. Cloud, H.A.	Circuit Analysis of Stray Voltage Sources and Solutions	ASAE Paper No. 81-3511
1981_00_00	Lillmars, Luke	How to Wire to Reduce Stray Voltage Problems	Hoard's Dairyman 125:531-533
1981_00_00	McCurdy, Joseph	Stray Voltages on Dairy Farms Experiences and Solutions	ASAE Paper No. NAR81-116
1981_00_00	Rakes, J.M. Kurz, R.F. Blocker, C.	Stray Voltage Measurements in Arkansas Dairy Barns	Arkansas Farm Res. - Arkansas Agric. Exp. Sta. 30(4):12
1981_00_00	Sanders, D.E. Sanders, J.A. Sanenario, J.	Low Milk Production Associated with Transient Environmental Voltage	J. Am. Vet. Med. Assoc. 179:69
1981_00_00	Stetson, L.E. Beccard, A.D. DeShaser, J.A.	Stray Voltages in a Swine Farrowing Unit - A Case Study	Trans. ASAE 24:1062-1064
1981_00_00	Surbrook, T.C. Reese, N.D.	Stray Voltage on Farms	Michigan State University Cooperative Extension Service; ASAE Paper No. 81-3512
1981_00_00	Zdrojewski, J. Davidson, J.N.	A Review of the Problems Associated with Stray Voltage in Dairy Herds	Bovine Pract. 16:54-57
1981_03_00	Bodman, Gerald Stetson, LaVerne Shull, Hollis Benes, Harvey	Extraneous Voltages Incidence in Nebraska Milking Centers	ASAE Paper No. MCR-81-502
1981_05_00	Widmer, S.	Stray Voltage from Off-Farm Source	Dairy Herd Management 18:48-52
1981_09_10	Ewers, T.H.	How One Stray Voltage Problem Was Solved	Hoard's Dairyman 126:1178
1981_09_18	Keller, Steven Weiss, Jay Schleifer, Steven Miller, Neil Stein, Marvin	Suppression of Immunity by Stress: Effect of a Graded Series of Stressors on Lymphocyte Stimulation in the Rat	Science 213:1397-1400
1981_12_00	Bodman, Gerald Stetson, LaVerne Shull, Hollis	Investigations of Extraneous Voltages in Nebraska Dairies	ASAE Paper No. 81-3510
1982_00_00	Anderson, P.M. McCurdy, J.A. Fairchild, J.W.	Dairy Farm Stray Voltage Traced to Various Causes	
1982_00_00	Cloud, Harold Gustafson, Robert	Diagnostic and Mitigation Procedures for Stray Voltage Problems	Rural Electrification Council Conference; IEEE Paper No. CH1733-5/82/0000-0009
1982_00_00	Craine, Lloyd	Liability for Neutral-to-Earth Voltage on Farms	ASAE Paper No. 82-3510
1982_00_00	Gustafson, Robert Cloud, Harold	Circuit Analysis of Stray Voltage Sources and Solutions	Trans. ASAE 25:1418-1424
1982_00_00	Gustafson, Robert Cloud, Harold Albertson, Vernon McDonald, Daniel	Stray Voltage Source Identification Procedure	ASAE Paper No. NCR 82-111
1982_00_00	Gustafson, Robert Cloud, Harold Appleman, Robert	Understanding and Dealing with Stray Voltage Problems	Bovine Pract. 17:4-15

Stray Voltage Research Paper Index

Date	Author(s)	Title	Publication Infor.
1982_00_00	Henke, D.V. Gorewit, R.C. Scott, N.R. Skyer, D.M.	Sensitivity of Cows to Transient Electrical Current	ASAE Paper No. 82-3029
1982_00_00	Kirk, John Reese, Norman	The Stray Voltage Problem with Dairy Cows	Comp. Cont. Ed. Pract. Vet. 4:S499-S506
1982_00_00	Lefcourt, Alan	Behavioral Responses of Dairy Cows Subjected to Controlled Voltages	J. Dairy Sci. 65:672-674
1982_00_00	Lefcourt, A.M. Akers, R.M.	Endocrine Responses of Cows Subjected to Controlled Voltages During Milking	J. Dairy Sci. 65:2125-2130
1982_00_00	Norell, R.J. Gustafson, R.J. Appleman, R.D.	Behavioral Studies of Dairy Cattle Sensitivity to Electrical Currents	ASAE Paper No. 82-3530
1982_00_00	Obst, J.	Tracking Down the Shocking Truth	Minn. Sci. 37:11-13
1982_00_00	Schweer, R. Hofflinger, B. Hosticka, B.J. Kleine, U.	Novel Stray-Insensitive Voltage Inverter Switches	AEU: Arch. Fuer Electron Und Uebertragungstech 36:270-274
1982_00_00	Soderholm, L.H.	Stray Voltage Problems in Dairy Milking Parlors	Trans. ASAE 25:1763-1767, 1774
1982_00_00	Stetson, LaVerne Bodman, Gerald Shull, Hollis	Digital Voltmeter for Checking Connections in Neutral Conductors	ASAE Paper No. 82-3506
1982_00_00	Surbrook, T.C. Reese, N.D. Jensen, C.J.	Grounding Electrode to Earth Resistance and Earth Voltage Gradient Measurements	ASAE Paper No. 82-3507
1982_01_00	Britt, Jenks	Stray Voltage Caused His Mastitis Problem	Dairy Herd Management 19:54
1982_05_25	Hammond, Cecil	Stray Voltage Can Have Many Causes	Hoard's Dairyman 127:741-746
1982_07_00	Gustafson, R.J. Albertson, V.D.	Neutral-to-Earth Voltage and Ground Current Effects in Livestock Facilities	IEEE Trans. Power Appar. Sys. PAS-10:2090-2095
1982_12_00	Arnholz, D.J. Wisker, J.E.	Indiana Farm Electrification Council Neutral-to-Earth Voltage Seminars	ASAE Paper No. 82-3509
1983_00_00	Gustafson, Robert	Stray Voltage: Detection and Diagnostic Procedures Guide for Rural Electric Systems	Energy Research and Development Division, National Rural Electric Cooperative Association
1983_00_00	Gustafson, Robert Christiansen, Grant Appleman, Robert	Electrical Resistance of Milking System Components	Trans. ASAE 26:1218-1221
1983_00_00	Hill, F.	Stray Voltage Could Have Wiped Us Out	Wis. Agric. 110:12
1983_00_00	Jaglinski, S.	Mastitis Caused by Stray Voltage	Wis. Agric. 110:20
1983_00_00	National Rural Electrical Cooperative Association	Summary Proceedings of Stray Voltage Workshop, August 1983, Minneapolis, MN	National Rural Electrical Cooperative Association
1983_00_00	Norell, R.J. Gustafson, R.J. Appleman, R.D. Overmier, J.B.	Behavioral Studies of Dairy Cattle Sensitivity to Electrical Currents	Trans. ASAE 26:1506-1511
1983_00_00	Shull, Hollis Stetson, LaVerne Bodman, Gerald	An Analog Model of Neutral-to-Earth Voltages in a Single Distribution System	IEEE Electric Rural Power Conference, Paper No. C1,1-17
1983_00_00	Stray Voltage Technical Committee	"Stray Voltage" Problems Suggested Procedures for the Electrician	Wisconsin Farm Electric Council
1983_00_00	Winter, D.F. Dick, W.K.	A Method for Compensating Neutral-to-Earth Potentials in Dairy Facilities	Proceedings of the National Conference on Agricultural Electronics Applications; ASAE Paper No. 9-84
1983_03_25	Gustafson, Robert	Here's One Way to Solve Stray Voltage Problems	Hoard's Dairyman 128:380, 397
1983_05_10	Gustafson, Robert	How to Prevent Stray Voltage in New Milking Parlors	Hoard's Dairyman 128:670-671
1983_06_25	Jarrett, J.A.	Faulty Light Wire Was Shocking Cows	Hoard's Dairyman 128:824
1983_08_00	Gorewit, R.C. Appleman, R.B. Henke Drenkard, D. Gustafson, R.J. Kirk, J. Lefcourt, A.M. Majerus, O. Norell, R.J. Pollard, K. Scott, N.R. Spencer, S.B. Steevens, B.J.	Effects of Stray Voltages on Animals	Workshop - August 10-11, 1983, Minneapolis, MN
1983_09_25	Spencer, S.B.	Does Stray Voltage Really Cause Mastitis	Hoard's Dairyman 128:1165
1984_00_00	Folen, D.A. Gustafson, R.A.	Transition Designs for Equipotential Planes	National Stray Voltage Symposium, Oct. 10-12, 1984; ASAE Pub. 3-85

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Date	Author(s)	Title	Publication Infor.
1984_00_00	Gustafson, Robert Cloud, Harold Albertson, Vernon	Circuit Analysis of Stray Voltage Interrupt and Offset Devices	ASAE Paper No. 84-3004
1984_00_00	Gustafson, Robert Appleman, Robert Brennan, Thomas	Electrical Current Sensitivity of Swine for Drinking	ASAE Paper No. 85-3504
1984_00_00	Hertz, C.M. Hall, J.P. Winsett, I.L.	Using Saturating Reactors to Mitigate Stray Voltage Problems	ASAE Paper No. 84-3505
1984_00_00	Kirk, J.H.	Possible Causes of Stray Voltage-Like Signs in Dairy Cows	National Stray Voltage Symposium, Oct. 10-12, 1984; ASAE Pub. 3-85
1984_00_00	Lefcourt, A.M. Akers, R.M.	Small Increases in Peripheral Noradrenaline Inhibit the Milk-Ejection Response by Means of a Peripheral Mechanism	J. Endocr. 100:337-344
1984_00_00	Lefcourt, A.M.	Physiological Stress Responses to Electrical Shock	National Stray Voltage Symposium, Oct. 10-12, 1984; ASAE Pub. 3-85
1984_00_00	Reese, Norman Surbrook, Truman Kehrl, Angela	Effects of Primary and Secondary Distribution System Interactions on Farm Stray Voltage Levels	ASAE Paper No. 84-3506
1984_00_00	Surbrook, T.C. Reese, N.D. Kehrl, A.M.	Stray Voltage: Sources and Solutions	Rural Electric Power Conference, IEEE Paper No. 84CH1969-5 B5
1984_00_00	Thomas, Edward Monroe, Philip	Computer Analysis of Neutral-to-Earth Potentials on Rural Systems	Rural Electrification Council Conference, IEEE Paper No. 84CH1969-5-C3
1984_00_00	Winter, D.F. Dick, W.K.	Field Experience with the Electronic Grounding System for Stray Voltage Reduction	ASAE Paper No. 84-3503
1984_08_15	Kirk, John Reese, Norman Bartlett, Paul	Stray Voltage on Michigan Dairy Farms	J. Am. Vet. Med. Assoc. 185:426-428
1984_10_00	Appleman, R.D. Gustafson, R.J.	Behavioral Experiments Quantifying Animal Sensitivity to AC and DC Currents	ASAE Pub. 3-85; National Stray Voltage Symposium, Oct. 10-12, 1984
1984_10_00	Gorewit, R.C. Henke Drenkard, D.V. Scott, N.R.	Physiological Effects of Electrical Current on Dairy Cows	National Stray Voltage Symposium, Oct. 10-12, 1984; ASAE Pub. 3-85
1984_10_12	Scott, N.R. Gorewit, R.C. Henke, D.V.	Effects of Electrical Current on Milking and Behavior	National Stray Voltage Symposium, Oct. 10-12, 1984; ASAE Pub. 3-85
1984_12_00	Buschermohle, M.J. Bunn, J.M. Spray, R.A.	Extraneous Voltage Levels on South Carolina Dairy Farms	ASAE Paper No. 84-3501
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1985_00_00	Appleman, R.D. Gustafson, R.J.	Source of Stray Voltage and Effect on Cow Health and Performance	J. Dairy Sci. 68:1554-1567
1985_00_00	Behrends, J.	Stray Voltage Update	Dairy Herd Management 22:67-68
1985_00_00	Gorewit, R.C. Scott, N.R. Czarniecki, C.S.	Responses of Dairy Cows to Alternating Electrical Current Administered Semirandomly in a Nonavoidance Environment	J. Dairy Sci, 68:718-725
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1985_00_00	Gustafson, R.J.	Instrumentation for Stray Voltage	National Stray Voltage Symposium, Oct. 10-12, 1984; ASAE Pub. 3-85
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1985_00_00	Gustafson, R.J. Cloud, H.A.	Modeling the Primary Distribution System	National Stray Voltage Symposium, Oct. 10-12, 1984; ASAE Pub. 3-85
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1985_00_00	Henke Drenkard, D.V. Gorewit, R.C. Scott, N.R. Sagi, R.	Milk, Production, Health, Behavior, and Endocrine Responses of Cows Exposed to Electrical Current During Milking	J. Dairy Sci. 68:2694-2702

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1985_00_00	Peterson, Richard	Stray Voltage Research: Past, Present, Future	ASAE Paper No. 85-3506
1985_00_00	Reese, N.D. Surbrook, T.C.	Modeling Primary and Secondary Electrical Systems	National Stray Voltage Symposium, Oct. 10-12, 1984; ASAE Pub. 3-85
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1985_00_00	Reese, N.D. Surbrook, T.C.	Voltage Gradient Control in Animal Areas	National Stray Voltage Symposium, Oct. 10-12, 1984; ASAE Pub. 3-85
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1985_00_00	Stetson, L.E. Bodman, G.R.	Analog Model and Flow Chart for Analyzing and Correcting Extraneous Voltages	ASAE Paper No. 85-3502
1985_00_00	Surbrook, T.C.	Stray Voltage Sources and Identification Procedures	National Stray Voltage Symposium, Oct. 10-12, 1984; ASAE Pub. 3-85
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1985_00_00	Thornton, Edwin Cernohorsky, Vic	Stray Voltage in Farm Buildings	Alberta Agriculture Engineering
1985_07_00	Wilcox, G.C. Jordan, H.C.	Stray Voltage May Cause Loss in Cage Layer Operations	Poultry Digest 44:288-290
1986_00_00	Bauman, B.	Changes in Farm Wiring Design Criteria According to the 1987 National Electric Code	ASAE Paper No. 86-3022
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1986_00_00	Gustafson, Robert Cloud, Harold	Stray Voltage: Guide to Equipotential Plane Installation	Energy Research and Development Division, National Rural Electric Cooperative Association
1986_00_00	Kammel, David Brooks, Lynndon Jones, Bret Hau, Roger	Design Criteria for Equipotential Planes	ASAE Paper No. 86-3021
1986_00_00	Lefcourt, A.M.	Usage of the Term "Stress" as it Applies to Cattle	Flemish Vet. J. 55:259-265
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1986_04_00	Southwick, Lee	Stray Voltage Update	Bovine Pract. 18:86-89
1986_09_00	Brennan, Thomas Gustafson, Robert	Behavioral Study of Dairy Cow Sensitivity to Short AC Currents	ASAE Paper No. NCR-86-202
1987_00_00	Aneshansley, D.J. Gorewit, R.C. Ludington, D.C. Pellerin, R.A. Xin, Z.	Effects of Neutral-to-Earth Voltage on Behavior, Production and Water Intake in Dairy Cattle	ASAE Paper No. 87-3034
1987_00_00	Appleman, Robert Gustafson, Robert Brennan, Thomas	Production Record Analysis of Dairy Herd Response to Neutral Isolation	ASAE Paper No. 87-3039
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1987_00_00	Currence, H. David Steevens, B.J. Winter, D.F. Dick, W.K. Krause, G.F.	Dairy Cow and Human Sensitivity to 60 Hertz Currents	ASAE Paper No. 87-3036
1987_00_00	Dick, W.K. Winter, D.F.	Computation Measurement and Mitigation of Neutral-to-Earth Potentials on Electrical Distribution Systems	IEEE Trans. Power Deliv. PWRD-2:564-571

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1987_00_00	Kammel, David Jones, Bret	Analysis of Equipotential Plane Installations	ASAE Paper No. 87-3037
1987_00_00	Ludington, D.C. Pellerin, R.A. Aneshansley, D.J. Gorewit, R.C.	Transmission of Neutral/Earth Current in Dairy Barns	ASAE Paper No. 87-3032
1987_00_00	Stetson, L.E. Bodman, G.R.	Grounding Resistance and Ground Currents in Dairy Facilities	ASAE Paper No. 87-3033
1987_00_00	Surbrook, Truman Reese, Norman Althouse, Jonathan	Parameters Affecting Neutral-to-Earth Voltage Along Primary Distribution Circuits	Rural Electric Power Conference, IEEE Paper No. CH2426-5-C6
1987_00_00	Surbrook, Truman Reese, Norman Althouse, Jonathan	Training Power Supplier Personnel to Find New Sources	ASAE Paper No. 87-3549
1987_00_00	Undrill, J.M. Clayton, R.E.	Distribution Line Performance with Imperfect Grounding	IEEE Trans. 24:805-811
1987_07_00	Appleman, R.D. Gustafson, R.J. Brennan, T.M. Cloud, H.A.	Effect of Neutral Isolation on Milk Production and Herd Health	Univ. of Minn. Dairy Update No. 80
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1987_12_00	Goodrich, Phillip Gustafson, Robert Kalkar, Santosh	The Stray Voltage Adviser	ASAE Paper No. 87-5539
1988_00_00	Gustafson, Robert Sun, Zhongyi Brennan, Thomas	Dairy Cow Sensitivity to Short Duration Electrical Currents	ASAE Paper No. 88-3522
1988_00_00	Prothero, J.N. Lukecart, B.W. DeNardo, C.M.	Primary Neutral-to-Earth Voltage Levels as Impacted by Various Wiring System Treatments	ASAE Paper No. 88-3528
1988_00_00	Reese, Norman Surbrook, Truman Li, Changming	Defining Circuit Parameters in the Animal Neutral-to-Earth Voltage Path	ASAE Paper No. 88-3525
1988_00_00	Skiles, James Nourani, Vahid	Minimizing the Effect of Motor Starting on Neutral-to-Earth Voltage Levels	ASAE Paper No. 88-3529
1988_00_00	Surbrook, Truman Althouse, Jonathan Reese, Norman	Stray Voltage Diagnostic Procedures	ASAE Paper No. 88-3520
1988_00_00	Surbrook, Truman Reese, Norman Althouse, Jonathan	Designing Secondary Electrical Systems to Minimize Neutral-to-Earth Voltage	ASAE Paper No. 88-3526
1988_00_00	Surbrook, Truman Reese, Norman Althouse, Jonathan Li, Changming	Designing Primary Distribution Systems to Minimize Neutral-to-Earth Voltage	ASAE Paper No. 88-3527
1988_01_00	Aneshansley, D.J. Gorewit, R.C. Ludington, D.C. Price, L.R. Pellerin, R.A.	Stray Voltage: Effects on Machine Milking	NRAES-26; In Proceedings of Milking Systems and Milking Management Symposium
1988_01_10	Bodman, G.R. Stetson, L.E.	Farm Voltage Problems Often Involve Grounding	Hoard's Dairyman 133:15-20
1988_04_00	Bahls, Jane	Stray Voltage: Is Suing Worth It	Dairy Herd Management
1988_12_00	Aneshansley, D.J. Gorewit, R.C. Price, L.R. Czarnecki, C.S.	Effects of Discontinuous Voltages Applied to Waterers	ASAE Paper No. 88-3523 An ASAE Meeting Presentation
1988_12_00	Gorewit, R.C. Aneshansley, D.J. Ludington, D.C. Pellerin, R.A.	Delays in Drinking Due to AC Voltages	ASAE Paper No. 88-3524 An ASAE Meeting Presentation
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1989_00_00	Halvorson, David Noll, Sally Bergeland, Martin Cloud, Harold Pursley, Richard	The Effects of Stray Voltage on Turkey Poults	Avian Diseases 33:582-585
1989_00_00	Kirk, J.H.	Stray Voltage and Dairy Cows	Agri. Practice 10:8-10
1989_00_00	Southwick, Lee English, Paul Sears, Philip	Association Between Neutral-to-Earth and Cow Contact Voltage on New York Dairy Farms	J. Dairy Sci. 72:2417-2420
1989_08_00	Gorewit, R.C. Aneshansley, D.J. Ludington, D.C. Pellerin, R.A. Zhao, X.	AC Voltages on Water Bowls: Effects on Lactating Holsteins	J. Dairy Sci. 72:2184-2192
1989_08_10	Public Service Commission of Wisconsin	Finding of Fact, Conclusion of Law and Amended Order 05-EI-106	Public Service Commission of Wisconsin
1990_00_00	Hultgren, J.	Small Electric Currents Affecting Farm Animals and Man: A Review with Special Reference to Stray Voltage I. Electric Properties of the Body and the Problem of Stray Voltage	Vet. Res. Comm. 14:287-298
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1990_00_00	Currence, H.D. Steevens, B.J. Winter, D.F. Dick, W.K. Krause, G.F.	Dairy Cow and Human Sensitivity to Short Duration 60 Hertz Currents	App. Eng. Ag. 6:349-353
1990_07_23	Public Service Commission of Wisconsin	Supplemental Findings of Fact and Order 05-EI-106	Public Service Commission of Wisconsin
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1990_12_00	Gorewit, R.C. Aneshansley, D.J. Price, L.R. Czarniecki, C.S.	Cow Sensitivity to Currents During Milk Ejection	ASAE Paper No. 90-3505 An ASAE Meeting Presentation
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1990_12_00	Aneshansley, D.J. Gorewit, R.C. Price, L.R. Czarniecki, C.S.	Milk Production with Voltage Exposure During Entire Lactation	ASAE Paper No. 90-3502 An ASAE Meeting Presentation
1990_12_00	Hendrickson, S.R. Harvey, T.J. Kammel, D.W. Bringe, A.N.	Occurrence of Neutral-to-Earth (N-E) Voltage in the Cow Contact Area and its Relationship to Milk Production on Randomly Selected Wisconsin Dairy Farms: Field Survey	ASAE Paper No. 903507 An ASAE Meeting Presentation
1991_00_00	Robert, S. Matte, J.J. Bertin-Mahieux, J. Martineau, G.-P.	Effects of Continuous Stray Voltage on Health, Growth and Welfare of Fattening Pigs	Can. J. Vet. Res. 1991; 55:371-376
1991_11_00	Coleman, William Durfee, George Eckhardt, Gary Gust, Larry Larson, Douglas Michaud, Michael	MN Planning - Stray Voltage - Report and Recommendations of the Stray Voltage Work Group to the Minnesota Environmental Quality Board	
1992_00_00	Gorewit, R.C. Aneshansley, D.J. Price, L.R.	Effects of Voltages on Cows over a Complete Lactation. 1. Milk Yield and Composition	J. Dairy Sci. 75:2719-2725

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1992_00_00	Gorewit, R.C. Aneshansley, D.J. Price, L.R.	Cow Sensitivity to Electricity During Milking	J. Dairy Sci. 75:2733-2741
1992_08_00	Gumprich, P.	Stray Voltage Effects on Dairy Cattle	New Liskeard College of Agricultural Technology
1992_08_01	Southwick, L.H. Wilson, D.J. Sears, P.M.	Milk production, water consumption, and somatic cell count responses of cows subject to one to two volts of alternating current	JAVMA, Vol. 201, No. 3 August 1, 1992
1994_03_28	Gustafson, R.J.	Letter to Minnesota Public Services Commission RE: Response to Docket No. E-999/R-92-245 by Mr. Gerald R. Bodman as Consultant to MN Dept. of Public Service	
1994_09_00	Hartsell, D. Dahlberg, D. Lusty, D. Scott, R.	The Effects of Ground Currents on Dairy Cows: A Case Study	The Bovine Practitioner - No. 28, September 1994
1994_12_00	Reinemann, D.J. Stetson, L. Laughlin, N.	Effects of Frequency and Duration on the Sensitivity of Dairy Cows to Transient Voltages	ASAE Paper No. 943597 An ASAE Meeting Presentation
1994_12_00	Cook, Mark Dasho, Daniel Reines, Richard Dick, William Reinemann, Douglas Ryder, John Winter, David	Effects of Source Resistance on Cow Contact Voltage Measurements	ASAE Paper No. 943601 An ASAE Meeting Presentation
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1997_00_04	Reinemann, Douglas Stetson, LaVerne Dasho, Daniel Cook, Mark	Stray Voltage Update 97	Conference Paper - Presented at the 1997 Rural Electric Power Conference, Minneapolis, Minnesota 20-22 April, 1997
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1997_08_00	Gorewit, R.C. Aneshansley, D.J.	Effects of Steady State Voltages on Holstein Cows with Histories of Subclinical Mastitis	ASAE Paper No. 97-3110 An ASAE Meeting Presentation
1998_07_31	Staehle, Roger Anderson, Larry Dziuk, Harold Hird, David Liboff, Abraham Polk, Charles Richardson, Jimmie Stetson, LaVerne Hoben, Patricia Hendrickson, Riley Furo, Alex	Final Report of the Science Advisors to the Minnesota Public Utilities Commission: Research Findings and Recommendations Regarding Claims of Possible Effects of Currents in the Earth on Dairy Cow Health and Milk Production	Minnesota Public Utilities Commission
1999_00_00	Reinemann, D.J. Stetson, L.E. Reilly, J.P. Laughlin, N.K.	Dairy Cow Sensitivity to Short Duration Electrical Currents	Trans. ASAE 42:215-222
1999_06_00	Reinemann, Douglas Rasmussen, Morten Wiltbank, Milo Sheffield, Lewis LeMire, Steven	Dairy Cow Response to Electrical Environment Final Report, Part I. Comparison of Behavioral to Physiological Responses and Part II. Comparison of Treatments Applied During Milking	Minnesota Public Utilities Commission

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1999_07_00	Aneshansley, D.J. Gorewit, R.C.	Sensitivity of Holsteins to 60 Hz and Other Waveforms Present on Dairy Farms	ASAE Paper No. 993152 An ASAE Meeting Presentation
2000_03_17	Minnesota Department of Commerce	Before the Minnesota Public Utilities Commission, Comments of the Minnesota Department of Commerce	Minnesota Department of Commerce
2001_00_00	Polk, C.	Cows, Ground Surface Potentials and Earth Resistivity	Bioelectromagnetics 22:7-18
2002_00_00	Reinemann, D.J. Rasmussen, M.D. LeMire, S.D.	Milking Performance of Dairy Cows Subjected to Electrical Current and Induced Milking Machine Problems	Trans. ASAE 45(3):833-838
2003_00_00	Hillman, Donald Stetzer, Dave Graham, Martin Goeke, Charles Mathson, Kurt VanHorn, Harold Wilcox, Charles	Relationship of Electric Power Quality to Milk Production of Dairy Herds	ASAE Paper No. 033116 An ASAE Meeting Presentation
2003_00_00	Reinemann, D.J. Wiltbank, M.C. Rasmussen, M.D. Sheffield, L.G. LeMire, S.D.	Comparison of Behavioral to Physiological Response of Cows Exposed to Electric Shock	Trans. ASAE 46(2): 507-512
2003_03_28	Reinemann, Douglas	What Do We Know About Stray Voltage	
2003_04_00	Reinemann, Douglas	Dairy Cow Response to the Electrical Environment: A Summary of Research Conducted at the University of Wisconsin-Madison	"Stray Voltage and Dairy Farms" A Conference for Farm Advisors, Educators, Utilities, and Public Policy Advisors
2003_07_00	Hillman, Donald Stetzer, Dave Graham, Martin Goeke, Charles Mathson, Kurt VanHorn, Harold Wilcox, Charles	Relationship of Electric Power Quality to Milk Production of Dairy Herds	CSAE/SCGR Paper No. 03-505
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2005_00_00	Reinemann, D.J. Stetson, L.E. Laughlin, N.K. LeMire, S.D.	Water, Feed, and Milk Production Response of Dairy Cattle Exposed to Transient Currents	Trans. ASAE 48(1):385-392
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