

Second Supplemental Report of Frank Martin - 10-27-07

I have reviewed additional data received from the University of Wisconsin at Madison. Documents reviewed were on a CD-ROM entitled "UW-Madison, D. Reinemann, Stray Voltage Data Request". Included among the items are (1) data underlying table two in "Dairy Cow Response to Electrical Environment, Final Report, Part III", submitted to the Minnesota Public Utilities Commission (MPUC); (2) a draft report entitled "Impact of Low AC Currents on Immune Function of Dairy Cattle" by Lewis G. Sheffield, undated¹, purporting to interpret data gathered and methodology approved by CALS IACUC; (3) letter dated 3-8-00 from Reinemann to Dean Aberle; (4) recommendations of the Rural Energy Management Council (REMC) dated 6-27-00 to the University of Wisconsin Research Community.

I previously reviewed a document entitled Dairy Cow Response to the Electrical Environment: A Summary of Research Conducted at the University of Wisconsin-Madison, at pages 72-83 from Stray Voltage and Dairy Farms, NRAES-149 Cooperative Extension, a presentation given in conjunction with a Conference for Farm Advisors, Educators, Utilities, and Public Policy Advisors on April 9-11, 2003 in Camp Hill, Pennsylvania. On page 77 of that document it is asserted that: "Although possible effects on IL 1, IL 2, and IgA concentrations were observed, these effects were not large enough to suggest major alterations in immune function by electric currents." I then analyzed the data underlying item (1) obtained by subpoena from the University of Wisconsin-Madison on August 17, 2007 with a purpose of investigating the basis for commentary by Professor Reinemann.

Examination of Table 2 and the above mentioned data shows that the statistical

testing was incorrect and neglected to account for replication effects. A correct analysis of the data which includes replication effects shows that there were statistically significant effects (P less than 0.05) caused by the 1 mA exposure on chemiluminescence, staph aureus, IL 1 serum (increase), and IL 2 serum (decrease). The statement in the report to the MPUC that “possible” effects were observed were strengthened and confirmed by my analysis. These effects were indeed observed.

In the Sheffield study listed as item (2) above, these same effects were again observed as statistically significant, corroborating the conclusion that 1 mA has been demonstrated to show an effect on IL 1 (increase) and IL 2 (decrease). Dr. Sheffield indicates that the disease processes arising from these changes “are likely to be modest, probably more long term and likely to be very difficult to detect in small samples.” This means that large, long term field studies are best suited to observing current effects on dairy cows. The few field studies and case studies that have been done also suggest improvements in herd health coincidental with improvement in current/voltage exposure.

In item (3) above, Professor Reinemann suggests at page 1 that it is “high priority” to conduct further research on actual dairy farms:

The Council concurs that this research should be conducted on an on-farm setting. Additional research in this area is likely to be restricted by available sample size, funding limitations, time constraints, and the inherent multi-variant nature of the problem. As such, we consider this a high risk but potentially high value research area.

REMC concurred that such research was indicated and necessary. Item (4) above. No such on-farm research has been conducted at the University of Wisconsin, and nothing regarding stray voltage has been performed since the unpublished report done by Dr. Sheffield as noted above.

¹ The stored document data indicates that the document was last modified on 7-26-04 at 9:50 p.m.

I also re-evaluated the chart at page 3-22 in the Red Book, upon which I have previously commented, seeking the basis for that chart in the bibliography of articles cited. That chart appears in the exact same form in “Summary of USDA Handbook on Stray Voltage/Current”, A.M. Lefcourt, ASAE paper number 90-3501. It appears in no other publication that I have seen preceding the publication of the Red Book. This publication preceded publication of the Red Book in 1991. Reference is made to 500 ohms being a “very conservative estimate of worst case impedance”, that being defined as no contact or source resistance and placing the cow resistance at 500 ohms. The only data quoted by Lefcourt is from Appelman and Gustafson (reference no. 10 in my original report) from 1985. The data in Appelman and Gustafson do not support the conclusion that cow resistance is 500 ohms. It is unclear how that data was analyzed to reach the conclusion drawn. At page 7, it appears some effort was made to establish a mean cow resistance. The density function of cow resistance is skewed to the upper tail, so that the mean of the density is substantially greater than the median of the density. As such, about 60% of the population would have a resistance below the mean. Targeting 500 ohms as the resistance to determine the voltage needed to produce harmful levels of current is therefore fundamentally flawed. I therefore re-confirm my statement that the use of the graph to determine dangerous voltage/current levels has no basis.