Cubitt & Cubitt

Attorneys at Law

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July 6, 2015

Department of Licensing and
Regulatory Affairs
Public Service Commission
7109 W. Saginaw Highway
PO Box 30221
Lansing, MI 48909

RECEIVED
JUL 08 2015
EXECUTIVE SECRETARY

U-17897

Attention: Robert W. Kehres, Director

Dear Mr. Kehres:

Since we did not apply for a contested hearing but rather an investigation, I do not believe that the Court Rule you cited applies. However, for the sake of getting something started, I have removed what you have requested.

For you to say that Exhibit D is something that does not exist raises very serious questions. I do not believe anyone could have made up that dialog and I truly believe that the sealed court session actually occurred and was buried in your archives. Irregardless, what is stated in Exhibit D is a good summary of the utility's attitude in protecting their turf.

I trust that you will follow through with the rule and appoint the appropriate experts and carry out the investigation.

Your cooperation is expected and will be appreciated.

Very truly yours,
CUBITT & CUBITT

H Dale Cubitt

BY: H. Dale Cubitt

HDC/cah
Enc.
pc David S. York, Esq.
Tyren R. Cudney, Esq.

MICHIGAN PUBLIC SERVICE COMMISSION

PO Box 30221
Lansing, Michigan 48909
57-241-6180

IN RE: JOHN G. SZYMANSKI, SR. and
CAROL A. SZYMANSKI, his wife
1375 Argyle
Snover, MI 48472

REQUEST FOR INVESTIGATION PURSUANT TO R460.2704 AND FOR APPOINTMENT OF EXPERT PURSUANT TO R460.2705

This matter is brought before the MPSC on behalf of John G. Szymanski, Sr. and Carol A. Szymanski, his wife, of 1375 Argyle Road, Snover, Michigan 48472, by their attorneys, Cubitt & Cubitt, 186 E. Huron Avenue, Bad Axe, Michigan 48413.

Background

The Szymanski Dairy Farm has suffered for years from neutral to earth voltage, more commonly known as "stray voltage" from Thumb Electric Cooperative, its sole electrical supplier. The Szymanski Dairy herd has suffered tremendously as a result and over the course of time have been poor producers of milk and dairy cows regularly die or have to be shipped as cull cows because of damage sustained by "stray voltage" making them unfit for dairy production.

A suit was previously filed and brought to trial in 2009 during which the utility's insurance company spent more than $300,000.00 on experts from all over the Country alleging things like the Szymanskis were using "used cows"; were feeding moldy feed because said feed was found thrown off from their regular feed pile because it was moldy; and they had a junky

storage room and for other reasons. The jury, despite finding that Thumb Electric Cooperative was negligent, they failed to give damages to Szymanskis.

The utility's Manager at that time, Mike Krause, knew that he had escaped luckily and vowed to make amends to the Szymanskis by making substantial modifications of the system. Thumb Electric Cooperative did so by trimming or cutting down multiple trees interfering with lines; by replacing entirely the line traveling in front of the Szymanski Farm adding numerous additional poles all with down grounds; moving the transformer poles from near the barn to out on the road and other significant improvements intended to alleviate the situation. However, it did not do so and the Szymanski dairy herd, farm and occupants continued to suffer damages.

Because of sanctions from losing the lawsuit, which sanctions amounted to $219,000.00, Szymanskis had to file Chapter 12 Bankruptcy and did so on April 23, 2010. Since then, they have received permission from Bankruptcy Court to file a lawsuit based on new tests and such a lawsuit was filed on or about April 30, 2013, which lawsuit can be found in the attached Appendix as Exhibit A.

Subsequently, a Motion for Summary Disposition was filed by Thumb Electric Cooperative and a visiting Judge in Sanilac County granted said Motion stating the Court did not have jurisdiction and Plaintiffs had not exhausted their administrative remedies. Both of these issues were incorrect for reasons that you can see in Exhibit B attached to the Appendix.

The matter was appealed to the Court of Appeals and the Court of Appeals rescued the visiting Circuit Judge with their Opinion interpreting the visiting Judge to have meant to defer the Court's jurisdiction under the Primary Jurisdiction Doctrine to the Michigan Public Service Commission. See said Opinion in the attached Appendix as Exhibit C.

Contrary to valid scientific research and prevailing scientific opinions, the Michigan Public Service Commission adopted a protocol to evaluate utility contribution to animal contact current in 2006 which is believed to have been signed in 2007. This protocol ignored valid scientific research and prevailing Supreme Court Opinions.

Plaintiffs have had expert investigations on their farm in 2011, 2012, and 2013 showing substantial damage being contributed to their animals and their farm all of which was ignored by Thumb Electric Cooperative. See Exhibit E which consists of investigative reports for Dr. Donald Hillman and Exhibit F, an investigative report with a fairly strong lecture by expert David Stetzer.

Several states including Wisconsin, Idaho and Minnesota (see Exhibit G in the attached Appendix) have ruled that the Public Service Commission Rules in existence in those states do not cover the actual facts on a dairy farm suffered from "stray voltage". Therefore, the rule does not apply and dairymen are entitled to file lawsuits and be heard in a local Circuit Court, frequently resulting in substantial damages awarded against the local utility.

That will ultimately happen here if the Michigan Public Service Commission does not correct its protocol which is based on junk science according to David Stetzer. It is the Szymanski's position that the MPSC Stray Voltage Protocol is based on Junk Science purposely designed to aid utilities and is Fraudulent.

Request for Investigation and Appointment of Experts

Pursuant to R400.2704 and R400.2705, Szymanskis request that the Michigan Public Service Commission appoint three to five experts to examine the documents provided and the Szymanski farm, if necessary, and file an investigative report with the Commission.

Szymanskis reserve their right to request a contested hearing based on the investigative report herein requested.

Dated: July 6, 2015

CUBITT & CUBITT

Attorneys for John and Carol Szymanski

/s/ Dale Cubitt

BY: H. Dale Cubitt P12374
186 E. Huron Avenue
Bad Axe, MI 48413
989 269 9903

APPENDIX

Exhibit A: Complaint filed on April 30, 2013.

Exhibit B: Issues I and II in Motion for Summary Disposition

Exhibit C: Opinion of Michigan Court of Appeals

Exhibit E: Reports of Dr. Hillman

Exhibit F: Report of David Stetzer

Exhibit G: Wisconsin, Idaho and Minnesota Cases

EXHIBIT A

Approved, SCAO

Original - Court
1st copy - Defendant
2nd copy - Plaintiff
3rd copy - Return

STATE OF MICHIGAN JUDICIAL DISTRICT 24th JUDICIAL CIRCUIT COUNTY PROBATE	SUMMONS AND COMPLAINT	CASE NO. 13 - 35107 CK

Court address: County Building, Sandusky, MI 48471

Court telephone no.: (810) 648-3212

Plaintiff's name(s), address(es), and telephone no(s).	v	Defendant's name(s), address(es), and telephone no(s).
JOHN SZYMANSKI and CAROL SZYMANSKI Argyle Road Argyle Twp., Michigan		THUMB ELECYRIC COOPERATIVE, 2231 Main Street UBLY MI 48475
Plaintiff's attorney, bar no., address, and telephone no. H. Dale Cubitt P12374 Cubitt & Cubitt 186 E. Huron Avenue Bad Axe, MI 48413 989 269 9903		

SUMMONS **NOTICE TO THE DEFENDANT:** In the name of the people of the State of Michigan you are notified:

1. You are being sued.
2. **YOU HAVE 21 DAYS** after receiving this summons to **file a written answer with the court** and serve a copy on the other party **or take other lawful action with the court** (28 days if you were served by mail or you were served outside this state). (MCR2.111[C])
3. If you do not answer or take other action within the time allowed, judgment may be entered against you for the relief demanded in the complaint.

Issued	This summons expires*	Court clerk
April 30, 2013	July 30, 2013	Lynda L. Kelley

*This summons is invalid unless served on or before its expiration date.

This document must be sealed by the seal of the court.

COMPLAINT ***Instruction: The following is information that is required to be in the caption of every complaint and is to be completed by the plaintiff. Actual allegations and the claim for relief must be stated on additional complaint pages and attached to this form.***

Family Division Cases

☐ There is no other pending or resolved action within the jurisdiction of the family division of circuit court involving the family or family members of the parties.

☐ An action within the jurisdiction of the family division of the circuit court involving the family or family members of the parties has been previously filed in _____ Court.

The action ☐ remains ☐ is no longer pending. The docket number and the judge assigned to the action are:

Docket no.	Judge	Bar no.

General Civil Cases

☑ There is no other pending or resolved civil action arising out of the same transaction or occurrence as alleged in the complaint.

☐ A civil action between these parties or other parties arising out of the transaction or occurrence alleged in the complaint has been previously filed in _____ Court.

The action ☐ remains ☐ is no longer pending. The docket number and the judge assigned to the action are:

Docket no.	Judge	Bar no.

VENUE

Plaintiff(s) residence (include city, township, or village)	Defendant(s) residence (include city, township, or village)
Argyle Twp, Sanilac County, Michigan	Huron County, Michigan
Place where action arose or business conducted Sanilac County, Michigan	

04/30/2013
Date

H. Dale Cubitt
Signature of attorney/plaintiff

If you require special accommodations to use the court because of a disability or if you require a foreign language interpreter to help you fully participate in court proceedings, please contact the court immediately to make arrangements.

STATE OF MICHIGAN

IN THE CIRCUIT COURT FOR THE COUNTY OF SANILAC

JOHN SZYMANSKI and
CAROL SZYMANSKI,
Husband and Wife,
Plaintiffs

Vs. File No. 13

THUMB ELECTRIC COOPERATIVE
Defendant

---/

Attorneys for Plaintiffs
CUBITT & CUBITT
BY: E. Duane Cubitt P12373
186 E. Huron Avenue
Bad Axe, MI 48413
989 269 9903

---/

COMPLAINT

NOW COME the Plaintiffs by their attorneys, Cubitt & Cubitt, and for their Complaint say:

1. That the Plaintiffs, John Szymanski and Carol Szymanski, are dairy farmers and reside in Argyle Township, Sanilac County, Michigan.

2. That the Plaintiffs operate a dairy farm with all of its components and receive electricity with their sole provider being Thumb Electric Cooperative, a corporation in the State of Michigan, which provides electricity primarily in rural areas in the Thumb of Michigan including Sanilac County.

3. That the amount in controversy exceeds $25,000.00 giving this Court jurisdiction.

Preliminary Information

4. That in the later 1930's or early 1940's Defendant constructed an electrical system in the Thumb of Michigan including Argyle Township, Sanilac County, Michigan, which was suitable for the time.

5. That Defendant obtained easements to put in their system including the south side of Argyle Road including poles and wires placed along the frontage of Section 13 of Argyle Township where Plaintiffs' farm is located.

6. That Defendant contracted with the owners of the Szymanski Farm which is now Plaintiffs' dairy farm to provide electricity to Plaintiffs' home and dairy farm operation; that said contract expressly or impliedly includes providing electricity in a safe and efficient manner such as not to cause harm to individuals or to animals on said farm.

7. That said system as originally built was obsolete by today's standards and it was not designed to handle today's technological loads.

8. That Defendant in recognition of its system's obsolescence in 2005 and 2006 attempted to make modifications by putting in a whole new distribution system 1 ½ miles from Plaintiffs' farm on Frieberger Road extended to Defendant's substation at the corner of Urban and Frieberger Roads; that they did not at that time make any changes from Frieberger Road eastward on Argyle Road.

9. That the initial system built by Defendant was designed for as much as 70% of the electricity being returned to the substation through the ground. In making a new system, it should have been designed to reduce or eliminate the ground component of the field by making the neutral conductor the lowest possible impedance path and making the ground the highest possible impedance path. In addition, a new system should have provided for filtering or isolating harmonic distortions and eliminating electromagnetic fields. In April and May of 2007 Defendant was fixing poles, insulators, transformers and other items up and down Argyle Road as part of its Frieberger Road Project.

10. That the new system has and allows for harmonic distortions in the electrical service and has an undersized neutral conductor which cannot properly handle loads allowing electricity to return to the substation on Urban Road through the neutral conductor but rather still allows for a substantial amount of the electricity to travel back to the Urban substation through the ground.

11. That a lawsuit was filed in 2007 resulting in a verdict in 2009 that Defendant was negligent but which did not provide any damages to Plaintiffs, resulting in damages being assessed to Plaintiffs of a very substantial sum in the form of sanctions.

12. That when the lawsuit was finally concluded, Defendant in 2010 took action to try to eliminate "stray voltage" it knew was there by trimming the trees that were arcing on their electrical services in the area; by installing numerous new poles along Argyle Road; by moving the service pole on the Szymanski Farm out to the road; by greatly enlarging the transformer to Plaintiffs' dairy operation; by replacing the wire on Argyle Road to eliminate the numerous connectors found in the previously installed wire; and by placing down grounds on every pole along Argyle Road.

13. That following all of the modifications made above, Defendant did nothing to test and see what changes took place resulting from all of their modifications.

14. That Plaintiffs' problems were supposedly fixed by May or June of 2007 constituting a new contract period with express and implied safe, "clean" electricity to be supplied to Plaintiffs. This contract period was further renewed by actions taken by Defendant in 2010 up and down Argyle Road. By the summer of 2010 it was clear Defendant had further breached its contract requiring Plaintiff to try some self-help.

15. That essentially nothing has changed on the quality of electricity supplied to Plaintiffs' dairy farm despite the new distribution system on Frieberger Road and the above modifications along Argyle Road which are connected to the system on Frieberger Road.

16. That Plaintiffs' dairy operation has and has had high quality dairy cows which should be producing on the average of 80 to 90 pounds per cow per day which are fed a proper and balanced nutritional diet but Plaintiffs' dairy animals have never been able to reach their potential and in fact have suffered and continue to suffer problems associated with "stray voltage" which are well known in the industry.

Count I
Breach of Contract

17. Plaintiffs reallege and reaffirm each and every allegation contained in paragraphs 1 through 16.

18. That Defendant has breached its contract with Plaintiffs to supply electricity that is safe and efficient and not harmful to humans or animals located on Plaintiffs' dairy farm.

19. That by using a Trifield Meter, Model # 100XE, under or near the lines in front of Plaintiffs' home, the needle goes right off the chart showing that there is a magnetic field far in excess of what is safe for human tolerance or animal tolerance.

20. That by using a Fluke Volt Meter, Plaintiffs from time to time show "stray voltage" in their water tank; "stray voltage" in their parlor; "stray voltage" in the floors of their barn; "stray voltage" on the bulk tank and even more significantly, when they measure the stop sign at the corner of Sheldon and Argyle Roads which is a half mile from their farm, frequently get 2 ½ to 3 or more volts on the Fluke Volt Meter from the stop sign which is not connected to any electrical source of any kind except what is flowing through the ground back to the Urban station from Defendant's lines.

21. That when testing the stop sign one mile south of the above mentioned stop sign, which is entirely in the DTE Energy system, Mr. Szymanski would get no readings; that the same is true under the lines on Sheldon Road where Plaintiffs' son lives, one-quarter mile south of Argyle Road, where measurements under the DTE Energy lines on the Trifield Meter are near zero.

22. That when testing the radiation levels in Plaintiffs' house with a Stetzerizer Micro Surge Meter made by Graham/Stetzer, the readings are substantially more than 100 frequencies per second and likewise in the barn have been as high as 350 and it is well known that a reading of more than 50 is undesirable.

23. That despite having genetically capable dairy cattle fed with proper feed, it is impossible for Plaintiffs' dairy farm to produce 80 to 90 pounds of milk per day with their dairy herd and frequently they are in the 50 pound average, which makes it impossible to pay all of the bills and payments required to be made in Plaintiffs' Chapter 12 Plan which Plaintiffs were forced into by Defendant's breach of contract.

24. That Defendant's breach of contract has cost Plaintiffs in excess of $3,000,000.00.

25. That by following proper engineering practices in accordance with published documents by the Electrical Power Research Institute and the Institute of Electronic Engineers, the system can be repaired by increasing the size of the neutral conductor on Frieberger Road and the repair might also require a larger neutral conductor along Argyle Road. Additional solutions include the following:

- Increased neutral conductor rating
- Double neutral conductor
- Neutral conductor with each phase conductor
- Zig zag transformer on the load side of the affected neutral conductor
- Parallel connected third harmonic filter on the load side of the affected neutral conductor
- Series filter to block third harmonic currents in the neutral

26. That in the event Defendant is unwilling to repair its system to a proper standard, it should be required to pay Plaintiffs for continuing damages until solutions have been enacted.

WHEREFORE, Plaintiffs pray that this Court order Defendant to repair using proper standards, its systems or to provide continuous damages until such corrections are made and, in addition, to pay current damages to Plaintiffs in the sum of in excess of $3,000,000.00, together with interest to day of payment, court costs and attorneys fees.

COUNT II
Violation of Constitutional and Civil Rights

27. Plaintiffs reallege and reaffirm each and every allegation contained in paragraphs 1 through 26.

28. That Plaintiffs under the United States and Michigan Constitutions and in accordance with the Civil Rights laws, have the right to pursue an occupation to support their family and to be free from wrongful interference with the rights of the pursuit of happiness and to be treated honestly and fairly in the business world without false and deceptive practices being perpetrated upon them. Defendant claims it is providing a safe and friendly product in the form of electricity

when in fact it is "dirty" and dangerous and it alleges that Plaintiffs are just poor farmers with poor management practices, when in fact it is a miserably poor product being supplied to Plaintiffs' farm recklessly and unconscionably.

29. That despite having good quality cows being properly cared for with proper nutrition, Plaintiffs' cows' production suffers from being in an electrical field at all times; that many of Plaintiffs' dairy herd die or have to be shipped early and Plaintiffs' cows can never conform to or live up to their potential.

30. That part of the violation perpetuated on Plaintiffs is the cruelty to their animals and the inhumane treatment to their animals which also results in inhumane treatment to Plaintiffs and their family members in being in an electrical field that is "dirty", unhealthy and life threatening.

31. That the activities on Plaintiffs' dairy farm are quite constant in the manner in which they operate, including the milking of the dairy cows, the feeding of the dairy cows and the handling of milk, while Plaintiffs' electrical bills vary tremendously from month to month and have been as high as $3,000.00 and as low as zero with every other figure in between with no explanation by Defendant.

32. That for a long period of time Plaintiffs have suffered in both their barn and their house the strange dimming of lights; constant burning out of light bulbs requiring frequent replacement; damage to Plaintiffs' electrical equipment; and such aberrations in their electrical service which are totally unexplainable service.

33. That Defendant puts out a monthly magazine which always has an ad in it that Thumb Electric Cooperative can fix when notified any neutral to earth electrical problems. These have never been repaired on the Szymanski farm and it is impossible for such problems to be repaired as the system is obsolete. Where modifications have been made, they have not been done up to proper standards and still create problems whether other farmers know or not; and, accordingly, such advertisement is false advertisement.

34. That Defendant in furtherance of its violation of Plaintiffs' rights, failed to have trained personnel to properly construct their system and to make any repairs in regards to "stray voltage" if such repairs were even possible.

35. That Defendant has discriminated against Plaintiffs by failure to fix problems when requested to do so and in most recent times, failed to even show up or call when complaints were made.

36. That failure to have or use properly trained personnel in designing and constructing a system that is ab initio obsolete regarding a completely too small and inadequate neutral conductor among other things is a further violation of Plaintiffs' rights.

37. That in furtherance of the violation of Plaintiffs' rights, Defendant bullies its customers and in particular, Plaintiffs, through their personnel coming and using non-definitive testing methods and declaring that everything is okay on Plaintiffs' farm.

38. That Defendant exercises terrorism in violation of Plaintiffs' rights by threatening to disconnect their service because Plaintiffs' tried some self-help which did help some by cutting ground wire and extending down ground electrical on the ground down a ditch some considerable length away from Plaintiffs' dairy buildings.

WHEREFORE, Plaintiffs pray that this Court order Defendant to repair using proper standards, its systems or to provide continuous damages until such corrections are made and, in addition, to pay current damages to Plaintiffs in the sum of in excess of $3,000,000.00, together with interest to day of payment, court costs and attorneys fees.

Count III
"Stray Voltage" Affects Animals, Constantly Causing Problems and Preventing Ordinary Milk Production

39. Plaintiffs reallege and reaffirm each and every allegation contained in paragraphs 1 through 38.

40. That Defendant used as an excuse that the Plaintiffs were still receiving "stray voltage" by saying Plaintiffs were not hooked up to their new system, despite the fact that they cause continuous, adverse effects.

41. That Plaintiffs were required to spend more than $4,000.00 which they did not have in order to change their hook up to the system, which new connection made no change in the electricity from Defendant's system constantly bombarding their cows and causing problems.

42. That Plaintiffs have had testing done on numerous occasions in 2011 and 2012 and have always discovered electricity on their farm that is not supposed to be there, which adversely affects their cows.

43. That Defendant has been supplied with much of this testing and ignores it or, on one occasion came and did testing with the wrong equipment improperly adjusted and claimed there was nothing there.

44. That from time to time there is a current in the cows' drinking water tank which causes them only to lap the water instead of drinking it, resulting in them getting insufficient water to make proper production.

45. That as a result of electricity flowing through Plaintiffs' barns and property, they have experienced excessive deaths and poor reproduction, acting up of cows in the parlor, having to cull cows much earlier than should occur, and have experienced poor production to the extent that where his cows should be producing 80 pounds to 90 pounds of milk per day, they have been fortunate if they stay above 50 pounds per day.

including pressure in the ears and tightness in the chest, gastrointestinal problems including belching, and other reactions not normally present in a clean environment.

53. That Plaintiffs' children while living at home suffered greatly from irritability and nose bleeds and their son, Johnny, who works full time on the farm although he does not live on the farm, still suffers extensive nose bleeds.

54. That Plaintiffs' health is seriously damaged from Defendant's breach of contract and failure to provide safe, clean electricity to their home and their farm and they have suffered health problems and will continue to suffer health problems for the remainder of their life.

WHEREFORE, Plaintiffs pray that this Court order Defendant to repair using proper standards, its systems or to provide continuous damages until such corrections are made and, in addition, to pay health damages to Plaintiffs in the sum of in excess of $4,000,000.00, together with interest to day of payment, court costs and attorneys fees.

Count V
"Stray Voltage" has Reduced the Value of Plaintiffs' Real Estate and the Value of Their Dairy Herd

55. Plaintiffs reallege and reaffirm each and every allegation contained in paragraphs 1 through 54.

56. That because Plaintiffs' farm on Argyle Road has suffered with "stray voltage" for many years and especially continuously since Defendant attempted to rectify the problem with a new system on Frieberger Road and other activities on Argyle Road thereafter and by demanding a new connection to their system to the dairy farm, Plaintiffs' farm is well known to have "stray voltage" problems which adversely affect Plaintiffs' dairy herd resulting in substantial damages to said dairy herd, the labeling of Plaintiffs' cows as unsalable as dairy cows and labeling Plaintiffs' dairy farm as unsalable as a dairy farm.

57. That at the time of an appraisal of the dairy farm for bankruptcy purposes, the appraiser was unaware of and was not advised of the environmental condition regarding electricity on the Plaintiffs' farm and, accordingly, did not reduce the value based on existing facts.

58. That the Honorable Daniel Opperman, United States Bankruptcy Judge in Bay City has made a temporary determination of the value of Plaintiffs' farm as of the date of filing the bankruptcy but has specifically ordered that Sanilac County Circuit Court can review the situation and further reduce the value of the farm for the bankruptcy purposes. See Exhibit A.

59. That since no one would buy Plaintiffs' dairy cow herd for dairy farm purposes, they are at all times limited in value to beef prices.

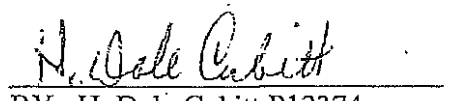
60. That likewise Plaintiffs' dairy farm cannot be sold as a dairy farm and it is likely that Plaintiffs' home could not be sold at all because of the "dirty" electricity and EMF being supplied by Defendant.

WHEREFORE, Plaintiffs pray that this Court order Defendant to repair using proper standards, its systems or to provide continuous damages until such corrections are made and, in addition, to pay current damages to Plaintiffs in the sum of in excess of $3,000,000.00, together with interest to day of payment, court costs and attorneys fees.

PLAINIFFS FURTHER PRAY that this Court will determine that because of environmental conditions existing at the time of an appraisal which was used for Bankruptcy purposes, the environmental contamination reduced the value of the farm as appraised by more than $83,728.00.

Dated: April 30, 2013

CUBITT & CUBITT
Attorneys for Plaintiffs



BY: H. Dale Cubitt P12374
186 E. Huron Avenue
Bad Axe, MI 48413
989 269 9903

UNITED STATES BANKRUPTCY COURT
EASTERN DISTRICT OF MICHIGAN
NORTHERN DIVISION

IN RE: JOHN G. SZYMANSKI, SR. &
CAROL A. SZYMANSKI,

CASE NO. 10 22054 dob
(Jointly Administered)
CHAPTER 12
HON. DANIEL S. OPPERMAN

/

ORDER DENYING DEBTORS' OBJECTION TO THUMB ELECTRIC COOPERATIVE'S SECURED CLAIM AND ALLOWING THUMB ELECTRIC COOPERATIVE'S SECURED CLAIM IN THE AMOUNT OF $83,728.00, AND THAT ANY FURTHER DETERMINIATION AS TO REDUCTION OF ITS CLAIM IS TO BE DETERMINED BY THE SANILAC COUNTY CIRCUIT COURT

WHEREAS, Thumb Electric Cooperative (TEC) filed a secured claim, and

WHEREAS, Debtors filed an objection to the claim, and,

WHEREAS, the Debtors and TEC agreed that there were legal issues that needed to be addressed and decided by the Court regarding TEC's claim and Debtors' objection, and

WHEREAS, the Court was prepared to render its decision on the issues raised on February 10, 2012, however, the parties waived any notice requirements which allowed the Court to render its opinion from the Bench on February 9, 2012.

THEREFORE, for the reasons stated on the record on February 9, 2012, it is hereby Ordered as follows:

1. Debtors' objection to Thumb Electric Cooperative's secured claim is denied, further,

2. Thumb Electric Cooperative's secured claim is allowed in the amount of $83,728.00, and further,

Exhibit A

3. Any further determination as to a reduction in the amount of the secured claim is to be made by the Sanilac County Circuit Court.

Signed on February 13, 2012

/s/ Daniel S. Opperman
Daniel S. Opperman
United States Bankruptcy Judge

STATE OF MICHIGAN

IN THE CIRCUIT COURT FOR THE COUNTY OF SANILAC

JOHN SZYMANSKI and
CAROL SZYMANSKI,
Husband and Wife,
Plaintiffs

Vs. File No. 13 35107 CK

THUMB ELECTRIC COOPERATIVE
Defendant

----------/

Attorneys for Plaintiffs
CUBITT & CUBITT
BY: E. Duane Cubitt P12373
186 E. Huron Avenue
Bad Axe, MI 48413
989 269 9903

----------/

ACKNOWLEDGMENT OF SERVICE

I ACKNOWLEDGE that I have received and accept service of the summons and complaint filed in the within cause for and on behalf of Thumb Electric Cooperative.

Dated: May ___ 2013

LENNON, MILLER, O'CONNOR
& BARTOSIEWICZ

Attorneys for Defendant

BY: _____
David S. York P22631
151 S. Rose Street, Ste. 900
Kalamazoo MI 49007

EXHIBIT B

ISSUE I

DOES THE CIRCUIT COURT HAVE JURISDICTION BASED ON THE FACTS OF THIS CASE?

It is clear under Michigan Law that at the very least the Circuit Court has concurrent jurisdiction.

In *Rinaldo's Constr Corp v Michigan Bell Telephone Co.,* 454 Mich 65 (1997) at page 474, the Court states:

> ....The circuit court has not been ousted of its original jurisdiction under Art. 6 § 13 of the Michigan Constitution by the regulatory legislation. [FN12]
>
> **FN12**. Article 6, § 13 provides in pertinent part:
>
> The circuit court shall have original jurisdiction in all matters not prohibited by law; appellate jurisdiction from all inferior courts and tribunals except as otherwise provided by law.....
>
> ....In other words, the Legislature has broadly defined the power and jurisdiction of the MPSC over such matters, without explicitly providing that this power and jurisdiction is exclusive. [FN13]
>
> **FN13**. As observed by Professor LeDuc, "the statute did not grant the agency sole jurisdiction...." (reference omitted)

In *Stark Steel v Mich Con 165 Mich App* 332 (1987) the Court cites *Valentine v Michigan Bell Telephone Company* 388 Mich 19 1972, and finds as follows:

> From our reading of *Valentine,* we discern the following principles applicable when a utility customer asserts a claim that is arguably subject to the PSC's statutory jurisdiction set forth in MCL 460.6; MSA 22.13(6):
>
> (1) If the claim challenges the prospective application of a tariff, code, or regulation promulgated by the PSC, then jurisdiction is properly in the PSC. *Valentine, supra,* pp 26, 30.
> (2) If the claim alleges a clear violation of a tariff or code, the validity of which is assumed, then jurisdiction is in a court of general jurisdiction. The tariff or code forms part of the contract between the parties, and the breach of such contract may be heard in the circuit court. *Id.,* 25-26, 30.
> (3) If the claim "covers some action by the utility outside of the regulations of the Public Service Commission," *id.,* 25, then jurisdiction is in a court of general jurisdiction.

(4) If the claim sounds in tort and not in contract, then jurisdiction is properly in a court of general jurisdiction. *Id.*, 26, 30.

In regards to (1), in this particular case, Plaintiffs are not challenging a tariff, code or regulation promulgated by the MPSC. In regards to (2), in a sense MPSC and TEC protocol for determining stray voltage are being challenged because they are based on a fraud which fraudulently and seriously affects the public including Plaintiffs and they are designed solely for protection of the utility and this is a breach of contract. In regards to (3), the utility has constructed a system which is obsolete, incapable of delivering electricity to Plaintiff without putting electricity through the ground into Plaintiffs' barns, cows and persons. In addition, Defendant refuses to perform proper scientific testing to verify what is coming from their lines onto Plaintiffs' property and causing substantial damage to Plaintiffs and cannot hide behind some archaic non-scientific protocol which is a fraud on the public. In regards to (4), although Count I of Plaintiffs' Complaint is for breach of contract, the contract between the parties is to supply electricity that is safe, efficient and not harmful to the animals on Plaintiffs' dairy farm which contact has been surely breached which is covered by item (2) in *Valentine*. The balance of Plaintiffs' Complaint sounds in tort including Counts II, III, IV, and V; and, accordingly, the court of general jurisdiction is the correct forum and not MPSC.

The damages being sued for by Plaintiffs have nothing to do with rate setting and there is nothing in the MPSC scheme of things that limits liability for TEC for its conduct especially in view of the fact that it has been constantly told and reminded that a proper instrument must be used to determine the real facts of what is occurring on the Plaintiffs' property and by use of proper instruments and a recognition of what is truly coming from TEC's lines would have provided them with the information to make corrections to avoid damage to Plaintiffs.

CONCLUSION

It is obvious that the circuit court has at least concurrent jurisdiction of this case and it cannot be dismissed under MCR 2.116 (C) (4) which says the court lacks jurisdiction of the subject matter.

ISSUE II

DOES THE REQUIREMENT OF EXHAUSTION OF ADMINISTRATIVE REMEDIES APPLY TO THIS CASE?

Regarding exhaustion of administrative remedies, in *Travelers Ins v. Detroit Edison*, 465 Mich 185, 197 (2001), the court stated:

> "'Exhaustion' [of administrative remedies] applies where a claim is cognizable in the first instance by an administrative agency alone; judicial interference is withheld until the administrative process has run its course. "'Primary jurisdiction', on the other hand, applies where a claim is originally cognizable in the court, and comes into play whenever enforcement of the claim requires the resolution of issues which, under a regulatory scheme, have been placed within the special competence of an administrative body; in such a case, the judicial process is suspended pending referral of such issues to the administrative body for its views'."

As plaintiffs' claims are not cognizable in the first instance only by an administrative agency, the requirement of exhaustion of administrative remedies does not apply.

Further, the requirement of exhaustion of administrative remedies is inapplicable in this case because of the exceptions of "futility" and "inadequate remedy". See *L&L Wine v Liquor Control Comm*, 274 Mich App 354, 358-361 (2007). Plaintiffs are seeking money damages. There is nothing in the statutes or administrative rules which would permit the MPSC to award money damages to plaintiffs if plaintiffs should prevail on the claims stated in their complaint.

CONCLUSION

It is obvious that the doctrine of exhaustion of administrative remedies does not apply for this Court has concurrent jurisdiction and likewise the Circuit Court must be reversed as it has ruled Plaintiffs failed to exhaust their administrative remedies.

EXHIBIT C

STATE OF MICHIGAN

COURT OF APPEALS

JOHN SZYMANSKI and CAROL SZYMANSKI, Plaintiffs-Appellants,	UNPUBLISHED March 19, 2015
v	No. 319316
THUMB ELECTRIC COOPERATIVE, Defendant-Appellee.	Sanilac Circuit Court LC No. 13-035107-CK

Before: BOONSTRA, P.J., and SAWYER and O'CONNELL, JJ.

PER CURIAM.

Plaintiffs appeal by right the trial court order holding that the Michigan Public Service Commission (MPSC or commission) had primary jurisdiction over plaintiffs' claim and granting defendant's motion for summary disposition. We affirm.

Plaintiffs filed a five count complaint on April 30, 2013, seeking over $3 million in damages allegedly stemming from defendant's breach of contract and damage to plaintiffs' dairy farm from stray voltage. They alleged that defendant's electrical distribution system was inadequate, thus failing to ensure safe and efficient delivery of electricity, and instead resulting in stray voltage throughout plaintiffs' dairy farm operations and inside their home.

Defendant filed a motion asking the court in pertinent part to "defer its own jurisdiction" to the MPSC, which it claimed was better suited to handle the parties' dispute. Plaintiffs opposed the motion and argued that the MPSC could not provide an adequate remedy for the damages caused by defendant. Plaintiffs further contended that the rules of the MPSC were based on "junk science" and that referral to the commission would be a "kiss of death" because the commission was biased in favor of utilities.

The trial court noted that the MPSC had "clearly established an administrative remedy" and had "complete power and jurisdiction to regulate public utilities;" thus, it concluded that plaintiffs were "required to exhaust their remedies with the [M]PSC prior to seeking relief from this [c]ourt." The court also noted that the primary jurisdiction doctrine was "[s]imilar to the exhaustion of remedies" rule and that the "primary jurisdiction rule [] require[s] Plaintiffs to seek relief from the [M]PSC through its regulatory process." Subsequently, an order was entered granting defendant summary disposition because plaintiffs "must first have the Michigan Public Service Commission determine Plaintiffs' rights."

An appellate court reviews both a motion for summary disposition and jurisdictional questions such as the primary jurisdiction of an administrative agency de novo. *Travelers Ins Co v Detroit Edison Co*, 465 Mich 185, 205; 631 NW2d 733 (2001); *Durcon Co v Detroit Edison Co*, 250 Mich App 553, 556; 655 NW2d 304 (2002). Additionally, applications of legal doctrines are subject to de novo review. *People v Trakhtenberg*, 493 Mich 38, 47; 826 NW2d 136 (2012).

We conclude that the trial court did not err in deferring jurisdiction to the MPSC. Primary jurisdiction has been an accepted doctrine in Michigan since the early twentieth century. *Travelers Ins*, 465 Mich at 193-194. In particular, the primary jurisdiction of the MPSC was recognized in 1970. *Id.* at 194-195. Primary jurisdiction "arises when a claim may be cognizable in a court but initial resolution of issues within the special competence of an administrative agency is required." *Id.* at 197 (citation and quotation marks omitted). The exhaustion of administrative remedies rule is closely related. *Id.*

> "Exhaustion" applies where a claim is cognizable in the first instance by an administrative agency alone; judicial interference is withheld until the administrative process has run its course. "Primary jurisdiction," on the other hand, applies where a claim is originally cognizable in the courts, and comes into play *whenever enforcement of the claim requires the resolution of issues* which, under a regulatory scheme, have been placed within the special competence of an administrative body; in such a case the judicial process is suspended pending referral of such issues to the administrative body for its views. [*Id.* at 197-198 (emphasis in original), quoting *United States v Western P R Co*, 352 US 59, 63-64; 77 S Ct 161; 1 L Ed 2d 126 (1956).]

A court determines application of the primary jurisdiction doctrine on a case-by-case basis, without a formulaic test, considering the rule in issue and the facts of each case. *Id.* at 198. Our Supreme Court has noted three factors for consideration:

> First, a court should consider "the extent to which the agency's specialized expertise makes it a preferable forum for resolving the issue . . . ." Second, it should consider "the need for uniform resolution of the issue . . . ." Third, it should consider "the potential that judicial resolution of the issue will have an adverse impact on the agency's performance of its regulatory responsibilities." Where applicable, courts of general jurisdiction weigh these considerations and defer to administrative agencies where the case is more appropriately decided before the administrative body. [*Rinaldo's Constr Corp v Michigan Bell Telephone Co*, 454 Mich 65, 71-72; 559 NW2d 647 (1997), quoting Davis & Pierce, 2 Administrative Law (3d ed), § 14.1, p 272.]

Primary jurisdiction remains a prudential doctrine of judicial deference and discretion, and it "is well settled that civil litigation is not precluded by deferring jurisdiction to the MPSC; rather, it is merely suspended," *Durcon Co*, 250 Mich App at 557, 563.

Historically, there has been a distinction between tort cases and contract cases when applying the doctrine of primary jurisdiction, such that tort claims have been viewed as being for

the courts and contract claims have been viewed as being for the MPSC. *Travelers Ins*, 465 Mich at 202; *Rinaldo's Constr Corp*, 454 Mich at 75. Yet, a circuit court's tort jurisdiction does not "preclude exercise by the MPSC of jurisdiction over those claims that have traditionally fallen within its authority." *Travelers Ins*, 465 Mich at 202. Even if a party alleges negligence in its pleadings, where the relationship arises out of a contractual relationship, primary jurisdiction is appropriate and the trial court may defer to the administrative agency. *Id.* at 195-196. This Court has stated that where the cause of action was pleaded as negligence, initial review by the commission is appropriate when the nature of the claim is contemplated by regulatory tariff or rule, or arises out of the same facts and circumstances governed by the rules or tariffs. *Durcon Co*, 250 Mich App at 561, 563. Numerous complex claims and issues of fact may require the expertise of the MPSC to decide the extent to which a plaintiff's allegations "implicate and are governed by the regulatory code and tariff rules." *Id.* at 563-564.

Here, the commission clearly was created with regulatory authority over defendant. The MPSC is "vested with complete power and jurisdiction to regulate all public utilities in the state" with a few exceptions not applicable here. MCL 460.6(1). This jurisdiction extends to "all rates, fares, fees, charges, services, rules, conditions of service, and all other matters pertaining to the formation, operation, or direction of public utilities." *Id.* This authority "extends well beyond" the prospective power to promulgate regulations and set rates, and "includes the power and jurisdiction to hear and decide breach of contract claims." *Travelers Ins*, 465 Mich at 202 n 17. Indeed, the commission has promulgated rules, procedures, and remedies regarding claims of stray voltage. Mich Admin Code, R 460.2701 - R 460.2707. These rules were incorporated into defendant's rate book filed with the commission. Therefore, whether viewed as a tariff under defendant's rate book or a regulatory rule from the commission, the stray voltage rules apply to plaintiffs' complaint.

The three factors that guide the primary jurisdiction doctrine are met in this case. *Rinaldo's Constr Co*, 454 Mich at 71-72. First, there are numerous issues of complex, material fact that must be resolved in the dispute. Even plaintiffs have acknowledged the technical nature of their claim. Second, uniform resolution of the issue is required given the rules adopted by the commission that are directly on point. The MPSC created fairly detailed procedures for reporting and responding to stray voltage concerns and "MPSC review is preferable over judicial review" for consistent application of the stray voltage rules and procedures. *Durcon Co*, 250 Mich App at 562. Although plaintiffs contest the scientific validity of the rules, not only can plaintiffs raise those issues in a contested hearing, Rule 460.2706(1)(c), but judging the scientific validity of the rules would be much better served after the application of those rules to the facts at plaintiffs' farm. If either party seeks further judicial review, the court will benefit from the factual development at the regulator level. Third, judgment in the circuit court would frustrate the regulatory scheme and the agency's ability to regulate because it would circumvent the entire, multi-step process designed by the commission to respond to stray voltage concerns. If required, plaintiffs could also seek monetary damages in circuit court following the administrative procedure. *Id.* at 563.

Primary jurisdiction is a doctrine of deference and discretion such that the court's own jurisdiction is merely suspended. *Id.* at 556-557. The trial court did not err in deferring its jurisdiction to the MPSC under the doctrine of primary jurisdiction. Since we find that the

doctrine of primary jurisdiction was properly invoked, we decline to review plaintiffs' argument that application of the exhaustion of administrative remedies rule was inappropriate.

Affirmed.

/s/ Mark T. Boonstra
/s/ David H. Sawyer
/s/ Peter D. O'Connell

EXHIBIT E

Report of Electrical Investigation at Szymanski Dairy Farm

Donald Hillman[1], Louis R. Hillman[2], and Phillip Smith[3]

[1]Donald Hillman, Ph.D., Professor Emeritus, Department of Animal Science (Dairy), Michigan State University, Investigator, Shocking News EMF, LLC, 750 Berkshire Lane, East Lansing, MI 48823
[2]Louis R. Hillman, M.S., Associate Investigator, 750 Berkshire Lane, East Lansing, MI 48823
[3]Phillip Smith, Electrician, Journeyman, Lansing, MI 48901

June 23, 2011

SUMMARY

Extraneous, uncontrolled electricity on the John and Carol Szymanski farm, a 200-cow dairy, was investigated, using an oscilloscope that measured power quality. Primary and secondary neutral-to-ground wires were bonded at the service entrance and contained peak-peak voltage averaging 10 Vac at regular 30-second intervals with occasional 25 Vac spikes. Spikes were apparent when a neighbor turned on equipment requiring high current draw. Fundamental PN-G (Primary Neutral to Ground) frequency was 60 Hertz with milking machine On. With milkers Off, the PN (Primary Neutral) and SN (Secondary Neutral) which were bonded to milking parlor steel, resulted in 2.67 volts Ac, and Vdc in cow-contact locations. Current measuring 0.03 ampere was flowing through drinking water measured with ammeter in tank to floor where cattle were standing. Cows refused to drink enough of the electrically spiked water resulting in decreased milk production and unexplained death of cattle. When the primary neutral was detached at the service entrance pole and diverted ¼ mile from the barn with shielded cable to a ditch, electropathic interference with the cattle was eliminated. Appropriate mitigation would require installing an appropriate neutral between the utility and the dairy service, since the primary neutral was incapable of returning the contaminated neutral current to the substation via utility conductors. Isolators on the utility conductors did not prevent harmful neutral voltage from a neighbor's farm entering Szymanski's dairy facilities. Families are at risk from induced currents radiating from the overhead distribution wires.

THE SITUATION

A history of extraneous, uncontrolled, "stray voltage" had been reported at the Szymanski Dairy Farm within the past year. Excessive current on primary neutral to ground was measured at the service entrance when the transformer pole was located near the dairy barn (Lawrence C. Neubauer, ME, and David F. Winter, EE, PE, correspondence). After extensive testing by independent electricians and engineers and litigation, the problem of utility negligence was recognized by a panel of peers in Sanilac County Circuit Court. The farm is adjacent to the Minden City Conservation Reserve. The soil is approximately 80% organic matter, classified as muck, retains moisture poorly during dry weather and is unreliable as a conduit for neutral current to return to the utility substation; thus, the utility wire must carry all neutral current.

On advice of competent electrical authority, emergency relief was obtained by diverting the primary neutral ground current from the premises with an insulated wire some ¼ mile off the premises into a drainage ditch. That practice alleviated the electrical interference. Milk production and cattle health improved dramatically. Within the recent six months the Utility, Thumb Electric Cooperative, Inc., installed some new poles, new wires, and new transformers on about four miles of the single-phase power line serving the farm at 1325 East Argyle Road, Snover, Michigan. At such time the utility disconnected the emergency diversion wire, thus leaving the new primary neutral down-ground wire to return the residual neutral current through the earth to the utility substation. Following the new installation, milk production and herd health have deteriorated.

The purpose of this investigation was to determine if extraneous transient and harmonic currents were appearing on the primary neutral-to-ground wire and whether any harmful currents were prevalent at cow contact areas of the dairy.

INVESTIGATIVE PROCEDURES

A Fluke®199C Scopemeter 200 MHz, sampling rate 2.5 GS/s (Giga Samples per second), and SureGrip banana nose Test Leads with BNC Ethernet extension cables as necessary were used to measure voltage and frequencies. Data were recorded on a Dell Studio laptop computer on site and printed using FlukeView© 4.2 software. Primary Neutral-to-Ground (PN-G) and Secondary Neutral-to-Ground (SN-G) were measured of circuits from the service entrance panel to the oscilloscope to a low voltage (<3 mV) remote copper ground rod driven into the earth, 50 feet west of the milk house, where the service panel was installed. Current in the cow water tank was measured with a Fluke® 77 Ammeter grounded to the floor. Fluke® 79III True RMS and Fluke® 87 Voltmeter were used for preliminary testing at the utility pole down-ground and other locations. Electromagnetic fields were measured in milliGauss (mG) near the power lines with a TriField® Gaussmeter, AlphaLab Inc.

RESULTS

Preliminary testing of voltage at utility down-grounds at the base of poles near the road yielded 1.77 to 1.9 Volts at the barn transformer pole, 1.7-1.9 Vac at the home transformer pole, and 1.88 V at the neighbor's service pole and at the power line down-ground in the front yard. The guide wire on the utility power line in the neighbor's front yard yielded 1.95 Vac and 276 mAdc.

Electromagnetic fields (EMF) under the power line measured 20-25 mG in the front yard of the Szymanski home at 1325 Argyle Rd, in the neighbor's front yard across the road, under the line in front of the Symanski's dairy some 200 yards East. Magnetic currents were not detectable under the utility twisted conductors (neutral wrapped around the phase wire) between the Utility transformer pole and the meter pole circa 200 feet South near the Szymanski dairy barn.

The primary neutral was grounded with 2-rods six feet apart near the foundation of the dairy facility, and the secondary neutral was grounded to earth about 6-feet from the PN-G rod.

Figure 1 displays 10 volts of 60 Hertz (cycles/sec) recorded when the secondary neutral was connected to the ground and the milking machine vacuum pump was running.

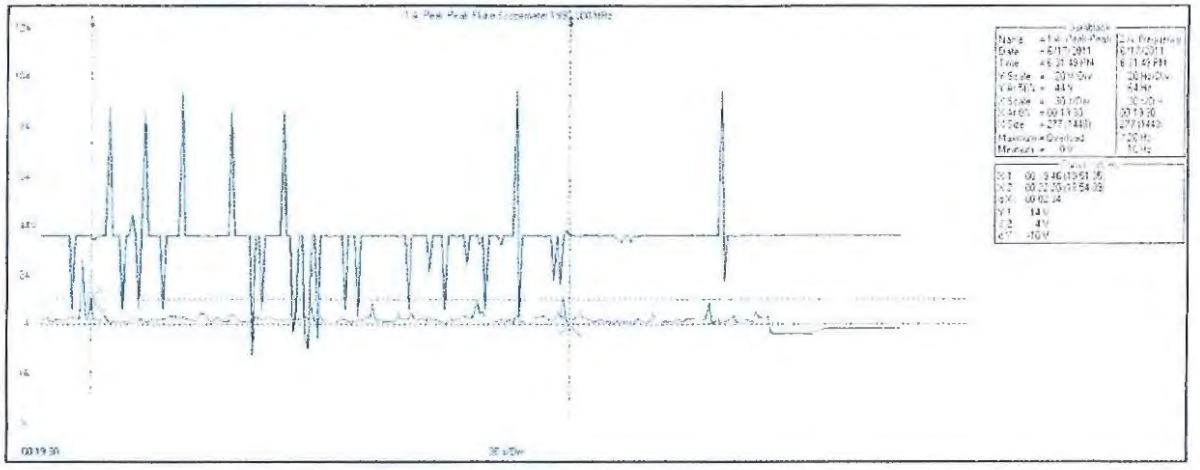


Figure 1. John Szymanski Dairy: Secondary Neutral-Ground connected, Milker On: 10 Vpk-pk, 30 Sec. Intervals, 25 V. Max, Overload & Frequency 60 Hz. Secondary Neutral was bonded to Primary Neutral-to-Ground in the Service Panel. "Holsteins are sensitive to peak-peak currents rather than RMS or peak values" (Ref: Aneshansley, et al, ASAE Paper No. 99-3152, Toronto, Ontario, Canada. 1999).

Figure 2 displays 2.04 Volts ac and 2.67 Volts ac+dc when milking machine was OFF, only barn fans and a few lights were ON.

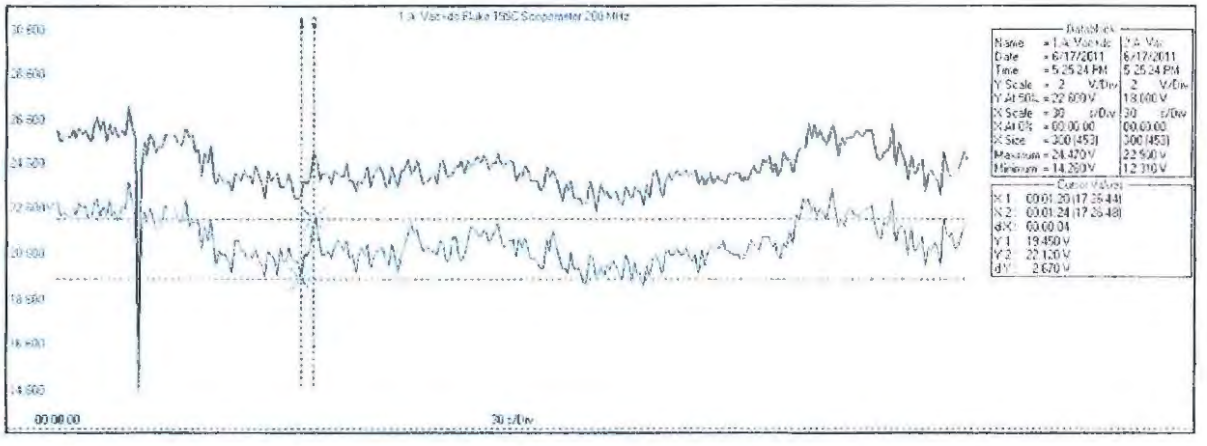


Figure 2. John Szymanski Dairy: Voltage 2.67 Vac peak-peak + Vdc, 2.04 Vac + 0.63 Vdc Primary Neutral-to-Ground and Secondary Neutral-to-Ground. Secondary is bonded to milking parlor hardware (steel stall dividers) and to Primary Neutral in service panel. "Holsteins are sensitive to peak-peak current rather than RMS or peak values."

Figure 3 displays increased voltage spikes on Szymanski PN-G and SN-G when a neighbor switched On a 10 HP silo unloader motor and other equipment increasing impedance and current draw on the TEC power line.

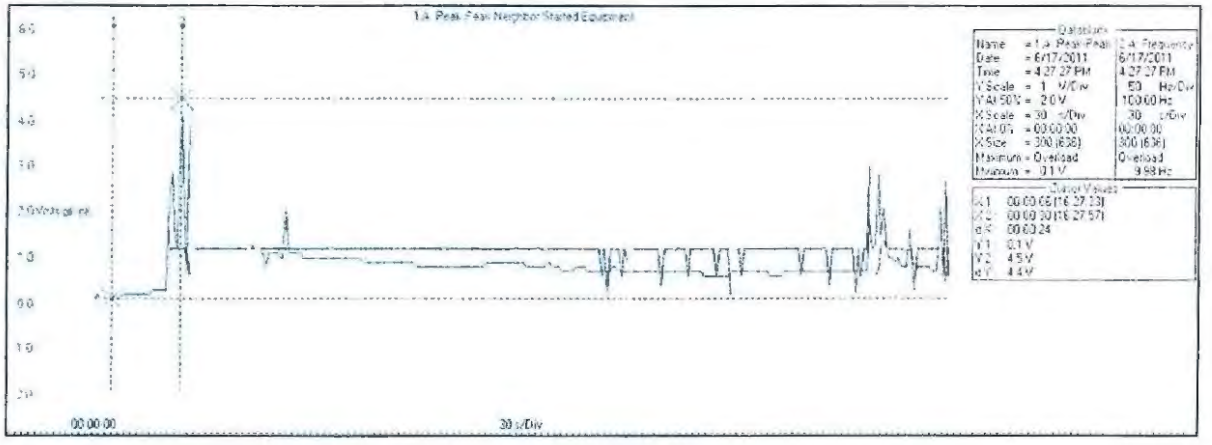


Figure 3. John Szymanski Dairy: Primary Neutral Voltage-to-Ground & Secondary Neutral Voltage-to-Ground increased 4.4 V when the Neighbor switched On 10-HP Silo Unloader and other equipment increasing impedance and current draw on TEC power line. Overload means the voltage was greater than the 6 Volts shown on the scale, exact V unknown. Frequency Max was in Overload, meaning frequencies exceeded 60 Hertz.

Figure 4 displays the frequency spectrum from Primary Neutral-to-Ground and Secondary Neutral-to-Ground Voltages.

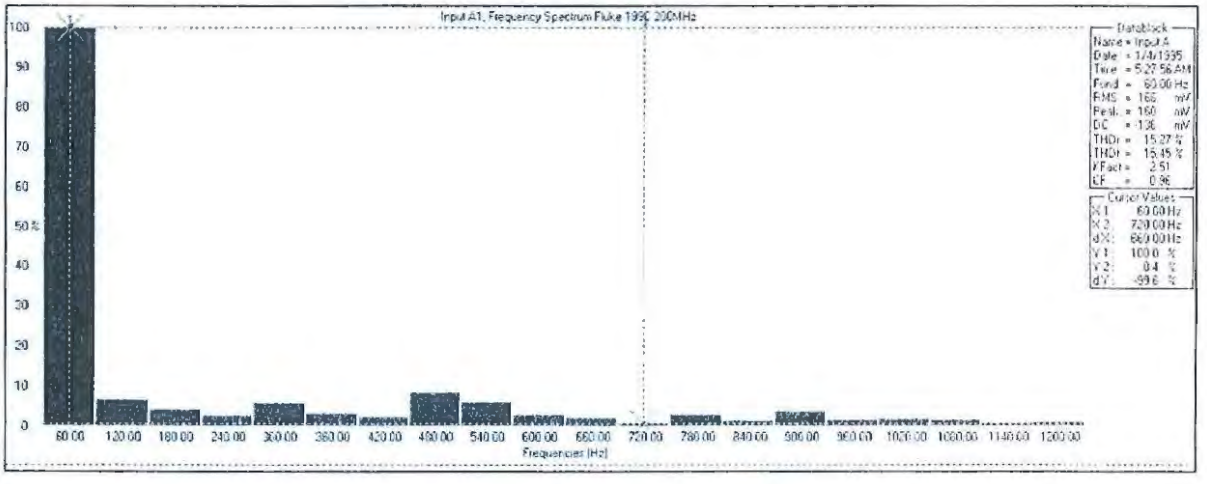


Figure 4. John Szymanski Dairy: Frequency Spectrum, Primary + Secondary Neutral-to-Ground; Milker OFF. Datablock shows Fundamental Frequency is 60 Hz; Total Harmonic Distortion (THDr) is 15.17% and (THDf) 15.45%. Harmonics are integer (whole number) multiples of the Fundamental 60 Hz in this distorted residual which is the current on the PN-G and SN-G current flowing to feet of cattle and 30 mA in drinking water-tank. Harmonic currents were related to childhood leukemia in homes of victims in Denver, Colorado. *Bioelectromagnetics* 23:177-188, 2002.

Current in the cow's drinking water tank registered 0.030 amperes (A) or 30 mA on the Fluke 77 ammeter with test leads measuring from water to floor where the cattle were standing.

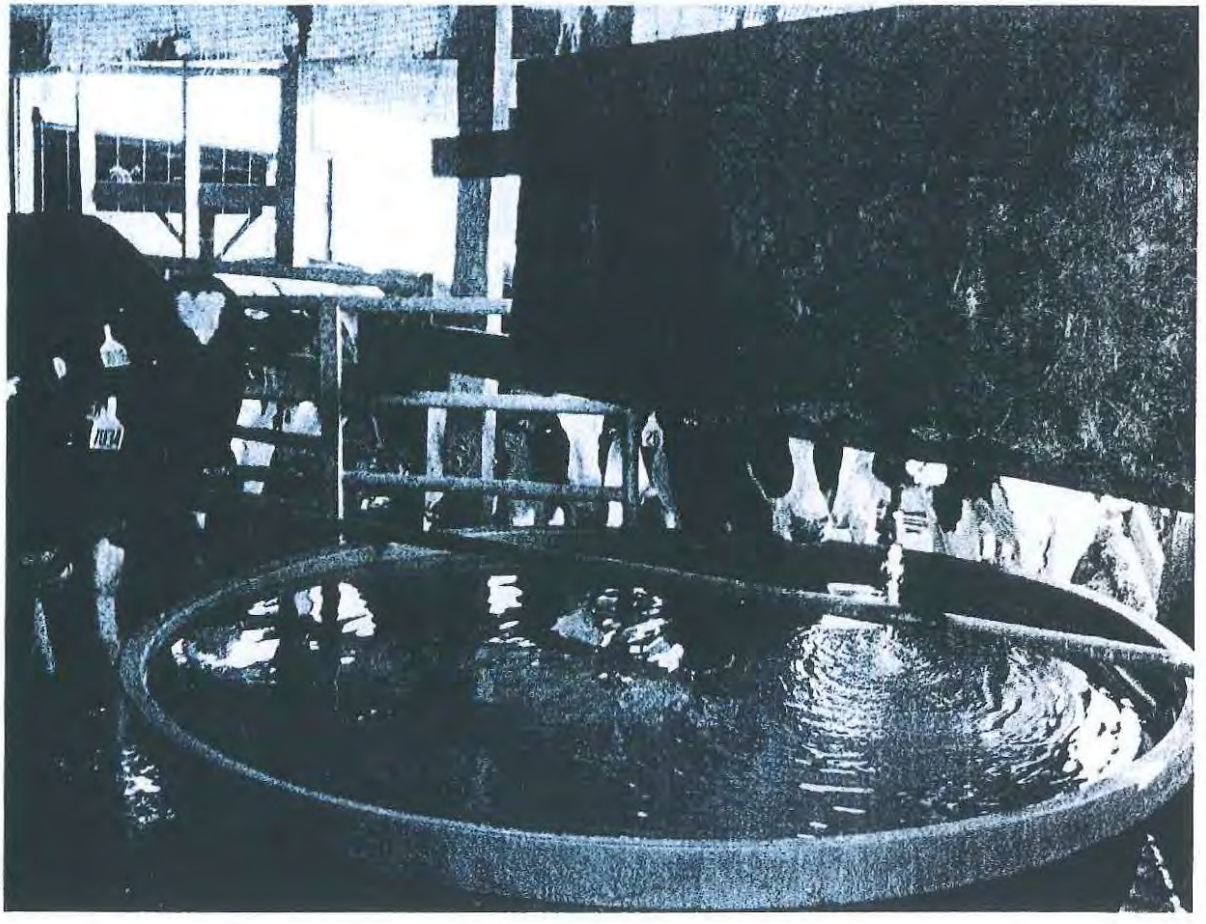


Figure 5. Cows will not consume sufficient water for high levels of milk production with 30 mA current in the watering tank, a fact that was first reported in 1969 (Craine et al, 1969), and recently observed in Michigan herds (Hillman et al, 2003, 2004, 2011).

DISCUSSION

"Holsteins are sensitive to peak-to-peak current rather than RMS (root mean square) or peak voltages" (Aneshansley et al, ASAE paper 99-3152, Toronto, Ontario, 1999). A power quality meter is required to measure peak-to-peak currents. "Average peak responding meters measure distorted waveforms with readings that are 25-50 percent below actual RMS values" (Barry Kennedy, *Power Quality Primer*, McGraw-Hill, 2000, p. 181).

Peak-peak voltage on the neutral-to-ground wire and distorted frequencies indicate inferior quality return current on the neutral, contaminating the ground and dairy facilities.

Since neutral current transfers to the Utility Primary Neutral first, a neutral current resulting from 240-Volt equipment on farms is a primary neutral current not a secondary neutral current as often claimed. "A common misconception is to relate an increase of NE [Neutral-to-Earth] voltage associated with operation of equipment on the farm to an on-farm problem. An increase of NE voltage with the operation of 'clean' 240-V loads is a primary NE voltage" (Appleman, R. D., and Gustafson, R. J., *Source of Stray Voltage and Effect on Cow Performance and Health*, J. Dairy Sci. 68: 1554-1557, 1985).

Current is conducted to the milking parlor steel stall-dividers to which the cattle are in contact while milking and standing with four feet on the floor of electrified concrete.

Resistance of cows to EMF decreases as frequency of voltage increases (Aneshansley et al, 1990-1995). Norell et al reported that cattle exhibited an avoidance response 13.8% of the time at 1.0 mA current and significant increases of response rates occurred with each 1.0 mA increment up to 5.0 mA. Namely, 2.0 mA = 30% response, 3.0 mA = 69.2%, 4.0 mA = 92.3%, and 5.0 mA = 98.4% response (In Appleman and Gustafson, 1985).

Requirement of a 500-Ohm resistor in the test circuit to represent R (resistance) of a cow would seem to represent over-kill and underestimate the current passing through a cow if using Ohm's Law to estimate current where: I (Current) = E (Volts) / R (Ohms). 1.0 mA is considered "Actionable Level" by MPSC, meaning utility must respond to customer complaint within 24 hrs.

HAZARDOUS ENERGY -- OSHA (Occupational Safety and Health Administration) considers exposure to V/500 Ohms greater than 1.0 mA "Hazardous Current" and requires OSHA employees to be properly protected from electrical exposure (U.S. Department of Labor, Directive CPL 2-1.18A, Standards to Protect Personal Injury, effective date October 20, 1997). *Enforcement of the Electric Power Generation, Transmission, and Distribution Standard* (above) states:

> "Hazardous energy means a voltage at which there is sufficient energy to cause injury. If no precautions are taken to protect employees from hazards associated with involuntary reactions from shock, a hazard is presumed to exist if the induced voltage is sufficient to pass a current of 1 milliAmpere (mA) through a 500-Ohm resistor. The 500-Ohm represents the resistance of an employee."

Utility employees working on Right-of-Ways acquired by TEC as in front of the John and Carol Szymanski property where 20-25 milliGauss, equivalent to 1.6-2.0 Amperes of electricity per square meter at head height, are certainly in a Hazardous Environment requiring shielded clothing. Therefore, the front yard or anywhere near the TEC lines is hazardous for children to play and family members to enjoy their property. Exposure while working near high power

lines has resulted in headache, nausea, arrhythmic heart, and hypertension among occupationally exposed workers (Hillman et al, 2009; Szmigielsk, Stanislaw, et al, 1998).

Chronic electrical exposure results in electropathic stress, a neuro-endocrine response in animals and man. Cattle subjected to 4 or 8 mA, 60-Hz current from udder–to-hoofs pathway had increased adrenal hormones in blood, increased heart rate and blood pressure; and oxytocin (the milk let-down hormone) release was delayed in blood compared to 0 exposure during experiments (Gorewit et al, 1984). Incomplete milking and milk retained in the udder is a major complaint of dairymen plagued with stray voltage. Also, milk retained in the udder can allow a few micro-organisms to incubate, increasing bacteria count and somatic cell count of milk (Mein, G., *Milking Machines and Mastitis*, Large Herd Management Conference, circa 1980).

At USDA-ARS in Beltsville, MD, cows subjected to 5 mA intermittent current (30 sec On-30 sec Off) while milking produced 11 to 17% less milk than controls during 2-week trials (Lefcourt et al, 1981). Resistance of cows averaged 266 Ohms; 1.1-1.6 Volts resulted in 5.0 mA current flowing through the cows.

A study of the effects of extraneous current on 12 farm herds in the Midwest revealed that transient and harmonic current other than 60 Hertz depressed milk production average of 7.5 pounds per cow per day/year for each of 5 years, so that production was one-half expected after 5-years (Hillman et al, 2003). Most Midwest utilities used average responding and peak value voltage multimeters which do not measure distorted waveforms and produce readings that miss 25-50 percent of True RMS values, per testimony in MPSC Case U-16129 (2011).

Canadian investigators exposed cows to 10-KV electric fields and 30-μT (microTesla) magnetic fields, overhead induced current and reported decreased milk production, reduced milk fat yield, delayed heat periods, changes in growth hormone and insulin-like growth factor, and leakage of the blood-brain barrier into cerebrospinal fluid (Burchard et al, 2003).

Others have reported that exposure to excessive current impairs the immune system, proliferates cancer and other infectious diseases, interferes with fertility and reproduction, increases metabolic diseases and calcium release, i.e. milk fever and post-calving disorders in cattle, concentrations of electrolytes in blood, and water balance in animals and man (Berne et al, Physiology, 1998; Stankiewicz, Wanda, Marek P. Dabrowski, Elzbieta Sobiczewska, and Stanislaw Szmigielski, *Immunotropic effects of low-level microwave exposures in vitro*, Military Institute of Hygiene and Epidemiology, Dept of Microwave Safety, 01-163 Warsaw, Kozielska 4, Poland, Published Eur. J. Oncol. Library, vol. 5, 2010; Hartsell, Daniel, DVM, Duane Dahlberg, Ph.D., David Lusty, and Robert Scott, DVM, *The Effects of Ground Current on Dairy Cows: A Case Study*. The Bovine Practitioner–No.28:71-78, 1994).

Cattle and other animals chronically exposed to excessive current become analgesic and dopamine concentrations increase in certain areas of the brain. Investigators have observed that cows may lay their head to one side against a post as if they might have a headache or even enjoy the current while other impairments are proceeding (Loscher and Kas, 1998; Aneshansley 1992; Dr. Maine, DVM, circa 2000).

Investigators have observed that children exposed to EMF in the classroom are less able to concentrate on their studies and are more likely to be restless than children in schools where the EMF was reduced by installing high frequency EMF filters (Dr. Magda Havas, Environmental Research Center, Trent University, Peterborough, Ontario, Canada).

Dairymen, their families, and employees working in the electrified environment may be at risk of impaired health, e.g. heart arrhythmia, hypertension, diabetes, and cancer (Milham, Sam, MD, MPH, *Dirty Electricity, Electrification and the Diseases of Civilization, 2010.* iUniverse, NY, and Bloomington, IN; and Allen, Russ, *Electrocution of America,* Glenmore Books, 2006). Russ Allen, a Wisconsin dairy farmer, offers insight to his family's stray voltage experience.

CONCLUSIONS

Electrical Voltage and current measured at the John and Carol Szymanski dairy farm exceeded levels that are compatible with dairy cattle milk production, health, and behavior. Primary neutral current is contaminating the Szymanski dairy facilities because of an inadequate primary neutral return to the substation. The primary neutral is a responsibility of the utility. Mitigation can be achieved by: a) installing a Shielded Neutral Isolation Transformer between the utility and the customer, b) increasing the size of the neutral wire to three times the size of the phase wire, as has been recommended, c) installing frequency filters to reduce the electromagnetic interference as has been effective where high-frequency currents were present. Power Quality Standards have been developed and are available from IEEE and ANSI (American National Standards Institute). Thumb Electric Cooperative must change the configuration of the main conductors and install shielding to reduce the hazardous current being radiated onto the premises of customers along Argyle Road.

REFERENCES

1. Stankiewicz, Wanda, Marek P. Dabrowski, Elzbieta Sobiczewska and Stanislaw Szmigielski. 2010. Immunotropic effects of low-level microwave exposures in vitro. Military Institute of Hygiene and Epidemiology, Dept of Microwave Safety, 01-163 Warsaw, Kozielska 4, Poland. Published Eur. J. Oncol. Library, vol. 5.
2. Hartsell, Daniel, DVM, Duane Dahlberg, Ph.D., David Lusty, and Robert Scott, DVM. 1994. The Effects of Ground Current on Dairy Cows: A Case Study. The Bovine Practitioner–No.28:71-78.

3. Dr. Javier Burchard, DVM, Ph.D, et al, McGill University, Quebec, Canada, reported in *Bioelectromagnetics,* Vol. 24:557-562 (2003), under the title "Effect of 10 KV/m and 30 μT, 60 Hz, electric and magnetic fields on milk production and feed intake in pregnant dairy cattle."
4. Craine, L. B., E. M. Ehlers, and D. K. Nelson. 1969. Effects of distribution system ground voltages appearing on domestic water lines. Paper No. 69-814, *ASAE*, St. Joseph, MI 49085.
5. Craine, L. B. 1982. Liability for neutral-to-earth voltage on farms. Presentation Paper No. 82-3510, *ASAE*. 2950 Niles Rd, St. Joseph, MI, USA.
6. Cloud, H. A., R. D. Appleman, and R. J. Gustafson. 1980. Stray Voltage with dairy cows. North Regional Extension Publication 125, University of Minnesota.
7. Bodman, G. R., L. E. Stetson, and H. Shull. 1981. Investigation of extraneous voltages in Nebraska dairies. ASAE Paper 81-3510.
8. Williams, G. F. 1981. Stray electric currents: economic losses, symptoms, and how it affects the cows. 20th Annual Mtg., Natl. Mastitis Council, Arlington, VA.
9. Kirk, J. H., N. D. Reese, and P. C. Bartlett. 1984. Stray Voltage on Michigan Dairy Farms. J. Am. Vet. Med. Assoc., 185(4):426-428.
10. Surbrook, T. C., and N. D. Reese. 1981. Stray Voltage on farms. ASAE Paper No. 81-3512, St. Joseph, MI.
11. Lillmars, L. D., and T. C. Surbrook. 1980. Stray Voltage Problems and Solutions in Michigan. ASAE Paper No. 80-3504, St. Joseph, MI.
12. Rodenberg, J. 1984. Survey of neutral-to-earth voltage on Ontraio farms, Ontario Ministry of Agriculture and Food. Reported in *Ontario Milk Producer*.
13. Albright, J. L., W. M. Dillon, R. M. Sigler, J. E. Whisker, and D. J. Arnholt. 1991. Dairy farm analysis and solution of stray voltage problems. *Agri-Practice* 12(3):23-27.
14. Hillman, D., D. Stetzer, M. Graham, C. L. Goeke, K. Mathson, H. H. VanHorn, and C. J. Wilcox. 2003. Presentation Paper No 03-3116, ASAE, St. Joseph, MI. DVD available.
15. Hillman, D., D. Stetzer, W. O. English, Martin Graham, and Edward Rothwell. 2009. Induced Voltage and Current near 46-kV Transmission Lines. International Symposium on Man and His Environment, American Environmental Health Foundation, Dallas, Texas.
16. Hillman, Donald, Charles L. Goeke, and Richard Moser. 2004. Electric and Magnetic Fields affect milk production and behavior of cows: Results using Shielded Neutral Isolation Transformer. *12th Int. Conf. on Production Diseases in Farm Animals.* College of Vet Med., Michigan State Univ., East Lansing, MI.
17. Phillips, D.S.M. 1962. Production of cows may be affected by small electrical shocks from milking plants. New Zealand, J. of Agric. 105(3):221-228.
18. Whittlestone, W. G. 1951. Studies on milk ejection in the dairy cow. The effect of stimulus on the release of the "milk ejection" hormone. New Zealand J. of Sci. Technol. 32A(5):1-20.
19. Loscher, W., and G. Kas. 1998. Extraordinary Behavior Disorders in Cows in Proximity to Transmission Stations. Der Praktische Tierarz &9:4237-444.In German [*Pract Vet Surg* 79:437-444 (1998)].
20. Gorewit, R. C., D. V. H. Drenkerd, and N. R. Scott. 1984. Physiological Effects of Electrical Current on Dairy Cows. *Stray Voltage: Proceedings of the National Stray Valtage Symposium*. American Soc. of Agricultural Engineers, St. Joseph, MI.

21. Gorewit, R. C., D. J. Aneshansley, and L. R. Price. 1992. Effects of voltage on cows over a complete lactation. 1. Milk yield and composition, and 2. Health and reproduction. *J. Dairy Sci.* 75:2719-2732.
22. Gumprich, J. 1992. Effect of Electricity on Cows. New Liskeard College of Agricultural Technology. Canadian Electrical Association (CEA 178 D 477).
23. Behr, Michael. 1997. *Stray Voltage Research Fraud.* Proprietary Publication, Northfield, MN.
24. Gustafson, R. J., Vernon D. Albertson, and Larry A. Kinney. 1979. Agricultural electronic equipment operating in an electric transmission line environment. Paper No. NCR 79-204, ASAE, St. Joseph, Michigan.
25. Armstrong, Benedict, Gillies Theriault, Paschal Guenel, Jan Deadman, Marcel Goldberg, and Paul Heroux. 1994. Association between exposure to pulsed electromagnetic fields and cancer in electrical utility workers in Quebec, Canada, and France. Amer. J. Epidem. 140(9):805-820.
26. Appleman, R. D., and R. J. Gustafson. 1985. Source of stray voltage and effect on cow health and performance. *J. Dairy Sci* 68:1554-1567.
27. Lefcourt, Alan M., and R. M. Akers. 1981. Endocrine Response of Cows Subjected to Controlled Voltages During Milking. *J. Dairy Sci.* 65:2125-2130.
28. Aneshansley, D. J., and C. S. Czarniecki. 1990. Complex electrical impedance of cows: Measurement and significance. Presentation Paper No. 90-3508, International Winter Meeting, Chicago, IL, ASAE, St. Joseph, MI 49085-9659.
29. Aneshansley, D. J., Roger A. Pellerin, James A. Throop, and David C. Ludington. 1995. Holstein cow impedance from muzzle to front, rear, and all hooves. Presentation Paper No. 953621. *ASAE.*
30. Paul, Clayton R. 2006. Introduction to Electromagnetic Compatibility. 2nd Ed., John Wiley and Sons, Inc., page 300.
31. Reilly, J. Patrick. 1998. *Applied electricity from electrical stimulation to electropathology*. Springer-Verlog, NY, adapted from the same title, Cambridge University Press, 1992.
32. Michigan Public Service Commission. 2006. Rules and Regulations Governing Animal Contact Current Mitigation. U-11684, U-13934, R 460.2701-R 460.2707. Docket U-13934, 6545 Mercantile Way, Lansing, MI 48909. Also Case No 16129, Tensen v Consumers Energy Company.
33. Kennedy, Barry W. 2000. *Power Quality Primer*, McGraw-Hill, New York, NY.
34. Aneshansley, D. J., and R. C. Gorewit, 1999. Sensitivity of Holsteins to 60 Hz and Other waveforms present on dairy farms. Paper No. 993152. ASAE/SCGR Meeting, Toronto, Ontario, Canada. July 18-21, 1999.
35. Gustafson, R. J., R. Pursley, and V. D. Albertson. 1990. Seasonal grounding resistance variations on distribution systems. *IEEE Tronsactions on Power Delivery*, Vol. 5, No. 2, April.
36. Brown, Marvin R., George F. Koob, and Catherine Rivier. 1991. *STRESS, Neurobiology and Neuroendocrinology*. Marcel Dekker, Inc.
37. Allen, Russ. 2008. Electrocution of America. Is your utility company out to kill you?© Russ Allen, Published by Glenmore Books, 498 pages.
38. Plaizier, J. C. B., G. J. King, and J. C. M. Dekkers. 1997. Estimation of Economic Value of Indices for Reproductive Performance in Dairy Herds. *J. Dairy Sci.* 80:277S-2783.

39. Stankiewicz, Wanda, Marek P. Dabrowski, Elzbieta Sobiczewska and Stanislaw Szmigielski. 2010. Immunotropic effects of low-level microwave exposures in vitro. Military Institute of Hygiene and Epidemiology, Dept of Microwave Safety, 01-163 Warsaw, Kozielska 4, Poland. Published Eur. J. Oncol. Library, vol. 5.
40. Hartsell, Daniel, DVM, Duane Dahlberg, Ph.D., David Lusty, and Robert Scott, DVM. 1994. The Effects of Ground Current on Dairy Cows: A Case Study. The Bovine Practitioner–No.28:71-78.
41. Polk, C. 2001. Cows, ground surface potentials, and earth resistivity. *Bioelectromagnetics* 22:7-8.
42. Reinemann, D. J., S. D. Lemire, M. D. Rasmussen, and M. C. Wiltbank. 1999. Dairy Cow Response to Electrical Environment. Final Report: Part III. Immune function response to low-level electrical current. Submitted to the Minnesota Public Utilities Commission, June 30, 1999.
43. Bradford P. Smith, DVM, 2002. *Large Animal Internal Medicine,* 3rd ed., Mosby, Harcourt Health Series.
44. Hillman, Donald, 2010. Electropathic Stress in Animals and Man. Shocking News #15, Shocking News EMF, LLC, 750 Berkshire Lane, East Lansing, MI 48823, donag1@aol.com.

Respectfully submitted,

Donald Hillman

Report 3 -- Electrical Investigation John and Carol Szymanski Dairy Farm 12/07/2011

Donald Hillman, Ph.D., and Louis R. Hillman,, MA

The John Szymanski Family requested retesting for extraneous current which they believe continues affecting the behavior, health, and milk production of the dairy herd.

The utility, Thumb Electric Cooperative, Inc., installed new lines, new transformers, and some new poles on the lines serving the Szymanski dairy and other customers on East Argyle Road, finishing about February 2011. TEC insisted that Szymanski needed to change certain electrical entrance installation and grounding. The changes were made according to TEC specifications within the last month. If other changes were performed by TEC on the power lines, the Szymanskis are unaware of them.

Prior to TEC's installing of the new circuits, the Szymanskis had routed Primary Neutral Current away from the farm and had acceptable performance of their herd during that period. Since TEC installed the new system, losses of cattle and milk production have continued on the Szymanski farm. Other dairy farmers in the neighborhood have complained of the same inferior service and cattle losses.

Our purpose for remeasuring was to determine if cow-contact currents >1.0 mA (milliampere) as proposed by Michigan Public Service Commission (MPSC) were present and in violation of MPSC Rule.

PROCEDURES:

We used a Fluke Oscilloscope that measures voltage, frequency, and current when an ammeter is attached. In addition a clamp-on ammeter measured 1) current from the downgrounds, 2) current from a 4"x 4" aluminum plate immersed in the stock-tank of drinking water for the cattle attached to the lead of the oscilloscope or ammeter, and 3) the plate used to measure voltage in the milking-parlor stall when weighted as recommended by MPSC.

A Graham-Stetzer Microsurge Meter measured extraneous >60 Hz radio frequency, microsurge units of current carried on 120-V outlet circuits.

RESULTS:

Preliminary Outside Measurements: (Instrument: Craftsman Professional Ammeter -- Model 82364)

1. Clamp-on ammeter over down grounds at the pole next to the service entrance:
    a. Current flowing through the Primary-Neutral to earth: 0.86 amperes
    b. Current flowing through secondary (farm) Neutral-to-earth: 0.85 amperes

c. Resistance of PN-Earth pathway approximately 11:30 A.M, 0.32 Ohms

d. Current flowing PN-Earth, 11:30 A.M, 0.43 Amps AC current.

2. GaussMeter Readings: Head high using TriField Meter 100xe (Alpha Lab) I
   a. Szymanski barn under pole beside road: 15-20 mG (milliGauss)
   b. Under power line between poles in front of barn near road: 10 mG
   c. Under power line in front of Szymanski home: 15-20 mG
   d. Neighbor across road, under Power Line: 10-20 mG
3. Current at neighbor's pole, front yard near road: 0.020- 0.030 Amp
   a. Downground pole, neighbor's barn service entrance: 0.040 A ac
   b. (Instrument: Craftsman Professional Ammeter – Model 82364)

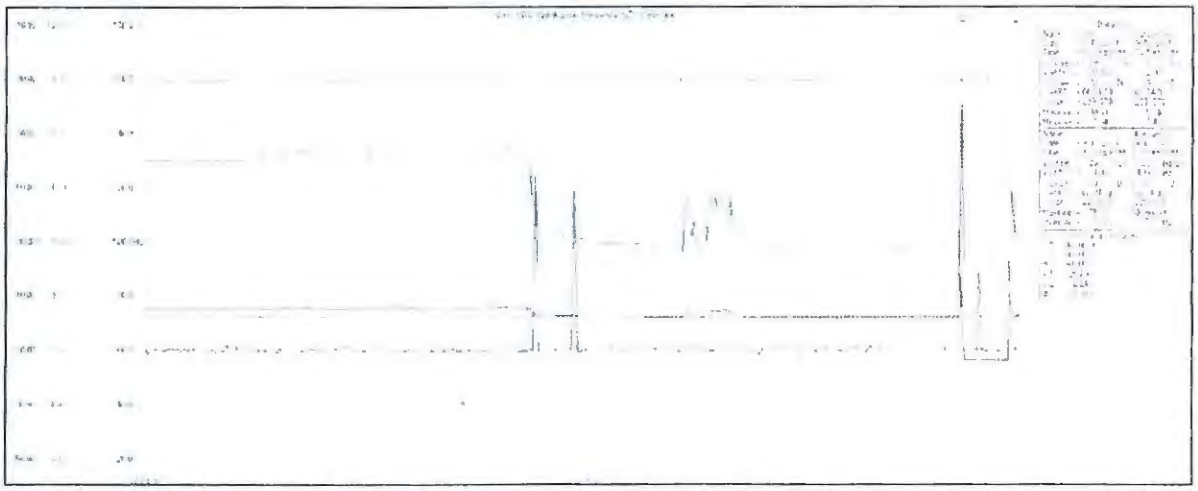


Figure 1. Szymanski Farm: Water tank: Regular peaks of 0.56 V dc drops tp -3/52 V dc and returns to -2.15 V dc spike, then drops to -4.0 V dc , and then spikes to -3.2 V dc. The 87.36 V rms spike occurred in conjunction with the 78.64 V p-p, circa 4.5 minutes (see right side of the FlukeView chart). Frequency spikes were 120-Hz variations of the 60-Hz nominal TEC frequency (12-7-11).

Figure 1 displays voltage in the drinking water tank for the cows.

- Electrical spikes of 0.56 V to 3.2 V dc were common in the water tank. Vrms spikes of 87.36 Volt appeared in conjunction with 78.64 Volt peak-peak spikes of unknown origin. The spikes are equivalent current to: 87.36 V (E)/500 Ohms (R) = 0.175 Amp or 175 mA (I) as calculated by MPSC: Ohms Law -- I (amps) = E (volts) / R (resistance or impedance).
- This is "dirty electricity" causing the cows to refuse to drink the amount of water required for high level milk production.
- The cattle become ill as in RF illness, and many cattle died within the last year.
- There is No Cow Impedance since the current-containing water is consumed by the cow and may become doped. Cattle and other species stressed by electricity for prolonged periods develop an Analgesic Response and act dopified since dopamine is produced in brain neurons. (Perhaps John should bottle the current-water and sell to TEC?)
- Current in the water contained 50-60 mA (milliamperes) of electrical energy flowing through the true RMS ammeter grounded to the floor.
- The Current exceeds the MPSC Rule 460.2703 (1) which states ". . . If the utility contribution exceeds 1mA RMS then the utility shall commence action within 2 business days to reduce the utility contribution to 1 milliampere or less . . . Etc, Etc.
- Current exceeding 1 milliampere is (1) in the water, (2) in the concrete stalls, and (3) in the air at the Szymanski farm and home yard.
- All three sources of RF Illness must be fixed promptly according to Michigan Laws promulgated by the MPSC docket Case No. 13934 (2006).

Figure 2 displays voltage in the milking-parlor stall from the metal plate on a wet floor with 220 pound weight on the plate.

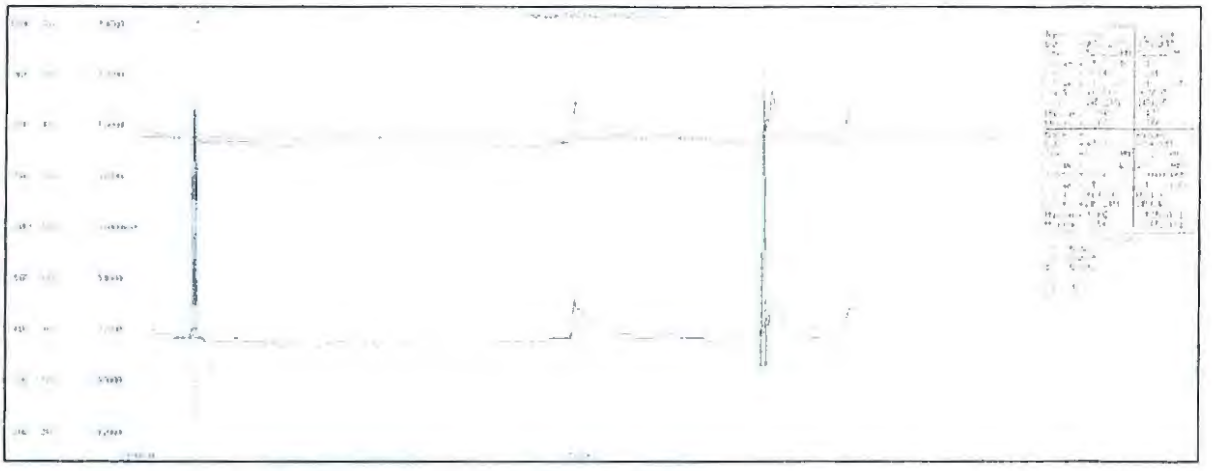


Figure 2. Szymanski Farm: Milking Parlor Cow-Stall Floor – Voltage spikes (blue) 5.12 Vrms; V p-p (green) 15.56 V p-p; V dc (red) -3.76 Vdc, smaller peaks -0.97 Vdc. Voltage was measured from 4" x 4" aluminum plate on wet floor with 220 lb. weight on plate – Fluke Oscilloscope to ground. Holsteins are sensitive to peak-to-peak currents, not RMS or "peak" values (Aneshansley, ASAE Paper 99-3152, Ontario, Canada, July 18-21, 1999).

- Note that the spikes accounted for 5.12 Vrms , -0.97 to -3.76 Vdc, and the spikes occurred simultaneously with the spikes of 16 Volts peak-peak.
- Using Ohms Law: Circa 16 Vp-p/500 Ohms = 0.032 Amps x 1000 = 32 milliAmperes.
- Current in milking-parlor stalls was 32 times the 1 mA actionable limit provided by MPSC. In fact the cows at Szymanski's dairy are immersed in "Actionable" current almost everywhere in the cow barn.
- Cows are responsive to peak-to-peak currents rather than RMS or peak values as demonstrated by Aneshansley et al, ASAE Paper 99-3152.

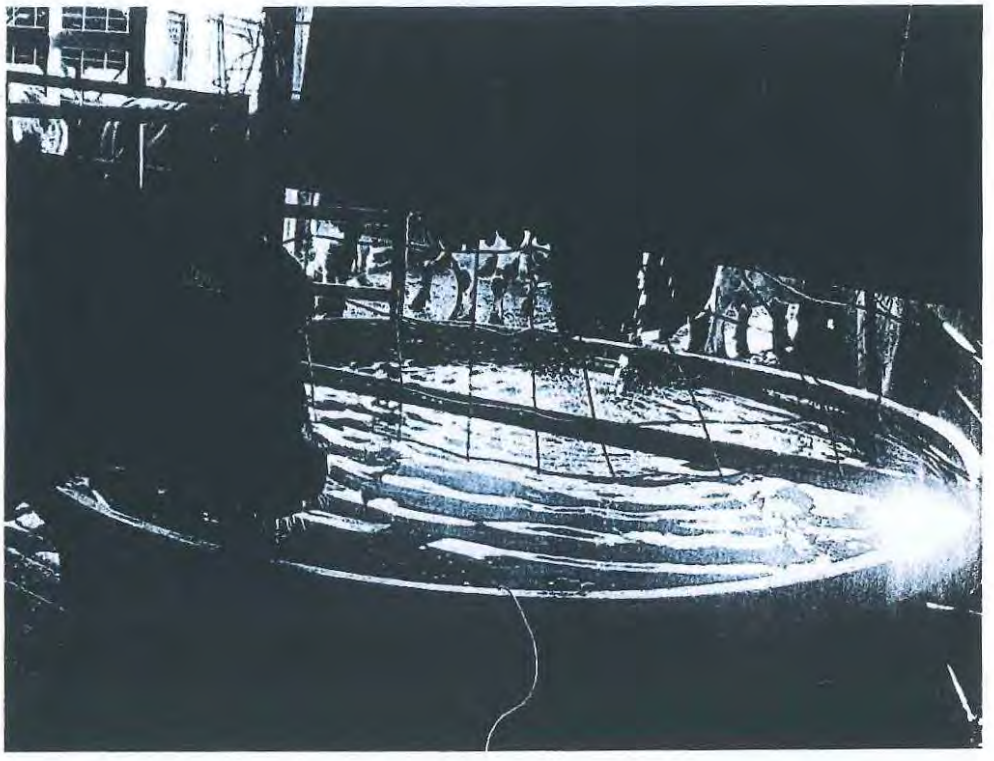
CONCLUSION:

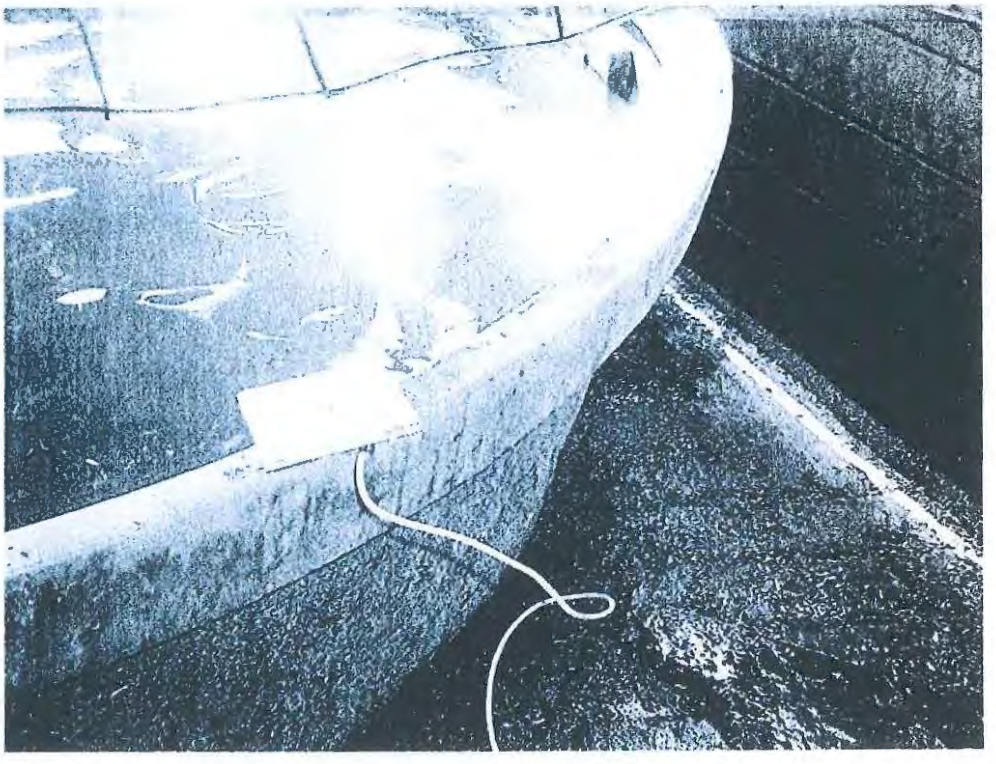
Extraneous electrical current (current in places it should not be) greatly exceeded MPSC actionable levels at John Szymanski's dairy farm and is at levels

that cause impaired immune response to cattle accounting for loss of over 100 head of cattle and large amounts of milk within the last year.

Secondly, the electrical exposure places family members and employees at extraordinary risk of health impairment caused by electropathic stress to both animals and man.

Considering the large amount of current being deposited into the earth at the Szymanski premises, mitigation will require expanding the size (diameter) of the neutral wire to carry the residual current back to the substation. TEC engineers can solve the dumping of unwanted current on the Szymanski premises or they can hire consultants to prevent the electrical interference at Szymanski farm. TEC, also, needs to determine the source of dc current that was found in the drinking water and milking stalls.



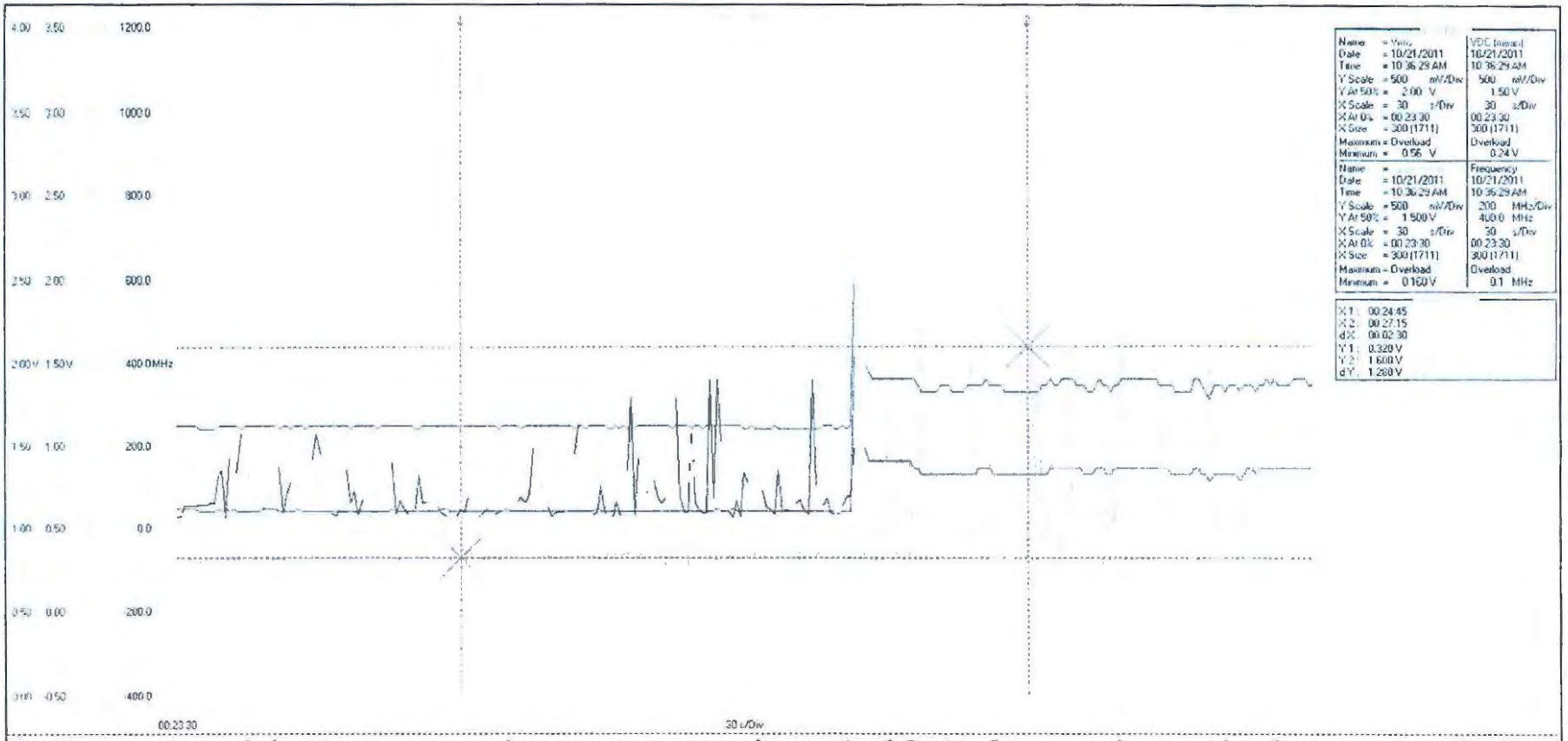


Aluminum Plate Electrode in Water Tank 1

Electrical Testing—Al and Mary Nichol Farm

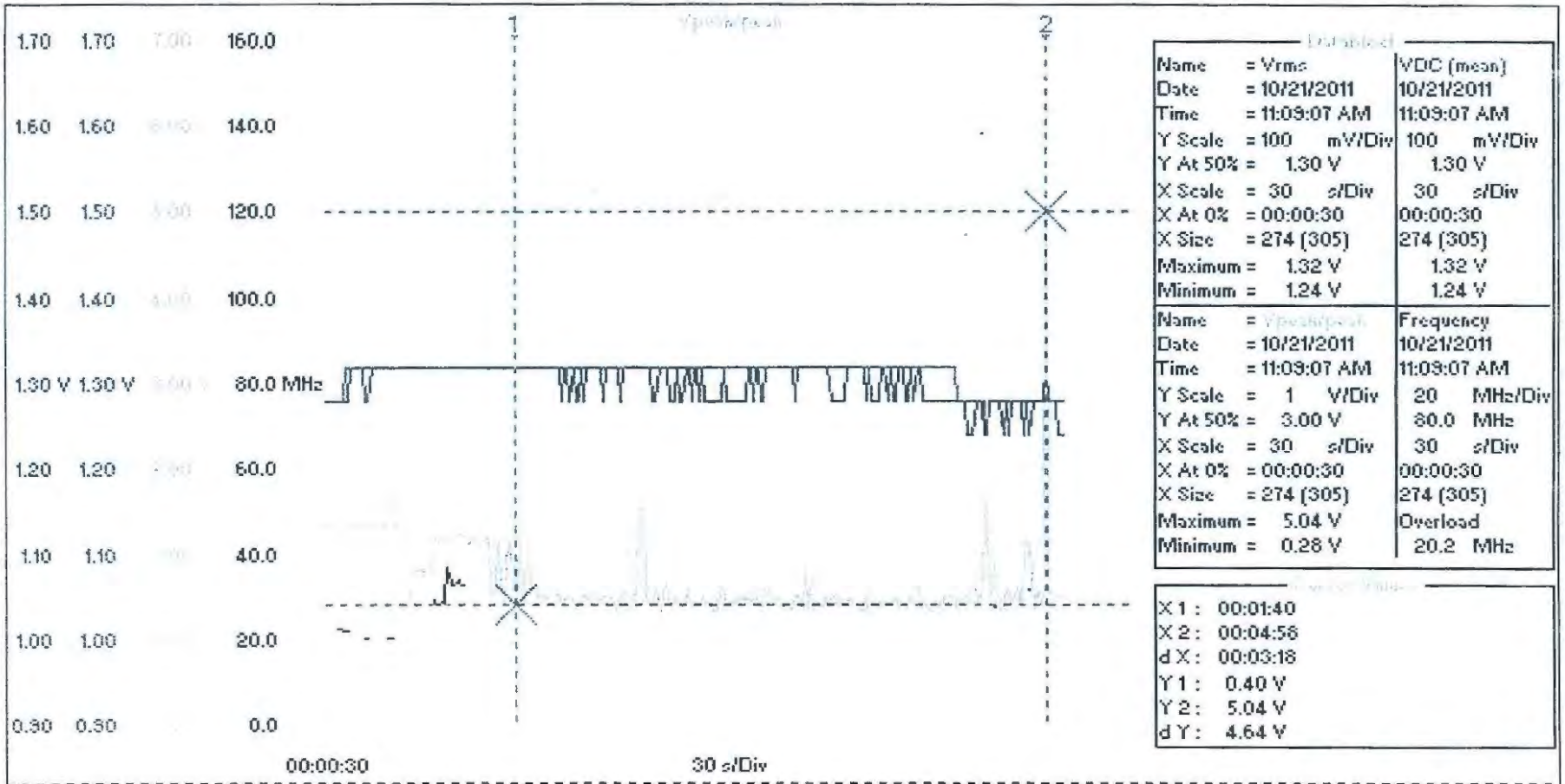
December 7, 2011

1. Under Power line west of house between poles—5 milliGauss (TriField)
2. On Primary Neutral to Ground, pole beside service entrance—0.020-0.030 Amperes. (Instrument: Craftsman Professional Ammerter Model 82364)
3. On PN-ground pole beside service entrance 1 Ohm resistance
4. On wall 120-V outlet in garage 40-50 GSU with Stetzer-Graham microsurge.

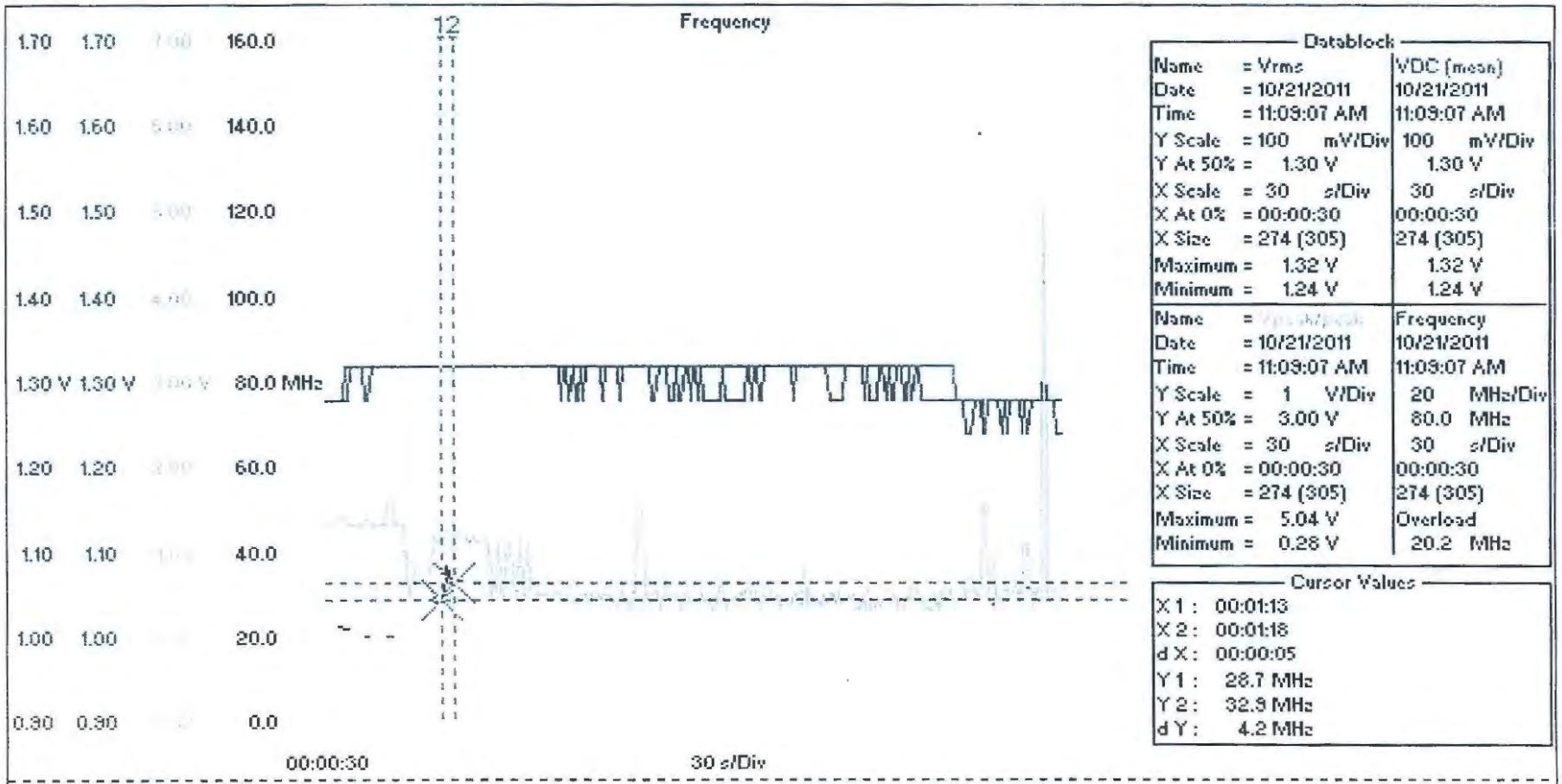


J&C Szymanski Farm: Cow's Water Tank-- 1.28 Volt-peak-peak from Aluminum Plate Electrode immersed in water tank to Reference Grd-to-Earth 1/9/12

EXHIBIT 4



J&C Szymanski: Cow's Barn Floor: 4.64 Volt-peak-peak AL plate-Ref Grd
1-9-2012. Ammeter clamp registered 0.03-0.04 Amps (30-40 mA) 11:00 A.M.



J&C Szymanski: Cow-Contact Barn Floor Voltage Frequency 4.2 MHz (RF) to Overload & 4.64 Vp-p 1/9/2012, 11:03 A.M. Overload means: the frequency exceeded the range shown on the scale (160 MHz, radiofrequency).

Electrical Report 4: John & Carol Szymanski Dairy Farm, 1/16/2012

Donald Hillman, Ph.D., and Louis R. Hillman, M.S.

Summary: We measured voltage, frequencies, and current on the utility power supply and at cow-contact locations on the John and Carol Szymanski dairy farm on 1/9/2012, then the utility made changes at the transformer after we had left the farm. The utility notified the Szymanski's that the numbers were lower and the problem was fixed. Our purpose for measuring 1/16/2012 was to determine whether the 50-60 milliamperes (mA) of current we had found in the cow's drinking water and barn floor previously had been decreased to 1 mA or less as required by the Michigan Public Service Commission.

Our data from 1/16/2012 reveals that the current remains too high and the radio frequency electrical interference continue to proliferate and exacerbate the decreased milk production and increased health problems on the farm. Since the same radiofrequency current was at dairy farms on the same distribution system, installation of a Shielded-Neutral Isolation Transformer at the apparent source of the induced rf current, a radio transmission tower near TEC transmission lines, just South of the Corner of M-46 and Frieberger Rd., or at each of the customers served by TEC may be the proper mitigation. Other sources may also be providing the high-frequency current. TEC will be familiar with such rf customers which may include wind-tower, AC/DC/AC Switch mode power suppliers.

Procedures

We arrived on the Szymanski farm about 9:30 A.M. and had two oscilloscopes ready for measuring before 10:00 A.M. An oscilloscope that measures frequencies of voltage and current was necessary to accurately access the impedance of cattle to electrical exposure because cow impedance decreases and current (amperes) flowing through the cow increases as frequency, e.g., Hz, cycles per second of the electrical current, increases.

Therefore, low voltage current oscillating at power line harmonics, which are multiples of the nominal 60-Hz voltage and radiofrequency energy induced on the power lines by switch-mode electronic devices, such as cellular phone transmitters, deposit large amounts of AC harmonics and DC, i.e., direct current on the neutral wire, when generating radio frequency communication signals. Utilities also use high-frequency signals on the power lines to control various switching devices to balance loads on lines and capacitors to maintain voltages within certain limits.

Release of voltage from a capacitor or other switch-mode device can cause a spike (or frequency) in power-line voltage and cause the cows to receive a shock. If the spike is composed of power-line frequencies > about 1 kHz, or radiofrequency, the cow may receive a harmful shock without feeling the shock (Aneshansley et al, ASAE, 1990, 1995). Cows,

EXHIBIT D

laboratory animals, and humans are known to develop an "opioid behavior" meaning more docile and oblivious to the environment after prolonged electrical stress because dopamine increases in neurons in the brain and can be measured in the urine (Milham, 2011; Buchner and Eger, 2011; Brown et al, 1991).

We used hand-held clamp on ammeters and True rms voltmeters to be sure we captured the distorted, nonsinusoidal voltage and current riding on the 60-Hz waveforms discovered on the TEC power lines (Zimmerman, Martin, and Szymanski, 2011-12) and at cow contact locations.

Results

Current on the Transformer pole Primary-Neutral down ground near Argyle road was 0.10 amperes (100 mA) at 9:30 A.M. and 0.110 A (110 mA) a bit later.

Current on the Transformer pole Secondary-Neutral was 0.01 A (10 mA) at the first reading and 0.040 A (40 mA) at the second reading, ca 11:00 A.M.

Current on the secondary wire near the service entrance pole copper-braid ground wire below the newly installed Watt Meter was 0.92 A (920 mA) on Primary side and 0.57 A (570 mA) at about 10:15 A.M.

The above currents were all deposited into the earth, where buildings, cows, calves living in huts a few feet away, and people in the return path are part of the resistance for currents to return to the substation several miles distant. The above 2.15 Amps per second energy should be returning on the neutral wire.

Current in the air under wires between poles in front of the barn registered 5-8 mG (milliGauss) at head height.

Radiofrequency current with the Graham-Stetzer Microsurge meter plugged into a 120-V outlet in the milk house registered 122-129 GSU, which is a measure of radio-frequency voltages > about 4 KHz on the power lines. The GS Units decreased to ca 70 later in the morning.

Cow contact current flowing in the water tank using a 4"x 4" aluminum plate as electrode in the water was 0.010-0.020 A (Amperes), i.e., 10-20 mA. Including a 470-Ohm resistor in the test circuit reduced the current flow to about ½ of the above values. However, oscilloscope readings of voltage and frequency of cow-contact current indicated that the currents were composed of radiofrequency voltages that resulted in overload of the oscilloscope. The fundamental frequency was 22.64 MHz and frequency doubled with each additional harmonic. The fundamental frequency was identical on the Fluke 96B and the new Fluke225C Scopemeter.

Current on the barn floor, using the plate weighted with a booted foot of a 200-lb man connected to the oscilloscope, carried 0.020-0.030 A (20-30 mA) where the cows were standing about 6 feet from the water tank between 1:00 P.M. and 2.00 P.M.

The cows were refusing to immerse their muzzles into the water contaminated with electrical current, would lap at the water with their tongues, and would not drink adequate water for high-level milk production and normal health, as we have observed previously.

The tissue impedance of power-line harmonic voltage decreases as frequency increases, i.e., currents from whole number multiples of the fundamental 60 Hz, e.g., 3rd Harmonic (180 Hz), 5th^h Harmonic (300 Hz), and 7th Harmonic (420 Hz), were associated with childhood Leukemia in Denver, Colorado (2002). And Triplen harmonics which are multiples of the 3rd harmonic and odd numbered multiples of the 3rd, e.g., 9th and 15th, etc, and radio frequency currents were significantly associated with decreased milk production in Midwest dairy herds; high-frequency currents must not be ignored in the living environment.

In Figure 1, the Frequency Spectrum of Neutral Current offers a perspective on the accumulation of current from 63 milliVolt contribution from the 22.64-mHz Fundamental Frequency to 17,900 mV (17.9 V) total Peak-peak, 2101 mV RMS, and 1403 mVDC. Total Harmonic Distortion 99.91% (THDr) and 2399.93% (THDf) indicate those high frequencies are distorting the 60-Hz waveform (attached).

References:

Aneshansley et al. 1995. Holstein Cow Impedance from Muzzle to Front, Rear, and All Hooves. ASAE Paper 95-3621, ASAE, 2950 Niles Road, St. Joseph, MI.

Aneshansley et al. 1990. Complex Electrical Impedance of Cows and Significance. ASAE Paper 90-3509., ASAE, 2950 Niles Rd., St. Joseph, MI.

Aneshansley, D. J., and R. C. Gorewit. 1999. Sensitivity of Holsteins to 60 Hz and Other Waveforms Present on Dairy Farms. ASAE, Niles Rd, St. Joseph, MI.

Buchner, Klaus, and Horst Eger. 2011. Changes of Clinically Important Neurotransmitters under the Influence of Modulated RF Fields – A Long-term Study. Original in German, Umwelt Medizin-Gesellschaft 23(1):44-57. Published on-Line 8/1/2011.

Hillman, et al. 2003. Relationship of Electrical Power Quality to Milk Production of Dairy Herds, Paper No. 03-3116, ASAE annual Meeting Las Vegas, NV. ASAE, 2950 Niles Rd., St. Joseph, MI.

See Complete List of References provided to Sanilac Health Department, July 2011.

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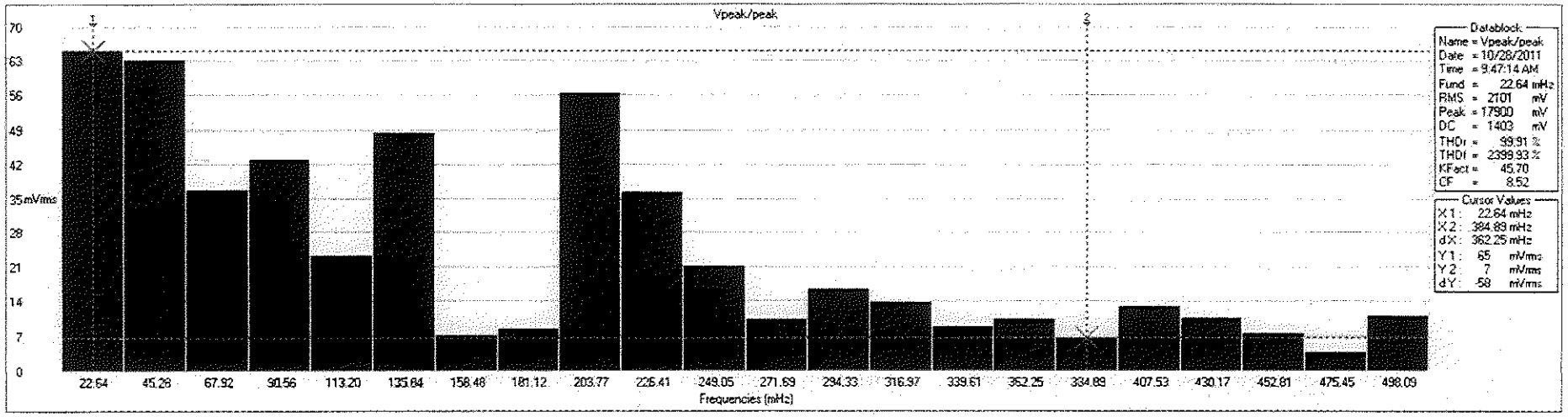

Figure 1. Szymanski Frequency Spectrum – mVolt at mHz: Datablock shows Fundamental Frequency = 22.64 mHz; RMS = 2101 mV; Peak-Peak = 17,900 mV; DC = 1403 mV; THDr (Total Harmonic Distortion) = 99.91% (% of 60-Hz Voltage Distortion); THDf (Total Harmonic Distortion/Frequencies) = 2399.93% (Reference: Barry Kennedy, Power Quality Primer, 2000, McGraw-Hill, Chapters 1-6.

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Report of Electrical Investigation, John and Carol Szymanski Dairy Farm January 9, 2012

Donald Hillman, Ph.D., and Louis R. Hillman, M.A.

We arrived at the Szymanski Farm at 9:30 A.M., January 9, 2012, and were present when Thumb Electric Cooperative, Inc. Technicians arrived at about 10 A.M. as we were advised by TEC Manager, Dallas Braund, and requested by Dale Cubitt, Legal Counsel in behalf of John and Carol Szymanski, via telephone January 4, 2012.

Our purpose was to observe Testing by TEC Technicians which they described as according to Michigan Public Service Commission Rules. While being careful to avoid interfering with TEC testing, we collected short-term measurements to compare with data we had collected at the Szymanski farm 6/17/2011 and 12/07/2011.

Procedure:

Three instruments were used to determine voltage, frequency, current, and magnetic fields at the Szymanski farm. An oscilloscope, Fluke 96B ScopeMeter, 60 MHz, was set up on a table in the milk room and attached to the Primary Neutral-to-Ground wire in the distribution panel (breaker box). Clamp-on ammeters measured current at Primary and Secondary down grounds on the pole next to the new Watt-meter installation, from a 4" x 4" aluminum plate electrode immersed in the water tank, and from the floor in the free-stall barn. A TriField 10xE Gauss meter (Alpha Lab, Inc.) measured electromagnetic fields in the air surrounding the Watt-meter and the power line wires at various locations.

Results:

Primary Neutral-to-ground from the transformer pole carried 1.2 Amperes (A) at 9:30 A.M. Primary Neutral-to-ground from the transformer pole carried 0.92 A at approx 11:00 A.M. **Secondary down ground on the opposite side of the pole** carried 0.96 Amperes at 9:30 A.M Secondary down ground on the opposite side of the pole carried 0.90 A at approx 11:00 A.M. Service entrance down ground 0.150 A (150 mA) at 12:30 P.M.

Water Tank in barn carried 0.03 - 0.04 A (30 - 40 mA) from electrode in tank to barn floor -- Cows were lapping at water but reluctant to drink the electrified water.

Free-stall barn floor about six feet from water tank: alum plate-to-meter-to-floor carried 0.03 - 0.04 A (30 - 40 mA). Frequencies ranged from 60 Hz to 4.17 MHz

Cows were standing in an electromagnetic field: 8.04 -.10.72 V (268 Ω cow impedance; or 15 to 20 volts according to MPSC Rule 460.2707(2) (ii) and (iii) 500 Ω cow impedance calculated using Ohms Law: E = IR, or I = E/R.

The current limit to require a Utility to fix the electrical problem is 2.0 milliAmperes from all sources (Rule 460.-2701 (n), or 1 mA from the utility contribution; then the utility shall commence action within two business days … to reduce the utility contribution to 1 milliAmp or less R-460.2703 Rule 3 (1) (2) and (3).

Feeder Pole down-ground beside Argyle road: One-side carried 0.21 A (210 mA).
Feeder Pole down-ground beside Argyle road opposite side carried 0.04 A (40 mA).

Graham-Stetzer Microsurge Meter when plugged into 120-V outlet in milk house: 340 to370 GS Units. This is a measure of high-frequency millivolts greater than approx 4 kHz, and corresponds to the Mega Hz currents recorded by oscilloscope and a true rms voltmeter.

Magnetic Fields Measured in the air with TriField Gauss Meter:

Service Entrance Near new Watt Meter: >100 milliGauss (needle passed 100 mG scale).
Under Power Line -- Driveway to barn: 7 - 8 mG at head height.
Under Line in front of Szymanski Home: 8-10 mG at head height:
Below Line on neighbor's lawn: 6 - 8 mG head height.

Current on Neighbor's pole near road down ground: 0.03 - 0.04 A (30 - 40 mA) & 0.02 - 0.03 A.
Current on Neighbor's pole near road Guide Wire: 0.02 - 0.03 A.
Voltage on Neighbor's pole near road Neutral-Ground: 0.334 - 0.381 Volt.
Voltage on Neighbor's Guide Wire: 0.016 to 0.018 volts (16 - 18 mV)

Conclusion:

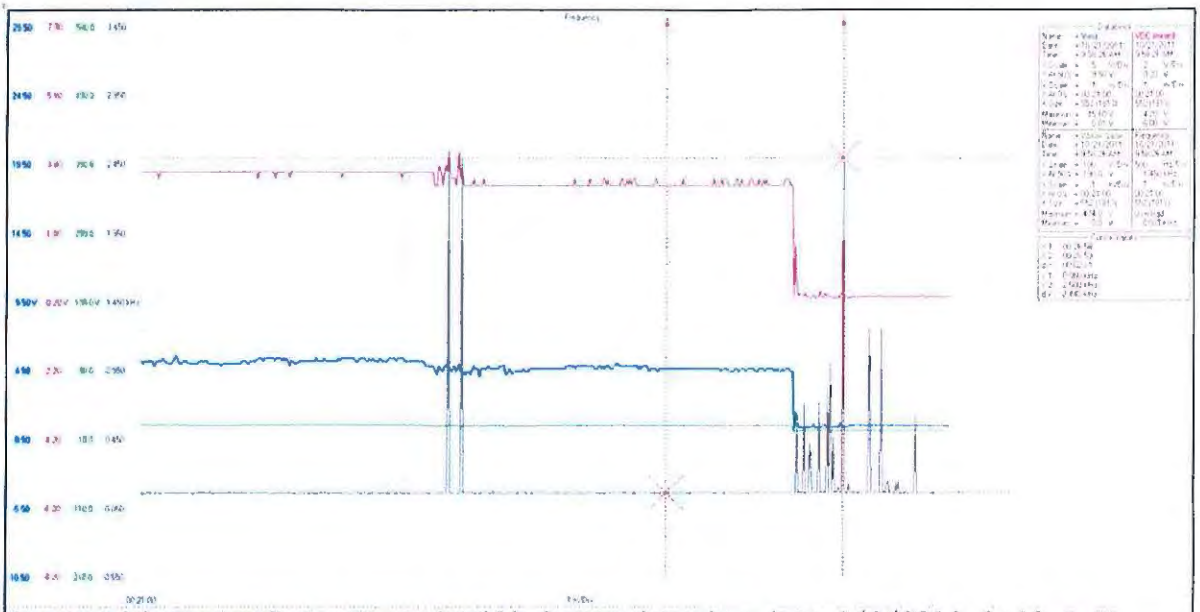
Extraneous electrical current (electricity in places where it should not be) in the cows water supply and on the floor in the barn was 30 to 40 times that permitted by Michigan Public Service Commission Rules. The electrical problem includes radio frequency (RF) currents riding on the 60-Hz waveform and distorting the nominal 60-Hz waveform. The utility failed to use power quality instruments that would measure the high-frequency current.

The poor quality current is little different than when we measured it using oscilloscopes and ammeters six months earlier, 2 months ago, again December 7, 2011, and today, January 9, 2012. The utility should fix the problem now. Any further testing delay and MPSC hearing will simply continue to deprive the Szymanski's of their **just**, expected income and happiness from the dairy business.

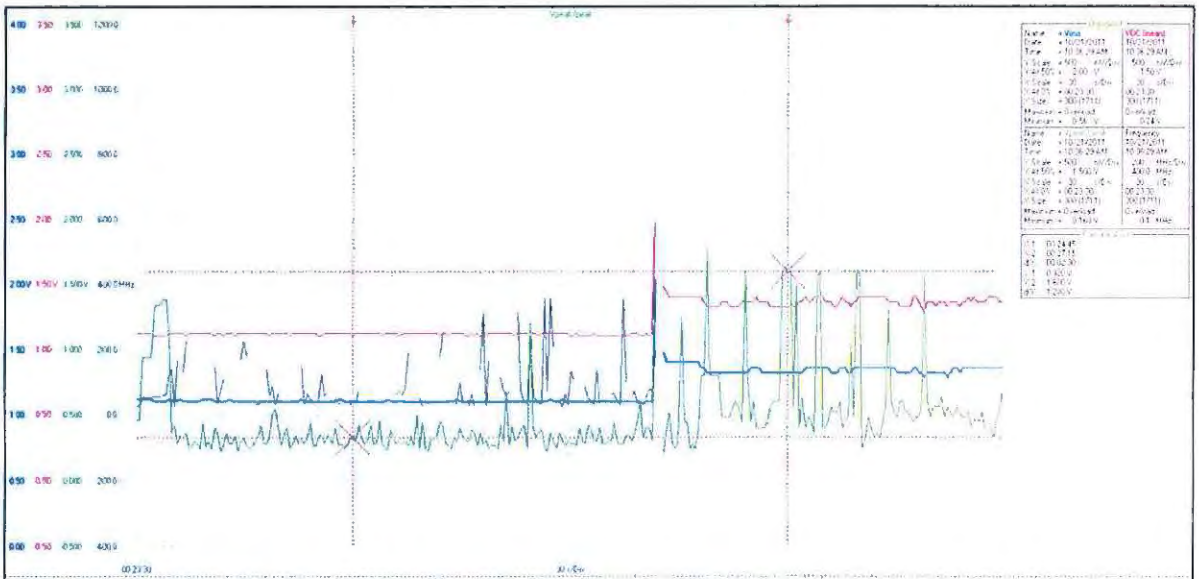
Signed:

Donald Hillman

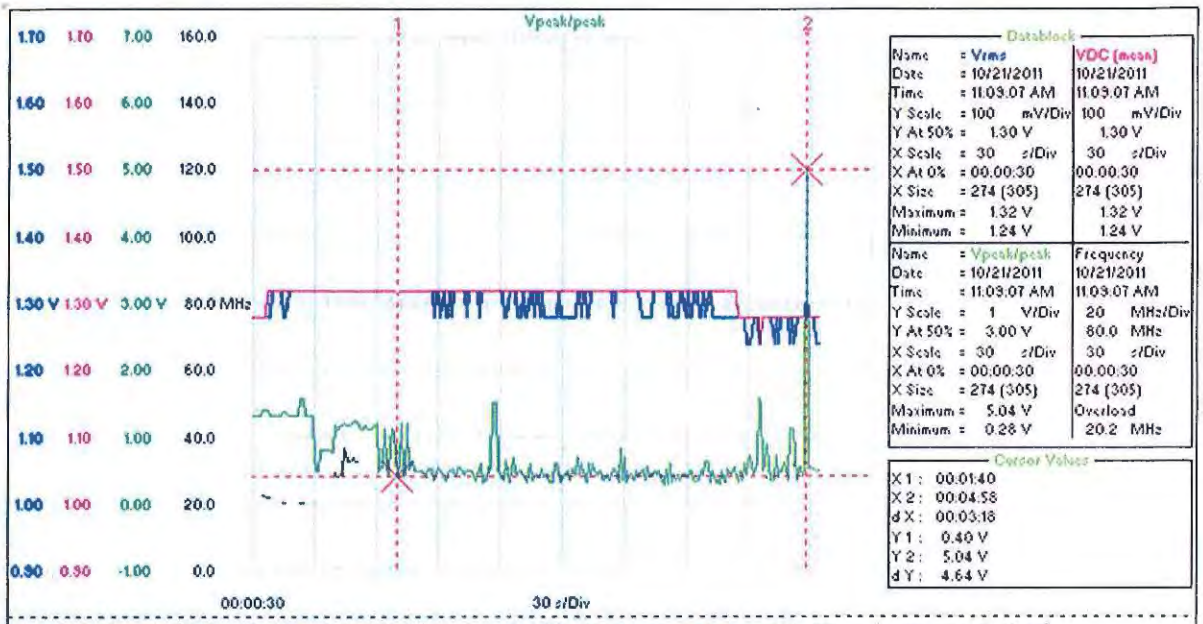
Donald Hillman, Ph.D.



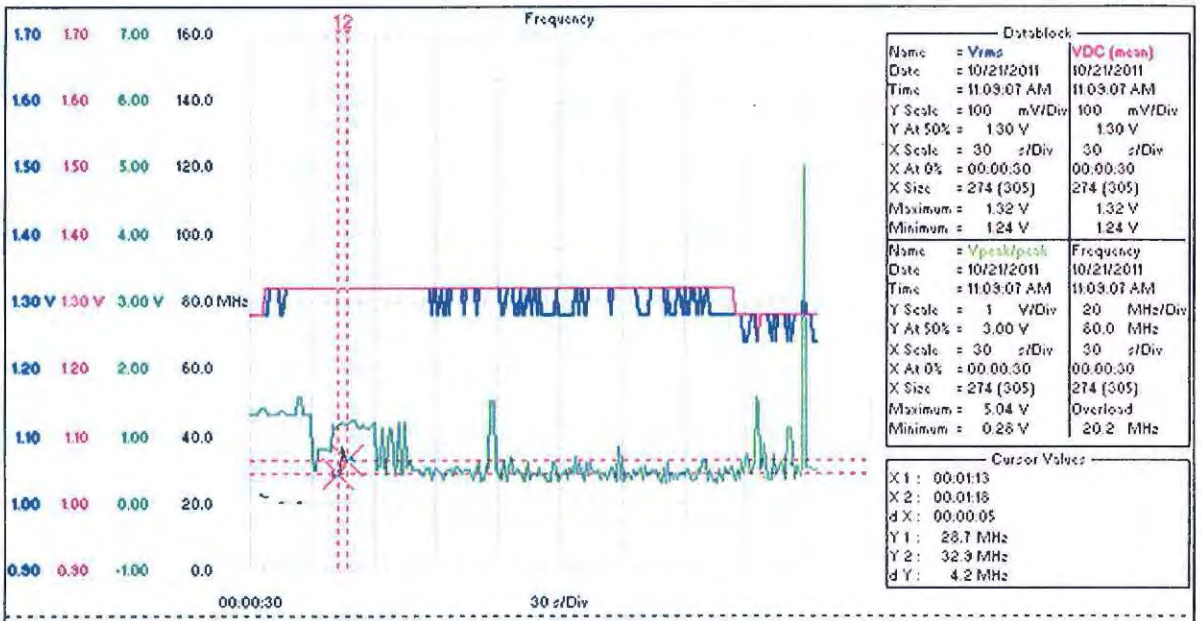
Szymanski Neutral-to-Ground,Milk house breaker-box 1/9/2012 9:40 A.M.



J&C Szymanski Farm: Cow's Water Tank-- 1.28 Volt-peak-peak from Aluminum Plate Electrode immersed in water tank to Reference Grd-to-Earth 1/9/12



J&C Szymanski: Cow's Barn Floor: 4.64 Volt-peak-peak AL plate-Ref Grd 1-9-2012. Ammeter clamp registered 0.03-0.04 Amps (30-40 mA) 11:00 A.M.



J&C Szymanski: Cow-Contact Barn Floor Voltage Frequency 4.2 MHz (RF) to Overload & 4.64 Vp-p 1/9/2012, 11:03 A.M. Overload means: the frequency exceeded the range shown on the scale (160 MHz, radiofrequency).

To: H. Dale Cubitt, Attorney and whoever it may concern
Cubitt & Cubitt, Attorneys at Law
186 East Huron Avenue
P.O. Box 178
Bad Axe, MI 48413-0178

From: Donald Hillman and Louis R. Hillman, Investigators

Report of Electrical Findings at the Farm and Home of John and Carol Szymanski, July 31, 2013

John Szymanski requested that we revisit his farm and bring an oscilloscope to confirm recent observations which he had made with a Fluke 79 III Voltmeter, a G-S Meter (Graham-Stetzer Microsurge Meter), and an Alpha Lab TriField Gauss Meter. We had found that Primary Neutral-to-Ground electricity on the premises was widely variable and was related to changes in milk production as we reported in communications with Attorney Dale Cubitt (6/17/2011, 12/07/2011, 1/9/2012, and 5/23/2013, plus a report of the Szymanski farm recorded by Dave Stetzer on 10/30/2012).

In a letter and report to Mr. Cubitt (March 8, 2012) from Dallas Braun, General Manager of Thumb Electric Cooperative, according to Mr. Braun, no extraneous cow contact voltage or current was found by TEC Engineering Technicians Allen Rutkowski and Brandon LeGault, Operations Supervisor. Mr. Braun apparently is unaware that the Power Monitors Inc., **one minute average** (page 1) at the animal contact locations is a faulty reading that measures nonsinusoidal distorted waveforms with 25-50% less voltage/current than True RMS meters, according to Barry Kennedy's *Power Quality Primer*. We will have the Engr Techs explain that method to the Judge and Jury. They will claim it is prescribed by MPSC Rules; and that is the problem. I am asking the Legislators to enter a bill to correct the MPSC Rules or to repeal them completely. Our finding of 30 mA in the water tank on June 13, 2011, was before any wires had been cut. The problem was already there. The cows were refusing to drink, the cows were down in milk, and many cows were already lost. We noted in that report that the Ronk Blocker failed to prevent the voltage surge from appearing on the Szymanski neutral wire when the neighbor started his silo unloader and other loads. The magnetic field (20-25 mG) under the lines near the houses were unsafe per OSHA in our report.

Mr. Szymanski reported that milk per cow per day had decreased from 71.7 to 52.4 pounds per cow per day at 150-day DHIA test-day average and cow numbers had decreased from 220 cows to 177 cows, at Szymanski's farm where many cows have died. We had visited the farm home May 23, 2013, and observed that the Graham-Stetzer Microsurge readings in the kitchen and living room wall 120-V outlets were 180-190 G-S Units, high as reported by Stetzer and by us previously. So, we brought Stetzerizer filters to test the effect of installing

the frequency filters at the highest outlets and to measure their effect on current released at the house, at the milking parlor, and in the cows' drinking water.

On July 31, 2013, we arrived at the farm at about 8:30 AM, while the farm crew was still milking. We used the Fluke 225c 200 MHz Oscilloscope, a G-S Meter, a Fluke 801-500s AC Current Probe, a Craftsman clamp-on Ammeter (No. 82364), and an Alpha Lab, Inc., TriField Gauss Meter.

In preliminary testing without the filters we recorded 100-150 mV (milliVolts) on the outside wall of the milk house and touching the milk tank on the outside of the milk house, using the Fluke 79 III Voltmeter. Using the G-S Meter we recorded 67 G-S units at the 60-Hz outlet in the milk house. Previously we had measured 966-1021 G-S units at the same location (5/23/2013). The Utility down ground at the pole was 80-90 mA (milliAmperes) and 30-40 mA, while the copper-braid ground was 1.37-1.38 Amperes, and at the cows' drinking water tank we measured 10 mA, using the Craftsman clamp-on Ammeter. Under the wires next to the Road, at head height was 10-15 mG using the Alpha Lab, Trifield meter. All of above measurements were immediate while the milkers were operating. There was considerable variation in the electrical readings.

We measured Secondary N-G from the Electrical Distribution Box at the milk house as in Figures 1 and 2. Then, after replacing the oscilloscope leads with 100 feet of Ethernet Cable (BNC), we proceeded to measure voltage from the floor of the milking-parlor, and from the water tank from which the cows were expected to drink.

Figure 1 shows Secondary Incoming Voltage measured 0.1 Volt, with spikes accounting for additional 2.5 Volts.

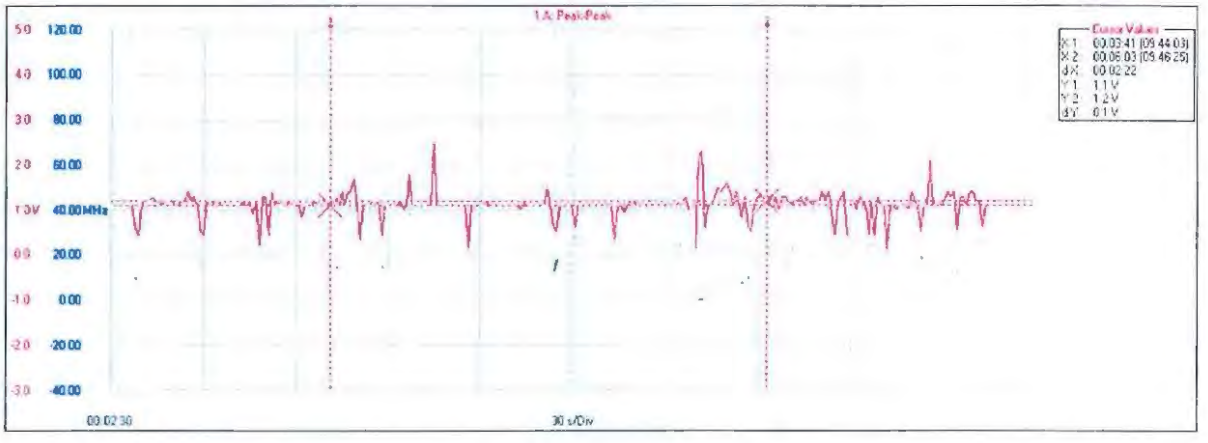


Figure 1. John Szymanski Farm: 0.1 V +/- 2.5 V spikes; Frequency = 40 MegaHertz (not 60 Hz) at Secondary Neutral–Ground Distribution Panel, Milker operating (9:48 a.m., 7/31/2013), Fluke 225c Oscilloscope reading.

Figure 2 shows an increase of Secondary Incoming Voltage -0.2 V plus 3.8 V spikes, and Frequencies equal to 20 MegaHertz, not the 60 Hertz as described by TEC, Inc.

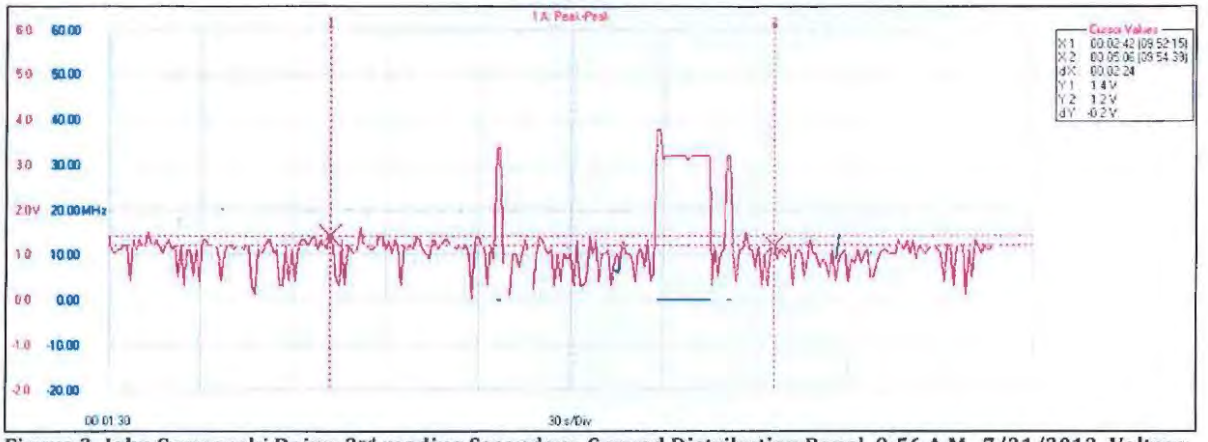


Figure 2. John Szymanski Dairy: 2nd reading Secondary-Ground Distribution Panel, 9:56 A.M., 7/31/2013. Voltage average -0.2 V + 3.8 V spikes; Frequency = 20 MegaHertz (not 60 Hz), Fluke 225c oscilloscope reading.

Figure 3 shows that Voltage was -0.1 V on the floor of the milking parlor and increased circa 6.0 V each of three times the milking machine pump was started.

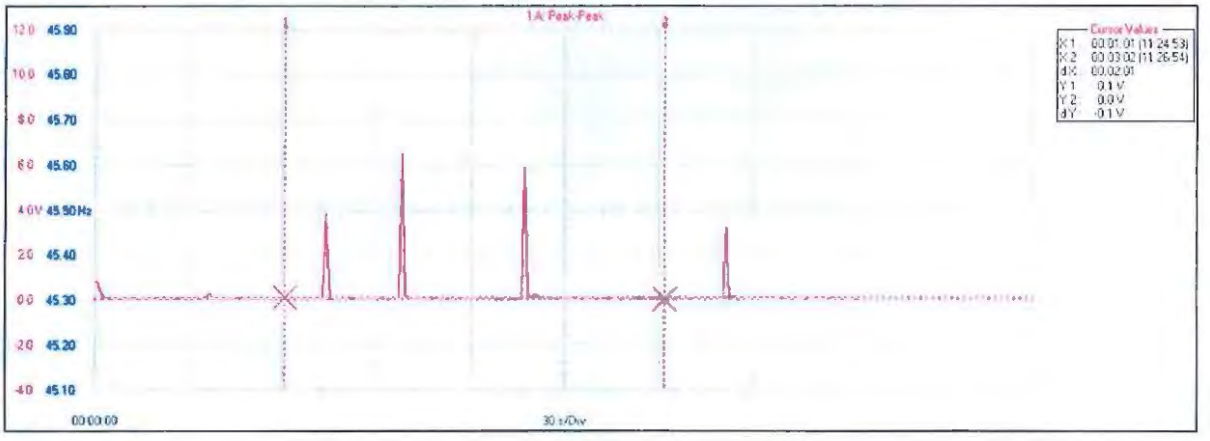


Figure 3. John Szymanski Dairy: Milking Parlor Floor – Cursor Value -0.1 V and spikes exceeding 6 V when the vacuum pump was turned on 3 times. Frequencies were abnormal as well (11:28 AM, 7/31/2013).

OUR EXPERIMENT

We installed Graham-Stetzer (G-S) Filters as necessary to reduce Frequency to less than 30 G-S units in each of the 120-V outlets in the House that exceeded 30 G-S units. These were on the north end of the west wall in the Living Room 325 G-S units and 92-95 G-S units at four other locations in the house, including the upstairs and to some outlets in the barn.

Figure 4 shows Voltage on Cows Drinking Water was 0.0 V at 10:56 AM, 7/31/2013. Frequency was returned to 60 Hz after installing G-S "Stetzerizer" filters in the "hot spots" identified in the house and some in the barn.

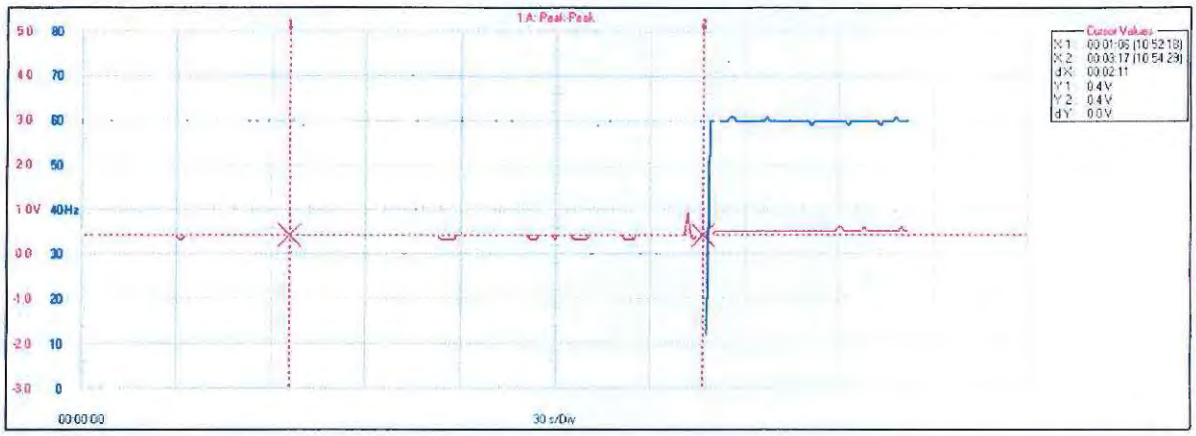


Figure 4. John Szymanski Dairy: Voltage on Cows' Drinking Water Tank was 0 V at 10:56 AM, 7/31/2013. Frequency was returned to 60 Hz after installing Graham-Stetzer (Stetzerizer) Filters at the house and barn. Note: Frequencies changed from about 11 to 60 Hz using Fluke 225c for measuring.

Figure 5 shows ZERO, 0.0 Voltage on Cows Drinking Water at 12:27 PM, 7/31/2013, after installing Graham-Stetzer (Stetzerizer) Filters at the house and elsewhere that registered greater than 30 G-S units of high-frequency electricity.

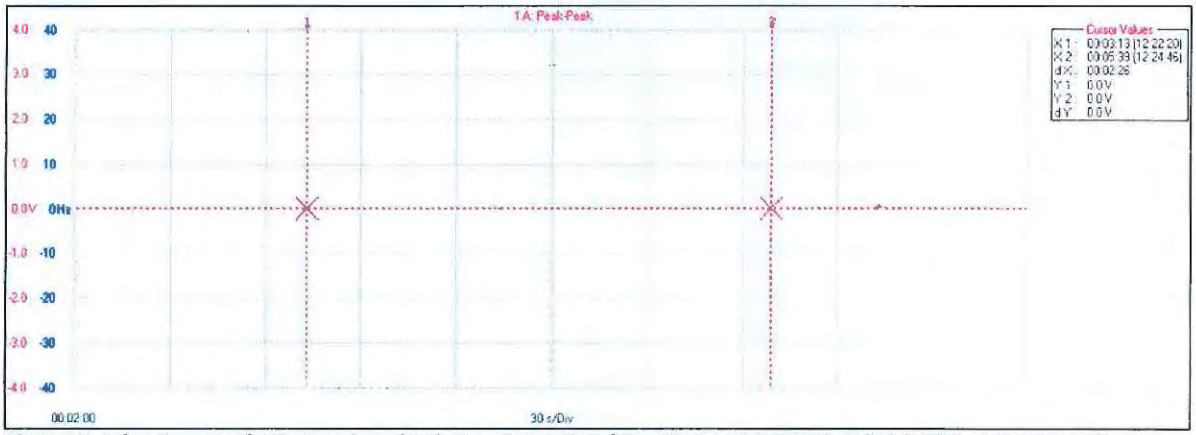


Figure 5. John Szymanski Dairy: Zero (0.0) V on Cows Drinking Water, 12:27 PM, 7/31/2013. After installing Graham-Stetzer (Stetzerizer) Filters at the house where Graham-Stetzer Microsurge Meters registered 384 to 89 G/S Units and at the barn where G/S Units had been recorded at 966-1021 previously.

Figure 6 shows a Black Light FLUORESCENCE in the cows' drinking water at Szymanski farm. It was photo copied from shining a Phillips 75 Watt 120 V Blacklight A19 into the water tank. While we attach no new significance to the observation, the fluorescence seen in the water was noted in a report by Emilio Del Giudice and Livio Giuliani in "Coherence in water and the kT problem in living matter," Eur. J. Oncol. – Library Vol.5, Bologna, Italy, 2010.

Figure 6. John Szymanski Dairy: Photocopy of fluorescence in water from Blacklight pointed at the water.

DISCUSSION

Electrical readings at various locations at the farm and home decreased significantly after Graham-Stetzer filters were installed at all locations of 120-Volt outlets containing greater than 30 G-S units of microsurge electricity, mainly at the house and some at the barn. The change in G-S units had not been read by employees of Thumb Electric Company, and apparently are the only changes in electricity observed at the farm and home. Medical examination of Mr. Szymanski and other members of his family have revealed hypertension and other disturbances not readily explained.

Our finding is consistent with the finding of Verne Lanphear, who reported to the Michigan Public Service Commission in U-17000, # 236, that he had measured the radio frequency in a child's (now his step-grandchild's) play room from a 120-V outlet on the inside wall where a Smart Meter had been installed by Detroit Edison Co (DTE). Using a Graham-Stetzer meter he determined that the G-S units fluctuated between 462 and 691. In the child's bedroom next to the playroom, the readings were 660-771 GS units. The child became ill and her thyroid had become totally inactive according to medical authorities at Beaumont Medical Center in Detroit. Verne installed seven Graham-Stetzer filters throughout the house which reduced the G/S units to less than 30 at all locations in the house in Ferndale, MI. The Utilities' claim, that Smart Meter emission is not harmful to humans and animals, is not valid. Photographs of the microsurge readings taken at the child's home before and after the filters were installed follows:

Readings before filters were installed.

Readings after filters were installed.

Verne had also measured the current with an Alpha Lab, Inc., Trifield Gauss Meter, at that time and the reading exceeded 100 mG (milliGauss). The child, who was suffering from thyroid deficiency, is now receiving thyroid medication and is greatly improved. Verne himself was involved in two Stray Voltage cases and is being treated for thyroid cancer.

The Verne Lamphear report was entered as an Affidavit by Donald Hillman in Oakland County Circuit Court in support of a complaint filed by Dominic and Lillian Cusumano relative to Smart Meters affecting Lillian's health. In testimony before the MPSC, DTE's only witness stated that he had never measured the energy disbursed by Smart Meters, and he was using what he had been told by others.

Investigative Reporter, Carolyn Stetler wrote about **The Rise of Thyroid Cancer** in May 2009 (Investigative Reporting, American University School of Communication, Washington DC). She noted that Thyroid Cancer increased at a rate of 6.5% per year between 1997 and 2006, making it the fastest increasing cancer in the United States, according to National Cancer Institute (NCI) data. Medical authorities do not know the cause of increased thyroid cancer, according to Dr. Elain Ron, NCI.

Herbert Dahman et al, in Bioelectromagnetics 30:299-306. 2006, observed in a study of blood values of 132 self-perceived EHS (Electromagnetic Hypersensitivity) patients that the identified laboratory signs of TSH (thyroid dysfunction), liver dysfunction, and chronic inflammatory processes (AST/LST) were significantly different than those for 101 voluntary controls.

A study concerned with assessing the role of exposure to radio frequency radiation (RFR) emitted from either mobiles or base stations and its relations with human hormone profiles, published in the Canadian Society of Clinical Chemists and republished by Elsevier in 2011, showed significant decrease in volunteers' ACTH, cortisol, thyroid hormones, prolactin for young females, and testosterone levels.

Because we found high levels of electricity in the water at the Szymanski farm where the cows refused to drink, we searched the literature and found M. Zadin, a Russian scientist, had studied and developed an interest in the effect of extremely weak magnetic field actions on water. His discovery reported in 2010 in **Non-Thermal Effects and Mechanism of Interaction between Electromagnetic Fields and Living Matter**, an ICEMS Monograph of the Ramazzini Institute edited by Livio Giuliani and Morando Soffriti in the European Journal of Oncology – Library Vol. 5, was that the fundamental physical mechanism of the resonant action of an extremely weak (40 nanoT) alternating magnetic field at the cyclotron frequency combined with a weak (40 mcT) static magnetic field, on living systems. His report was titled: **On Mechanism of Combined Extremely Weak Magnetic Action on Aqueous Solution of Amino Acids**. Others publishing in the Journal concluded: "Living organisms generally are complex systems where a huge number of molecular species interact within a large amount of water. All these components have, in these conditions, configurations quite different from the one assumed when they are isolated."

Interestingly Zadin stated (in1985) that 25 years earlier USA Profs Abraham Liboff (at Oakland University, Rochester, Michigan), and Carl Blackman at the U.S. Department of EPA, had similar findings but had not tested the extremely weak magnetic fields.

As far back as 1957, Albert Szent-Gyorgyi[1] said that biologists were still unable to provide a formal definition of "animated matter" since they limited themselves to study biomolecules to the neglect of the two matrices without which biomolecules cannot perform any functions: water and electromagnetic fields (EMF).

As a matter of fact, by the middle of the last century it has been recognized that a thick layer of "Special water" appears on hydrophilic surfaces reaching a depth of several hundreds of microns.[2] The same result has been reproduced quite recently, in much more detailed way by the group led by Pollack.[3] Since living matter is a dense assembly of macromolecules embedded in water, the ensemble of biomolecules constitutes a huge surface area hydrated by water, so that we can safely assume that biological water would assume the same properties of the "special water" existing near the hydrophilic surfaces. Consequently physical-chemical processes going on in living matter should be considered quite different from those occurring in diluted solutions.[4]

The main properties of this "*special water,*" named EZ water, are:

a) EZ water excludes solutes: hence the name Exclusion Zone (EZ) for the region occupied by such water.
b) Its viscosity is higher than viscosity of normal water
c) It is an electron-donor, namely a reducer, whereas normal water is a mild oxidant: consequently the interface EZ-water/normal water is a redox pile, where the redox potential could have a jump of a fraction of a volt.
d) EZ water exhibits a fluorescent response in the UV region at 2700 Angstroms."

This report may help explain why Thumb Electricity Cooperative, Inc., at Ubly, Michigan, could not find the problem while using inadequate measuring equipment at Szymanski farm.

In addition, our discovery that TEC, Inc and the Michigan Public Service Commission were using meters that would not measure the high frequency current, should be corrected by the Governor. We found that none of four Electrical Contractors in Huron and Sanilac Counties were regularly using oscilloscopes in their business.

The cows' response will be vital to explaining the health and milk production of the dairy herd, and the many years of high-frequency electric current's effect on the personal health of his family and neighbors.

Some 2-months or more may be required for the cows to return to nearly normal if the problem is corrected, according to experience of other dairymen where high frequency current caused destruction of the herd.[5]

CONCLUSIONS

Health and milk production of dairy cattle at the John and Carol Szymanski farm were related to the frequencies of Electric and Magnetic Fields found on the farm. Elimination of the fields by installing Graham-Stetzer Filters filtered most of the EMF. Some time will be required for the cattle to recover as experienced by other dairymen.[5]

REFERENCES

[1] Szent-Gyorgyi A. Bioenergetics. Academic Press, New York, 1957.

[2] Henniker JC. The depths of surface zone of a liquid. Rev Mod Physics, 1949; 21: 322-41.

[3] Zheng JM, Chin WC, Khijniak E Jr, *et al.* Surfaces and interfacial water: evidence that hydrophilic surfaces have long range impact. Ad Colloid Interface Sci 2006, 23: 19-27.

[4] Pollack GH. Cells, gels and engines of life. Ebner & Sons, USA; 2001.

[5] Hillman D, Stetzer D, Graham M, Goeke CL, Mathson KE, VanHorn HH, and Wilcox CJ. Relationship of electric power quality to milk production of dairy herds – Field study with literature review. Elsevier, Science of the Total Environment 447 (2013) 500-514.

EXHIBIT F

Ground Current Investigation on the John Szymanski Farm

David Stetzer

Stetzer Consulting, LLC

Table of Contents

Introduction

In October 2012, I was contacted by Professor Emeritus, Donald Hilman, about going to Michigan and testing the farm of John Szymanski for ground current issues that he felt were negatively impacting the health and milk production of Mr. Szymanski's dairy herd. On October, 29th, 2012, I went to Michigan to take electrical measurements and investigate the claims on the Szymanski farm. This report, resulting from my work at the Szymanski farm, will provide:

1) A brief history regarding the issue of ground currents/voltages,

2) Information from published research on ground currents/voltages in an effort to show that the electric utility had the ability, and a responsibility, to know that such issues existed,

3) Data collected during my testing at the Szymanski farm showing that a ground current/voltage issue is present, and any on farm contributions that appear to impact animal comfort and milk production and,

4) Recommendations to Mr. Szymanski and his electric utility for actionable steps to take to remediate the issues on the Szymanski farm.

I. History

In 1972 there was an oil embargo that forced countries to become more energy efficient. Energy efficient lightning, variable speed frequency drives, electronic motor starters, light dimmer switches, as well as a host of other electronic loads were rapidly being connected to the electrical grid. These devices use current in short pulses that create harmonics and high frequencies transients on the electrical circuits. Prior to this time the majority of the loads were linear loads. With Linear loads the current was drawn in a continuous manner. The electrical grid was designed for only 60-cycle linear loads like light bulbs and motors and not for the high frequency producing electronic loads that were being added rapidly after 1972. Most electric utilities have not updated their obsolete lines to handle the technological loads that started being connected to their system in the late 70's and continues to date. The electric utility's primary neutral wire that was designed to bring the unbalanced current back to the substations was, and still is, no longer capable of handling the excess current and higher than 60-cycle currents now riding on the wire. The wire has too much impedance (opposition to AC current) due to its inadequate size, which causes overheating and a buildup of voltage on the wire called Primary Neutral to Earth Voltage (PNEV). The Institute of Electrical and Electronics Engineers (IEEE) recognized the problems caused by these changing loads and adopted a national standard, the IEEE-519, in 1981. The IEEE revised the standard in 1986, and again in 1992. It was a problem that was recognized and addressed by industry worldwide, except for most electric utilities. It became the topic of most power quality magazines and publications throughout the industry. For example, in the June 1999 issue of Electrical Construction and Maintenance (EC&M) Magazine, Ken Michaels wrote, "Harmonics: It surfaced as a buzzword in the early 1980's, ...".

From the IEEE (1996) *Guide for Applying Harmonic Limits on Power Systems*:

> When single phase electronic loads are supplied with a 3-phase, 4-wire circuit, there is a concern for the current magnitudes in the neutral conductor. Neutral current loading in the 3-phase circuits with linear loads is simply a function of the load balance among the three phases. With relatively balanced circuits, the neutral current magnitude is quite small. This has resulted in a practice of under sizing the neutral conductor in relation to the phase conductors.
>
> With electronic loads supplied by switch-mode power supplies, the harmonic components in the load currents can result in much higher neutral current magnitudes. This is because the odd triplen harmonics (3, 9, 15, etc.) produced by these loads show up as zero sequence components for balanced circuits. Instead of canceling in the neutral (as is the case with positive and negative sequence components), zero sequence components add together in the neutral conductor. The third harmonic is usually the largest single harmonic component in single phase power supplies or electronic ballasts. (p. 63)

Glen A. Mazur, in his 1992 technical manual *Power Quality Measurement and Troubleshooting*, stated:

> Triplen harmonics do not cancel, but add together in the neutral conductor. In systems with many 1-phase nonlinear loads, neutral current can exceed an individual phase current. Generally, the amount of neutral current is between 125% and 225% of the highest phase

current. The third harmonic current is usually responsible for most of the neutral current because the third harmonic typically represents the harmonic with the highest current value. High neutral current is dangerous because it causes overheating in the neutral. Because there is no CB in the neutral conductor to limit current, as in the phase conductors (A, B, and C), overheating of the neutral can become a fire hazard.

Because of the increased and higher frequency currents on the utilities' primary neutral, the electric utilities decided to use the earth as a return path to their substations for the excess currents they are responsible for. Once the currents are in the earth, they flow uncontrolled over the surface, across private property, into homes and barns, and through humans and animals. This was done despite national standards and electrical safety codes, as evidenced in the IEEE's *National Electrical Safety Code* book under Rule 92D, which states, "Ground connection points shall be arranged so that under normal circumstances there will be no objectionable flow of current over the grounding conductor" (1996, p. 16).

Also regarding objectionable flow of current, the IEEE's *NESC Handbook, Fourth Edition* (1996) tells us that:

> Such flow may be disturbing to the service, as is sometimes the case around dairy barns in which cows are connected to milking systems. ...installations near areas that are often known to present specific problems (such as milking barns without adequate voltage gradient control, pipelines, electric railways, conduits, etc.) may need special attention to limit damage to equipment or uncomfortable conditions for personnel or animals. (p. 30)

In 1991, the United States Department of Agriculture (USDA) published a report entitled "Effects of Electrical Voltage/Current on Farm Animals". Within this report is a section on the electrical power system of the United States, which tells us:

> The U.S. electrical power system is a huge network and is based on a specific transmission, distribution, and utilization philosophy. When consumer equipment consisted primarily of lights, motors, and tube-type electronic equipment, and electrical loads were relatively small, neutral-to earth voltages and transients were not great problems, due to the lower neutral currents and the tolerance of the equipment. With increasing use of low-signal-level solid-state computers and microprocessors, increasing electrification and automation of farms, and increased loads on distribution lines, the issue of power quality and tolerable neutral-to-earth voltage is becoming increasingly important. It will become necessary in the future to more clearly specify the power characteristics that the utility is to provide at the delivery point, the limits to which a consumer's type of usage can he allowed to affect other customers and the utility, and who is to monitor and require conformance to the specifications. The ramifications of meeting these needs are that difficult economic, technical, and legal problems will arise and will have to be solved. (p. 6-2)

A subsequent section on electrical system load growth says:

> The increase in neutral currents and leakage or uncleared fault currents to earth due to electrical load growth on a farm or along a distribution line can lead to an increase in the neutral-to-earth voltage. (p. 6-3)

It should be noted that the electric utilities did not create the high frequencies present on their distribution lines due to consumer load growth. The manufacture and use of electronic equipment created the problem, and the electric utilities inherited it. However, the electric utilities are responsible for what is on their lines and for putting the current into the earth, thus allowing currents to flow uncontrolled over the earth's surface. To reiterate – from the first footnote in this report – the term "stray voltage" was coined by electric utilities and public utilities commissions. The word "stray" infers that no one is responsible. There may be stray dogs and stray cats; it may be unknown where they come from or where they are going. Voltage, on the other hand, does not stray; it is governed by scientific laws (Ohm's Law, Kirchhoff's Law, etc.) and it goes where people put it.

II. Initial Observations and Testing

Upon arrival at the Szymanski farm, I observed a primary neutral isolator had been installed by the electric utility, and a new electrical service had been installed by Mr. Szymanski's electrical contractor. The milking parlor along with the freestall system and milkhouse were all fitted with compact fluorescent light bulbs, which are reported to cause health issues in both humans and animals. They put between 50 and 100 kHz back on the electrical system, including the grid, and also radiate through space. Upon bringing this to Mr. Szymanski's attention, he immediately proceeded to purchase incandescent bulbs and replaced all CFL bulbs with incandescent. The integrity of the primary neutral isolator was then tested. There was a more than 4:1 ratio drop between the primary and secondary neutral when the isolator was in the circuit, as shown in Figures 7 and 8 below. This shows that the primary neutral isolator is working the way it was designed, especially on the day we were there, as it had been raining and the ground was saturated with standing water.

We randomly selected two points in the milking parlor to serve as hoof-to-hoof cow contact measurement points. The floor was then scraped and cleaned, and two 16 square inch metallic plates were bolted to the floor with a salt brine soaked cloth between the floor and the plates. A shielded cable was connected to the plates at one end and the other was connected to channel B of a Fluke 199 scope meter located in our power quality test trailer. All cow contact measurements were conducted using a 500 ohm resistor shunted across the oscilloscope leads. Channel A of the scope meter was connected between the electric utility's primary neutral down ground at the transformer pole and a remote ground rod. The oscilloscope was then connected to a laptop PC to plot and record the measurements. The PC was connected to a video mixer. A remote video camera was placed in the milking parlor to record animal movement. The camera was connected to the video mixer as well. This allowed us to record the electrical activity on the barn floor simultaneously with video footage of the animal response and movements.

The animal response recorded in our video footage correlates with that described in a 1998 report of the Minnesota Science Advisors, which states, "the frequency of behaviors such as hoof lifting and kicking during milking have been suggested as measures of cow discomfort during milking. These are likely to be sensitive measures for hoof-to-hoof voltage exposure". Transient voltages in excess of 350 mV were recorded at cow contact during our testing.[1] It should be noted that the levels that were measured at the Szymanski farm were of just a small window. The levels would change as the loads increased on the electrical system at different times of the day or week, and also with varying weather and soil conditions.

In a USDA (1991) report, Lloyd B. Craine defines transients as "voltages or current impulses of short duration that occur either regularly or irregularly" (p. 6-3). Furthermore, he states, "The effect of a transient voltage superimposed on the regular power voltage (dc or ac) is to cause a momentary change in the waveform. When the transient causes the momentary voltage to be greater than normal, it may cause a transient current to flow in an animal. [...]. If the transient waveform has sufficient energy (magnitude and duration), there may be an animal response" (p. 6-4). Trade publications and newspaper articles have also addressed the issue of ground currents and voltages over the past decade.

Marek Samotyj, EPRI's manager for power quality stated in a July 5, 1999 *Fortune* magazine article, "Hot New Technologies for American Factories", "[t]he quality situation will get worse before we will be able to mitigate it . . . One reason is that EPRI [Electrical Power Research Institute] expects 70% of all electricity produced within the U.S. to flow through electronic devices by 2002, vs. 30% today" (Bylinski, p. 4)

An article by Beck Ireland in the September 2006 edition of EC&M, "Clearing up Confusion on Unwanted Voltages", highlights numerous incidents of "stray voltages" affecting humans, animals, and electric utilities, including:

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[1] Unfortunately, most PUCs have adopted a standard of 1 volt (V) rms, 60 cycle as the acceptable voltage threshold to which animals may be exposed. This threshold is based, in part, on a report by Douglas J. Reinemann of the University of Wisconsin – Madison entitled *Effects of Frequency and Duration on the Sensitivity of Dairy Cows to Transient Voltages* (1994). The method and criteria Mr. Reinemann used to determine this 1V threshold are, 1) "[t]wo trained observers seated, one in front of the cow and one behind, observed and recorded animal behavior and movements during tests", and, 2) "[f]acial reaction including a twitch of the nose or ears or blink of the eyes".

This report is based on "junk" science; facial reaction of cows had never been used, nor has it since, as criterion for animal discomfort due to electrical shock. To date, Mr. Reinemann refuses to answer any questions regarding his selection of this criterion. The Minnesota Science Advisors, of which Mr. Reinemann was a member, published their findings in a 1998 report entitled *Final Report of the Science Advisors to the Minnesota Public Utilities Commission*. The report states, "the frequency of behaviors such as hoof lifting and kicking during milking have been suggested as measures of cow discomfort during milking. These are likely to be sensitive measures for hoof-to-hoof voltage exposure". The Ontario Hydro Power Quality Reference Guide (1998, 3rd), states that "tingle voltage is mainly a problem with farm animals, since many of them can feel voltages as low as 0.3V; this is one hundredth of what the average person can detect" (p.63).

Cows do not feel peak or rms voltages, they feel peak-to-peak voltages; as reported by D.J. Aneshansley and R.C. Gorewit in ASAE Technical Paper No. 993152 (1999), "[t]he combination of equal amounts of 60 and 180 Hz with different phase shifts and their lack of sensitivity to DC bias indicates that cows are sensitive to peak-to-peak voltages and not peak or rms" (p. 12).

- East Village, NY, 2004: Jodie S. Lane, a 30-year-old Columbia University graduate student, was killed when she stepped on a metal plate.
- Feb 12, 2006: Four people shocked by service box near Port Authority Bus Terminal.
- Feb 17, 2006: Dog electrocuted on patch of concrete in Park Slope Brooklyn
- March 2006: Nine-year old boy hospitalized after an electric jolt while walking over a metal plate in Harlem.
- March 2006: New York City's Consolidated Edison found 1,214 instances of stray voltage during a year-long examination of electrical equipment on city streets.
- Con Ed expects to spend $100 million this year [2006] toward reducing the risk of stray voltage.

More recent evidence of this issue can be found in a *Toronto Sun* newspaper article, "Children Shocked by Stray Voltage", where Don Peat reports, "Several children shocked by stray voltage – just two weeks after a second dog was electrocuted – has finally prompted Toronto Hydro to mobilize 600 workers to inspect its aging street-level infrastructure" (January 30, 2009).

The issue of ground current has been addressed not only in consumer publications, but also in electrical industry engineering manuals, code books and other published guidelines. For example, the *Wiley Encyclopedia of Electrical and Electronics Engineering, Volume 8* (1999), states, "It is an unsafe practice to allow current to flow over the earth continuously, uncontrolled. All continuously flowing current must be contained within insulated electrical conductors". Also, in a 2006 white paper "BC Hydro Deals With Farm Neutral to Earth Voltage", David M. Rogers, an Agricultural Specialist for BC Hydro, states:

> The Canadian Electrical Code Rule 10-200 states that concerning "The Rule (for grounding and bonding conductors) does not intend there be current flowing through the bonding and grounding system during normal operation." Its Subrule (3) of Chapter 10-200 states that: "Where by using multiple grounds objectionable flow of current occurs over the grounding conductor:
>
> - One or more of the grounds shall be abandoned;
> - The location of the grounds shall be changed;
> - The continuity of the conductor between the grounding connections shall be suitably interrupted;
> - Other effective action shall be taken to limit the current." (p.3)

According to Rogers (2006), BC Hydro has developed a positive approach to dealing with the issue of ground currents/voltages, ultimately producing positive results for both Canadian farmers and BC Hydro, including, 1) a reduction in mastitis in farms at any one time from 230 in 1997 to fewer than 20 in the period from 2003 to 2006, and, 2) never having had a legal suit over farm ground current/voltage issues (p. 13).

To summarize, this issue has been well-publicized and well-documented, and Mr. Szymanski's electric utility personnel would be remiss in claiming they had no knowledge of this issue.

III. Collected Data

Our measurement results are presented below, following a brief commentary.

Collected data plots show readings in excess of 350 mV in the animal contact area that the cattle are exposed to while standing in a barn stall. A 1998 report by the Minnesota Science Advisors states, "we have estimated that voltages as low as 0.002 volts could conceivably cause internal electric fields in the cow that are high enough to produce a physiological response" (p. 27). The report also states that "internal body electric fields of 0.001 volt/meter to 0.01 volt/meter have been shown to produce physiological responses in other animals", and "front-to-rear hoof step potential exposure of 0.002 to 0.02 volts would produce such field strengths" (p. 19; p. 20).

Also, according to Charles Polk (2001), "Values as low as approximately 10 mV could conceivably be significant". Furthermore, the Ontario Hydro Power Quality Reference Guide (1998, 3rd), states that "tingle voltage is mainly a problem with farm animals, since many of them can feel voltages as low as 0.3V; this is one hundredth of what the average person can detect" (p.63).

During signature tests performed with utility power the data plots show that as on-farm loads, as well as neighboring electrical loads, increased, the primary neutral voltages also increased; this demonstrates a poor utility primary neutral return.

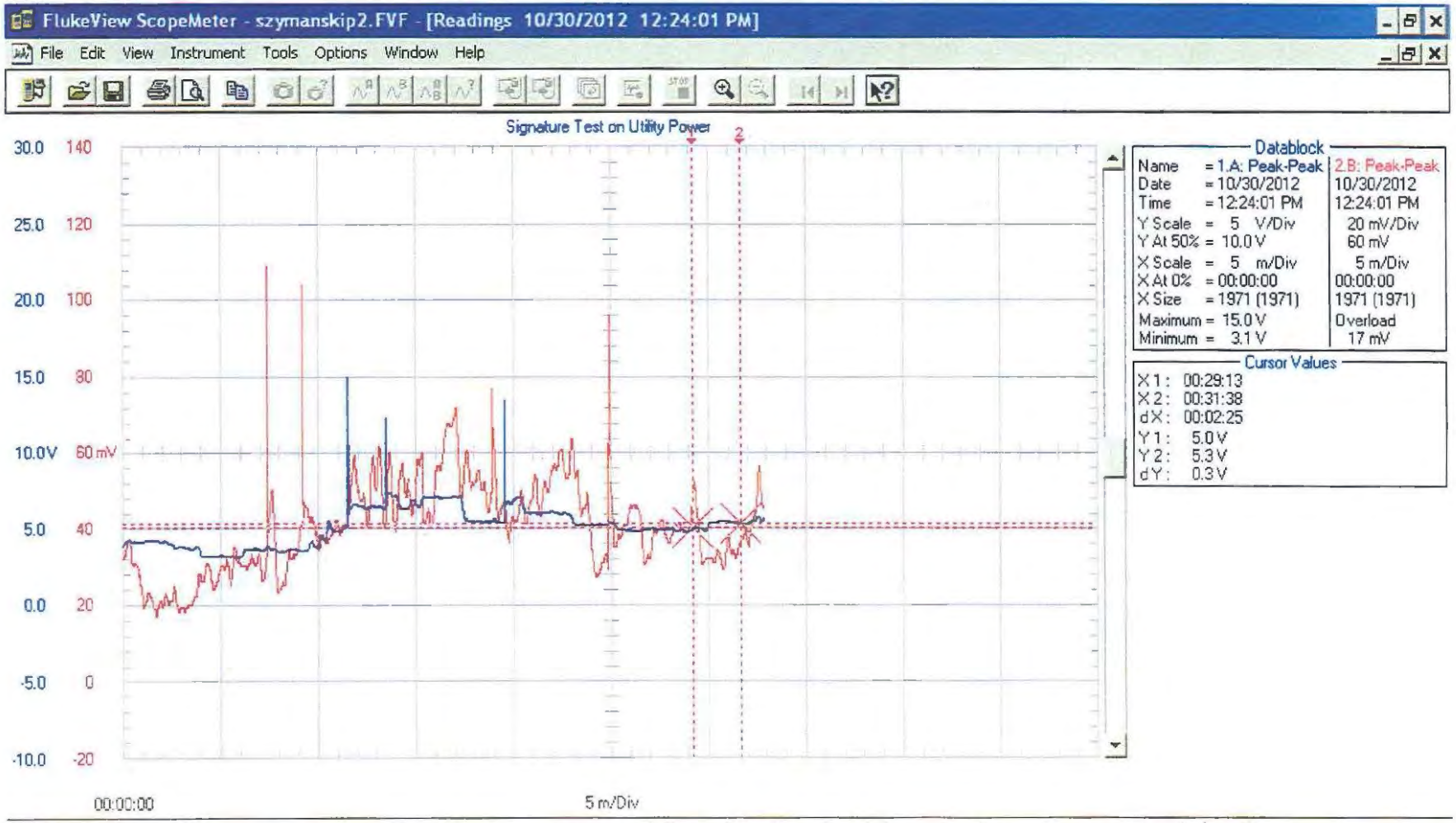
While performing a signature test on generator power, there was no significant change in PNEV due to the farm loads. This test differentiates any on-farm contribution versus the electric utility's contribution to cow contact voltages. A poor utility primary neutral return exists. These measurements also show that with the farm disconnected from utility power there was still voltage being plotted in the animal contact area with high frequency currents, including high frequency transients and harmonics. The collected data signify a utility poor primary neutral return. The electric utility's primary neutral system is no longer adequate to handle the technological loads that are now on their system.

During the test with the generator, transients from the on-farm electric fencer were measured in the cow contact area and affecting cow comfort during milking, as seen in the video. Also, transients from an off-farm electric fencer on the neighboring farm were measured during milking. The lighting circuit in the free stall area of the barn also contributed to cow contact voltages. Suggestions to correct these on-farm problems are: 1) connect the fencer in a manner in which the transients do not show up at cow contact (see Addendum I), or eliminate the fencer entirely, and, 2) rewire the lighting circuit in the free stall area using PVC conduit with liquidtite connectors and approved devices for damp areas.

Figure 1.

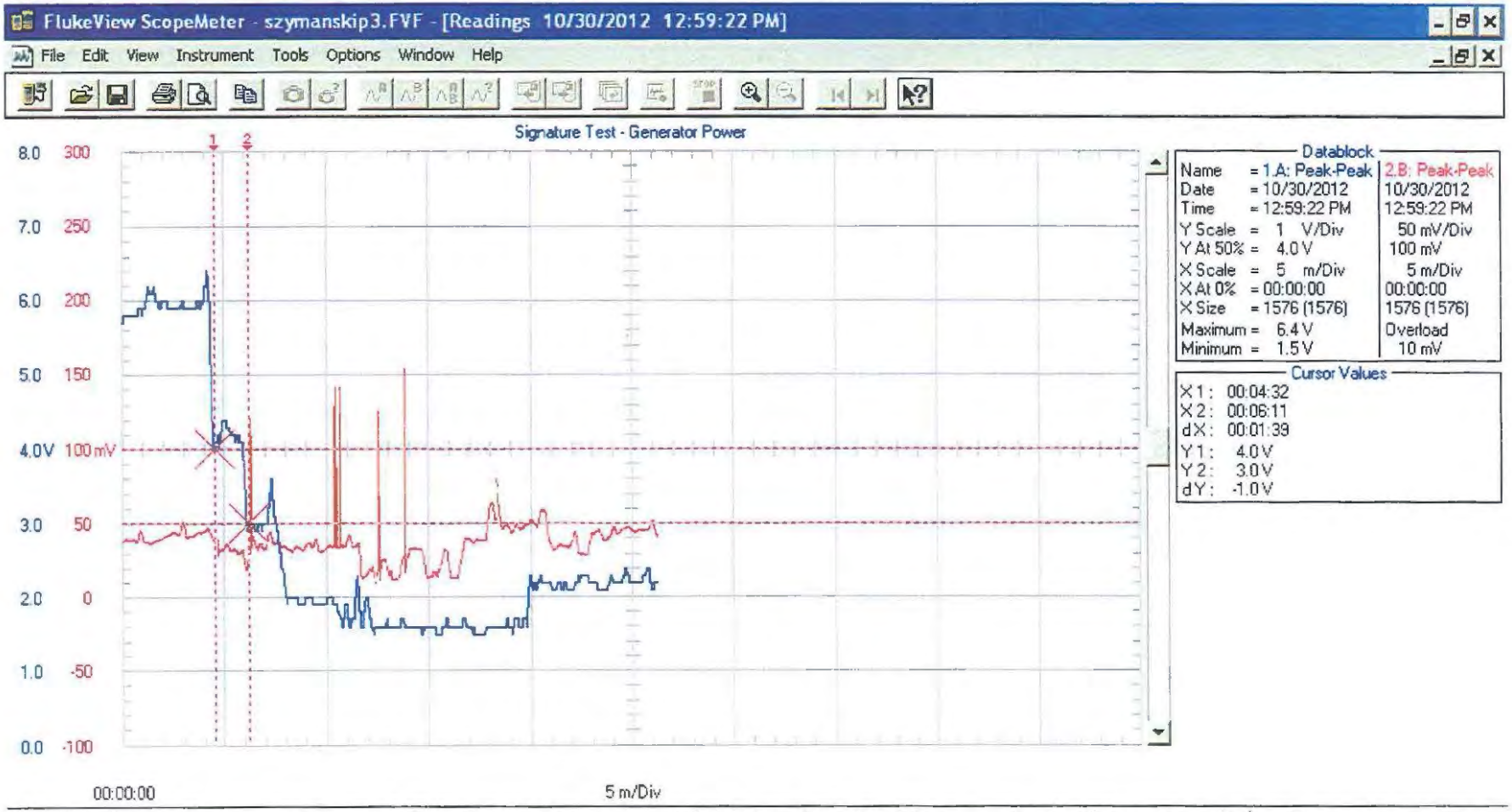
The compressed data plot was collected at the John Szymanski farm near Argyle, Michigan. Channel A was connected to the primary neutral down ground and a remote ground rod. Channel B was connected to cow contact in the milking parlor. The transients in the cow contact area were due to the electric fencer.

Figure 2.



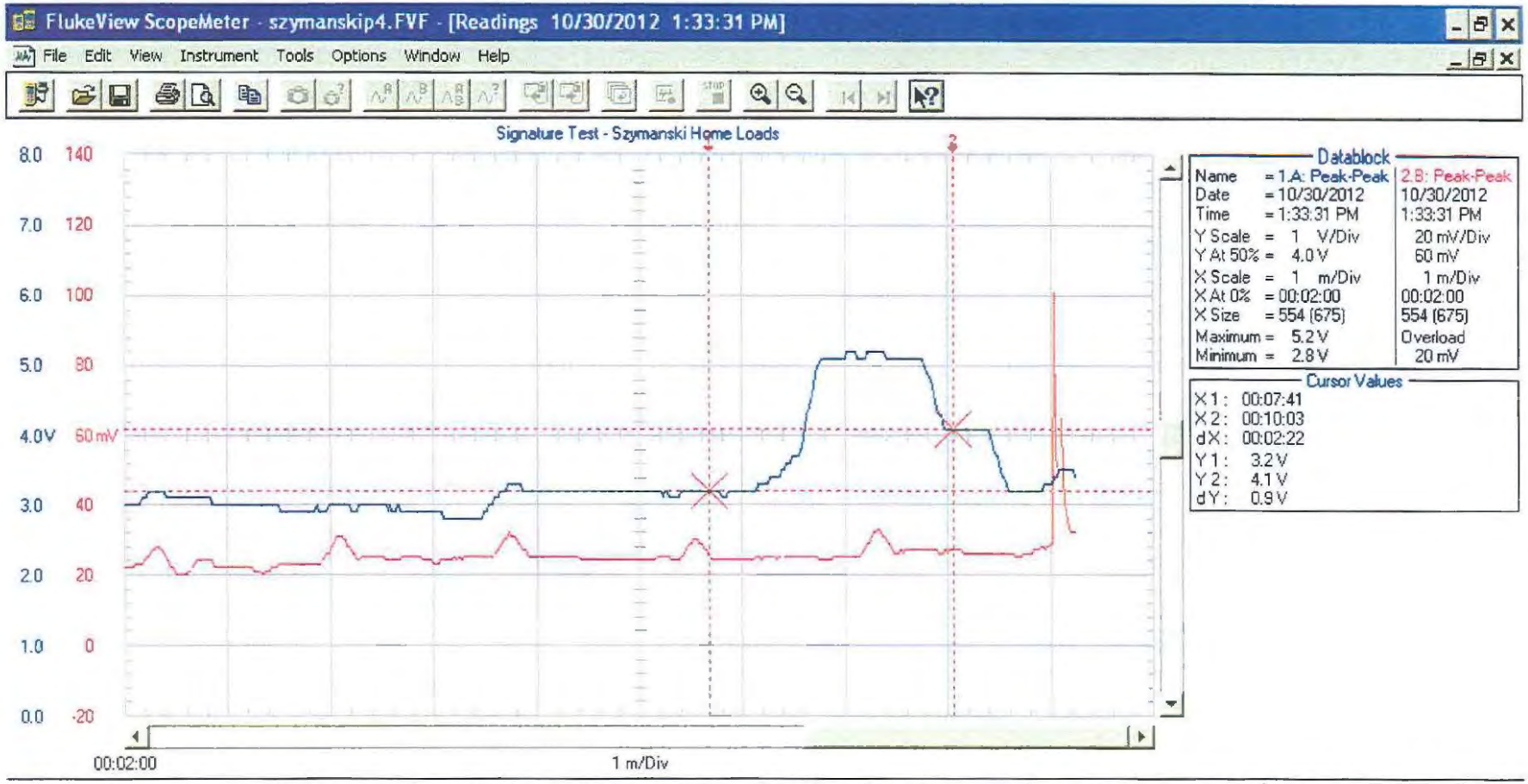
The above compressed plot was collected at the John Szymanski farm near Argyle, Michigan. Channel A was connected to the primary neutral down ground and a remote ground rod. Channel B was connected to cow contact. The signature test was performed on utility power. As farm loads increased, so did cow contact and PNEV levels.

Figure 3.



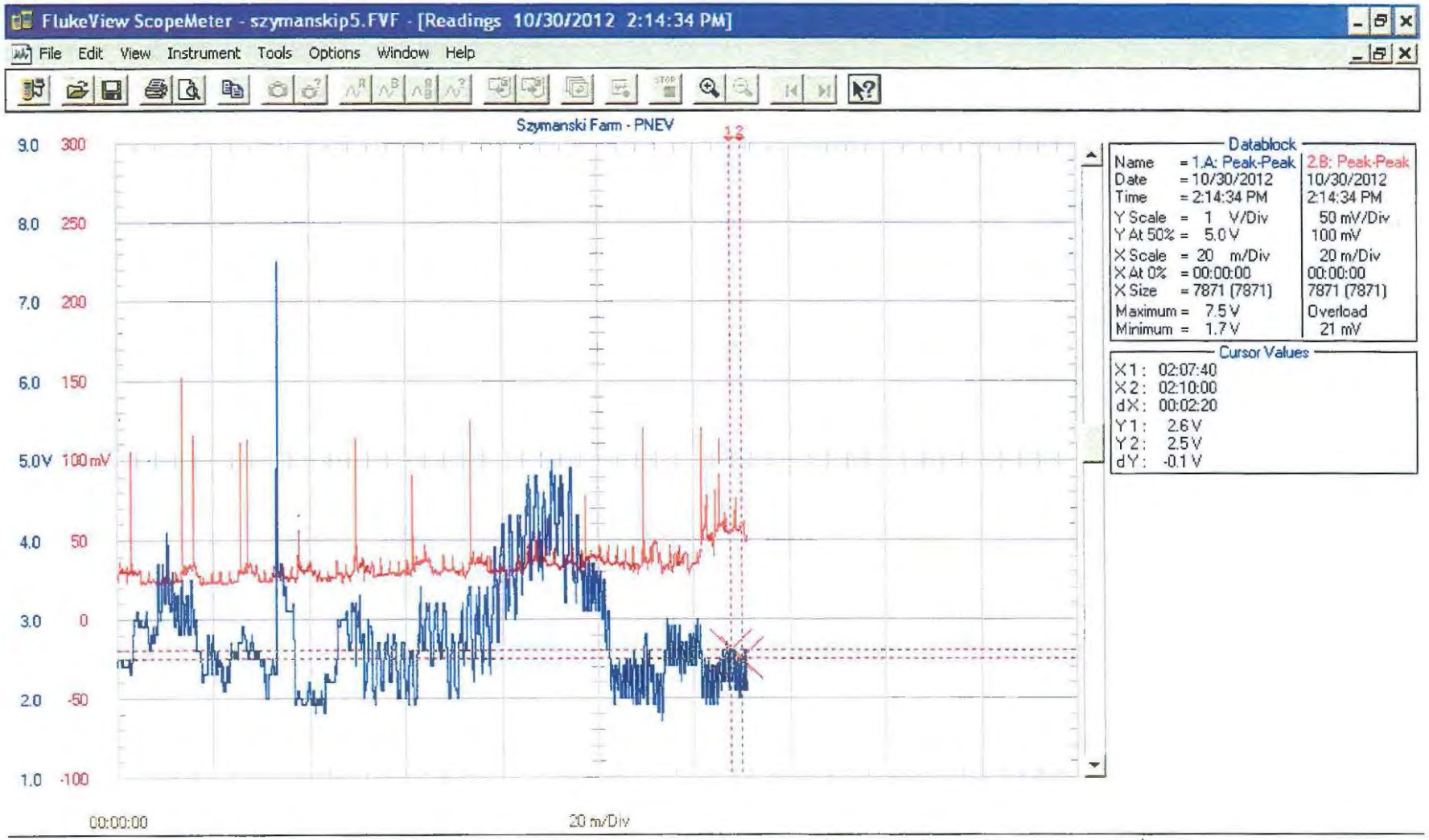
The above compressed plot was collected at the John Szymanski farm near Argyle, Michigan. Channel A was connected to the primary neutral down ground and a remote ground rod. Channel B was connected to cow contact. The signature test was performed on generator power. Utility power to the farm was turned off at +4:33. On-farm loads did not contribute to PNEV or cow contact voltages while the farm was operating on generator.

Figure 4.



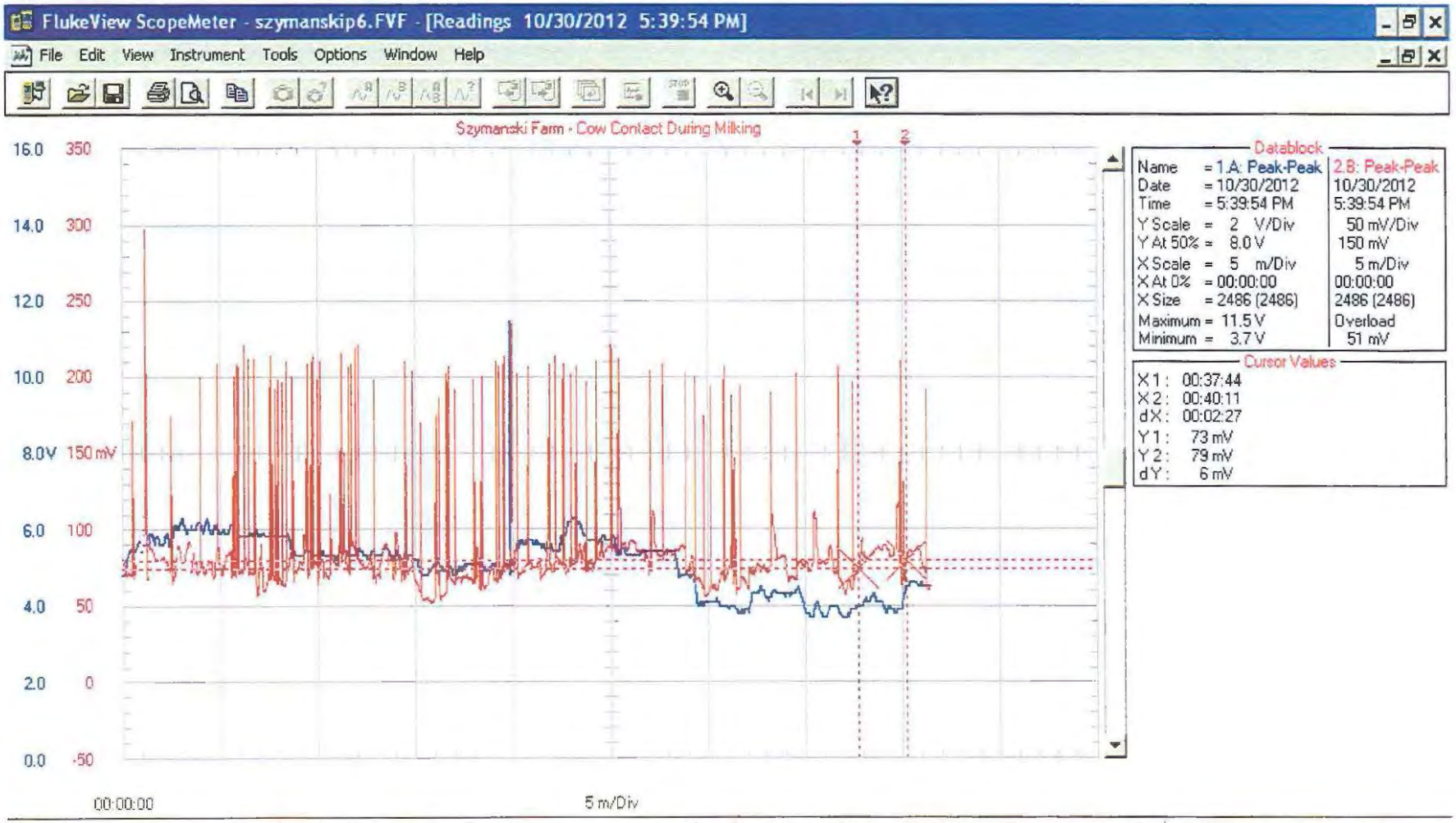
The above compressed plot was collected at the John Szymanski farm near Argyle, Michigan. Channel A was connected to the primary neutral down ground and a remote ground rod. Channel B was connected to cow contact. The signature test was performed using appliances in the Szymanski home just up the road from the farm, which is on a different utility transformer. The area between the cursors represents when loads were being switched in the Szymanski home.

Figure 5.



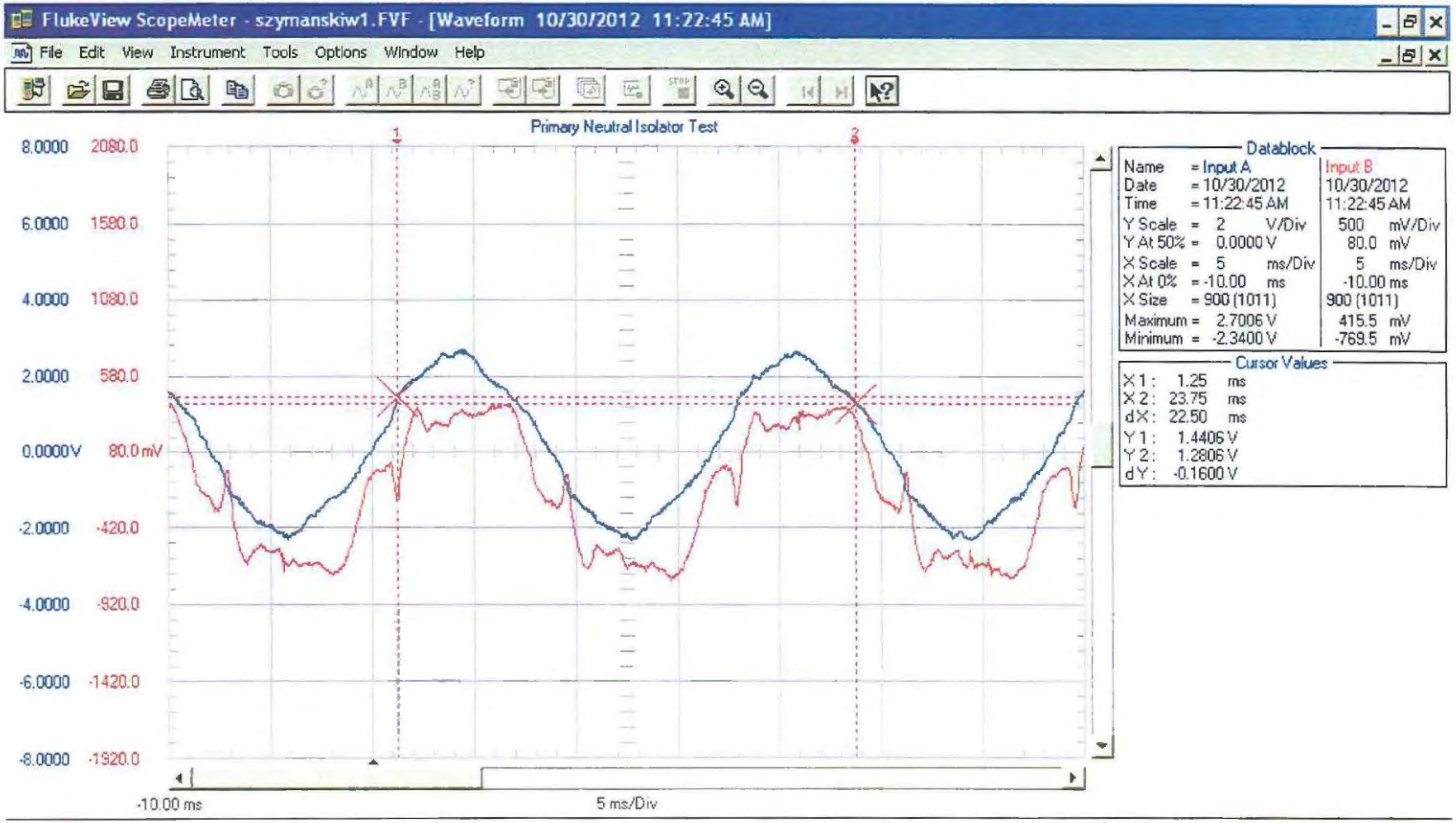
The compressed data plot was recorded on the John Syzmanski farm near Argyle, MI. Channel A was connected to the primary neutral down ground and a remote ground rod. Channel B was connected to cow contact with a 500 Ohm shunt resistor.

Figure 6.



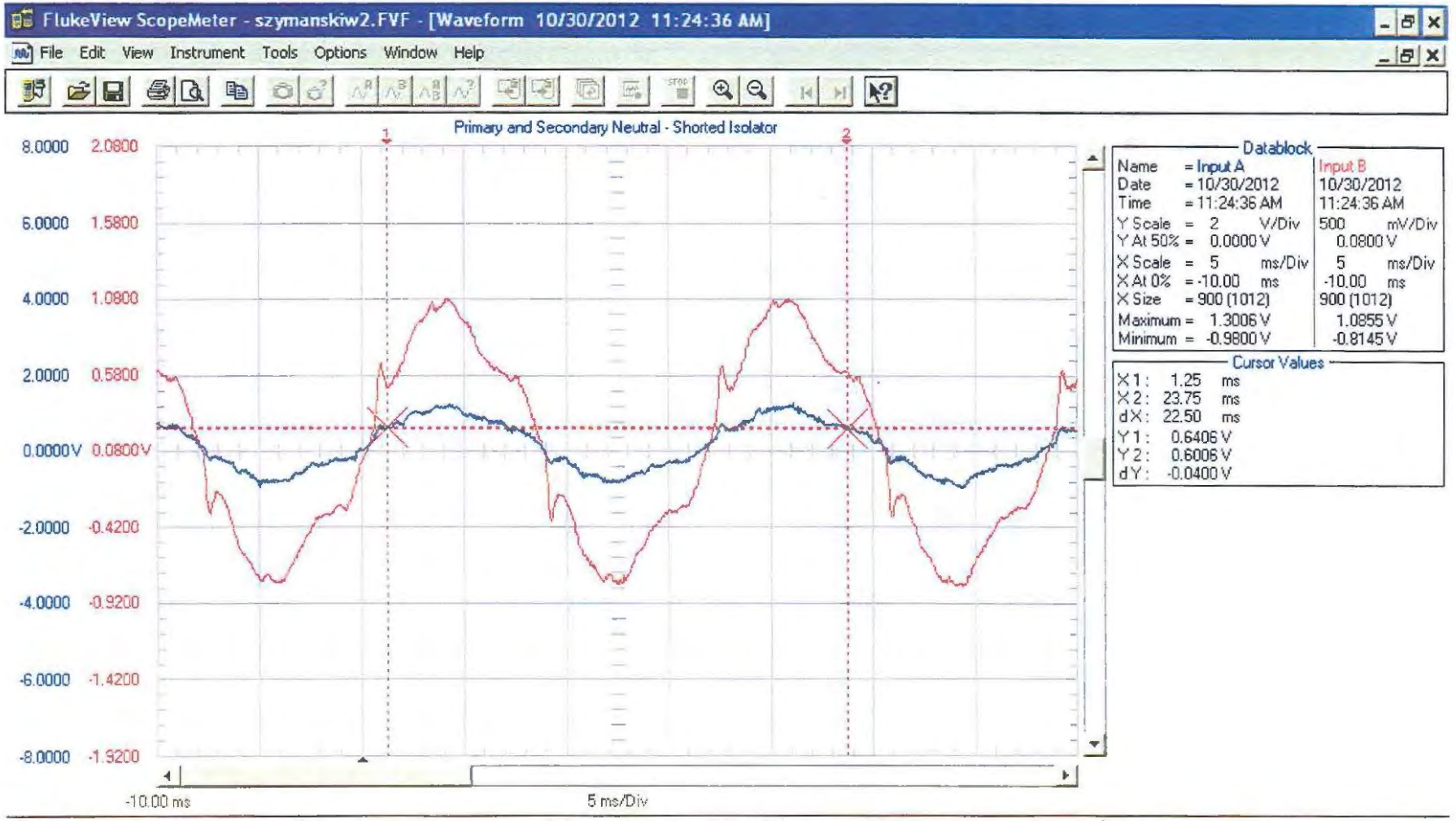
The compressed data plot was recorded on the John Syzmanski farm near Argyle, MI. Channel A was connected to the primary neutral down ground and a remote ground rod. Channel B was connected to cow contact with a 500 Ohm shunt resistor. Data plot was recorded during filming of milking.

Figure 7.



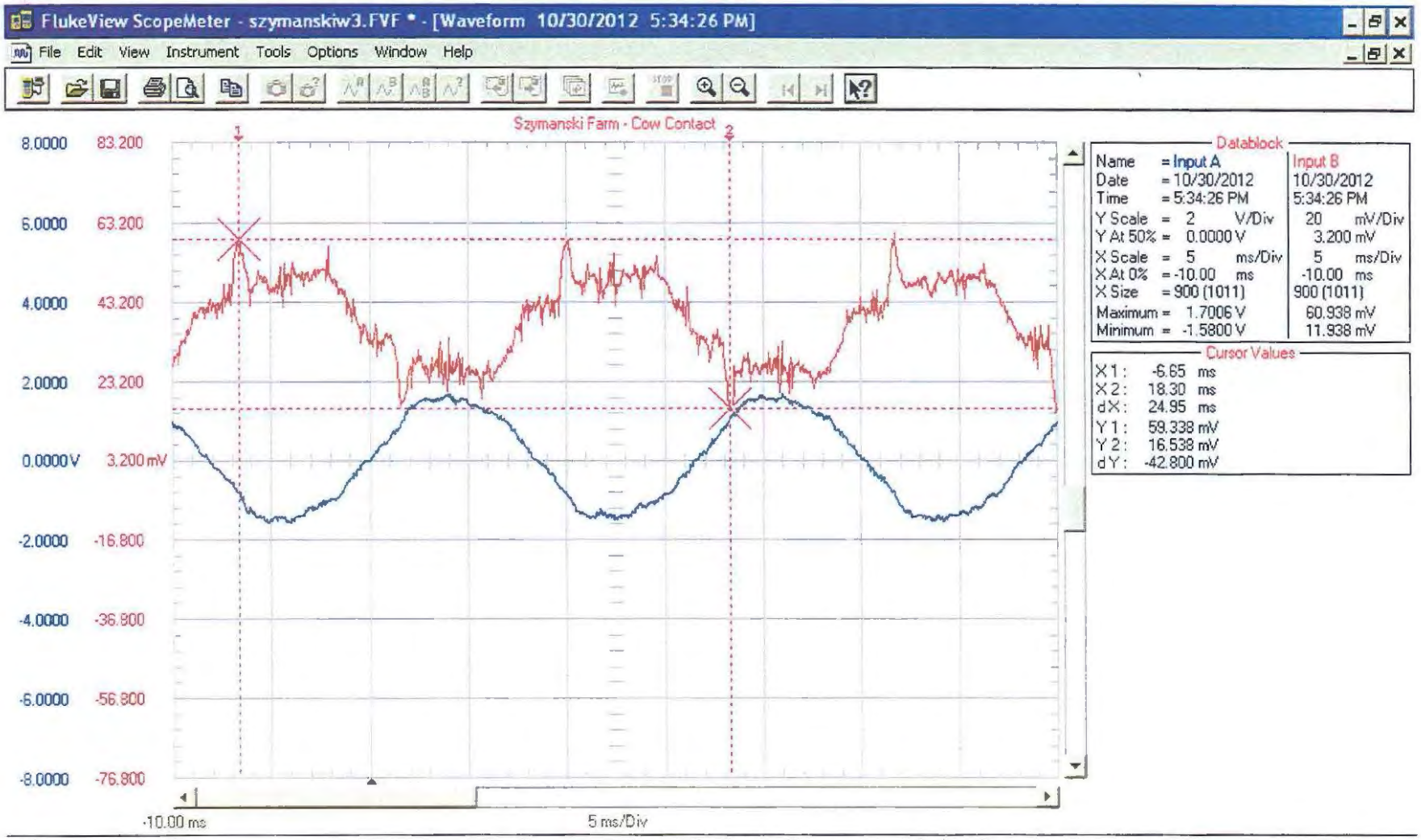
The above waveforms were collected at the John Szymanski farm near Argyle, Michigan. Channel A was connected to the primary neutral down ground and a remote ground rod. Channel B was connected to the secondary neutral and the same remote ground rod. The primary neutral isolator was in the circuit. A: 5.0406V B: 1185mV

Figure 8.



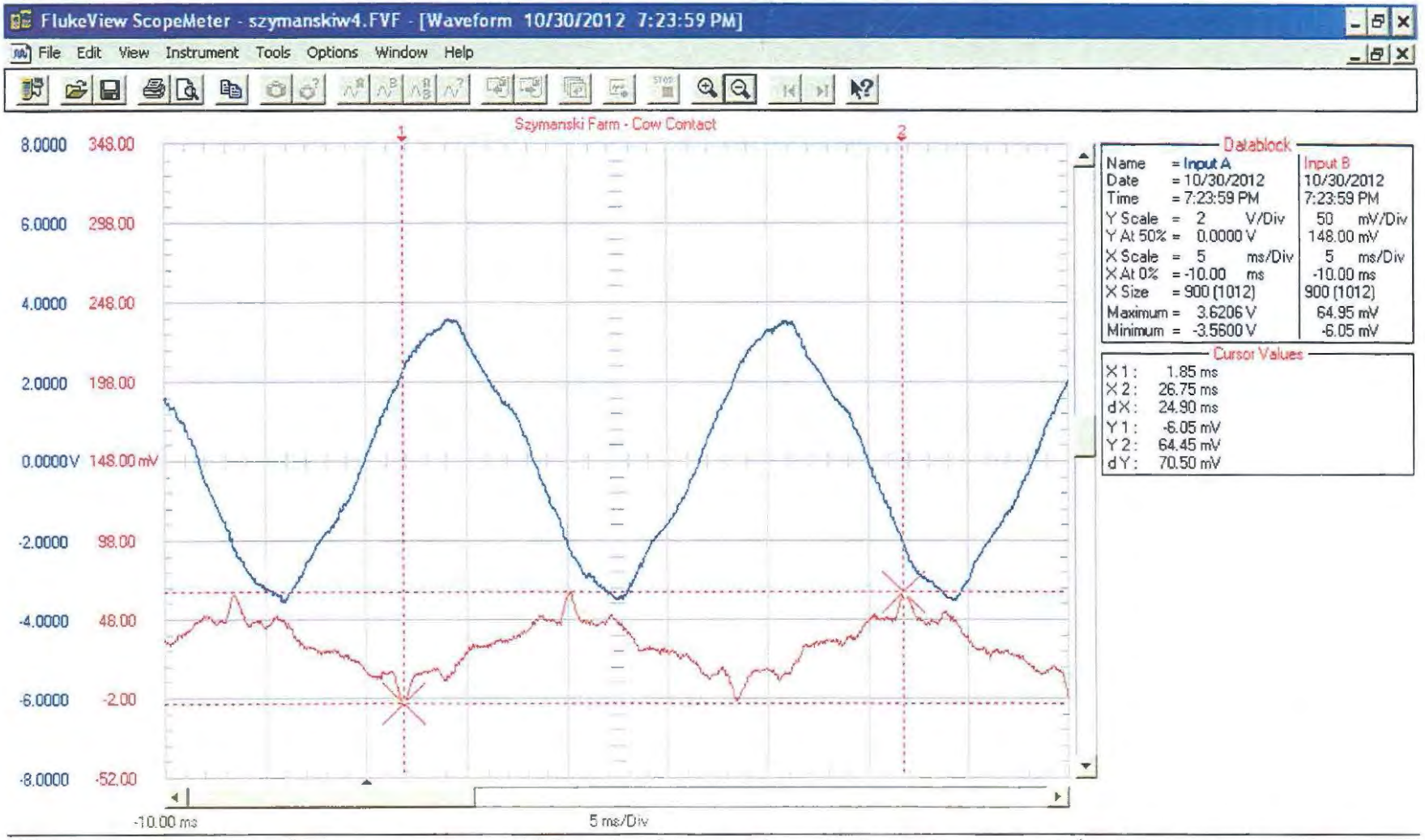
The above waveforms were collected at the John Szymanski farm near Argyle, Michigan. Channel A was connected to the primary neutral down ground and a remote ground rod. Channel B was connected to the secondary neutral and the same remote ground rod. The primary neutral isolator was shorted. A: 2.2806V B: 1.9V

Figure 9.



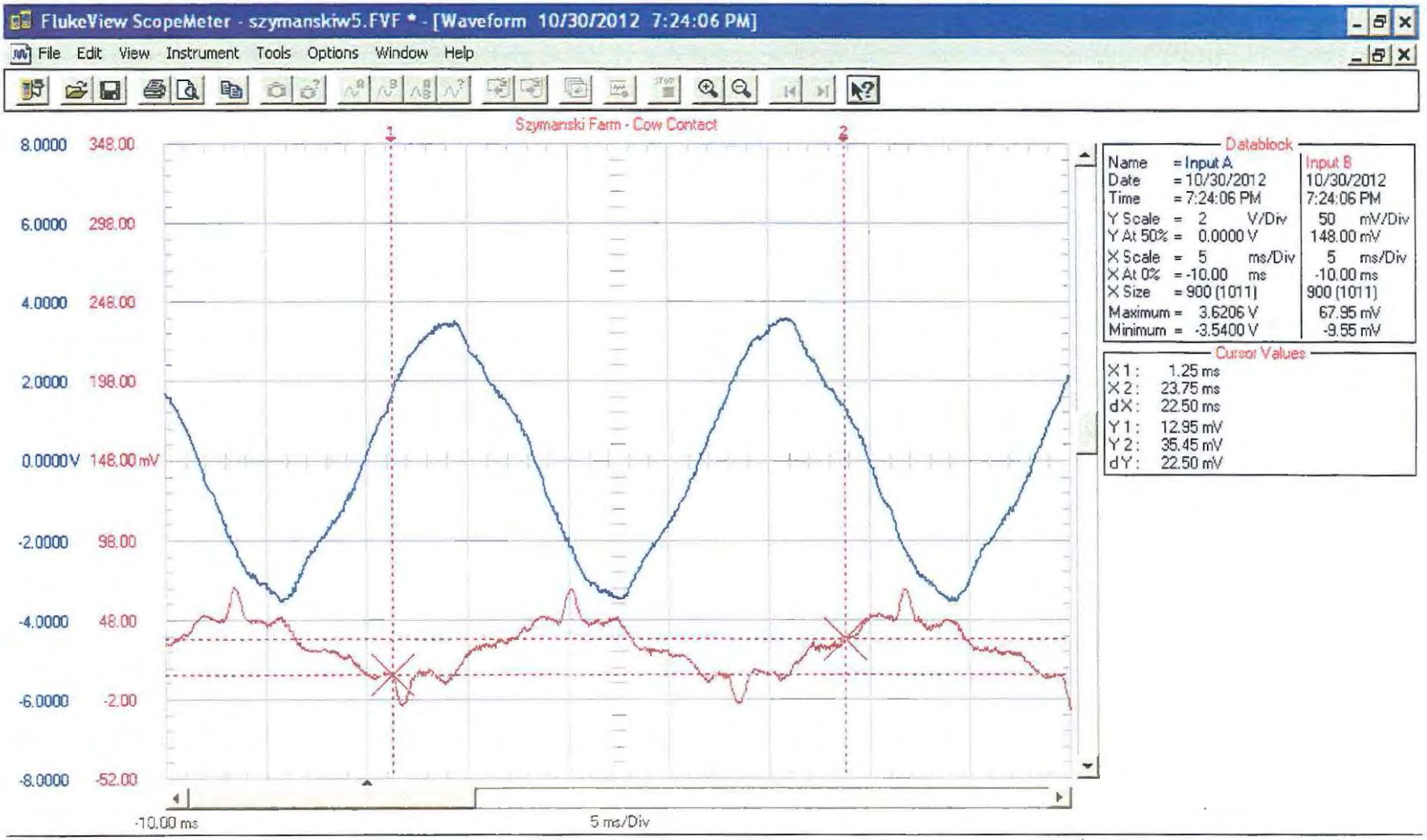
The waveforms were recorded on the John Syzmanski farm near Argyle, MI. Channel A was connected to the primary neutral down ground and a remote ground rod. Channel B was connected to cow contact with a 500 Ohm shunt resistor.

Figure 10.



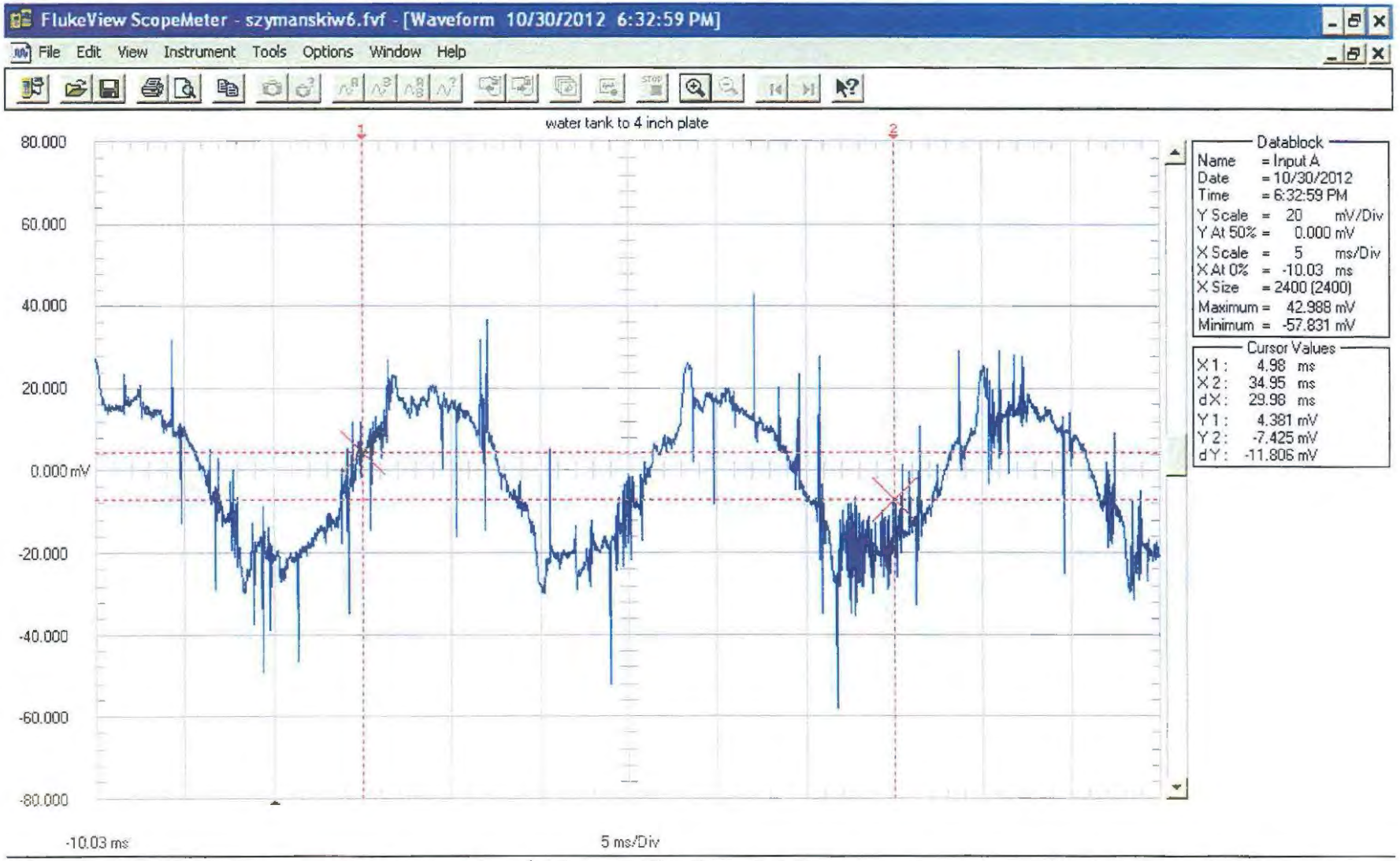
The above waveforms were collected on the John Syzmanski farm near Argyle, MI. Channel A was connected to the primary neutral down ground and a remote ground rod. Channel B was connected to cow contact with a 500 Ohm shunt resistor. PQ trailer was unplugged from farm power.

Figure 11.



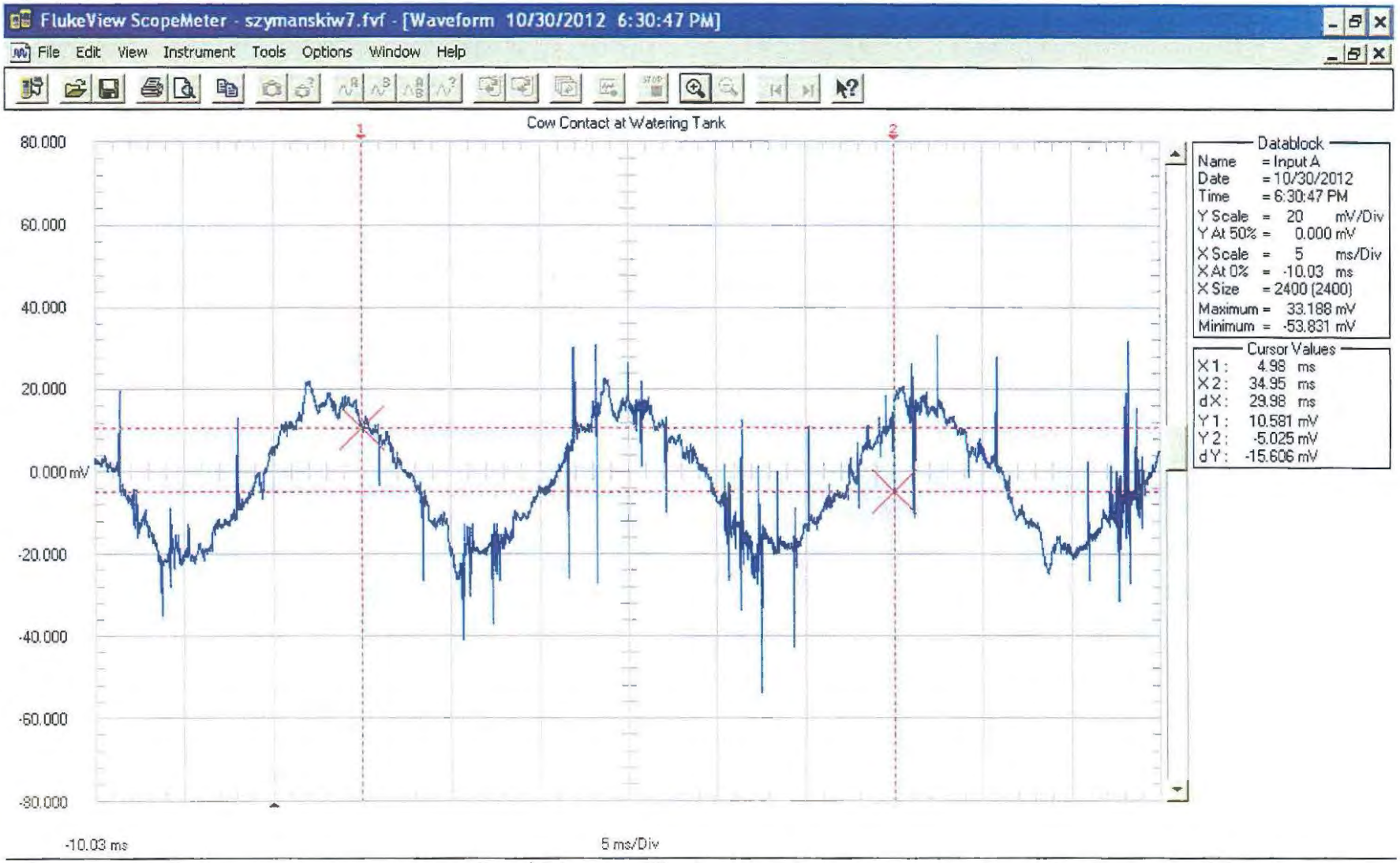
The above waveforms were collected on the John Syzmanski farm near Argyle, MI. Channel A was connected to the primary neutral down ground and a remote ground rod. Channel B was connected to cow contact with a 500 Ohm shunt resistor. PQ trailer was unplugged from farm power.

Figure 12.



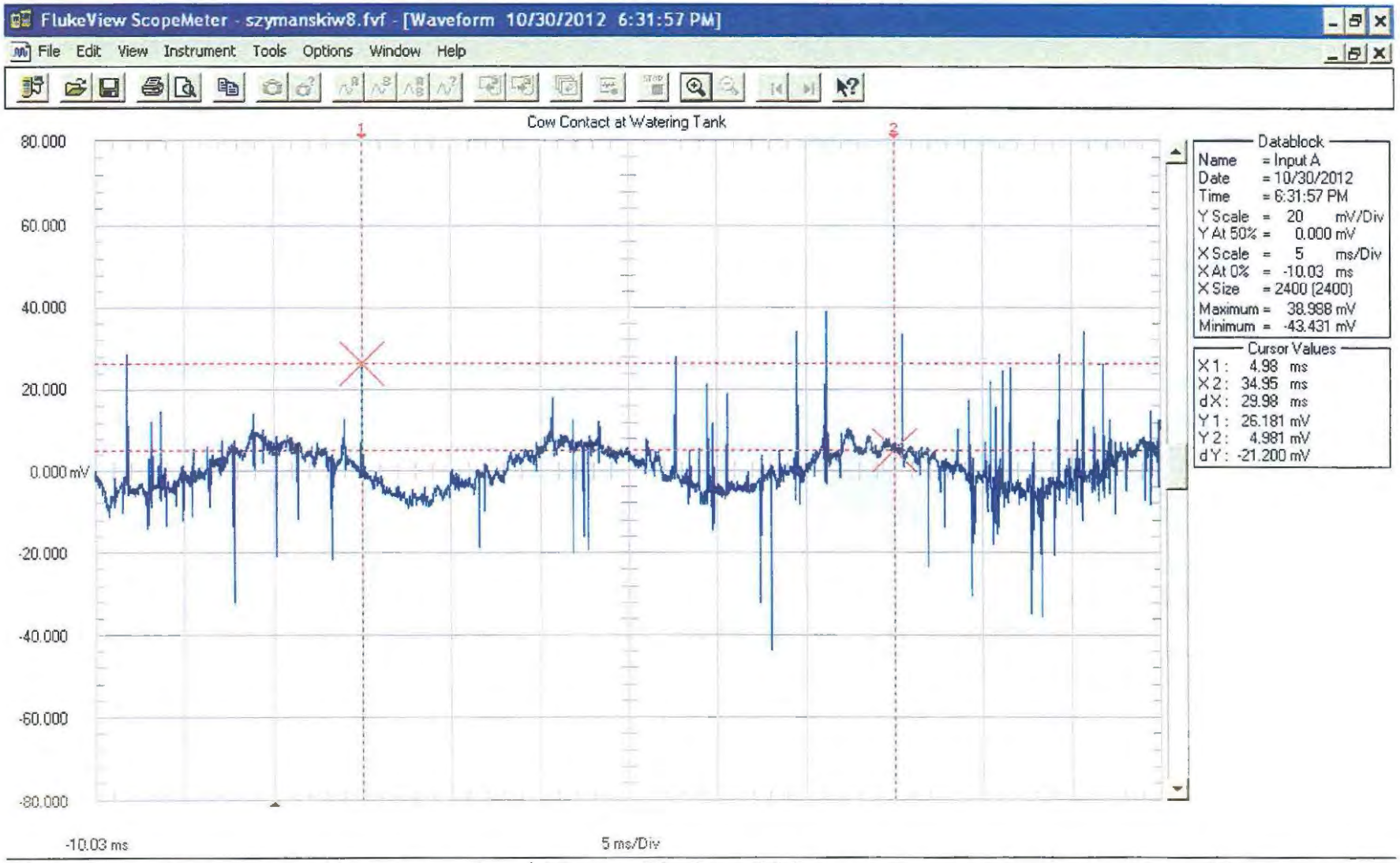
The waveform was measured with a fluke 199 scope meter between the cow watering tank and a 16 square inch metal plate 5 feet back from the tank on the John Syzmamski Farm near Argyle Michigan.

Figure 13.



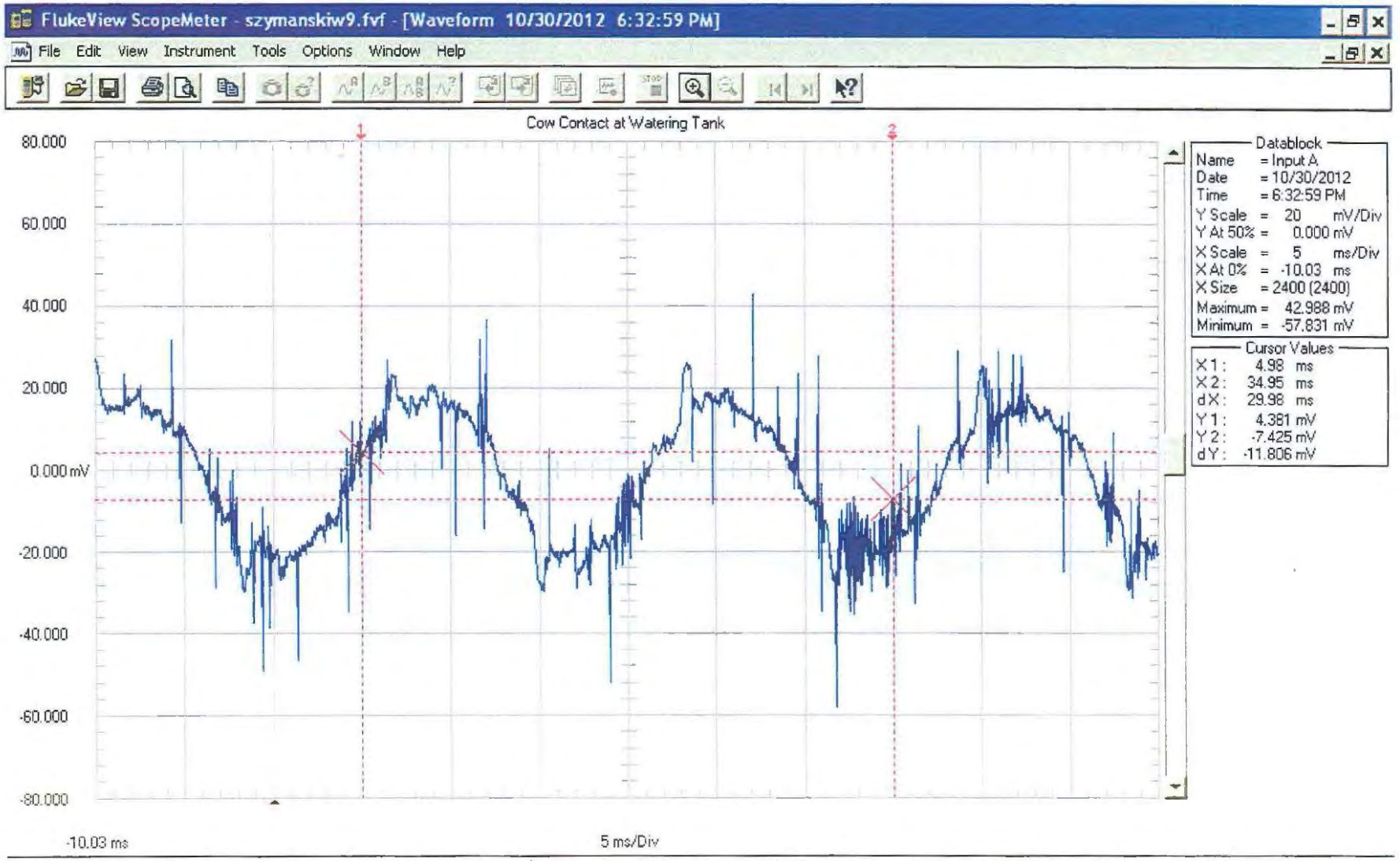
The waveform was measured with a fluke 199 scope meter between the cow watering tank and a 16 square inch metal plate 5 feet back from the tank on the John Syzmamski Farm near Argyle Michigan.

Figure 14.



The waveform was measured with a fluke 199 scope meter between the cow watering tank and a 16 square inch metal plate 5 feet back from the tank on the John Syzmamski Farm near Argyle Michigan.

Figure 15.



The waveform was measured with a fluke 199 scope meter between the cow watering tank and a 16 square inch metal plate 5 feet back from the tank on the John Syzmamski Farm near Argyle Michigan.

Figure 16: Primary Neutral Down Ground on Szymanski Farm

Figure 17: AEMC Readings on Primary Neutral Down Ground (55mA)

Figure 18: 3-Phase Line Feeding Szymanski Farm

Figure 19: 3-Phase Line Feeding Szymanski Farm

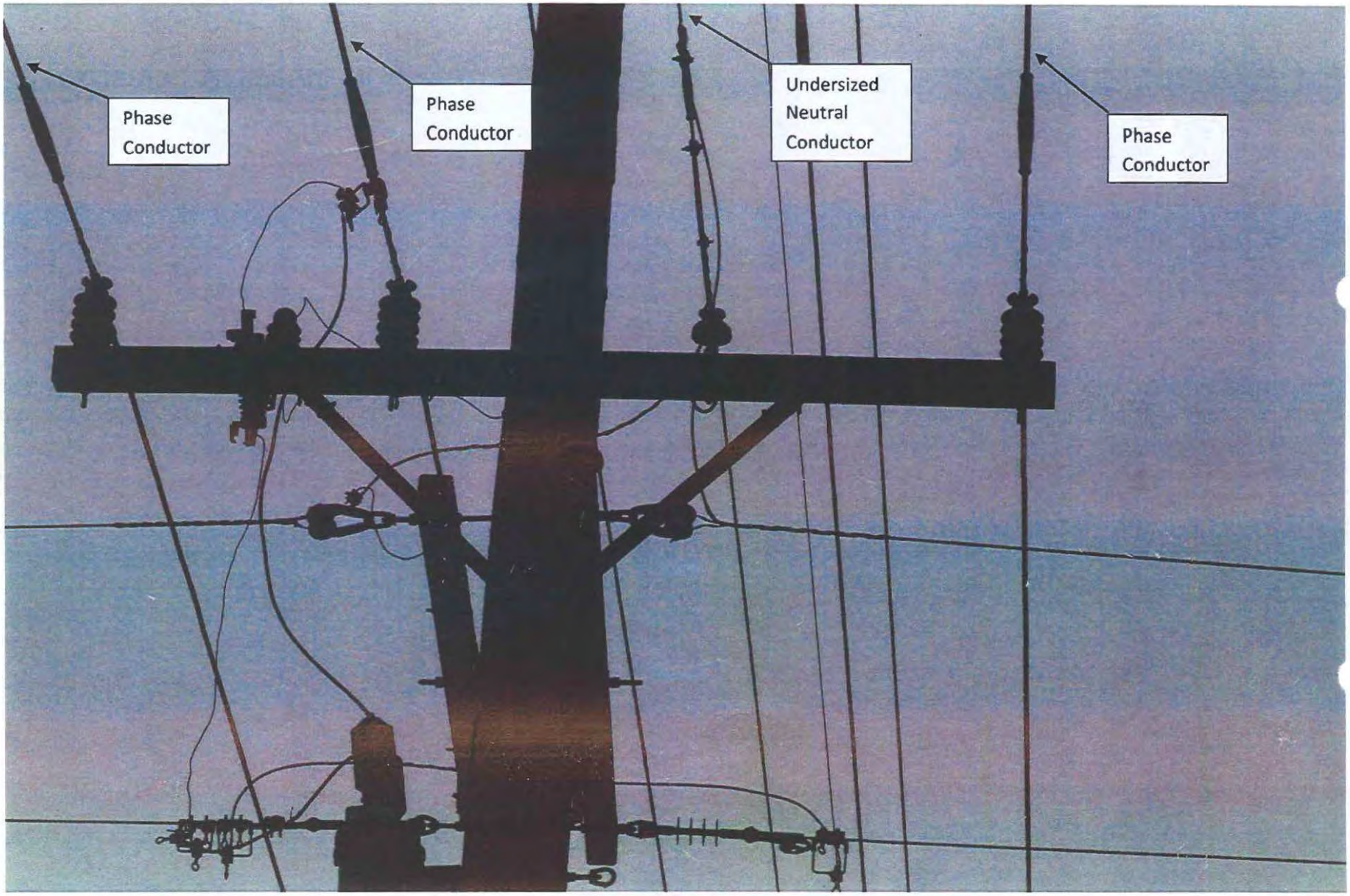


Exhibit C

Figure 20: 3-Phase Line Feeding Szymanski Farm

Figure 21.

$$I_{phase} = (I_1^2 + I_3^2)^{1/2} = (1.0^2 + 0.7^2)^{1/2} = 1.22$$

$$I_{neutral} = (I_3 + I_3 + I_3) = (0.7 + 0.7 + 0.7) = 2.1$$

$$I_{neutral} / I_{phase} = 2.1/1.22 = 1.72$$

The neutral current in this case will be 172% of the rms phase current magnitude. The conclusion from this calculation is that neutral conductors in circuits supplying electronic loads should not be undersized. In fact, they should have almost twice the ampacity of the phase conductors. An alternative method to wire these circuits is to provide a neutral conductor with each phase conductor. The figure below illustrates how the neutral current is dominated by the third harmonic component in this type of circuit.

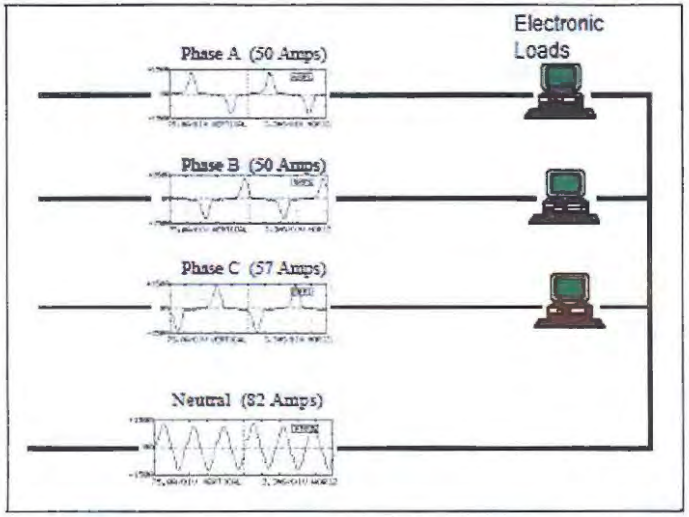


Figure 6.3.1. Phase currents and neutral current for a circuit supplying electronic loads.

An approximate formula for calculating the neutral current magnitude as a percentage of the rms phase current is given below. The formula is based on the assumption that the circuit loading is balanced, that the nonlinear load watts are a fraction p_{nl} of the total load, and that the load current has a third harmonic component equal to 70% of the fundamental.

$$Ineutral_{rms} = 3\sqrt{\frac{0.56p_{nl}^2}{1+0.56p_{nl}^2}}Iphase_{rms}$$

This relationship is illustrated in graphical form in Figure 6.3.2.

Figure 22.

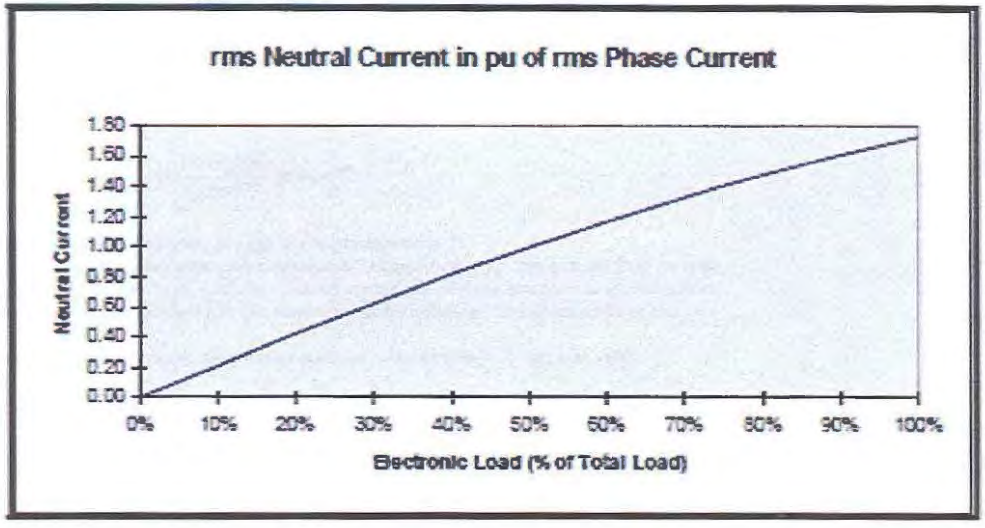


Figure 6.3.2. Rms neutral current as a function of the portion of electronic load in the circuit.

Solutions to the overloaded neutral conductor problem include the following:

- increased neutral conductor rating
- double neutral conductor
- neutral conductor with each phase conductor
- zig zag transformer on the load side of the affected neutral conductor
- parallel connected third harmonic filter on the load side of the affected neutral conductor
- series filter to block third harmonic currents in the neutral

IV. Conclusions and Recommendations

In conclusion, the electrical grid has become obsolete to handle today's technological loads. The power distribution system serving Mr. Szymanski is no exception. Mr. Szymanski's ground current issue is a simple engineering problem that requires a simple engineering solution. Mr. Szymanski's electric utility should be capable and have the knowledge to solve this problem using sound engineering practices. Although the line serving Mr. Szymanski was built recently, a reduced neutral conductor was installed (see Figures 18,19,20) despite published industry recommendations to the contrary (see Addendum II).

There are well-published documents addressing the simple solutions to the issue of ground currents and voltages, and I recommend that the electric utility stiffen the primary neutral to the Szymanski farm, reducing the voltages in the animal contact area to acceptable levels. I also recommend that the electric utility adopt policies in accordance with industry standards set forth by organizations such as IEEE and EPRI, among others cited in this report.

According to the Electrical Power Research Institute's (EPRI) *Handbook for the Assessment and Management of Magnetic Fields Caused by Distribution Lines* (1995), "A method that practically eliminates ground currents associated with primary distribution lines and still maintains the advantages of a four-wire multi-grounded system, is the five-wire system" (p. 6-11). EPRI (1995) also states, "A way of reducing the ground component of the field is to make the neutral the lowest possible impedance path and, conversely, the ground the highest possible impedance path" (p. 6-8). In a report entitled "Five-Wire Distribution System Demonstration Project", published in *IEEE Transactions on Power Delivery*, the authors found that, "During initial monitoring periods, the stray voltage in the five-wire configuration was about 40% lower than the four-wire configuration", and, "During five-wire operation, the magnetic fields were generally lower. At most locations, the magnetic fields were generally 10% to 50% lower than at the same locations during four-wire operation" (Short, Stewart, Smith, O'Brien, & Hampton, 2002).

Under Section 11, Recommended Practices for Utilities, of IEEE standard 519-1992 it is stated:

> The factors that define the quality of electrical service include harmonic distortion in addition to more familiar factors such as safety of service (e.g. surge protection and step-and-touch voltage [my emphasis]), ... If the [maximum voltage distortion] limits are exceeded [at the point of common coupling (PCC) with each consumer], the following steps may be taken:
>
> (1) Perform harmonic measurements at selected points within the utility circuit, including the PCC, and look for consumers with converters operating with current distortion beyond the limits. If identified, such consumers should be asked to keep the harmonic distortion within the recommended limits by installing filters, by reducing harmonic generation, or through other means.
> (2) Install filters to control the harmonics.
> (3) Install a new feeder. This is effective in stiffening the source and isolating the harmonic problems. (p. 83)

The IEEE (1996) says that **monetary losses** from the presence of harmonic distortion on the utility system include such things as "accelerated aging of equipment due to heating and other harmonic effects" and "derating and oversizing of equipment to withstand harmonic duties" (p. 76).

To correct the on-farm problems, as mentioned above, we recommend: 1) connecting the fencer in a manner in which the transients do not show up at cow contact (see Addendum I), or eliminate the fencer entirely, and, 2) rewire the lighting circuit in the free stall area using PVC conduit with liquidtite connectors and approved devices for damp areas.

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References

Aneshansley, D. J., & Gorewit, R. C. (1999). Sensitivity of Holsteins to 60 Hz and Other Waveforms Present on Dairy Farms. *Presented at the 1999 ASAE/CSAE-SCGR International Meeting, Paper No. 993152.* 2950 Niles Rd., St. Joseph, MI 49085-9659 USA: ASAE.

Bylinski, G. (1999, July 5). Hot New Technologies for American Factories. *Fortune.*

Electric Power Research Institute. (1995). *Handbook for the Assessment and Management of Magnetic Fields Caused by Distribution Lines.* Palo Alto: Electric Power Research Institute.

Hillman, D., Stetzer, D., Graham, M., Goeke, C., Mathson, K., VanHorn, H., & Wilcox, C. (2003) *Relationship of electric power quality to milk production of dairy herds (ASAE Paper No. 033116).* Las Vegas: ASAE.

Institute of Electrical and Electronics Engineers. (1993). *IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems.* New York: Institute of Electrical and Electronics Engineers, Inc.

Institute of Electrical and Electronics Engineers. (1996). *Guide for Applying Harmonic Limits on Power Systems.* New York, NY: Institute of Electrical and Electronics Engineers, Inc.

Institute of Electrical and Electronics Engineers. (1996). *National Electrical Safety Code C2-1997.* New York, NY: Institute of Electrical and Electronics Engineers, Inc.

Institute of Electrical and Electronics Engineers. (1996). *NESC Handbook* (Fourth ed.). New York, NY: Institute of Electrical and Electronics Engineers, Inc.

Ireland, B. (2006, September 1). Clearing up Confusion on Unwanted Voltages. *Electrical Construction and Maintenance.*

Mazur, G. A. (1992). *Power Quality Measurement and Troubleshooting* (Second ed.). Homewood, IL: American Technical Publishers, Inc.

Michaels, K. (1999, June 1). Fundamentals of Harmonics. *Electrical Construction and Maintenance.*

Ontario Hydro (Ryan, Maura C). (1998). *Power Quality Reference Guide* (Third ed.). Toronto: Ontario Hydro.

Peat, D. (2009, January 30). Children Shocked by Stray Voltage. *Toronto Sun.*

Polk, C. (2001). Cows, Ground Surface Potentials and Earth Resistivity. *Bioelectromagnetics, 22*(1), 7-18.

Reinemann, D. J., Stetson, L., & Laughlin, N. (1994). *Effects of frequency and duration on the sensitivity of dairy cows to transient voltages (ASAE Paper No. 943597).* Atlanta: ASAE.

Rogers, D. M. (2006). *BC Hydro Deals With Farm Neutral to Earth Voltage.*

Short, T. A., Stewart, J. R., Smith, D. R., O'Brien, J., & Hampton, K. (2002). Five-Wire Distribution System Demonstration Project. *IEEE Transactions on Power Delivery, 17*(2), 649.

Staehle, R. W., Anderson, L. E., Dziuk, H. E., Hird, D., Liboff, A. R., Polk, C., et al. (1998). *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.* St. Paul: Minnesota Public Utilities Commission.

United States Department of Agriculture. (1991). *Effects of Electrical Voltage/Current on Farm Animals: How to Detect and Remedy Problems (Agriculture Handbook Number 696).* Washington, D.C.: United States Government Printing Office.

Zipse, D. W. (1999). *Wiley Encyclopedia of Electrical and Electronics Engineering* (Vol. 8). (J. G. Webster, Ed.) New York: John Wiley & Sons, Inc.

Addendum I: Cow Trainer Installation and Maintenance

COW TRAINER INSTALLATION AND MAINTENANCE

A SELF-HELP GUIDE FROM...

mREC
Midwest Rural Energy Council

Cow trainers are often installed incorrectly. This publication will help you to find the right equipment and get your trainer installed right the first time.

What Kind of Energizer Should I Use?

Never use an energizer designed for powering long runs of fence for a cow trainer. Do not exceed a 2500-volt energizer for a cow trainer. Too much power can cause excessively nervous behavior in animals. Higher voltage also increases the likelihood of the energizer pulses traveling to undesired locations.

What about the UL Rating?

Buy an energizer with a UL rating. There are many energizers that are not UL approved. The UL rating will ensure that the device complies with the National Electric Code.

Where Should I Put The Energizer?

An energizer should be placed on the outside perimeter of a building and near a 120 volt outlet. This location should be a minimum of 50 feet from the main electrical service panel grounds.

What Kind of Wire Should I Use?

Always use wire with 20,000 volt insulation for the 'hot' lead-out from the energizer. Common wire with 600-volt insulation used for the building wiring must never be used on the hot side of an energizer circuits. Do not connect the high voltage output terminal to anything not associated with the energizer.

The wire for the grounding circuit should be the same high voltage wire (20,000 volt insulation) if the ground wire passes through the wall of a building, as it almost always does with a trainer.

Proper Grounding is Essential!

One of the most important parts of an energizer circuit is the grounding system. An improper ground can result in unintentional shocks to livestock at grounded equipment such as waterers, feeding equipment, or even in a milking barn or parlor.

If an energizer does not control livestock, the solution is not necessarily a more powerful energizer. Improving the grounding may be the lowest cost, most effective means of improving the operation of the trainer. The proper installation of the earth-return rods for a cow trainer is shown in the Figure.

Remember These Important Points:

- Each energizer (fencer, trainer, crowd gate) must have its own dedicated earth-return system. DO NOT combine the earth-return systems from two different devices.
- NEVER connect the trainer's grounding system to the farm's electrical grounding system (including utility system grounds, equipotential planes, and metal objects in a building, such as milklines, waterlines or stalls).
- Keep the ground rods 50 feet away from building ground rods, cattle waterers, underground metal water pipes, telephone lines, or lightning rods.
- Use a minimum of two eight-foot ground rods spaced at least 12 feet apart. If using shorter ground rods, space them 1½ times the length of the rod. More ground rods may be needed in sandy and rocky soils. Try to

locate the rods in areas that are likely to receive moisture on a regular basis but do not locate them under overhangs or in buildings.

- Use wire with insulation rated at 20,000 volts to connect the energizer to the earth return rods if the wire passes through a building wall.
- Use an acorn-style ground rod type connector for connecting the ground wire to the ground rod.

How Should I Adjust The Trainer?

A cow trainer is designed to train cows not to arch their back while defecating or urinating so that waste falls in the gutter. Cow trainers must be carefully adjusted for each individual cow in order to be effective. Agitation and stress can result if cows cannot easily avoid the trainer.

With most cow trainer circuits, the barn floor is part of the earth-return path. The trainer pulses will appear at all locations in the barn whenever any cow touches a trainer bar. This makes it especially important that trainers be adjusted properly so that cows contact the trainers infrequently.

Adjust the trainer bars so they are approximately 3 inches above the cow's shoulders, or until they are effective in training the cows to drop their manure in the gutter. It is essential that the trainer be fastened securely to eliminate the possibility of the unit sliding down onto the cow's back. It is also important to make sure cows get back into their own stall which has had the trainer bar adjusted for them. If this cannot be done then the bars must be adjusted every time cows return to the barn.

What about Maintenance?

Trainer wires and insulators can become covered with whitewash, dust and dirt that can provide a path for trainer shocks to appear at unwanted locations. Check the coil wires, condition of the insulation, presence of pinch points, condition and operation of hangers, for fouling or deterioration.

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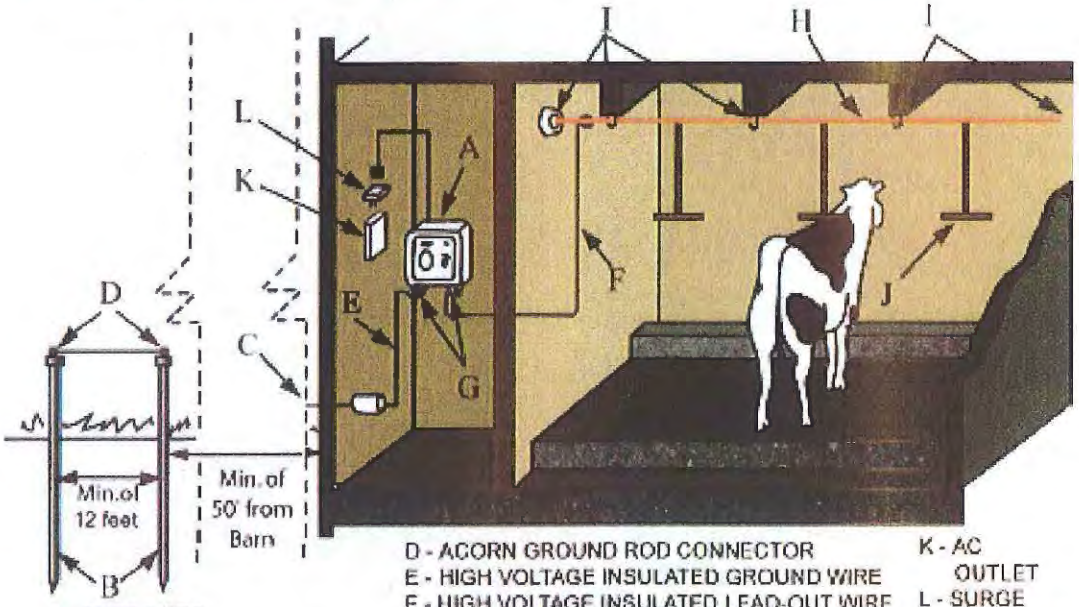

A - ENERGIZER
B - EARTH RETURN RODS
C - HIGH VOLTAGE INSULATED GROUND WIRE
D - ACORN GROUND ROD CONNECTOR
E - HIGH VOLTAGE INSULATED GROUND WIRE
F - HIGH VOLTAGE INSULATED LEAD-OUT WIRE
G - ENERGIZER TERMINAL LUGS
H - HIGH VOLTAGE INSULATED TRAINER WIRE
I - TRAINER WIRE SUPPORTS
J - TRAINER HANGERS
K - AC OUTLET
L - SURGE ARRESTOR

Addendum II: Power Quality Research

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Power Quality Research

1.) (c) On a 4-wire, 3-phase wye circuit where the major portion of the load consists of nonlinear loads, harmonic currents are present in the neutral conductor; the neutral shall therefore be considered a current-carrying conductor.

During the cycle for the 1996 *NEC,* a task group composed of interested parties was created to recommend to the *National Electrical Code* Committee what direction should be taken in its standards that would result in improving the safeguarding of persons and property from conditions and property that may be introduced by nonlinear loads. This group was designated the *NEC* Correlating Committee Ad Hoc Subcommittee on Nonlinear Loads. The scope of this subcommittee was as follows:

1. To study the effects of electrical loads producing substantial current distortion upon electrical system distribution components including, but not limited to:
   a. Distribution transformers, current transformers, and others.
   b. Switchboards and panel boards
   c. Phase and neutral feeder conductors
   d. Phase and neutral branch-circuit conductors
   e. Proximate data and communications conductors
2. To study harmful effects, if any, to the system components form overheating resulting from these load characteristics
3. To make recommendations for methods to minimize the harmful effects of nonlinear loads considering all means, including compensating methods at load sources
4. To prepare proposals, if necessary, to amend the 1996 *National Electrical Code,* where amelioration to fire safety may be achieved

The subcommittee reviewed technical literature and electrical theory on the fundamental nature of harmonic distortion. They reviewed the requirements in and proposals for the 1993 *NEC* regarding nonlinear loads. The conclusion of the subcommittee was that while nonlinear loads can cause undesirable operational effects, including additional heating, no significant threat to persons and property had been adequately substantiated.

The subcommittee agreed with the existing *Code* text regarding nonlinear loads. However, the subcommittee submitted many proposals for the 1996 *NEC*. These proposals included a definition of nonlinear load, revised text reflecting that definition, fine print notes calling attention to the effects of nonlinear loads, and permitting the paralleling of neutral conductors in existing installations under engineering supervision.

As part of the subcommittee's final report, nine proposals for changes to the 1993 *NEC* were submitted. All were accepted and without modification as changes to the 1996 *NEC*.

Also included in this report and pertinent to the 1999 *NEC* Section 310-15(b)(4)(c) is the following discussion.

Should Neutral Conductors Be Oversized?

There is concern that because the theoretical maximum neutral current is 1.73 times the balanced phase conductor current, there is a potential for neutral conductor overheating in 3-phase, 4-wire, wye-connected power systems. The subcommittee acknowledges this theoretical basis; however, in reviewing the documented information, fires attributed to the use of nonlinear loads could not be identified.

The subcommittee reviewed all the data that was made available to the subcommittee regarding measurements of circuits that contain nonlinear loads. This data was obtained from consultants, equipment manufactures, and testing laboratories, and included hundreds of feeder and branch circuits involving 3-phase, 4-wire, wye-connected systems with nonlinear loads. This data revealed that many circuits had neutral conductor current greater than the phase conductor current greater than the phase conductor current, and approximately 5 percent of all circuits reported had neutral conductor current exceeding 125 percent of the highest phase conductor current. One documented survey with data collected in 1988 from 146 three-phase computer power system sites determined that 3.4 percent of the sites had neutral current in excess of the rated system full-load current.

According to Section 384-16(c) of the 1993 *NEC* the total continuous load on any overcurrent device located in a panelboard shall not exceed 80 percent of its rating (the

exception being assemblies listed for continuous operation at 100 percent of its rating). Since the neutral conductor is usually not connected to an overcurrent device, derating for continuous operation is not necessary. Therefore, neutral conductor ampacity is usually 125 percent of the maximum continuous current allowed by the overcurrent device.

Also important for gathering electrically measured data from existing installations is the following excerpt continuing in this report.

Measurements of Nonsinusoidal Voltages and Currents

The measurement of nonsinusoidal voltages and currents may require instruments different from the conventional meters used to measure sinusoidal waveforms. Many voltage and current meters respond only to the peak value of a waveform, and indicate a value that is equivalent to the rms value of a sinusoidal waveform. For a sinusoidal waveform the rms value will be 70.7 percent of the peak value. Meters of this type are known as "average responding meters" and will only give a true indication if the waveform being measured is sinusoidal. Both analogue and digital meters may be average responding instruments. Voltages and currents that are nonsinusoidal, such as those with harmonic frequencies, cannot be accurately measured using an average responding meter. Only a meter that measures "true rms," can be used to correctly measure the rms value of a nonsinusoidal waveform.

Source: NEC 1999 National Electrical Code Handbook

2.) 6.3.1 Neutral Conductor Overloading

When single phase electronic loads are supplied with a 3-phase, 4-wire circuit, there is a concern for the current magnitudes in the neutral conductor. Neutral current loading in the 3-phase circuits with linear loads is simply a function of the load balance among the three phases. With relatively balanced circuits, the neutral current magnitude is quite small. This has resulted in a practice of undersizing the neutral conductor in relation to the phase conductors.

With electronic loads supplied by switch-mode power supplies, the harmonic components in the load currents can result in much higher neutral current magnitudes. This is because the odd triplen harmonics (3, 9, 15, etc.) produced by these loads is show up as zero

sequence components for balanced circuits. Instead of cancelling in the neutral (as is the case with positive and negative sequence components), zero sequence components add directly in the neutral. The third harmonic is usually the largest single harmonic component in single phase power supplies or electronic ballasts.

Source: Guide for Applying Harmonic Limits on Power Systems (63) – May 4, 1996

7.0 Applying Harmonic Limits for Residential Customers

... With existing load characteristics, the current distortion for residences rarely approaches 15%. However, a growing percentage of the load in a household is electronic and may use switch mode power supplies. ASDs for heat pumps and air conditioners, compact fluorescent lights (electronic ballasts), and electric vehicle battery chargers also use diode bridge rectifiers in the front end. All of these new loads have the potential to cause residential loads to become a significant source of harmonics on a distribution system.

A major concern associated with the proliferation of electronic loads on the distribution system is that all of these loads tend to draw current waveforms that are similar and in phase with each other. This is an inherent characteristic of the diode bridge rectifier with capacitive smoothing. As a result, the lower order harmonics from these loads tend to add on the distribution system with little cancellation. The triplen harmonics can be of particular concern on systems that supply single phase loads line-to-neutral on the transformer primary. Some analytical cases evaluating the possible impacts of this increasing penetration of nonlinear loads are provided in this section.

Source: Guide for Applying Harmonic Limits on Power Systems (69-70) – May 4, 1996

8.0 Utility System Considerations

The electric utility is responsible for the quality of the voltage supplied to its customers. This voltage can become distorted due to harmonics introduced by nonlinear loads within customer facilities, due to harmonics introduced by nonlinear devices applied directly on the power system (e.g. static var systems, high voltage dc converters, traction power rectifiers, etc), or due to resonance conditions on the system. IEEE 519-1992 was developed to help with the coordination that is needed to keep voltage distortion levels on the overall system within reasonable limits.

8.1 General Considerations

The level of service quality provided to customers has always been a concern for electric utilities. Utilities and their customers continue to work together to address service quality problems. With increasing utilization of loads that include electronics that can be sources of harmonics and can also be sensitive to disturbances, the utility industry concern for service quality continues to grow.

Harmonic distortion is one of the many types of power quality variations present on the power system that can degrade service quality. This section of the application guide discusses the various measures that utilities can consider to minimize the effects that harmonic distortion has on the overall service quality provided to customers. Many of these considerations have already been addressed in previous sections.

Source: Guide for Applying Harmonic Limits on Power Systems (72) – May 4, 1996

8.2.2 Current Distortion Limits

The harmonic distortion of the system voltage is a product of the flow of harmonic currents on the system and the impedances of the system elements....

Current distortion, while influenced somewhat by system impedance, can easily be measured with commercially available monitoring equipment at the point of common coupling and is determined by the characteristics of the load equipment....

Hence, *it is in the interest of both the utilities and their customers to follow the harmonic current distortion limits.* By working together, acceptable levels of service quality can be provided to all customers.

Source: Guide for Applying Harmonic Limits on Power Systems (73)

– May 4, 1996

8.4 Harmonic Mitigation Techniques

Excessive harmonic levels (voltage and/or current) on the utility system can result in increased equipment heating, equipment malfunction and premature equipment failure, communication interference, fuse blowing in capacitor banks, and customer equipment and process problems. When the distortion levels on the utility system are a problem, mitigation measures need to be implemented. IEEE 519-1992 helps identify reasonable limits for the individual customers on the system. If specific customers are causing unacceptable harmonic levels, the mitigation may be best applied at those customers. If the overall system response is causing unacceptable distortion levels, mitigation measures may be required on the utility system.

Source: Guide for Applying Harmonic Limits on Power Systems (75) – May 4, 1996

8.5 Economic Considerations

The presence of harmonic distortion on the utility system results in incremental costs in the operation of the system. Categories for these losses include:

- costs of harmonic mitigation measures (filtering)
- increased losses in conductors, transformers, motors, etc.
- engineering effort to diagnose problems
- accelerated aging of equipment due to heating and other harmonic effects
- derating and oversizing of equipment to withstand harmonic duties

Results of preliminary efforts to characterize these costs have been published [31]. This study showed that the most important cost component is likely to be the costs associated with applying mitigation measures, such as harmonic filtering, to reduce harmonic levels. Based on these incremental costs alone, substantial investment in mitigating harmonic generation in the end use equipment could be justified.

Source: Guide for Applying Harmonic Limits on Power Systems (76-77) – May 4, 1996

5.4.1 Distribution Systems

Balanced system analysis does not apply in many cases. However, it does provide useful information in cases with large three-phase harmonic sources or in cases in which phase location of single-phase loads are not known. Any of the following conditions can result in the need to analyze the distribution system response with a full three-phase representation.

1) Large single-phase harmonic sources (nonlinear loads)
2) Significantly unbalanced load characteristics
3) Single-phase capacitor banks on the system

Source: IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems (32) Std 519-1992

6. Effects of Harmonics

6.1 General

…The least susceptible type of equipment is that in which the main function is in heating.

6.2 Motors and Generators

A major effect of harmonic voltages and currents in rotating machinery (induction and synchronous) is increased heating…
If the frequency of a mechanical resonance exists close to the frequency of electrical stimulus. high-stress mechanical forces can be developed.
There are two concerns with these rotor harmonics: 1). Resultant rotor heating 2) Pulsating or reduced torques
The sum effect of harmonics is a reduction in efficiency and life of the machinery. Neither reduction is pronounced for normally encountered harmonic content, but the harmonic heating typically reduces performance.
As noted above, the harmonics can also cause a pulsating torque output… The resultant mechanical oscillations can cause shaft fatigue and accelerated aging of the shaft and connected mechanical parts.

6.3 Transformers

The effect of harmonics on transformers is twofold: current harmonics cause an increase in copper losses and stray flux losses, and voltage harmonics cause an increase in iron losses. The overall effect is an increase in the transformer heating, as compared to purely sinusoidal (fundamental) operation.

Source: IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems (35-36)

6.6 Electronic Equipment

Power electronic equipment is susceptible to misoperation caused by harmonic distortion. This equipment is often dependent upon accurate determination of voltage zero crossings or other aspects of the voltage wave shape. Harmonic distortion can result in a shifting of the voltage zero crossing or the point at which one phase-to-phase voltage. These are both critical points for many types of electronic circuit controls, and misoperation can result from these shifts.

Perhaps the most serious of these are malfunctions in medical instruments.

6.8 Switchgear and Relaying

As with other types of equipment, harmonic currents can increase heating and losses in switchgear, thereby reducing steady-state current carrying capability and shortening the life of some insulating components.

6.9.2.2 Residual or Ground Return Currents

Telephone circuits are particularly susceptible to the influence of ground return currents. Special care should be exercised in holding these to an absolute minimum. As long as both conductors of a telephone circuit have equal exposure to a balanced three-phase power circuit, as is the case with twisted pairs, the induced harmonic voltages and currents cancel.

Source: IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems (38-39, 42)

Triplen harmonic currents (odd ordered) harmonic currents that are multiples of three {e.g., 3rd, 9th, 15th, and so on} flow on the neutral path from line-to-neutral connected *nonlinear* loads. These harmonic currents are additive only on the shared 3-phase, 4-wire wye-connected neutral path and result in simple I^2R heating problems. This creates higher rms currents on the neutral conductor than appear on the associated line conductors. Continuous rms current on the neutral can approach 173% of the line current --- overloading and even burning-out 100%-rated neutral conductors, terminations, buses, etc. *anywhere* along the neutral path.

Source: CEE News, February 1999, p. 18

Since the neutral bus bar assembly in a typical 3-phase, 4-wire panelboard rates at 100% of the line current bus bar ratings, you'll need a *nonlinear load-rated* panelboard. It has a 200%-rated neutral bus bar system and is product safety listed for use with *nonlinear load* equipment. Without the use of this special kind of listed panelboard, the local inspector can raise questions regarding the NEC suitability of any other kind of panelboard you may be using.

Once you make the case for a 200% rated neutral bus bar in the panelboard, it's logical to apply the same reasoning to the neutral conductor in the 3-phase, 4-wire feeder supplying the panelboard.

If you terminate a 200%-rated neutral conductor of a feeder to a 200%-rated neutral bus bar in a panelboard, what should the ampacity be for the neutral bus bar arrangement in the AC

supply source to which the feeder is attached for supply purposes? If you said 200%, you're right!

Source: CEE News, February 1999, p. 19

D. Current in Grounding Conductor

Ground connection points shall be arranged so that under normal circumstances there will be no objectionable flow of current over the grounding conductor. If an objectionable flow of current occurs over a grounding conductor due to the use of multi-grounds, one or more of the following should be used:

1. Abandon one or more grounds.
2. Change location of grounds.
3. Interrupt the continuity of the conductor between ground connections.
4. Subject to the approval of the administrative authority, take other effective means to limit the current.

The system ground of the source transformer shall not be removed.

The temporary currents set up under abnormal conditions while the grounding conductors are performing their intended protective functions are not considered objectionable. The conductor shall have the capability of conducting anticipated fault current without thermal overloading or excessive voltage buildup. Refer to Rule 93C.

Source: National Electrical Safety Code; CS-1997

92D. Current in Grounding Conductor

(This rule was numbered 92C prior to the 1977 Edition. The 5th Edition requirements of Rule 92E—Service Conduit *were included within Rule 92D*—Equipment and Wire Raceways; *these requirements were placed into Rule 93C in the Edition.)*

Rule 92D refers to actions required in the case of "objectionable" flows of current over a grounding conductor. The word "objectionable" is undefined in the NESC; it is left to the designer's discretion, utilizing good design and operating practice, to appropriately identify and remedy the situation.

Where multiple grounding is used, there generally will be some circulating current between the different ground connections. These currents may arise from unbalanced loads, improper connection or loss of ground wires, or other reasons. A fraction of an ampere, or even several amperes on circuits of large capacity, may not be a serious matter. In other cases, however, such flow may be disturbing to the service, as is sometimes the case around dairy barns in which cows are connected to milking systems. It is recognized that interrupting the circulating current between the primary neutral and the secondary neutral may not solve the problems at dairy barns and may actually cause other problems. Such problems are often related the National Electric

Code (NEC) violations, unbonded building construction, and other building-related problems the produce voltage gradients at entrances or in building floors. While it is generally both infeasible and unnecessary to ascertain the circulating current flow ate every ground location, installations near areas that are often known to present specific problems (such as milking barns without adequate voltage gradient control, pipelines, electric railways, conduits, etc.) may need special attention to limit damage to equipment or uncomfortable conditions for personnel or animals.

Source: NESC Handbook; Fourth Edition, "A Discussion of the National Electrical Safety Code."

Voltage harmonics

The power line itself can be an indirect source of voltage harmonics.
The harmonic current drawn by non-linear loads acts in an Ohm's law relationship with the source impedance of the supplying transformer to produce voltage harmonics.

Neutral conductors

In a 3-phase, 4-wire system, neutral conductors can be severely affected by non-linear loads connected to the 120V branch circuits. Under normal conditions for a balanced linear load, the fundamental 60 Hz portion of the phase currents will cancel in the neutral conductor. In a 4-wire system with single-phase non-linear loads, certain add-numbered harmonics called triplens—odd multiples of the third harmonic: 3^{rd}, 9^{th}, 15^{th}, etc.—do not cancel, but rather add together in the neutral conductor. In systems with many single- phase non-linear loads, the neutral current can actually exceed the phase current. The danger here is excessive overheating because there is no circuit breaker in the neutral conductor to limit the current as there are in the phase conductors.

In overloaded neutrals

In a 3-phase 4-wire system, the 60 Hz portion of the neutral current can be minimized by balancing the loads in each phase. The triplen harmonic neutral current can be reduced by adding harmonic filters at the load. If neither of these solutions are practical, you can pull in extra neutral for each phase. Or you can install on oversized neutral shared by three phase conductors.

Source: Fluke's In Tune with Power Harmonics; "Basic troubleshooting using multimeters and current clamps."

Sec. 2-206. Higher Harmonics is Polyphase Systems.

In a balanced n-phase system the time angle between two consecutive star voltage is $2pi/n$. If the voltage wave has a q-th harmonic, the angle between the phases of these harmonics will be $2pi\ q/n$. When $q=n, 3n, 5n,$ etc., the q-th harmonics in all the voltages are in phase with each other. When the neutral points of the system are isolated, such harmonics give rise to the so-called oscillating neutral. With the neutrals grounded, currents of the corresponding frequency flow

through all the phases and return through the ground. In the three-phase system the harmonic voltages in phase with one another are the 3rd, the 9th, the 15th, etc.

Source: Standard Handbook for Electrical Engineers

In a 3- phase, 4-wire system, neutral conductors can be severely affected by nonlinear loads connected to 120 V branch circuits. The 1-phase nonlinear loads produce odd-numbered triplen harmonics (3rd, 9th, 15th, etc.). *Triplen harmonics* are odd multiples of the third harmonic. Triplen harmonics do not cancel, but add together in the neutral conductor.
In systems with many 1-phase nonlinear loads, neutral current can exceed an individual phase current. Generally, the amount of neutral current is between 125% and 225% of the highest phase current. The third harmonic current is usually responsible for most of the neutral current because the third harmonic typically represents the harmonic with the highest current value. High neutral current is dangerous because it causes overheating in the neutral. Because there is no CB in the neutral conductor to limit current, as in the phase conductors (A, B, and C), overheating of the neutral can become a fire hazard. Excessive current in the neutral conductor can also cause higher than normal voltage drops between the neutral conductor and ground at 120 V outlets. See Figure 6-8.

Source: Power Quality Measurement and Troubleshooting; Glen A. Mazur-Author.

Fundamentals of Harmonics

Harmonics: It surfaced as a buzzword in the early 1980's, making many people reconsider the effectiveness of their building's wiring system. Yet, many *still* view the concept as a relatively new phenomenon. However, harmonics have been around well before the early 1980's: The associated problems existed in the electrical world way back when transistor tubes were first used in the 1930's. Aside from grounding, many deem harmonics as one of the greatest concerns for the power quality industry today.

Circuit Overloading.
Harmonics can cause overloading of conductors and transformers and overheating of utilization equipment, such as motors. Triplen harmonics can especially cause overheating of neutral conductors on 3-phase, 4-wire systems. While the fundamental frequency and even harmonics cancel out in the neutral conductor, odd-order harmonics are additive. Even in a balanced load condition, neutral currents can reach magnitudes as high as 1.73 times the average phase current. This additional loading creates more heat, which breaks down the insulation of the neutral conductor. In some cases, it can break down the insulation between windings of a transformer. In both cases, the result is a fire hazard. But, you can diminish this potential damage by using sound wiring practices.

When most electrical engineers design the building's wiring, they usually leave the sizing of the neutral conductor to the dictates of the NEC. In most cases, the installed neutral is the same size as the phase conductors. However, the Notes to the Ampacity Tables (in NEC Art. 310) instruct you to consider the neutral conductor as a *current-carrying* conductor *if electronic equipment or electronic ballasts are used at the site*. This correlates into the neutral conductors being sized larger than they would be with conventional wiring means.
To be on the safe side, more engineers are doubling the size of the neutral conductor for feeder circuits to panel boards and branch circuit partition wiring to handle the additive harmonic currents.

Source: EC&M – June 1999

"The third harmonic, like any other electrical frequency, is not a concern for people or animals unless they the person or animal becomes part of an electrical circuit…"

Source: Agri-View, October 1999 By Chuck DeNardo – Senior Engineer- Wisconsin Electrical Power Company.

The combination of equal amounts of 60 and 180 Hz with different phase shifts and their lack of sensitivity to DC bias indicates that cows are sensitivity peak-to-peak voltages and not peak or rms.

This could only have implications to current measurement techniques when there are significant harmonics present at steady state.

Source: ASAE Paper No. 993152; Sensitivity of Holsteins to 60Hz and Other Waveforms Present on Dairy Farms By D.J. Aneshansley, Associate Professor and R.C. Gorewit, Professor, Cornell University.

The conclusions of this research are:

1. Deep grounds will be of little help.
2. "Isolation" as implemented achieves little isolation.
3. Low level third harmonic step voltage has an adverse effect on cows that are subjected to it over a period of many weeks.
4. The utilities are responsible for third harmonic currents in the earth.

Source: ASAE Paper No. 993155; Deep Grounding By Martin Graham, Professor Emeritus, Electrical Engineering, University of California, Berkeley, California.

However, the measured voltages are high enough to support the low level voltage hypothesis.

If earth currents induce any kind of physiological response, it must be through the associated step potential across the ground.

The low level step potential hypothesis is supported by the data in the field study…

We concluded that the perceptions of farmers about the possibility of electrical causes of problems with herd health and production are not sufficiently objective to use as a basis for farm selection.

Little work has been done to document hoof-to-hoof exposures, yet this is a common exposure pathway in the field.

The frequency of behaviors such as hoof lifting and kicking during milking have been suggested as measures of cow discomfort during milking. These are likely to be sensitive measures for hoof-to-hoof voltage exposure. The milk letdown reflex is influenced by stresses experienced during milking. Discomfort during milking may decrease both the peak and average milk flow rate during milking, increase the time taken to remove the milk and increase the amount of milk remaining in the udder after machine milking.

According to a 1994 survey of Minnesota electric utilities by the PUC, a large fraction of current originating from utility, rural distribution systems returns to the substation through the earth, with the remainder on the neutral conductor.

Source: 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 July 31, 1998, Minnnesota Public Utilities Commission. Submitted to the Minnesota Public Utilities Commission by Douglas J. Reinemann, Ph.D., Associate Professor, Biological Systems Engineering, University of Wisconsin-Madison, Morten Dam Rasmussssen, Ph.D., Senior Research Scientist, Danish Institute of Agricultural Science, Department of Animal Health and Welfare, Milo C. Wiltbank, Ph.D., Associate Professor of Dairy Science, University of Wisconsin-Madison, and Jenks Britt, DVM, Associate Professor of Veterinary Medicine, University of Wisconsin-Madison.

"To understand grounding one must understand several facts. The first is that the earth is not a sponge that absorbs electricity. The second is that the earth is a conductor. The third is that every grounding system, be it used for power distribution, radio, lightning, or static, consists of a circuit. Understanding the route the ground current takes to complete its circuit is critical to understand grounding and grounding systems. Completing the ground circuit will resolve most grounding.

Step Voltage The technical definition of step voltage is "the difference in surface potential experienced by a person bridging a distance of 1 m with his feet without contacting any other grounded object" (2). The soil has resistance. When a high fault current flows through the earth due to a conductor coming into contact with the earth, a voltage is developed across the earth as long as the current flows.

Touch Voltage The touch voltage is "the potential difference between the ground potential rise and the surface potential at the point where a person is standing, while at the same time having his hands in contact with a grounded structure" (2). This is like the stop voltage, except the person is standing on the ground and at the same time touches a grounded metal object. The potential difference between the point on the earth where the person is standing and the point where he touches the metal object is called the touch voltage, or touch potential. See the subsection "grounding grid" under "Connecting to earth."

For example, the installation of ground mats under operating handles of high-voltage switches, and bonded to the metal switch parts, reduces the potential between the earth where the feet are and the switch handle where the hands are touching.

Uncontrolled Flow of Current over the Earth It is an unsafe practice to allow current to flow over the earth continuously, uncontrolled. All continuously flowing current must be contained within insulated electrical conductors.
Neutral-to-earth faults allow the current to flow uncontrolled over the earth continuously. This uncontrolled flow of current over the earth can result in electrical shocks to humans and animals, cause computer screens to flutter, damage electrical equipment, cause fires, and generate magnetic fields.

Distribution Circuits. In distribution circuits (>600 V), it is the practice in some countries to connect the primary neutral to the secondary neutral, as in Fig. 3. The object is to protect the secondary from primary-voltage excursions. Also, in the United States there is a requirement that the primary neutral conductor be connected to earth four times per mile. In addition, some utilities depend on the earth to carry part of the return current. It is common to have only 40% to 60% of the return current carried by the neutral conductors of the primary distribution system and the rest returned over the earth. This flow of primary return current over the earth is uncontrolled and unrestrained, and has caused serious problems.

...(3) install a device that will block the connection between the primary and the secondary neutral (a neutral blocker). The neutral blocker devices allow fault current to flow but block any normal current flow.

Source: Wiley Encyclopedia of Electrical and Electronics Engineering, Volume 8, by John G. Webster, Editor, Department of Electrical and Computer Engineering University of Wisconsin-Madison, published by John Wiley & Sons, Inc.

1.1 Background and Objectives

Furthermore, proximity to distribution lines has been associated with the risk of childhood cancer in three epidemiological studies.

6.5 Five-Wire Primary Lines

A method that practically eliminates ground currents associated with primary distribution lines and still maintains the advantages of a four-wire multi-grounded system, is the five-wire system…

Source: Handbook for the Assessment and Management of Magnetic Fields Caused by Distribution Lines, EPRI TR-106003, Project 3959-07, Final Report, December 1995

EXHIBIT G

B. A Number of States PSC have a "Stray Voltage Protocol" Which are Based On Junk Science, do not Cover the Truth and State Courts have Allowed Suits and Judgments because the Rule does not Cover what Occurred on a Farm.

In Plaintiffs' Brief in Support of Answer to Motion for Dismissal for Deferral to MPSC dated July 31, 2013, Plaintiffs had an Exhibit G with (a) through (e) and attached reports of a number of cases and states as follows:

> Attached hereto and made a part hereof as Exhibit G are a number of cases and reports of cases as follows:
>
> a. A report of a jury award of $5 million dollars in a record stray voltage suit in Wisconsin.
>
> b. Regarding the same case, a Wisconsin Law Journal Report shows in the last paragraph of its report as follows:
>
> As in many of these cases, the "cow contact voltages" as measured by the methods of the Public Service Commission of Wisconsin (PSCW) did not exceed the PSCW "level of concern" for 60 Hz., steady state AC rms voltage. However, the herd was exposed to ground current transient voltages, originating from the power line, which are short duration bursts of electrical energy and whose measurement and mitigation are not addressed by the PSCW protocols. As in *Hoffmann v. Wisconsin Electric Power Co*, 2003 WI 64 262 Wis. 2d 264, 664 N.W. 2d 55, negligence was established under the common law.

c. Associated Press Report about the Minnesota Supreme Court stating that each stray voltage case can proceed and explaining same.

d. A report that Wisconsin Supreme Court upholds stray voltage award.

e. The case of *Vierstra v. Idacorp, Inc. dba Idaho Power Co., et al* (2004).

These are examples of cases in other states decided by the court of general jurisdiction. The Bollant case in particular as quoted above that when transient voltages, for example, are involved and are not covered by any rules of the public service commission, it is a matter for a court of general jurisdiction as in the case now before this Court.

The case mentioned above in (a) and (b) is *Bollant Farms, Inc., Steven Bollant, Delores Bollant and Thomas Bollant v Scenic Rivers Energy Cooperative and Federated Rural Electric Insurance Exchange and ABC Insurance Company.* This is a case decided by a Grant County Wisconsin jury granting Bollant Farms, Inc. $3,700,000.00 in economic damage and the individual Bollants $1,250,000.00 in nuisance damages. The lower court case no is 2007CV349. It was decided on April 20, 2010. The Defendant appealed only the verdict in favor of the individuals for nuisance damages and this case can be found as a Court of Appeals decision for the State of Wisconsin dated August 25, 2011, the same being appeal no. 2010 AP 1758, 357 Wis 2d 427.

The case above in (c) is *Greg Siewert, et al v Northern States Power Co. dba* Xce, 75 NW 2d 909 was decided on January 26, 2011 by the Supreme Court of

Minnesota. Subparagraph (d) above is the case of *James and Grace Gumz v Northern States Power Co. dba Xcel Energy*, 305 Wis 2d 263, 742 NW 2d 274, Wis (2007) upholding a Marathon County Wisconsin Jury award of $533,000.00. (e) is a lower court decision asking the lower court to reverse a jury verdict and the lower court meticulously analyzes the case as an appellate court. It covers much of the situation in the Szymanski's earlier trial in Sanilac County and the facts of this case.

Michigan, like many Public Service Commissions, has adopted a stray voltage measurement protocol and state a level of concern described as a "Preventive Action Level" which means "a steady animal contact current that meets or exceeds 2 milliamperes RMS using a nominal 500 ohms register at 60 Hz from all sources, including off-premises and on-premises sources." (R 460.2701 (m)) Continuing on in that rule under (o), it describes "Root mean square" (RMS) and says that it "means a measure of the effective energy value of a wave or cycle. For regularly-shaped sine waves, the RMS value is 0.707 multiplied by the peak value of the sine wave." The problem with this protocol is it only measures regularly shaped sine waves of 60 Hz electricity and only measures peak value and not peak to peak. Modern day science makes it clear dairy animals feel electricity measured peak to peak and in fact under modern day nonlinear loads, there are transients, triple harmonics and all sorts of electrical currents other than 60 Hz flowing on utility lines and absent a sufficient primary neutral on an Wye system such as TEC's system, electricity flows through the ground and not back on the primary neutral and causes damage. TEC uses average responding meters which display the peak value of an electrical current and voltage or the average root-means-square (rms) value. TEC only takes into consideration 60 Hz

electricity and with an average responding meter, measures peak value and in so doing, "average responding rms meters measure distorted wave forms with readings that are 25% to 50% below the actual rms values.' (See Power Quality Primer, McGraw Hill, copyright 2000, page 181. This was contained in Dr. Donald Hillman's testimony before the MPSC on April 25, 2011, in the Tenson Family Farms case being U-16129, page 389 and 390, which testimony is attached as Exhibit 2 to Plaintiff's Motion for Reconsideration dated November 8, 2013.)

Accordingly, when the rule does not cover the actual facts of the situation on the farm, other State's Courts have said the rule does not apply and a Court of general jurisdiction may proceed to a verdict which is more often than not a jury verdict. This issue to counsel's knowledge has not been before this Court and this Court should enact the same ruling.