S T A T E O F M I C H I G A N

BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

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In the matter of the Complaint of **ATTORNEY GENERAL JENNIFER M. GRANHOLM** on behalf of the State of Michigan, the People of the State of Michigan, and all of the electric customers of Consumers Energy Company, against **CONSUMERS ENERGY COMPANY**, arising out of the significant, dangerous, and harmful stray voltage problem that exists on this utility's electric system.	)	Case No. U-11684

PROPOSAL FOR DECISION

I.

HISTORY OF PROCEEDINGS / FACTUAL BACKGROUND

In 1993, the Michigan Public Service Commission (MPSC) established a Stray Voltage Task Force[1] that, among other things, considered available options for addressing stray voltage. The Task Force presented a report to the MPSC. In it, the Task Force recommended that a formal hearing or rulemaking procedure be initiated to consider establishing an action/concern level of stray voltage and current, as well as a standardized testing and mitigation procedure.

On April 17, 1997 the Michigan Electric and Gas Association[2] (MEGA) and the

[1] The Stray Voltage Task Force members included Daniel Nickerson, Jr. (Chairman), Roger Fischer (Co-Chairman), Kristen Brock, William Celio, William English, Lauchlin MacGregor, Jr., James Padgett, and Greg White.

[2] MEGA is a statewide trade association representing the collective interest of investor-owned electric gas utilities. Consumers Energy Company is a member.

Michigan Electric Cooperative Association[3] (MECA) filed a request for the MPSC to commence a rulemaking proceeding on stray voltage. On July 31, 1997 the MPSC issued an order setting a schedule for a hearing on the proposed rules and the filing of written comments. The hearing was held on October 8, 1997. Comments were filed by October 15, 1997. The Attorney General for the State of Michigan (AG) was one of those filing comments. In the interest of continuity with the briefs filed in this case, the AG is referred to in the female gender. When the initial complaint was filed, Frank J. Kelley was the Attorney General of the State of Michigan. The AG's comments challenged the MPSC's authority to promulgate rules that would allow utilities to operate their systems with any level of stray voltage.

On April 22, 1998 the AG filed a stray voltage complaint against Consumers Energy Company (Consumers), which the MPSC docketed as Case No. U-11684. On April 27, 1998 the MPSC determined that the AG's stray voltage complaint against Consumers stated a prima facie case. For the next six months the MPSC took no action with respect to the AG's stray voltage complaint against Consumers. On October 15, 1998 the AG filed a complaint for superintending control against the MPSC in Ingham County Circuit Court, Docket No. 98-89071-AS.

On November 4, 1998 about 6 ½ months after the AG filed the stray voltage complaint against Consumers in Case No. U-11684, the MPSC served a copy of the AG's complaint on Consumers. On April 6, 1999 the AG and the MPSC settled the AG's superintending control complaint case in Ingham County Circuit Court. The MPSC

[3] MECA is an association formed by Michigan's rural electric cooperatives to represent their collective interests in regulatory and legislative matters.

assured the court that the MPSC staff would investigate the matters raised in the AG's stray voltage complaint.

On April 8, 1999 a prehearing conference was held in Case No. U-11684 before Administrative Law Judge Daniel E. Nickerson, Jr. (ALJ), and the AG was given approximately 7 months to investigate Consumers' rural distribution system and electric service to livestock farms in order to prepare her case. On May 19, 1999 the AG served MECA and MEGA with a Subpoena Duces Tecum seeking relevant scientific and factual evidence relating to matters raised in the AG's stray voltage complaint against Consumers. On June 9 and June 19, 1999, respectively, MECA and MEGA filed objections to the AG's Subpoenas Duces Tecum and refused to provide the requested information. On November 1, 1999 the ALJ denied the AG's motion to compel discovery through the Subpoenas Duces Tecum issued to MECA and MECA. 3 Tr 141.

On March 15, 2000 the AG filed her direct testimony. Direct testimony was submitted by Dave Stetzer, William English, Alexander Furo, Nancy Bellville, Dr. Donald Hillman, Frank Perri, Larry Wallman, Dr. Kenneth Main, Dr. Martin Graham, and Dr. Andrew P. Johnson.

On March 16, 2001 Consumers filed its direct testimony. Direct testimony was submitted by Dr. Jack Albright, Dr. Daniel Aneshansley, Dr. V. Michael Lane, Dr. John Kaneene, Charles Denardo, Dr. Wayne Knoblauch, Laverne Stetson, Wayne Leja, Dr. Michael Stringfellow, Charles Forster, Dr. Linda Erdreich, Dr, Douglas Reinemann, Frank Denbrock, Johnny Dagenhart, James Schrandt, Dr. Edward Rothman, Dr. Richard Andrews, and Richard Thompson.

On May 29, 2001 Staff filed the direct testimony of its witness, Richard D. Whale.

On January 29, 2002 the AG filed her rebuttal testimony. The AG's witnesses filing rebuttal testimony are Ms. Bellville, Mr. Furo, Dr. Graham, Dr. Hillman, Dr. Main, Mr. Wallman, Mr. English, Mr. Stetzer, Dr. Michael Behr, Dr. Duane Dahlberg, and William Peloquin.

On July 2, 2002 Consumers filed surrebuttal testimony. Dr. Aneshansley and Dr. Erdreich submitted surrebuttal testimony.

On August 19, 2002 Consumers was permitted to file substitute testimony sponsored by Dr. Edward Rothman for the unexpected unavailability of Dr. Andrews.

The AG requested but was denied the opportunity to file substitute testimony by Donald Zipse for the unavailability of Dave Stetzer, consequently Mr. Stetzer's testimony was removed from the AG's direct testimony.

On June 4-5, 2002 and September 10 and 12, 2002 motions to strike testimony were heard. The various motions were granted in part and denied in part. From September 16, 2002 to October 10, 2002 sixteen days of hearings were held. The evidentiary record was closed on October 10, 2002. Consumers, Staff, and the AG all filed initial briefs on December 5, 2002. Consumers and the AG filed reply briefs on January 30, 2003. Staff did not file a reply brief.

The record in this case consists of 41 volumes of transcripts totaling 4648 pages and 315 exhibits being admitted.

II.

JURISDICTION / BURDEN OF PROOF

The ALJ finds that the MPSC has jurisdiction in this proceeding pursuant to the provisions of the Electric Transmissions Act, MCL 460.551 et seq; MSA 22.151 et seq, the Public Service Commission Act, MCL 460.1 et seq; MSA 22.13(1) et seq, and the Public Utilities Commission Act, MCL 460.51, et seq; MSA 22.1 et seq.

Rule 103 of the Rules of Practice and Procedure before the Commission[4] (R 460.17103) provides that the MPSC "rules govern practice and procedure in all proceedings before the commission, except as otherwise provided by statute or these rules." Rule 515 of the MPSC's Rules (R 460.17515) discusses the appropriate burden of proof for the parties involved in a complaint. Specifically, Rule 515 provides that:

> The complainant generally shall have the burden of proof as to matters constituting the basis for the complaint and the respondent shall have the burden of proof as to matters constituting affirmative defenses. The burden of proof, however, may be differently placed, or may shift, as provided by law or as may be appropriate under the circumstances.

It is established precedent that the Complainant in an MPSC case has the burden of proof. Consequently, as the Complainant in this case, the AG has the burden of proof as to all the material elements contained in her complaint. In order for the AG to gain the requested relief, she must prove each of the elements of her complaint beyond a preponderance of the evidence.

[4] The Rules of Practice and Procedure before the Commission will be referred to as "MPSC Rules."

Also provided in the MPSC Rules is the availability of summary disposition. Rule 323 of the MPSC's Rules (R 460.17323) permits an ALJ to recommend summary disposition in certain circumstances. Rule 323 provides that:

> A party may make a motion for summary disposition of all or part of a proceeding. If the presiding officer determines that there is no genuine issue of material fact or that there has been a failure to state a claim for which relief can be granted, the presiding officer may recommend, to the commission, summary disposition of all or part of the proceeding.

While the AG does not dispute her level of burden for Counts I and III of her complaint, she does, however, dispute her burden for Count II, which involves the AG's claim that Consumers' unreasonable and prejudicial treatment of rural customers was a contributing factor to stray voltage problems. The AG requests that the ALJ grant summary disposition on Count II after she only presents a *prima facie* case. The AG argues that since she presented a *prima facie* case, Consumers then had a burden of production to rebut the claim, which it failed to do. Consequently, since, according to the AG, Consumers failed to meet its burden of production to rebut the claim, the AG should be successful on this count for that reason, and the ALJ should grant summary disposition for Count II.

The AG, in support of her request for summary disposition in regards to Count II, offers MPSC Rule 515, which specifically provides a burden shift from the Complainant to the Respondent under certain circumstances. The AG emphasizes part of MPSC Rule 515 which states that the Complainant generally shall have the burden of proof but that the "burden of proof, however, may be differently placed, or may shift, as provided by law or as may be appropriate under the circumstances." Additionally, in further support of her request for summary disposition, the AG refers to a burden-shifting

approach discussed in a footnote from *Gelman Sciences Inc* v *Fidelity & Casualty Co*, 456 Mich 305, 326 n 12 (1998).

The AG, in her reply brief on page 8, argues that she presented a *prima facie* case and Consumers failed to meet its burden of production to rebut the claim. In relying on the burden shifting theory discussed in footnote 12 from *Gelman*, she argues she must only establish a *prima facie* case, and Consumers has the burden to rebut. The AG interprets the footnote, which is based on a concept from another case, *Abel* v *Eli Lilly & Co.,* 418 Mich. 311 (1984), as her authority for the burden-shifting theory that she requests be applied here. The *Gelman* court, in discussing *Abel,* stated that the court employed rules designed to assist a plaintiff when faced with an insurmountable burden of proof, and discussed how courts "can employ fair rules to alleviate an impossible burden when justice requires." *Gelman*, *supra*, P 326 n 12.

In the AG's reply brief, *Gelman, supra,* is offered as a vehicle for allowing courts to shift the burden when justices requires. When "justice requires" is indicative of an approach that attempts to utilize a court's equitable powers. As provided by *Gelman,* supra, describing *Abel*, supra, the court's theory underlying the burden shift, provided in that case, is the utilization of the equitable powers of the court. However, the Commission has no common law powers. *Huron Portland Cement* v *Michigan Public Service Commission*, 351 Mich 255 (1958). "If there is no statute telling the PSC that it can do something, then the PSC cannot do that thing." *Midland Cogeneration* v *PSC*, 199 Mich App 286 (1993).

Nonetheless, MPSC Rule 515 does indeed provide that "the burden of proof, however, may be differently placed, or may shift, as provided by law or as may be

appropriate under the circumstances." The question remains, however, under what circumstances should the MPSC allow the burden to shift. From the language of the cases used to support the contention that a burden shift should be permitted when justice requires, the authority provides this option when the plaintiff is faced with an insurmountable[5] burden.

To determine what an insurmountable burden is, and ultimately answering the question as to when a burden shift is required in the interest of justice, the AG offers footnote 12 from *Gelman, supra*. *Abel, supra,* discussed in *Gelman,* is offered as authority for the ALJ to allow a burden shift from the AG to Consumers for Count II. But, the facts of *Abel, id,* are significantly different than those in the present case. In *Abel, id*, the court utilized the theory of alternative liability. In *Abel*, *id*, the plaintiffs were mothers who had taken a prescription drug during pregnancy, which was known as DES. The plaintiffs were suing the drug manufacturers. However, since the plaintiffs were attempting to sue the drug manufacturers many years after they had ingested the drug, the task of proving which one of the several manufacturers had supplied the drug to each plaintiff was extremely difficult. In fact, the court described the burden under the circumstances as being "insurmountable."

The court in *Abel, id,* held that under the theory of alternative liability, the burden of proof on causation and proof of which manufacturer supplied the drug, shifted to the defendants. This burden shifted to the defendants in a situation where all the defendants acted negligently, but only one of the defendants actually caused the plaintiff's injury. The court reasoned that rather than deny an innocent plaintiff relief, if

[5] According to Webster 3rd International Dictionary, insurmountable is defined as "incapable of being surmounted, passed over, or overcome."

the plaintiff could demonstrate that all defendants acted tortiously, the burden of proving which defendant individually manufactured the drug would shift to the defendants. If the defendants could not meet the burden and exculpate themselves, joint and several liability would be imposed.

The *Abel, id,* court included a discussion on the development of alternative liability, the theory behind this particular type of burden shift. As discussed in *Abel, id,* alternative liability was first recognized in *Summers* v *Tice*, 33 Cal2d 80, 199 P2d 1 (1948). In *Summers, id,* the case involved a plaintiff who was shot with a gun during a hunting expedition with two companions. Both companions had negligently shot in the plaintiff's direction; however, the plaintiff was unable to prove, beyond a 50% probability, which of the defendants had caused his injury. Consequently, the plaintiff was unable to prove that either one of the defendants was more likely than not to have caused the injury of the plaintiff.

The court in *Summers, id,* while acknowledging that the plaintiff had failed to meet his burden as to who actually caused the injury, recognized that only one shot from one defendant injured the plaintiff. Therefore, the court, as a matter of policy, shifted the burden of proof on causation from the plaintiff to the defendants, since both defendants were wrongdoers and both had acted negligently. The court decided that it was preferable that the two wrongdoers should have the burden of clearing themselves rather than leaving the innocent plaintiff without a remedy.

In *Abel* and *Summers, supra,* as well as other cases following the same burden shifting approach, the underlying theme is that there are multiple tortfeasors. In these cases, the burden shift from the plaintiff to the multiple defendants is on the element of

causation, and only in cases where it has been shown that all of defendants had acted negligently, but deciphering which individual tortfeasor caused the specific injury is close to impossible for the plaintiff to prove. In these cases, however, the burden of proof on the element of breach is not shifted. Consequently, the plaintiff is responsible for meeting this burden, and maintains responsibility for the burden.

In support of the AG's request that the ALJ grant summary disposition on Count II, the AG argues that a burden-shifting approach is appropriate in this case, and should be employed. The AG offers footnote 12 from *Gelman*, supra and consequently the line of cases supporting the burden shift theory outlined therein, as authority to demonstrate the ability of courts to shift the burden of proof when justice requires. But as shown, the line of cases stemming from the AG's offered support for the contention that the burden should be shifted only deals with the shifting of the burden in terms of causation, and only in terms of multiple wrongdoers, and when determining the individual tortfeasor is close to impossible, or insurmountable, to prove. In that unique case, the defendants have the burden to exculpate themselves. However, in other circumstances, the plaintiff still has the burden.

The AG's contention that the ALJ should allow the burden of proof to shift from the AG to Consumers after the AG's establishment of prima facie case would result in Consumers, the lone defendant in this case, being saddled with the burden of rebutting the claim. The ALJ finds that the AG's support for the burden shift, prior to a showing by a preponderance of the evidence of the existence of Consumers' unreasonable and prejudicial treatment of rural customers, is fatally flawed. The circumstances, which are present in the line of cases that the AG offers for support, are not congruous with the

present case. In this case, there is only one defendant. Additionally, the ALJ does not find that the burden of proof the AG is faced with to prove her case as to Count II of her complaint insurmountable. Furthermore, the ALJ finds that in following the language of MPSC Rule 323, the granting of summary disposition in the situation would be improper.

The ALJ finds that under the circumstances of the present case, the shifting of the burden from the AG to Consumers, prior to the showing of a preponderance of the evidence, and after the AG only presented a prima facie case, is not appropriate. The ALJ finds that the AG, in order to be successful on Count II, must establish beyond a preponderance of the evidence that Consumers did in fact partake in unreasonable and prejudicial treatment of rural customers, and that the burden to rebut the claim is not shifted to Consumers upon the mere showing of a *prima facie* case.

After reviewing MPSC Rule 515 and the AG's offered authority, the ALJ rejects the AG's argument for a burden shift. The ALJ finds that the AG will have the burden of proof as to all three counts of her complaint.

III.

DEFINITION OF STRAY VOLTAGE

The AG commences its argument regarding the definition of stray voltage with a criticism of Consumers recitation of the existence and harm stray voltage may cause. The AG argues that the Consumers pamphlet *"Understanding Neutral-to-Earth Voltage and Stray Voltage",* Exhibit R-258, is only a good starting point but is intended to

mislead the public and the MPSC from fully understanding the extent and solutions of the problem.

The AG proposes the following definition of stray voltage as more inclusive and illustrative of the problem:

> Any electrical energy (whether alternating current, direct current, transients, harmonics or other spikes, etc.), regardless of strength that is flowing outside the circuit's designed path be it from the electric utility's transmission or distribution lines and facilities, or the telephone, cable or gas utilities' designed systems.

Consumer relies on a definition found in the United States Department of Agriculture Handbook Number 696, *Effects of Electrical Voltage/Current on Farm Animals: How to Detect and Remedy Problems* (USDA Redbook). The USDA Redbook defines stray voltage as follows:

> Stray voltage is a small voltage (less than 10 V) measured between two points that can be contacted simultaneously by an animal. Exhibit R-148, p 119.

The MPSC Stray Voltage Task Force defines stray voltage as:

> Any voltage or current existing between two points, where none is expected which may be contacted by persons, animals and/or equipment. Exhibit C-20, p 1.

The AG asserts that its definition is broader in scope than traditional definitions of Stray Voltage. Traditional definitions and the definition used by Consumers tend to mislead the public and the MPSC, argues the AG. One of the most misleading and deceptive problems with the utility's limited stray voltage/stray current definition is how it fails to fully explain where the stray voltage/stray current originates, why it exists, who benefits from it, who is harmed by it and how to eliminate it." AG's brief, p 122. Mr. English testified on behalf of the AG and offered a definition from the *Encyclopedia*

on Electrical and Electronics Engineering published by John Wiley & Sons, Inc., in support of the AG's proposed definition. It states:

> The continuous flow of current over the equipment ground, water pipes, metal enclosures, and earth can result in conditions hazardous to human safety. Uncontrolled current flow has been reported to cause electric shocks in swimming pools, showers, and other wet environments. Cows are sensitive to voltage due to their step distance. (See the subsections "Step voltage" and "Touch voltage" under "Personnel safety protection.") The voltage resulting from stray uncontrolled current is one cause of cows not giving milk.

The AG witness, Mr. Furo defined stray voltage as:

> Stray Voltage is manmade electromagnetic energy that directly affects livestock. Most of it is associated with the electrical power distribution system.

Consumers believes that the definition of stray voltage in the context of this complaint proceeding is a matter of pleading. Once the AG has defined stray voltage then the basis of the complaint must turn on the proposed definition, reasons Consumers. Consumers argues that the AG's definition buttresses its position that the AG's complaint is a collateral attack on the National Electrical Safety Code (NESC) and the MPSC rules. Consumers, although not opposing the AG's proposed definition for purposes of this complaint, nonetheless continues to support its definition of stray voltage which it believes is supported by contemporary scientific study.

The ALJ recognizes and applies the definition of stray voltage as set forth by the AG. In doing so, the ALJ desires to make it emphatically clear that the definition adopted here as proposed by the AG is for the express limited purpose of evaluating the allegations of the AG's complaint. The ALJ recognizes that the definition cited by Consumers is consistent with the current significant reputable scientific evidence presented in this case concerning stray voltage as will be pointed out further.

In addition, the ALJ would only point out here that the AG's definition correctly recognizes sources of stray voltage other than a utility's transmission or distribution system. It also includes sources such as telephone, cable or gas industry. Noteworthy here, the AG's definition does not, specifically, include on farm sources of stray voltage. As the evidence will show, on farm sources of stray voltage have been found to be a significant source of stray voltage. This is a complaint against Consumers. Therefore, the ALJ believes the AG must show, regarding any alleged stray voltage problem, that the source of the stray voltage is Consumers, the Respondent, in this proceeding and not some other source. Stated in a legal framework, sources of stray voltage emanating from Consumers are relevant to the allegations of the AG's complaint. Sources of stray voltage, other than Consumers itself, logically must be eliminated when determining whether Consumers is responsible under the allegations of the complaint or legally stated are irrelevant.

IV.

COUNT I – CONSUMERS' ALLEGED NEGLIGENT OPERATION AND MAINTENANCE OF ITS ELECTRICAL DISTRIBUTION SYSTEM

A. Use of the Earth as a Conductor of Return Current

A particularly controversial issue raised by the AG's complaint concerns the AG's assertion that Consumers has intentionally used the earth and private property for more than 30 years as a conductor for return current in violation of the NESC and MPSC Rules. The AG's brief at page 152 states:

> Consumers knew that using the earth as a conductor for return current could cause problems for the farmers in its service territory even before the 1970s since the NESC Handbook discusses the fact that the

use of the earth as a sole conductor was prohibited back in the 1960s because of the problems with circulating currents and dairy barns.

The AG contends that Consumers continued to build more distribution systems of the same type, which continued to use the earth as a conductor for return current. There are significant amounts, up to 75% of the neutral return current flowing through the earth from Consumers' distribution system according to the AG.

Relying on Rule 012(C) of the NESC, the AG claims that Consumers' construction and maintenance of a multi-grounded wye distribution system causes harm to dairy farms and livestock farms in its service territory and even to the farmers themselves. The AG contends that Consumers continues the damaging practice of poor maintenance which contributes to the problem as evidenced by the presence of 75% of the neutral return currents on the ground conductor flowing through the earth. The AG states that the NESC, a safety code, prohibits the use by Consumers of the earth as the sole path for return current. The AG reasons that it is logical then that 99% and smaller percentages of return current in the earth will also be safety concerns.

The AG asserts that, in violation of Rule 092D of the NESC, Consumers is injecting objectionable levels of current into the earth at the pole grounds. It is a characteristic of a multi-grounded wye distribution system to expose people and property to objectionable levels of current contrary to the NESC, the AG argues. According to the AG, it is an unsafe practice and the source of stray voltage to continue to use the earth as a return path. The AG seeks a Commission order requiring Consumers to eliminate the use of the earth as a path of return of current to the substation.

Consumers insists that the AG's complaint is a collateral attack on existing MPSC regulations and NESC. Consumers asserts that the most recently adopted version of the NESC expressly permits the construction and operation of a multi-grounded wye distribution system and when one is used, the NESC requires interconnection with the earth. Consumers postulates that based on the laws of physics, whenever, there is in use a multi-grounded wye distribution system current will be present on the ground neutral with associated current flow into the earth. Consumers disputes that the practice is unsafe and relies on the NESC as permitting the practice. Consumers argues that the AG's recitation of the NESC's prohibition of objectionable levels of current into the earth is misplaced.

Staff takes the position that based on public health and safety as well as regulatory concerns elimination of all stray voltage or current from the earth is neither practical nor economical. Staff asserts that in order to properly address the issue of stray voltage, there should be in place an MPSC scientifically based determination of action/concern levels. Staff believes that absent a standard in place, then, the mitigation methods proposed by the AG are based only on conjecture and speculation. Staff concludes that since there is no existing MPSC action/concern level, the AG's complaint must be denied.

The AG responds that Consumers and Staff's arguments are nonsensical. She points out that the NESC permits a utility to use a variety of distribution systems, for example the Delta System, a Five-Wire Distribution System as well as the multi-grounded wye distribution system. The AG argues that even though a

multi-grounded wye distribution system is permitted, it must conform to other NESC rules including the following:

> For all particulars not specified in these rules, construction and maintenance should be done in accordance with accepted good practice for the given local conditions known at the time by those responsible for the construction or maintenance of the communication or supply lines and equipment. NESC Rule 012(C).
>
> * * *
>
> Use of Earth as Part of Circuit
> a. Supply circuits shall not be designed to use the earth normally as the sole conductor for any part of the circuit.
>
> b. Monopolar operation of a bipolar HVDC system is permissible for emergencies and limited periods for maintenance. NESC Rule 215 (B) 5.
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> * * *
>
> Current in Grounding Conductor
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> Ground connection points shall be so arranged 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. NESC Rule 92(D).

The AG maintains that Consumers violates the above provisions of the NESC through its negligent maintenance, design, and operation of its multi-grounded wye distribution system. The AG states that an ungrounded delta or the single-point

grounded five-wire system eliminates or virtually eliminates earth currents/stray voltage from an electric distribution system. The AG disputes that she is attacking the NESC. Rather, she argues, a safer practice is to adopt the ungrounded or five-wire electric distribution system.

The AG rejects Staff's position as unsupported by the evidence. She maintains that Staff witness, Mr. Whale lacks the formal education without a degree in electrical engineering to refute the testimony of its expert witnesses, Mr. English, Mr. Furo and Dr. Graham on this subject. Through analogy, the AG, attempts to show the fallacy of Staff's position that eliminating virtually all ground current is impractical noting the fact that the Environmental Protection Agency (EPA) routinely sets zero tolerance threshold levels for chemicals and probable human carcinogens. *Western Greenhouses et al v US,* 878 F Supp 917, 924 (1995); *Dunn L Johnson et al v AJ&K Operating Co et al,* 1999 US Dist Lexis 22296, 13; *International Fabricare Institute v EPA,* 972 F2d 384, 390-392 (1992).

The AG refutes Staff's assertion that a standard is needed by which to judge whether a utility exceeds some action/concern level. The AG believes that contained within the NESC and MPSC rules are sufficient standards to evaluate Consumers' objectionable electric service practices. There is no need to set a stray voltage action/concern level because Consumers should design and construct its distribution system as a five-wire distribution system or expand the use of the ungrounded Delta System claims the AG.

The NESC is a national safety code whose provisions govern electric utilities in those jurisdictions adopting the code. The NESC is reviewed at five-year periods with

public comment and input into the process. 39 Tr 4203. The MPSC has adopted the NESC as a regulatory requirement for compliance by utilities operating in the State of Michigan. R460.813 et seq. On October 3, 1997, the MPSC adopted the 1997 Edition of the NESC Parts 1,2 and 3; Sections 1,2,3 and 9. *MPSC Case No. U-11288.* There has been no challenge to the history of the MPSC's adoption of the latest edition or past editions of the NESC. Exhibit R-231, p 11.

Section 013(B) of the NESC is essentially a grandfather clause of sorts sanctioning existing installations. It states:

> B. Existing Installations
>
> 1. Where an existing installation meets, or is altered to meet, these rules, such installation is considered to be in compliance with this edition and is not required to comply with any previous edition.
> 2. Existing installations, including maintenance replacements, that currently comply with prior editions of the Code, need not be modified to comply with these rules except as may be required for safety reasons by the administrative authority.

Mr. Whale is a licensed professional engineer. 40 Tr 4434. He testified that the MPSC requires Consumers to comply with the standards for electric plant construction, operation and maintenance set forth in the NESC. Mr. Whale interpreted Section 013(B) as providing an exemption for existing installations including maintenance and replacement except in the case of safety concerns. 40 Tr 4441.

The NESC permits the operation and maintenance of a multi-grounded wye distribution system. The NESC does not require the use of multi-grounded wye distribution systems exclusively. The operation and maintenance of other types of distribution systems such as a Delta system and five-wire system are also permissible under the NESC.

The NESC requires not less than four grounds per mile in a multi-ground wye distribution system. NESC 096(c). Consumers has shown that it meets this requirement of the NESC. The AG does not dispute this rather significant point. Instead, the AG argues that the grounded wye system is inherently defective due to the nature of its design. The AG refutes that this represents a collateral attack on the NESC or the MPSC rules concerning electric service distribution. The ALJ does not agree. Where, as here, the MPSC has adopted the NESC, then an attack of the NESC outside of a proceeding focusing on the NESC, is by definition a collateral attack.

The ALJ finds that the AG is misguided in her interpretation of the NESC. The ALJ finds that the NESC clearly endorses the operation of Consumers' multi-grounded wye distribution system. The AG seeks an order from the MPSC, which would require Consumers to spend millions of dollars to convert its existing multi-grounded wye distribution system to either a Delta system or a five-wire distribution system. However, there is absolutely no evidence to support such a request. The ALJ finds there is no question that the multi-grounded wye system is an approved distribution system based on the NESC and the MPSC's adoption of the NESC.

The ALJ further finds that the AG's claims that Consumers uses the earth as the sole conductor of return current is baseless. The testimony of Mr. Dagenhart is illuminating on this point. Mr. Dagenhart is chair of the NESC Subcommittee on Grounding Methods. He testified:

> Q. (by Mr. Brunner) When you say "sole conductor," as long as—as long as 1 percent of that return current is on the wire, does that meet the code?
> A. (by Mr. Dagenhart) It essentially says "shall not be used as a sole path." If there's more than one path, then it meets the intent of the rule, at least the way it's stated. 39 Tr 4210

When Mr. Dagenhart refers to the wire, he is apparently referencing the neutral conductor. Exhibit R-244; NESC Section 2, Definitions of Special Terms, p 8.

Mr. Dagenhart testified that "It is clear that the Code recognizes and allows the earth to be part of the current path, but does not allow the earth as the exclusive path. 39 Tr 4195. Mr. Dagenhart described the configuration of Consumers' multi-grounded wye distribution system, which is indicative of a typical multi-grounded wye distribution system. A component of the multi-grounded wye system is the neutral conductor. Exhibit R-244. The neutral conductor[6] is designed to return current to the substation in conjunction with the use of the earth as a parallel conductor, to return current to the substation.

The NESC defines the neutral conductor in the following manner:

> A system conductor other than a phase conductor that provides a return path for current to the source. Not all systems have a neutral conductor. An example is an ungrounded delta system containing only three energized phase conductors. NESC, Section 2, Definitions of Special Terms, p 8.
>
> The neutral conductor is also designed to safely disburse excessive buildup of voltage through the ground faults. Thus, the neutral conductor provides a path for the return current. The neutral ground is connected to the neutral conductor. Exhibit R-244.

Based on the laws of physics there is going to be return current on both the neutral conductor and the neutral ground. 39 Tr 4195. The NESC recognizes that current on the neutral ground may create neutral to earth voltages (NEV). 39 Tr 4195. The AG presented Exhibit C-46, which it states is an admission by Consumers of a finding of 75% of the current returning through the earth. Exhibit C-46 is an internally generated document showing Consumers' review of its Farm Service Maintenance Program. At

[6] In fact, one of the AG's claims is that the neutral conductor is sized too small.

page 3, it states as a pilot project conclusion, “Up to 75% of the neutral return current flows through the earth. Magnitude remained unchanged after isolations”.

Consumers argues that the word sole should be interpreted based on its plain meaning and that if the NESC intended to say more than it could have. The ALJ agrees. The use of the word sole is not ambiguous but clear. NESC Rule 215(B)5 addresses the design component of the distribution circuit. Consumers complies with the Code’s design provision through its design feature incorporating the neutral conductor which is designed to return current along its path to the substation. The ALJ finds that the fact that there is 75% of the return current on the ground conductor changes nothing in terms of the design feature. The issue then becomes, as presented by the AG and discussed below, whether the 75% return current on the neutral is objectionable. Generally speaking: the level of neutral current at any one point in a distribution current is usually very low. 39 Tr 4179. However, the ALJ finds that the AG has failed to show any violation by Consumers of the NESC or MPSC rules concerning its design of the multi-grounded wye distribution system. The ALJ finds that the neutral conductor as a designed path for the return current satisfies the NESC’s prohibition against the use of the earth as the sole path for return current. Consumers’ multi-grounded wye distribution system by incorporating the neutral conductor, is not designed in a manner to use the earth as the sole conductor.

Mr. Dagenhart also espoused extensively on the virtues of the multi-grounded wye distribution system. The multi-ground wye system is in use in 96% of Consumers distribution system. It is used predominantly by most of the electric utilities in the United States. 39 Tr pp 4166-4176. Safety and operational characteristics of the

multi-grounded wye system makes it the predominant system most used by electric utilities in the United States. 39 Tr 4166-4177. Improved lightning protection and overall system reliability are attributes of the multi-grounded wye distribution system. Fewer components and associated costs of integrating one system to another system also weight in favor of the multi-grounded wye distribution system. There is afoot a gradual conversion of Delta systems to multi-grounded wye distribution systems. 39 Tr 180. In Michigan, Detroit Edison initially built its distribution system as an ungrounded Delta at 4800 volts. 40 Tr 4282. Detroit Edison's electrical system is about 75% ungrounded Delta. 40 Tr 4282. Detroit Edison has, by policy, been gradually converting its Delta system to a multi-grounded wye system.

B. Alleged Negligent Operation of Consumers' Distribution System

After having found that the NESC permits Consumers operation of the multi-grounded wye system, the next issue is whether Consumers' operation of the multi-grounded wye system has been negligent or it has failed to properly maintain its distribution system and through the failure to properly operate or maintain the distribution system permits objectionable levels of current into the earth. Here, the ALJ believes there is an issue within an issue. Does the fact that the MPSC has not adopted an action/concern level, in and of itself, preclude a potential finding of objectionable levels of current or the negligent operation of Consumers' Distribution System? The ALJ concludes that its does not. An action/concern level would certainly prove to be the most expedient measure. However, where the AG is able to show, that levels of current returning to the substation through the earth violated other standards, such as the NESC's prohibition against objectionable levels of current or other NESC

violations, then, the ALJ believes the AG's proofs could verify the allegations of its complaint.

Mr. English testified that, "When current escapes the neutral conductor into the earth, control over the current is lost. No one can be absolutely certain where it will show up except at the substation where it originated." 26 Tr 1465. Mr. English believes that the continuous flow of current as a result of grounding the primary neutral is objectionable and hazardous to humans and animals. 26 Tr pp 1461-1472; Exhibit C-53. Mr. English relies on Exhibit C-53 entitled *Wiley Encyclopedia of Electrical and Electronics Engineering,* Volume 8 which states:

> 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. Exhibit C-53, p 481.

Exhibit C-53 goes on to discuss four common types of ground faults which are phase-to-phase-short-circuit, phase-to-neutral-short-circuit, phase-to-ground-fault, and neutral-to-ground-fault. Exhibit C-53, pp 478-479.

The ALJ finds here that when Mr. English makes specific reference to continuous flow of current as a result of the grounding of the primary neutral it is unclear whether the reference is intended to refer to neutral-to-earth faults or stray voltage. It appears to the ALJ that Exhibit C-53 clearly distinguishes neutral-to-earth faults, which are the result of some breakdown in the design of the typical multi-grounded wye distribution system. The reference to a breakdown refers to a situation in which immediate remedial measures are required and is disguisable from stray voltage as defined by the AG since the current flow is "outside the circuit's designed path".

In March 2000[7], Mr. English investigated a few locations near sites that he had investigated while employed with the MPSC to take measurements and perform visual inspections. Exhibits C-10-19. Mr. English took readings which ranged from 0 mA to over 1000 mA on ground rods at various distances from the ground neutral. 26 Tr 1475. One of the locations was where Consumers had separated the neutrals. At that site, Mr. English testified that he was able to actually measure current on the secondary neutral with all of the farm electricity shut off. 26 Tr 1475. Mr. English took no measurements in animal contact areas.

The ALJ finds the testimony of Mr. Stetson credible and poignant in the area of the correlation between earth currents and stray voltage as it relates to the allegations of the AG's complaint. It is important to note here that up to this point the discussion has centered on the issue of current as it appears on the neutral conductor, ground conductor, and in areas other than animal contact areas. Now, it is appropriate to begin discussion regarding the detection of the current in animal contact areas and other areas where the evidence has shown it may cause harm to animals at sufficiently high enough levels.

Mr. Stetson is one of the contributing authors to the USDA Redbook and the *Final report of the Science Advisors to the Minnesota Public Utilities Commission* (Minnesota Science Advisors Report) Exhibit R-183. He testified that the subject of earth currents initially in the Minnesota Science Advisors Report, was treated as a

[7] The ALJ notes the timing of Mr. English's investigation and inspection is after the April 8, 1999 prehearing. The ALJ ruled at the prehearing that prior to any subsequent investigations or measurements the AG was to notify Consumers and Staff to permit them to have personnel present to witness the investigation. The AG failed to comply with the ALJ's ruling regarding Mr. English's March 2000 investigation.

separate issue from stray voltage. 35 Tr 3496-3497. However, over time it became apparent that in order for earth currents to interact with animals there necessarily had to be interaction with the animal. He believes that there are only three ways that earth current could potentially interact with animals. They are:

1) the "earth current" is associated with current that passes through an animal ("animal contact current")
2) the earth current produces an electrical field which passes through an animal
3) the earth current produces a magnetic field that passes through an animal.

Mr. Stetson describes item number 1 from above as simply a restatement of classic stay voltage. However, the other two items identified above, electrical fields and magnetic fields have likewise been studied in relation to whether there are adverse effects on animals. Mr. Stetson indicates that the research has born out that there is no adverse effect on animals due to electric and magnetic fields. 35 Tr 3499; Exhibit R-183, p 39. Regarding the issue of adverse effects on animals from earth currents the Minnesota Science Advisors Report concluded among other findings that:

1) We have not found credible scientific evidence to verify the specific claim that currents in the earth or associated electrical parameters such as voltages, magnetic fields and electric fields, are causes of poor health and milk production in dairy herds. Exhibit R-183, p 38.

The ALJ recognizes that Mr. Stetson's testimony is contrary to witnesses presented by the AG. For example Mr. English, Dr. Hillman and Mr. Furo essentially provided alternate theories, computer models, video tapes and experiments to show that current present in the earth traced to the source of Consumers' neutral ground would in one manner or another adversely affect humans and farm animals. These witnesses criticize the findings of the Minnesota Science Advisors Reports, the Public

Service Commission of Wisconsin (PSCW) (Exhibit R-171) and the USDA Redbook. According to the testimony of these experts the current state of the science in the area of determining the adverse impact on dairy herds is lacking in one way or another. According to these witnesses, even though there is a reading taken at the animal contact point, which is at levels acceptable to current science, the animals may still be adversely affected.[8]

Mr. Schrandt testified regarding methods used to measure and detect the presence, level and sources of stray voltage. 40 Tr 4278-4279, exhibit R-258. He states that the proper methodology involves the use of a voltmeter with measurements initially taken without a shunt resistor.[9] Then, measurements are taken placing a shunt resistor between the two leads of the voltmeter to simulate the body of an animal.

The USDA Redbook discusses detection techniques. Exhibit R-148, Chapter 5. The methods described by Mr. Schrandt and the USDA Redbook are completely consistent. Both recognize the importance of the use of a shunt resistor to simulate the body of an animal.

The ALJ finds that Consumers was able to effectively discredit the testimony of the AG's expert witnesses. These experts for the AG assert in the most rudimental sense, that all of this current flowing into the earth has to show up somewhere and that somewhere is the cause of harm to livestock and humans. The AG witnesses present theories of how this happens but there is no verified data or scientific measurements to

[8] Consumers argues that it happens to be very convenient to the AG's case in point for her to argue that there is harm caused to humans and animals from stray voltage even though it cannot be detected by conventional means. Consumers also points out that this circular argument is fatal to the AG's case since it essentially means the AG cannot prove her case.

[9] The use of a shunt resistor is an issue of contention with the AG's position. The AG, as discussed later, believes the levels of resistance are too high and should be lower.

support these theories. Here, based on the current contemporary reputable scientific evidence there is a sharp division between the AG's expert testimony, on one hand, and Consumers' and Staff expert testimony, on the other hand.

The ALJ further finds that based on the testimony of numerous Consumers' witnesses, as stated below, and despite the criticisms lodged against the Minnesota Science Advisors Report, the findings of the PSCW and the USDA Redbook by the AG witnesses these publications represent several of the major current reputable scientific views on the subject of earth currents, stray voltage, and the proper detection and mitigation of stray voltage problems.

Regarding Mr. English, Consumers was able to show that his testing protocol failed to make any provisions for taking measurements of electrical current at the animal contact points. Mr. English testified that he took some recent measurements. However, none of these measurements were taken at the animal contact point and were over 100 yards from the milking parlor. 27 Tr 1601. The basic testing protocol, adopted by the ALJ, for detecting the presence of stray voltage is testing at the animal contact point according to Mr. Schrandt and the USDA Redbook. Mr. English, in his investigations of stray voltage on farms did not conduct an analysis of on-farm contributions to stray voltage. 26 Tr 1459. Mr. English's computer modeling does not accurately reflect Consumers' separation of neutrals and fails to include possible on-farm sources of electrical current. 35 Tr 3412-3415.

Regarding Dr. Hillman, Consumers was able to show the fallacy of his taking measurements, at the Ranthum farm, using a Fluke event recorder plugged into wall sockets. Dr. Hillman attempted to correlate through a regression analysis the electrical

transients measured from wall sockets with milk production. Exhibits C-65, C-66 and C-75. Dr. Hillman's regression analysis initially yielded a "p"[10] value that failed to sustain the correlation. Then there were adjustments made by Dr. Hillman to his regression analysis. 28 Tr pp 1986-1987; Exhibit R-83, letter dated December 13, 1999 from Dr. Hillman. The adjustments made by Dr. Hillman involved subtracting the production of the highest yielding cows (fresh cows) and cows at the end of their lactation cycle. 34 Tr 3285-3286. Dr. Lane, testifying on behalf of Consumers, points out the serious methodological flaw of Dr. Hillman's regression analysis. Dr. Lane found that Dr. Hillman's regression analysis after adjustments were explained perfectly by lactation factors in dairy herds. 34 Tr 3282-3283.

Regarding Mr. Furo, he claims that there is some mechanism or method of transmitting electrical energy to animals, which is not currently considered by other scientist. Mr. Furo states:

> In my over ten years of experience I have seen several stray voltage cases where there was no doubt that cattle were experiencing electrical shocks which caused them to avoid certain area like waterbowls. The only problem was, there were no significant readings with point to point measurements and questionable reading with point to reference measurements. 27 Tr 1692.

Mr. Furo goes on to explain that there was a known mechanism to explain this behavior and that he constructed a bench sized demonstration of it. Over Consumers objections, the ALJ ruled that Mr. Furo be permitted to show his demonstration during the hearing. The AG did not present the demonstration. Consumers points out that the demonstration only works because of the significant amount of increased voltage (ten to

[10] A "p" value or attained significance is a measurement used by scientists to measure whether a parameter is statistically significant. 40 Tr 4422. A "p" value of less than .05 means is an indication of the parameter showing statistical significance.

hundreds of times higher than normally seen on dairy farms). 37 Tr 3684. The ALJ finds it discerning that the AG did not present the demonstration to show Mr. Furo's theory in application. Further, based on Mr. Furo direct testimony concerning the cow's avoidance of the waterbowls actually cast doubt on his other mechanism theory. If, as Mr. Furo contents, the electrical energy is reaching the animal through means other than contact then its counter intuitive that the animals should avoid the waterbowl where the actual measurements at contact show no significant measurements. If there are no significant measurements at the waterbowl and the cows are receiving the electrical energy anyway there would apparently be no need for them to avoid the waterbowl. Mr. Furo would apparently explain this through electromagnetic energy and conduction. However, Mr. Furo offers no tangible evidence such as measurements in support of his explanation.

The AG argues that Mr. Wallman took measurements which support its allegations of objectionable current and stray voltage. Mr. Wallman prepared a power quality report on the Nansue Dairy Farm for Brian and Nancy Bellville. The report shows it was prepared on September 29, 1999.[11] He testified that when he monitored several dairy farms in Consumers' service territory the most common problem he found was too much current on the pole ground. Mr. Wallman also referenced the NESC handbook standard for the proposition that the earth cannot be used as the sole source for return current. Exhibit C-118, p 2. He states that another common problem was too much current on the neutral wire. The ALJ found this testimony lacking in the most

[11]The timing of Mr. Wallman's power quality report is significant, inasmuch as, it is five months after the date of the first prehearing in this case on April 8, 1999. At the prehearing conference, the ALJ ruled that the AG should notify Consumes and Staff prior to any subsequent formal investigations so that Consumers and Staff could have their people on site to witness the testing protocol and procedures. In the case of Mr. Wallman's power quality report, the AG did not comply with the ALJ's ruling.

fundamental sense. First, Mr. Wallman never quantified the exact amount of current that was measured, where exactly on Consumers system it was measured and failed to provide any standard in support of his claim that it was too much.

Further, the animal contact measurements submitted by Mr. Wallman at the Nansue Dairy, Exhibit C-118, appear to contradict Ohm's law. According to Ohm's law there is a direct correlation between voltage and current. 41 Tr 4554. However, the readings provided by Mr. Wallman appear to show no correlation. 31 Tr 2669-2670. When queried about this apparent contradiction, Mr. Wallman attributed it to "Stray Capacitance". 31 Tr 2672. This theory of "Stray Capacitance" came out for the first time in the cross examination of Mr. Wallman during the hearing. He never mentioned this theory during his deposition. 31 Tr 2673. Finally, Mr. Wallman even admits that this theory of "Stray Capacitance" is not borne out by any scientific evidence. 31 Tr 2706.

Compounding the credibility of Mr. Wallman's findings is the fact that he failed to attempt to ascertain whether the source of his readings were from Consumers or the source was on-farm or yet even another source. (reference to the AG's definition of stray voltage). According to the AG's definition of stray voltage governing this proceeding, as well as, traditional stray voltage theory stray voltage may eminent from sources other than the public utility. The ALJ finds that Mr. Wallman's failure to show the source of the perceived stray voltage demonstrates the shortcomings of his testimony in this particular case and of the AG's case in general.

The ALJ found the testimony offered by Ms. Bellville lacking in the most basic sense. Ms. Bellville undoubtedly believes that the problems at her farm are the result of

stray voltage. At one point, Ms. Bellville states that 14 volts was found on the primary and that the cows kicked off milkers when .023 volts was measured. However, the ALJ finds that Ms. Bellville was unable to document any of these events. The ALJ believes that Ms. Bellville was sincere in her belief of the causes of her Diary herd problems. However, Ms. Bellville's belief is simply not substantiated by the weight of the evidence. She presents no appropriate stray voltage measures and readings. As pointed out by numerous experts in this case, measurements taken in the animal contact points, using proper testing procedure and proper equipment is the only method to properly identify quantify, and locate of the source of possible stray voltage problems. The Bellville farm is no exception.

There were numerous investigations at the Bellville farm including the aforementioned investigation by Mr. Wallman through Power Quality Services Company, a company selected by Ms. Bellville, and several investigations by Consumers. As stated above, the ALJ finds Mr. Wallman's testimony unpersuasive.

Yet again, Consumers was able to effectively refute the Bellville's allegations. Mr. Schrandt stated that on numerous calls to the Bellville Farm since 1994, there has never been a documented case of stray voltage levels exceeding .184 volts. Exhibit R-262; 40 Tr 4314.

Staff also conducted an investigation of Consumers' distribution system serving the Bellville Farm. Exhibit R-284. Staff's investigation was prompted by a complaint filed by Brian and Nancy Bellville. The complaint raised three issues which are (1) The Prescott substation is not suitably grounded; (2) The service transformer is not large enough to serve their load; and (3) The ground wire (grounded neutral) should extend

from the farm transformer to the Prescott substation. On all three issues raised by the Bellvilles, Staff's investigation found Consumers' distribution system in compliance with the NESC. Staff's conclusions on the three issues raised were (1) we believe the grounding of the Prescott substation is more than adequate; (2) we believe that the exiting 50 kVA transformer is adequate for the Bellville load; and (3) we conclude that the portion of the Maple Ridge circuit is properly grounded with continuous grounded primary neutral from the isolation transformer at the Bellville farm.

Interestingly, as stated above, the Bellvilles problems commenced in 1994. In 1999, Staff invited Consumers and the AG to participate in a stray voltage investigation by designating five farms each for investigation by the Staff. Consumers participated and designated five farms. The AG refused to participate. The AG presented no evidence or argument regarding its failure to participate or designate the Bellville farm for an investigation by Staff. The Bellville farm from the AG's vantage point seemingly represents a farm with persistent dairy herd problems over a period of several years with stray voltage alleged as the source of the problem. Seemingly, the Bellville farm would be an ideal candidate for inclusion in the investigation of stray voltage problems. However, the Bellville Farm was never nominated.

Even considering for a brief moment, the Bellville farm represents a documented verified case of persistent stray voltage problems which it does not. Consider whether one stray voltage problem is sufficient to show a systematic problem in Consumers' service territory with stray voltage.

Consumers provides electric service to over 1.7 million customers in total. In the year 2000 approximately 13,000 of its electric customers were livestock farms.

Consumers distribution system covers over 63,000 miles of lines with another 4,500 miles of high-voltage distribution lines.

The ALJ finds that it is not even a close call. One documented case, on one Michigan farm out of all the thousands of farms served by Consumers shows no systematic problem with Consumers distribution system as alleged by the AG.

The ALJ finds that the allegations contained in the AG's Complaint requires a showing of stray voltage problems widespread throughout the service area served by Consumers Energy. There must be either a demonstrated systemic problem or failing that then there must be a showing that numerous Consumers Energy's customers have experienced stray voltage problems. The ALJ finds that the AG has failed on both counts. There has been an attempt to condemn Consumers Energy multi-grounded wye distribution system as a systemic cause of stray voltage due to the inherent nature of a multi-grounded wye system. However, the ALJ finds that the great weight of the evidence is to the contrary. The ALJ finds that the AG has failed to present any reputable tangible evidence of a single stray voltage problem in Consumers' service territory. The design of Consumers' distribution system conforms to the NESC which, although it does not require the operation of multi-grounded wye system, recognizes that such a system is consistent with safe and reliable electric service operation.

The AG attempts to breach this critical gap by relying on its interpretations and theories concerning the laws of physics and the characteristic of the multi-grounded wye distribution system which is that the earth is used as a path for return current.

> Even assuming, arguendo, that the Attorney General did not present animal contact current measurements on Consumers' electric distribution system, the evidence submitted by the Attorney General and Consumers regarding the amount of current in the earth and an application of the laws

> of physics to this evidence demonstrates that Consumers' electric distribution system is unsafe and violates MPSC and NESC Rules. There is no need to do animal contact current at every livestock farm on Consumers' system because Consumers admits that it placers 1000 to 52,000 milliamps in the ground and admits that the neutral separation "fix" is only a temporary mitigation step. As explained by Mr. English and Mr. Furo, a simple application of the laws of physics demonstrates that Consumers is contributing to stray voltage on livestock farms in its service territory. In addition, using a realistic impedance of a cow measuring all the current contributed by Consumers shows high levels of current that even Consumers' witnesses explain would harm herd health and milk production." AG's Reply Brief, p 5.

Consumers asserts that the failure of the AG to offer evidence of stray voltage at an animal contact point is fatal to the Complaint filed. Consumers sums up its argument in the following fashion:

> A central element of the AG's utter failure to prove her case, is her failure to offer any credible evidence of currents or voltage at locations accessible to animals or people that were created by CE. Evidently, the AG intends to rely upon general assertions about earth currents, or measurements made at ground conductors, as the basis for her essential claim that Consumers is creating currents, which cause harm to animals or people. Something more than a general assertion that all utilities are creating earth currents, and Consumers is no better than all the rest, is necessary to get this point. This is not a rulemaking proceeding. Consumer's Initial Brief p 119-120.

The ALJ agrees with the assertions set forth by Consumers and finds that these assertions summarize very succinctly the pivotal issues presented by the AG's complaint. As already concluded, the AG bears the burden of proof. There has been substantial credible evidence presented regarding stray voltage measurement and mitigation techniques. These tried and tested methods provide at a minimum that at measurement be taken at the animal contact point with the proper instrumentation.

The AG believes that there is no need to perform measurements at every animal contact point because Consumers admits that it places 1,000 to 52,000 milliamps in the

ground. The ALJ finds this argument of the AG directly contrary to the great weight of the evidence presented here concerning stray voltage and animal contact points. The ALJ finds that the current reputable scientific evidence in this area shows that stray voltage can be detected at animal contact points. The ALJ does not believe that the AG has to perform measurements at every animal contact point. However, the AG attempted to present measurements of representative farms situated throughout Consumers' service territory. The AG failed to present measurements taken at farms which withstood scrutiny. The ALJ finds that by failing to show even one bona fide measurement of stray voltage at an animal contact point traceable directly to Consumers, the AG has absolutely and utterly failed to sustain its allegations.

The AG cites, as another example of Consumers alleged negligent operations causing stray voltage, a direct and detrimental impact on the dairy and farming industry in the State of Michigan. The AG argues that the very livelihoods of the agricultural rural community is at risk due to stray voltage related problems. The AG has presented anecdotal testimony but nothing in terms of quantifiable data. On the other hand, Consumers has presented testimony to show just the contrary.

Mr. Knoblauch provides data published by the United States Department of Agriculture via the National Agricultural Statistics Service. The data refutes the AG's anecdotal cases and shows a Michigan dairy industry that has performed above the national average. Mr. Knoblauch highlights the data results compiled over a ten-year period as follows:

?Michigan began the ten-year period above the national average in milk production and remains above national average in 1999. 35 Tr 3444.

?Dairy herds in Michigan and throughout the United States have increased production per cow by about 19% from 1990 to 1999. 35 Tr 3444.

?Milk production per cow is higher in Michigan than any of the surrounding states. In Michigan, in 1999, the milk production per cow was 18,244 pounds per cow compared with 17,391, 16,902, 17,096, 16,496, 16,066 and 16,645 for the states of Minnesota, Wisconsin, Ohio, Illinois, Indiana and Pennsylvania. Exhibit R-180.

?Milk production per cow is greater in the 12 counties served exclusively by Consumers than the state average. 35 Tr 3446.

Mr. Schrandt testified on behalf of Consumers concerning several issues central to the condition of Consumers' distribution system in general. Mr. Schrandt is a professional engineer registered in the State of Michigan. He has approximately 35 years experience with electrical distribution systems. Mr. Schrandt testified concerning the proper methods and techniques of stray voltage detection and measurement; methods of providing reliable and trouble-free electric service; Consumers' customer communication program; the advantages of multi-grounded distribution systems; and information regarding electrical facilities and investigations conducted at 8 farms identified as a central focus of the complaint.

Mr. Schrandt states that between 1994 and 1998, Consumers' personnel performed farm maintenance service at over 13,000 farms including separating the neutral at all agricultural customer locations. 40 Tr 4278. Consumers advertises and promotes and encourages farmers to call the toll free number. In 2000, Consumers received 118 calls from livestock farmers requesting a stray voltage evaluation, 62 of the calls involved dairy farms. Mr. Schrandt testified that all of the dairy farms involved measured 0.3 volts or less. One component of the stray voltage investigation involved testing of the separation of the neutrals. The conclusion was that the separation of the neutrals was effective.

Mr. Schrandt oversaw investigations of eight farms in Consumers' service territory reported by the AG to suffer from stray voltage problems. The eight farms are:

Name of Owner of Dairy Farm	Location of Dairy Farm
Steven Simon	Ionia County
Jack Tenbrink	Oceana County
Arlyn Walt	Ottawa County
Donald Vanderberg	Allegan County
Frank DeBacker	Hillsdale County
Brian Bellville	Ogemaw County
James Graham	Isabella County
Victor Mier	Ogemaw County

Mr. Schrandt states that electric service is provided to these eight farms from eight different circuits and seven separate substations. Customers on seven of the farms receive service from a multi-grounded wye distribution system and the one customer receives service from an ungrounded Delta system. There are 2,836 customers served by the eight circuits. Over the last five years there has been 14 complaints of service quality. Mr. Schrandt provides a detailed analysis of each of the eight farms including information on the location of the Farm in relation to the substation, and the substation service records. 40 Tr 42 4295-4313. Summarily, concerning the eight farms in question, specific measurements at animal contact points for stray voltage showed any measurable signs of stray voltage levels well below any levels of concern. *id.*

Mr. Schrandt addressed the allegation of the AG concerning the failure of Consumers to routinely upgrade its distribution system. He testified that as customers and new load are added to the distribution system consideration is given to building new substations or upgrading existing facilities. 40 Tr 4285-4286. He identified the Alger substation added in 1974, which absorbed a substantial portion of the load of the

Prescott substation. 40 Tr 4286. The Maple Ridge circuit coming out of the Prescott substation has had upgrades over the last five years coveting it from single-phase to three-phase service. 40 Tr 4286.

In support of its claims that Consumers negligently maintained and operated its distribution system, the AG depended on the testimony of Mr. English and Mr. Wallman. Basically, the AG relied on Mr. English's computer model and the fact that he took recent measurements on Consumers' distribution system and found currents on the ground rods over 1 mA. Mr. English's testimony in these areas has been addressed earlier in this PFD.

Turning now to those portions of Mr. Wallman's testimony concerning his observations of Consumers' distribution system, which have not been previously addressed. Mr. Wallman's testimony and Exhibit C-118 attempt to point out numerous alleged violations of the NESC found in the wiring and maintenance of Consumers' distribution system. The ALJ will address two illustrative examples here to demonstrate Mr. Wallman's reliance on outdated and inappropriate technical references. Mr. Wallman testified regarding the Rosebush circuit as follows:

One thing I found incredible was how they ran the primary neutral wire through the city of Rosebush. The primary neutral wire ties directly into the secondary neutral wire. The workmanship of this line through the town of Rosebush is one of the worse I have ever seen in 28 years of line and substation work. 30 Tr 2613.

Mr. Wallman prepared and sponsored Exhibit C-118, the Power Quality Report for the Nansue Dairy, located in Prescott, Michigan. At pages 2-3 of the report, Mr. Wallman references the NESC Code Handbook and Rule 215B. He relies on the

NESC Code Handbook and Rule 215B for provisions concerning grounding of neutrals, other conductors, and surge arrestors and in general grounding methods for the electric supply.

Consumers effectively refuted these two alleged violations in a manner, which convincingly shows that the Power Quality Report assessment of the distribution system as being in violation of the NESC is unwarranted. Mr. Denbrock testified that as it relates to wiring through the town of Rosebush, Mr. Wallman used an old electrical engineering handbook and confused the NESC with the NESC Code Handbook. Mr. Denbrock states that the NESC Code Handbook is only a compilation of considerations given by the subcommittees as they deliberate in review of possible rule revisions.

> It should be pointed out that the NESC Handbook is only a guide to what the ANSI C2 Committee Members consider when developing the actual National Electrical Safety Code. The NESC contains the rules and Regulations that represent the national standard of care that State Commissions adopt, not the handbook." Exhibit R-231, p 2.

Mr. Denbrock refers to a common neutral as the alleged violation of having the primary neutral and the secondary neutral tied together. He states that the use of common neutrals is common and used extensively. "Common primary and secondary neutrals are used extensively throughout the world to provide reliable electrical service." 38 Tr 4044. Mr. Denbrock states that both, "fundamentally and technically it is completely proper to utilize common neutrals for such loads as that serviced by the Delwin circuit out of the Rosebush Substation." 38 Tr 4045. The use of common neutrals is permitted by NESC Rule 097 under certain conditions which Mr. Denbrock and Mr. Dangenhart testified are met.

Mr. Dagenhart testified that Mr. Wallman is quoting from the 10th edition of the Handbook published in 1968. The current edition of the handbook is the 14th edition and the references relied upon by Mr. Wallman were deleted in the 11th edition. 39 Tr 200. Mr. Dagenhart conducted an inspection of the Prescott Substation and much of the circuitry from that substation. He testified that he did not observe any code violations as alleged by Mr. Wallman. Mr. Dagenhart did observe conditions, which needed attention but states that they were not significant and none involved flow of current over the neutral or the earth under normal circumstances. 39 Tr 4201-4202. Both Mr. Denbrock and Mr. Dagenhart concluded that there were no NESC violations at the Prescott Substation and related circuitry.

The ALJ finds that the above testimony shows the various concerns with the testimony of Mr. Wallman as it relates to Consumers' distribution system. Mr. Wallman's reliance on the NESC Code Handbook instead of the NESC is contrary to the hierarchy of the NESC and its Code Handbook in terms of controlling authority. Clearly, it is the NESC, which controls as a safety code and not the NESC Code Handbook. The NESC permits the use of common neutrals contrary to the conclusion of Mr. Wallman. This represents a significant deficiency in Mr. Wallman's testimony, as the ALJ views it.

Staff conducted an investigation of Prescott substation and the entire portion of the Maple Ridge circuit serving the Bellville farm from the Prescott substation. A report of the Staff investigation from Steve Paytash and Pete Derkos was admitted as Exhibit R-284. Both Mr. Paytash and Mr. Derkos are engineers. The report notes that the Maple Ridge circuit is grounded at least four times per mile in compliance with the

NESC. 40 Tr 4452. Mr. Paytash and Mr. Derkos report that based on their visual inspection and a review of test results at the Prescott substation ground is more than adequate for the type of facility. Exhibit R-284, p 2.

The ALJ finds that the AG has failed to show that Consumers negligently operated or maintained its distribution system. Consumers and Staff witnesses investigated Consumers distribution system. There were findings of only relatively minor NESC or MPSC rules violations. The allegations by the AG have not been substantiated by the testimony of its witnesses. The ALJ found significant shortcomings in the testimony of the AG witnesses. These significant shortcomings involved the findings of these witnesses as it related to the alleged NESC violations. Also, the ALJ was persuaded by the findings in other parts of the PFD, which concluded that in the AG has failed to show that Consumers has a stray voltage problem in its service territory.

C. Stray Voltage Action/Concern Level

The AG's definition of stray voltage does not contain an action/concern level. In fact, the AG opposes the adoption of an action/concern level asserting instead its position that no level of stray voltage is acceptable. "Setting a stray voltage/stray current level at action/concern which to investigate is not only useless but it is also a ploy by Consumers to avoid solving the stray voltage/stray current problems on the livestock farms within its service territory." AG's brief, p 135.

Consumers responds that the AG's position conclusively shows that as far as the AG is concerned no level of current is acceptable. Consumers continues that this clearly shows the AG's case is a collateral attack on the NESC. Consumers states that

it was not the first to come up with action/concern levels but that action/concern levels have been adopted by the PSCW, in 1989, after review of the available science concerning stray voltage. Exhibit R-171. Consumers also argues that the USDA Redbook handled the issue raised by the AG by showing a range of action/concern levels and the expected effects of the ranges on dairy cows. Consumers argues that the AG basically admits through its opposition to setting action/concern levels that she cannot prove her case in this Complaint.

Interestingly, Consumers points out that the AG's argument against setting any levels is essentially that there are too many uncertainties, variables and concerns. Consumers states this same argument works against the AG in meeting her burden of proof. Consumers recognizes that there is some variable, however, it relies on Figure 3-4 of the USDA Redbook which sets a range of conservative cow perception levels. Exhibit R-148.

Staff supports the adoption of an action/concern level. Staff points out that the elimination of any and all stray voltage is a practical impossibility. Staff views the adoption of an action/concern level as the first measure to evaluate whether a utility is complying with the level and the appropriate mitigation measures in the event levels exceed an established action/concern level. Staff asserts that any evaluation of the AG's claims of harm caused by stray voltage requires a scientifically based determination of a threshold level of stray voltage that causes harm. Staff believes that without an established action/concern level, the validity of the AG's complaint cannot be evaluated.

The AG relies on a portion of Dr. Aneshansley's testimony. Dr. Aneshansley testified, in part:

> Research has indicated the current levels that could cause stray voltage problems. However, the voltage necessary to produce these current levels changes with the resistance of the electrical path to and through the animals. Therefore, it is difficult to specify stray voltage problem levels exactly.
>
> Furthermore, animal sensitivity to current level is as variable as the resistance of the paths. 33 Tr 3180.

The PSCW reviewed the available relevant science at the time concerning stray voltage and deemed it appropriate to set an action/concern level. The PSCW on July 11, 1996 revised upwards its stray voltage action/concern level. The PSCW upped its action/concern level from 1 mA to 2 mA . Exhibit R-171. The PSCW saw fit to adopt basically a two-part action/concern level. The two-parts are based on the recognition that sources of stray voltage include the utility and on-farm sources as well. It states,

> This tariff shall be based on the 2.0 mA AC RMS 60Hz, steady state, overall level of concern and 1.0 mA AC RMS 60 Hz, steady state, utility level of concern set forth in this order . . . Exhibit R-171, p 38.

The MEGA and the MCEA proposed a similar standard before the MPSC on April 17, 1997. The proposed standard was similar to the one adopted by the PSCW and also required preventative action if stray voltage at an animal contact point exceeded 1 millliamperes on a 1-minute average steady state basis. Included with the proposal was a stray voltage investigation protocol for measuring stray voltage. The AG filed comments opposing the proposal. The AG's position similar to its position in this complaint was that any stray voltage standard should be zero tolerance and any level of stray voltage is unacceptable. The case was closed by the MPSC with no standards set and the issue remains unresolved in the State of Michigan.

The USDA Redbook is particularly relevant to this Complaint because several of the co-authors of the Redbook were presented as witnesses in this case. The Red Book, at page 3-22, recognizes various behavioral responses in dairy cows, which would be expected at various current levels. One of the thresholds set by the USDA Redbook is that there is expected no loss in production anticipated at or below 4 mA. Another threshold is that any loss in production is not due to physiological change in the dairy cow up to 6 mA. Up to 6 mA, any loss of production is expected to be as a result of the dairy cow's response to the presence of stray voltage for example avoiding a watering stanchion since milk is 87% water any reduction in water intake reduces milk production. Exhibit R-148, p 3-11. The USDA Redbook notes animal responses which could result in a loss of production in the range of 4 mA to 6 mA.

Numerous Consumers witnesses testified that the USDA Redbook levels are acceptable based on conventional scientific evidence. Furthermore, Dr. Reinemann found the USDA Redbook actually conservative in its action/concern levels. Dr. Reinemann, after the publication of the USDA Redbook, conducted several additional studies on cow perception levels. 38 Tr 3924. The latest research study involved hundreds of cows. 38 Tr 4013. In this research study, Dr. Reinemann indicates that only a relatively small percentage of cows will perceive 1 mA with the average perception level closer to 6 mA. 38 Tr 4013. He states that the USDA Redbook levels therefore are extremely conservative. 38 Tr 4012.

Dr. Kaneene, a Professor of Epidemiology, at Michigan State University conducted a review of scientific research concerning stray voltage. Exhibit R-166. Dr. Kaneene states:

> There are valid studies in the published literature indicating that cattle can perceive electric current from stray voltage. Even though some animals have been reported to perceive as low as 0.7 mA, the average level perceived by animals seems to be 2-3.5 mA. Exhibit R-166, p 11.
>
> The levels for behavioral changes are even higher, reports Dr. Kaneene:
>
> Some studies have reported animals exhibiting behavior change at various stray voltage levels. However, most studies with adequate sample size and power could not demonstrate significant behavior changes when animals were exposed to currents of levels below 4.0 mA. Exhibit R-166, p 12.

Dr. Kaneene reviewed work performed by Dr. Aneshansley concerning the levels of exposure to stray voltage, which would impart a loss in production of dairy cows. Dr. Kaneene reports of Dr. Aneshansley's work that it:

> . . . did not demonstrate statistically significant differences in milk production and protein fat concentrations between unexposed cows and those exposed to 0-4 volts for twenty-one days. In another study (involving 24 cows) by the same authors (Aneshansley et al., 1988), the voltage exposed to dairy cattle was increased to 5 to 8 volts, and no demonstrable difference in milk production, milk quality, and somatic cell counts was seen between exposed and non-exposed cows. Exhibit R-166 p 17.

The AG contends that the USDA Redbook erred in utilizing too high of an impedance for cows at 500 ohms. In support of this the AG, notes that the USDA Redbook reports that there are studies, which suggest that, the resistance is 200 to 400 ohms. Exhibit C-153, p 43 actually states that the electrical resistance of a cow under certain dry conditions is 1000 ohms but based on another set of circumstances involving the cow's wet skin and a wet floor may drop to 200 to 400 ohms. The relevant portion states:

> Measurements show that the electrical resistance of a cow between a piece of metal pipe placed on the wetted flank and a conducting floor surface is of the order of 1,000 ohms. A similar resistance was measured

> via the milk stream, through the udder to the floor by Phillips and Parkinson (1963) when they first reported on this problem.
>
> The resistance is independent of applied voltage and depends largely on the contact resistance to the skin surface. With wet skin and a floor surface rendered highly conductive by the presence of urine, the resistance may drop to 200 to 400 ohms. Exhibit C-153, p 43.

The AG's issue with the PSCW findings are found, in part, through the testimony of Mr. English. Mr. English believes that the use of 500 ohms is an error. He finds that it doesn't truly represent the number of contact points of a cow. 26 Tr 1501. Mr. English explains that, under real conditions a cow will have more contact points with each contact point providing more paths for current. Also, Mr. English believes that "more contact resistance is introduced into the circuit above what is already incorporated in the 500 ohm value." 26 Tr 1501.

The ALJ finds Mr. English's beliefs contrary to the numerous studies conducted on the resistance levels of cows. Exhibit 148, p 50. The USDA Redbook shows both means and ranges of cow resistance. Exhibit 148, p 50. It also identifies the related studies in support of its findings. The USDA Redbook concludes that its behavioral response table, at page 66, "estimated using a worst-case circuit impedance (500 ohms) and a more realistic impedance (1,000 ohms)." Exhibit R-148, p 66.

Furthermore, the ALJ found the testimony of Dr. Reinemann convincing. Dr. Reinemann has reviewed and conducted numerous studies on the levels of perception of electrical current for dairy cows. He testified that the most sensitive cows begin to perceive current at about 1 mA. 38 Tr 3915. He agrees with studies he has reviewed that show an avoidance response between 3 and 6 mAs. 38 Tr 3915-3916. Dr. Reinemann states that he finds the response to voltage and current summarized in the USDA Redbook reasonable for even the most sensitive cows. 38 Tr 3924.

The ALJ finds that due to the definition set forth by the AG it is not necessary to set an action/concern level in the context of this proceeding. In fact, the ALJ finds that this compliant proceeding is not the proper forum to set an action/concern level. There are other more appropriate methods such as rulemaking or through a MPSC initiated proceeding involving all interested parties. However, the ALJ is convinced that any action/concern level should be driven by the rather volumous reputable scientific research readily available. The ALJ further believes that jurisdictional boundaries should have only limited influence in the establishment of any action/concern levels, there being no evidence presented to show that animals in one part of the country react any differently than animals in other parts of the country.

D. Separation of Neutrals

The AG argues that separation of neutrals[12] is only a mitigation device a fix and only a temporary fix at best. Consumers used separation of the neutrals as the cheapest fix it could find without ever addressing the real issue of objectionable current flow into the earth, according to the AG. The AG believes that as long as Consumers continues to use the earth as a return path then it hasn't solved the stray voltage problem on its distribution system. The AG contends that separation of the neutrals is ineffective at reducing or eliminating stray voltage as a problem.

Consumers argues that the AG is under a misconception regarding the burden of proof for establishing the effectiveness of neutral separation. Consumers argues that even if it had not separated any neutrals in its service territory then the AG still could not prove her case. The AG's case would suffer from the nature of her complaint being a

[12] The term "isolation of the neutrals" is also used generally throughout the research and testimony interchangeably.

collateral attack on the MPSC rules and NESC. Consumers argues that the AG has presented no proof of any levels of current or stray voltage at animal contact points; unreliable scientific studies and non-existent action/concern levels of stray voltage. Nonetheless, Consumers stands by its presentations of witnesses who describe neutral separation as effective.

The issue of the separation of the neutrals is covered more extensively here to address the division of the parties with regard to the technical and scientific data on yet another aspect concerning stray voltage. The ALJ finds that the testimony of Consumers witnesses again demonstrates that the conventional scientific technical data supports its claims that separation of the neutrals is effective in eliminating off-farm sources of stray voltage. Consumers has not presented neutral separation as a panacea and the ALJ does not view it as such. However, neutral separation is shown to be an effective method to eliminate off-farm sources of stray voltage.

The process of separating the neutrals involves disconnecting the bonded neutral connection between the primary and secondary neutral at the customer service transformer. 40 Tr 4279. This form of separating the neutrals is appropriately referred to as a physical separation of a the neutrals and not an electrical separation of the neutrals. Separate grounds are then provided for the primary neutral and the secondary neutral. 40 Tr 4279. The process permits the primary neutral to operate independent of the secondary neutral system. 40 Tr 4280.

Consumers weighted the cost of alternative methods to mitigate or eliminate stray voltage on its distribution system. Exhibit C-266. Exhibit C-266 is a memorandum entitled Stray Voltage Reduction Program dated September 24, 1993. Separation of

neutrals was estimated to cost about $1.84 million. Other alternatives examined included converting single-phase service to three-phase service at a cost of $94 million. The cost to convert from a multi-grounded wye distribution system to a Delta system for the primary lines serving dairy/swine farms was $135 million. The cost to install equipotential planes on dairy/swine farms was estimated at $15 million. The recommendation of the authors of the memorandum was to implement separation of the neutrals at all dairy and swine livestock farms. The authors further note that this is not a complete and final solution. Exhibit C-266.

The AG relies on page 5 of Exhibit C-313 for the proposition that it is important to identify the sources of stray voltage before undertaking attempts at solutions. Exhibit C-313 states in the first full paragraph at page 5 under the heading Solutions as follows:

> It is important to identify the sources of stray voltage before undertaking attempts at solutions. Taking the "shotgun" approach may simply cover up valuable data that could become important at a later time…The source can be traced to on-farm and /or off-farm origins. The on-farm sources can and should be corrected to reduce the neutral-to-earth voltage to levels that will not be bothersome to animals. Exhibit C-313.

Mr. English finds separation of the neutrals as only a first mitigative step. He does however recognize that separation of the neutrals "may reduce the direct contribution of current between the primary and secondary neutrals." 26 Tr 1505. Mr. English would prefer instead of a physical separation of the neutrals to have an electrical separation. He believes that even with separation of the neutrals there will be current from other sources that travel through the earth and pass into the barnyard and barn. Mr. English explains that in his opinion the only way to achieve true isolation is through the use of a five-wire system or Delta system. 27 Tr 1630.

Consumers performed a pilot study in 1994 on the impact of a livestock farm when neutral separation is conducted. The pilot study was presented to the ASAE in 1994. Exhibit R-295. Mr. Schrandt was a co-author of the presentation before the ASAE. Mr. Schrandt testified that after neutral separation, "Off-farm sources of NEV can no longer contribute to an on-farm stray voltage condition that could cause animal contact current at problematic levels." Measurements to detect stray voltage were taken after neutral separation at livestock farms throughout Consumers service territory including the 17 farms where Mr. English conducted studies while employed with the MPSC. Measurements at none of the 17 farms showed more than 1 mA. The highest level happened to be at a farm location at which neutral separation had not occurred. In 2000, Consumers tested neutral separation at 59 dairy farms. All of the measurements at animal contact points were 0.3 volts or less.

The AG's reliance on the PSCW's finding that neutral separation can remain in place for no more than 90 days as evidence of neutral separation ineffectiveness is also misplaced. Consumers correctly points out that the AG used only snippets of the PSCW's findings regarding neutral separation.

The PSCW order, dated July 11, 1996, is the PSCW's update of earlier decisions about stray voltage and its effects on livestock. A major issue addressed by the PSCW was, "whether isolation should be available to farmers on demand, regardless of whether stray voltage exceeds the 1.0mA utility level of concern." The Farmers Union, the Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP) and the Staff of the PSCW recommended neutral separation upon demand for a one-year trial period. The utilities opposed neutral separation on demand. The PSCW ultimately

adopted many of the utilities recommendations regarding neutral separation except their proposal that the utility would be able to deny a request for neutral separation.

In this case Consumers does not oppose neutral separation but rather, as discussed above, taken the steps for neutral separation at all of the livestock farms in its service territory. The PSCW's stated concern regarding neutral separation involved the utility conducting inspections after neutral separation and follow-up inspections. Consumers appears to have addressed both those concerns in its neutral separation program. 40 Tr 4290.

Neutral separation does nothing to lower the levels of stray voltage when the sources are on-farm and may in fact aggravate the problem. Exhibit R-171 p 15. The PSCW addressed this concern by requiring that farms that request neutral separation first must supply an up-to-date certificate that a state-certified electrical inspector has inspected the farm and the farm's electrical system complies with applicable codes. Exhibit R-171 p 17.

Interestingly, the PSCW also addressed the issue of the effect of transients on cows. The PSCW found that motor starts are a major source of transients. The PSCW states:

> A motor start initially draws more current when it start, to overcome inertia and achieve its running speed. This is a short-term "transient" event, lasting approximately 0.02 to 0.15 second. Framers tend to use a number of large motors to operate fans, pumps, gutter chains and grain elevators. A motor can draw up to six times more current when starting than when running. Exhibit R-171 p 25.

The PSCW found that these motor starts could cause transients as high as 6.0 mA in cow contact areas. The PSCW noted that its earlier concern level of 1.0mA in its 1989 and 1990 orders applied to steady state current and not transients. In

recognizing the work of Professor Reinemann and Dr. Aneshansley, the PSCW concluded:

> Cows are less sensitive to short motor start transients and do not perceive them as readily as steady state current. An average cow will begin to perceive motor start transients only when they are above 6.0 mA. Exhibit R-171 p 36.

The ALJ concludes that neutral separation is an effective measure to eliminate off-farm sources of stray voltage. The ALJ recognizes that neutral separation is not a cure-all. However, as discussed above, sources of stray voltage on many occasions is on-farm. Exhibit R-171 p 10. The ALJ finds that the AG is again misguided it its criticism of the separation of the neutrals. The ALJ agrees with Consumers assessment, that the AG's claim that separation of the neutral does not solve the problem, presupposes the existence of a problem. The ALJ finds that there has been no showing of a problem and further that there has been no showing that the neutral separation is ineffective. To the contrary, the ALJ finds that Consumers has shown that neutral separation is effective.

E. Effects on Humans

Another issue raised by the AG concerns the harmful effects of stray voltage on humans. The AG presented the testimony of Dr. Main, a veterinarian for almost 30 years. Dr. Main testified primarily regarding the harmful effects of stray voltage on animals. However, Dr. Main offered the following explanation in support of his observations concerning harmful effects of stray voltage on humans:

> First of all, realize that I am a veterinarian and I deal with animals on farms. However, what we have to understand is that these cows are like the canaries were for the miners. They are letting us know that something is going on and that it is negatively affecting the health of living mammals.

> Since humans are mammals too, it shouldn't be too surprising to reach the conclusion that this stray voltage has got to be affecting the human health of those in the same farm environment. 31 Tr 2717.

Dr. Main then goes on to discuss Mrs. VanDenBerg, heart palpitations; Mike VanDenBerg, liver disease; an individual on the Jerome Larson farm, aching shoulders; at the Bender farm a man whose health deteriorated so badly that he had to quit farming altogether; a man on the Rainey farm, the father could not sleep in his house; again at the Rainey farm the grandkids, wet the bed at night; and also on the Rainey farm a son with back troubles. 31 Tr 2718. Dr. Main concludes that in addition to concerns about harmful effects of stray voltage on animals he is also concerned about the physical well-being of the people on the farms. The AG presented similar anecdotal testimony from Dr. Graham and Dr. Hillman.

Consumers presented the testimony of Dr. Erdreich. Dr. Erdreich is an Epidemiologist[13]. She found the testimony of the AG's witnesses Dr. Main, Dr. Graham and Dr. Hillman based only on symptoms and conditions described by farmers. She pointed out that in her opinion these are not scientific or medical opinions of causation. She believes that such opinion on causation must be based on objective criteria that take into consideration toxicological and epidemiological data. Dr. Erdreich identified procedures used by scientists to assess collective information and she also summarized the available scientific evidence on the effects of stray voltage on humans. Dr. Erdreich's opinion, after review of all available information, is that stray voltage does not present potential risks to human health. 37 Tr 3776.

[13] "Epidemiology is the study of the distribution of disease in the population and the characteristics and exposures of groups of people to determine what affects the occurrence of disease. Epidemiology is one of the main sciences used in public health." 37 Tr 3776.

Dr. Erdreich discusses components of a scientific inquiry that distinguish it from the anecdotal stories presented by the AG's witnesses. Typically, a scientific inquiry seeks objective evidence to explain how things work, what causes diseases. The scientific inquiry is used to maximize accuracy and objectivity while reducing limitations of bias and errors through the use of control groups and controlled studies; "blinded" physicians and researchers; precise and accurate measurements of dose or exposure and precise definition of variables in use; the ability to replicate or confirmation of the experiment; and the use of the peer review process. 37 Tr pp 3778-3785.

Dr. Erdreich employed the *weight of the evidence* approach, which is a comprehensive assessment of all the relevant scientific research available. The purpose is to be unbiased and comprehensive assigning more weight to studies of better quality while avoiding selection of only those studies with a finding supporting a preconceived notion. 37 Tr 3792. She reviewed studies on the health and behavior of animals exposed to stray voltage and studies in humans and animals to identify threshold levels of effects. She reviewed no epidemiological studies because she could find none and points out that the AG did not review or present any either. Here she points out that humans are subjected to less exposure level than would typically a cow in a barn setting because, "they are not obligated to maintain repeated contact with two fixed objects that might be a source of stray voltage, as for examples cows that must contact both the waterer and the ground when drinking, and they are insulated by their shoes or boots." 37 Tr 3794.

In her review of studies, Dr. Erdreich cautions against drawing conclusions from any one particular study or experiment and recommends a review of all relevant

research. She relies on the USDA Redbook as a source of data and studies conducted by Dr. Reinemann, Norell, Gustafson, Currence, Lefcourt and Reilly as well as the Cornell Full Lactation Study. She observes that studies on perception levels of cows show that they can definitely perceive contact current but only when the current flow is strong enough. She notes that Dr. Reinemann reports that cows rarely perceive currents below 2 mA with most cows perceiving current only at the higher level of 4 mA.

She describes the testimony of Dr. Main concerning the effects of stray voltage on humans as a list of symptoms and conditions which are unspecific and not useful as true medical evidence or diagnosis. She points out that there is no direct evidentiary links between the symptoms and conditions. These reports, she states, are merely isolated reports or anecdotes with no analysis to rule out coincidence or other possible causes. As it relates to other possible causes of the symptoms and conditions described by Dr. Main, Dr. Erdreich testified that farmers are exposed to hazardous chemicals, animal wastes, animal viruses and zoonotic[14] diseases.

The ALJ has, as discussed above, concluded that the AG has failed to show that Consumers has a stray voltage problem due to its distribution system. Thus, the AG's allegations of harmful effects on humans are based on a false premise. However, Consumers did prepare a response that addresses harmful effects on humans. The ALJ finds that, based on the testimony of Dr. Erdreich, the AG's presentation regarding harmful effects of stray voltage on humans is woefully lacking. Again, there is no finding that Consumers, in fact, has a stray voltage problem in its service territory and there is no finding, based on the AG's presentation that stray voltage is a source of harm to humans.

[14] Diseases that may be transmitted to people by vertebrate animals.

F. Harm Caused by Stray Voltage/Stray Current

There is a dispute over the level of harm that stray voltage causes and the various types of diseases and harmful conditions caused by stray voltage. The AG has presented a long list of symptoms and conditions it alleges is caused by stray voltage. Consumers accepts some of the symptoms and conditions as possible causes of stray voltage but rejects most.

What has been vehemently disputed is whether Consumers' distribution system causes stray voltage problems in its service territory. The ALJ has found that the AG has failed to show that it does. The ALJ finds no need to further address this issue since Consumers, the utility providing the service, recognizes that stray voltage does have harmful effects and has taken effective measures to mitigate its contributions to stray voltage.

G. Transients and Harmonics

The AG believes that transients and harmonics play a role in stray voltage by exacerbating the harmful effect on animals when present. Much of the AG's presentation concerning harmonics is found in the prefiled testimony of Dave Stetzer. Mr. Stetzer was unavailable to testify and his testimony is not part of the record. However, the subject of transients and harmonics are mentioned in several other AG witnesses' testimony as a concern. The ALJ finds a description of the characteristics of transients and harmonics is helpful to understand their role in stray voltage problems.

A transient is a short duration electrical event. It may more technically be described as a monetary disturbance within one or more cycles of the 60 Hz waveform.

39 Tr 4184. "Transients occur on any electrical system, primary or secondary, when the current or voltage changes from one steady state condition to another. Often, a transient develops when load is suddenly added to or taken away from the circuit. But that isn't always the case." 39 Tr 4184.

There are numerous causes of transients. Lightning is an obvious source of transients. Other sources of transients include electrical faults, loose connections, capacitor switching, large electrical loads which switch off and on, adjustable speed motor drives and even power quality protection equipment. 39 Tr 4186. The customer facility may be the most common source of transients according to recent industry research. 39 Tr 4186. Transients are traceable to the source through measurable frequency. 39 Tr 4188. The higher the frequency of the transient the more likely that the transient was generated within the building system wiring with frequencies above 80kHz almost always generated within the building wiring. 39 Tr 4188. Surge suppressers and proper grounding methods help protect against sources of transients other than lightning. 39 Tr 4186. Transients lose their power as they travel away from their source. 39 Tr 4186. Generally, transients attenuate quickly. 39 Tr 4187.

Dr. Reinemann has conducted extensive research concerning transients. He finds that typically the sources of transients are from switching equipment on and off the farm. Dr. Reinemann testified that the shorter the duration of a transient, then the larger the level of current that is necessary for detection by animals.

Harmonics is the change or distortion in the normal 60Hertz power supplied by a utility. 39 Tr 4197. Harmonics are created by "nonlinear loads." A "nonlinear load" is typically found in adjustable speed motor drives used in industrial and commercial

applications. Also, uninterruptible power supplies (computers) are nonlinear loads. 39 Tr 4197. When viewed on an oscilloscope a harmonic appears as a not smooth 60-Hertz waveform. Harmonics can cause interference with communication circuits, computers and other electrical equipment. 39 Tr 4197. In motors and transformers, harmonics may cause vibration and overheating. 39 Tr 4197. Typically, farm loads are not large nonlinear loads and therefore are not typically a source of harmonics. 39 Tr 4198. Usually harmonic levels do not represent a problem on distribution circuits. 39 Tr 4198. Harmonics are mostly present where there are large commercial or industrial facilities.

The ALJ finds, as stated earlier, that the AG has failed to show that a stray voltage problem exists on Consumers distribution system. Certainly, transients and harmonics could have a harmful effect either in the presence of stray voltage or even in the absence of stray voltage. However the AG has failed to show that either transients or harmonics are a problem in Consumers service territory. Clearly, there is nothing in the record to support a finding that transients and harmonics are causes of stray voltage but rather may be present in the event stray voltage is present. Once stray voltage is detected, with the proper equipment, transients and harmonics may likewise be detected but they may also be detected absent any measurements showing the presence of stray voltage. The ALJ concludes that transients and harmonics have not been shown here to be a concern on Consumers distribution system.

V.

COUNT II - AG'S CLAIMS OF CONSUMERS' UNREASONABLE AND PREJUDICIAL TREATMENT OF RURAL CUSTOMERS

The AG argues that Consumers is contributing to stray voltage on rural farm customers' property within its service territory. The AG alleges that Consumers' failure to eliminate its contribution to stray voltage on rural farms demonstrates the unreasonable and prejudicial treatment of its rural customers. Furthermore, the AG asserts that Consumers is legally required to treat all of its customers reasonably and without prejudice.

The AG, in support of her assertion that Consumers is legally bound to treat all customers reasonably and non-prejudicially, cites Section 17 of the Railroad Act. The AG in her initial brief states that the "statute essentially prohibits the disparate, unequal, or inferior service accorded to different customers, groups of customers, or customers in different localities." AGB, p 172. Section 17 of the Railroad Act provides:

> It shall be unlawful for any common carrier, subject to the provisions of this act, to make or give any undue or unreasonable preference or advantage to any particular person, company, firm, corporation or locality or any particular description of traffic in any respect whatsoever, or to subject any particular person, company, firm, corporation or locality or any particular description of traffic to any undue or unreasonable disadvantage or prejudice in any respect whatsoever.
> MCL 462.17; MSA 22.36.

In support of the AG's claim of Consumers' unreasonable and prejudicial treatment of rural customers, the AG, in her initial complaint, provides, among other things, that Consumers has subjected dairy and livestock farmers, rural residents, and rural communities to undue and unreasonable disadvantages and inferior service with respect to stray voltage and currents. Also, the lack of upgrades and improvements to

equipment in rural and farm communities has left these customers with inferior and inadequate electric service. Furthermore, the AG contends that Consumers has neglected its rural electric distribution system in favor of its metropolitan and major suburban electric distribution systems, and has disproportionately impacted rural localities and dairy and livestock farmers. The AG maintains that this type of activity constitutes an unlawful, undue, and unreasonable disadvantage and prejudice specifically prohibited by Michigan law. The lack of upgrades and improvements in rural areas, the AG contends, has increased the incidents of stray voltage and currents in the affected rural communities and on diary and livestock farmers' private property. In the AG's initial brief, the AG argues that Consumers is knowingly contributing to stray voltage on rural farm customers' property within its service territory, and since Consumers has failed to eliminate the contribution, it is evident that Consumers treats rural customers unreasonably.

In support of Count II of the AG's complaint, the AG provides information of alleged disadvantages that rural customers were subjected to. The areas of alleged disparate treatment of rural customers can be divided into basically three areas. The AG alleges that Consumers' unreasonable and prejudicial treatment can be demonstrated with information regarding the stray voltage investigation employee's education and training backgrounds, the type of equipment used to investigate stray voltage, and what Consumers has done for their rural customers in general to address stray voltage.

a. Consumers' Employees Performing Electricity Investigations

Consumers has a Power Quality Services Department, which has two different sections, consisting of the Commercial and Industrial and the Agricultural Services section. The two sections of the Power Quality Services Department employee separate groups of people that are responsible for different types of customer issues.

The Commercial and Industrial section, as Mr. Schrandt explained, focuses on issues inside customers' facilities. The Commercial and Industrial section deals with the quality of electric service at a particular piece of equipment that has sensitive electronic controls. Basically, according to Mr. Schrandt, the Commercial and Industrial section employees would "assist customers with solving and preventing on-site problems related to the quality of electric service at end-use equipment." 40 Tr 4340.

In determining what type of customer will fall under the Commercial and Industrial section, Mr. Schrandt explained that the defining characteristic is the type of electric rate the customer is on. Consequently, even if a farm, for example, had over 500 head of cattle, with computerized milking systems, and a lot of computerized work and variable speed drives, the operation will not fall under the Commercial and Industrial Section. 40 Tr 4341. Even a large farm with 500 head of cattle can be on a farm rate, and will consequently not be under the purview of the Commercial and Industrial Section.

The educational requirements for the two sections of the Power Quality Service Departments are different. Specifically, the AG stresses that in order to work for the Commercial and Industrial Services section, a person is required to have a bachelor degree in engineering or its equivalent. The AG takes issue with the fact that the

educational requirements for an employee working for the Agricultural section is less stringent and requires only the possession of a bachelor degree in any discipline along with an interest or background in agriculture, and some experience in the utility business. The AG offers Mr. Schrandt's testimony illustrating the fact that an employee in the Agricultural Services section is not required to have the same background as an employee in the Consumer and Industry Services section. Mr. Schrandt testified that to work for the Agricultural Services section, "[a]n electrical engineering degree was not a requirement." 40 Tr 4334.

The AG's witness Mr. Wallman[15], in regards to the training of Consumers Power Quality employees stated that:

> I think that if they were going to call this the Department of Power Quality and referred farmers who had power/quality stray voltage concerns to them, they should have staffed this department with qualified individuals with electrical engineering experience. The current title of the group is Agricultural Services, which much more adequately represents to their customers what the true nature of the services they perform are. It is obvious that Consumers is a utility of considerable and [sic] resources, and it seems they could staff their power quality department with real power quality engineers, i.e., electrical engineers or other qualified personnel with a background other than sales. When you send unqualified personnel out to perform electrical investigations, it is no wonder that problems never seem to get discovered, and farmers never get any satisfaction or resolution. 30 Tr 2621.

While Mr. Wallman, the AG's witness, at one time was under the opinion that the Agricultural Services section should have been employed with "qualified individuals with electrical engineering degrees," Mr. Wallman changed his opinion. In fact, upon cross-examination, Mr. Wallman no longer had an opinion regarding this matter. While

[15] Mr. Larry Wallman's qualifications include a journeyman primary meterman ticket and a journeyman secondary meterman ticket. The requirements for obtaining these tickets are not set by any national or state certification standard. 30 Tr 2643.

Mr. Wallman had criticized Consumers' Agricultural Services section for not having electrical engineering degrees, Mr. Wallman himself did not have an electrical engineering degree. However, similar to many of Consumers' employees in the Agricultural Services section, i.e. Mr. Thompson, Mr. Wallman had many years of practical experience. Mr. Wallman, in response to being asked if he was an expert on the NESC stated that, "[i]f 28, 30 years of experience of going through the electrical code at various troubleshooting jobs make an expert, then I'm an expert." 30 Tr 2640. While Mr. Wallman at first declared that he was not an expert in different areas dealing with electricity, he later offered that he was an expert on electricity, in electrical measurement techniques, and power quality. 30 Tr 2641.

As discussed above, Mr. Wallman criticized Consumers for sending out employees, without an electrical engineering degree, to investigate farms with potential stray voltage problems. Mr. Wallman, however, provided testimony regarding his investigations at the Bellville farm. Mr. Wallman's testimony demonstrates the fact that through his work with Power Quality Services he has been involved with power monitoring of electrical panels on dairy farms and industrial plants, and "power monitoring for the State of Michigan Attorney General's Office at dairy farms." 30 Tr 2609. Mr. Wallman, based on his testimony, considered himself an expert, and even without an electrical engineering degree.

Consumers' witness, Mr. Schrandt, provided that the amount of education that the Agricultural Investigators had was in fact more in-depth than characterized by the AG. Mr. Schrandt discussed how Consumers' employees that conducted stray voltage

investigations received specific training to conduct these types of investigations. 40 Tr 4335-4336.

In particular, The AG emphasized the lack of educational background of Mr. Thompson. Mr. Schrandt testified that Mr. Thompson did not have a degree in electrical engineering, nor was he a licensed electrician. Mr. Schrandt did admit that if a customer called up Consumers requesting Consumers to investigate a potential stray voltage problem, Mr. Thompson could be the Consumers employee that would be dispatched to investigate the possible problem. Furthermore, Mr. Schrandt offered that Mr. Thompson had been on probably hundreds of farms to conduct such investigations. 40 Tr 4339.

In Mr. Thompson's direct testimony, Mr. Thompson stated that he received a Bachelor of Science degree in Agricultural Economics in 1968. 41 Tr 4584. Mr. Thomson began his career at Consumers in agricultural marketing, and in this capacity, he was working with all agricultural customers in numerous counties. *id*. His duties included assisting the agricultural customers in the design of their farm electrical systems, coordinating customer's energy needs with design technicians, and selection and use of different types of electrical equipment to improve the efficiency of their operations. *id*.

After working for Consumers for approximately 23 years, Mr. Thompson commenced work in 1991 with Consumers' Agricultural Services section. 41 Tr 4585. From 1991 until mid-1994, Mr. Thompson spent the majority of his time responding to calls from farms involving stray voltage inquiries. Additionally, Mr. Thompson, stated that he was a field leader for research carried out by Consumers and Michigan State

University in 1994. This research evaluated the effects of separating the primary and secondary neutrals at livestock farms on two circuits. *id*. Also, Mr. Thompson stated that he had worked with some of the most recognized experts in the field of stray voltage. *id*.

Mr. Thompson, in describing his background in the area of stray voltage, stated that he used "a variety of measurement instruments and equipment to measure and analyze stray voltage and other electrical phenomena, including, digital RMS multi-meter clamp-on amperage meters, ground rod resistance testers, data loggers, oscilloscopes, three-point resistance testers, sound measurement equipment, and still and video cameras." 41 Tr 4586. As far as training for the different types of equipment, Mr. Thompson stated that his training for the equipment was acquired over his 32 years of working with Consumers in a variety of ways. The training that he received in the equipment came from a number of sources, including representatives and engineers from the equipment manufacturers themselves, which included the Fluke Corporation and Rustrak. Mr. Thompson acquired additional training from leading experts in the instrumentation field, attended seminars, and received formal training and in-the-field training with Doctors Stringfellow and Aneshansley. 41 Tr 4586-4587.

The AG's asserts that the Agricultural Investigators were "unqualified and almost untrained stray voltage investigators". AG's Brief, p 171. Consumers in response to the AG's assertions of the ineptness of Consumers' investigators, offered several arguments to rebut the AG's position, which included the fact that Mr. Thompson, a senior agricultural service employee and stray voltage investigator, while not trained as an engineer, was probably one of the most highly qualified stray voltage investigators in

the country. 41 Tr 4584. Consumers added that Mr. Thompson has a college degree in an area of agricultural science, and teaches others how to conduct stray voltage investigations, including engineers. 41 Tr 4587.

Consumers, to further rebut the AG's argument that Consumers was prejudicial to its rural customers, adds that even though an engineering degree was not required to be an Agricultural Investigator, engineers were at the Agricultural Investigators disposal. Specifically, Dr. Stringfellow, who had a physics degree and considerable amount of work in the field of electricity, would conduct measurements when necessary. 41 Tr 4499.

In an exhibit offered by Consumers' expert witness Dr. Aneshansley, from the USDA Redbook, which states in particular that:

> **Simple cases of stray voltage can be detected by persons with minimal electrical experience** if they select the appropriate equipment and adhere strictly to the detection procedures outlined in this handbook. However, identifying the source of a stray voltage can require considerable expertise. Also, detailed knowledge of the farm and local distribution electrical systems is often needed to determine appropriate mitigation techniques.
>
> Because of these constraints, we recommend that voltage and current measurements related to stray voltage investigations be made by persons knowledgeable about farm electrification, instrument characteristics, and proper measurement procedures and capable of properly interpreting the measured values. Exhibit R-148, p 129 (emphasis added).

An additional excerpt from the USDA Redbook involving the role of electrical engineers in terms of the training of people involved in stray voltage states that "[e]lectrical professionals (consultants) generally engineers dealing in electrical power, will play a role in … the training of others involved in stray voltage …." Exhibit R-148, p 132. From the two excerpts from the USDA Redbook, it is evident that persons not

possessing an electrical engineering degree can detect stray voltage. The USDA Redbook clearly offers that people with minimal electrical experience can detect simple cases of stray voltage, and that electrical engineers will teach others to conduct stray voltage tests.

The ALJ acknowledges that Consumers has a Power Quality Services Department that has two different sections, which are the Commercial and Industrial and the Agricultural Services section. The two different sections are responsible for different types of customers. The Agricultural Services section is involved with agricultural customers, which includes dairy farmers. Additionally, the ALJ acknowledges that the educational requirements for the Agricultural Services section are different than the educational requirements for the Commercial and Industrial section. While the AG attempts to make an argument that the disparity in the educational requirements of the two sections amounts to unreasonable and prejudicial treatment to rural customers, the ALJ does not agree.

The ALJ finds that the employees of the Agricultural Services section of the Power Quality Services Department, while not required to have an electrical engineering degree, have substantial education and experience. The ALJ finds there has not been an adequate showing of any unreasonable or prejudicial treatment of rural customers, due to the educational and training requirements of the Agricultural Service employees.

b. Equipment Used In Electricity Investigations

To further show that Consumers treated its rural customers prejudicially, the AG argues that the type of equipment that Consumers' Agricultural Services employees used was different, when compared with the Commercial and Industrial section. The

AG, in her brief, refers to the testimony of Mr. Schrandt. AG's Brief, p 171. In response to a question by the AG, Mr. Schrandt replied that the Commercial and Industrial Section of the Power Quality Services Department used instruments like disturbance analyzers, BMIs, and oscilloscopes. 40 Tr 4339. Mr. Schrandt also offered that the Agricultural Services employees were not specifically trained to use all the equipment that the Commercial and Industrial Services employees were using. The AG argues that since there was not a requirement that the Agricultural Services Employees be trained on the same types of equipment that the Commercial and Industrial Services employees were trained on, the ALJ should find this as indicative of prejudicial treatment towards Consumers' rural customers.

The ALJ finds, however, that even though the Agricultural Services employees were not required to be trained on the same types of equipment as the Commercial and Industrial Services employees, this is not enough to show unreasonable and prejudicial treatment towards Consumers' rural customers. The AG has acknowledged that Mr. Thompson was a senior agricultural service employee and stray voltage investigator. Additionally, the AG has acknowledged that Mr. Thompson has investigated many farms where there was a concern of a potential stray voltage problem. While there may not be a requirement to be trained on the same type of equipment that the Commercial and industrial Services employees were trained on, Mr. Thompson was trained on many different types of equipment, including, "a variety of measurement instruments and equipment to measure and analyze stray voltage and other electrical phenomena, including, digital RMS multi-meter clamp-on amperage meters, ground rod resistance testers, data loggers, oscilloscopes, three-point

resistance testers, sound measurement equipment, and still and video cameras." 41 Tr 4586.

The ALJ finds that even though the Agricultural Services and Commercial and Industrial employees were not required to be trained on the same type of equipment, this is not in itself a showing of unreasonable or prejudicial treatment by Consumers towards its rural customers. While different types of equipment were requirements for the different sections of the Power Quality Services Department, the AG has not shown by a preponderance of the evidence that this equates to unreasonable or prejudicial treatment of Consumers' rural customers.

c. What Consumers Has Done for Their Rural Electric Customers

The ALJ finds that there are numerous examples of ways that Consumers has attempted to alert, educate, and help its rural customers with issues involving stray voltage. Mr. Schrandt, in reference to special services that Consumers has provided to meet the needs of its rural customers with livestock operations stated that:

> Consumers Energy's Farm Service Maintenance Program has been targeted specifically for the livestock customers. Over a four-year period, from 1994 to 1998, over $8 million was spent and Consumers' personnel visited over 13,000 farms to complete this program to make sure our system does not contribute to an on-farm stray voltage condition. The Company continues to spend more than $1 million each year to inspect and maintain Consumers' electric service facilities at livestock locations. The Agricultural Services Department has a specific 800-toll free telephone number for these customers to reach us and a staff of Agricultural Specialists who will respond to their needs regarding stray voltage with appropriate test equipment. Stray voltage inquiries from livestock customers have averaged 150 each year since 1996.
> 40 Tr 4278-4279

Additionally, Consumers produced a bulletin entitled, "*Understanding Neutral-to-Earth and Stray Voltage*," Exhibit R-258 that Consumers and the Agricultural

Engineering Department at Michigan State University wrote specifically for Consumers' agricultural customers. This bulletin, which was copyrighted in 1993, won the National Food and Energy Council's Silver Switch Award as the outstanding agricultural program by an electric utility for 1994. 40 Tr 4278. The bulletin, which was distributed to rural customers, explained many aspects of neutral-to-earth voltage (NEV). The bulletin explained what NEV is, how NEV can effect livestock, the conditions that cause NEV to occur, how stray voltage can be identified on a farm, how NEV conditions can be corrected, and what can be done to prevent NEV.

The ALJ found the bulletin informative, and a valuable tool for farmers with concerns about a stray voltage problem. The ALJ also found that Consumers was addressing the potential problem of stray voltage and attempting to educate rural customers and livestock businesses of the phenomenon of stray voltage. Additionally, Consumers provided a toll free number, 1-800-252-VOLT, for anyone to call that thought that they had a stray voltage problem. The ALJ finds that Consumers was attempting to explain a potential problem and give farmers a means of investigating and fixing the problem. It does not appear that Consumers was being prejudicial or treating agricultural customers in an unreasonable way.

Mr. Schrandt stated neutral separation[16] is one of the methods that Consumers has utilized to mitigate its contribution to stray voltage problems on farms. 40 Tr 4279. Mr. Schrandt further explained that Consumers has modified the grounded electrical system on livestock farms by separating the neutrals for over 10,200 livestock farms. Mr. Schrandt explained the procedure of separating the neutrals and the benefits of the procedure. Mr. Schrandt explained that after the procedure is completed, off-farm

[16] Neutral Separation is also discussed at pages 44-49 of this PFD.

sources of NEV are no longer able to contribute to any on-farm condition that could cause problematic levels of current that could cause animal contact current at problematic levels. The changes made on the many different farms were made in accordance with provision of the NESC. *id*., p 80.

Mr. Schrandt explained that many of the farms where Consumers separated the neutrals, did not actually have a stray voltage problem. However, Consumers separated the neutrals at all the farms under the program for precautionary measures. Mr. Schrandt explained that Consumers took these precautionary measures so that there would not be the possibility of a stray voltage problem in the future, even if there was not stray voltage at the time the neutrals were separated.

Other steps that Consumers took to assist livestock customers was the enlisting of the Michigan Department of Agricultural dairy inspectors, which was done in cooperation with the Michigan Agricultural Electric Council. The dairy inspectors measure NEV at each dairy farm they inspect. 40 Tr 4280. Also, Consumers has provided voltmeters, as well as instruction on their proper use, to farmers to monitor for stray voltage on their own farms. *id*. Also Consumers sent out notices to customers, including a videotape, to advise livestock customers about stray voltage and its mitigation.

Concerning whether Consumers has done more to address stray voltage than any other major utility, Mr. Schrandt was adamant of the fact that there is simply no question that it is true.

> Q (by Brunner) When you were asked some questions about the basis for your statement that Consumers has done more than other utilities to address this subject of

stray voltage, do you recall those questions being asked by counsel for the Attorney General.

A (by Schrandt) Yes.

Q Mr. Schrandt, are you aware of any other large electric utility which has undertaken to separate neutrals at all of its livestock customer locations?

A I'm only aware of two other utilities that have taken this proactive approach, and both of those utilities are relatively small compared to Consumers.

Q Are you aware of any other utility which has provided voltmeters free of charge to its livestock customers?

A No.

Q Are you aware of any other utilities which have conducted seminars for its dairy and livestock customers.

A I know the utilities in Wisconsin have conducted seminars on a variety of topics, including stray voltage, over the years. But within Michigan I'm only aware of what we at Consumers Energy did several years ago by conducting seminars for dairy customers at several locations throughout the state.

Q Are you aware of any other utility which visits the premises of each of its livestock customers once a year to assure that neutral separations are still effective?

A Well. As far as dairy customers, I think Consumers Energy is the only utility I'm aware of that conducts an annual inspection. 41 Tr 4501-4502.

The ALJ finds that Consumers has made substantial steps in attempting to assist rural customers in avoiding an on-farm stray voltage problem. It is fact that Consumers has spent a considerable amount of money in attempting to alert and educate its rural customers of potential stray voltage problems. Consumers has also spent a considerable amount of money in precautionary measures to eliminate potential stray voltage sources, which included separating the neutrals on farms with stray voltage problems, as well as on farms that were not exhibiting stray voltage problems. The ALJ finds that Consumers has done a considerable amount to alleviate stray voltage problems for its rural customers. The attention that Consumers has given its rural

customers is not indicative of unreasonable or prejudicial treatment. Consequently, in terms of what Consumers has done for its rural customers to alleviate any stray voltage problems, the ALJ does not find any indication of unreasonable or prejudicial treatment.

d. Customer Satisfaction Of Consumers' Customers

The ALJ has not found that the AG has proven, beyond a preponderance of the evidence, that Consumers is treating their rural customers in an unreasonably or prejudicially. Furthermore, ALJ finds that the level of customer satisfaction reported by Consumers is congruent with this finding. According to Mr. Schrandt, Consumers' customers[17] rate their energy provider quite high in regards to customer satisfaction. Mr. Schrandt stated that Consumers' customers have consistently rated them as outstanding in customer service. Specifically, Consumers' customers have rated Consumers, on the average, a 9.3 on a scale of 1-10. 40 Tr 4281. This rating is an average for the previous years beginning with 1995.

Additionally, Mr. Thompson provided that he has not investigated many livestock customers in the last several years. Specifically, Mr. Thompson stated that in the last several years "very few complaints or inquiries have been made by or received from Consumers livestock customers." 41 Tr 4589.

The ALJ, for the reasons discussed above, finds that the AG has not proven Count II beyond a preponderance of the evidence. Consequently, the ALJ finds that Consumers is not treating their rural customers in an unreasonable or prejudicial manner.

[17] It should be noted that Consumers has the majority of the farm customers in the state of Michigan. According to Mr. Schrandt, approximately 50% of the dairy farms in Michigan are serviced by Consumers. *id*. at 4282.

VI.

COUNT III - DISALLOWANCE OF COSTS FROM EXISTING ELECTRIC RATES ATTRIBUTABLE TO STRAY VOLTAGE PROBLEMS

The AG seeks a MPSC Order requiring the removal from Consumers' electric rates for the costs of professional and other consultative services related to stray voltage. Consumers could have avoided these costs, according to the AG, if Consumers had upgraded and improved its distribution system. The AG argues that rather than upgrade and update its distribution system Consumers chose to oppose farmers through unnecessary stray voltage research and litigation. The AG sponsored Exhibits C-160 through C-164 which it states represent professional and consultive charges for the years 1997-2001.

Consumers states that the AG offers no proof to show that the costs are unreasonable. There is no evidence that these costs are included in its electric rates or in its test year. Consumers points out that it is a costly endeavor to defend against the cost of stray voltage lawsuits even where the claims lack merit.

Staff argues that this is not the proper forum but rather a rate case is the proper forum to address rate issues and disallowance of costs. Staff argues that in the context of this case, the record has not been adequately developed by the AG to grant the requested disallowances.

The ALJ agrees with Consumers and Staff. There is no evidence to show that the costs incurred were unreasonable. Exhibits C-160 – C-164 only identify the name and address of the person or company providing the service; a description of the service performed; and the amount. There is nothing in the exhibits to show which, if

any, of the costs flow through to Consumers electric rates. Therefore, the ALJ finds that the AG's request to disallow costs from Consumers' electric rates should be denied.

VII.

CONCLUSION

The ALJ finds that the AG's complaint should be dismissed. The ALJ finds that the AG has the burden of proof to show by the preponderance of the evidence the allegations set forth in its complaint including Count II of its complaint. The ALJ finds that the AG has failed to show a stray voltage problem in Consumers' service territory or, that Consumers has violated the NESC or MPSC rules, or negligently operated or maintained its distribution system. The AG has failed to show that Consumers treated its rural customers in an unreasonable or prejudicial manner. The AG has failed to show that Consumers electric rates are unreasonable as a result of the inclusion of

costs attributable to stray voltage research and litigation. Therefore, the ALJ recommends that the Commission dismiss with prejudice the AG's complaint in its entirety.

MICHIGAN PUBLIC SERVICE COMMISSION

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Daniel E. Nickerson, Jr.
Administrative Law Judge

April 17, 2003
Lansing, Michigan
dp

ISSUED AND SERVED: April 22, 2003