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To: Ontario Energy Board Secretary

Re: Farm Stray Voltage Consultation - Board Staff Discussion Paper
Board File No: EB-2007-0709

This following is in response to your request for written comments from interested parties on the OEB "Staff Discussion Paper Pertaining to Farm Stray Voltage in Ontario".

By way of background I respond as a Registered Professional Agrologist and both a Certified Agricultural Consultant and Agricultural Farm Advisor. I have been deeply involved with this whole issue since the earliest days farm stray voltage was known to be impacting livestock producers in Ontario, especially with dairy. Firstly as a Provincial Government Agricultural Representative I was involved in Ontario as an extension agent over several years with R. Lee Montgomery of Dover Centre. All of a sudden in 1975 he began experiencing major dairy production and reproduction issues over which he could not make adjustments based on his vast practical experience and from his ag-business advisors. In the last 10 years as a Certified Agricultural Consultant and a Certified Agricultural Farm Advisor, I have continued to work on developing solutions for Farm Stray Voltage issues on the farm, including assisting M.P.P. Maria Van Bommel in writing her Private Member's Bill "Ground Current Pollution Act" of October 3, 2006 leading to the Directive to the Ontario Energy Board from the Minister of Energy on June 22, 2007. Subsequent to that I have followed the current OEB Consultations on Farm Stray Voltage of which I attended three and also the Provincial one in Toronto. I made a submission to the Board dated January 7, 2008.

A close associate of mine through all the process has been and continues to be R. Lee Montgomery who provides professional and knowledgeable advice based on direct business experience in the dairy industry for 55 years, including being named a Master Breeder by the Holstein Canada in 1971, the youngest ever at the time. He was a leading

dairy producer until he was unfortunately forced out of the business due to FSV some 15 years ago. He has as well followed very carefully the discussions and provided considerable input leading up to the OEB Staff Discussion Paper. He has developed a strong network of connections with veterinarians, professors, government officials, electrical engineers and technicians, researchers and lawyers skilled in stray voltage/ground current terminology and techniques in mitigation.

Another associate is Dr. Jim Morris, Professional Agrologist, and the former Head of the Livestock Division and Coordinator of Research at the Ridgetown College of the University of Guelph for 17 years. He now operates FRAAB Agri-Services. He has extensive experience with transient stray current on livestock farms and consults with farmers and lawyers on animal behaviour, management and nutrition and transient stray currents.

Lynn Girty has been an active member of the Ontario Federation of Agriculture's Electrical Committee and a member of the Electrical Safety Authority's Public Advisory Committee. It was at the farm of Peter Hensel that Minister of Energy Dwight Duncan, in the company of M.P.P. Maria Van Bommel, announced the Minister's Directive to initiate the Ontario Energy Board's Consultation on Farm Stray voltage.

A. The problem as we see it:

Despite all of the work relating to the uncontrolled electricity issue on the farm, it still exists. The research reviews are quite variable on the issue to say the least. The safe limit for **steady state stray voltages** ranges from 0.5V to 10V. The limits for currents indicate a wide variation as well indicating cow sensitivity from less than 1 MA to over 3 MA. Cow resistance varies as well being from 250- 1960 ohms depending on where the measurements are taken. The variation is dependent upon many factors including the way it is measured, the animal resistance, cow contact conditions, dampness on the floor where the current is flowing and what is actually causing the problem. Using the average resistance of 500 ohms to calculate the current affecting the cattle is not appropriate. The individual variation must be put into the equation and address the issue at least the 95 percentile level. Furthermore, not only should 60 Hz electricity be examined but also other frequencies including the harmonics and EMF's must be addressed. Expanding the exploration on the farm should go beyond Steady State stray electricity to encompass the **transient currents (non-steady state) and EMF's**. We are dealing with "electrical pollution" and "dirty power" on the farm. What needs to be done when a suspected uncontrolled electricity problem is suspected on the farm is to perform due diligence and explore all potential issues associated with that farm (See A farm situation outlined below).

B. Poorly trained advisors

It is unfortunate to see the confusion that exists amongst advisors to the farming community. Such confusion only results in delay and inadequate resolutions to the electrical power issues on the farm. This fact is emphasized in a 2002 report by Dr.

John R. Robert, DVM, (Wisconsin Department of Agriculture, Trade and Consumer Protection) and Mark A. Cook (Wisconsin Public Service Commission). In this report, they indicate that confounding the assistance to farmers is the degree to which local professionals (i.e. veterinarians, nutritionists, milk plant field persons or university extension agents) contribute to the misconceptions about stray voltage. They continue to say that when a local farm service professional has an inadequate understanding of the research-based information about stray voltage it can complicate any efforts to resolve the actual animal health concern.

A fall in **resistance to disease (immunosuppression)** accompanies the body's reaction to stress. According to a veterinary report "production and profits usually decrease as well due to a variety of reasons. **Dairy producers need to realize that stress management is part of the foundation of a healthy herd."**

A partial list of the common causes of cattle stress are:

1. Heat
2. Humidity
3. Cold
4. Dampness
5. Poor ventilation
6. Noise
7. **STRAY VOLTAGE**
8. **Electric Shock**
9. Uncomfortable Free-stalls
10. Crowding
11. Dehydration
12. Pain
13. Shipping/Hauling
14. High Production Stress
15. Ration Changes
16. Other Nutritional Disorders
17. Acidosis
18. Castration
19. Dehorning
20. Difficult Births (Dystocia)
21. Surgery
22. Exhaustion
23. Trauma
24. Lack of Rest

It is worthy to note that when production/health issues with animals occurs the advice **usually focuses on causes other than electrical. This must change**. A number of advisors possessing training and experience in different areas need to form a team to quickly and efficiently solve uncontrolled electricity. Even electrical advisors often

are narrow in their approach because they only understand or are experienced in a narrow area of the problem. No one person has all of the answers.

The best way to address an uncontrolled electrical issue is to use a team approach. Here, a more accurate assessment of the problem is likely. Even with the electrical advisors, different personnel with their unique training and experience would likely more effectively and quickly resolve the problem.

C. Research thoroughness

Research Studies have been identified as contributing to the confusion and delay as well. Reference has been made to very widely referred research studies where inadequate cow numbers for the large variances recorded within treatment groups rendered the identification of significant differences impossible. This would render the data as unreliable and conclusions invalid as identified in a report by Behr, (1997) referring to the deficiencies in research associated with stray voltage. In **addition the uncontrolled electricity has changed from steady state stray electricity to transient currents not only at 60 Hz but also including the harmonics (and other frequencies) and EMF's.**

There appears to be **selective filtering of research information** that may lead to misdiagnosing the problem or missing it altogether. There is more recent research conducted by Hillman et al. that needs to be taken seriously. In their papers they identified a relationship between the number of transients impacting on the farm and milk production. For every transient on average per day each cow dropped in daily milk production by 0.0281kg. If an average of 20 transients is present in the barn, one would extrapolate over a year for 100 cows a loss of milk production of 18462 kg. This represents a calculated loss of $10,755 at 60/hectoliter. Of course, there are additional losses due to sickness, mortality and longevity of the cattle as well as the cost of attempting to correct the problem by examining other areas of production and not the electrical element.

In order to effectively use research **we need to keep up-to-date and not get stuck in a rut with research done 10-30 years ago**. Pay attention to Dr. Don Hillman, Dave Stetzer, and Dr. Martin Graham's work in this area.

D. Earth Current Diagram

Figure 4.1 of the Staff Discussion Paper illustrates the electricity current flow in the system. It shows currents emanating from a ground in a misleading fashion. The illustration as shown indicates that the electrons flow in concentric circles about the source. This leaves the impression that these earth currents are both not significant and not harmful. In reality the currents would be quite gagged and spiked about the ground depending on the varying resistances of the earth, wetness of the earth and the ease of flow to other low potential points. To us it is like water flowing out from a source on a sheet of plastic and if a person stepped on to the sheet crating a

depression (low potential) then the flow will be greatly increased to this point. This would be analogous to a low potential ground rod at the barn being stuck with earth currents flowing to it.

E. A Success Story related to an actual stray voltage problem on a dairy farm

It often starts with the farm operating in a normal manner. The cows are productive and all is going well. Then, suddenly it seems, everything deteriorates. That's the way it happened on one farm. Until one day they noticed a case of mastitis during the evening milking. Somatic cell counts had been low – less than 100,000, but now, they began to climb to 340,000, then to 1 million by the end of the month. The vet was called, and several possibilities were reviewed. None of the usual suspects seemed to fit the situation. The farm was participating in a Herd Improvement Program. A systems check was run on the milking equipment and management practices were reviewed. No problems could be identified.

Finally, on a chance suggestion**, the local power utility was called and a request was made for stray voltage testing. That happened nearly six weeks after the initial problems had appeared.** There was a customer-owned cooperative utility which prides itself on its pro-active approach to customers' problems, so the stray voltage specialists appeared on the client farm that same day. Primary neutral current from the utility was found on the farm's secondary system, so a Dairyland Isolator was installed. That reduced voltages that had been detected in the barn. And then, two days later, the farmer reported that production was up 200 lbs/day for their cows. But later that day, a call came back to report that the cows were acting up again. The stray voltage specialist was back on the farm the next day, and changed a circuit in the barn to balance loads on the electrical distribution. The cows started drinking better. Things were up and down for the next ten days, but then more problems appeared. The stray voltage crew was again on the scene and bonded the stanchions to the milk and water lines.

Twenty days after their first visit, the stray voltage team placed their test trailer on the farm and let it record readings from several key points for two full days. The tests showed that the isolator was working and the voltage readings in the barn were low. Then, a feed man stopped by the farm with a megohm meter which measures the insulation on electrical wiring and equipment. The lighting systems and transfer pump checked out ok. Further tests a week later found damaged wiring on a sump pump.

During the next two months the stray voltage crew moved the secondary ground on the isolator 15' away from the primary ground, the stray voltage trailer was brought back for additional testing, and the farm was operated from a generator while system load testing was conducted. They discovered high primary neutral resistance, but verified that the isolator was working correctly to counter the problem. Cow behavior was variable, sometimes good, but then poor for a time. The farmer noticed a correlation between cow difficulties and the wet ground following a storm. It was now fully three months since the farmer had called the utility.

Another dairy farmer, living 80 miles away, was consulted because he had been dealing with electrical problems on his farm over a period of six years, but was now achieving reliably positive results. A meeting took place between the SV crew, the farmer's electrician and the farmer with the experience. This farmer reviewed the test methods that had worked for him, and described the wiring configuration that led to acceptable herd performance in his case. After some discussion a plan of action was formulated. The stray voltage company agreed to install a new 37.5 kVA transformer at the road and run parallel 4/0 quad overhead to a new meter pole near the existing one. They also installed a new 400 amp disconnect and new CT metering. The Dairyland isolator was reinstalled near the new transformer. The Stray Voltage company rep was assisted by the farmer's electrician as he installed a new 4-wire service for the barn. This work was completed and by the end of the month the on-farm rewiring had been completed.

In summary, when all the work was completed, voltage sags under load were greatly reduced, voltages at cow contact points in the barn all but disappeared, the grounding system was cleaned up to include only those points required by code, and ground current on the farm was measured at about 4 MA total. It took corrections and changes by the utility, a rewire of the on-farm distribution, and, most importantly, the cooperation of all parties involved to finally achieve results.

It took the combined respective contributions of a team of individuals with varying experiences and skills to realize what appears to be a winning result. Systems can weather and deteriorate, so periodic testing is required to detect subtle changes before disaster strikes. A simple 'light bulb test' can verify that wiring is correct after servicing or replacing electrical equipment, and tests of the current flowing in the ground rods can indicate that problems may be developing which can lead to rising cow contact voltages. With vigilance, future serious problems can, for the most part, be avoided through continued cooperation between the dairy farmer and the utility.

This is an example of "Due Diligence". This is a good example of **using the team approach.** Although the time seemed lengthy to achieve resolution, with more practice and experience of the "Stray Voltage Team" mitigation should become more effective and efficient. Team Members could include: a variety of electrical engineers and electricians with varying experience in uncontrolled electricity, the OFA electrical committee member, the utility electrical representative, credible animal management specialists, an Animal Scientist working in the field, plus other persons as would be deemed appropriate.

We have to get past the blinders that often arise from a combination of limited research, lack of proper equipment, the lack of experience or an unwillingness to try.

The following are specific responses to the OEB's Discussion Paper detailing "A Farm Stray Voltage Regulatory Framework: Issues and Options":

- The eventual delivery of a new **Regulatory Framework** must involve collaboratively organizations such as the OEB, the Electrical Safety Authority (ESA), both the Ministries of Energy and Agriculture, Food and Rural Affairs, Hydro One and the Local Distribution Companies (LDC'S) in Ontario, the General Farm Organizations (GFO'S) in the Province and the livestock producer groups, especially Dairy Farmers of Ontario (DFO).

- The **threshold level**, (distributor remediation target) that distributors be responsible for must not be in excess of 1mA (or O.5 V) at 60 Hz steady state. This limit should be reviewed within the Regulation as more details assessment is received on the impact of non-steady state transients and harmonics which as well are known to impact livestock based on peer reviewed scientific research. It is agreed the primary Neutral to Earth Voltage (NEV) measured on the farm and the distributor contribution to Animal Contact Current (ACC)/ Animal Contact Voltage (ACV) be the key criteria to follow.

- The Board should take a **proactive approach** by establishing detailed requirements to be followed by distributors to ensure a consistent approach across all LDC jurisdictions in the Province.

- The statement "that most with dairy cows are not affected by exposure to animal contact current/voltage below 2 MA (or 1 V equivalent when measured using a 500 OHM shunt resistor) needs to be re-evaluated and reassessed using a **wider window of expert opinion**. This level has been in place in other jurisdictions - in some cases 20 years (Wisconsin) - and should reflect the additional scientific research in recent years.

- **FSV Regulations** should apply to all classes of livestock, with the lowest numerical thresholds applying to dairy and beef cattle.

- **Comprehensive investigation procedures** must be carried out by properly trained technicians with the cost covered by the distributor.

- It is agreed the **distributor remediation target indicators** be a combination (sum of) primary NEV and the contribution of the distribution system to ACC/ ACV on the farm.

- Again it is agreed the **action threshold values** be no greater that 2.0 V at the primary/secondary connection point on the farm as well as 1mA ACC or 0.5 V ACV being the distributor's contribution to stray voltage/current. As pointed out previously this is based on steady state 60Hz and again pointing out the need for further study on non-steady state impacts.

- It is strongly agreed that **stray voltage investigation protocols and procedures** should ensure that:
    - The cost of investigation is transparent and consistent regardless of who performs the investigation or where it is carried out.
    - The results of the investigations indicate clearly whether OEB regulatory requirements are met.
    - All investigations be carried out with consistent thoroughness and accuracy.
    - Re-testing permits initial results to be verified and confirm that the remedial actions have achieved the desired results.

- **Investigation procedures** by distributors need to be embedded in Regulations and not left to the distributor to develop their own procedures.

- **Sources of stray voltage** must be determined by testing, both on the distributor side and on-farm, with the distributor responsible for the cost of that investigation. Any repairs/adjustments and equipment needed on the on-farm side to be covered by the farmer.

- Strongly agree that all distributors use **specific Board-approved procedures** that ensure:

    - same procedure to all investigations
    - .consistency of customer treatment
    - predictable costs
    - ease of comparisons across different tests
    - repeatability

- Collaboration amongst distributors in itself is good but **standardization must be embedded in a Board Regulation.**

- **Investigation procedures** should identify whether stray voltage is present and measure contribution from the distribution system. The testing for on-farm sources of stray voltage needs to also be included in those procedures with all possible sources then resolved together. The costs of these investigations need indeed to be covered by the distributor and then recovered through overall customer rates, not back to the individual complainant.

- **Training** need to ensure persons have the expertise to take measurements, analyse them properly and then select the appropriate remediation measure(s). The Electrical Safety Authority (ESA) should take the lead to ensure persons have the certification required to maintain consistency across jurisdictions. The ESA and the Ontario Ministry of Energy could well contract with the Ridgetown Campus of the University of Guelph where there are already dairy cattle and hog production units, for hands-on instruction to develop Qualified (Testing) Professionals (QP's) for Farm Stray Voltage. Staff at this Campus already

contract with OMAFRA and the Ministry of the Environment (MOE) for the delivery of the Ontario Pesticide Training and Certification Program. They deliver on the Ontario Grower Pesticide Safety Certificate for farmers, the Ontario Agriculture Grower Pesticide Trained Assistant Certificate, the Ontario Licensed Exterminator Certificate and the Ontario Exterminator Technician Certificate. These above programs are overseen by OMAFRA and MOE.. Future QP'S could include electrical engineers, electricians and electrical technicians for FSV. Costs of this training would be recovered through rates.

- **Minimum training standards** need to be established, not just recommended. This would ensure testing and recommendation are carried out competently, cost effectively and with consistency.

- **A customer response procedure** must be regulated and then followed by distributors when dealing with FSV requests. It is agreed this process would include:

    - Setting out how customers should go about requesting a distributor's attention to a problem.
    - Indicating target timelines for key activities which would include:
        - Acknowledging the request-
        - Arranging for an information meeting
        - Dispatching personnel to the farm
        - Communicating results back to the farmer
        - Initiation of the remediation
        - Ensuring there is a documental paper trail that can be used by either party for future reference.

- A **FSV Ombudsman Office**, or certainly a **formal appeal process**, needs to be available for farmers unsatisfied with a distributor's response to a complaint. This would enhance the mitigation process and minimize the likelihood of lawsuits.

- Distributors must be required to determine the **safest, most cost effective remedy**, **(remedies) to a given FSV case**. It is agreed these can include following a primary NEV standard by considering:

    - Repairing defective splices,
    - Load balancing on a 3-phase line
    - Adding ground rods
    - Installing a solid- state primary (secondary) neutral isolator
    - System upgrades such as increasing circuit voltage or replacing single phase with 3- phase lines to reduce primary NEV and hence FSV
    - Installing a 5-wire system.

  The prime objective is to keep the maximum amount of current on the line where it belongs and a minimum amount directed to the ground where the problems can

begin quickly. **The Regulator must ensure the greater public interest, especially in rural Ontario, where the infrastructure is aging and jeopardizing the quality of the rural hydro distribution system.**

- It is agreed that distributors with livestock customers be required to provide **access to information on FSV** and the customer response and dispute resolution procedure. Farmers are generally well schooled in the basics of electricity and certainly if related basic and more detailed information is provided they will respond if a response mechanism is known. Then they certainly will be better equipped with background information and cooperate to get an efficient, effective and timely mitigation process in place. Organizations in the Province to facilitate this to happen would be OMAFRA, the Ontario Federation of Agriculture, the Dairy Farmers of Ontario, the Ontario Cattlemen's Association, the Ontario Pork Producers, the Ontario Egg Producers, the Ontario Sheep Producers, etc.

- It is agreed the estimated 15-20 Ontario farmers who report suspected FSV issues to their distributor **should be viewed with real caution and even suspicion.** It is strongly suspected many farmers with possible stray voltage problems do not report their concerns to their distributor as there is a strong sense of cynicism that nothing or little would be done to correct their problems. They do not want to run the chance of being reminded by the distributor that "it must your management"!

- The OEB needs to facilitate a much clearer assessment of the **true incidence and impacts of FSV in Ontario**. The last time a survey was done in the Province was in 1983 by the then Ontario Ministry of Agriculture and Food entitled "Field Survey of Neural to Earth Voltage on Ontario Dairy Farms". That was 25 years ago! The OEB through the Ontario Federation of Agriculture and the Dairy Farmers of Ontario needs to take a solid reality check via a new **"Dairy Survey of Milk Yield, Reproduction, Herd Health, Herd Environmental Impacts of Farm Stray Voltage".** This would allow the industry to deal with real **case**s and sort out fact from 'fiction/heresy/rumour and suspicion'.

Our team as noted below would be pleased to respond to the many points made in this submission.

Yours truly,

(Original signed)

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