Electrical Safety Authority

Electrical Distribution Safety

VIA E-MAIL

July 11, 2008

To: Kirsten Walli
Board Secretary

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

Please accept the attached comments by the Electrical Safety Authority (ESA) in response to the invitation in the OEB cover letter of May 30, 2007. The ESA welcomes the opportunity to provide comments to the Ontario Energy Board regarding the Staff Discussion Paper on Farm Stray Voltage.

The ESA supports the Farm Stray Voltage consultation undertaken by the OEB and commends the OEB staff for producing a thorough and clear Discussion Paper which provides a basis for exploring options within a regulatory framework model.

Should further clarification by required, please contact me.

Yours truly,

Jenifer Robertson
General Manager
Utility Regulations

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Electrical Distribution Safety

Farm Stray Voltage

Electrical Safety Authority Comments
On the OEB
Staff Discussion Paper
EB-2007-0709

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ESA as an Electrical Safety Regulator

The Electrical Safety Authority (ESA) is a stand alone, financially self-sustaining not-for-profit corporation delegated by the Ministry of Government and Consumer Services (MGCS) under the *Safety and Consumer Statutes Administration Act, 1996 (SCSAA)* to administer and enforce Part VIII of the *Electricity Act, 1998* and regulations under that Part. The SCSAA and an Administrative Agreement with MGCS establish the legal framework for ESA's operation as a Delegated Administrative Authority (DAA).

ESA is the DAA responsible for a number of Ontario Regulations made under the *Electricity Act*, including the Ontario Electrical Safety Code (OESC), the Electrical Distribution Safety regulation, the Electrical Contractor and Master Electrician Licensing regulation and the Product Safety regulation. ESA's scope of responsibility includes, among other things, electrical wiring in and around buildings, privately owned distribution electric systems, electric utilities distribution systems, contractor licensing, and electrical products used in Ontario.

In 2004 Ontario Regulation 22/04 - *Electrical Distribution Safety* was established as an objective based electrical safety regulation for distribution systems owned by licensed distributors. ESA's overall mandate with respect to licensed distributors is to reduce the risk of electrical contact injuries & fatalities and improve the overall safety of Ontario's electrical distribution infrastructure.

ESA's Experience with stray voltage

Currently ESA addresses stray voltage concerns from the public in both the urban and rural settings. In addressing these concerns, ESA has found that, in many cases, stray voltage can be a symptom of a more serious safety issue either;

- on the customer side of the demarcation point due to installations not meeting the Ontario Electrical Safety Code (OESC) or,
- on the electric utility distribution system as a result of poor neutral connections, tracking or poor grounding.

Farm Stray Voltage – role of ESA

The farm stray voltage issue straddles both the Ontario Energy Board (OEB) jurisdiction with respect to quality of service and the ESA jurisdiction with respect to compliance with safety technical standards and exposure to safety hazards by persons.

ESA has an interest in the management of farm stray voltage from a public safety perspective given that ESA has regulatory oversight for both the safety of the distribution system and the safety of on farm installations. As a result, ESA is in a unique position to provide valuable

technical insight regarding the management of this issue. ESA would be very interested in assuming a role in the regulatory framework outlined in the OEB Staff Discussion Paper to ensure electrical safety concerns are addressed. Irrespective of the type of regulatory approach pursued, any option must address potential safety concerns and must ensure compliance with electrical safety. By integrating OEB and ESA regulatory oversight within the proposed OEB regulatory framework model, a seamless regulatory oversight can provide assurance to farm operations and licensed distributors that efficient and effective solutions are implemented to address farm stray voltage and ensure electrical safety continues to be addressed.

Depending on the evolution within the OEB regulatory framework, ESA can develop regulatory oversight to:

- Enshrine or certify standardized investigation procedures that align with OEB investigation objectives.
- Coordinate mandatory training/certification requirements to conduct investigations or perform data analysis
- Review distributor filings or on farm consultant filings to assess compliance with investigation procedures, remediation choice and post remediation results
- Specify remediation options and restrictions
- Act as a Technical Dispute adjudicator or establish a regime for a technical appeal process.

The ESA, in developing any appropriate oversight, would consult stakeholders in a number of different forums. The ESA has a history of following a transparent consultative process with stakeholder input when exploring new regulatory regimes, in consultation with the MGCS.

Once the OEB has made decisions and set timeframes to create regulatory rules, the ESA can work within these timeframes quickly by issuing Director's Orders establishing new regulatory requirements in the short term until appropriate regulation progresses through consultation, drafting and government approval.

Specific comments on issues raised in the Discussion Paper are summarized below.

DISTRIBUTOR REMEDIATION ACTION TARGET INDICATOR & THRESHOLD

Section 9.2.3 Issues – Issue 1:
Where ACC / ACV is found to be above 2mA / 1V, what electricity service quality indicator should serve as the trigger for distributor action?

ESA recommends that Distributors or others appointed by ESA base their actions, to address a given stray voltage situation, on the contribution of the distribution system to measured stray voltage at the animal. The initial trigger for action is based on an actual farm complaint.

This addresses the actual animal contact point versus the distributor's NEV. Addressing the animal contact point of reference is the better measurement to trigger action. It has been demonstrated in the United States that it is an appropriate target.

The distributor's NEV, as noted in the Discussion Paper, has an inconsistent relationship between animal contact stray voltage and the distributor's primary NEV and therefore this option should not be adopted. Using the NEV as the trigger could lead to actions by the distributor or others that do not appropriately address the stray voltage contribution of the distributor to the animal and could lead to unresolved stray voltage concerns and numerous disputes between the farm operator and the distributor.

Section 9.2.3 Issues – Issue 2:
What should the numerical threshold value be?

ESA recommends a third option that would be more efficient and effective in addressing the stray voltage issue.

ESA recommends that two thresholds be adopted. The first threshold or phase one would require relatively simple tests with a limited number of procedural steps to obtain sufficient information to identify if further action is required by the distributor. This threshold value would be the total ACV of 1.0V or 2mA ACC. This value would confirm whether or not stray voltage is an issue. If the total ACV is less than 1.0V or if the total ACC is less than 2 mA then no further action would be required by the distributor.

If the total ACV is greater than 1.0V then, a phase two threshold value of 0.5V ACV or 1mA ACC of distributor's contribution to the stray voltage could be the secondary trigger (the action threshold) resulting in further action by distributor. This is the same threshold as noted in option b).

Implementing Option b) (without a phased threshold approach) as noted in the Discussion Paper forces additional testing by the Distributor or others, perhaps unnecessarily, to

determine their contribution level leading, in some cases, to the same conclusion as a relatively quick and simple test - that stray voltage is not the cause of the on farm concern. This testing would result in an unnecessary delayed response to the farm operator.

Option a) addresses NEV which, as mentioned above, provides an inconsistent relationship with animal contact stray voltage and leads to less definitive results.

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Section 9.2.3 Issues – Issue 3:
Should cow-based thresholds be applicable to all types of livestock farms?

ESA recommends option b) be adopted. By applying the numerical threshold to dairy and cattle farms only- and adopting alternative thresholds where other livestock species are involved -will best serve both the farm operation and the distributor.

To address non- dairy and cattle farms, the same procedural steps and engineering methods identifying sources of stray voltage can be applied. However, specific stray voltage thresholds should be based on the individual animal from the best scientific evidence available. Basing all farms around one set of thresholds will cause unnecessary actions to be performed, without benefit.

INVESTIGATION PROCEDURE

Section 9.3.3 Issues – Issue 4:
Should details of the investigation procedure be prescribed?

A third option can be explored that is a variation of option b). The ESA recommends that investigators be required to use prescribed procedures certified by the ESA. This approach will minimize disputes between the farm operation and the Distributor.

ESA recommends prescribed procedures to be adopted, that aligned with the OEB objectives documented in the Discussion Paper. ESA can develop and maintain technical documents to address both on-farm and off-farm sources of stray voltage.

Prescribed procedures would ensure a consistent approach to farm stray voltage investigation regardless of the geographic location of the farm operation. In addition, the sharing of investigative procedures with other provinces and states set the stage for national or North American standards and best practices.

By only outlining the goals and objectives of the procedure, as outlined in option a), there will be significant inconsistencies across the province with respect to the data acquired from

an investigation due to equipment or methodologies. The development of individual distributor investigation methods would be onerous particularly if the distributor services only a few farms that have not had farm stray voltage issues for years.

Both farm operations and distributor's are best served with standard investigative procedures.

Part VIII of the *Electricity Act*, 1998 provides a mechanism for ESA to develop specifications for the inspecting and testing of electrical distribution systems and to appoint persons, associations or organizations who have special knowledge or facilities to inspect, test and report on any works or matters or things referred to in the Act, including distribution systems.

Section 9.3.3 Issues – Issue 5:
Should distributors be responsible for identifying on-farm stray voltage sources?
On-farm sources fall within the scope of the Ontario Electrical Safety Code (OESC). On-farm source investigation work needs to be performed by persons or organizations appointed by ESA. In many cases, without testing or an investigation, an ESA inspector can identify a defect or hazards that, once corrected by a licensed electrical contractor, will reduce the on-farm source to an acceptable level without any further action required by the Distributor. Because of these types of scenarios the ESA recommends that Distributors be responsible for the contribution from distribution system, if one of the threshold valued are exceeded.

It is important to note that on-farm source investigation could be conducted at the same time as the distribution system contribution investigation for the quickest resolution.

Section 9.4.3 Issues – Issue 6 and 7:
Should stray voltage investigators be specifically trained?
Should minimum training standards be specified?

ESA suggested Option **c)**:

1. Investigators should undergo established minimum specialized training.
2. Field staff performing test procedures under the supervision of the Investigator would not require minimum training.

The Investigator should have sufficient training to determine quality of the data from the field, direct field staff and analyze the data. The training could be offered by ESA on farm stray voltage and testing procedures. Field staff would not require specific training to perform the test procedures as the ESA believes there may be an insufficient number of investigations to warrant specialized training for them.

Section 9.4.3 Issues – Issue 8:
Should investigators be certified?

The ESA comments are similar to the above response.
ESA suggested Option **c)**:

1. Investigators require certification, which is tied in with the training.
2. Recommend that stray voltage field staff be certified, but not required.

The Investigator should have sufficient training to determine quality of the data from the field, direct field staff and analyze data. Through ESA training on stray voltage an Investigator could obtain certification. ESA believes training for field staff and recording of that training is a benefit, however field staff may receive an insufficient number of investigations to warrant certification.

Part VIII of the *Electricity Act*, 1998 provides a mechanism for the creation of this certification requirement and associated training through regulation.

Section 9.5.3 Issues – Issue 9:
Should a special farm stray voltage customer response procedure be used?
Consistency across the province is beneficial however some situations such as very cold weather can hamper progress in identifying the source and resolving the stray voltage concern. Because of this there may need to be some specialized response that may deviate from the existing generic customer response requirement.

Section 9.6.3 Issues – Issue 10:
What should distributors be required to do regarding farm stray voltage record-keeping and information gathering?

ESA recommends Option **a)** be adopted. Specifying the types of information Distributors, or others must keep on file regarding farm customer stray voltage requests, investigations, remediation efforts and outcomes is the best approach.

The ESA can act as a repository for this technical information assuming the OEB would be most interested in feedback on the quality of service and any performance indicators. This approach would allow technical analysis to identify issues, enhance the farm stray voltage process and ultimately to make progress in reducing incidence of stray voltage concern.

Benchmarking Ontario's technical information with external jurisdictions could lead to changes in procedures, remediation choices or any other initiatives that would reduce the incidents of stray voltage concern. It can also lead to proposals to improve the Canadian

standards that affect the design and construction of distribution systems and wiring and equipment on the farm side of the demarcation point. ESA through its extensive involvement at the national level in the development of electrical codes and standards is well positioned to identify and move forward relevant standards changes.

ESA currently receives annual filings from Distributors as required through Ontario Regulation 22/04 and has the ability to obtain filings with regards to farm stray voltage investigations or have them available on request. The ESA can also document on-farm source incidence. This combined farm stray voltage provincial status can then be shared with the OEB, farm operators and Distributors.

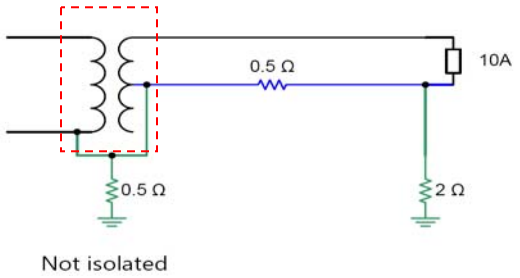
Section 9.6.3 Issues – Issue 11:
Should distributor discretion over the choice of remediation method be subject to restrictions?

The ESA recommends Option **b)** be adopted. ESA believes that stipulating restrictions on the use of certain remedies and the conditions under which they may be employed is in the best interests of all parties involved. Stipulations regarding remedies should drive root cause analysis of the situation. Potential hazards should be discovered and removed from the system. The stipulations could allow for rebuilding in the future, temporary relief while root cause analysis is being performed, etc… It should be recognized that mitigation devices such as the "Hammond Filter" may be appropriate for long term use by the customer.

It is important to note that the installation of some devices may shift voltage levels on the system creating issues in new areas, or worse, can mask safety issues such as a farmer's secondary neutral hazard. Sometimes treating the symptom masks a more important underlying issue that still presents a hazard.

Example of an inappropriate remediation choice masking a safety hazard:

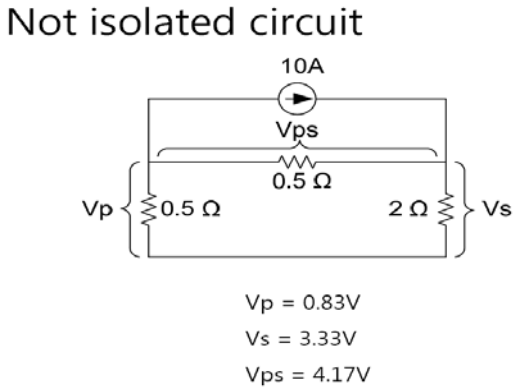
Picture #1: Shows an example of a farm system which could exist. This farm is modeled with a high resistance value on a secondary neutral, due to a loose connection in a barn (shown in blue). The loose connection could lead to excessive heating which in turn could lead to a fire, particularly in a barn environment with highly combustible material.



Picture #1

- Distribution transformer (shown in red box).
- Total distribution system resistance of 0.5 ohms (parallel paths on adjacent poles).
- The farm's secondary neutral is 0.5 ohms (shown in blue).
- The measurement from the farm's panel ground to remote earth is 2 ohms.

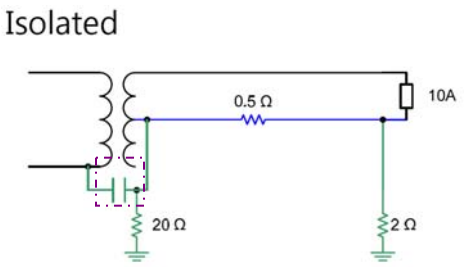
Picture #2: Shows a schematic view of the same farm system (from Picture #1) with a 10A current that will return to the distribution transformer (source). Voltages measured under this scenario are shown below (Vp, Vs, Vps). We can see there is a significant voltage between the farm's panel ground to remote earth (Vs=3.33V). The value of the ACV is a reflection of Vs and under this scenario the farmer may be experiencing issues with stray voltage on the farm (exceeding 1.0V).



Picture #2

- Vp represents the voltage at the transformer pole's ground wire to remote earth
- Vs represents the voltage at the farm's service panel's ground wire to remote earth
- Vps represents the voltage drop of the farm's secondary neutral between the farm's service panel and the transformer pole

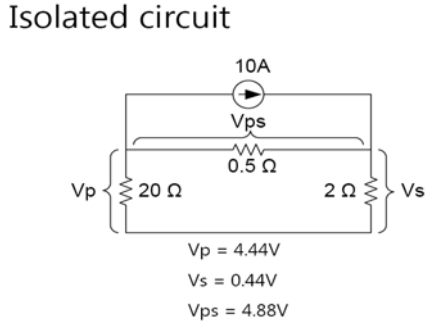
Picture #3: Shows the same farm system, as Picture #1, however this time with an isolator installed. Since the parallel ground rods on the distribution system are now isolated the resistance at the transformer pole increases to 20 ohms. We still have the same issue with the loose connection and the only change is with the neutral isolator installed.



Picture #3

- Isolator (shown in purple box)

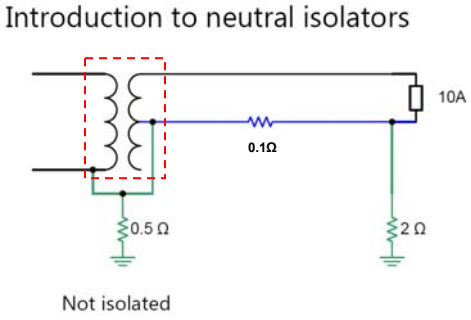
Picture #4: Shows a schematic view of the same farm system (from Picture #3) with a 10A current that will return to the distribution transformer (source) and isolator. Voltages measured under this scenario are shown below (Vp, Vs, Vps). When we compare the values (Vp, Vs, Vps) with isolation and no isolation, we can see there is a significant reduction in the value of Vs (3.33V down to 0.44V). Noting that the value of the ACV is a reflection of Vs we have resolved the farmer's stray voltage concern as the ACV is now be under 1.0V.
The safety issue of the loose connection on the farmer's secondary neutral however still exists. By using the isolator we have masked the underlying a safety issue, but have not eliminated it.



Picture #4

- Vp represents the voltage at the transformer pole's ground wire to remote earth
- Vs represents the voltage at the farm's service panel's ground wire to remote earth
- Vps represents the voltage drop of the farm's secondary neutral between the farm's service panel and the transformer pole

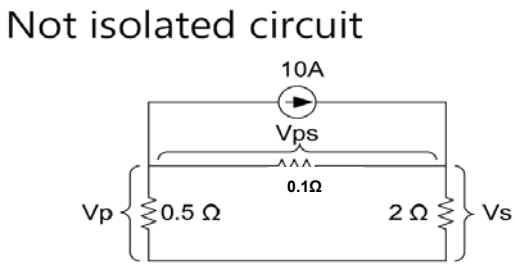
Picture #5: Shows an example of a farm system where we address the loose connection on the farm. In this scenario we don't use an isolator.



Picture #5

- Distribution transformer (shown in red box).
- Total distribution system resistance of 0.5 ohms (parallel paths on adjacent poles).
- The farm's secondary neutral is 0.1 ohms (shown in blue).
- The measurement from the farm's panel ground to remote earth is 2 ohms.

Picture #6: Shows a schematic view of the same farm system (from Picture #5) with a 10A current that will return to the distribution transformer (source). Voltages measured under this scenario are shown below (Vp, Vs, Vps). We can see there is a significant decrease in voltage between the farm's panel ground to remote earth (Vs=0.77V). By fixing the loose connection the hazard is removed and the ACV has been reduced to 0.77V without a device.



Vp = 0.19V
Vs = 0.77V
Vps = 0.96V

Picture #6

- Vp represents the voltage at the transformer pole's ground wire to remote earth
- Vs represents the voltage at the farm's service panel's ground wire to remote earth
- Vps represents the voltage drop of the farm's secondary neutral between the farm's service panel and the transformer pole

Section 9.7.3 Issues – Issue 12:
What are the distributors' responsibilities to farm customers in terms of providing information?

ESA suggests Option **a)** be adopted. Engaging the farm community and informing them of what action to take in the event of farm stray voltage concern and describing the process will lessen disputes, and resolve issues quickly. Distributor's, with livestock farm customers, should provide farm customers with information on farm stray voltage and customer response and dispute resolution procedures.

ADDITIONAL ISSUES
The ESA offers additional discussion on the following:
Issue A:
Should there be an independent third party dispute resolution body?

In the event the farmer and the Distributor cannot resolve a technical issue through the dispute resolution process ESA can act as an independent technical adjudicator. If ESA staff are involved in the investigation and thus could not act independently other options could be explored such as an independent technical appeal that could be fleshed out through a consultation process. The province has already established a specific Appeals Regulation related to the Ontario Electrical Safety Code and electrical distribution safety that could be adapted to address these types of technical disputes.
Issue B:
Should there be requirements around post-investigation data sharing with the farmers?

ESA believes in full disclosure of information with the farming community and believes the results of Distributor testing should be available to the farmer within a specified time period.

Issue C:
Should there be annual or bi-annual reporting of the farm stray voltage issue in the province?

Once the regulatory framework is in place and sufficient stray voltage concerns have been identified and resolved, an overall assessment of the regulatory framework, the processes and the resulting data should be undertaken.

This type of feedback to the stakeholder should be available that can answer the question- Is the regulatory framework (and the associated processes) and results addressing the Directive issued by the Ministry of Energy? The ESA would be prepared to provide the assessment based on the scope of the ESA regulatory involvement.