



**Ontario Energy Board**  
Commission de l'énergie de l'Ontario

## Farm Stray Voltage Consultation

EB 2007-0709

STAKEHOLDER CONSULTATION CONFERENCE

WEDNESDAY DECEMBER 5, 2007

Doubletree International Plaza Hotel  
Toronto Ontario

**WELCOME**



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## INTRODUCTIONS

- The OEB's *Farm Stray Voltage Consultation Team*
  - Marika Hare, Managing Director – Regulatory Policy Development
  - Takis Plagiannakos, Manager, Energy Infrastructure Policy
  - Stephen Cain, Policy Advisor & Consultation Manager
  - Gordon Ryckman, Senior Advisor
  - George Dimitropoulos, Research Assistant
- The OEB's *Farm Stray Voltage Consultative Group*:

Mike Bell	Hydro One Networks
Steve Clarke	Ontario Ministry of Agriculture & Rural Affairs
Jason Hrycyshyn	Electrical Safety Authority
Kevin Mackenzie	Electricity Distributors Association
Don McCabe	Ontario Federation of Agriculture
John Savage	Ontario Ministry of Energy
Erik Veneman	Waterloo North Hydro/Chair ESA UAC FSV Working Group



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## THE PURPOSE OF OUR MEETING TODAY

- To address the *Minister's Directive* to the Board, the FARM STRAY VOLTAGE CONSULTATION was set in motion
- Information is being collected from a number of sources
- The information will be used by Board staff to prepare a Discussion Paper about how best to address the *Directive*
- The purposes of this meeting are to provide:
  - An update on Consultation information gathering activities
  - An opportunity to learn about the preliminary findings of experts looking into specific subjects related to stray voltage; and
  - An outline of the next steps in the Consultation process



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## SCHEDULE FOR THE DAY

- 9:40 – 10:30 a.m. The Consultation Process to Date
- 10:30 – 10:45 a.m. Summary of Comments from meetings with Farmers
- 10:45 – 11:00 p.m. Health Break
- 11:00 – 12:00 p.m. Literature Review and Synthesis of Research Findings on the Impact of Stray Voltage on Farm Operations - Preliminary Findings
- 12:00 – 1:00 p.m. Buffet Lunch
- 1:00 – 2:00 p.m. Regulatory Approaches to Addressing the Impact of Stray Voltage on Farm Operations – Preliminary Findings
- 2:00 – 3:00 p.m. Question & Answer Session on Both Presentations
- 3:00 – 3:15 p.m. Health Break
- 3:15 – 4:15 p.m. Next steps in the Consultation process
- 4:15 p.m. Meeting adjourned

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## Farm Stray Voltage Consultation

CONSULTATION PROCESS & ACTIVITIES

STEPHEN CAIN – FARM STRAY VOLTAGE CONSULTATION MANAGER

## THE BOARD'S FARM STRAY VOLTAGE CONSULTATION ACTIVITIES

- Discussion Paper – research topics to be addressed
- Consultative Group – role & contributions
- Farmer consultation meetings – summary



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## DISCUSSION PAPER TOPICS

- What is “stray voltage”?
  - ‘Tingle voltage’, ‘stray voltage’, ‘ground current’ and ‘earth current’ are often used interchangeably but can refer to different things

*Stray voltage is a small voltage (less than 10 V) measured between two points that can be contacted simultaneously by an animal.*

USDA - Agriculture Handbook 696; p. 7-3



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## DISCUSSION PAPER TOPICS

- How does stray voltage affect farm operations?

*...stray voltage problems alter animal behaviour and may influence milking characteristics and/or affect production performance.*

OMAFRA - Stray Voltage Problems in Livestock Production

- If animals experience tingle voltage when milking, drinking, entering and leaving a barn or stabling, they can become stressed and avoid these areas
- Farm output and productivity can be adversely affected
  - Reduced milk production
  - Weight loss
  - Lower reproductive success

## DISCUSSION PAPER TOPICS

- What are the potential off-farm and on-farm sources of stray voltage?
  - Multi-grounded neutral conductors used for both distribution utility and farm wiring systems for safety purposes
  - On the farm or on a neighbour's property:
    - Improperly grounded equipment (e.g. water or manure pumps)
    - Improperly installed electric fence chargers and electrical panels
    - Faults from poorly maintained electrical equipment
    - Faults related to telephone, cable TV and gas lines

## DISCUSSION PAPER TOPICS

- What can be done to reduce stray voltage?
  - Adding groundings and inspecting/maintaining groundings
  - Proper sizing of neutral conductors
  - Balancing loads on multi-wire utility and farm building feeders
  - Electrically isolating the utility and farm neutrals at the transformer
  - Maintaining wiring to minimize impact of corrosion or damage
  - Connecting farm equipment grounds directly to the supply source instead of the farm neutral

## FARM STRAY VOLTAGE CONSULTATIVE GROUP Contribution Summary

- Role of the CG is to communicate information about the Consultation process and activities to their stakeholders/agencies and to share their experience with other CG members
- Obtained information from members/stakeholder experience
- Assisted in identifying areas where the Board might require expert assistance to prepare and analyze information
- Helped to schedule, organize, arrange and publicize six Farmer Consultation Meetings across Ontario
- Helped to answer farmer's questions ranging from specific concerns to explaining aspects of the Ontario Electrical Safety Code

## FARM STRAY VOLTAGE CONSULTATIVE GROUP

### Farm stray voltage in Ontario – history

- Late 1970s: farmers first report problems to Ontario Hydro
- Early-mid 1980s: hundreds of farmer complaints each year
- 1982: *Stray Voltage Problems with Dairy Cows* published by Min. of Agriculture
  - symptoms, causes, inspection procedures & mitigation measures
- 1984: Min. of Agriculture does random survey of Ontario dairy farms
  - Measures utility neutral to earth and animal contact voltage levels
- 1980-85: Ontario Hydro
  - developed 'tingle voltage filter': protects farm ground wire systems from voltage 'spikes' on the utility neutral – about 3,000 installed
  - prepared Manuals for utility staff and electrical contractors for measuring and dealing with tingle voltage
- Late 1980s–1990s: number of farmer complaints declined



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## FARM STRAY VOLTAGE CONSULTATIVE GROUP

### Farm stray voltage in Ontario – recent experience

- In recent years about 15 to 20 farmer complaints are received per year
- 21 Ontario distribution utilities report having farm customers
- Six report having had experience over the years dealing with farmer questions or complaints about stray voltage
- Complaints are concentrated in regions with high numbers of dairy and livestock farms

Electricity Distributors Association Poll of 84 Members



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## FARM STRAY VOLTAGE CONSULTATIVE GROUP Farmer Consultation Meetings



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## FARMER CONSULTATION MEETINGS Format

- Informal (no transcript)
- 2 hours planned (3 to 4 hours actual)
- Consultative Group representatives present (as available)
- Staff presentation: Consultation purpose, scope, activities & deliverable
- Q & A
- Open forum (opinions, experiences, etc.)

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## FARMER CONSULTATION MEETINGS

### Categories of Topics Raised

1. Farmer experiences past & present
2. Technical issues
3. Utility responses to farmer complaints
4. Experience with Mitigation
5. Government Agency Roles
6. Compensation for Losses
7. Farmers' Suggestions



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## 1. FARMER EXPERIENCES PAST AND PRESENT

- Past experience with stray voltage issues and impact:
  - Production loss, livestock illness, livestock loss
  - Increased farm operating costs, reduced farm income
- Present concern that stray voltage is responsible for animal behaviour and health problems
  - Refusing to enter areas like milking parlours, or go near metal fences or stalls; altered drinking and resting habits
  - Slow/low milk production, high mastitis, anaemia, weight loss, curbed breeding, calving problems, newborn calves won't suck, dry hides



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## 1. FARMER EXPERIENCES PAST AND PRESENT

- Suspected off-farm stray voltage sources
  - Utility lines or nearby substations
  - Neighbouring industrial facilities; wind farms
- Identified on-farm stray voltage sources
  - Sentinel light, well casing, automated equipment



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## 2. TECHNICAL ISSUES

- The relationship between current from the utility neutral and voltage measured on water cups, stalls, etc.
  - Some farmers expressed that 10 V utility neutral to earth voltage is too high
- The relationship between voltage measured in animal contact areas and effects on animals
  - Some farmers expressed that 1 V animal contact voltage is too high
- Ontario electrical safety code standards for grounding on-farm equipment and structures
  - Some farmers questioned whether where alternative grounding techniques are allowed, some might produce better results than others



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### 3. UTILITY RESPONSES TO FARMER COMPLAINTS

- Some farmers reported that utility investigators seemed unfamiliar with stray voltage and how to investigate it
- Some farmers reported that they developed a productive relationship with utility personnel
- Some farmers reported that utility investigation results were not communicated to them
- If initial tests showed that the utility neutral to earth standard was met, some farmers felt they had no recourse to additional assistance



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### 4. EXPERIENCE WITH MITIGATION

- Concern with respect to ground rods
  - Number, placement, effectiveness relative to grounding plates
- Filters and isolators
  - Hammond filter, Dairyland filter, Ronk Blocker, Agri-Volt System
- Concern that filters & isolators only reduce utility sources and are not always effective all the time
- Equipotential planes
  - are expensive to retrofit into existing barn floors
  - not always effective at eliminating all sources
- Farmers served by lines that have been upgraded seem to have fewer problems
  - Increasing number of ground rods on utility line can help but not always eliminate the problem
- Recognize that each farmer's situation might require a combination of measures



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## 5. ROLES OF GOVERNMENT AGENCIES

- Roles and authority of the Board, Electrical Safety Authority and utility in inspections, implementing solutions and ensuring regulatory compliance



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## 6. COMPENSATION FOR LOSSES

- Farmers feel that consideration should be given to providing compensation for losses related to stray voltage



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## 7. FARMERS' SUGGESTIONS

- Information should be available to farmers
  - on recognizing and addressing stray voltage
  - on the proper procedure to follow when stray voltage is suspected
  - on how to claim compensation for losses due to stray voltage
- Investigations and record keeping should be standardized
  - Follow ups and written inspection reports sent to farmers
  - Same test procedures for all utilities
- Investigators should be trained or certified
- Rural distribution systems should be rebuilt using European designs
- Farmers should have access to an ombudsman or some other means of redress if unsatisfied by their utility's response or findings



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## SPECIAL STUDIES

- **To date, the Board has arranged for two studies to be prepared by consultants**
  - A. A review of the literature as to the impact of stray voltage on farm operations
  - B. A comparison of regulatory approaches and measures adopted in other jurisdictions to address the farm stray voltage issue



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## Farm Stray Voltage Consultation

LITERATURE REVIEW AND SYNTHESIS OF RESEARCH  
FINDINGS ON THE IMPACT OF STRAY VOLTAGE ON  
FARM OPERATIONS - PRELIMINARY FINDINGS

DOUG REINEMANN, PhD – DJ Research LLC



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## Farm Stray Voltage Consultation

REGULATORY APPROACHES TO ADDRESSING THE  
IMPACT OF STRAY VOLTAGE ON FARM OPERATIONS –  
PRELIMINARY FINDINGS

PAULA ZARNETT, SHAWN OTAL – BDR NorthAmerica Inc.



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## Farm Stray Voltage Consultation

NEXT STEPS IN THE CONSULTATION

STEPHEN CAIN – CONSULTATION MANAGER

### NEXT STEPS

- Receive and evaluate completed consultants' reports
- Evaluate all input from Consultation activities
- Prepare the Discussion Paper
- Distribute the Discussion Paper for written public comment
- Receive and evaluate all written comments
- Finalize the Discussion Paper based on comments received
- Submit to the Board for consideration and decision



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## ISSUES TO BE ADDRESSED

- Impact of stray voltage on farm operations
- Lessons learned from jurisdictions that regulate utilities regarding stray voltage
- Elements for consideration
  - Complaint response procedure
  - Inspection procedure or protocol
  - Voltage levels triggering utility mitigation response
  - Responsibility for costs of inspection and mitigation measures
  - Dispute resolution procedure
  - Utility investigator training
  - Farmer access to information