

## ABOUT STRAY VOLTAGE



## STRAY VOLTAGE FACT SHEET

### WHAT IS STRAY VOLTAGE?

**Stray – or ‘tingle’ voltage – is a low-level electrical current or shock (typically under 10 volts) that results primarily from an improperly grounded or, in some cases an ungrounded, electrical distribution system.**

Stray voltage can be found in any electrical system and is strictly a power distribution issue – improper grounding causes low voltage current to travel along a neutral wire. An electrical wiring system is grounded in order to keep voltage potential differences between the neutral wire and the ground, below levels that could be considered harmful.

While potential exists for stray voltage in residential areas, it is most commonly found at agricultural operations and is often attributed to poor grounding of the neutral wiring system in an environment where the presence of water increases conductivity between points of contact.

Stray voltage is unwanted electricity that in some cases can pose a safety risk to animals – and to lesser degree, humans – that come in contact with it.

**Farming operations are especially susceptible to incidences of stray voltage for two key reasons:**

- 1) Many working farms have electrical systems and wiring that have not been fully updated to current electrical codes and standards
- 2) Farms have a higher number of potential contact points (e.g., metal), water and wet conditions, i.e. feed bowls and wet concrete floors

### WHAT'S IN A TERM?

**The term ‘stray voltage’ is often misused due to poor understanding of its cause.**

Stray voltage has incorrectly been called ‘dirty electricity’, implying that some forms of electricity are better or cleaner than others. Electricity from all sources is equally ‘clean’. Stray voltage has also been confused with electromagnetic fields (EMF), grounding systems or even naturally-occurring current found in the earth.

## **ANIMAL REACTION TO STRAY VOLTAGE**

**Stray voltage may affect farm animals through nerve stimulation, causing a ‘tingling’ effect.**

This so-called ‘tingle’ can occur when the animal comes in contact with two points that have a voltage potential – such as a metal dish filled with water and a wet concrete floor - creating a path for current (electricity) to flow through the animal.

This nerve stimulation may have an effect on an animal’s behaviour directly – in the form of involuntary muscle contractions and/or pain; or indirectly in the form of behavioral responses such as reduced food and water intake, or proving difficult to handle.

All electrical current must be respected as potentially harmful and stray voltage, although present in low amounts, is no different. Based on research, levels below 1 V are considered to be inconsequential, and generally not believed to cause behavioral changes in farm animals.

## **DETECTING AND REPAIRING INCIDENCES OF STRAY VOLTAGE**

**In most cases the source of stray voltage can be identified, allowing it to be either mitigated or eliminated.**

Suspected cases of stray voltage should be investigated by an inspector from a local utility operator such as Hydro One, Toronto Hydro, etc., as it is a common distribution issue for farm operators as a result of inconsistent wiring quality. A utility inspector will investigate the farm’s existing wiring system to ensure proper installation, wire condition and code compliance. An inspector will seek to isolate the source of neutral-to-earth (ground) voltage through measurement of voltage at various points within the electrical system. This helps to determine whether the issue is related to on-farm wiring and distribution or whether the issue is related to the electrical distribution system off the farm.

## **COUNTERING INCIDENCES OF STRAY VOLTAGE IN ONTARIO**

In 2007, the province of Ontario began an extensive research and consultation process into the phenomenon of stray voltage and its effects on the farm sector. In 2009, the Ontario Energy Board (OEB) enacted code amendments detailing procedures and methodology for dealing with incidences of stray voltage.

As part of its two-year research and consultation process, the OEB employed Dr. Douglas J. Reinemann, a Professor of Biological Systems Engineering and a leading authority on stray voltage to review studies and literature on the subject.

Recognizing stray voltage's connection to farming operations, Dr. Reinemann sought to further clarify the term 'stray voltage' by further defining it as "...a low-level electrical shock that can produce sensation or annoyance in farm animals". He also further specifies the term as "a special case of voltage developed on the grounded neutral system of a farm".

### **STRAY VOLTAGE AND WIND ENERGY**

**There has been much confusion on the topic of stray voltage, and wind turbines have at times been inappropriately linked as direct sources of stray voltage.**

Stray voltage is a potential symptom in *any* system of electrical distribution, regardless of source and is especially prevalent on working farms. Wind turbines are often located in agricultural areas, connecting to the provincial electricity grid with farm operators leasing the land on which the turbines sit. Through improved regulation and electrical code enforcement, incidences of stray voltage will be increasingly detected and eliminated.