

## **Definitions associated with Electricity and EMF**

There are many terms associated with electricity. Some terms such as harmonics, stray voltage, etc., can be scientifically defined and understood. Other terms such as dirty electricity or electro-hypersensitivity are phenomena which have not been scientifically defined or proven to exist. The following highlights some key terms associated with electricity:

### **1. Corona Discharge**

Corona discharge can occur when air surrounding an electrode becomes ionized due to a voltage gradient exceeding a certain value (typically 30 kV/cm), resulting in faint light and often audible noise. This electrode is usually found as tall, sharp, and/or metallic objects which may include conductors, hardware, accessories, or insulators in the immediate vicinity of 500 kV conductors.

### **2. Dirty Electricity**

The term ‘dirty electricity’ is used to describe transformed or corrupted electricity that does not look like a smooth sine wave in an oscilloscope. It is not a scientifically defined term. There has been a significant amount of research on the health effects of non-ionizing radiation, and “dirty electricity” would fit within the scope of many of these studies.

It is suggested that dirty electricity is generated by electronic equipment such as dimmer switches and compact fluorescent bulbs (CFLs). The noise associated with harmonics in an electrical system is seen as an indication of this transformed or corrupted electricity.

Like EMF, the issue with dirty electricity is that some feel it causes adverse health impacts, including headaches, sleeplessness and nausea. At present, reputable institutions like the World Health Organization (WHO) have concluded that there is no evidence to confirm that low level EMF, and by extension, “dirty electricity” causes any health concerns.

### **3. Electric and Magnetic Fields**

Electric and magnetic fields (EMFs) are invisible lines of force that surround any electrical device. They are found everywhere electricity is used such as appliances, computers, office equipment, home wiring, and electric power facilities such as transmission & distribution lines. Electric fields are produced by voltage and magnetic fields result from the flow of current through a device. A detailed description of electric and magnetic fields is available in the NIEHS document “Q&A Electric and Magnetic Fields Associated with the Use of Electric Power.

[http://www.niehs.nih.gov/health/assets/docs\\_p\\_z/emf-02.pdf](http://www.niehs.nih.gov/health/assets/docs_p_z/emf-02.pdf)

## **4. Electrostatic Induction**

To understand induction you must know that when a conductor is energized, electric and magnetic fields are produced which surround the conductor. The electric field is produced by the presence of a voltage potential, while the magnetic field is produced by the flow of current.

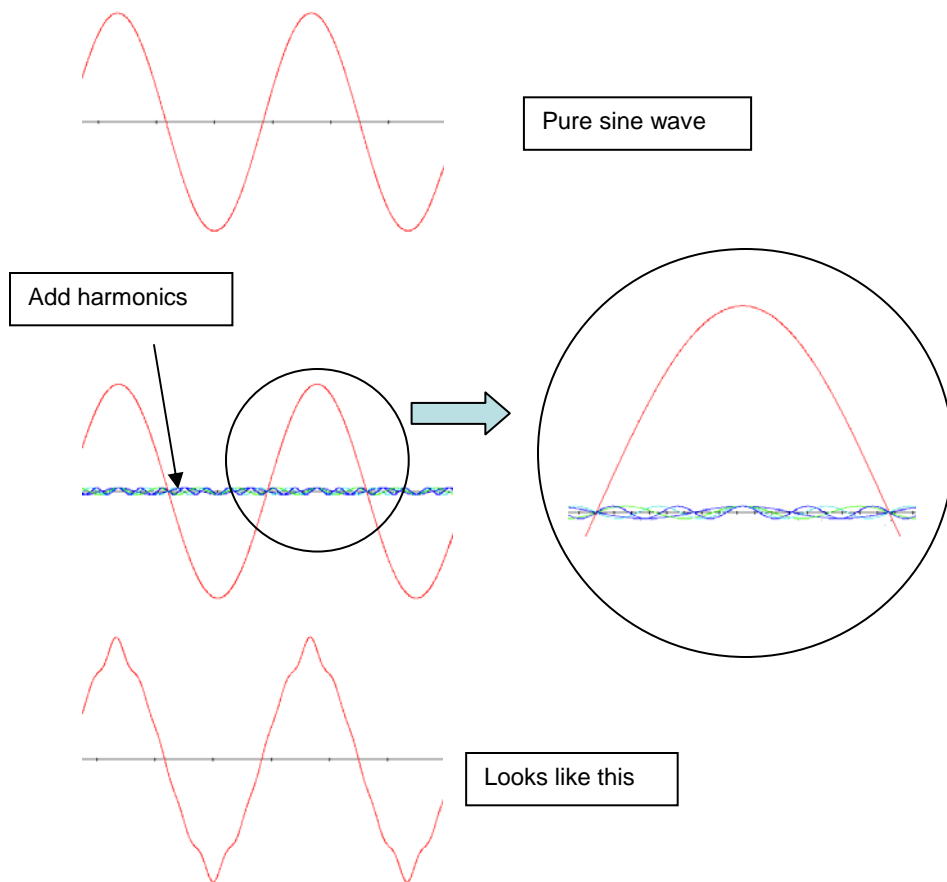
An object, which is isolated from ground, placed near a high voltage conductor may acquire an electrical charge, because it is within the electric field of the energized conductor. The isolated object will assume a potential greater than that of the earth and therefore a potential difference exists between the isolated length of conductor and anything which is at ground potential, such as a steel structure. There would also be a potential difference between a person and the isolated object. The isolated object will act like a capacitor and will store an electrical charge. When a ground is applied, a continuous current may flow to ground.

You can experience a shock from electrostatic induction in two different ways. If you touched an electrostatically charged object, while some other part of your body was touching ground, you could receive a severe shock. Your body would be providing the path for the charging current to flow to ground. This is why objects within a field need to be properly grounded.

One other possibility is that “you” could become the charged object simply by walking through an area with EMF fields. Your body could become charged to a higher potential than that of the earth and a potential difference would be created between your body and any grounded object. If you are isolated from ground (e.g. wearing shoes with rubber soles), when you touch something which is grounded, the charging current will flow from you to ground, and you will feel a small static shock. The charge from these nuisance shocks is normally quite small and not life threatening.

## **5. Harmonics**

In Ontario, electricity is generated and transmitted at a frequency of 60 Hertz. When, for instance, it is produced by a hydro generator, voltages and currents look like a pure sine wave when viewed with an oscilloscope. The use of electrical equipment such as motors, transformers, arc furnaces, etc. may however alter this pure sinusoidal wave shape. Often these alterations look as if very small sinusoidal wave shapes were added to the original 60 Hz. These superimposed voltages and currents are known as harmonics and have frequencies that are multiples of 60 Hz (for instance 180 Hz, 300 Hz, etc.)



Harmonics can be measured through the use of power quality instruments. Excessive harmonics can impact the operation and performance of AC powered equipment.

Industry standards exist outlining permissible levels of harmonics (e.g. IEEE 519). The standards are classified by voltage (below 69kV, 69.001kV-161kV, and above 161kV), and outline permissible percent amounts of current and voltage harmonics.

The EPRI document “Electric Power Waveform Distortion” (product 1025390 Published May 23, 2012) provides detailed information on sources and characteristics of waveform distortion - [http://my.epri.com/portal/server.pt?Abstract\\_id=00000000001025390](http://my.epri.com/portal/server.pt?Abstract_id=00000000001025390) .

## 6. Hypersensitivity to Electricity (EHS)

The term electromagnetic hypersensitivity (EHS) is used to describe the physical and/or psychological symptoms that are reported at EMF exposure levels tolerated by the general public. Nearly all electrically-powered equipment produce an electromagnetic field. High frequency EMFs are produced by radio and TV transmitters, cell phones. Low frequency EMFs are produced by light bulbs, computer monitors, power lines, and household electrical appliances. Reported symptoms of EHS include headache, fatigue, nausea, ringing in the ears, digestive disorders, skin redness and burning sensations. Research has failed to link the symptoms of EHS with exposure to EMFs.

## 7. Stray Voltage

Varying amounts of low-level voltage often exist between the earth and electrically-grounded farm equipment such as metal stabling, feeders, or milk pipelines. Usually, these voltage levels present no harm to animals. However, if an animal touches a grounded metal object where these low voltages are found, a small electric current may pass through the animal. The voltage that causes this small current is known as “animal contact voltage,” “stray voltage” or “tingle voltage”.

Reported symptoms for dairy cows include reluctance to enter milking parlour, reduced water or feed intake, nervous or aggressive behaviour, uneven and incomplete milk-out, increased somatic count, and lowered milk production.

These symptoms can also be the result of other nonelectrical farm factors such as disease, poor nutrition, unsanitary conditions or milking equipment problems. Farmers should consider and investigate all possibilities, including stray voltage, when attempting to resolve these symptoms.

Stray voltage is a term that is sometimes also used to describe city maintenance covers and other metallic objects that can be inadvertently energized by a frayed/damaged underground cable. This kind of situation often affects pets than people because shoes are often a sufficient barrier to prevent shock. Cases of pets being seriously harmed or killed appear in the press every so often.

Hydro One has a process for examining potential farm stray voltage situations. Please call 1-888-664-9376 or visit our website at

<http://www.hydroone.com/MYBUSINESS/MYFARM/Pages/StrayVoltage.aspx>

The EPRI document “Overview of Stray Voltage” (product 1025392 dated May 23, 2012) also contains technical information on stray voltage -

[http://my.epri.com/portal/server.pt?Abstract\\_id=00000000001025392](http://my.epri.com/portal/server.pt?Abstract_id=00000000001025392) .