Stray Voltage

Telegraph Herald picture
IOWA STRAY VOLTAGE GUIDE

A Guide Addressing Stray Voltage Concerns

The Iowa Stray Voltage Guide outlines the steps farmers, electricians, utilities and their advisors can take to discover and resolve stray voltage concerns on livestock farms.

Information includes:
- Common Causes of Stray Voltage
- Ways to Avoid On-Farm Stray Voltage
- Farm Wiring Checklist
- Proper Testing & Installation Procedures
- Utility Contacts
- Frequently Asked Questions
HAVE CONCERNS ABOUT STRAY VOLTAGE?
WONDERING WHAT COURSE OF ACTION TO TAKE?

Start by downloading this FREE Iowa Stray Voltage Guide.
www.iowastrayvoltageguide.com
Sponsoring Organizations:

- Alliant Energy
- Iowa Association of Electric Cooperatives
- Iowa Cattlemen’s Association
- Iowa Energy Center
- Iowa Farm Bureau Federation
- Iowa Institute of Cooperatives
- Iowa State Dairy Association
Tug-of-War
Facing Off
Gridlock
Squaring Off
Debate
Challenged
Controversial
Restrict Fault
Battles
• Utilities ↔ Livestock Customers: Dairy & Cattlemen’s Associations
• REC Utility ↔ REC Member-Owners
• REC Boards & Utility Assoc. ↔ Farm Bureau & Trial Lawyers
• Farm electrical advisors ↔ utility reps
• Electricians ↔ Livestock Customers
Jersey Jewel

Jersey Jewel was created by Young “Dutty” Lyon for the Iowa State University Dairy Farm. “Dutty” Lyon is a 1951 graduate of Iowa State College in Animal Husbandry. As a student, she took several courses from Christian Petersen, resident artist at Iowa State College. For 46 years, she sculptured a butter cow for the Iowa State Fair, which received national recognition. This bronze cow sculpture was commissioned to recognize the work of “Dutty” Lyon and is part of the Iowa Art in State Buildings Project. The bronze cow was made possible by a generous gift from the Swiss Valley Farms Co., Davenport, Iowa.

2006
Iowa Agriculture

In 2014, Iowa farms helped raise

• 3.7 million cattle and calves
• 885,000 beef cows
• 205,000 dairy cows
• 19.2 million hogs
• 2.3 billion bushels of corn
• 507.5 million bushels of soybeans.
IA Rural Electric Public Policy

• Stray Voltage
  – No legislation or regulation
  – Increase in legal actions

• Electric Transmission Lines
  – Moving wind power from west to east

• Distributed Generation
  – More and larger on-farm installations

• Who Pays for Upgrading Rural Lines?
  – Larger farm loads on single phase lines
IA Dairy Producers Association

• AHW-10 Stray Voltage – 2014 Policy
• WHEREAS, stray voltage can cause serious complications for a dairy herd, including reductions in milk production, animal health issues and in severe cases death, and
• WHEREAS, utilities, when at fault, should be held accountable for stray voltage
• THEREFORE, BE IT RESOLVED, the ISDA supports current Iowa Code Section 1, Subsection 657.1 as it relates to stray voltage
• BE IT FURTHER RESOLVED, the ISDA supports designing and implementing a program similar to Alliant Energy’s procedures to test for, identify and mitigate stray voltage on livestock farms.
IA Dairy Producers Association

• AHW-11 Electric Transmission Lines – 2014 Policy
• WHEREAS, electric transmission lines have the potential to interfere with a dairy operation
• THEREFORE, BE IT RESOLVED, future high voltage electric transmission lines should be set back from all existing buildings and structures
• BE IT FURTHER RESOLVED, setback distances should correspond to the size of the high voltage transmission line.
Iowa Code - Nuisances

• Iowa Code §657.1 Whatever is injurious to health, indecent, or unreasonably offensive to the senses, or an obstruction to the free use of property, so as essentially to interfere unreasonably with the comfortable enjoyment of life or property, is a nuisance, and a civil action by ordinary proceedings may be brought to enjoin and abate the nuisance and to recover damages sustained on account of the nuisance.
Iowa Code – Public Utility Nuisance Bill

- Iowa Code §657.1(2) states that in a nuisance action against an electric utility, the utility may assert a defense of comparative fault if the utility demonstrates that they provided the electricity in a way that complied with certain engineering and safety standards.
Iowa Code – Public Utility Nuisance Bill

• An example – A utility is determined to responsible for 55% of the problem and the remaining 45% is determined to be the farms responsibility, then the compensation award from the utility would only be 55% of the financial losses to the farm’s business.
Supreme Court Cases

• Schlader v. Interstate Power Co., (Iowa Supreme Court, 1999) Issue: expert witness
• Martins v. Interstate Power Company. (Iowa Supreme Court, 2002) Issue: nuisance only claim without evidence of negligence.
• Dalarna Farms v. Access Energy Coop., 792 N.W.2d 656 (Iowa Sup. Ct. 2010). Issue: can a comparative fault defense be used in nuisance claim seeking damages against an electric utility.
Legislative

- 2007 - Public Utility Nuisance Bill: Iowa Code §657.1(2)
- 2012 - Stray Voltage Bill Introduced – Did not become law
- 2013 - Stray Voltage Bill Introduced – Did not become law
- 2013 - Stray Electric Current and Agriculture Study Committee established by the Legislative Council.
- 2014 - Stray Voltage Bill Introduced – Did not become law.
Stray Electric Current & Agriculture Study Committee

• The Iowa Legislative Stray Electric Current and Agriculture Study committee’s charge: “Study the issues associated with claims that stray electric current or voltage is affecting dairy cattle milk production. Work with stakeholders in considering options to address the issues and make recommendations to resolve the issues.”

• The Study Committee meeting was held October 18, 2013.
Stray Electric Current & Agriculture Study Committee

- 5 State Senators and 5 Representatives
- Iowa State University
- Iowa Utilities Board
- Iowa Association of Electric Cooperatives
- Iowa Farm Bureau Federation
- Iowa State Dairy Association
- Iowa Assoc. for Justice
- Dairy Farmer and REC member
- Alliant Energy – Interstate Power & Light
Stray Electric Current & Agriculture Study Committee

• Require written notice?
• Require a response time?
• How big of a problem is this?
• Utility representatives access to a farm – behind the meter?
• Iowa Utilities Board role?
• Third party independent expert hired by the board?
• Investigation rules – model after Wisconsin, Idaho or Michigan? Vermont?
Stray Electric Current & Agriculture Study Committee

- Final Report issued in December of 2013.
- **Outcome:** The stakeholders were encouraged to continue their dialogue in an effort to achieve a workable consensus solution. A non-legislative option to this issue was encouraged.

  - January 2014 – Sponsoring groups began work on a stray voltage guide.
FARMER HAS CONCERNS WITH STRAY VOLTAGE

Call Electric Utility?

Yes

- Utility explains stray voltage investigation protocols and policies
- Farmer explains any investigation work done or completed by others
FARMER HAS CONCERNS WITH STRAY VOLTAGE

Utility unaware of farmer’s stray voltage concerns

No

Call Electric Utility?
Is an investigation necessary?

- Utility performs no on-farm stray voltage testing

No

- Farmer explains biosecurity protocols and policies

- Date & time set or utility site visit for stray voltage investigation

- Utility visits farm to begin Phase I testing

(See page 16 of this guide)

- Utility returns to farm to retrieve equipment and data from Phase I testing

Yes
Is stray voltage level above 0.5 volt at the animal contact point?

Yes

• Utility and farmer review results from Phase I testing

Yes

• Phase II testing begins. (See page 16 of this guide)

• Utility returns to farm to retrieve equipment and data from Phase II testing

Is utility contributing 0.5 or more volt at the animal contact point?

Yes

• Utility takes action to reduce its contribution to below 0.5 volt at the animal contact point.
• Utilify and farmer review report and discuss options of reducing off-farm contribution.

• Utility testing complete.

• Utilize and farmer discuss options for future monitoring or other actions.
Stray Voltage Sources

• Utility
• Farm
• **Important point:** farm and utility share neutral and grounding parts of the electrical system.
Stray voltage is a difference in voltage measured between two surfaces that may be contacted simultaneously by an animal.
Stray Voltage: Utility Goal

Utility’s Goal: Provide a quality utility system neutral path for current so relatively less primary neutral current flows through the farm grounding system to return to its source (substation).
Stray Voltage: Utility Challenges

- Large 1 phase loads at one farm site
- Three phase not close to most farms
- More and larger customer generation
- Allocation of costs to upgrade
- Livestock dense areas
- Customer cooperation with farm mitigation
- Damaged equipment
- Neutral isolation impacts
Action Levels

- Action levels are based on animal contact voltage and “level of concern” (LOC)
- Animal Contact Voltage Defined:
  - The steady-state, rms, AC, 60 Hz, voltage measured across a 500-Ohm (nominal) resistance connected between two animal contact points.”
Action Levels

• Animal contact voltage LOC (Level of Concern) defined:
  – One volt or greater of animal contact voltage
  – Or 2 milliamps or greater of animal contact current
  – It has two parts
    ➢ 1-milliamp (0.5 volt) from the utility (based on a 20 kW resistive load test)
    ➢ 1-milliamp (0.5 volt) from the farm
Action Levels

• The LOC is a conservative, pre-injury level below where a cow’s behavior or milk production would be harmed.
Action Levels

• Utilities will take action to improve the utility system if it contributes one milliamp or 0.5 volt or more to animal contact voltage based on a 20 kW resistive load.
• Customers with livestock who install equipment resulting in single phase loads larger than 20 kW can choose to take additional preventative measures such as equipotential planes, paying for line upgrades, ask about neutral isolation or converting to 3-phase.
Phase 1 Investigation

• Identify animal contact monitoring location:
  – Ask farmer if there is an area of concern.
  – Spot check around farm to identify location for monitoring.

• Monitor voltage levels overnight or 2 milkings:
  1. animal contact voltage
  2. voltage between ground wire at the transformer to a remote ground rod
  3. voltage between the service entrance panel neutral or equipment ground bar to a remote ground rod.
Phase 1 Investigation

• Designed for first-time visits to check for possible stray voltage concerns.
• Provides an assessment of the basic characteristics of the farm’s electrical system and utility’s distribution system.
• If animal contact voltage is less than 0.5 volt steady-state, rms, AC, 60 Hz, voltage measured across a 500-Ohm (nominal) resistance, then no further testing is necessary.
• If 0.5 volt or higher, more testing may be done to determine sources.
Phase 2 Investigation

- This set of tests assist investigators in determining the sources of stray voltage.
- The tests are done as needed to determine sources of higher animal contact voltage levels.
Phase 2 Investigation - Tests

- Load Box
- Secondary Neutral Voltage Drop
- Signature
- Primary Profile
- Farm Load Monitoring
Load Box

- Evaluates
  - utility’s neutral system resistance to earth
  - farm’s electrical system resistance to earth
- Utility contribution to animal contact is determined with this test.
- Is animal contact voltage 0.5 volt or higher with the farm off and a 20 kW load at the transformer?
Secondary Neutral Voltage Drop

- Evaluates condition of secondary neutral system
- Measures the resistances of the farm’s various service drop neutrals.
Signature

- Designed to identify equipment faults and problems with the farm wiring.
- Done by turning things on and off around the farm.
Primary Profile

• Designed to assess condition of primary neutral system near the farm.
• Measure voltage at pole grounds each direction from a farm.
Farm Load Monitoring

- Usually overnight or 2 milkings.
- Also take voltage spot checks during milkings or higher load times of the day at other animal contact locations around the farm.
Standard Test Protocol

Standard Test Protocol Used:
- To evaluate stray voltage levels present
- To diagnose the sources of stray voltage

Benefits of Standard Test Protocols
- Provide a systematic analysis that can be duplicated
- Provide comparable information for the utility and the customer
Nothing Beats Good Wiring

- Good design when installed
- Regular maintenance
- Proper protection
Things to watch in Iowa

• Can a voluntary approach work with this issue?
• Will farmers and their electricians use the book as a guide?
• Will lawsuits decline?
• Who will be the “independent” stray voltage consultants?
Resources:

- Iowa Stray Voltage Guide
  www.iowastrayvoltageguide.com

- Midwest Rural Energy Council
  www.mrec.org

- Midwest Plan Services
  www.mwps.org
We don't have a strong voltage problem.
Visit Dubuque

Diamond Jo Casino
Mystique Casino
Port of Dubuque