

# Stray Voltage Testing and Detection



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# Stray Voltage Sources

- Utility
- Farm
- Both – Most Common
- Reason: farm and utility share neutral and grounding parts of the electrical system.





10/25/20

# Stray Voltage Sources

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



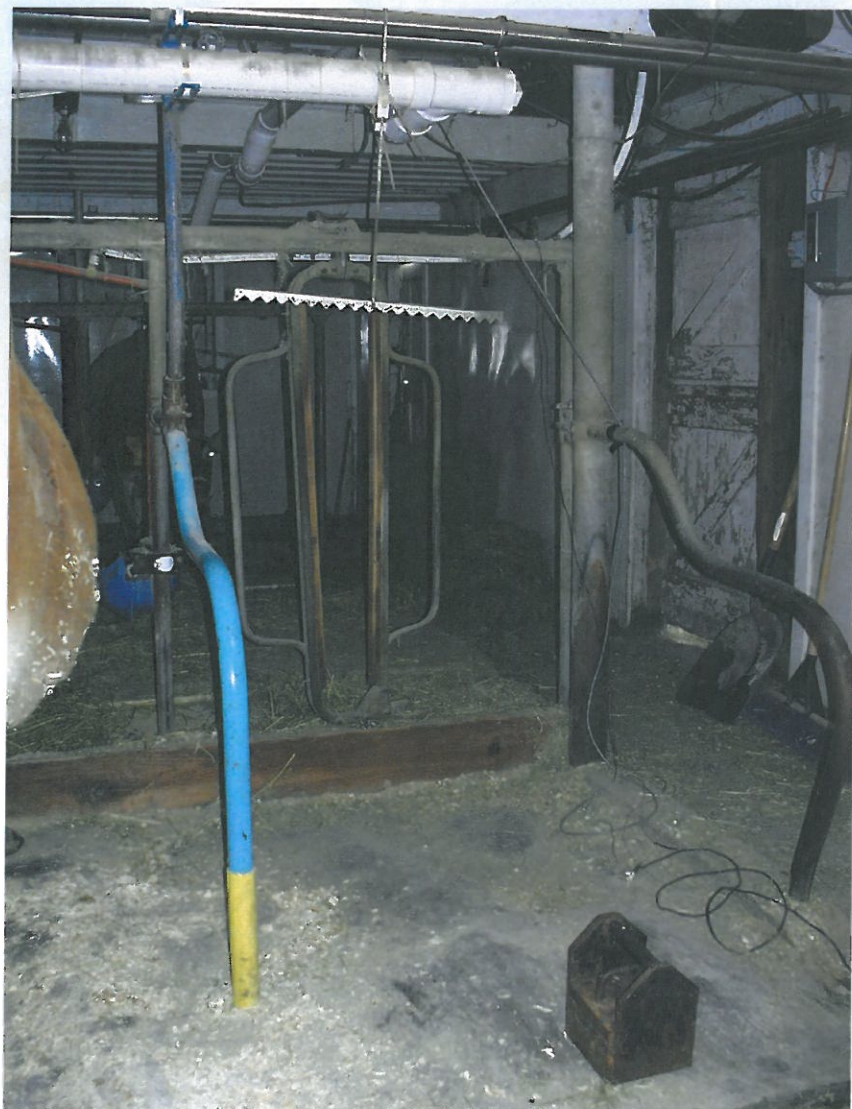
# Action Level

- Alliant Energy operates in 3 states.
- One of those states has regulations or standards for the utility to take action related to stray voltage.
- To provide the same kind of service to all its livestock customers, Alliant Energy – Interstate Power & Light has chosen to apply the standards of that state to each of the states it does business in.

# Action Level

- Action level based on animal contact voltage and “level of concern” (LOC)
- Animal Contact Voltage Defined:
  - The voltage measured across a 500-Ohm (nominal) resistance connected between two animal contact points.”





10/25/2013

# Action Level

- Animal contact voltage LOC defined:
  - One volt of animal contact voltage
  - Or two milliamps of animal contact current
  - It has two parts
    - 1-milliamp (0.5 volt) from the utility
    - 1-milliamp (0.5 volt) from the farm



# Action Level

- The LOC is a conservative, pre-injury level below where a cow's behavior or milk production would be harmed.
- Research studies document avoidance behaviors in the range of 3 – 6 milliamps flowing through the cow.

# Action Level

- Alliant Energy – IPL will take action to improve the utility system if it contributes one milliamp or 0.5 volt or more to animal contact voltage.



# 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 animal contact voltage overnight or 2 milkings
- Monitor voltage between ground wire at the transformer and the service entrance panel 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, then no further testing is necessary.
- If 0.5 volt or higher, more testing is 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

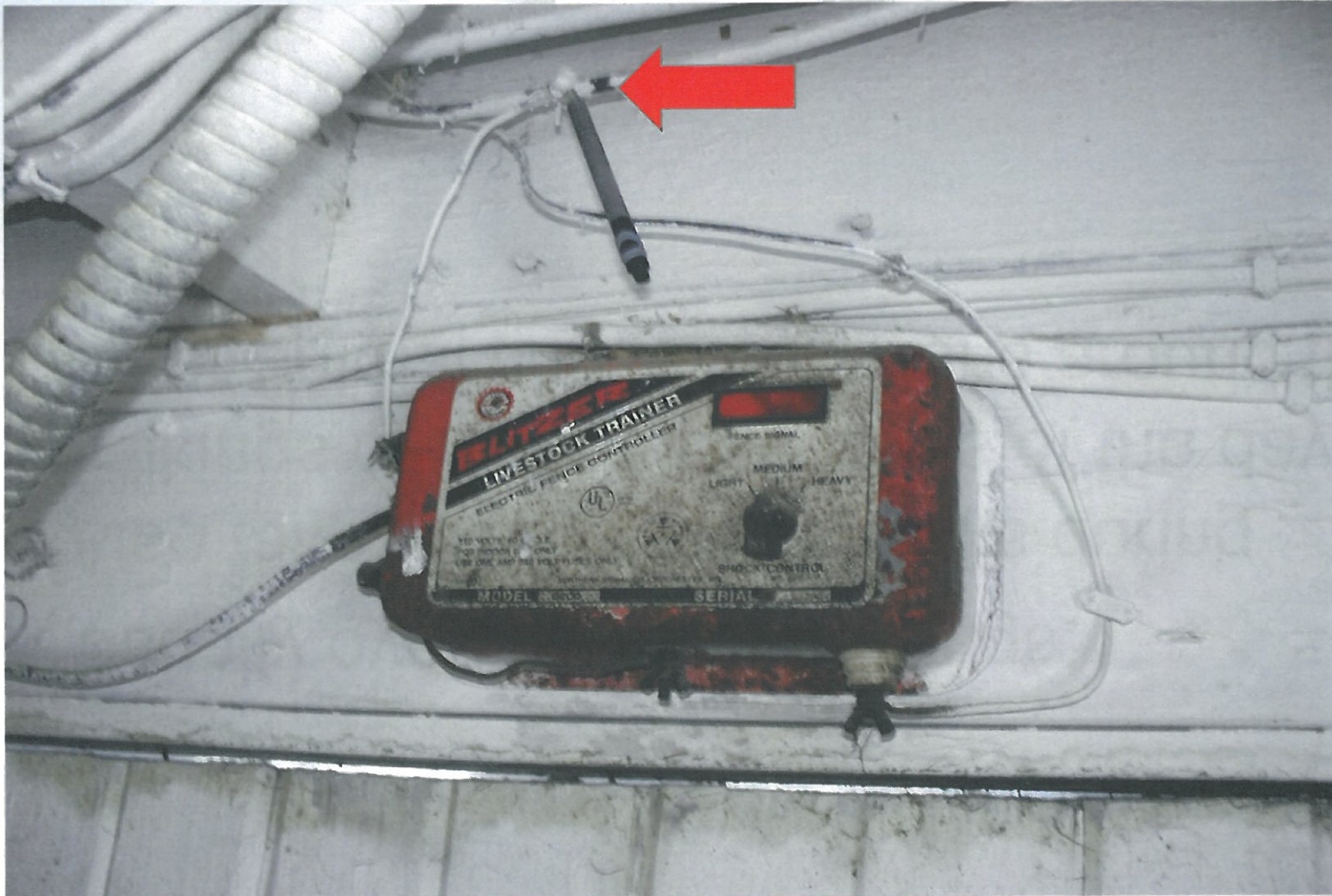
- Designed to assess condition of primary neutral system near the farm.
- Measure voltage at pole grounds each direction from a farm.



# 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.

# Energizers for Fences, Trainers and Crowd Gates





# Action Level

## **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

# Questions?

