BEFORE THE PUBLIC SERVICE COMMISSION

OF THE STATE OF MISSOURI

In the Matter of Union Electric Company, d/b/a AmerenUE's Tariffs to Increase Its Annual Revenues for Electric Service	)))	**Case No. ER-2010-0036**

NOTICE REGARDING EXTERNAL COMMUNICATION

Issue Date: October 14, 2009

On October 1, 2009, we received the attached correspondence from Dale Grant, Grant Electrical, concerning Spring Lake in Jefferson County, Missouri.

Respectfully Submitted,

Robert M. Clayton, III
Chairman

Jeff Davis
Commissioner

Kevin Gunn
Commissioner

Robert S. Kenney
Commissioner

Dated at Jefferson City, Missouri,
on this 14th day of October, 2009.

rec. 10/1/09

Memorandum

To:
Jay Nixon, Governor of Missouri
Robert M. Clayton III, Missouri Public Service Commission Chairman
Jeff Davis, Missouri Public Service Commissioner
Terry M. Jarrett, Missouri Public Service Commissioner
Kevin Gunn, Missouri Public Service Commissioner
Robert S. Kenney, Missouri Public Service Commissioner
Dan Beck, Engineering Analysis Supervisor, Missouri Public Service Commission

CC:
Members of local government and press agencies within the state of Missouri

Subject:
Unresolved hazardous conditions at Spring Lake in Jefferson County, Missouri

Gentlemen-

I have been in contact with Dan Beck via the Missouri Public Service Commission website request for information. However, Mr. Beck has failed to respond to any follow-up questions pertaining to the Spring Lake incidents (detailed below). My sole purpose for sending this letter to you, local members of the county government and members of the press across the state is to prompt you to resolve the unsafe conditions that have persisted since 2006. AmerenUE is clearly aware of these conditions and has refused to take action to correct the problem as evidenced by an incident that occurred on June 21, 2009. In this recent incident a woman was admitted to the hospital even though her only her feet were in the water.

The October edition of EC & M Magazine will carry a story written by Donald Johnson about the dangers of concentric neutrals and earth current. Mr. Johnson was the Professional Electrical Engineer investigating for the Plaintiffs in the civil suit and the article is based on his findings at Spring Lake. Please review the enclosed article and be prepared to defend your actions to the people you are charged to protect.

Finally, I would like to repeat the my sole motivation for this letter and method of contact is to spur those in authority to hold AmerentUE accountable for correcting the unsafe condition their lines have caused. I grew up in Valle Lake subdivision only a few miles from Spring Lake. I have spent many summer days swimming in this lake completely unaware that these hazards might exist. This incident could easily have happened to me and I feel a personal responsibility to follow through with resolving this situation. I have tried utilizing the PSC's system to file a complaint with no response.

If you require additional information or would like to discuss a remedy for this condition, please contact me.

Regards,

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Grant Electrical
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Dale Grant

From: newsletters@mikeholt.com
Sent: Wednesday, September 23, 2009 9:15 PM
To: Dale Grant
Subject: A Case of Stray Voltage in a Lake
Follow Up Flag: Follow up
Flag Status: Red

Topic - Stray Voltage
Subject - A Case of Stray Voltage in a Lake

September 23, 2009
This newsletter was sent to 19945 newsletter subscribers

The Case of Stray Voltage in a Lake

October 1, 2009 By Donald R. Johnson, P.E., Johnson Engineering (donjohn@silverstar.com)
Faulty concentric neutrals on high voltage underground cables was the cause of one drowning death and brain injury to two others while swimming in a lake.

Stray voltage is a popular term resulting from electrical currents flowing through the earth, or other conductive surfaces not normally expected to carry electric currents. Small amounts of electric currents travelling through the earth are prevalent throughout the nation primarily due to electric utilities using the earth as a grounding medium for grounded wye distribution systems. Even though these grounded wye systems do carry a neutral conductor return current path since the neutral conductor is grounded to the earth at multiple locations, (as required by the NESC), the result is the earth is a parallel path for these currents. Typically, depending upon the conductivity of the earth and the amount of return neutral current on the electric distribution system, the amount of current flowing through the earth is small. As electric loads across the nation continue to increase, these earth currents are also increasing. These earth currents became noticeable many years ago on dairy farms. The dairy farmers noticed a significantly higher mortality rate among the dairy cows along with a major loss of milk production. The culprit was directly tied to the amount of earth currents flowing through the dairy facilities. Electric utilities across the nation have found out the hard way (through multi-million dollar lawsuits) that they must reduce these earth currents to non-damaging levels.

The Scene:
Six teenagers were enjoying a cool evening in an outdoor hot tub in a home near a small lake. Several of the teenagers decided to exit the hot tub and run out onto a small dock (owned by the homeowner) and jump into the lake.

Photo of the dock where the accident occurred.

The Accident:
The teenagers were swimming near the dock for several minutes when they began to notice electric currents flowing through their bodies. One boy who experienced the phenomena at the site describes the currents as causing him to lose muscle control such that he could no longer swim and he began sinking in the water. Several of the teenagers that were on the dock saw the swimming teenagers' plight and called to the adults in the house for help. Several of the adults came running out, called 911, and began diving into the water trying to retrieve the teenagers that were under the water (Note: It was determined during later testing that the currents in the water were intermittent thus not causing damage to the adults.). After multiple dives the adults were able to retrieve the two boys and one girl that were under the water. CPR was immediately administered until the paramedics arrived. After the three were taken to the hospital the outcome was that one boy drowned and the other boy and girl received brain damage due to lack of oxygen caused by near-drowning.

The Investigation:
The first thoughts by those at the scene after the accident was that the dock wiring was somehow faulty which caused the electric current to be in the water. My services as a professional electrical engineer were then engaged by attorneys representing the plaintiffs (who filed suit against the electric utility and others) to try to determine the cause of the electric currents in the lake water. After numerous investigations by me and other experts, it was determined that the dock wiring was not the cause of the electric currents in the lake water. I later determined through discovery from the electric utility that they had major corrosion problems with the bare concentric neutrals of their high voltage underground cables that were buried under and around the lake where the accident occurred.

The electric utility realized up to nine years prior to the accident, through concentric neutral testing procedures, that the bare concentric neutrals were in a serious state of deterioration throughout the

lake area and the housing subdivision around the lake. Even though the electric utility realized the problems they were having with the deteriorated concentric neutrals in the area they didn't seem to realize the importance of immediately fixing the problem. They began a multi-year program of replacing the bare concentric neutral cables with new jacketed concentric neutral cables in the area. However due to difficulty in installing new cable in two particular sections of underground cable under and around the lake, these sections were not replaced. It turned out that these two particular sections of underground cable that were not replaced were the primary paths for the neutral current return for the entire lake area subdivision back to the electric utility substation source. The result was that the electrical load within the subdivision was essentially on an "island" in terms of an adequate return current path. Because of this "island" effect the currents took the least resistant path into the lake water heading to the dock which was more than adequately grounded to the electric utility system overhead neutral which was then tied directly to the utility substation source.

To verify the above scenario numerous tests were completed by me during several site visits. During one visit a Fluke Model 289 recording multimeter was installed at the dock where the accident occurred and left to record for eight to ten consecutive days (The wiring to the dock was totally disconnected and removed at this time.). The voltages were recorded by placing a ground rod off the end of the dock into the lake water where one meter probe was attached. The other meter probe was attached to the house ground which was in turn attached to the electric utility ground. A 500-ohm shunt resistor was included in the voltage measuring circuit. The currents were measured using the same technique however the 500-ohm resistor was placed in series with the circuit. The results of the testing indicated that both the voltage and current levels followed the electric loads of the utility in that the load peaks were at the highest levels during the morning and evening hours (Note that the accident occurred during the evening hours when electric loads were at the highest.). In addition the frequency of all voltage and current measurements were measured at 60 Hz. This was a direct indication that the electric utility was the source of these measured voltages and currents. The highest currents measured during this test period reached .5 amperes and the highest voltage reached 6.2 volts.

During another visit to the site, with the electric utility present to allow access to their underground cable junction enclosures, numerous readings were conducted to measure the current on both the underground electric utility energized phase conductors and the concentric neutrals. Voltage measurements were also taken from the ground system in the enclosures to a remote ground. The results indicated that indeed the concentric neutrals in the two particular critical sections were likely non-existent. In one particular section right near the lake the neutral current on the concentric neutral was less than one-tenth of an ampere whereas the energized phase current was in excess of 6 amperes. Obviously the remainder of the return current was flowing through the earth and in this case the lake water. In addition the voltage measured from these same junction enclosures was in excess of 7 volts to a remote ground rod. These measurements were a clear indication that the concentric neutrals on these underground sections were likely absent due to corrosion.

The Conclusion:

Using an assumed human body resistance of 300ohms[1] when immersed in fresh water and assuming a current range through the human body where muscle control is lost in the range of 6 to 30 milliamperes[2] using Ohm's law the voltage necessary to cause a drowning in fresh water is in the range of 1.8 to 9 volts, 60 Hz AC. The above testing results show that the necessary voltage and current levels were at a level well within the range to cause the drowning and near-drowning of the victims of this case.

This case went to a trial by jury and the jury awarded the plaintiffs a total judgment of $2,325,000. No appeal was filed by the electric utility defendant.

This case shows the dramatic effects of stray voltage especially in an area where people are exposed to stray voltages when in a wet environment. Electric utilities must be vigilant in maintaining their distribution systems such that stray voltages are kept at extremely low levels such that humans and animals alike are not exposed to these dangers. As electric loads continue to increase across the

nation many experts are even encouraging electric utilities to modify their distribution systems so that the earth is not used as a current carrying medium.

1. "Stray Voltages – Concerns, Analysis and Mitigation" National Electric Energy Testing Research & Applications Center (NEETRAC) Manual Project Number 00-092, August 2002, Page 5-24.
2. http://www.osha.gov/SLTC/etools/construction/electrical_incidents/eleccurrent.html