REPORT OF ONE DAY SEMINAR ON LIGHTNING PROTECTION

SHONE SCHOOL – 27th November, 2017

Some of the participants posing with school children at Shone Primary School at Katuugo before the lectures.

Community opinion leaders, mainly farmers from around the school at Katuugo.

A. Lectures delivered – *(please check back later for these to be on YouTube)*

1. Lightning Science by Richard Tushemereirwe
2. Mechanisms of lightning injury by Mary Ann Cooper
3. Myths about lightning by Mary Ann Cooper

B. List of participating schools / stakeholders

1. Schools

i. Kifumura Primary School
ii. Kifumura Primary School
iii. St. Prisca School
iv. Butema CS Primary School
v. Katereiga Primary School
vi. Kitoonya Primary School
vii. Kyohairwe Primary School
viii. Nyahaira Primary School
ix. Mbegu Primary School
x. Toonya Primary School
xi. Kabaale Primary School
xii. Kigaaga Primary School
xiii. Iguru Primary School
xiv. Buhirigi Primary School
xv. Kitemba COU Primary School
xvi. Kibengeya Primary School
xvii. Kijonjomi Primary School
xviii. Kibengeya Primary School
xix. Buseruka Primary School
xx. Kibengeya Primary School
xxi. Kibiro Primary School
xxii. Kibaire Primary School
xxiii. Bururu Primary School
xxiv. Busanga Primary School
xxv. Nyamasoga Primary School

2. District officials

i. DEO Kiryandongo – Rev. Edward Kirya
ii. DEO Hoima – Mr. Ebong Kenneth
iii. DEO Kyankwanzi --- Mr. Deo Kahonda

3. Community opinion leaders

i. Mr. Bwahika William
ii. Mrs. Peace Bwahika
iii. Mr. Osborn Dete
iv. Mr. Denis Beta
v. Mr. Basil Opio
vi. Mr. Amos Okol
vii. Mr. Monday
viii. Mrs. Musinguzi Betty
ix. Mr. Sentongo Douglas
x. Mr. Kihangire Bosco
xi. Mr. Aciro Brenda
xii. Mr. Sebuliba Moses
xiii. Mr. Kamoga Brian
xiv. Mrs. Nanyonjo Jesca
xv. Mrs. Kyoshabire Peace

C. Questions posed by teachers – Answers by Dr Cooper

i. What is the origin of Lightning?
   a. Lightning is a physical phenomenon, like rain, earthquakes, or tsunamis, that has a physical cause and can be described by lightning physicists and engineers, and by meteorologists. Lightning is from electrical charges

that build up within turbulent clouds, flash within the cloud in nearly every direction, with some heading toward the earth to cause damage.

ii. How long can lightning travel? (Possible distance over land covered by one lightning strike).

a. Most lightning does not go further than a few kilometers, but it is important to remember that lightning can travel any direction from a thunderstorm and can hit outside the rain area beneath the cloud.
b. The longest flash that was ever detected was over 175 km in length from start to finish. This is not usual – remember this was only one detected among the billions of lightning flashes that occur every year!

iii. Which mechanism of injury is most prevalent?

a. Ground Current causes nearly half of the injuries in developed countries. The percentages are not known for developing countries and is an area we are concerned to find out. We suspect it may be much higher in developing countries.

iv. Apart from lightning arrestors, is there any other effective way to protect houses from lightning?

a. A lightning protection system consists of three parts:
    i. Lightning arrestors – commonly call a 'lightning rods'
    ii. Downconductors – which take the energy that attached to the arrestors safely down around the building to the earthing system
    iii. Earthing or Grounding system – These are usually long rods pounded into the earth or a ring buried around the base of a building that are attached to the downconductors. The earthing system is meant to spread the electrical charge harmlessly away from anyone inside the building being protected.
b. Because most injuries are from ground current, that is the mechanism, not from direct strike (which the 3 part system protects against), that is the most important to study. ACLENet is working with our Research Advisers to start research into whether wearing shoes, sleeping on mats, burying a cable around the base of a building or similar ideas would protect at least some of the people who might otherwise be killed by ground current. Of course, the further away someone is from the lightning strike, the more likely they are to survive with these measures – but *we don't have the data to recommend these yet*.

v. Is it true that females are preferred (struck most) by lightning than males (for example, when 15 of the 19 pupils struck by lightning at Runyanya in 2011 were girls compared to only four boys)?
   a. Actually, multiple studies in developed countries nearly always find that males make up 80% of the deaths from lightning. This is usually attributed to their greater risk-taking behavior, more work and recreation outdoors than women, etc.
   b. Our research shows that in communities where both men and women work equally outside, and where there are nearly equal numbers of male and female student in a classroom, that the numbers of males and females injured are nearly equal.
   c. If we averaged many school situations, we would find that the deaths are nearly equal between males and females, at least if an equal number of boys and girls attend school. We cannot generalize what happened in only one situation like Runyanya to the entire community of schools or victims.
   d. It is a matter of 'exposure'. Unfortunately, in developing countries such as Uganda, especially in the rural areas where there are few or no lightning safe place, everyone, regardless of sex, is vulnerable 24/7.

vi. Is it true that certain body fluids (for example vaginal fluids) attract lightning?
   a. No. Lightning has burned its way a km or two through the air. It cannot sense the makeup of anything it eventually hits, let alone whether the person is male or female.
   b. The things that lightning is more likely to hit are tall objects, pointy objects and isolate objects, where they are trees, cows, people, or cornstalks.

vii. In the traditional understanding of lightning, it is understood that lightning has a leader and a follower. Is this the same as western science understanding?
   a. I am not sure of the terminology you are using so I will answer varieties of the question and hope I have understood your question:
      i. A single lightning '<u>flash</u>' may have several '<u>strokes</u>'
      ii. As lightning comes down from the cloud, upward leaders rise off of anything on the ground that is close to the downward leader – including trees, homes, people, cows, etc. *These upward leaders can have enough electricity to kill a person, even if the whole lightning stroke does not make it to ground*. Eventually the

downward leader connects to one of more of these upward leaders. Nearly half of lightning flashes have two or more connection points to the ground.

iii. Lightning has the downward leaders heading down from the cloud to the ground. Once the connection has been made between the cloud and earth has been made, lots of electricity from the ground will flow up through the lightning channel. These are called 'return strokes' and can be seen as brightening, flickering or pulsing of the main lightning channel. There can be several return strokes, usually an average of about 3-5 for any lightning flash, but many more have been measured in rare flashes.

viii. Does the leader have the same charge like the follower?

a. No, they are opposite charges, one + and one -, but either the downward or the upward leaders may be + or - .

ix. Is it possible to scientifically explain lightning which takes place without rain?

a. While lightning most often occurs in a thunderstorm with rain, at least 10% of lightning hits outside the rain area. As your question **ii** asked above, lightning can travel tens of kilometers away from the cloud and hit away from the rain area.

x. Can we use scientific means to predict lightning?

a. Yes and No – see below.
b. Thunderstorms form quickly, usually over a few minutes and are not very large (a few kilometers in size). They move on fairly quickly and an individual storm does not last for more than 20-30 minutes. So it may be raining in one village and dry in one only a few kilometers away. Even in the USA, meteorologists do not try to predict *individual* storms, much less individual lightning flashes.
c. For more violent storms, the storms can be stacked right next to each other and seem much larger and longer.
d. In fact, there is no way to protect from the very first lightning flash in a storm.
e. Individual lightning flashes cannot be 'predicted', only said to be more likely if certain weather conditions exist. However, it is possible for Meteorologists, such as those at UNMA (Uganda National Meteorological Authority) to see if weather conditions are right for thunderstorms to form and warn people. With advanced tools and lightning detection

equipment, they can also tell where an existing thunderstorm is and which direction it is going to give a pretty good idea of where it will be in a few minutes. But remember, meteorologists cannot predict an individual small storm nor each and every lightning flash that is going to occur – they don't even try.