

CORRECTING THE MISINFORMATION AND MISREPRESENTATIONS ON LIGHTNING PROTECTION IN THE PUBLIC DOMAIN

1. INTRODUCTION

The rainy season has arrived across Uganda, and with it comes the impacts of the lightning hazard that has been reported more often in recent years. There is a great deal of misinformation, and worse, misrepresentations about lightning protection in the public domain. Properly installed lightning protection (LP) measures can save people and property from death and damage. However, installations that are based on misinformation, poor engineering or misrepresentation can lead people to feel that they are protected when they are not, or leading them to do things that they may have avoided with proper caution - things that can increase their risk of lightning injury and death. It is a cyclic problem.

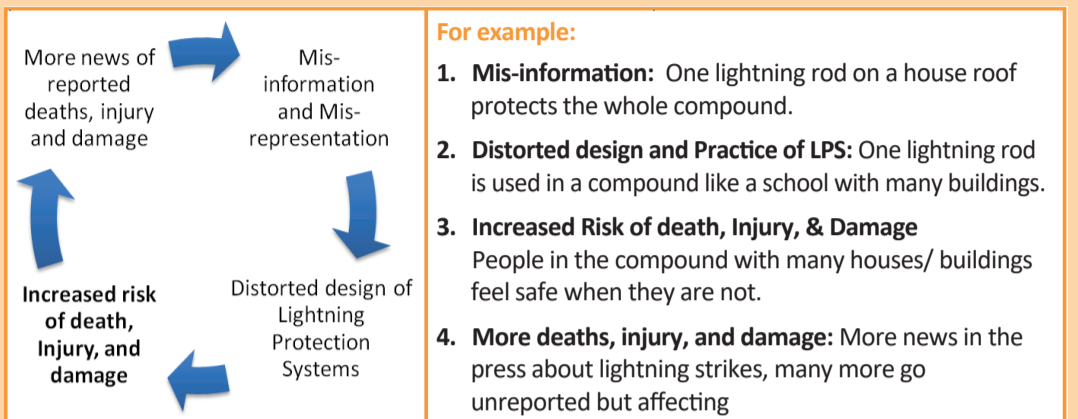


Figure 1. Cycle of misinformation

2. A FEW MYTHS (MISINFORMATION)

a) Lightning is sent by witches. This is dangerous because it pushes the lightning hazard into the supernatural domain, making us think that we can do nothing about it except hire a more powerful witch and Sangoma or use more muthi!

b) Lightning cannot strike the same place twice.

This is dangerous because people in those areas think they are safe when they may not be. Any place that is prone to lightning strike will remain prone to it – tall buildings are hit many times a year. No one can predict where lightning will strike, but scientifically, we know that things that are tall, isolated or pointed are more likely to be hit by lightning.

c) A dead body of someone killed by lightning is bad omen – whoever touches it will be struck by lightning. This is dangerous because people who could have given first aid, CPR or other aid may be too afraid to touch the person who was injured. A myth similar to this is that people who have been hit by lightning can be dangerous because they hold an electrical charge – also false. Lightning lasts only a few millionths of a second and is gone from both the person and the surroundings. They are safe to touch. BUT no place near thunderstorms are safe, so one should always be wary that more lightning can occur and injure at this same location.

d) Certain tree species can stop lightning. This is very dangerous because it offers a false sense of security to anyone who places their home close to these supposedly safe trees. Some trees show more damaged than others when struck by lightning. However, since trees are tall, isolated and pointed, the type of tree does not matter with respect to being struck.

e) Lightning arrestors repel lightning: Lightning protection systems protect a building that was going to be hit anyway, so the systems intercept the lightning and channel the energy safely around the building instead of through it where it could injure people, electronics or start a fire. That is the challenge for engineers – to know how to use the lightning protection codes that have been proven scientifically to minimize the risk of lightning injury and damage.

3. LIGHTNING PROTECTION

Lightning Protection is a very specialized field. Even most university-trained electrical engineers have never had training in it. Most of the training is done 'on-the-job' from others, although more African countries are developing standards and certification for lightning protection designers and installers.

The simple truth is that nothing has been proven to be safer than the original Franklin rod (often called an arrestor in Africa), invented by Benjamin Franklin in the 1700's. Arrestors do NOT attract lightning nor do they dissipate it, weaken it or 'force' it away. Properly designed and installed, a Lightning protection system(LPS) intercepts lightning that was going to hit the structure and channels it harmlessly to the ground. Franklin rods are not glamorous or shiny or fancy – but they are reliable and relatively inexpensive. *Nothing has been shown to be more effective than the simple Franklin rod in a properly designed and installed LPS.* This conclusion is based on multiple independent testing and research studies that have been done over the last 50 years around the world.

A lightning protection system of a building is made up of four parts:

a) Arrestors (usually Franklin rods also called **Air Termination**) – enough should be placed on buildings to intercept the lightning as it comes down from the cloud to the ground.

b) Down-conductors – a minimum of two for every building. These take the energy captured by the arrestor harmlessly down to the earthing system.

c) Earthing or grounding system – these may be several long metal poles that

are pounded deeply into the ground. With the often dry African soil, it may be easier to dig a trench around the building and lay a ring of wire that is bonded to the down-conductors.

d) Bonding or separation between the parts above.

For buildings that contain expensive electrical systems, electronics, and equipment, a fourth part may be needed for protection. This is called 'surge protection'.

NOTE: Surge protectors, properly selected and installed, could protect only your electrical and electronic appliances, but not your building from direct lightning strikes

3.1 MISREPRESENTATION AND MISUNDERSTANDING OF LIGHTNING PROTECTION

Unfortunately, because few have studied or understand what is required for proper lightning protection, many misunderstandings and resulting fraudulent claims have arisen.

A primary false claim is that 'if one point (Franklin rod) is good, then 5 or 25 or 100 points must be 5 or 25 or 100 times more effective'. This has been shown to be false in all reputable scientific studies. Nevertheless, ACLENet sees multi-pointed arrestors on nearly every school where we install a lightning protection system (Figures 2 and 3). To take this idea to an extreme, some will try to sell 'lightning dissipators' that look like brushes or upside down tassels as shown in Figures 4 through 7.

NOTE: 'Whether it is a multi-point or single point air termination, the effect is similar. The multiple points are more of a marketing tool than scientific.'



Figure 2. Runyanya school building where 18 students were killed and 38 injured by lightning in 2011. Note the multiple Franklin rods on the roofline with the old multi-prong shorter rod in the center.

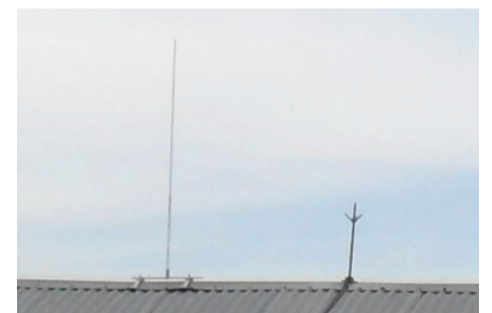


Figure 3. Close-up view of Franklin versus the multi-pointed shorter arrestor.



Figure 4. SLE (Semiconductor Lightning Eliminator) air terminals (circled) installed on petrochemical processing plants. Their claimed ability to reduce the 'captured' lightning current by 99% has been disproved by scientists



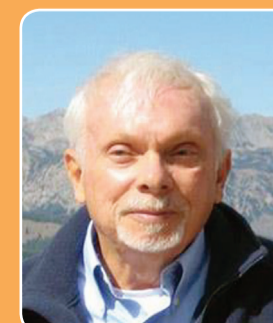
A team from ACLENet put together this advisory to help the Ugandan public face the lightning hazard with the right information while avoiding the misinformation and misrepresentation.



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Figure 5. Another lightning dissipator with the brand name blocked.



Figure 6. Or you can have four of them!!

For over two hundred years, vendors have been making all sorts of modifications, adding glass balls, cylinders or odd shapes of shiny brass or silver, or using pretty colors, in addition to making more points. (Figure 7). They look impressive, but NONE of these are any better than the plain, original, simple Franklin rod – yet they are usually MUCH more expensive than the Franklin rod. Most of these alternative arrestors fall under the name of *Early Streamer Emitters, also known as ESE's*. There are many other claims to be wary of, and cause great concern for their false claims:

a) An electrical charge is extruded from the



Figure 7. Multiple varieties of 'enhanced' lightning arrestors.

tips' that some will claim can either drive away a lightning strike, weaken it, or will somehow be more effective in capturing the lightning.

TRUTH: 'Upward streamers' arise from anything that is near an electrical charge (like a thunderstorm), whether it is a tree, a telephone tower, a person, a cow or a blade of grass. This is part of the normal physics of electricity and magnetism - and lightning is an electrical phenomenon. So, while their claim is not *false*, it is also not something they designed into their arrestors or is special about their brand or design that they should be able to claim or charge for!

b) 'Adding a radioactive source will enhance the arrestor' by adding another source of 'emission' that ionizes the air around it.

TRUTH: There is no evidence whatsoever that this is true, based on multiple scientific studies. And do you really want a radioactive source around your kids or family or employees?

c) ESE vendors tried a number of other strategies. One is to claim that they can protect a larger area because of increased effective height, increased volume capture (can capture lightning strikes within a larger radius from the arrestor)

and other claims, even going so far as to claim 'Our arrestor will protect anyone within ten kilometers' as a recent Uganda news report stated. One of the reasons that ESE vendors continue their claims is that designing and installing a Franklin type system is usually more complicated and requires many more arrestors (rods) than an ESE system. So the ESE vendor does not have to have the knowledge of a reputable lightning protection specialist and can install one ESE arrestor in much less time while charging much more for their ineffective product.

TRUTH: All of these claims have been proven false by multiple reputable scientists worldwide for the last two decades.

d) Oversimplified presentation in mass media
In early 2017, the *New Vision* newspaper published an article in which an electrical engineer presented lightning protection in a very simplified form. While not an outright untruth, it stretches the truth and simplifies it beyond safety. The engineer also went on to advocate the use of an air



Figure 8. *New Vision* article.



terminal with a 'pronged shape'. Obviously, the engineer had fallen for the ESE claims. Lightning protection is a very specialized area and a tiny part of most engineers' experience. It is no wonder many of them do not know the codes that specify the design techniques for proper lightning protection. It is important that African electrical engineers/technicians become educated about Lightning Protection. Proper Lightning Protection that is code (IEC 62305) compliant starts with design. We should start to recognize the critical importance of qualified expertise in lightning protection.

4. PROPER LIGHTNING PROTECTION

The most comprehensive guideline in lightning protection is the internationally-recognized standard (IEC 62305) by International Electro-technical Commission. The IEC 62305 standard parts 1 to 4 reorganizes and updates the previous standard publications [IEC 61024 series, IEC 61312 series, and IEC 61663 series] on lightning protection systems.

Part 1 - General principles

This part presents general information on lightning and its characteristics and general data, and introduces the other documents.

Part 2 - Risk management

This part presents the analysis making it possible to calculate the risk for a structure and to determine the various protection scenarios in order to permit technical and economic optimization.

Part 3 - Physical damage to structures and life hazard

This part describes protection from direct lightning strikes, side flashes, step potential, and touch potential by including the air-termination, down-conductor, earthing, and equipotential bonding/minimum separation as an integrated system.

Part 4 - Electrical and electronic systems within structures

This part describes protection from the induced effects of lightning, including the protection system by Surge Protection Devices (SPD Types 2 and 3), cable shielding, rules for installation of SPD, etc.

This series of standards is supplemented by:

- The IEC 61643 series of standards for the definition of SPDs
- The IEC 60364-4 and -5 series of standards for application of the products in LV electrical installations/

However, IEC 62305 is not well represented in Africa. Instead, there are many European/American/Chinese based products that violate IEC Standards and are flooding into the African market. These products have been branded fraudulent by those who are mindful about standard code compliance because they make claims which cannot be scientifically justified. For example, ESE and SLE products claim that they emit energy to 'arrest' incoming lightning. This is simply NOT TRUE and can be dangerous as well because they offer a false sense of security.

ESE and SLE manufacturers have dominated the African market with their propaganda and have spread **FAKE science** concerning lightning protection. This has led to engineers installing these fraudulent products without questioning the validity of claims on efficiency or potency. This is because

practicing engineers are not investigators or researchers. So, we have complacency and mediocrity with lightning protection which is a result of economic ecosystems established in Africa rather than anything else.

5. WHO IS RESPONSIBLE, IN GOVERNMENT, FOR ADDRESSING THE LIGHTNING HAZARD?

The government of Uganda has assigned the responsibility of standards in Lightning Protection to ERA (Electricity Regulatory Authority). This is on the right assumption that lightning is natural electricity. ERA also licenses electrical engineers and technicians otherwise called electrical installers. But have these been educated on IEC 62305 and its implementation?

The responsibility (mandate) for alerting the public on lightning and thunderstorms is placed with the Uganda National Meteorological Authority (UNMA). However, when lightning strikes, killing or injuring people, or destroying property and infrastructure, the responsibility lies with NECOC (National Emergency Coordination Centre) under the Ministry of disaster preparedness and first responders in Uganda Police Force.

The biggest challenge in propagating proper lightning protection is the misinformation and misrepresentations in the public domain, even among the educated classes of people. The other challenge is the dominance of ESE products, with false claims, in the African market.

6. ACLENet FIELD WORK

ACLENet has continued to lead by example. Friends and partners have helped us to install proper lightning protection wherever we could, such as the current school projects in Uganda shown in Figure 15. This also serves to demonstrate code (IEC 62305) compliant LPS so that when we advocate, we have practical examples. Demonstrating practicality is the reason we have spread our reach in every corner of Uganda.

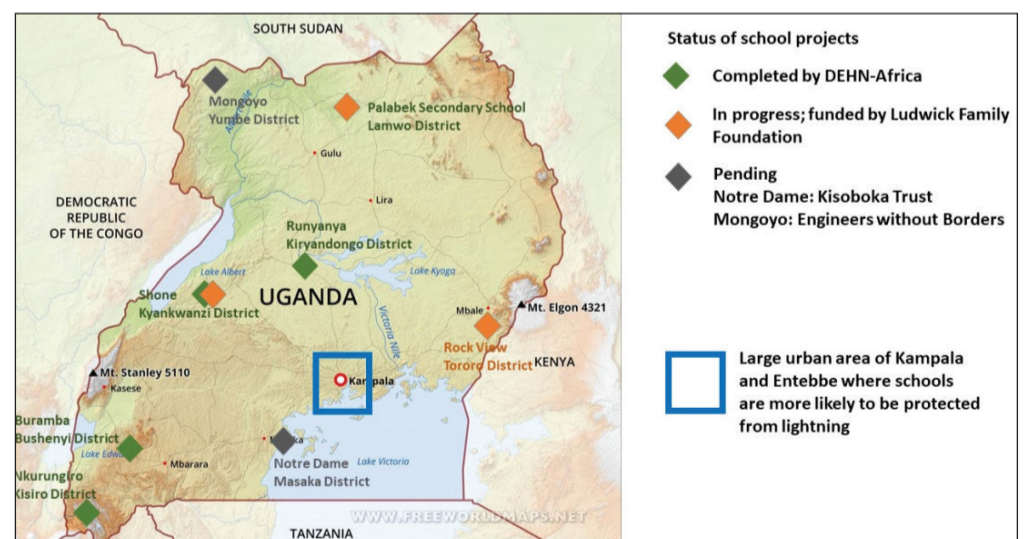


Figure 15. Current school lightning protection projects within Uganda with involvement of ACLENet.

ACLENet, the African Centers for Lightning and Electromagnetic Network, is dedicated to reducing deaths, injuries and property damage from lightning across Africa. Part of their work is to put right this misinformation and misrepresentation. In Uganda, ACLENet works with the Uganda National Council for Science and Technology (UNCST) as the central point for all Science and Technology advice. Internationally, ACLENet has organized a pool of internationally recognized research advisers and lightning protection experts who are proud to be volunteering their time and expertise for the public good in Africa.

There are many long-held cultural beliefs about lightning, such as stories that your grandmother and great-grandmother told you every time a thunderstorm occurred. These beliefs may have started with a grain of truth but, as they are re-told countless times, may become embroidered and grow a little with each telling. They may date back many generations, even before the scientific (industrial) revolution. Many are stories that cause no harm, but a few can cause behavior that can be dangerous to the individual and sometimes to friends and family.