

## Reactions towards Mr Abdul Mousa statements.

**M Abdul Mousa, based in Canada, is working for a utility named BC Hydro. He is the co-moderator of a discussion group on Internet. According to Mr Rick O'Keefe, founder and co-moderator of the group, it is dedicated to lightning safety. Instead, it seems to be used as a tribune to lobby against the spread of non conventional air terminals, including active systems and ESE systems.**

*July 2005*

### 1- Mr MOUSA, the new ESE prosecutor

Firstly, we need to present Mr Mousa recent positions and comments for those who are not members of the discussion group: Mr Mousa is opposing ... everything since the Benjamin Franklin rod invention more than 200 years ago. He is one of the more active opponents to ESE systems and considers that the rejection of the NFPA 781 draft standard in 1997 was a "victory". He is also opposed to "active systems" and he recently wrote (January 30, 2003):

*"...Our concern about the situation in Australia is justified as the existence of a French standard for ESE (Early Streamer Emission) lightning rods was similarly used to attack the standards authorities in other nations, including NFPA..."*

This opposition is not based on Mr Mousa own research or publications. He is just combining a few papers published in various publications or conferences during the last decade against ESE systems : University of Manchester tests in High Voltage Laboratory, Mr Rison experimentation in New Mexico, ICLP statement sent to the NFPA during the review of the draft standard NFPA 78 , Mr Hartono's pictures from Malaysia... These papers are already well-known and we had multiples opportunities to answer.

Very recently (Feb 4, 2003), Mr Mousa wrote a new paper entitled "The standard that never was". His position is very simple and based on two major considerations:

1- The French Standard organization has been "abused" by ESE manufacturers and published a Standard (NFC 17- 102) without precautions or consensus:

*"The «standard» turned out to be a document cooked up by the manufacturers of ESE devices in France, rather than a consensus document that has been approved by a national group having wide representation including learned societies."*

Mr Didier GEORGES, Managing Director of the UTE (Union Technique de l'Electricité), French Standard body, promptly answered this type of defamatory statement:

*"I can't accept your false allegations about UTE and the whole French Standardisation System, that clearly shows your dishonesty.*

*I will send in few days a complete answer explaining the way AFNOR and UTE work.*

*UTE, French member of IEC, is the electrical Standardisation Body of AFNOR. I can't accept that UTE's neutrality should be questioned.*

*Didier GEORGE*

*Directeur Général de l'UTE »*

2- Mr Mousa considers that all related parties (foreign standard committees, end users....) are victims of "vendors that continue to use the discredited standard to promote their gadgets":

According to the author, members of standard committees in Spain, Romania, Portugal or Argentina, end users, consultants and engineers specifying ESE systems have all been "abused" for years !

But on the other hand, a recent market survey has been conducted by IPSOS in France (2002) towards 476 industrial sites. 97% of the ESE technology users interviewed have declared that they are "satisfied" or "rather satisfied" of their ESE air terminal. Shall we consider that these end-users are so stupid that they are satisfied to purchase inefficient and unreliable "gadgets" despite their several years of satisfactory use of ESE? Shall we extend this comment to our 50 000 customers throughout the world protecting their premises with our system for the last 15 years ?

Our company accept to take part of a discussion as long as it is based on scientific or technical facts and comments. We accept the opposition of some scientists and we are always open to discuss with them, sharing our experience and our data collected on our installations as well as during our test campaigns. But Mr Mousa comments are just oriented and part of a political campaign rather than a technical discussion. As an example, his Feb 4, 2003 starts with the following sentence:

*"This news item will surprise, or even shock, most of our readers.*

*Hopefully, it will also delight the majority."*

This comment does not require any additional comment: Mr Mousa is taking the leading position of an anti ESE political campaign, in any case he is intending to entertain a fair and instructive scientific debate.

## 2- Our position towards the ESE debate

Besides the nauseating political campaign, I would like to explain again our position towards the technical opposition to ESE air terminals:

The "opposition" papers are usually based on the following comment: the ESE efficiency is not enough scientifically proven, and therefore the Franklin rods are staying the only recommended LPS.

As far as the efficiency of our ESE air terminal is concerned, INDELEC has been conducting test campaigns not only in High Voltage laboratories but also in real lightning conditions on 3 continents during the last 10 years. These results have been presented in international conferences (IWLP 1999, ICLP 2000, Foudre 2001 ...) and they are available on requirement.

Besides these test campaigns, we have also a long experience installing its systems in more than 80 countries since the mid-eighties. These air terminals are sometimes installed for years in very high keraunic level sites and areas. No casualties, no damages, no complaint have been reported.

According to our contradictors, these results, these references are not (and may never be !!) meeting their expectations to prove the efficiency of our ESE air terminal.

But on the other hand, the same authors are not taking the same precautions to assume that the Franklin systems are efficient, based on their wide acceptance and installation references for more than 200 years.

*"Traditional lightning protection is based on over 250 years of empirical observations of the effectiveness of the systems and over 100 years of scientific research into lightning and lightning protection" according to Mr William Rison.*

Basically, ESE efficiency needs to be proven but in the same time authors assume that conventional air terminal are working perfectly without need of proof. But Mr Hartono's pictures for example are clearly showing that many buildings in Kuala Lumpur have been struck by lightning even though a Faraday cage was installed :

For the first time in 1999, an official NFPA report underlined the lack of scientific or technical background behind the "natural" acceptance of the conventional systems:

*"It appears to the Panel that the NFPA 780 document does not meet the NFPA criteria for a standard since the recommended lightning protection system has never been scientifically or technically validated and the Franklin rod air terminals have not been validated in field tests under thunderstorm conditions".*

1999 – Third Party Independent Evaluation Panel on Early Streamer Emission Lightning Protection Technology.

## Conclusion

As manufacturer of the ESE air terminal Prevelectron since 1986, we are open to the discussion. We are taking the scientists concerns into account to conduct our research programs, to keep on improving our system. These programs are based on wide international cooperation (Japanese, French, Canadian, Brazilian partners for the two on-going research projects) and these test sites are widely open for visits of scientists.

In our mind, the debate must be technical and scientific. Under Mr Mousa leadership, the LightningProtection discussion group turns to be a clearly anti ESE oriented web site. The comments are not anymore technical, but only intending to discredit ESE image.

Mr Mousa papers turned full of rash statements and defamatory comments. His partition of "good people (ESE opponents) and "fraudulent people" (ESE vendors) is completely useless and a waste of time.

It will surely not help to improve our knowledge of the lightning phenomenon. But most probably Mr Mousa himself do not really care about that as long as the ESE air terminals are discredited.

In the meantime, we follow our test campaigns and researches on the lightning phenomenon and the air terminals compared efficiency. We wish to open a real scientific debate. We feel this is worth spending our time and energy rather than wasting them answering clearly oriented literature such as Mr Mousa pamphlets.

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# E.S.E. and non conventional LP systems

Extracts from the paper of Prof. Aage E. PEDERSEN introduced during the 27th I.C.L .P. conference in Avignon- France- and interesting comments and response from a Malaysian lightning protection engineer.

January 2006

The following are Quotes extracted from the paper and our Comments with regards to your quotes.

## THE TECHNICAL ASPECTS:

Quote:

*Radioactive rods have been used for many years but have shown no advantage relative to ordinary lightning rods, and the use of radioactive material for this purpose has now been abandoned in most countries.*

Comment:

Radioactive rods have been abandoned not because it shows no advantage relative to ordinary rods but because of environmental concern as it contains Radioactive substance which are currently banned in most countries after the nuclear disaster in Russia. In actual fact, radioactive rods are part of ESE rods too. The only difference is that Radioactive substance were used to launch the upstreamers while majority of today's ESE rods rely on the electric field to trigger the launch of upstreamers.

Quote:

*Early Streamer Emission System (ESE), attempts to utilize an emission of early discharges (streamers) on special lightning rods, to provoke and trigger an early lightning flash and thus protect the surrounding over a greater area than in the case of ordinary lightning rods. Even though the name Early Streamer Emission indicates, that it is the early onset of streamers on ESE rods relative to the ones on ordinary lightning rods, that is a measure for the advantage, it appears that the advantage actually is determined by the time difference between the instances of the first appearance of any type of discharges on the two types of lightning rods, an interpretation that will favour the rod with the smallest curvature radius on the tip.*

Comment:

I think there has been some confusion between the upstreamer and other discharges. Sharp tip does not mean that it can launch up streamer earlier. Sometimes the Corona Effect of a sharp tip forms space charge to prevent the launch of up streamer. A good ESE rod will launch upstreamers only at suitable time to prevent space charge problem.

Quote:

*Even though the hypothesis seems logical, actual experience in the field has shown that the triggering of a flash is extremely complex and much more complicated than anticipated in the hypothesis.*

Comment:

If TRIGGERING of a flash is extremely complex and much more complicated than anticipated, then is it correct to state the following?

Quote:

*Therefore, the concept of early streamers is not sufficient and inadequate as a parameter for the determination of any advantage of ESE rods versus ordinary lightning rods.*

Comment:

If the ESE rods do not have early streamer emission then the number of ESE rods required to protect a building will have to be the same as ordinary lightning rods i.e. one ESE rod every 10 to 15 meters apart. However there are many buildings that are equipped with only 1 ESE rod or even 1 ESE rod for several buildings.

In Hong Kong a total of more than 1000 ESE rods of our proprietary product; E.F. have been installed since 1975. Out of which 450 systems were monitored through our maintenance scheme as attached in Appendix A «E.F. in Hong Kong». Some of these systems were equipped with lightning counters and the total number of lightning discharges onto the system till date is 1266. The very rare cases where lightning did bypass the ESE rod and caused very minimal and minor damages are also listed in Appendix A. Based on this data, if ESE rod does not have any advantage versus ordinary lightning rods, then wouldn't most of the building suffer damages to the façade especially at the corners since the ESE rods are mostly placed at the centre of the buildings?

Quote:

«Moreover, several investigations (for inst. by Z.A.Hartono and by Charles B.More et al) have shown numbers of missinterceptions, and lightning strokes terminating in the close vicinity of ESE rods, and that competition race between ordinary Franklin rods and ESE rods arranged in parallel setups and exposed to natural lightning did not favour the ESE rods as it should be expected according to the claimed properties.»

Comment:

Does this mean that there are NO missinterceptions by the ordinary rods? Could we have more information as to the parallel setups? Were these setups done in actual Field Application where both ESE and ordinary Franklin rods were in placed? How many systems were installed? What was the coverage area?

The Lightning Flash Density in Kuala Lumpur is more than 25 per kilometer square per year (1). We have been supplying E.F. since 1995 in Malaysia and till date we have supplied more than 250 systems with 75 systems located in Kuala Lumpur. If there are missinterceptions and ESE rods do not have the claimed properties, then wouldn't all these buildings have damages to the façade especially when located in an extremely high lightning flash density area? For your further information, 45 of these buildings located in Kuala Lumpur are higher than 60 meters while more than 95% of the systems installed in Hong Kong are higher than 60 meters. Our data clearly proves the effectiveness of ESE rods for buildings of any height and open areas. This would also mean that our proprietary product is above IEC 1024 and NF C 17-102 since the standards are meant for buildings less than 60 meters only.

## Creditability

New concepts are always turned down by authorities who are always cautious. It normally takes a long time; sometimes many decades to centuries before a new theory or concept is being approved depending on the evolution of the item especially any theory that cannot be simulated or tested in laboratory. For example, when car was first invented, people said that a car can never run faster than a horse but today we cannot live without a car. When Kolaj Kopenik first presented the theory that the earth moves around the sun no one believed him and he was even persecuted. After he died many years, then only people accepted his theory. As another example, when wireless communication was first invented, a British general said that wire is the only way for telecommunication. Today, a mobile telephone has become a basic necessity. Even until today, some people still disagree with Darwin's evolution.

Quote:

Therefore, relevant standards are important for components, apparatuses or systems where safety is the issue, or where safety is involved, and moreover, that the standards contain tests' specifications relevant to the circumstances under which the items are going to be used.

Comment:

I agree that standards are important especially where safety is the issue. However in lightning protection can any standard i.e. IEC 1024, NF C 17-102, BS 6651, etc. provide 100% guarantee? If lightning cannot be simulated in the laboratory and triggering lightning is very complex, then can any standard prevent or withstand Mother Nature?

In today's world, a day can hardly go by without the use of electronics. However electronics are very susceptible to damaged by effects of a lightning strike. BS 6651:1992 Appendix C. «General advise on protection of electronic equipment within or on structures against lightning» provided a guidance on this topic. However when this standard was revised in 1999, it still remained in Appendix C. When will be the next issue and will it be part of the standard or remain as Appendix C? This clearly shows that for a standard to recognize new components, apparatuses or systems, it takes a very long time and until it has been fully adopted, end-users continue suffer damages and losses.

Quote:

Consequently standards, norms and code of practice should comply with at least one of the following requirements:

- Founded on recognized and verified physical theory and models.
- Founded on recognized and verified empirical models and experiences.
- Founded on recognized tradition and practice and experiments from the field collected over sufficient number of years.

Comment:

Because of the unpredictable nature and incomplete understanding of the mechanism of lightning, the condition of today's lightning research has not changed much from Benjamin Franklin's time where there were no verified physical theory and models. All suggested modeling of today are still full of assumptions which means it is not much different from Benjamin Franklin - No Model.

Recognized tradition? In the 1990s, French scientists made «life-size» experiments on lightning during several years in Saint Privat d'Allier. Subsequently in 1995, the NFC 17-102 standard was issued.

Practise and experiments from the field? Improvement of ionising initiation used in ESE devices is also inspired by what has always been observed in the nature such as lightning strikes favoured by hot ionised air coming out of chimneys, emission coming out of radioactive rocks, discharges between objects with a floating potential, etc.

Quote:

However, laboratory tests are insufficient and inadequate because it is impossible in any laboratory to simulate natural lightning conditions not least due to the limited space and the vast nonlinear characteristics of the lightning processes.

Comment:

Therefore I agree that at this moment we should only consider Field Application instead of laboratory test because lightning is unpredictable and a natural event. However my interpretation of Field Application is to collect data containing the following parameters namely:

- a) The total number S lightning strike intercepted by ESE systems.
- b) The number N of ESE system observed/monitored
- c) Monitoring period in Year
- d) Number F lightning bypass the ESE system
- e) Number K bypass due to malfunction of ESE system such as poor up keep and incomplete system or misapplication
- f) The area covered by the above monitored ESE systems.
- g) Exact location of installation for third party to verify the data easier.

With the above parameter, we can calculate the failure rate R of ESE system in respect to number of ESE system by:

$$R = \frac{F - K}{N}$$

And the failure rate P of ESE system in respect to number of lightning strike by:

$$P = \frac{F - K}{S}$$

In order to minimize the random effect, the field statistic should fulfill the following criteria:

- 1) The number of ESE systems to be observed must not be in tens but in hundreds to thousands ....the more the better.
- 2) The area covered must in the hundreds to thousands KM2 ...the more the better.
- 3) The monitoring period must be more than 10 years ....the longer the better.

We know that there are not many sites in the world that can fulfill the above conditions, except Hong Kong. Nearly 70% of Hong Kong buildings are using ESE systems which have been installed since the 1970s (2). Appendix A shows that we have been monitoring the systems and have records of more than 20 years. It clearly proves the effectiveness of E.F. i.e a type of ESE rod. A similar study of another brand of ESE system also indicates the effectiveness of ESE system. The failure rate R is less than 1% per year and the main reason of failure was weak lightning discharge. If you or any other international independent research body is interested to have a further study or research through the Hong Kong platform, please contact us and we are willing to render our assistance.

### To conclude:

Quote:

*Similarly, it has neither been possible for independent scientists nor organizations to confirm the claimed advantages. On the other hand several investigations have indicated that the ESE devices offer no advantages relative to ordinary lightning rods.*

Comment:

If ESE rods are ineffective but there are so many buildings around the world that utilizes it, then would it mean that these buildings are not protected from lightning? Malaysia has the second highest lightning incidences in the world and there are more than 1,000 installations of ESE rods by many different manufacturers in the entire country. If your findings are true, then at least 50% of these buildings would have damages to the façade. We cannot provide a very detailed data as our Hong Kong counterpart can, but what we can share is the following:

- 1. Empire Tower in Kuala Lumpur installed E.F. on 27th Dec. 2001 has recorded 2 lightning discharges as of 11th March 2002.
- 2. Berjaya Times Square in Kuala Lumpur installed E.F. on 11th Sept. 2002 has recorded lightning discharges as of 24th Nov. 2004 as follows:

	Total Lightning Discharge
High Zone Tower A	15
High Zone Tower B	18
Low Zone Tower B	4
Low Zone Tower A	0

- 3. Federal Hill Housing installed E.F. on 2nd Dec. 2004 has recorded 3 lightning discharges as of 2nd Dec. 2005

### THE MORAL ASPECTS:

Quote:

*In spite of the lack of verification of the claimed properties, and in spite of the repeated criticisms from the scientific community, the ESE manufacturers have continued for more than 15 years to sell and promote ESE systems with promises of the non-proven efficiencies compared to ordinary lightning rods.*

Comment:

What other proof is better than seeing and experiencing it yourself? ESE rods have been used for 30 years. If it is not proven in Field Application, this system would have been abandoned just like the others. Engineers continue to use ESE rods and ESE market continue to expand instead of shrinking not because person, organizations, companies, etc. are being intimidated but merely because they are confident in ESE rods. The number of systems installed without having much problems arising after thunderstorm has

proved the effectiveness of ESE rods. Lightning is totally unpredictable but with its wide used in tropical country it is only a matter of collecting the data from Field Application as a prove.

## **THE LEGAL ASPECT:**

What sort of responsibility do standard bodies carry? In MS IEC 61024-1-2:2001 it states in the National Foreward «Compliance with a Malaysia Standard does not of itself confer immunity from legal obligations.» In IEC 61024-1-2 clause 1.1 states «This part of IEC 61024 serves as a guide and is applicable to the design and installation of LPS for common structures up to 60 m high». Hence if an engineer were to do any design for lightning protection does the standard enlighten their responsibility? What more when the building is more than 60m high?

I hope to hear from you soon on the issues I raised because I strongly feel that it is unjust to ban ESE system unless you can provide reference data. We also hope that you will consider withdrawing your paper until a thorough study on ESE performance in Field Application is carried out.

## **References:**

- (1) MS 1460:1999 pg. 3
- (2) A Preliminary Survey of Lightning Protection Practices in Hong Kong Buildings. By Y DU, PhD CENG MIEE and K M LAU, B Eng (Hons) Msc. Published in The Hong Kong Institution of Engineers Transactions. Volume 10. Number 3.