

Report of Webinar on

***Nonstandard ESE Lightning Protection System in India.
The truth and facts***

on 18 July 2021: 10.30 Am. Total attendance: 530

This report contains the following parts.

1. Introduction,
2. Indian standards on Lightning protection,
3. Nonstandard LPS in India,
4. Nonscientific mass education carried out across India,
5. Webinar contents as per the invitation,
6. Brief bio data of presenter and moderators,
7. Webinar proceedings, subjects covered in the webinar,
8. Further discussions by experts,
9. Participation and feedback,
10. Conclusion.

1. Introduction

Lightning hazards are ubiquitous regardless of the status of any nation. However, availing the existing scientific knowledge of Lightning Protection System (LPS), developed nations have significantly mitigated the loss of lives and property whereas, the scenario in the developing countries is different.

Lightning safety is a vital subject in India. Annually more than 1500 people get killed due to lightning, in addition to failure of electrical system and fire in few cases. In order to reduce the loss of human lives and property damage, LPS is installed in a structure. Lightning protection system if properly installed on a structure can provide protection for people and its contents.

2. Indian Standards (IS/IEC 62305 & NBC-2016):

The Indian standard and the national building code of India set the benchmark for Lightning protection in structures. The NBC disapproves the usage of nonstandard LPS such as ESE/CSE/dissipation system etc. However, large number of non-standard LPS suppliers challenge the recommendation of NBC, claiming that the non-standard systems are modern, advanced, simple and effective.

3. Non-standard LPS and the dangers of nonscientific mass education:

Non-standard and non-scientific LPS systems are being promoted across India claiming that one air terminal protects up to a radius of 110 meters. These nonscientific rods are also called as New and Latest technology, Advanced technology, Emission technology, Modern technology, etc in order to create an impression to the user. However, the promotional videos circulated in the social media claim that one lightning arrester protects up to 1.4 Sq.KM. The promoters also claim that these systems confirm to French code NFC-17 102. Fig 1 gives an idea about the method with which these devices are installed in India.

4. Nonscientific mass education carried out across India

There were widespread education and awareness classes carried out across India. Some of the non-scientific principles that have been educated to the people during these mass education programs are

- 1) High frequency sound in lightning (1 to 30 MHZ),
- 2) Lateral strikes and its effects and the methods to limit it,
- 3) Rural lightning, urban lightning, semi urban lightning, coastal lightning,
- 4) Planting tall trees around houses can dissipate lightning,
- 5) ESE devices absorb lightning as a result there is no sound and light,
- 6) Low-cost lightning protection with cycle rim fixed on a wooden pole and an alternate metal pole for protection of people outside buildings,
- 7) Usage of COWDUNG in earthing to reduce earth pit resistance,
- 8) Complete cities and villages are protected in some states in India,
- 9) All critical communication installations in India are protected with these ESE rods

Note: Explanations from these mass scale awareness programs included in final page of this report

5. Webinar date, time and contents

Date: 18 July 2021 (Sunday)

Time: 10.30 AM to 12.30 PM

Following subjects, the scientific reasons and methods are explained and discussed during the webinar.

- a) An overview of scientific and non-scientific Lightning Protection System,
- b) How ESE systems are explained / installed in India,
- c) What is ESE and an analysis of claims,
- d) Why ESE is not included in IEC / IEEE, and the reasons behind the rejection of ESE by the scientific community,
- e) Mass education of nonscientific methods of LPS,
- f) An overview of LPS installed in cyclone shelters in Odisha,
- g) Protection of people outside “substantial buildings” and the development of low cost LPS,
- h) Importance of understanding and following Indian Standards IS/IEC 62305 and National Building Code of India.

6. Brief biodata of moderators

6.1 Dr. Shriram Sharma (PhD)

Department of Physics, Amrit Campus, Tribhuvan University, Kathmandu, Nepal

Dr. Shriram Sharma obtained his PhD and conducted post-Doctoral research in the field of Lightning from Uppsala University Sweden and Colombo University Sri Lanka. He has been educating engineers and technocrats for more than a decade. Dr. Sharma is the chairman of South Asian Lightning Network, Chairman of Lightning and Atmospheric Research Centre Nepal and the senior faculty of Department of Physics, Amrit Campus, Tribhuvan University, Kathmandu Nepal. Dr. Sharma is one of the influential presenters in the field of lightning and a globally recognized lightning expert and a leader of drafting of the electrical code of Nepal under Department of Urban Development and Building Construction (DUDBC) of the Government of Nepal.

6.2 Prof. Dr. G. R. Nagabhushana, (Retd.)

BSc (Mysore University), BE, ME, PhD (all from Indian Institute of Science, Bengaluru)

From 1965, Dr. Nagabhushana has been dealing with various aspects of lightning and protection from lightning of: Transmission lines, Satellite Launch Pads (of ISRO), Power equipment & Insulation coordination, 1989- A project was awarded by ADA, Bengaluru for design, fabrication & commissioning of a unique Lightning Test Facility having 4 million volts Impulse (Lightning) Voltage Generator, 200,000 A, 100,000 A, 2000 A and 200A Impulse (lightning) Current Generators representing the worst lightning stroke, for lightning performance evaluation of Light Combat Aircraft (LCA) of ADA. This facility was and even now being used under his guidance to evaluate the lightning performance of Light Combat Aircraft, Hansa Aircraft, other Aircraft components of HAL (Bengaluru, Hyderabad, Lucknow, etc.)

6.3 Prof. Mohd Zainal Abidin Ab Kadir, FASc FIET PEPC ACPE CEng PTech

Centre for Electromagnetic and Lightning Protection Research (CELP), Advanced Lightning, Power and Energy Research Centre (ALPER), Faculty of Engineering, Universiti Putra, Malaysia.

Prof Zainal received his BEng and PhD degrees from Universiti Putra Malaysia (UPM) and University of Manchester, UK, respectively. He is a Professional Engineer (PEPC), a Chartered Engineer (CEng) and a Professional Technologist (PTech). Prof Zainal is a Fellow of Academy of Sciences Malaysia (FASc) and Fellow of the IET (FIET), as well as an IEEE Power & Energy Society (PES) Distinguished Lecturer in the field of lightning and high voltage engineering. He has authored and co-authored over 400 journals and conference papers. He has supervised over 28 PhD and 42 MSc students. His research interests include high voltage engineering, lightning protection, electromagnetic compatibility, power system transients and renewable energy. Currently, he is the Chairman of the NMC of IEC TC 81 (Lightning Protection) and Local Convener of CIGRE Malaysia C4 on System Technical Performance.

6.4 Er. Gopa Kumar S

Technical coordinator of Lightning Awareness and Research Centre (LARC), Trivandrum.

Gopa Kumar is an Electrical Engineer, having more than 27 years' experience in electrical safety, lightning protection, EMI/EMC of electrical installation. Conducted 100's of site studies on failure in electronic equipment and presented papers in more than 1000 seminars and training programs, globally. He has published articles about safety in various magazines and published the book, THE MISSING LINK in the subject of electrical safety. He is a member in the working groups of IEC technical committees and a member in BIS committees.

- IEC - TC64: (LV electrical safety) MT 3, MT 12, MT40, MT 41, PT 60364-8-3, WG 43
TC81: (IEC 62305 – Lightning protection) ahG 19, MT 3, MT 14, MT 21, WG 18
SC 37 A: (IEC 61643– SPD's for LV application): WG3 & WG 5
- BIS - ETD 20 (National Electrical Code, IS732, IS3043, IS/IEC 62305) & ETD 30
National Building Code-2016 (electrical committee).

7. Webinar proceedings, subjects covered in the webinar

As the Chairman of SALNET, **Dr. Sriram Sharma**, invited all guests and introduced the experts to the participants and invited Er. Gopa Kumar for his presentation on Nonscientific Lightning protection system in India the correct methods followed worldwide.

Er. Gopa Kumar explained the methods of LPS as per Indian standards, National electrical code and the IEC 62305. This IEC standard has been adopted internationally by almost every nation. The standard explains about designing

- a. Air termination system consisting of mesh, rods etc.
 - b. Number of down conductors depending upon the size of building,
 - c. Type A and Type B earthing,
 - d. equipotential bonding and SPD's,
 - e. Separation distance.
- i. In comparison to the Indian national standard, the ESE systems are explained as (1) A rod capturing lightning from a distance over 100 meters, (2) Passing the lightning current to the soil without damaging the building through a 70 mm² copper flexible and (3) An earth electrode. The promoters call these devices as new and modern technology and conforms to the French standard NFC 17 102.

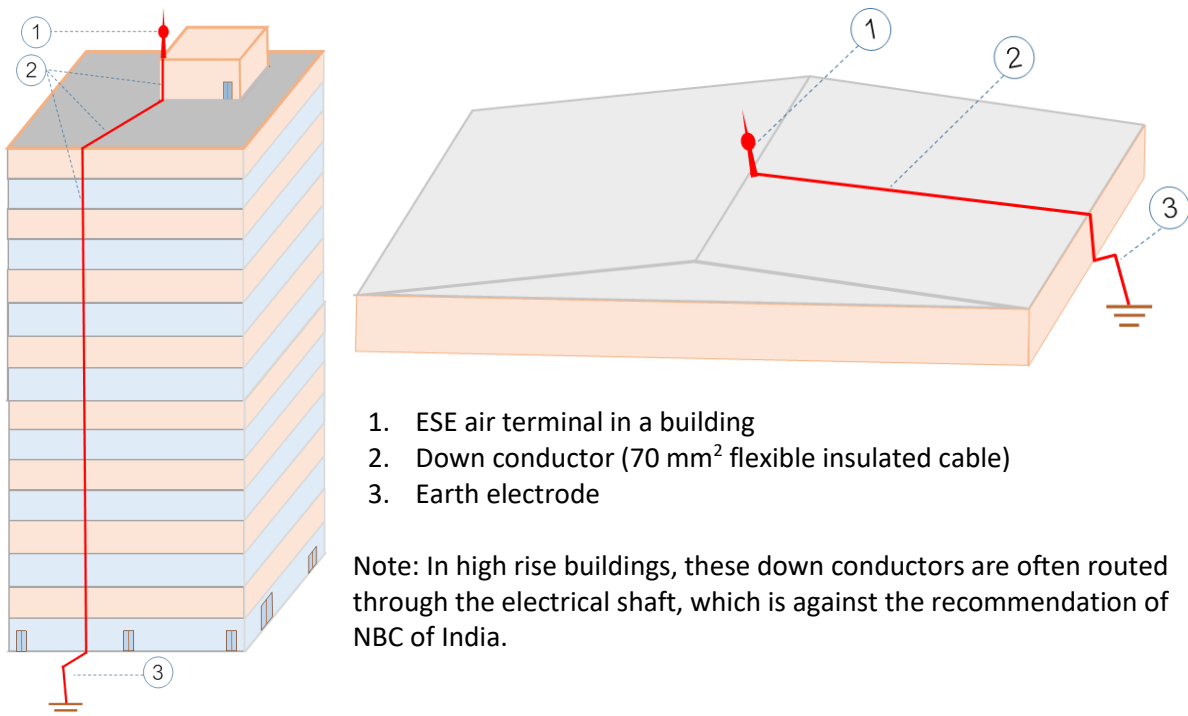


Fig. 1: ESE lightning protection system installed in India in typical high rise and industrial building.

- ii. Various clauses from this French code NFC 17 102 were explained and evaluated by Er. Gopa kumar. The French code explains the ESE LPS in a way which is in total disagreement with the ESE promotions happening in India. The French code explains about more than one down conductor, more than one earth electrode, proper equipotential bonding system,

separation distances, using natural components such as building steel for increased efficiency etc as explained in fig 2.

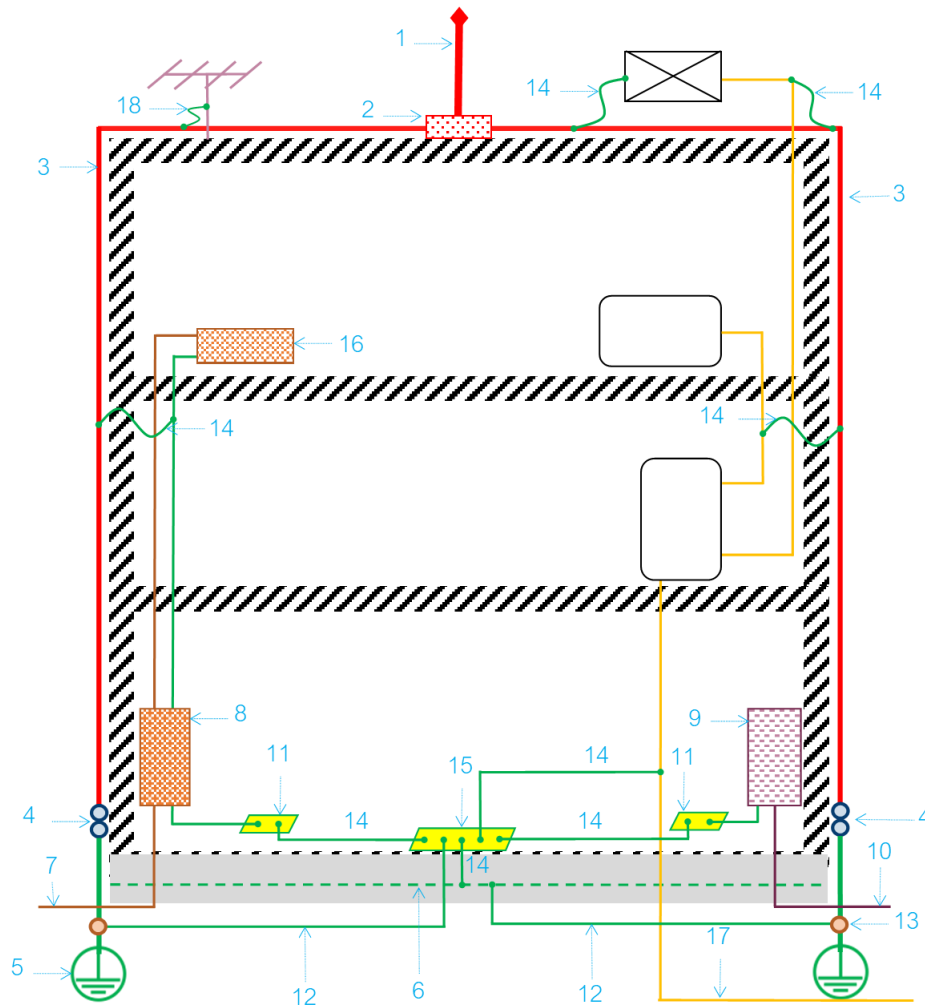
The French code claims increased efficiency of ESE rods with nonscientific principles such as

- (1) the time efficiency in time of an ESE rod in comparison to a normal rod (ΔT),
- (2) Speed of streamer as 10^6 m/s
- (3) formula to calculate the radius of protection

$$R_p(h) = \sqrt{2rh - h^2 + \Delta(2r + \Delta)} \quad \text{for } h \geq 5 \text{ m and}$$

$$R_p = h \times R_p(5) / 5 \quad \text{for } 2 \text{ m} \leq h \leq 5 \text{ m.}$$

- iii. Scientific communities, including the leading Standard committees in the world, strongly reject these claims, as the available experimental and theoretical knowledge falsify the computation method of ΔT . Even the speed of the answering leader is measured to be 10^4 - 10^5 m/s, as per the latest fast video techniques available at present. This results in 10 -100 times decrease in the efficiency (height advancement) of these rods. The working principle of these rods are included either in IS standards or in IEC and most other international / national standards.
- iv. NFC17-102 recommend the ESE rod to be tested to prove its Δt , as this is the most important parameter deciding the controversial protection radius. However, the rods sold in India are tested with a completely different idea of a short time current flow of 8/20 μ S of few 10^4 's of kA's. This test at CPRI have no relation to the ESE concept. However, the ESE promoters falsely claim the CPRI test report as a proof of the efficiency of ESE rods.
- v. A more serious problem was brought up for discussion by Er. Gopa kumar in his presentation. There are some agencies making mass awareness classes on lightning safety. They educate nonscientific and funny theories about lightning and its safety measures. Some of the examples are
 - a. Lightning strikes such as Hill / Jungle lightning, river base lightning, coastal lightning, urban/semiurban lightning, carpet lightning.
 - b. A wooden rod and a cycle tire attract lightning and protect people.
 - c. ESE rod is called as lightning arrester, it works without sound and light during lightning, and they protect up to 1 SQ KM.
 - d. Lightning produces VHF sound (1-30 MHz)
 - e. Lateral strikes travel large areas through soil and kill people.
 - f. Planting tall trees around building dissipate lightning.
 - g. Mobile phone camera lights will attract lightning.
 - h. Hybrid lightning protection system installed to protect cities and villages.
- vi. It is learned that 37,000 of such non-science-based systems were installed in some states. Problems in LPS installed in cyclone shelters are also discussed and some commonly usable low cost LPS designs were presented.



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| <ul style="list-style-type: none"> (1) One or more air terminal (2) Connection component (3) Down conductor (4) A test joint for each down conductor (5) One earth termination for each specific down conductor (6) Foundation earth electrode (earthing of structure) (7) Electric power cable (8) Main electric power distribution box with SPD (9) Main telecommunication distribution box with SPD | <ul style="list-style-type: none"> (10) Telecommunication cable with SPD (11) One or more equipotential bonding bars (12) One or more equipotential bonding's between earth terminations (13) Dis-connectable bonding device (14) One or more equipotential bonding's (direct or via isolation spark gaps) (15) Main earthing bar (16) Electrical equipment (17) Metallic pipe (18) One or more equipotential bonding's (through spark gap for aerial mast) |
|---|--|

Fig. 2: Various components used in an ESE LPS as per French standard NF C 17 102.

Dr. Nagabhushana in his presentation explained the science behind the lightning and explained in detail the reasons behind the non-acceptance of claims (such as ΔT , 10^6 m/s and the formula for calculating the radius of protection). He expressed that the situation is alarming, the scientific community in India should woke up and STOP such nonscientific theories. Dr. Nagabhushana also

expressed his willingness to associate with agencies who are interested to do research on the Lightning protection.

Prof. Zainal in his presentation explained the ESE systems installed in Malaysia. There were several damages in buildings where ESE's are installed. Malaysia adopted IEC 62305 as the national standard for Lightning protection. He also explained

- i. The energy commission of Malaysia made a directive (energy commission direction/ST/No.4/2019, electricity suppl act 1990 [act 447]) as

"In accordance with the provisions under section 47, electricity act 1990 [act447], the commission hereby stipulates that the design, installation, supervision, testing, operation and maintenance of lightning protection device in buildings shall be made in accordance with the method of lightning protection system set by standard Malaysia MS IEC 62305 – Protection against lightning".

"it is reminded that, someone who found failed to comply with the commissions directive is to commit an offense and shall in conviction, be liable to a fine not exceeding two hindered thousand ringgit (MYR 200,000.00) or to imprisonment for a term not exceeding two years or to both in accordance with the provision of section 50 E, electricity supply act 1990 [act 447]".

- ii. As a result of this directive, it is mandatory to use LPS as per MS IEC 62305, violations will be treated as an offense and the violators are liable for affine and/or imprisonment. Prof. Zainal expressed that the government of India shall enforce this kind of a regulation in India to stop nonscientific lightning protection system.

8. Further discussions by experts

i. Explanation by Dr. Chandima Gomes

Dr. Chandima Gomes who participated the webinar explained about the speed of upward leader. Studies conducted in Brazil and South Africa with high-speed video cameras measured the speed of upward leader, which is 10^4 m/s or 10^5 m/s. This actual figure reduces the claim of ESE 10 to 100 times. This information is also published in journals.

With respect to the standards, No difference in French standard & IEC 62305 except for the attraction radius of the ESE devices. Surveys done in countries like Sri Lanka, Bangladesh, Malaysia where most people go for only one ESE rod instead of several rods, similarly only one ESE rod & one down conductor is used. Only in Malaysia scientific community could make the government accept & convince that ESE air-termination is wrong. Hence the energy commission directed that LPS shall confirm MS IEC 62305, violations will attract penalty and imprisonment.

Brief Bio of Dr. Chandima Gomes

(PhD, CEng (UK), CPhys (UK), FSAIEE, PrPhys (SA), MIET (UK), MInstP (UK)).

Professor of High Voltage Engineering,

Chairman, ESKOM Power Plant Engineering Institute (EPPEI)-HVAC,

Director, Center of Excellence on High Voltage Engineering,

University of the Witwatersrand, South Africa

Prof. Gomes is a Chartered Engineer (UK), a professional physicist in South Africa and a fellow of South African institute of Electrical Engineers. He was a Professor of Electrical Engineering at Universiti Putra Malaysia until October 2018, and the first Head of the Centre for Electromagnetics and Lightning Protection Research, Malaysia. He was a senior advisor of National Lightning Safety Institute (USA), and the chief advisor of African Center for Lightning Electromagnetics (ACLENet). He is also a founder & senior advisor of South Asian Lightning Network (SALNet).

In addition to lightning protection, grounding, and bonding, he is also an expert in EMI/EMC, occupational safety, atmospheric physics, and disaster management. He is a member of TC 81 of IEC 62305 Protection against Lightning, SABS TC 0067/SC Electricity Distribution, components and installation, and WG SANS 10313 Protection against lightning - physical damage to structures and life hazards.

He is a well-known engineering trainer in Asia and Africa, Prof. Chandima has conducted over 120 training programs worldwide and also published over 300 research papers.

ii. Explanation by Dr. Murali Das

Dr. Murali Das, Worked in fair weather atmospheric electricity & Lightning. Based on his experience in the field Earlier Streamer Emission will not work. In Global Electric Circuit, lightning does the function of generator. In this circuit if something is placed to produce longer streamer & early streamer it is simply nonsense. People get confused about static electricity & electricity. They think lightning is similar to static electricity. When people don't understand, it is easy to sell ESE devices & neutralizing devices. There was a Workshop in Bangalore where a few people in Chennai told they were being sold ESE rods for 3.5 Lakhs in 2006, at that time the normal installation of lightning rods might be only 15,000 rupees. ESE sellers don't follow Bureau of Indian Standards. Malaysia is able to impose the Malaysian standards as mandatory. India also strictly follows the Indian Standards.

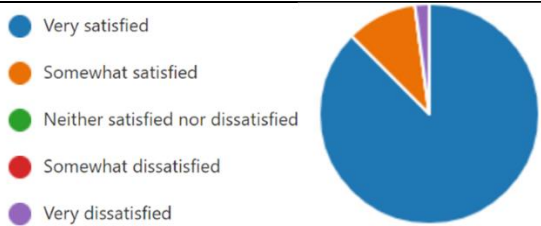
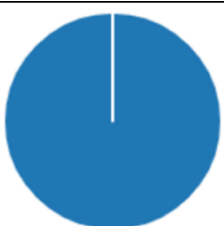
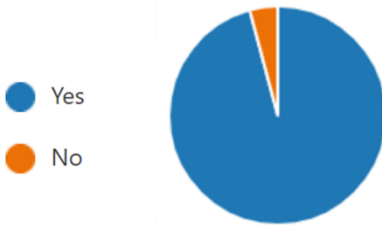

Brief Bio of Dr. S. Murali Das,

Scientist (Retd.), Atmospheric Sciences Division, National Centre for Earth Science Studies, Thiruvananthapuram.

He did his Ph. D in Atmospheric Electricity. He has executed three projects on Lightning, one funded by Ministry of Home Affairs. Govt. of India and the other two founded by Govt. of Kerala. His interest has been on the physics of the lightning, the mechanism of injury and property destruction in lightning accidents. He has been involved in development of instrumentation for monitoring cloud electric fields related to lightning. In one of the projects, he was involved in research to understand the cause of high lightning in Kerala too. He has several Publications in Atmospheric Electricity and Lightning in journals of repute.

9. Participation and feedback

The webinar started at 10.30 Am and continued up to 1.15 PM attended by more than 270 participants continuously. The total visitors during the webinar (who did not continue for complete) was 530. The report of the feedback is as below. Most of the participants were active throughout the event which is visible from the comments received in the chat box.

<p>Overall, how satisfied are you with the training</p>	<p>Presented concepts is clear and easy-to-understand</p>
	
<p>Thoroughly answered questions from participants</p>	<p>How likely are you to recommend this training to a friend or colleague?</p>
	

Some of the Important comments from the participants about the program are given below.

- A real eye opener on the unscientific approach in lightning protection
- very informative. expecting training regarding all aspects related to of electrical safety.
- Thank you for giving the idea on misconceptions of ESE LPS.
- Trainers are very clear about the topics, gained great experience after attending the webinar
- Why are the authorities not recommending to the government what has to be strictly followed and to stop the usage of cycle rim?
- 'The subject chosen was very good and need of the hour and the content of the training was good enough to explain the requirement of Non standards and nonscientific awareness session. Kindly share the PPT materials and slides.

10. Conclusion

The training program 'Non-standard lightning protection' was a complete success program, training more than 250 people at a time about the nonscientific methods followed in India on lightning protection.

All the experts and participants expressed their shock and worry on the nonscientific awareness classes conducted across India and requested the organizers to plan large scale awareness programs on the correct methods of lightning.

Faculties in this training program explained the subjects clearly to the participants, especially difference between myths and reality. Lightning is a deadly but often avoidable hazard. If the recommendations of the IS / IEC standards are implemented, the threat of this hazard can be greatly reduced. Through this training program faculties could make good awareness and understanding of standard lightning protection.

**The organisers thank and appreciate the presenters and the participants,
who has made this training program a complete success.**

Video of webinar
Nonstandard ESE Lightning
Protection System in India.

The truth and facts

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