

# Earthing Conference UK

25th & 26th May 2022

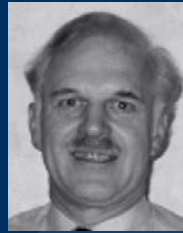
Park Regis - Birmingham, United Kingdom

## Your Keynote Speakers



### Stephen Palmer

- ◆ Managing Director at Safearth
- ◆ Originally Australia's leading earthing specialists, but now a true international business
- ◆ Committee Member for IEEE Std80, Std81, Std 837, Std 998, Std 1268 & Std 1246
- ◆ Convenor of the International CIGRE Working Group B3.54
- ◆ Secretary of the CIGRE & CIRED Joint Working Group B3.35 who produced TB 749



### John V H Sanderson

- ◆ Director, Power Engineering Consultants Plc - 32 years
- ◆ Director, Power System Protection
- ◆ Laboratory of UMIST. Supervised 15 PhD and 30 MSc students to completion - 18 years
- ◆ Chairman of IEE professional group P11- protection, metering and control - 3 years
- ◆ Organiser: IEE North Western Centre, HV Earthing course - 1 year

## What You Will Gain From Attending?

- ◆ Learn how optimal electrical earthing design can improve production and reduce costs
- ◆ Gain practical advice on earthing system measurement
- ◆ Discuss compliance to standards with experienced electrical engineers
- ◆ Discuss safe and effective lightning protection and earthing
- ◆ Understand how to design earthing systems for challenging conditions
- ◆ Discuss the pitfalls of inappropriate earthing and the hazards caused
- ◆ Learn best practice when it comes to split factors in earthing design
- ◆ Hear relevant local case studies from the UK electrical industry
- ◆ Network with specialists in the field and your peers
- ◆ No sales pitches – non commercial presentations

## Who Should Attend?

- ◆ Electrical engineers and technicians
  - ◆ Substation, generation and transmission engineers
  - ◆ Maintenance engineers and asset managers
  - ◆ Engineering managers and electrical consultants
  - ◆ Plant, project and design engineers
  - ◆ Engineering and safety managers
  - ◆ Lightning protection professionals
  - ◆ Renewable energy specialists
  - ◆ Government safety regulators/inspectors
  - ◆ Network, protection and distribution engineers and technicians
  - ◆ Maintenance specialists
- And all other electrical engineering professionals who have an interest in earthing.

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# Introduction to Earthing

Few topics generate as much controversy and debate as that of earthing and the associated topics of bonding, grounding, surge protection, shielding and lightning protection of electrical and electronic systems. Poor earthing practices can be the cause of continual and intermittent difficult-to-diagnose problems in a facility. This conference will explore these issues from a fresh yet practical perspective to help delegates reduce expensive downtime in their plant and/or equipment by identifying

the correct application of these principles.

The aim of this conference is to demystify the subject of earthing and present the subject in a clear, straightforward manner. Earthing as a subject has been under-represented over the years and this event will attempt to remedy the gaps in technical knowledge and improve practices in the industry. The UK & Europe need a unified practical approach to earthing which can be commonly understood and widely applied.

## Conference Program – Day One

25th May 2022

8:30am – Registrations Open

8:55am – Opening Address

9:00am – Session 1 **KEY NOTE**



### Optimising Earthing System Design and Management Through the Responsible Application of Quantified Risk Analysis

**Stephen Palmer** – Managing Director at Safeearth  
Convener of the International CIGRE Working Group B3.54

For years, many engineers involved in earthing system design and management have recognised that traditional approaches can lead to over investment through expensive, potentially unjustified, additional control measures at one extreme, and unreasonable residual risks to staff and the public at the other. The work of the Cigre and Cired Joint Working Group B3.35 was to investigate the optimisation of earthing system design through the application of quantified risk analysis approaches. The technical brochure subsequently published as TB 749, details the findings and recommendations of that group. In this presentation the author will illuminate that work and provide accessible and practical guidance on how earthing related risks can be better managed with consideration of economic, justified improvements or demonstrated tolerable residual risks.

10:00am – Session 2 **CASE STUDY**



### Earthing Rural Substations - Why There is No Such Thing as a Standard Earthing Design!

**Steve Sommerville** – Managing Director,  
SPE Electrical Ltd

A common mistake in earthing is the assumption that a standard design approach can be used at 11 kV. This assumption is both wrong and dangerous. HV earthing studies are carried out to determine the touch and step voltages of the system during a phase-earth fault; if these values are above a certain threshold then special mitigation measures are required to prevent shock risks to personnel, public and livestock. These risks are driven by local site conditions which may not be immediately obvious, and a standard design that may give a safe condition at one site, can give rise to a highly dangerous condition at a similar site, just a few miles away.

10:45am – Morning Tea

11:15am – Session 3



### HV and LV Earthing Requirements for HV Substations

**Alex Bezugly** – Senior Design Engineer, Freedom  
Electrical Design Services

This paper will offer a detailed explanation of HV and LV earthing system arrangements, and the requirements to keep those earthing systems combined or separate. HV bonding conductors and LV CPCs definitions will be covered and the common confusion these may cause

(examples will be given from relevant UK Standards). Alex will touch briefly on LV Neutral Earthing with explanation of TN-S, TN-C-S (PME and PMB) systems, examples of their utilisation and interface with an HV earth system. Finally, earthing conductor sizing for HV and LV earths and a overview of site constraints. This presentation aims to improve the quality of earthing designs and client's earthing specifications.

12:00pm – Session 4



### Assessing the earthing grids on solar farms using current injection techniques

**Richard Horan** – Managing Director, Horan Power  
Engineering Ltd

The earthing installations on UK solar farms are often poorly documented, which makes it difficult to assess the impressed voltages on metal structures during a fault. Commercial solar farms are vast, and the zone of influence is similarly extensive. Direct measurement of impressed voltages is possible, but only if you can get a voltage probe at a remote location out of the influence of the earthing grid. Existing methodologies for direct measurement of touch and step voltages are aimed at transmission applications where budgets are high and transmission lines can be used for the remote current probes. With a unique requirement to test over 130 solar farms, we looked to modify existing techniques to allow direct measurement of impressed voltages during an injected fault on a live solar farm.

The results matched well with computer models, but more importantly, some of the highest risks were associated with elements that are not usually modelled, such as CCTV towers and post and wire boundary fences. The direct measurement technique allowed us to quickly identify high risk areas and put in place mitigation.

This technique has applications across many large scale earth grid applications such as wind farms where the integrity and effectiveness of earthing grid is difficult to assess.

12:45pm – Lunch

1:30pm – Session 5



### Analysis of Earthing Grids in Multilayer Soils at High Frequencies

**Jayson Patrick** – Technical Director, Electrotechnik

Modelling earthing system behaviour during both power frequency fault conditions and at high frequencies, especially related to lightning phenomena, is of interest to earthing system designers. The behaviour of earthing systems at varying frequencies is quite different and this paper will present details of the algorithm developed and results in the form of a parametric analysis for multiple grids in different soil conditions for high frequencies.

## 2:15pm – Session 6



### Complex Earth Fault Current Distribution at Co-Located, Interconnected Sites

**Matthew Taylor** – Principal Engineer / Managing Director, Earthing Risk Management

The need for fault current distribution calculations, to provide accurate results in earth fault or 'rise of earth potential' studies is known. The technical standards provide equations that can be used to calculate the ground-return component of earth fault current. However, at complex sites such as power stations, transmission/distribution substations, onshore substation interfaces or battery storage sites, further analysis is necessary in order to determine the correct distribution of ground-return fault current. Failure to recognise this can lead to incorrect evaluations with the potential to cause safety hazards and under-size earth conductors or produce over-engineered solutions, even when accurate modelling software has been used. This paper explains the accurate simulation of ground-return fault current within complex earthing systems.

## 3:00pm – Afternoon Tea

## 3:30pm – Session 7



### A case study analysing the impact of earth potential rise from adjacent power system equipment at small industrial park

**Don Court** - Consultant, Electrical Engineer  
BSc (Hons) CEng MIET at Hoare Lea

The paper will provide a case study for a small park made up of typical steel framed, metal clad, industrial units which are to be constructed in close proximity to a 132 kV overhead line tower. The paper will evaluate the extent to which the proximity of the tower may introduce a hazard to the park in the event of power system faults, in particular 132kV system earth

faults at the tower or adjacent towers. Analysis will show that a 132kV system earth fault results in an area of high earth potential rise in the park which may interact with the metalwork in the part to introduce an unacceptable touch potential risk in and around the buildings. A number of structures of concern are identified, that may be intentionally or unintentionally earthed, where the earth potential rise – transferred from the earthing of the overhead line tower – gives rise to unacceptable touch potentials and locations that may give rise to equipment damage risks. The magnitude of the individual risks are appraised, following procedures outlined in the UK national annex of BS EN 50522 and the industry practice document ENA TS 41-24 to determine if mitigation measures are appropriate. A range of mitigation measures are then discussed for the risks identified.



4:15pm

PANEL DISCUSSION

### Panel discussion and Q&A with some presenters from day one and day two

**Hosted by Jonathan Williams** -  
Engineering Consultant PSE 2 Consulting

## 4:45pm – Day One Closing

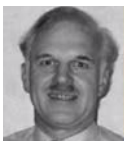
## 5:00pm – 6:00pm – Networking Drinks



## 8:30am – Registrations Open

### Arrival, tea & coffee

## 9:00am – Session 8 KEYNOTE PRESENTATION



### Some theory, and stories, about earthing, lightning and cable armour currents

**John V H Sanderson** - Fellow, Director, Power Engineering Consultants Plc.

Currents must return from whence they came, except for lightning! Cable armour currents are very widely used as part of HV earthing but they may cause damage if not well managed. Results of Computer modelling of earthing designs are difficult to check. Lightning current is unstoppable - all we can do is divert to somewhere safe.

John spent the whole of his life doing theoretical and practical work on power systems. He was Director of the Power System Protection Laboratory of UMIST at the University of Manchester for 15 years. He taught under graduate and post graduate courses and supervised approximately 30 PhD and MSc students. He left academia to set up Power Engineering Consultants Plc in 1989. From an early date the Company had seven engineers engaged on setting protection relays and doing arc flash, earthing and lightning studies. This was in addition to substantial amounts of commissioning of HV plant especially 33kV substations, 11 kV generators and generator control panels. John engaged with the IEE as chairman of committee P11 which organised international conferences on Protection, Metering and Control. He also took his turn to chair the UK North Western Centre of the IEE.

The keynote presentation at this conference is about putting earthing matters in perspective. John will do this by giving examples from his experience, some but not all, in anecdotal form.

## 10:00am – Session 9



### A decade without fault: reimagining telecommunications earthing

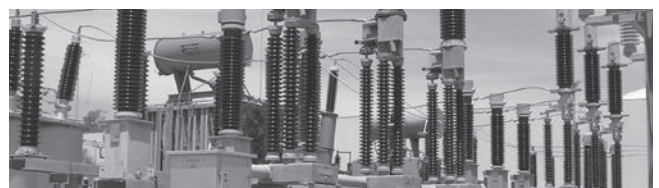
**Sean Elliott-Maher** - Communications Director, Earthing Services UK Ltd.



**John Maher** - Technical Director, Earthing Services UK Ltd.

Superfast Broadband deployments heralded a new era of access to information, communication and entertainment. However, the technology was reliant upon antiquated earthing methods. Costs spiralled, construction programmes slid and failures threatened the viability of the deployments. By embracing this point of weakness and seeking expert help new methods were explored until the optimal solution was determined, reducing OpEx, achieving target values every time and preventing earthing threats from ever causing service interruptions. Since then further earthing enhancements have been incorporated, procurement methods mitigating contractor deviation have been adopted, and centralised compliance methods provide a robust, holistic approach to telecommunications earthing.

## 10:45am – Morning Tea



## 11:15am – Session 10



### Safety in Underground High Voltage Power Lines Ancillary Facilities

**Himanshu Negi** – Senior Electrical Engineer, Arcadis Consulting (UK) Limited

The cables are an essential part of the modern power transmission network. The common types of modern underground cable construction include high-pressure fluid-filled, gas-filled as well as solid cross linked polyethylene (XLPE) cables. Due to the demand for longer lines, higher current capacity and environmental problems at critical locations, cables are also used in combination with overhead power lines. In both partial and complete underground cable networks the metallic sheaths of cables are connected to earth at certain points of the circuit to minimize energy losses as well as to protect workers who maintain the power lines. Depending on several factors, the cable system requires different ancillary facilities such as sealing ends or transition stations and joint bays. Some of these facilities are constructed underground while others are aboveground. This paper discusses touch voltages and Earth Potential Rise (EPR) issues at such ancillary facilities.

## 12:00pm – Session 11 VIRTUAL PRESENTATION

### Increasing foot to ground impedance using crushed aggregate, footwear, and bitumen – Magic bullets or what?



**Dr. William (Bill) Carman** – Director of Bill Carman Consulting (BC2) BE (Elec)(Hons 1) PhD FIEAust CPEng NER APEC Engineer IntPE(Aus) SMIEEE

If EPR reduction and equipotential grading aren't practical risk reduction measures for a project, can high resistivity surfacing materials such as crushed aggregate and bitumen, or safety work boots be relied upon to limit electric shock hazards for utility operators, maintenance staff and the public? Is 3kohmm crushed aggregate or 10k ohmm asphalt a realistic assumption for a designer to make? How do lab test results relate to field installation performance? How will the new work done by the IEEE task force help designers? This presentation evaluates the performance of series impedance insulation used as an earthing system safety mitigation measure in the light of testing work undertaken and the inclusion of QRA within Australian standards for indirect shock risk management.

## 12:45pm – Lunch



## 1:30pm – Session 12

### AFTERNOON WORKSHOP



### Earthing System Measurement – Traditional practices, modern techniques, real experience and practical advice

**Stephen Palmer** – Managing Director at Safeearth.

Historically, the measurement of earthing systems has been difficult, expensive, and in some cases, inaccurate. New testing methods, instruments and analysis techniques are being developed which are increasingly being adopted across the globe. In contrast, earthing is becoming more complex due to shrinking substation footprints, closer proximity to third party infrastructure and increased interconnection through the wider use of various earth wires and cabled networks. This has made simple test methods ineffective and led to the broader adoption of more advanced methods.

This context has led many to contemplate what is being done in terms of earthing system testing, by whom, how often and with what justification regarding period and cost. Furthermore, some have wondered, of these commonly applied techniques, what are their strengths and weaknesses, what positives and negatives are evident from each, and how have they been improved or modified, if at all, by others around the world.

August 2018 saw the formation of a Cigre Working Group designated B3.54 with the specific assignment to research, analyse and understand all the information necessary to write a Technical Brochure on these issues.

Of particular interest are the range of testing methods applied and the great spread of what is considered best practice or what is even necessary. There is also evidence throwing into question whether earthing system testing is well enough understood to obtain reliable results and whether anything other than reliable results is sufficiently valuable to justify the costs, including the cost of the test and the associated costs such as storage, review, decision making and other asset management activities.

### About the Workshop Presenter

**Stephen Palmer** – Stephen Palmer is Managing Director of Safeearth. He is an internationally recognised earthing specialist, with expertise in all areas related to earthing, including design, testing and investigation in sectors including power generation and delivery, heavy industry, mining and rail. For over 20 years Stephen has investigated and managed the risks associated with earthing, lightning protection and interference. As the leader of an international team of 40 consultants & researchers, his experience extends well beyond the technical aspects of the field. He has been a contributing member on the committees responsible for Australian documents including EG-0, AS/NZS 3007 and AS 2067. He is a committee member for IEEE Std80, Std81, Std 837, Std 998, Std 1268 & Std 1246. He is the Convenor of the international CIGRE Working Group B3.54 on earthing system testing and was the secretary of the CIGRE & CIRED Joint Working Group B3.35, which published TB 749 on substation earthing design optimisation including quantified risk analysis. Stephen has delivered formal earthing training for more than a decade and has presented at numerous Australian and international conferences including for the NSW Government, Energy Networks Association (ENA), Engineers Australia, CIGRE, CIRED and the IEEE.

## 3:00pm – Afternoon Tea

## 3:30pm – Conference Closing

## Sponsorship Opportunities

Representing your business at the Earthing UK Conference in 2021 will provide you the opportunity to reach key decision makers from a multitude of industries.

For more information on sponsorship and exhibition opportunities please contact:

**Emma Cameron** at: [emma.cameron@idc-online.com](mailto:emma.cameron@idc-online.com)



# About the Keynote Presenters



## Stephen Palmer

Stephen Palmer is Director of Safeearth, Australia's leading earthing specialists. Stephen has expertise in all areas related to earthing, including design, audit and test in sectors including power generation and delivery, heavy industry, mining and rail. For over 20 years

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## General Information

### Confirmation Details

A confirmation email and invoice will be sent to delegates within 3 days of receiving the registration.

### Cancellation Policy

A 20% cancellation fee will apply for cancellations received 7 – 14 days prior to the start date of the conference. Cancellations received less than 7 days prior to the start date of the conference are not refundable, however substitutes are welcome.

### Venue

#### Park Regis Birmingham

160 Broad Street, Five Ways, Birmingham B15 1DT, UK  
Tel: +44 121 369 5555

### Accommodation

The conference venue has accommodation available. Please book through their website and use the code 'CORPORATE' which will give you a 15% off discount code off the best available bed & breakfast rate. For any booking questions please speak to the reservations team on [hello@parkregis-birmingham.com](mailto:hello@parkregis-birmingham.com) or call 0121 369 5555.

### Food and Beverages

All lunches, morning and afternoon refreshments are included in your delegate registration.

### Unable to Attend

If you are unable to attend the full conference program, contact us for details to attend individual sessions or to purchase the Conference Resource Kit.



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### Attendees

1:  Mr  Mrs  Ms Name: \_\_\_\_\_ Job Title: \_\_\_\_\_  
Email: \_\_\_\_\_

2:  Mr  Mrs  Ms Name: \_\_\_\_\_ Job Title: \_\_\_\_\_  
Email: \_\_\_\_\_

3:  Mr  Mrs  Ms Name: \_\_\_\_\_ Job Title: \_\_\_\_\_  
Email: \_\_\_\_\_

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## 02 How Did You Hear About This Event?

- Received an email from IDC  Received an email from the Institution of Engineering and Technology IET  
 Searched online (Google, Yahoo etc)  Recommended by a friend/colleague  Magazine advertisement/insert  
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