JWG CIGRE Study Committees C4, A3, B2 and B4

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

JWG N° C4/A3/B2/B4.75	**Name of Convenor:** Massimo Marzinotto (ITALY) **E-mail address**: massimo.marzinotto@terna.it
Strategic Directions #[2]: 1,2,3	**Sustainable Development Goal #[3]:9**

The JWG applies to distribution networks: ☒ Yes / ☐ No

Potential Benefit of JWG work #[4] : 2,3

Title of the Group: ***GUIDE TO PROCEDURES FOR THE CREATION OF CONTAMINATION MAPS REQUIRED FOR OUTDOOR INSULATION COORDINATION***

Scope, deliverables and proposed time schedule of the JWG:

Background:

Contamination is a dominant factor for the dimensioning of outdoor insulators, especially for AC in medium/heavy polluted environments and in general for all polluted environments in DC.

A minor revision of the IEC 60815 Technical Specification is ongoing mainly focused of the selection and dimensioning of insulators in polluted conditions. This work highlights that many aspects for the selection and dimensioning are still not technically clear and even sometimes misleading with an impact that can give rise to an over or an under dimensioning design and even incorrect insulator type selection as well.

The uncertainty on the site contamination severity most of the time hampers the proper insulator selection and design. Sites can be exposed to different types of contaminations clustered in two different type A and B as per IEC 60815. One of the two can prevail, but sites with both types of contamination are also possible, with one type predominant in a specific period of the year and the other predominant in another period of the year. According to the IEC procedure, the Site Pollution Severity (SPS) is mostly defined based on the direct contamination measurements on reference insulators (presently standard glass or porcelain cap and pin insulators and long rod porcelain insulators, both in vertical position). For AC applications reference is made to non-energised insulators, while for DC the energised insulators are an obliged step (due to the strong influence of the electric field on the contamination capture). One of the main challenges is how to manage such measurements on the insulation design: are the statistics robust? Furthermore, a proper statistical post processing of the data is needed to extend the measurements to insulator types different from the reference ones.

Many countries are facing the need to create a contamination map and are proceeding with different approaches, including traditional methods of direct contamination measurements on insulators, but also indirect contamination measurements (dust deposit gauges), leakage current measurements, salt and dust transportation modelling in combination with meteorological data and satellite data. A review of such methods with particular attention to the new approaches based on a mixture of measurements and inference through specific numerical models should be collected by CIGRE with the aim to report the state of the art, discuss pros and cons of each solution and provide guidelines to aid practitioning engineers when conducting this type of analysis.

Purpose/Objective/Benefit of this work:

Contamination maps are essential to optimise the insulator design from the contamination point of view, thus increasing the system reliability and reducing the overall costs deriving from over or under design.

The main objective of the JWG is to analyse and compare the experience in the different countries and approaches to give guidelines for the creation of contamination mapping for use in insulation co-ordination and to stress the advantages of the statistical approach for insulator design.

Scope:

The JWG will produce a guideline document dealing with the following main topics:

1. A review of different approaches for insulator contamination assessment: traditional approaches (e.g., based on direct and indirect site measurements, service experience, etc.) and new approaches based on contamination modelling, etc.
2. Analyse and compare the experience of the different countries regarding contamination mapping following the IEC approach (site severity established based on the reference insulator/configuration) and statistical post processing of the measurements.
3. Duration of a contamination measurement campaign to give the minimum necessary robust information of a site.
4. Re-mapping the contamination: when does it become necessary?
5. How to extend contamination data revealed on reference insulators to different type of insulators: the influence of diameter, shape, material (ceramic vs. non-ceramic), orientation, etc.
6. The differences in the insulation contamination with the insulator installation height.
7. Contaminants to be used for laboratory artificial contamination tests: experience with non-conventional contaminants and their influence.
8. How to rearrange contamination data valid for the AC case to the DC case: the influence of static electric field and how take it into account.
9. Influence of the environmental relative humidity on the development of critical conditions that can lead to insulator flashover. How to take it into account: deterministic approach or statistical approach through specific probability distributions?
10. How to manage differences between laboratory tests and real field conditions: the representativeness of laboratory tests.

Some References:

Contamination mapping was partially discussed in the following CIGRE technical brochures and other relevant papers not reported here for the sake of brevity:

[1] CIGRE TF 33.04.01, "Polluted Insulators: A review of current knowledge", Technical Brochure, No. 158, June 2000.

[2] CIGRE WG C4.303 “Outdoor insulation in polluted conditions: Guidelines for selection and dimensioning: Part 1: General principles and the AC case.”. Technical Brochure 361. 2008.

[3] WG C4.303 CIGRE “Outdoor Insulation in Polluted Conditions: Guidelines for Selection and Dimensioning Part 2”: The DC Case Brochure 518-2012.

[4] E. Volpov et al, “Development of Outdoor Insulation Pollution Maps for IECo Power Grid”, paper C4-201. CIGRE Paris session 2018.

[5] E. Volpov et al, “Development of Desert-Dust and Sea-Salt Deposition Database Required for Outdoor Insulation Coordination in Israeli Power Grid”, paper C4-326. CIGRE Centennial session 2021.

Remarks:

Liaison members from SC C3 will be invited for their expertise in environmental aspects.

Deliverables:

☒ Annual Progress and Activity Report to Study Committee
☒ Technical Brochure and Executive Summary in Electra
☒ Electra Report
☐ Future Connections
☐ CIGRE Science & Engineering (CSE) Journal
☒ Tutorial
☒ Webinar

Time Schedule:

- Recruit members (National Committees) Q4 2023
- Develop final work plan Q2 2024
- Draft TB for Study Committee Review Q4 2025
- Final TB Q4 2026
- Tutorial Q4 2026
- Webinar Q4 2026

Approval by Technical Council Chairman:

Date: June 22nd, 2023

Notes:
[1] Working Group (WG) or Joint WG (JWG),
[2] See attached Table 1,
[3]See attached Table 2 and CIGRE reference Paper: Sustainability – at the heart of CIGRE's work.
[4] See attached Table 3

WG Membership: refer Comments at end of document

Table 1: Strategic directions of the Technical Council

1	The electrical power system of the future reinforcing the End-to-End nature of CIGRE: respond to speed of changes in the industry by preparing and disseminating state-of-the-art technological advances
2	Making the best use of the existing systems
3	Focus on the environment and sustainability (in case the WG shows a direct contribution to at least one SDG)
4	Preparation of material readable for non-technical audience

Table 2: Environmental requirements and sustainable development goals

	CIGRE selected the 7 SDGs that are the most relevant to CIGRE. In case the WG work refers to other SDGs or do not address any specific SDG, it will be quoted 0.
0	Other SDGs or not applied
7	**SDG 7: Affordable and clean energy** Increase share of renewable energy; e.g. expand infrastructure for supplying sustainable energy services; ensure universal access to affordable, reliable, and modern energy services; energy efficiency; facilitate access to clean energy research and technology
9	**SDG 9: Industry, innovation and infrastructure** Facilitate sustainable infrastructure development; facilitate technological and technical support
11	**SDG 11: Sustainable cities and communities** Increase attention on sustainable and resilient buildings utilizing local (raw) materials, power for electric vehicles, strengthening long-line transmission and distribution systems to import necessary power to cities, developing micro-grids to reinforce the sustainable nature of cities; protect and safeguard the world's cultural and natural heritage; reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and waste management
12	**SDG 12: Responsible consumption and production** E.g. Promote public procurement practices that are sustainable; address reducing use of SF6 and promote alternatives, encourage companies to adopt sustainable practices and to integrate sustainability information into their reporting cycle, address inefficient fossil-fuel subsidies that encourage wasteful consumption
13	**SDG 13: Climate action** E.g. Increase share of renewable or other CO_2-free energy; energy efficiency; expand infrastructure for supplying sustainable energy; strengthen resilience and adaptive capacity to climate-related hazards and natural disasters; integrate climate change measures into national policies, strategies and planning; improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning
14	**SDG 14: Life below water** E.g. Effects of offshore windfarms; effects of submarine cables on sea-life
15	**SDG 15: Life on land** E.g. Attention for vegetation management; bird collisions; integration of substations and lines into the landscape

Table 3: Potential benefit of work

1	Commercial, business, social and economic benefits for industry or the community can be identified as a direct result of this work
2	Existing or future high interest in the work from a wide range of stakeholders
3	Work is likely to contribute to new or revised industry standards or with other long term interest for the Electric Power Industry
4	State-of-the-art or innovative solutions or new technical directions
5	Guide or survey related to existing techniques; or an update on past work or previous Technical Brochures
6	Work likely to contribute to improved safety.

Comments:

1) CIGRE Official Study Committee Rules: WG Membership

a. Only one member per country (by exception of SC Chair)

b. WG nominees must first be supported by their National Committee (or local SC Member) as an appropriate representative of their country.

c. Acceptance of the nomination is granted by the SC Chair and advised to the WG Convener

2) Collaboration Space

https://www.cigre.org/article/GB/collaborative-tools-2

CIGRE will provision the WG with a dedicated Knowledge Management System Space.

The WG will use the KMS for drafting collaboration, capture and retention of discussion and meeting records.

Official country WG Members will be sent registration instructions by the Convener.

Official country WG Members may request the WG Convener to allow additional access for an extra national subject matter specialist to aid in the work at the national level, including NGN members.