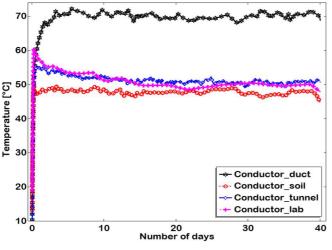


PS2-Q3: To what extent tests including more variable environmental scenarios offer enhanced reliability and system integrity?

The answer is in the context of Prequalification (PQ) testing of cables system under variable environments.

Testing in variable environment/ambient conditions leads to cable section of different temperature. See below a simulation based on the temperature measurement, from a circuit comprising 4 different environmental scenarios.



Ref: Abbasi et al, Cigré Session 2022, paper B1-10513

In this case only the hottest section will be maximally stressed and aged. However, the volume/length of cable under test is important since the probability of failure in a cable circuit increases with the cable length. Even in the test recommendations and standards a cable length of 100 m is required in a PQ.

See below paragraph from TB852.

Approximately 100 m of cable including complete accessories (at least one of each type) with a dielectric design suitable for practical applications shall be tested. Where appropriate, mechanical preconditioning may be considered before starting the Prequalification Test.

Increasing the length is not straight forward since the total length of testing loop is limited by equipment and testing facilities. To accommodate several testing environments in one loop, the length of hottest section might become shorter than 100 m, and hence the probability of failure decreases.

In addition, in a PQ with variable environment, the hottest spot of the loop may change in both position and high-temperature duration, and temperature regulation point needs to be adapted. Therefore, the accumulative ageing of loop may become lower. Certainly, the temperature control becomes very challenging.

Instead of simulating variable environments which happens in the field, the testing philosophy should be based on simulating possible failure modes/mechanisms. To the knowledge of the author there is no evidence of enhanced capturing of failure modes when variable environment is utilized. In conclusion, PQ testing of the entire cable length in nearly identical and thermally well controlled environments, will maximally stress the whole length to ensure the system reliability.