

## **Cigré Working Group A2/C4-39 – Transient Electrical Interaction between Transformers and the Power System**

### **Progress Report July 2009**

Prepared by Angélica da Costa Oliveira Rocha, Convenor

#### **Summary**

The working group was proposed by Mr Pierre Boss at A2 2007 Bruges Colloquium and was given formal approval by the Cigré Technical Committee in July 14<sup>th</sup> 2008. The group aim to issue an interim report in the end of 2010.

The objective of the JWG was to assess and discuss the different types of transient electrical interaction between transformers and other components of the T&D power system, motivated by a general increase in transformer dielectric failures in the system.

#### **Membership**

The membership of the group is, so far, mainly from transformer manufacturers, universities and consultants. The group lacks sufficient representation from utilities to deal with system simulations, necessary to characterize the types of transients imposed on transformers. Currently, it has 24 members, some have already attended meetings and others have sent contributions. These are:

| <b>Name</b>             | <b>Company</b>           | <b>Country</b>       |
|-------------------------|--------------------------|----------------------|
| Shin Yamada             | Toshiba                  | Japan                |
| Ryszard Malewski        | Consultant               | Canada               |
| Gabriel Alvarez Cordero | REE                      | Spain                |
| Barry Mirzaei, P.Eng    | Hydro One                | Canada               |
| Paul Jarman             | National Grid            | UK                   |
| M.Popov                 | Tudelf                   | Netherlands          |
| Xose M. Lopez-Fernandez | Universidade de Vigo     | Spain                |
| Usa Savadamuthu         | Anna University          | India                |
| Carlos Roy              | ABB                      | Spain                |
| Robert Middleton        | BCHydro                  | Canada               |
| Robert Degeneff         | USPOWER                  | USA                  |
| Daivd Peelo             | IEEE.                    | Canada               |
| Wolfgang Hribernik      | Arsenal                  | USA                  |
| Zhongdong Wang          | University of Manchester | UK                   |
| John Lapworth           | Doble                    | UK                   |
| Bjorn Gustavsen         | SINTEF                   | Norway               |
| Rene Martin Wimmer      | Siemens                  | Germany              |
| Hideki Motoyama         | Criepi                   | JAPAN                |
| Triomphant Ngnegueu     | AREVA                    | France               |
| Zanji Wang              | Tsinghua University      | China                |
| Robert Jeanjean         | Consultant               | France               |
| Alexaner Troeger        | ABB                      | Switzerland          |
| Q. Su (Charles )        | Petroleum Institute      | United Arab Emirates |
| Muhamad Reza            | ABB                      | Sweden               |

## **WEBSITE**

The group has recently organized a Cigre website and will use this to further enhance group communications

## **Meetings**

The group meets twice a year. It has held three meetings to date and a further meeting is planned to take place during the A2 Colloquium to be held on August 17th and 18th, 2009 in Cape Town, South Africa.

## **Actions at meetings**

### **1. Paris France 28<sup>th</sup> August 2008 – 1<sup>st</sup> meeting**

This was a start-up meeting, during the Paris Session, with 27 participants (C4 and A2 members, WG candidates and guests) interested in the work of the group.

The main focus of this meeting was to present the WG scope and plan the future actions. The main highlights were:

- The convener presented a summary of the work being carried out by the Brazilian Cigré A2/C4.3 and IEEE Transformer committee on this subject.
- Mr Glinkowski gave a brief presentation of the conclusions of the Cigre JWG 12/13/23.21 “Electrical Environment of Transformers”.
- Mr Tenbohlen, WG A2-37 convener, presented the importance of the transformer reliability survey as a reference for the work of A2/C4.39.
- The discussion about the scope of the group pointed out the importance of having case studies, based on failure descriptions, to be considered in transient simulations. Utility participants are expected to make contributions to this.
- The convener will propose an action plan, based on the scope of the WG, to be submitted to the members before the next meeting.
- The convener circulated among the participants some papers about transformer failures due to transients.
- The Japanese participant distributed copies of two IEEE papers about transformer failure due to resonance overvoltage caused by winter lightning.

### **2. Manchester, England 28<sup>th</sup> December 2008 – 2<sup>nd</sup> meeting**

- Presentation and discussion of WG scope review.
- Overview of the work of previous Cigré groups on the subject.
- Overview of the work of IEEE groups on the subject.

- The necessity to study and access the insulation coordination aspects not only in the time domain (Voltage transient amplitude) but also in the frequency domain (Voltage transient frequency spectrum).
- Creations of two task forces :

- Simulation Task Force, responsible for the definition of the case studies and digital simulations. The TF leader is Mr. Robert Middleton from BCHYDRO, Canada.

- Transformer Modeling Task Force, responsible for the analysis of the state of the art and different approaches of transformer modeling to be applied to the simulations. The TF leader is Mrs. Zhongdong Wang, University of Manchester, UK.

### **3. Lisbon, Portugal 28<sup>th</sup> March 2009 – 3<sup>rd</sup> meeting**

- Definition of the case studies considering once-only surge impulses (damped oscillatory waveform with different gradients) and repeated voltage impulses (circuit-breaker, disconnector reignitions etc).
- Frequency range to be analyzed : 10kHz to low MHz
- Transformer nominal voltage to be considered 52kV and above
- Substations for case studies: Substation 400/220kV in Spain REE, Brazilian GIS substation, Wind Power substation.

### **Conclusion**

The group as a whole has made good progress so far, but, due to the lack of a significant number of participants from utilities, the WG may have some difficulties to fulfill to the fullest extent some items of its scope, especially the ones concerning the utility experience regarding transformer failures/occurrences involving transients, risk factors pinpointing and the effect of different voltage levels and arrangements. As the transient electrical interaction between transformers and the power system is very application dependent, the greater the number of case studies, the richer will be the results. The WG convener is doing her best to draw more participants from utilities.

It is expected that the WG meeting next August in Cape Town will help to find ways to tackle this limitation considering the excellent expertise already available in the group.

Angélica da Costa Oliveira Rocha  
WG A2/C4.39 Convener

15<sup>th</sup> July 2009