IEEE/PES Transformers Committee
Fall 2005 Meeting
Memphis, Tennessee, USA

" The Evolving Problem of Corrosive Sulfur in Transformer Oil"

-- Panel Presentation & Discussion --
Monday, October 24; 4:45 to 6:00 p.m.

By Clair Claiborne, Anne Goldsmith, Lance Lewand, Tom Lundquist, and others

1. Abstract

Transformer oils meeting industry standards have historically proven to be essentially excellent products. Recent transformer failures attributed to corrosive sulfur have resulted in a reevaluation of present specifications and testing methods for transformer oil. New oils placed in transformers have been found to be corrosive when tested by proposed new test methods. Preventing or stopping the corrosive effect of sulfur contained in some oils is a challenge. This "panel presentation" will discuss:

- Crude oil selection and what decisions are made by the refiner regarding sulfur content.
- How corrosive sulfur attacks copper and how it impacts paper insulation and leads to transformer failure.
- A discussion of oil specifications and the investigation and testing of transformer oils regarding corrosion.
- What one might expect when tests are conducted on a large population of transformers.

2. Learning Objectives

This panel discussion will introduce the engineer to the corrosive sulfur problem with the intent the participant will leave the discussions with the following accomplishments:

- Basics of oil refining and how the refiner deals with sulfur in oil
- What corrosive sulfur can do in a transformer
- What new test methods are proposed to detect potentially harmful levels of sulfur
- How to prevent corrosive sulfur from being introduced into a transformer
- Steps that are available to stop the damage process
- What is a passivator (metal deactivator) and how it works

3. Learning Outcomes

Attendees at this presentation will gain a fundamental understanding of oil refining and the corrosive sulfur issue. They will also learn why careful consideration should be given to determine the level of corrosive sulfur in each transformer, particularly those transformers less than 5 or 6 years old. Participants will also gain insight into what is not well known about the issue and what steps are going on in the industry to further investigate these unknowns. They will get a summary of the results of tests conducted on over 100 transformers at one utility.

Participants will be given relevant facts that will prepare them to contribute to the industry as the solutions to the corrosive sulfur problem are addressed.

4. Presenter's Biographies

C. Clair Claiborne: Dr. Clair Claiborne received his B.A. in chemistry from the University of Kansas, Lawrence in 1973. He was employed by Sued-Chemie A.G. for two years and then obtained his Ph.D. in materials science and engineering from Northwestern University in 1984. Prior to completing his PhD, he was employed as a research chemist with Phillips Petroleum Co. for two years. In 1984, he joined Westinghouse Electric Corp and transferred to ABB Inc. in 1989, where he is a principal consulting R&D scientist and Environmental Specialist. He has worked on thermal analysis of insulating materials, combustion product determination, and a reclassification process for PCB transformers. His work has dealt in general with structure–property relationships of materials, insulating fluids and analysis and development of insulating materials, together with many related factory technical assistance issues. Dr. Claiborne is a member of the American Chemical Society, a senior member of the Society of Plastics Engineers, a member and committee officer of the American Society of Testing Materials and a member of IEEE. He is the co-inventor of six U.S. patents, and the author or co-author of more than 30 technical papers, and two books, "Working with Non-Metals in the Plant", and "Working with Metals in the Plant." In addition, he has been honored with the ASTM Award of Merit and the American Chemical Society's 54th Southeast Regional Industrial Innovation Award and shared an IR100 award for a natural ester based dielectric fluid. Clair lives in Apex, NC with his wife, Patricia.

Anne Goldsmith, CQM: Anne Goldsmith has over 20 years experience in research, production and operations planning for the plastics and petroleum industry. Originally a plastics research & development scientist, Anne helped develop and implement a corporate operations assessment program for use in synchronizing R&D-to-shipment processes. By using basic business and scientific tools, Anne is able to re-align products, product lines, operations and sales strategies. Anne has taught seminars and provided technical training to over 1500 in-house and industry research, sales and operations professionals. Her experience with specialty products and process development projects include military, automotive and environmental (EPA) specific products. As the Marketing Technical Services Manager for Calumet Lubricants Co., Anne currently overseas the technical data management and product line education of Calumet Lubricants' diverse petroleum product offering including aliphatic solvents, specialty oils such as refrigeration oils and transformer oils, motor oils, and waxes. Anne holds degrees in Biology and Psychology from Bowling Green State University and is an American Society for Quality Certified Quality Manager. She is an active technical member of ASTM, API, ILMA and is an officer of the EPA's Horticultural Spray Oil Task Force.

Lance Lewand: Lance Lewand is the Laboratory Manager for the Doble Materials Laboratory. The Materials Laboratory is responsible for routine and investigative analyses of liquid and solid dielectrics for electric apparatus. Since joining Doble in 1992, Mr. Lewand has published numerous technical papers pertaining to testing and sampling of electrical insulating materials and laboratory diagnostics. Mr. Lewand was formerly Manager of Transformer Fluid Test Laboratory and PCB and Oil Field Services at MET Electrical Testing Company in Baltimore, MD for seven years. His years of field service experience in this capacity provide a unique perspective, coupling laboratory analysis and field service work. Mr. Lewand received his Bachelor of Science degree from St. Mary's College of Maryland. He is actively involved in professional organizations such as ASTM D-27 since 1989 and is a sub-committee chair. He is also the secretary of the Doble Committee on Insulating Materials.

Thomas G. Lundquist: Mr. Lundquist is an Executive Engineer, in the Electric System Engineering Department at Salt River Project in Phoenix, Arizona. Work assignments include special projects involving EHV equipment, consulting for system grounding and shielding, and transformer applications in utility facilities. He worked for Westinghouse Electric Corporation as a district engineer and as a service center manager. He is a recipient of the ASTM International Award of Merit and is Chairman of ASTM International D27 Electrical Insulating Liquids and Gases Committee. He is a senior member of IEEE, and Chairman of the Power Transformer Subcommittee. He received a BS degree in Electrical Engineering from the University of Arizona and an MBA -Technology Management from the University of Phoenix. He is a registered Professional Engineer in Arizona and Colorado.