

# Transmission Underground Cables Interest Group

Both fluid-filled and XLPE High Voltage Underground cables are an essential part of many urban transmission systems. While they offer a number of distinct advantages in certain environments, they are expensive to maintain and replace. Adding to these maintenance costs, many fluid-filled installations (self-contained and Pipe Type) have been in operation since the early twentieth century, and a great number of these systems are being operated outside their original design parameters. Additionally, demographic shifts leading to retirement and voluntary departures in the electrical utility industry have resulted in a decrease in technical knowledge and expertise in the area.

The objective of the Transmission Underground Cables Interest Group (TUCIG) is to provide a forum for the exchange of information on cable asset management and to establish and promote techniques and tools for improving the management of fluid-filled and XLPE High Voltage underground cable systems. The group's current emphasis is on the refinement of an asset management strategy and a cable health ranking system. The ultimate goal is to prioritize work programs in an organized fashion while taking budget concerns into account.

## Topics & Issues

Development of an Asset Health Index Model

Preventive and Corrective Maintenance

Strategies for Life Cycle Asset Management

Assessment of Available Technologies and Practices for Line Rating and Condition Monitoring Systems

Means of Minimizing Environmental Impact

Strategies to Mitigate the Reduction of Expertise



## Technical Advisor



**Mr. Joseph Jue**, a professional electrical engineer and graduate from McGill University with a Master of Engineering, has over 35 years of experience in the design, management and maintenance of underground cables. After working with cable manufacturers he moved to Ontario Hydro in the design of 230 HPPF cable projects. The majority of his career was then spent with BC Hydro/BC Transmission Corp where he was responsible for development of underground and submarine cable systems and investigation of failures, progressing to responsibility for the asset management, maintenance and operation of transmission cable systems. Until recently Joseph Jue had been a participant of the TUC Interest Group since the group was formed.



## Projects

- Workshop on Cable Racking and Anchoring
- Thermal Ratings for Cables at Crossing of Other Cables or Utilities
- Design and Installation of Racking and Anchoring Systems for EHV XLPE Cable in Manholes and Tunnels
- Design Guide for Cable Accessories
- Reference Manual for Transmission Underground Cable Systems
- Transmission Cables Systems Seminar
- Acceptable Vibration Limits and Forces in the Vicinity of Underground Cables, Phase I & II
- Cable Health Index Software
- Development of Non-Destructive Field Tests to Evaluate Insulation Condition of Paper-Insulated Transmission Cables
- Guide for the Selection of Transmission Underground Cable Systems
- Mitigation of Stray Currents on Underground Transmission Systems

## Topics & Issues

### Development of an Asset Health Index Model

- Determination of the major contributing factors required to assess the health of aging cable systems (e.g. an understanding of different components' aging processes, the determination of appropriate diagnostic tests and factors that affect life expectancy)
- Development of a mathematical Asset Health Index Model - an algorithm based on the major contributing factors
- Ranking of the results to prioritize alternative projects

### Preventative and corrective maintenance

- Best in class practices for inspection frequency and procedures
- Emergency response plan for major incidents and/or failures
- Mutual aid agreement between participating utilities
- Methods and equipment for non-destructive testing
- Guidelines for entering an energized manhole for maintenance inspection
- Data collection automation to facilitate a real-time health index
- Reliability Centered Maintenance

### Strategies for Life Cycle Asset Management

- Planning and decision making methodology to optimize spending allocation for maintenance and refurbishment or replacement projects
- Tools for evaluating residual life of cable systems
- Strategies for life extension of existing plant infrastructure
- End-of-life criteria

### Assessment of available technologies and practices for line rating and condition monitoring systems

- Guide for application of Distributed Temperature Sensors (DTS) for real time rating and condition monitoring
- Assessment and acceptance criteria for Dissolved Gas Analysis (DGA) results.
- Continuous online monitoring techniques to replace manual processes
- Eliminate the need for jacket tests on self-contained jacketed cables with sheath bonding by utilizing sheath current monitoring equipment

### Means of minimizing environmental impact

- Guidelines for managing oil leaks
- Spill containment systems
- Procedure for identifying and locating oil leaks



## Annual Activities

2-3 Meetings

1-2 Workshops

5-7 Conference Calls

Bi-Weekly Information Exchange

## Participation is open to:

Organizations owning and operating transmission cable assets

## Project Reports

Over the years more than 1300 projects have been completed and published in the fields of:

### Generation; Transmission Distribution; Utilization

For a complete listing, please consult our website.

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