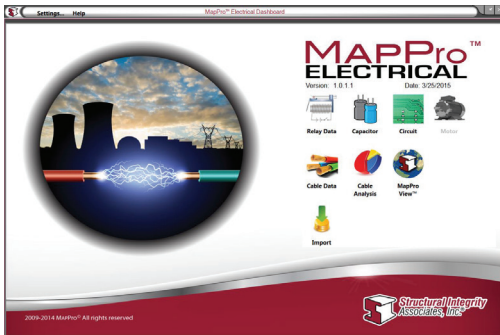




Structural Integrity
Associates, Inc.®

MAPP_{ro} ELECTRICAL AGING MANAGEMENT OF ELECTRICAL COMPONENTS



MAPP_{ro} Electrical is an integrated suite of applications for performing Life Cycle Management of electrical components and leverages SI expertise in the aging management and failure modes of cables, relays, EPAs, motors and other components. Sharing the same system architecture and user interface as the rest of the MAPP_{ro} family minimizes training and support costs while enabling plants to maximize component life, minimize maintenance costs and maintain operability of electrical systems and components.

WHY CONSIDER A CABLE AGING MANAGEMENT TOOL?

Electrical cables are a critical part of industrial facility and power generation infrastructure. The cables power the equipment and provide sensing information and control signals. For nuclear plant first and second license renewal, cable aging management remains one of the top 3 long term regulatory issues to manage, along with piping/vessels and concrete/structures. As with other long-lived passive components, cable aging needs to be managed to help ensure reliable performance for the life of the plant. The likelihood of failure increases the longer cable systems have been in service.

Cable failures have a variety of causes, including exposure to electrical transients, latent installation defects, or adverse local environmental conditions during operation. Some cables age relatively rapidly because of severe environments or service conditions. Independent of the mechanism, understanding and managing the data necessary to perform a rigorous engineering assessment and targeting the most susceptible cables is critical to success.

l to success.

EPRI recommends that plants have a cable aging management program. Most later license renewal programs require a cable aging management program, which includes determining the scope of the program and identifying the assessment strategy. The program scope should include both medium and low voltage cables. Current industry practices focus on inspection of cables approximately every 6 years for medium voltage cables, with sampling strategies used for low voltage cables. l functions by 2012.

MAPP_{ro} CABLE FOR CABLE AGING MANAGEMENT

The MAPP_{ro} Cable Module is part of the MAPP_{ro}™ family of Applications and can capture data into the MAPP_{ro} industry standard database platform. Elements of the database include cable screening, relative risk ranking, service environment, historical performance and inspection/test results.

This application considers the guidance provided in NUREG-1801, Generic Aging Lessons Learned (GALL) Report Section XI.E¹ and EPRI Plant Support Engineering guides on Low Voltage² and Medium Voltage^{3,4} cable aging management programs. The risk module considers industry inspection experience and NRC requirements⁵ for information to be included in cable aging management programs.



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WHY USE MAPPRO CABLE?

MAPPro CABLE allows users to manage information about low and medium voltage cables as part of a Cable Aging Management program. Data can be linked for viewing in MAPProView™. Risk ranking results can be viewed and data can be sorted and filtered for any element in the risk algorithm. Cable risk results can be integrated and evaluated along with testing results to better understand overall system risk conditions and recommended test interval. All data can be printed or exported to a spreadsheet for further manipulation.

MAPPro MODULES FOR RELAYS, CAPACITORS, CIRCUIT CARDS AND BEYOND

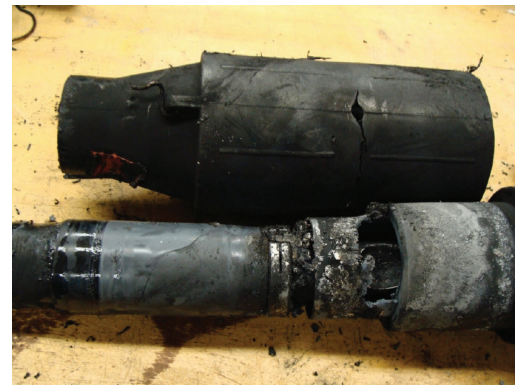
In 2010 INPO reported that a study of operating experience (OE) data from 2006 to 2010 identified relays, capacitors and circuit cards as significant issue components. As a result, INPO is now focused on these components. That same year the NRC issued Operating Experience Smart Sample (OPESS) FY 2010-01 which reported on findings and non-cited violations where components being used past their vendor recommended service life without adequate justification, or where accelerated aging occurred due to environmental conditions was the root or contributing cause. Relays and capacitors were leading components in these findings. In response, SI developed MAPPro modules for relays, capacitors and circuit cards. These modules enable plants to track service life and environmental conditions for these components, as well as to input inspection and test results. SI is also working to develop additional modules based upon components specific expertise and industry demand, with modules for motors and EPAs in current development.

MAPPro SUPPORT FOR SLR AND 50.69

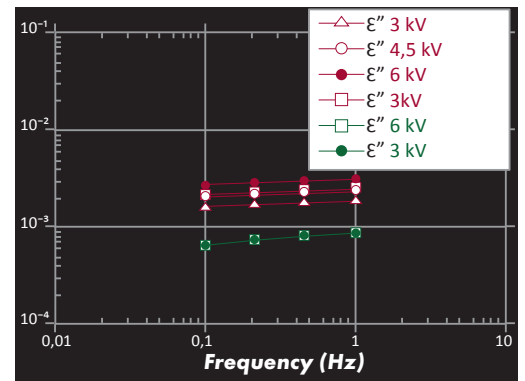
Industry needs are not stagnant but are driven by a need to extend plant life while simultaneously meeting regulatory requirements and reducing operating costs. For plants approaching Second License Renewal (SLR), the GALL-SLR has added Aging Management Program (AMP) requirements for metal enclosed bus, fuse holders, and high voltage insulators⁶. SI is currently developing modules to support AMPs for these components.

Another major industry trend is toward risk informed programs conforming to 10 CFR 50.69. The MAPPro data model allows for electrical components to inherit the 50.69 status of the plant system to which they belong, and can be easily modified to support the assignment of a risk category and, if applicable, alternate treatments. This allows for the LCM of all electrical components, including 50.69, in the same integrated system.

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Failed Medium Voltage Splice Assembly



Dielectric Spectroscopy Analysis
Provides Easy to Interpret Data for Wet Aging

REFERENCES

- ^[1] NUREG 1800, Generic Aging Lessons Learned Report
- ^[2] EPRI 1020804 – Aging Management Program Development Guidance for AC and DC Low-Voltage Power Cable Systems for Nuclear Power Plants
- ^[3] EPRI 3002000557 – Aging Management Program Guidance for Medium-Voltage Cable Systems for Nuclear Power Plants
- ^[4] EPRI 1021070 – Medium Voltage Cable Aging Management Guide
- ^[5] NUREG/CR-7000, Essential Elements of an Electric Cable Condition Monitoring Program
- ^[6] NUREG 2191, Vol. 2, Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report