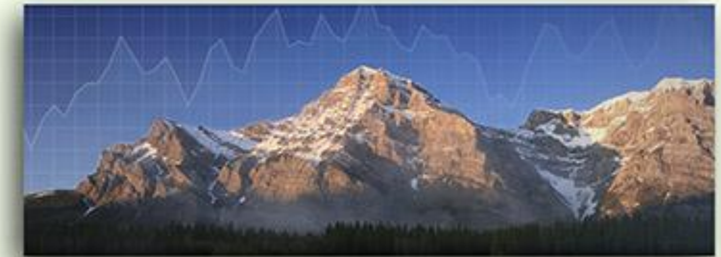




EPRI | ELECTRIC POWER RESEARCH INSTITUTE

EPRI Cable Aging Management Program Guidance Implementation

Fall ICC Meeting
Fountain Hills, AZ

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Topics

- Impetus for Cable Aging Management Programs
  - NRC push
  - Industry management push
- EPRI Cable Aging Management Program Implementation Guides

Impetus for Cable Aging Management Programs

- From 2008 through 2010, approximately 29 plants received NRC violations related to having submerged medium voltage cable
- In 2010, at least 3 plants received violations for having submerged low voltage cable
- Even though these cables were purchased for wet conditions, the NRC has not accepted that the cables were designed for wet conditions
- The NRC Inspection Manual requires Resident Inspectors to inspect three cable vaults and manholes twice a year for water and directs the inspector to give a violation if cables are water covered

Impetus for Cable Aging Management Programs

- In the EPRI Nuclear Power Council (the highest level EPRI advisory committee), January 2009, utility chief nuclear officers directed EPRI to create the guidance needed to resolve cable aging issues including guidance on setting up programs
- EPRI began work with utility members to develop cable aging management program guidance

EPRI Cable Aging Management Guides

Two Guides were issued in June 2010:

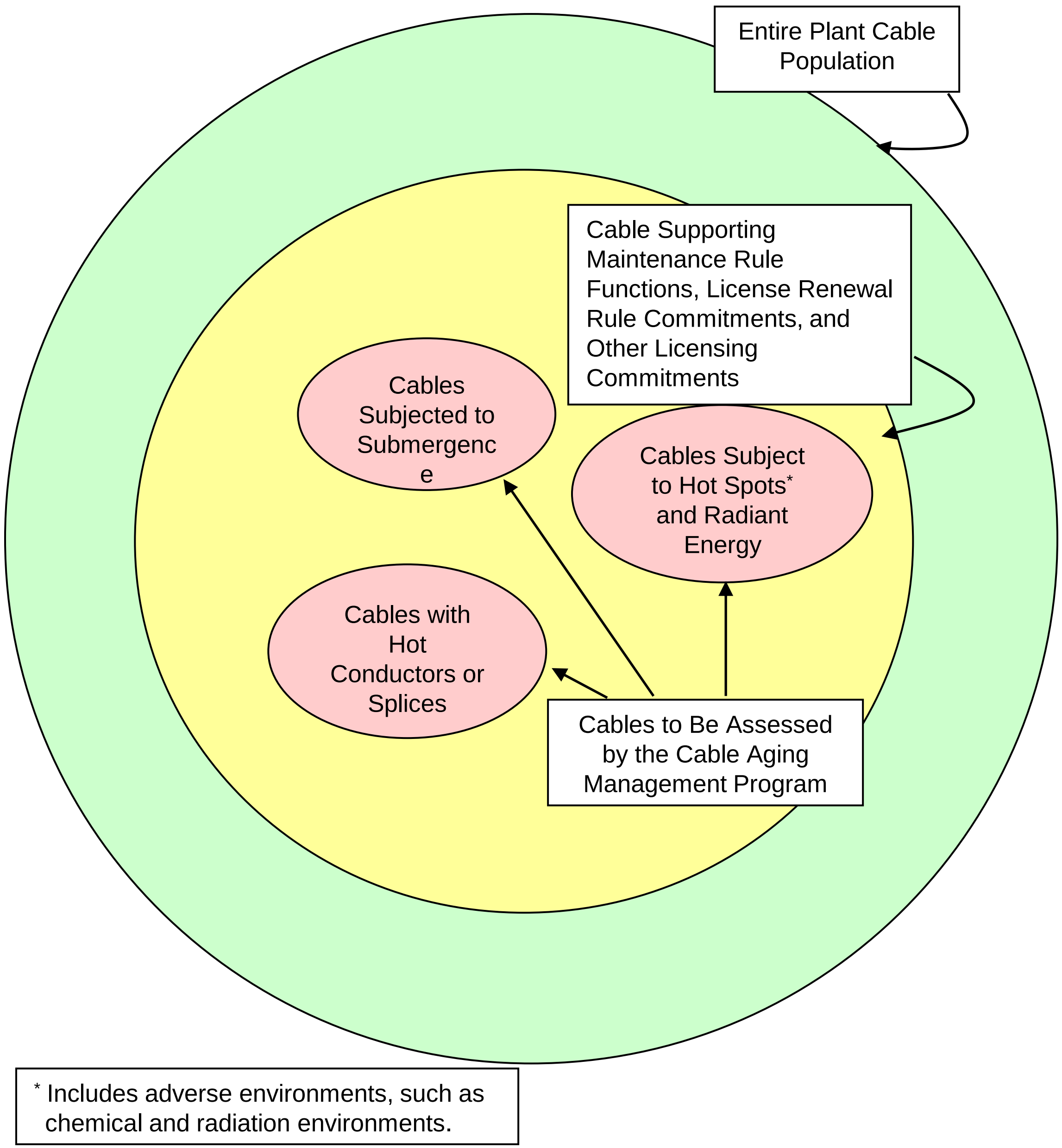
- 1020804: *Aging Management Program Development Guidance for AC and DC Low-Voltage Power Cable Systems for Nuclear Power Plants*
- 1020805: *Aging Management Program Guidance for Medium Voltage Cable Systems for Nuclear Power Plants*

Basic Guide Concepts

- Both Guides start with the concept that the overall scope of cables that could be considered is that set that supports Maintenance Rule functions:
  - Safety-related…systems and components that are relied upon to remain functional during and following design basis events to ensure the integrity of the reactor coolant pressure boundary, the capability to shut down the reactor and maintain it in a safe shutdown condition, or the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposure….
  - Non-safety related…systems, or components:
    - (i) That are relied upon to mitigate accidents or transients or are used in plant emergency operating procedures (EOPs); or
    - (ii) Whose failure could prevent safety-related structures, systems, and components from fulfilling their safety-related function; or
    - (iii) Whose failure could cause a reactor scram or actuation of a safety-related system.
- Additional scope cables include any additional cables from License Renewal (brings in a few more) and any cables that come from commitments in other licensing actions
- Operationally important cables not covered by Maintenance Rule scope can be added at management option

Basic Guide Concepts

- The cables to be assessed are those cables subject adverse environments or service conditions
  - Adverse environments:
    - Elevated temperature
    - Elevated radiation
    - Oil, chemical, hydraulic fluid exposure
  - Adverse service conditions
    - Wet/submerged
    - High ohmic heating
    - High resistance connections



Entire Plant Cable Population
Cable Supporting Maintenance Rule Functions, License Renewal Rule Commitments, and Other Licensing Commitments
Cables Subjected to Submergence
Cables Subject to Hot Spots* and Radiant Energy
Cables with Hot Conductors or Splices
Cables to Be Assessed by the Cable Aging Management Program
* Includes adverse environments, such as chemical and radiation environments.

Cable Program Development Guides

- Each nuclear power plant should have an aging management program for medium-voltage cable systems.
- The program will assess the condition of cables
- Plants will test wetted shielded MV cables and wetted LV cables that support Maintenance Rule functions
- MV cable tests will require separation from loads and circuit breaker back planes
  - Cable replacement may be necessary for a few MV circuits that have been wetted for extended periods (entire population will not be degraded)
- For dry low and medium voltage cables, adverse localized environments (high temperature, high radiation, or chemical exposure) will be identified and the effects on cables determined
  - Some thermal damage may be identified that requires repair or replacement of cable

Benign Environment Cables

- Much of the cable system is subjected to benign conditions (dry, low temperature (<104°F) and radiation, no chemicals)
- Under these conditions, the cables barely age leading to very long lives (>>60 years)

  The Cable Aging Management Programs will not evaluate these cables
- If some unexpected failure mechanism exists for benign environment cable, we will rely on the Maintenance Rule and corrective action programs for identification and requiring the issue to be addressed

Draft Regulatory Guide 1240 – *Condition Monitoring Program for Electrical Cables Used in Nuclear Power Plants*

- This guide describes a method that the NRC staff considers acceptable for condition monitoring of electric cables to meet the requirements of 10CFR50.65, the Maintenance Rule
- The NRC developed this Regulatory Guide in parallel with and independently of EPRI Cable Aging Management Guides

Summary of Comments on Draft Regulatory Guide 1240

- Section B, *Discussion*, contains many technical errors that could mislead utility and regulatory personnel. Examples are:
  - Medium voltage and low voltage condition monitoring techniques for wet and dry conditions are discussed as if they apply to all cables. The reader will likely misunderstand what tests to use and the types of degradation they can detect
  - The text while trying to encourage condition monitoring, disparages practical methods and reads as if getting useful results will be very difficult
  - Dc tests that IEEE standards state should not be applied to polymer insulated medium voltage cables are recommended
  - Nearly all of the 11 test methods listed in the RG are mischaracterized with respect to what they can detect or what cables they apply to

Summary of Comments on Draft Regulatory Guide 1240

- Section C.1, *Implementation* has elements that are similar to those in the EPRI Cable Aging Management Guides (1020804 and 1020805) with the following exceptions:
  - The Reg Guide infers all cables must be monitored rather than concentrating on cables subject to adverse environments
  - The Reg Guide assumes that data will be tracked on a per circuit basis rather than from a local hot spot basis, which is a key alternative that will be used
  - The Reg Guide assumes that all cable environments should be monitored and documented.
  - Section A lists the Maintenance Rule as the main requirement for implementing cable condition monitoring. However, the Maintenance Rule allows other alternatives and does not demand a large cable condition monitoring program

Current NEI-NRC Status of DG-1240

- Comments closure occurred on August 13
- NEI issued a formal letter to the NRC requesting withdrawal from further consideration of the Draft Regulatory Guide based on DG-1240 being "Unnecessary and Inconsistent with 10 CFR 50.65 (Maintenance Rule)"
  - Letter suggests that "the industry guidance documents" (1020804 and 1020805) should be used instead

    (Copy of Letter will be with meeting minutes)
- NEI also issued technical comments on DG-1240

Potential DG-1240 Outcomes

- NRC may decide to go no further
- NRC may decide to revise the DG
  - If a revision is made, the revisions are expected to be substantial and a new comment period is expected to be necessary

Conclusions

- Implementation of a Cable Aging Management Program is necessary for each plant
- EPRI 1020804 and 1020805 should be used as a basis
- EPRI 1021629 on I & C cable (very similar to LV Power guide) is expected by the end of 2010
- Development of a Cable Aging Management Plan in the very near term is highly recommended
- Determining scope and identifying assessment strategy is needed in the short term
- Full implementation of initial inspections and tests is recognized as taking a 2 to 3 operating cycles