



Cabling For New Nuclear Plants



Agenda

- Cable Types
 - Data
 - Fiber Optic
 - Instrumentation
 - LV Control & Power
 - MV
- Cable Options
- Accessories
- IEEE 383



Data Cable

- Coaxial/Triaxial Cable Used Now
 - Tested With Systems
 - New Systems – May Need To Be Tested
 - More Stringent Profiles
 - Higher Data Rate May Require New Cables
- Category Cables
- Field Bus
- May Need To Be Tested With Systems



Test Data Cable With System

- In RG 1.211
- “The qualification type tests for coaxial, triaxial and twinaxial cables should include sufficient testing of cable’s critical electrical performance characteristics to permit an adequate analysis of the compatibility of the coaxial, triaxial and twinaxial cables for the specific application, as appropriate.”



Fiber Optic Cable

- IEEE 1682 Being Written For Fiber
 - More Will Be Learned As Test Cables
 - Probably Not Very High Radiation
 - Higher Than Few Years Ago
 - Lower Temperature Maybe Worse For Fiber
 - Higher Temperature Worse For Polymeric
 - Fiber Copper Hybrid May Need to Be Addressed



Instrumentation

- Digital Circuit Vs Analog
- May Need Data Cable In Some Cases
- Shields May Need to Function Under DBE
- Insulating Jackets



LV Control & Power

- Shielding For Condition Monitoring?
 - How About I/C Cables?
 - If Shield, Insulating Jackets?
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MV

- **IEEE 383-2003 Requires Thermal Aging:**
 - Conductor Shield
 - Insulation
 - Insulation Shield
- **LCS Shields For Condition Monitoring**
- **Insulating Jacket?**
 - 75C



Cable Options

- Wet Rated Designs
 - Issue With NRC
 - How Do We “Qualify” For 40 or 60 Yrs?
 - How About Splices, etc
 - Issues With Data Cable and Fiber Change in Transmission Characteristics
 - Moisture Impervious Designs



Beta Shields

- Metal Shields Maybe Used as Beta Shields
- Need To Address Jackets Over Shield
 - Beta May Still Effect Jacket
 - Issue With Sumps
 - Insulation Jacket Under DBE



Low Smoke Zero Halogen

- To What Extent Required in US?
 - Better Systems Now
 - Still Some Compromises
 - Flame Testing
 - Aging
 - Pulling Lubricant Compatibility
 - Long Term Performance in Water



Condition Monitoring

- To What Extent Should Condition Monitoring Techniques Be Factored Into Initial Qualification?

- Can Jackets Be Used As Leading Indicators For Insulation?
- What Else Can Be Done To Put In Pacing Cables?



Accessories

- From RG 1.211
 - NRC Research Suggests The Potential For Cracking Of Age-Embrittled Cable Materials During Subsequent Installation Of Field Splices
 - Field Splices Of Age-Embrittled Cables Should Be Avoided
- Not Necessarily Correct, But Should This Be Addressed In Revision of IEEE 383?

Connectors

- In RG 1.211
 - The NRC Staff Has Witnessed Cables Which Have Passed A Qualification Type Test Without Connectors Only To Fail The Test When The Connectors Were Attached
 - The Failure Was Traced To Unequal Thermal Expansion Of The Different Cable Components Fixed At Both Ends Of The Cable With Connectors
- Does This Need To Be Addressed? IEEE 572 Has Connectors



IEEE 383 Revision

- Qualification For Submergence
- Condition Monitoring
- Data Cable Critical Characteristics
- Additional Descriptions
- Aging: Minimum Temp Point
- Flame Testing (Aged, Splice, etc)
- Average vs Peak Stress
- Expand Section 10 on Modifications



IEEE 383 Comments

- Looking For Comments
 - Send Them To John White Or Robert Konnik
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