Qualification of Fiber Optic Cables for Nuclear Power Plants

Presentation to SC-2

New Orleans, LA

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Jan Pirrong

CableLAN Products, Inc
800-840-6655
www.cablelan.com

Who We Are

CableLAN Products is the exclusive distributor of Draka Comteq communication cables for nuclear power plants, including fiber optic cables, coaxial and electrical communication cables.

Draka Comteq manufactures loose tube and tight buffered cables for a variety of harsh environments. It is located in Franklin, MA and is the **only** fiber optic and “Category” cable manufacturer with a 10CFR50, Appendix B QA program.

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Qualification Program

- In cooperation with GLS
- Tests conducted at Georgia Tech

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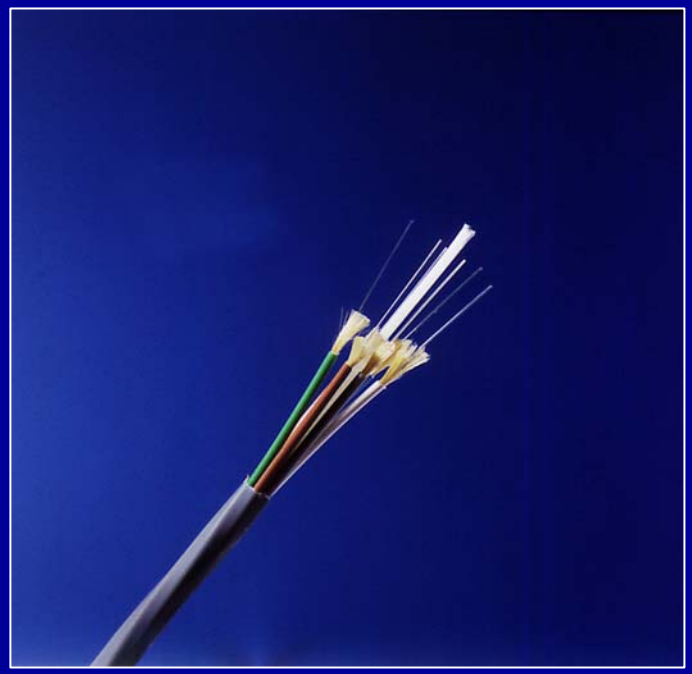
Relevant Standards



- IEEE 323
- IEEE 383

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Fiber vs. Electrical Cables

Electrical Cable

- Evaluate insulation
- Conductor not considered

Fiber Optic Cable

- Evaluate signal transmission
- Buffering only provides physical protection

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Electrical Cable Considerations

- Insulation Resistance
- Dielectric Strength
- Aging
- Flexibility
- Flame
- DBE’s

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Fiber Optic Considerations

- Monitor Attenuation
- Radiation
  - Dose
  - Dose Rate
- Thermal Aging
  - No Conductor Heat Rise
- Flame
- DBE’s

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Fiber Optic Cable Construction Evaluated

- Single Fiber
- 900 um Polyester Tight Buffer
- Aramid Strength Member
- Outer Jacket Non-Halogenated Thermoplastic Polyolefin

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Fiber

- 62.5/125 um
- Special Glass Formulation
- Lessened Radiation Impact
- Suitable for tight buffer and loose tube constructions

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Test Sequence

- Radiation
- Aging

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Establish Performance Base

Fiber Sensitivity to

- Total Dose Rate
- Dose Rate

Buffer and Jacket Material

- Aging

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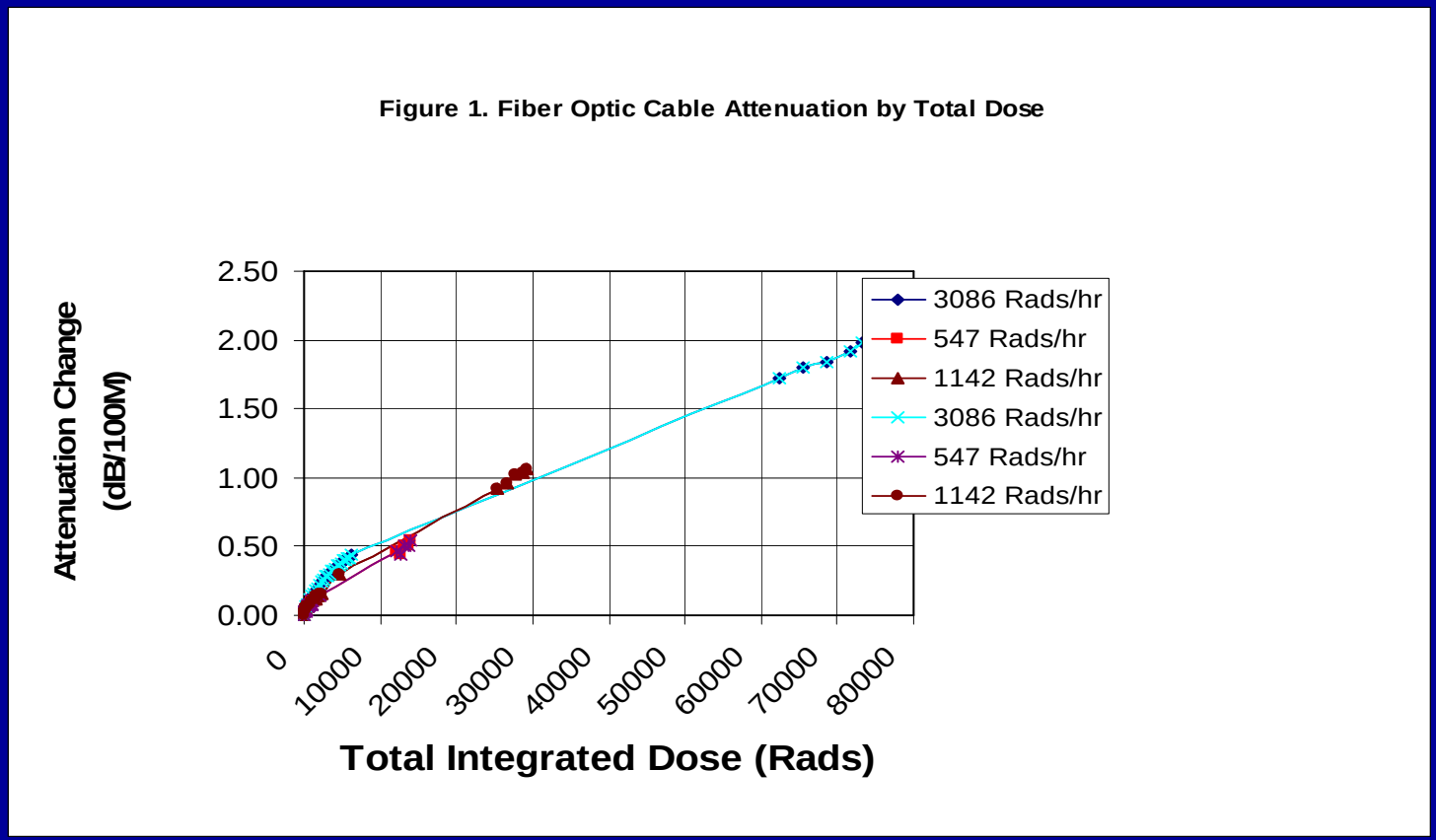
Attenuation by Total Dose



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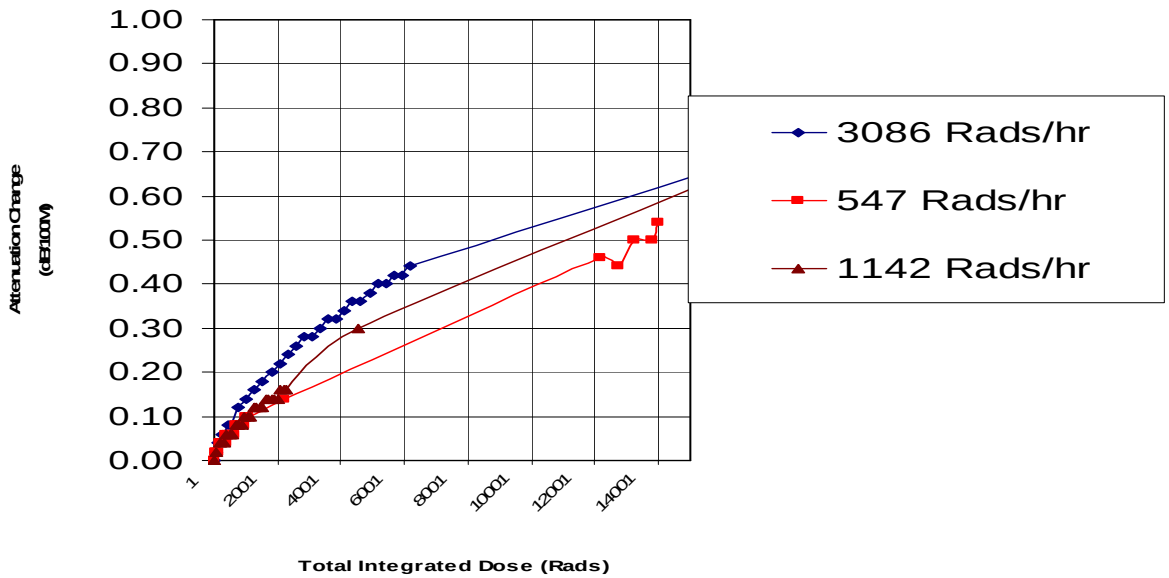
Dose Rate Effect

Figure 2.Fiber Optic Cable Dose Rate Effect



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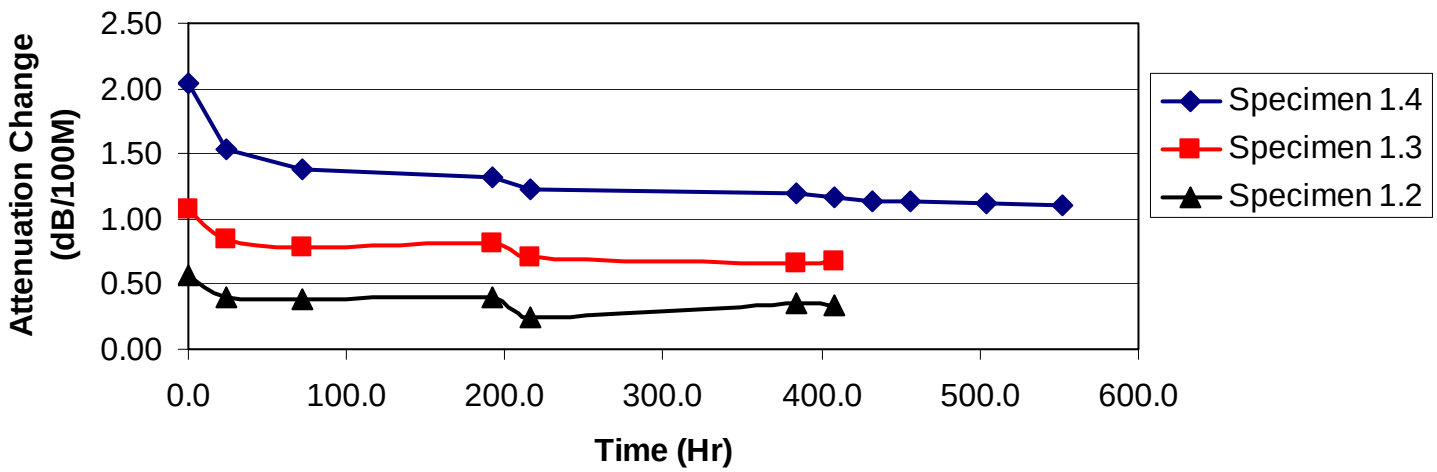
Post Radiation Recovery

Figure 3. Fiber Optic Cable
Post Radiation Exposure Recovery



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Aging

Both the buffer material and the outer jacket material were analyzed using Arrhenius methods

- Qualified life > 50 yrs @ 35 C

Flame Testing

The completed cables will pass the following flame test requirements:

IEEE 383

UL 1666 (Riser Rating)

UL 910 (Plenum Rating)

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Conclusions

- Increased attenuation is modest (<2 dB/100m) through ~70 kRad
- There is a small dose rate affect
- There is some recovery of induced loss once the radiation source is removed
- It is unlikely that fiber can withstand megarad level radiation exposure without significant increased attenuation

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Future Study

- Other fiber types
  - Singlemode
  - 50/125 10 gig
- Higher doses
- Higher dose rates
- Bandwidth?

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