

July 12, 1984  
SBN- 680  
T.F. J10.1.6

United States Nuclear Regulatory Commission  
Washington, D. C. 20555

Attention: Mr. George W. Knighton, Chief  
Licensing Branch No. 3  
Division of Licensing

References: (a) Construction Permits CPPR-135 and CPPR-136, Docket  
Nos. 50-443 and 50-444  
(b) Telephone Conversation of April 26, 1984 between V. Nerses  
and J. Knox of NRC, G. Tsouderos and A. Legendre of Yankee  
Atomic Electric Company, and G. Aggarwal of United  
Engineers and Constructors, Inc.

Subject: Spaced Conductors

Dear Sir:

During the telephone conversation in Reference (b), we discussed an apparent deviation of FSAR Section 8.3.1.4 i(1) which deals with the cable tray loading criteria for heavy power cables and specifies that the cables in the trays be in one layer with a nominal one-quarter diameter air spacing between the cables. In the field, there is an occasional crossing or touching of cables. This typically occurs when cables exit the trays to terminate at a switchgear or other point of termination. This has been considered as a deviation from the FSAR commitment.

It was explained to Messrs. Knox and Nerses of NRR that we have investigated the subject of spaced conductors, and it is our engineering judgement that even though the conductors may touch (point contact) here and there or cross each other, the effect on ampacity is not significant. There is no calculation to our knowledge that can prove this theoretically; therefore, in trying to resolve this issue generically, we have decided to have our engineering judgement in this matter verified by a third party, such as a cable authority (recognized cable manufacturer).

We have, therefore, written to two recognized cable manufacturers and requested that they determine the effects on conductor ampacity of not adhering to strict spacing requirements, such as occasional crossing or touching of conductors. Our letters to them and their responses are enclosed. As it can be seen from their responses, they have concurred with our engineering judgement.

Boo!  
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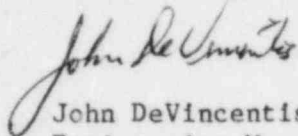
United States Nuclear Regulatory Commission  
Attention: Mr. George W. Knighton, Chief

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Based on the above, we plan to add a note to FSAR Section 8.3.1.4 i(1) to clarify the spacing requirement of heavy power cables. Our proposed change is shown on the attached marked up page of the FSAR and will be included in a future OL Application Amendment. We believe that this resolves the issue of the spaced conductors and the apparent deviation from the FSAR.

Very truly yours,

YANKEE ATOMIC ELECTRIC COMPANY



John DeVincentis  
Engineering Manager

Enclosures

cc: Atomic Safety and Licensing Board Service List

Director, Office of Inspection and Enforcement  
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Richard E. Sullivan, Mayor  
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The factors which are considered when selecting a raceway for an application include mechanical strength to support and protect the cables, resistance to chemicals, resistance to moisture, resistance to high temperature, length of life, flexibility, internally generated heating, vulnerability to fire, and general environmental considerations.

The criteria for thermal and physical loading of raceways are based on IEEE/ICEA recommendations or test results for cables installed in different raceways. In cable trays, the percentage fill requirements are as follows:

1. For all 15 kV and 5 kV power cables and 480 volt heavy power cables (4/0 and larger in size) - one layer with a nominal one-quarter diameter air spacing. (See Note 2)
2. For 480 volt medium and small size power cables (2/0 AWG and smaller in size) - 40% (see Note 1) of usable tray volume fill, and
3. For control and instrumentation cables and control rod drive power cables - 40% (see Note 1) of usable tray volume fill.

In the Nuclear Island, raceways that carry nuclear safety-related circuit cables are embedded in Category I walls, floors, and duct banks or supported by steel numbers which are qualified by means of seismic analysis.

The bases for selecting, laying out, and loading raceways are to minimize the loss of function of cables in the raceway due to adverse conditions external or internal to the raceway.

j. Electrical Penetrations

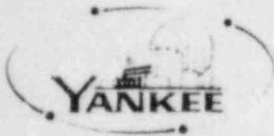
The electrical penetration assemblies provide the means to allow passage of power, control and instrument circuits through the containment pressure barrier while maintaining the integrity of the pressure barrier. The criteria for physical separation of electrical penetrations is the same as for raceways as described above.

*It is understood that there will be occasional crossing and touching (point contact) of cables installed in ladder type trays. This has no appreciable effect on cable ampacity and therefore is acceptable.*

Note 1: 40% fill is based on nominal cable diameters. Actual fill percentage might vary because of manufacturing tolerances in cable construction. Cable ampacity reduction factors remain unaffected by decreased or increased fill percentages.

*Note 2: a*

# YANKEE ATOMIC ELECTRIC COMPANY



1671 Worcester Road, Framingham, Massachusetts 01701

May 10, 1984

Dr. T. H. Ling  
Senior Technical Consultant  
Anaconda-Ericsson, Inc.  
Wire and Cable Division  
901 East 86 Street  
Indianapolis, IN 46240

Dear Dr. Ling:

## Spaced Cables

As we discussed on April 27, 1984, we have some questions on the potential effects on conductor ampacity of not adhering to strict spacing requirements, such as occasional crossing or touching, of cables that are installed in ladder-type cable trays.

At the Seabrook Nuclear Power Station, the sizing of 15 kv, 5 kv, and 600 volt heavy power cables (4/o and larger size) is based on ICEA Publication No. P-46-426, utilizing one horizontal layer of cables, spaced 1/4 diameter apart. Maximum ambient temperature is assumed to be 50°C. Anaconda cables used at Seabrook are 5 kv and 15 kv interlocked armor 3 conductor 2/o and 4/o and 5 kv triplexed 350 MCM.

In the actual installation at Seabrook, the cables are tied down to the cable tray rungs at intervals in order to maintain the nominal 1/4 diameter spacing assumed in the sizing calculations. It is possible that the cables might touch here and there in between the tiedown intervals. Also, we may have cases where the cables cross each other when they exit the tray on the way to be terminated at a switchgear or other termination point.

The question raised is whether the point touch or crossover constitutes a violation of the assumed 1/4 diameter spacing and whether this will have an appreciable affect on cable ampacity.

It is our engineering judgement that it will not have an appreciable affect and that this is an acceptable construction practice. We are asking for your opinion on this subject.

Dr. T. H. Ling

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We will appreciate your early response.

Very truly yours,

*Randy C. Jamison*

R. C. Jamison  
Electrical Engineer  
Seabrook Projects

RCJ/pmb

bcc: J. DeVincentis  
R. DeLoach  
R. Guillette/F. Bean  
G. Tsouderos

# ANACONDA

WIRE & CABLE COMPANY

June 25, 1984

R. C. Jamison Electrical Engineer  
YANKEE ATOMIC ELECTRIC COMPANY  
1671 Worcester Road  
Framingham, MA 01701

Subject: Spaced Cables

Reference: Your Letter dated May 10, 1984

Dear Sir:

Your referenced letter has been reviewed. We offer the following comments for your purusal.

- (1) Fundamentally, the calulation of power cable ampacities involve the determination of the amount of heat generated within the cables and the heat dissipated from them.
- (2) Some of the numerical values that are required for such calculations are well known, some are empirical and some are estimates. This situation is true with any of the generally accepted tabulations of power cable ampacities, including ICEA P-46-426.

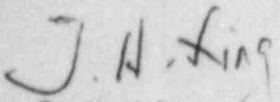
Obviously cables that are touching each other are a violation of the 1/4 to 1 cable diameter spacing criteria and would limit the convection heat transfer from the cables at and near their point of contact.


However, when cables are lashed to the rungs of a cable tray those rungs may be either a heat source or a heat sink depending upon the amount of heat being dissipated from the other cables in that tray. But, the contact area between the cables and the tray runs is so small compared to the effectively cooled area between the rungs that whatever influence the rungs may have on the circuit ampacities is usually disregarded.

- (3) It would be expected that the occasional casual point contact between cables, where there is a considerable longitudinal distance between those contact points, would have little effect on the circuits actual ampacity.

We sincerely hope that the above comments are of use to you.

Yours truly,

  
T. H. Ling  
Senior Consultant  
CO

**ERICSSON**  Anaconda Wire & Cable Company is a member of the Ericsson Group.

Anaconda Wire & Cable Company/Power Cable Division

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Post Office Box 340  
Ramsey, New Jersey 07446  
201-825-0300/Cable: Okonite

May 10, 1984

Mr. G. Tsouderos, Lead Electrical Engineer  
Seabrook Project  
Yankee Stomic Electric Company  
1671 Worcester Road  
Framingham, Massachusetts 01701

Dear Mr. Tsouderos:

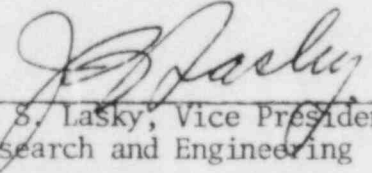
Spaced Cables

I have your letter of May 7, 1984 asking our opinion on the potential effects on ampacity rating due to occasional crossing and touching of cables installed in ladder type trays.

We are in agreement with you that there will be no appreciable effects on cable ampacity. The methods for sizing used in ICEA P-46-426 are conservative.

Very truly yours,

THE OKONITE COMPANY

  
J. S. Lasky, Vice President  
Research and Engineering

JSL/row

cc: Mr. W. J. Lenahan



6 Boudier

Telephone (617) 872-8100  
TWX 710-380-7619

# YANKEE ATOMIC ELECTRIC COMPANY



1671 Worcester Road, Framingham, Massachusetts 01701

May 7, 1984

Dr. J. S. Lasky  
Vice President, Research and Engineering  
The Okonite Company  
P.O. Box 340  
Ramsey, NJ 07446

Dear Dr. Lasky:

### Spaced Cables

Mr. W. Lenahan suggested that I address this letter to you. It pertains to the potential effects on conductor ampacity of not adhering to strict spacing requirements, such as occasional crossing or touching, of cables that are installed in ladder-type cable trays.

At the Seabrook Nuclear Power Station, the sizing of 15 kv, 5 kv, and 600 volt heavy power cables (4/o and larger size) is based on ICEA Publication No. P-46-426, utilizing one horizontal layer of cables, spaced 1/4 diameter apart. Maximum ambient temperature is assumed to be 50°C. Okonite cables used at Seabrook are 600 volt triplexed, 250 and 500 MCM and 1/c 500 MCM.

In the actual installation at Seabrook, the cables are tied down to the cable tray rungs at intervals in order to maintain the nominal 1/4 diameter spacing assumed in the sizing calculations. It is possible that the cables might touch here and there in between the tiedown intervals. Also, we may have cases where the cables cross each other when they exit the tray on the way to be terminated at a switchgear or other termination point.

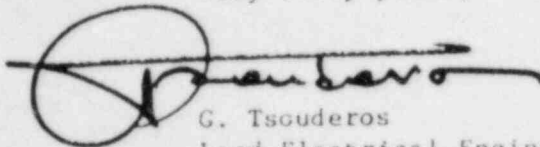
The question raised is whether the point touch or crossover constitutes a violation of the assumed 1/4 diameter spacing and whether this will have an appreciable affect on cable ampacity.

It is our engineering judgement that it will not have an appreciable affect and that this is an acceptable construction practice. We are asking for your opinion on this subject.

Dr. J. S. Lasky  
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We will appreciate your early response.

Very truly yours,

A handwritten signature in black ink, appearing to read 'G. Tscuderros', written over a horizontal line. The signature is stylized with a large loop at the beginning.

G. Tscuderros  
Lead Electrical Engineer  
Seabrook Project

GTs/pmb

cc: W. Lenahan  
22 Industrial Park Road  
Hingham, MA 02043

bcc: J. DeVincentis  
R. DeLoach  
R. Guillette/F. Bean  
R. C. Jamison