UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

July 12, 2000

MEMORANDUM TO: Cynthia A. Carpenter, Chief
Generic Issues, Environmental, Financial &
Rulemaking Branch
Division of Regulatory Improvement Programs, NRR

FROM: Joseph L. Birmingham, Project Manager
Generic Issues, Environmental, Financial &
Rulemaking Branch
Division of Regulatory Improvement Programs, NRR

SUBJECT: SUMMARY OF JUNE 22, 2000 MEETING WITH NUCLEAR ENERGY INSTITUTE AND INDUSTRY REPRESENTATIVES CONCERNING OKONITE CABLE TEST FAILURES

On June 22, 2000, staff of the Nuclear Regulatory Commission, (NRC) met with representatives of the Nuclear Energy Institute, (NEI), the Okonite Company (Okonite), and licensees, to discuss a Brookhaven National Laboratories report of Okonite single conductor bonded-jacket cable loss-of-coolant accident (LOCA) test failures. The staff presented a summary of the test results and discussed preliminary information about the impact on operating reactors and possible responses being considered by NRC and industry. In addition, the staff discussed regulatory actions identified in a May 9, 2000, memorandum from Brian Sheron to Samuel Collins to address the test results. Those attending the meeting are listed in Attachment 1.

Jack Strosnider, NRC, began the meeting by stating the purpose of the meeting and conducting introductions of the attendees. Jit Vora, NRC, presented the results of a Brookhaven National Laboratories (BNL) test of a #12 AWG single conductor bonded jacket Okonite cable. A copy of the presentation is in Attachment 2. For the test, 2 cables were aged the equivalent of 20 years and 3 cables were aged the equivalent of 40 years. After aging, the cables were subjected to conditions expected during a double-peak LOCA. The test results showed that 1 of the cables aged to the equivalent of 20 years failed and that 3 of the cables aged to the equivalent of 40 years failed. The BNL test may be conservative compared to conditions experienced by cables installed in a facility but raises concerns for the use of this type of cable in plant areas where conditions may be similar to the test conditions and also the adequacy of original qualification reports.

Tony Pietrangelo, NEI, asked if NRC planned to issue an information notice on the test results. NEI had notified its industry contacts of the report and its availability from NRC but could not provide the regulatory perspective on the test results. The staff indicated that it had no immediate plans to issue an information notice and was following the process in SECY 99-143 regarding the issuance of generic communications. However, Mr. Strosnider stated that the

question of whether or not an IN would be issued would be reconsidered based on the NEI request. NEI planned to issue a survey to industry to identify those facilities that had this type of cable installed. NEI expected that it would take 2 weeks to issue the survey, 60 days for industry to respond and 30 days to collate the results.

Phil Holzman of STAR, Inc./Nuclear Utility Group on Environmental Qualification (NUGEQ) then presented information regarding the cable testing. He noted that the test by BNL may have been conservative and pointed out other documented test reports where the cable had passed testing. He presented charts showing that the cable had consistently passed testing at certain temperature parameters and had passed 40 year aging tests at 60 degrees Centigrade. Attachment 3 contains charts and graphs shown during this presentation.

After the above presentation, the staff asked additional questions about the proposed survey. NEI responded that preliminarily the survey would ask whether industry has this cable installed in their plants, is the cable exposed to more than 60 degrees Centigrade, and is the cable on the environmental qualification list. This process is expected to take four months. After collating the survey responses, the results will be made available to the NRC and corrective actions will be considered.

Project No. 689

Attachment: As stated

cc w/att: See next page

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*SEE PREVIOUS CONCURRENCES

Document Name: G:\RGEB\JLB\NEI OKONITE CABLE MSUM 06-22-2000.wpd

OFFICE	RGEB/DRIP	RGEB/DRIP	EEIB/DE	NRR/DE
NAME	J. Birmingham	S. West SW	J. Calvo	JStrosnider
Date	07/11/00	07/12/00	07/05 /00	07/07/00

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TQuay
JCalvo
DThatcher
PShemanski
SAggarwal
KKarwoski
MFields
EHacket
JVora
CJulian

List of Okonite Cable Meeting Attendees
June 22, 2000

NAME	ORGANIZATION
Tony Pietrangelo	NEI
Doug Walters	NEI
James Fitzgerald	Okonite
John Farranetta	Okonite
Francis Giuliano	Counsel for Okonite
Gary Toman	EPRI
John Wheless	Southern Company
Sushant Kapur	Bechtel
Nancy Chapman	SERCH/Bechtel
Bill Horin	Winston&Strawn/NUGEQ
Millau Straka	NUSIS
Phil Holzman	STAR, Inc./NUGEQ
Bob Lofaro	BNL*
Jack Strosnider	NRC/NRR/DE
Richard Wessman	NRC/NRR/DE
Jose Calvo	NRC/NRR/DE/EEIB
Dale Thatcher	NRC/NRR/DE/EEIB
Paul Shemanski	NRC/NRR/DE/EEIB
Joe Birmingham	NRC/NRR/DRIP/RGEB
Satish Aggarwal	NRC/RES
Jit Vora	NRC/RES/DET
Peter J. Kang	NRC/NRR/DRIP/RLSB
Ken Karwoski	NRC/RES/DET/MEB
Caudle Julian	NRC/Region II/DRS*

* Via phone

Attachment 1

ENVIRONMENTAL QUALIFICATION RESEARCH PROGRAM

RESULTS OF LOCA TEST #5

Okonite Bonded-Jacket Cables

Open Public Meeting with NEI and Industry Representatives

J. Vora/S. Aggarwal
Office of Nuclear Regulatory Research

June 22, 2000
Rockville, Maryland

Attachment 2

OBJECTIVE OF LOCA TEST # 5

The objective of the LOCA test # 5 was to determine if bonded jacket cables have a unique failure mechanism not present in un-bonded jacket cables.

DESCRIPTION OF OKONITE TEST SPECIMENS

Low-Voltage I&C Cables:

No Outer Jacket

0.030" EPR Insulation

0.015" CSPE Bonded Individual Jacket

1/C, # 12 AWG

600 V

# of Test Specimens in Test

No Aging (1) **20 Yrs Aging (2)** **40 Yrs Aging (3)**

DESCRIPTION OF PREAGING TO SIMULATE 20 AND 40 YEARS

Thermal Aging		Irradiation Aging
252 Hrs @ 302 F	20 Years	25 Mrad @ 0.65 Mrad/Hr
504 Hrs @ 302 F	40 Years	50 Mrad @ 0.65 Mrad/Hr

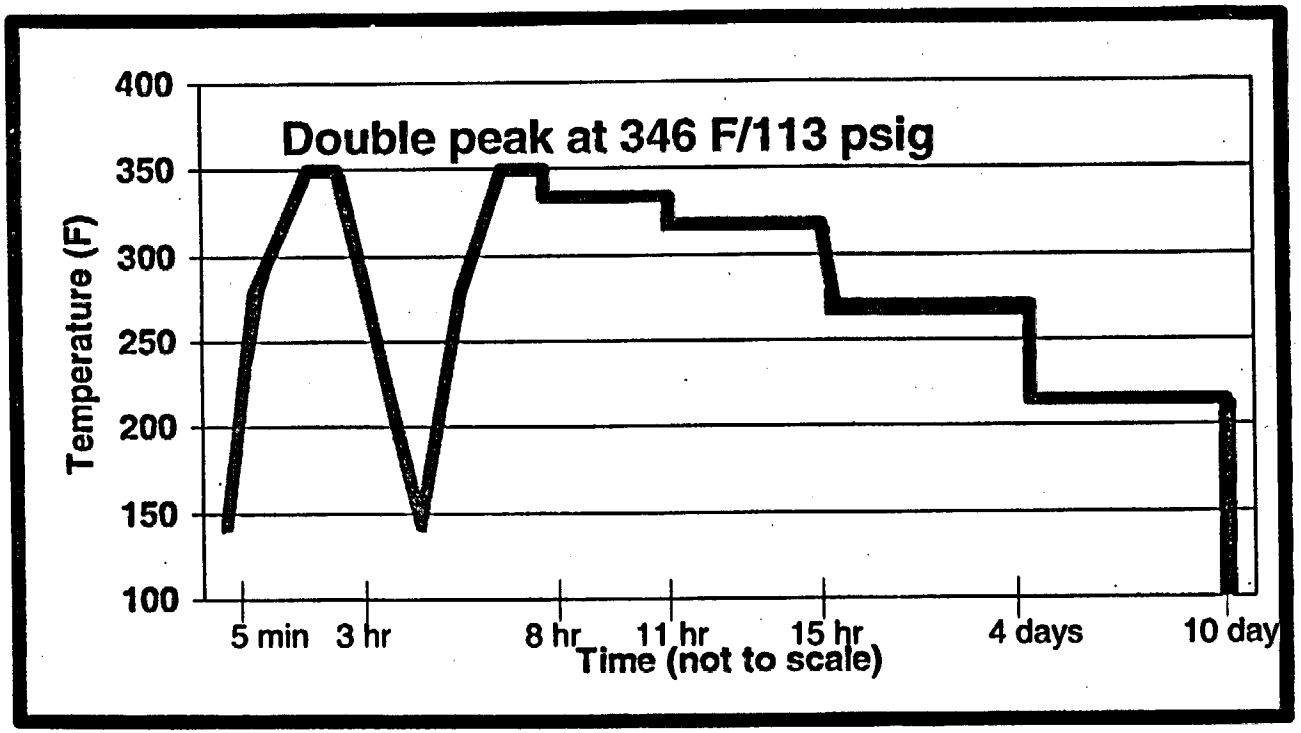
Qualification Report Used

Nuclear Environmental Qualification Report for Okonite Insulated Cables, NQRN-1A, Rev. 5, 10/24/88.

Activation Energy Used in Original Qualification

40 Yrs @ 194 F (90 C) Ea = 1.10 eV

LOCA TEST 5:
ACCIDENT PROFILE USED



TEST AND INSPECTION RESULTS

Specimens preaged to 20 Yrs - 1 out of 2 had split open
Specimens preaged to 40 Yrs - 3 out of 3 had split open

Average Elongation-at-Break (%)Values for Insulation

Equivalent Aging	Baseline	Post Service Aging	Post Accident Irradiation	Post LOCA Testing
No Aging	471	-	232	134
20 Yrs	471	8	<5	<5
40 Yrs	471	4	<5	<5

Specimens aged to 40 years experienced significant leakage current upon initiation of chemical spray at 15 hours.

TEST AND INSPECTION RESULTS-cont'd
(Performed in accordance with IEEE Std. 383-1974)

Results of Submerged Voltage Withstand Test

Preaged to 20 Yrs - One out of two specimens failed.

Preaged to 40 Yrs - Three out of three specimens failed.

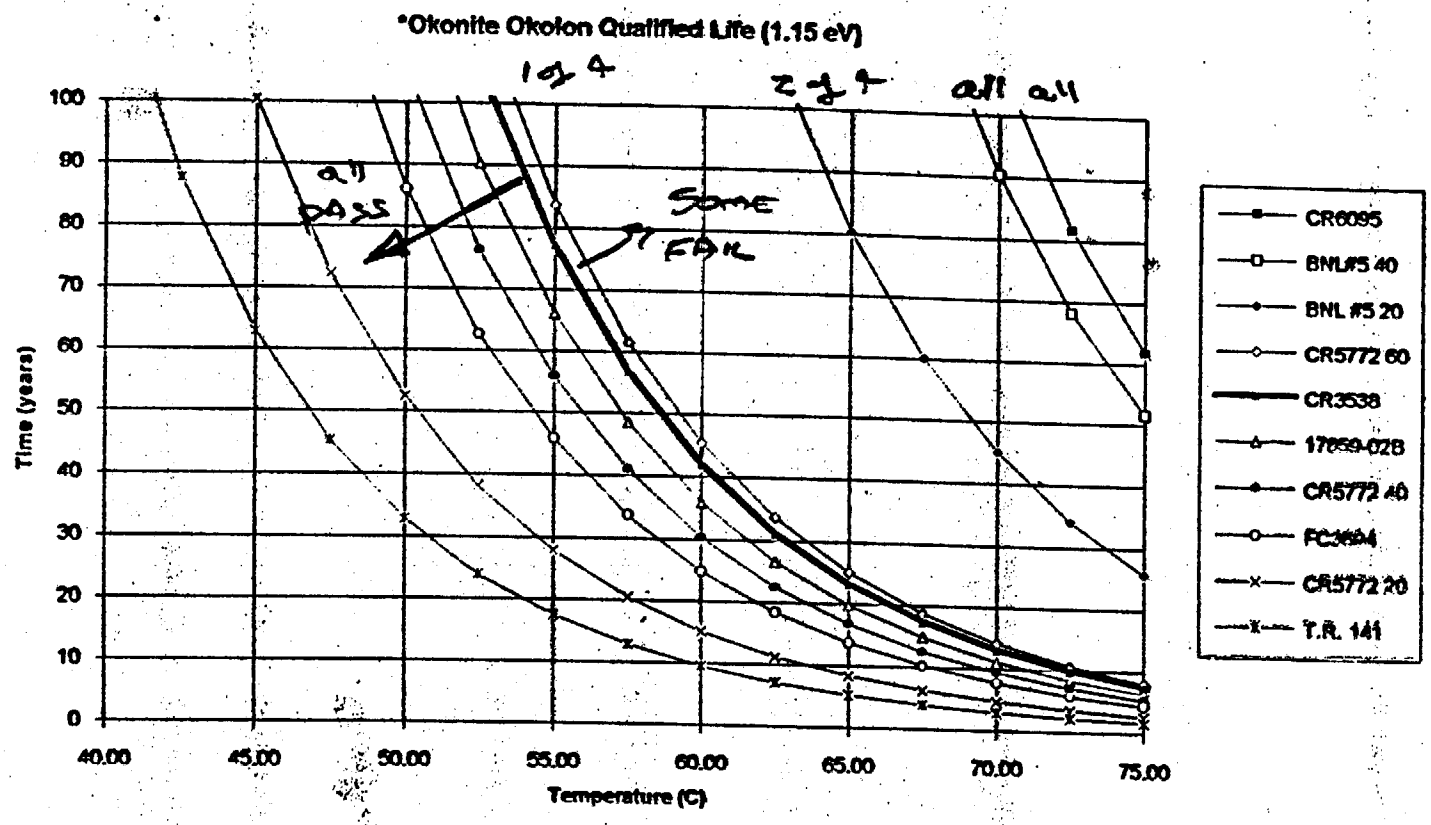
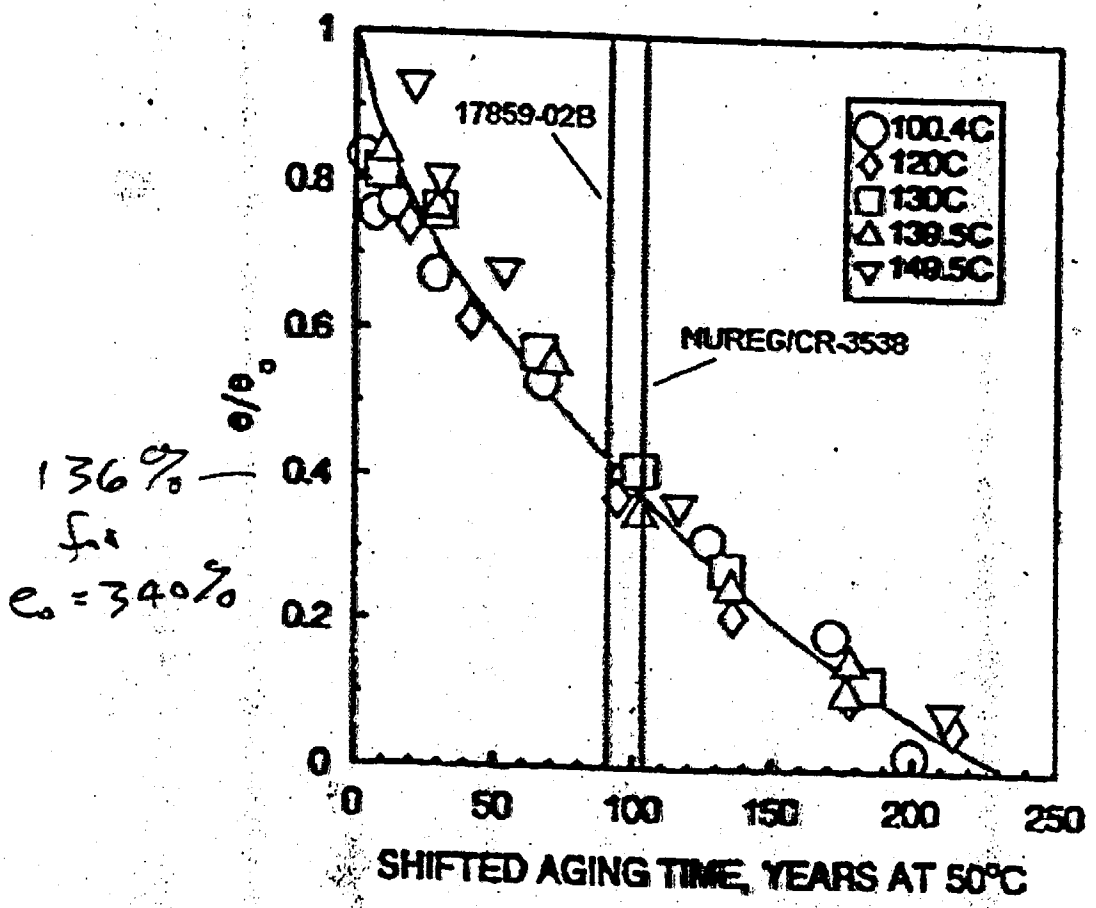


Figure 1 - Calculated Life Values Based on Test Report Aging



136% — f_s $\varepsilon_0 = 340\%$

Fig. 8. Time-temperature superposition of the normalized elongation data for the Anaconda hypalon using E_a = 25.5 kcal/mol.

Figure 4 - WRSI Hypalon Aging with NUREG/CR-3538 & 17859-02B Data

BASIS FOR SURVEY TEMPERATURE SCREENING CRITERION

Table 1 – Summary Information Okonite Okolon Test Programs

Report	Okonite Okolon Styles	Aging	Accident	Results
NUREG/CR-6095 (Sandia)	(10) 1/c #12awg 30/15 mil	130 Mrds then 336 hrs @ 158°C (circumferential cracks on 9 Sandia-damaged wires)	340°F/10 days	all fail/split starting at 14 to 182 hours
BNL/Wyle Test #5 (unaged)	(1) 1/c #12awg 30/15 mil	unaged	150 Mrd then 346° F/10 days	pass
BNL/Wyle Test #5 (20 year simulation)	(2) 1/c #12awg 30/15 mil	252 hrs @ 150°C and 25 Mrd (stiff but no cracks)	150 Mrd then 346° F/10 days	1 fail/split (visual at end of test)
BNL/Wyle Test #5 (40 year simulation)	(3) 1/c #12awg 30/15 mil	504 hrs @ 150°C and 50 Mrd (circumferential cracks)	150 Mrd then 346° F/10 days	all fail/split (visual at end of test)
NUREG/CR-5772/2 (Sandia) (unaged)	(1) 1/c #12awg 30/15 mil	unaged	~138 Mrd then 340°C/12± days	all pass
" (20 year simulation)	(3) 1/c #12awg 30/15 mil	(S) 3 months @ 98°C + 17 Mrd	~110 Mrd then 340°F/10 days	all pass
" (40 year simulation)	(3) 1/c #12awg 30/15 mil	(S) 6 months @ 98°C + 29 Mrd	~110 Mrd then 340°F/10 days	all pass
" (60 year simulation)	(4) 1/c #12awg 30/15 mil	(S) 9 months @ 98°C + 36 Mrd	~110 Mrd then 340°F/10 days	1 fail/split beginning at 133 hr.
NUREG/CR-3538 (Sandia)	(2) 1/c #12awg 30/15 mil	(S) 169 hrs @ 139°C + 43 Mrd	(S) ~106 Mrd + 340°F/21 days	all pass
Wyle 17859-02B (ComEd)	(4) splices L5, L6, L7, L8 with 1/c #14awg (also others to less aging)	16 Mrds then 298 hrs @ 130°C	~184 Mrd then 340°F/10 days	no split Okonite wires
F-C3694 (Okonite)	(1) 7/c #12awg 47/15 mil w 60 mil jkt (1) 1/c #12awg 45 mil * (1) 7/c #12awg 30/15(n) mil w 60 mil jkt**	336 hrs @ 121°C then (S) 168 hrs @ 115.5°C + 50 Mrd	(S) ~150 Mrd + 340°F/31 days then 212°F/100 days	all pass 31 day exposure
Report 141 (Okonite)	(1) 4/c #12awg 47/15 mil w 45 mil jkt. (1) 1/c #14awg 30/15(n) mil (1) 1/c #4/0 55/45(n) mil (1) 4/c #14awg 30/15(n) mil w 45 mil jkt(n) (1) 7/c #14awg 30/15(n) mil w 45 mil jkt(n)	168 hrs @ 121°C	200 Mrd then 252F°C/7.5 days then 345F°C/100+ days	all pass

(n) neoprene jacket (i.e., Okonite Okoprene)
(S) Simultaneous aging (thermal and radiation) or simultaneous accident (high temperature steam and radiation)
* EPRI insulation only - no jacket layer
** neoprene jacket on singles; experimental thermoset overall jacket

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cc: Mr. Ralph Beedle
Senior Vice President
and Chief Nuclear Officer
Nuclear Energy Institute
Suite 400
1776 I Street, NW
Washington, DC 20006-3708

Mr. Alex Marion, Director
Programs
Nuclear Energy Institute
Suite 400
1776 I Street, NW
Washington, DC 20006-3708

Mr. David Modeen, Director
Engineering
Nuclear Energy Institute
Suite 400
1776 I Street, NW
Washington, DC 20006-3708

Mr. Anthony Pietrangelo, Director
Licensing
Nuclear Energy Institute
Suite 400
1776 I Street, NW
Washington, DC 20006-3708

Mr. H. A. Sepp, Manager
Regulatory and Licensing Engineering
Westinghouse Electric Corporation
P.O. Box 355
Pittsburgh, Pennsylvania 15230

Mr. Jim Davis, Director
Operations
Nuclear Energy Institute
Suite 400
1776 I Street, NW
Washington, DC 20006-3708

Ms. Lynnette Hendricks, Director
Plant Support
Nuclear Energy Institute
Suite 400
1776 I Street, NW
Washington, DC 20006-3708

Mr. Charles B. Brinkman, Director
Washington Operations
ABB-Combustion Engineering, Inc.
12300 Twinbrook Parkway, Suite 330
Rockville, Maryland 20852

Mr. Kurt Cozens
Nuclear Energy Institute
Suite 400
1776 I Street, NW
Washington, DC 20006-3708

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June 5, 2000

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Generic Issues, Environmental, Financial &
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Division of Regulatory Improvement Programs, NRR

FROM: Joseph L. Birmingham, Project Manager
Generic Issues, Environmental, Financial &
Rulemaking Branch
Division of Regulatory Improvement Programs, NRR

SUBJECT: MEETING WITH NUCLEAR ENERGY INSTITUTE (NEI) AND INDUSTRY REPRESENTATIVES CONCERNING OKONITE CABLE TEST FAILURES

DATE & TIME: June 22, 2000
1:00-3:00 pm

LOCATION: U.S. Nuclear Regulatory Commission
One White Flint North
11555 Rockville Pike
Rockville, Maryland 20852
Room O-3B4

PURPOSE: To discuss Brookhaven National Laboratories report of Okonite cable test failures. Also, to discuss with industry preliminary information about the impact on operating reactors and possible responses being considered by NRC and industry. Agenda attached.

*PARTICIPANTS:

NRC	NEI
J. Strosnider	D. Walters, et al.
J. Calvo	
D. Thatcher	
P. Shemanski	
S. Aggarwal, et. al.	

Project No. 689
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*Meetings between NRC technical staff and applicants or licensees are open for interested members of the public, petitioners, interveners, or other parties to attend as observers pursuant to "Commission Policy Statement on Staff Meetings Open to the Public" 59 Federal Register 48340, 9/20/94. Members of the public who wish to attend should contact Paul Shemanski at (301) 415-1377 or pcs@nrc.gov.

June 5, 2000

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Generic Issues, Environmental, Financial &
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Division of Regulatory Improvement Programs, NRR

FROM: Joseph L. Birmingham, Project Manager /RA/
Generic Issues, Environmental, Financial &
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NAME	J. Birmingham	S. West*	D. Thatcher*
Date	06/ 6 /00	06/ 1 /00	06/ 5/00

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Proposed Agenda For Meeting With NEI on Okonite Cable Tests
June 22, 2000, Room O-3B4, 1:00-3:00 pm

NRC/NEI/ MEETING ON OKONITE CABLE TEST RESULTS

1. Introductions and Purpose of Meeting - Joseph Birmingham, NRC NEI Project Manager

2. Discussion of BNL Test Results and NRC Concern for Operating Reactors - Jack Strosnider, Director, Division of Engineering; Jose Calvo, Chief, Electrical and Instrumentation & Controls Branch (EEIB), NRR, et. al.

3. Presentation of Industry Understanding of the Concern and Potential NEI and Industry Actions - Doug Walters, NEI, et. al.

4. Input from Vendor - TBD

5. Response to Industry - Jose Calvo, et. al., NRR

6. Questions/Feedback to NRC, Summary of Proposed Industry/Vendor Actions- Doug Walters, et. al., NEI

7. Meeting Adjourned

Attachment

cc: Mr. Ralph Beedle
Senior Vice President
and Chief Nuclear Officer
Nuclear Energy Institute
Suite 400
1776 I Street, NW
Washington, DC 20006-3708

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Programs
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1776 I Street, NW
Washington, DC 20006-3708

Mr. Charles B. Brinkman, Director
Washington Operations
ABB-Combustion Engineering, Inc.
12300 Twinbrook Parkway, Suite 330
Rockville, Maryland 20852

Mr. Kurt Cozens
Nuclear Energy Institute
Suite 400
1776 I Street, NW
Washington, DC 20006-3708