

December 31, 1998

LICENSEE: Southern Nuclear Operating Company, Inc.
FACILITY: Joseph M. Farley Nuclear Plant (FNP), Units 1 and 2
SUBJECT: MEETING SUMMARY OF DECEMBER 15, 1998

The U.S. Nuclear Regulatory Commission (NRC) held a meeting with Southern Nuclear Operating Company, Inc. (SNC), on December 15, 1998, at NRC Headquarters in Rockville, Maryland. The purpose of the meeting was to discuss technical issues associated with the Kaowool fire barriers installed at the Farley Nuclear Plant, Units 1 and 2.

Enclosed is a list of attendees and meeting handouts.

In accordance with Section 2.790 of NRC's "Rules of Practice," Part 2, Title 10 of the Code of Federal Regulations, a copy of this meeting summary and its enclosure will be placed in the NRC's Public Document Room.

ORIGINAL SIGNED BY D. JAFFE FOR:

Jacob I. Zimmerman, Project Manager
Project Directorate II-2
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Docket Nos. 50-348 and 50-364

Enclosures: As stated

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

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A handwritten signature in black ink, appearing to read "J. Zimmerman", is positioned above the typed name.

Jacob I. Zimmerman, Project Manager
Project Directorate II-2
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

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Distribution for Meeting Summary dated December 31, 1998

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Docket File
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PD II-2 Rdg.
J. Zimmerman
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cc: Licensee & Service List (with enclosure)

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Joseph M. Farley Nuclear Plant

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LIST OF ATTENDEES

U.S. Nuclear Regulatory Commission

Jacob Zimmerman, NRR/DRPE/PDII-2, Farley Project Manager
Herb Berkow, NRR/DRPE/PDII-2, Director
John Zwolinski, NRR/DRPE, Acting Director
L. B. Marsh, NRR/DSSA/SPLB, Branch Chief
K. Steven West, NRR/DSSA/SPLB, Section Chief
Patrick Madden, NRR/DSSA/SPLB
Mark Salley, NRR/DSSA/SPLB
Tanya Eaton, NRR/DSSA/SPLB
Amarjit Singh, ACRS
Jonathan Bartley, Region II, Farley Resident Inspector
Al Belisle, Region II via video conference
Jerry Wiseman, Region II via video conference

Southern Nuclear Operating Company, Inc., et al.

Dave Morey
Mark Ajluni
David Jones
Dom Sutton
Les Bailey
Ray Sprankle, Westinghouse
Fred Emerson, NEI
Bob Puhl, Bechtel
Jesse Love, Bechtel

NRC HANDOUTS

**AGENDA FOR
MEETING BETWEEN NRC AND SOUTHERN NUCLEAR OPERATING, INC.
REGARDING FARLEY NUCLEAR PLANT KAOWOOL FIRE BARRIERS
DECEMBER 15, 1998**

PURPOSE:

Discuss raceway barrier fire protection issues related to enforcement, compliance, and safety at Farley Nuclear Plant (FNP).

AGENDA:

Introductions and Remarks -- (J. Zimmerman, NRC/D. Morey, SNC) **8:15 a.m.**

- Introduction of Participants
- Purpose of Meeting

SNC Management Overview (D. Jones) **8:30 a.m.**

- Historical Perspective
- Conclusions

Discussion of Kaowool fire barrier issues at FNP (D. Jones) **8:45 a.m.**

- Explain FNP's licensing basis as it relates to raceway fire protection and associated exemptions, including the conservatism built into our program.
- Discuss regulatory violations and experiences regarding raceway fire protection.
- Describe plans to ensure continued compliance with NRC requirements

NRC Management Overview (L.B. Marsh) **10:00 a.m.**

- Historical Perspective
- Conclusions

NRC Technical and Licensing Issues (M. Salley) **10:15 a.m.**

- Region II request
- Licensing Basis
- RAI/FNP Response
- NRC Formal Correspondence:
 - Generic Letter 92-08
 - Information Notices 93-40 & 93-41
- Review of FNP Response
 - Fire Tested Configuration vs. Plant Configuration
 - Discuss of Fire Test Reports
 - Installation Procedures & Ampacity Derating
- Conclusion

Future Direction - NRC and SNC personnel

11:15 a.m.

Closing Remarks - NRC and SNC personnel

11:45 a.m.

NRR Staff will be available from 1:00 p.m. to 4:00 p.m. to continue detailed discussion of the technical and licensing issues, if requested by SNC.

RACEWAY FIRE BARRIER HISTORY & REGULATORY ACTIONS

- 1981 Appendix R effective
 - 1-, 3-hour rated barriers required
- 1991 Thermo-Lag Fire Barrier Technical Issue
 - Affected majority of plants
 - Regulatory Activity
 - 2 Bulletins & Supplements
 - 1 Generic Letter
 - 14 Information Notices & Supplements
- 1993 NRC Self-Assessment
 - Major Findings
 - Appendix R is Effective
 - Staff review & follow-up not always thorough & consistent
 - Need improvement in staff programs & practices
- 1994-Present Other Fire Barrier Systems (3M, Kaowool, Versawrap)
 - Affects minority of plants
 - Regulatory Activity
 - 5 Information Notices

Kaowool Fire Barriers - Farley Nuclear Plant

- 1996
 - September/October - Inspection reports 50-348 364/96-09
 - Kaowool 1-hour Fire Barriers do not appear to be bounded by testing
 - November Region II requests NRR Technical Review (TIA)
 - December- Notice of Violation (Level III)
- 1997
 - August - Additional Region II Inspection reports 50-348 364/97-12
 - October - SNC request meeting with Region II and NRR
 - Meeting postponed pending enforcement and NRR Tech. Review
 - November - Additional Information on TIA to NRR
 - December - NRR requests additional information from FNP
- 1998
 - February - SNC submits exemption for Kaowool protected Charging Pump Cables
 - March - SNC responds to RAI, intensive review begins
 - June - SPLB briefs Office Director
 - October - NRR completes preliminary review
 - November - SPLB briefs Office Director
 - December - NRC/SNC meeting

NRR REVIEW DOCUMENTING INFORMATION

- Region II Inspection results
- Region II Task Interface Agreement
- Region II TIA Supplemental information

- SNC response to TIA
 - Design Basis of Kaowool barriers
 - Supporting fire test
 - Engineering analysis

 - Date of barrier installation
 - Appendix A to BTP ASB 9.5-1
 - Appendix R to 10CFR50

- Other Tests, Standards and Data

NRR REVIEW FARLEY INSTALLED CONFIGURATIONS

- About 6,300 linear feet of Kaowool fire barriers
- Plant protected raceways
 - 1" to 5" diameter steel conduits
 - 3/4" to 5" diameter aluminum conduits
 - 12" to 24" wide aluminum ladder back cable trays
 - 4" wide aluminum cable channel
- Kaowool Configurations
 - Type 'R' - Two 1" layers w/ Zetex wrap
 - Type 'H' - One 1" layers w/ Zetex wrap
 - Type 'J' - One 1" layer on bottom & sides only w/ Zetex wrap

NRR REVIEW DESIGN BASIS

- Reviewed 23 fire test documents submitted by SNC (Ref. E.4-E.27)
- Observations:
 - Tests-prepared, performed, & documented by the vendor
 - Non-standard test furnace
 - Non-standard test fire, e.g., heptane pan fires
 - No hose stream test
 - Configuration different than those installed @ FNP
 - Different material
 - Different number of layers of material
 - Different installation techniques
 - Different raceway sizes & materials
 - Different cable sizes & fill

ERR REVIEW DESIGN BASIS

- Fire Test Results
 - No tests met NRC acceptance criteria
- Observations:
 - Electrical failure of cables occurred early for single layer of Kaowool
 - Cable damage common in majority of tests.
 - Failure modes included:
 - Thermal performance
 - Structural (joint) failures
 - Minimal information on supports/intervening items

THERMO-LAG 330-1 VS. KAOWOOL THERMAL COMPARISON

Time (Minutes)	Kaowool Temp. (°F)	Thermo-Lag Temp. (°F)
00:10	120	104
00:20	200	205
00:30	390	305
00:40	550	427
00:50	700	506 ¹
00:60	850	

¹NEI test terminated at 48 minutes.

- Kaowool results from 10/24/78 B&W test. Temperature recorded on cables at the cable tray rail interface.
- Thermo-Lag 330-1 results from NEI base-line test 2-7. Maximum temperatures recorded on cable tray rail.

FNP LICENSING BASIS

- Unit 1 SER - May 1975
- Units 1 & 2 Supplement 5 - March 1981
 - Kaowool barriers meet Appendix A to BTP- APCSB 9.5-1 August 1980
 - Unit 2 committed to meet Appendix R, Sections III G. J. & O. December 1980
- Appendix R effective February 17, 1981
- Supplement 6 - March 1981
 - License condition requiring compliance with Appendix R

APPENDIX R EXEMPTIONS

- SER approves Appendix R exemptions based on:
 - “One-hour barrier enclosures will be installed...”
 - “Raceway ... will be protected by a one-hour fire barrier.”
- Kaowool barrier technical review calls into question the basis for the exemptions.

NRC FORMAL CORRESPONDENCE

- Generic Letter 92-08: “However the staff expects that the recipients of this generic letter will review the information to determine if it applies to other barrier materials and systems used at their facilities and consider actions, as appropriate, to avoid similar problems.”
- SNC response to GL 92-08: “Thermo-lag 330-1 fire barrier material is not used at the Farley nuclear plant facility.”

NRC FORMAL CORRESPONDENCE

- Information Notice 93-40 "Fire endurance test results for Thermal Ceramics FP-60 fire barrier material"
- SNC response to IN 93-40: "SNC has determined that FP-60 fire barrier systems are not installed in either unit 1 or unit 2 at FNP."
 - SNC RAI response - March 1998, Reference E.26 and E.27 FP-60 fire test, Reference E.30 FP-60 installation instructions.

NRC FORMAL CORRESPONDENCE

- Information Notice 93-41 “One-hour fire endurance test results for Thermal Ceramics Kaowool, ...”
 - very small-scale test
 - horizontal sample- one joint-no direction change
 - non-standard furnace - 1 TC. - control
 - no hose stream
 - exhibited cable damage
 - not independently performed
- SNC/Bechtel performed review of IN 93-41
 - Conclusion: “Kaowool would provide adequate protection.”
- NRR review does not reach the same conclusion

SAFETY SIGNIFICANCE

- Kaowool fire barrier performance issues similar to Thermo-Lag
 - Fire resistive performance of the Kaowool fire barrier system is indeterminate.
 - The fire endurance test results used as the licensing basis for Kaowool fire barriers have not adequately demonstrated the validity of the associated tests and their applicability to installed plant designs.
 - The fire endurance test do not demonstrate the installed Kaowool fire barriers meet NRC fire protection requirements, granted exemptions, and guidance (e.g., GL 86-10).

Impact on Defense-in-Depth

- Incomplete and inconclusive fire endurance/hose stream testing of Kaowool fire barrier systems does not provide the reasonable assurance needed to assure barrier integrity will be maintained during significant fire condition.
- Fire barrier integrity important in reducing the likelihood that both post-fire safe shutdown trains will be damaged by fire or fire fighting operations.
- Safety margins implied by Appendix R exemptions may be impacted
 - Fire loading and the potential energy release from fire hazards may exceed the fire rating of the Kaowool barrier (due to inadequate qualification testing, fragility of the barrier system, and unproven installation practices).

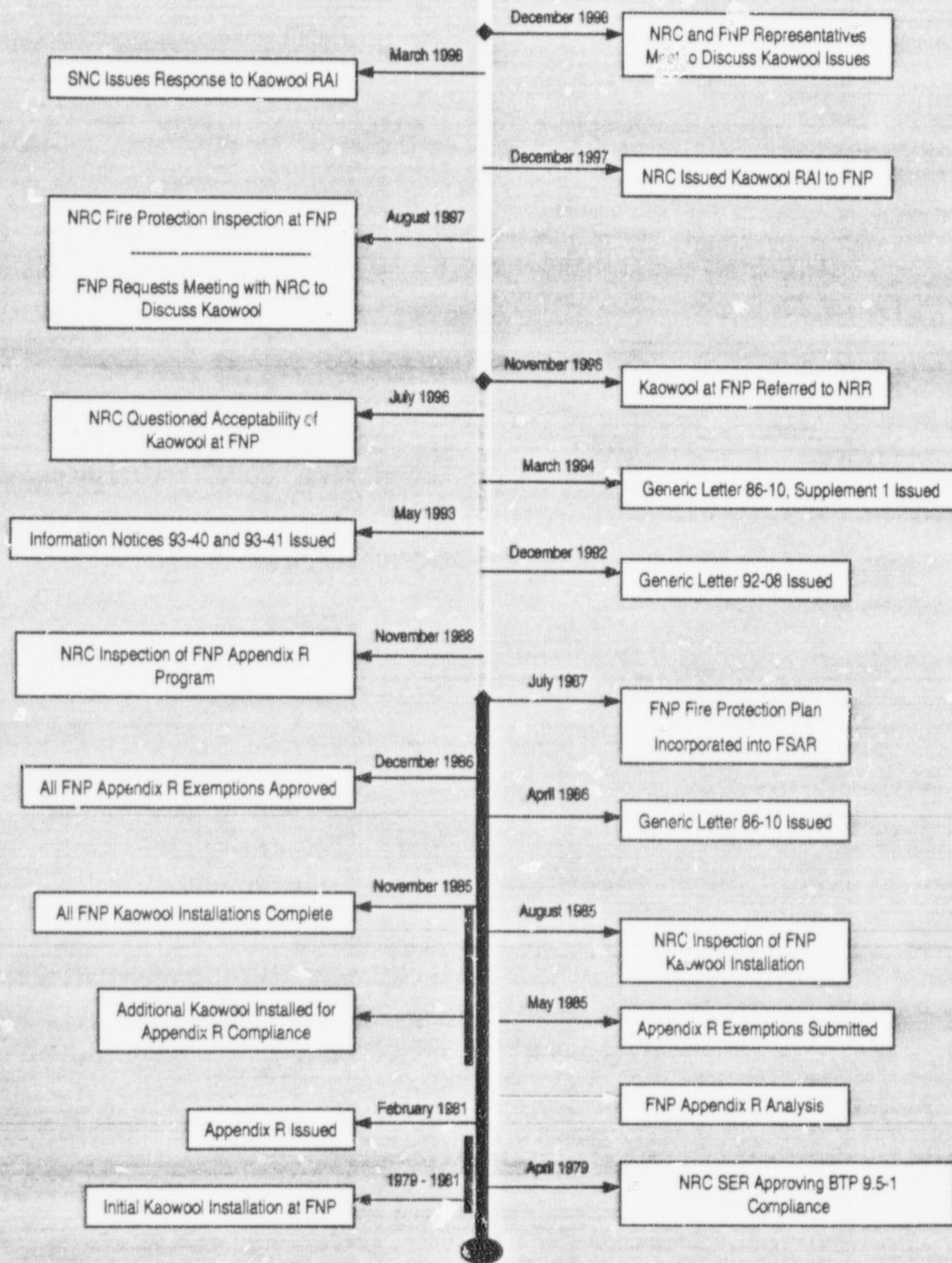
OTHER NUCLEAR PLANTS USING KAOWOOL

- Sequoyah Units 1 & 2 - remove/replace with Thermo-Lag 330-1
- Susquehanna Units 1 & 2 - remove/replace with another material
- Salem Units 1 & 2 - remove/replace with another material
- Prairie Island - remove/replace with another material

NRR CONCLUSIONS FARLEY KAOWOOL

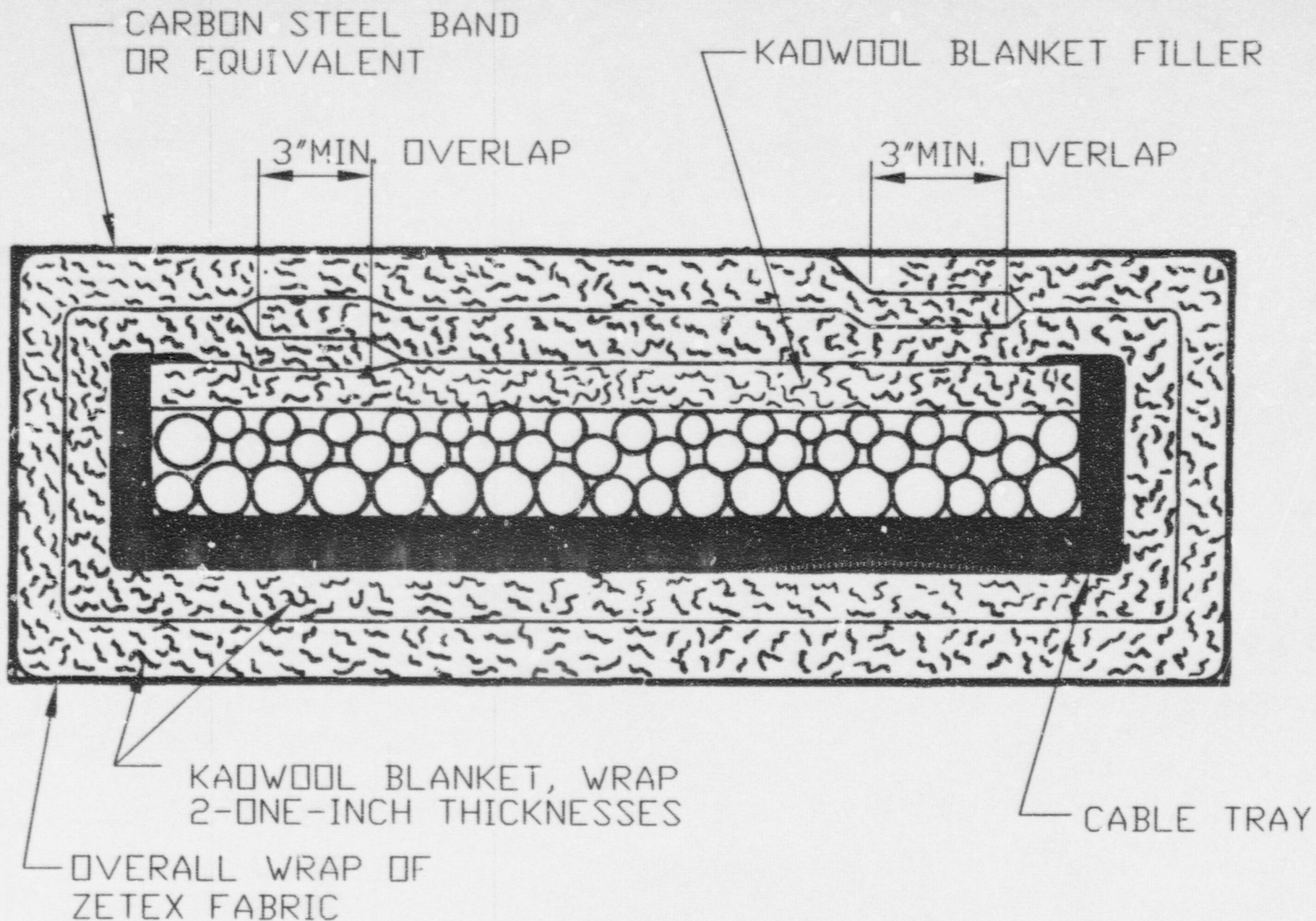
- Design Basis documents submitted do not establish 1-hour fire rating
- Tests do not bound installed configurations
- Testing demonstrates failures
- Kaowool installed at Farley
 - less than required 1-hour fire barrier
 - thermal performance is indeterminate
- Ampacity derating
 - Installed configurations differ from limits established in tested configuration
- Distinction between Appendix R vs. Appendix A requirements
- Not in compliance with approved Appendix R exemptions

SNC HANDOUTS

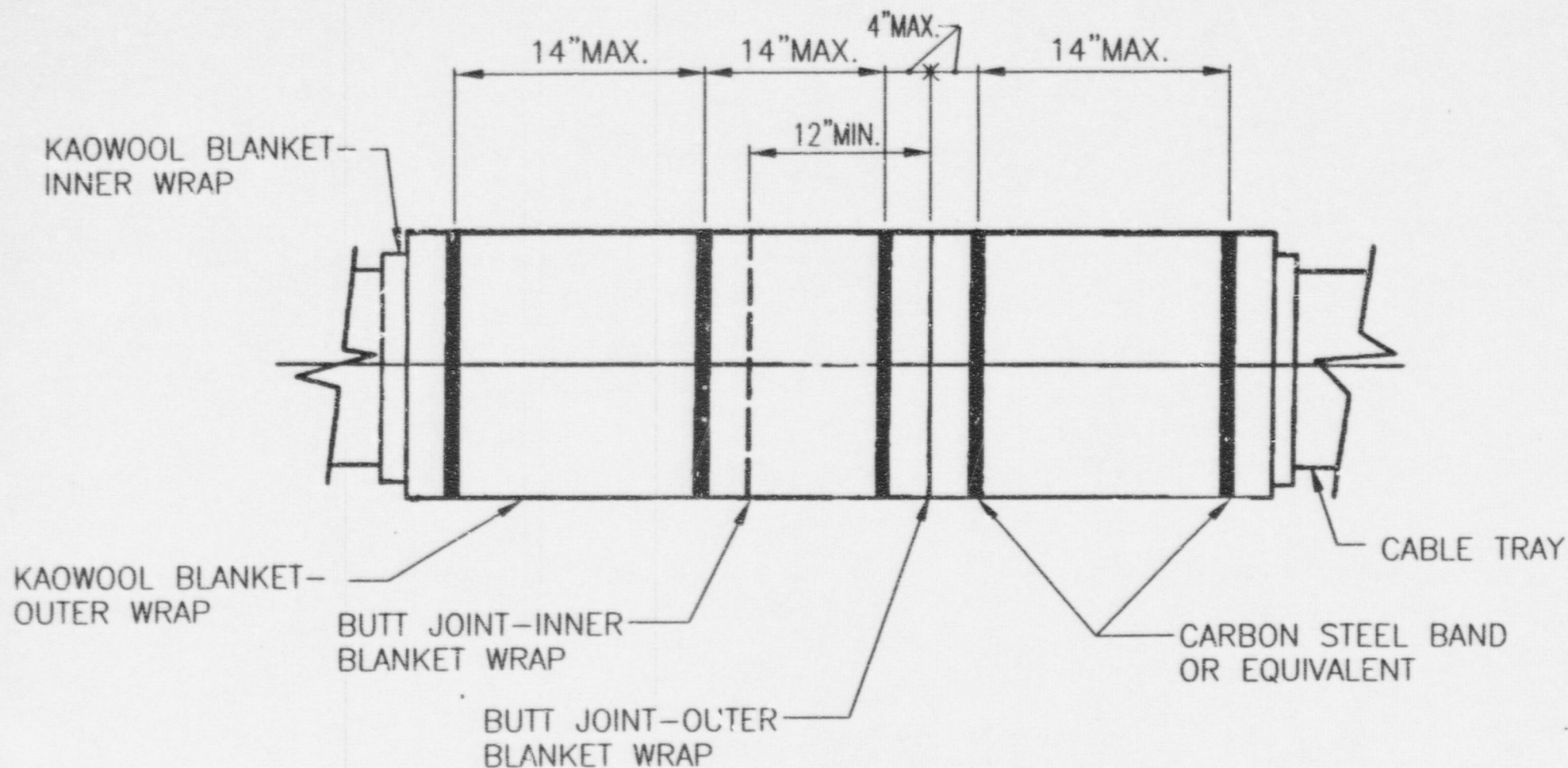


Kaowool Timeline

Created December 1998



TYPICAL KAOWOOL INSTALLATION
CUT-AWAY VIEW



TYPICAL KAOWOOL INSTALLATION
EXTERIOR DETAIL

The NRC Inspection Report from September of 1985 notes that "Included in the [NRC] review was an evaluation of the acceptability of the barrier or enclosure construction and configuration . . . as used in the plant."

Typical Exemption Request:

“One train of redundant cables are provided with fire barriers consisting of two 1-inch layers of Kaowool blanket with an overall layer of Zetex cloth...”

Typical NRC SER:

“Based upon our evaluation, we conclude the licensee’s alternative fire protection and shutdown configuration will provide an acceptable level of fire protection to that required by the technical requirements of 10 CFR 50 Appendix R, Section III.G.2.”

GENERIC LETTER 86-10

Documentation Required to Demonstrate Compliance:

“...where the licensee chooses not to seek prior NRC review and approval of, for example a fire area boundary, an evaluation must be performed ...”

GENERIC LETTER 86-10, Supplement 1

"This guidance will be used by the Staff to review and evaluate the adequacy of fire endurance tests and fire barrier systems **proposed** by the licensee **in the future** to satisfy existing NRC fire protection rules and regulations."

Backfit Discussion:

"...this...supplement will be used by the Staff for review and evaluation of the adequacy of fire barrier systems and fire endurance tests that may be **proposed in the future** to satisfy existing NRC fire protection rules and regulations."