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

May 4, 2000

MEMORANDUM TO: Stuart A. Richards, Director
Project Directorate IV & Decommissioning
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

FROM: Stewart N. Bailey, Project Manager, Section 2
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

SUBJECT: SUMMARY OF APRIL 3, 2000, MEETING WITH FRAMATOME TECHNOLOGIES INC. ON ELECTROSLEEVING OF STEAM GENERATOR TUBES (TAC NO. MA8593)

On April 3, 2000, the U.S. Nuclear Regulatory Commission (NRC) staff met with Framatome Technologies, Inc. (FTI), to discuss the status and future plans related to electrosleeving of steam generator (S/G) tubes. Two primary issues were discussed, ultrasonic test (UT) qualification issues and electrosleeve performance during beyond-design-basis severe accident conditions.

FTI discussed their progress in qualifying UT methods to size flaws in electrosleeved tubes. As part of this, cracks in the electrosleeve were generated by fatigue (a practice not typically used for UT qualifications) since the material is not susceptible to corrosion cracking. FTI discussed the difficulties in testing tube integrity with electrosleeving applied to inside-diameter cracks, since the crack is partially filled by the electrosleeve and cannot be detected again unless it grows sufficiently to penetrate either the inside or outside surface. However, FTI noted that for an electrosleeved tube, the original tube material is in compression during normal operation such that there is no mechanism for crack growth.

FTI stated that many licensees do not consider electrosleeving to be a viable option, primarily because of issues related to the sleeve's ability to withstand severe accidents. Despite this, FTI has performed tests which indicate that an electrosleeved tube withstands severe accident conditions as well as or better than an unflawed tube in the freespan. FTI noted that one of their significant hurdles is defining acceptance criteria for tube qualification. FTI asked the NRC staff to docket an ANL report, if it is completed, which provides some guidance for determining a plant-specific temperature criteria which would preclude a risk issue from arising (e.g., if the tube and electrosleeve were qualified to that temperature there would be no risk associated with the repair). The staff is pursuing this.

The staff thanked FTI for their update on electrosleeving. The staff expressed an interest in the testing which demonstrates the behavior of an electrosleeved tube during a severe accident. A list of those attending the meeting is provided as Attachment 1. The slides used by the FTI during the meeting are provided in Attachment 2.

Project No. 693

Attachments: 1. Meeting Attendees
2. Slides

cc w/atts: See next page

DISTRIBUTION:

Hard Copy
PUBLIC
PD IV-2 r/f

E-Mail
JZwolinsky (RidsNrrDlpm)
SBlack (RidsNrrDlpm)
AMendiola (RidsNrrDlpmLpdiii2)
SBailey (RidsNrrPMSBailey)
WBateman (RidsNrrDeEmcb)
RidsOgcMailCenter
RidsAcrsAcnwMailCenter
EMurphy
SCoffin
SLong

DOCUMENT NAME: G:\PDIV-2\B&WOG\BWOG_MTG000403SUM.WPD

To receive a copy of this document, indicate in the box: "C" = Copy without enclosures "E" = Copy with enclosures "N" = No copy

OFFICE	PM:PDIII/2		LA:PDIV/2		SC:PDIV/2			
NAME	SBAILEY:lcc SMB		EPEYTON eop		SDEMBEK			
DATE	5/4/00		5/4/00		5/4/00			

OFFICIAL RECORD COPY

cc:
Mr. Guy G. Campbell, Chairman
B&WOG Executive Committee
Vice President - Nuclear
FirstEnergy Nuclear Operating Company
Davis-Besse Nuclear Power Station
5501 North State Rt. 2
Oak Harbor, OH 43449

Ms. Sherry L. Bernhoft, Chairman
B&WOG Steering Committee
Florida Power Corporation
Crystal River Energy Complex
15760 West Power Line St.
Crystal River, FL 34428-6708

Mr. J. J. Kelly, Manager
B&W Owners Group Services
Framatome Technologies, Inc.
P.O. Box 10935
Lynchburg, VA 24506-0935

Mr. F. McPhatter, Manager
Framatome Cogema Fuels
3315 Old Forest Road
P.O. Box 10935
Lynchburg, VA 24506-0935

Mr. R. Schomaker, Manager
Framatome Cogema Fuels
3315 Old Forest Road
P.O. Box 10935
Lynchburg, VA 24506-0935

Mr. Michael Schoppman
Licensing Manager
Framatome Technologies, Inc.
1700 Rockville Pike, Suite 525
Rockville, MD 20852-1631

MEETING ATTENDEES
FRAMATOME TECHNOLOGIES, INC.
MEETING ON ELECTROSLEEVING
APRIL 3, 2000

NAME	AFFILIATION
Stewart Bailey	NRR/DLPM
Bill Bateman	NRR/DE/EMCB
Emmett Murphy	NRR/DE/EMCB
Stephanie Coffin	NRR/DE/EMCB
Steve Long	NRR/DSSA/SPSB
Phillip Rush	MPR Associates
Ceslie Collins	ABB CENP
Mike Schoppman	FTI Rockville
Bubba Humphries	FTI Lynchburg
Jeff Brown	FTI Lynchburg
James Galford	FTI Lynchburg

Attachment 1

NRC Meeting Agenda

April 3, 2000

- Update on Electrosleeving
- UT Qualification Outline
- Process Fabrication NDE Issues
- Severe Accident Considerations

FRAMATOME TECHNOLOGIES

Attachment 2

"Structural" Electrosleeve™ Licensing Issues

Objective:

Define NRC/FTI Expectations for Technical Specification Amendments Submittal for Repair of Steam Generator Tubes Using an Electrosleeve™

Reference Issues: NRC SECY-99-199.

- **UT Qualification Issues**

- **Performance during beyond-design-basis severe accident conditions**

FRAMATOME TECHNOLOGIES

NRC Topical Review Issues

- Qualify UT Depth Sizing Methods (Accuracy)

- Add Design Fatigue Curve to the Test Data Curve of Fatigue Data

- ID Pits in Sleeve

  Technical Specification vs. Topical for ISI
  20% degradation vs. 100% TW Sleeve Fabrication Anomaly.

- Evaluation of Honing Electrosleeve™

  Surface Material, Corrosion, and NDE Issues

FRAMATOME TECHNOLOGIES

"Structural" Electrosleeve™ Licensing Issues

- **Qualify UT Depth Sizing Methods (Accuracy)**

  Work Completed:

  UT Analysis Methods researched and documented in Rev. 3

  Fabricate Corrosion Induced Cracks (Real Flaws) in Roll Transitions

  Axial

  Circumferential

  UT and ECT Analysis of Samples
  - Base Line, Flaw Detection

  Electrosleeves Installed

  ECT Sleeved Samples
  - Acquisition, Analysis (Detection)

  UT Inspection
  - Acquisition

FRAMATOME TECHNOLOGIES

FLAW Depth Variations

- **Corrosion Induced Flaw Variations**

  Axial

  Circumferential

- **Analysis Methods Evaluation**

  - Successive Layering of sleeve material.

  - Flaw fixed, Remaining Wall Changes (Increases)

- **Fatigue Cracks into Electrosleeve™ as Simulation of Degradation**

  - Partial thickness

  - Propagate Sleeve Flaw into Electrosleeve using pressure cycling.

  - No plastic deformation

  - 100% TW Combined Wall (Leak @ ≈ 1000 psi)

  - Add Sleeve material

FRAMATOME TECHNOLOGIES

Remaining Tasks.

Analysis Procedures

UT MCS/FSN Analysis of Samples
- Roll Transition Impact on Flaw Depth Sizing.

Analysis of Progressive Sleeved Samples
Layered Sleeve to vary % TW of Flaw in Combined Thickness.

Appendix J Qualification

Destructive Examination (DE)

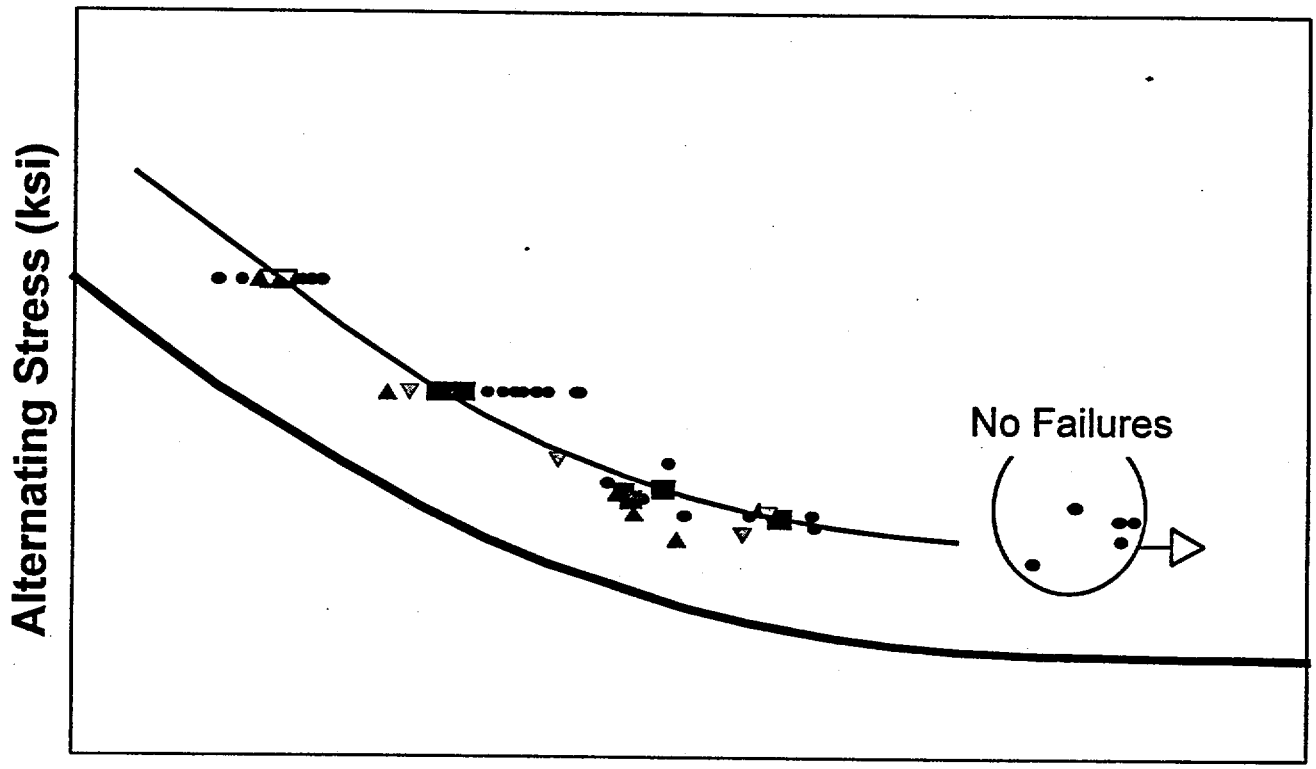
Separate documentation of DE plan.

FRAMATOME TECHNOLOGIES

Fatigue Data needed in Topical.

Electrosleeve Fatigue Data

(R = -1)



FRAMATOME TECHNOLOGIES

Additional

"Structural" Electrosleeve™

Licensing Issues

- **Severe Accident Issues**

Objective: **Provide Basis for Technical Specification Submittal**

Discussion:

Results of "Added Thickness" Burst Test

Results of "Real Crack" Burst test

Burst Correlation vs. Thickness
(Understand ANL's Analysis)

Flaw Growth Rate Data

FRAMATOME TECHNOLOGIES

Sleeved Corrosion Induced Flaw
Severe Accident Simulation

- OD Axial Flaw,
  (1.36" long, 0.030" or 60% TW @ UT)
- ANL transient ramp simulated to 1400 °F
- Pressure = 2350 psi
- Leak developed after 90 minutes at 1400 °F,
  EDM reference in tube with no sleeve on ID
- No leakage in Sleeve
- Conclusion:

  Results are comparable to a virgin tube

FRAMATOME
TECHNOLOGIES

"Added Thickness" Burst Test Results

Sleeve target for 7/8" tube = 0.038"wall

Laboratory	Sleeve Thickness inches	Flaw Description Length-TW	Failure Temperature ° C	Failure Temperature ° F
ANL	0.0395	3"-99.6%	643	1189
ANL	0.035	3"-97%	630	1166
ANL	0.044	3"-100%	673	1243
FTI	0.045	3"-100%	652	1206
Reference:				
"ANL -3ΔP"			681	1258

FRAMATOME TECHNOLOGIES

Plugging Criteria
for
"Free Span Axial Flaw"

"Free Span" = Length of structural significant flaw outside structural support structure:

Structural Support:

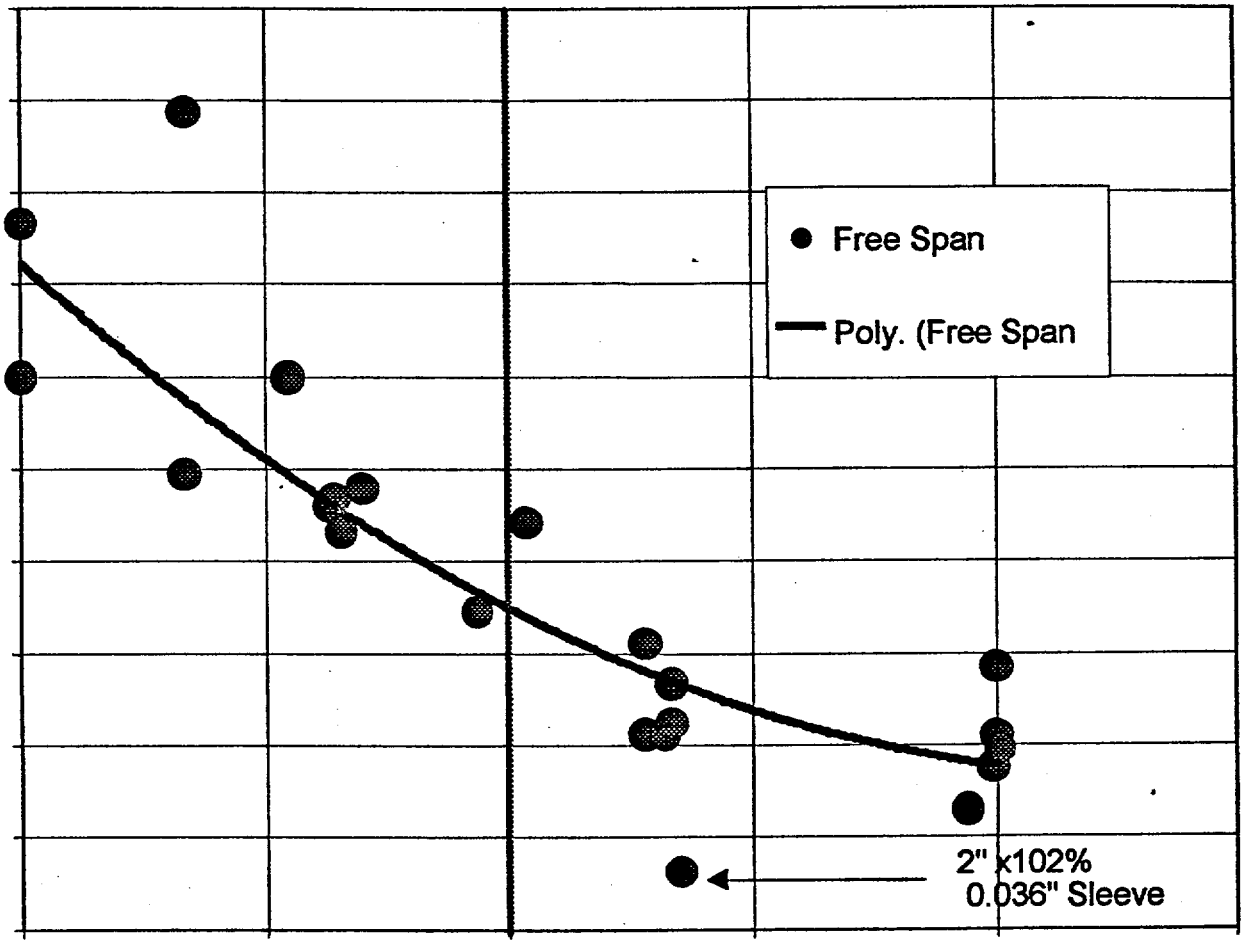
- **Tubesheet**
- **Drilled Support Plate**

ISI Plugging Criteria for Severe Accident;

An axial flaw with a degraded area that is structurally significant based on FTI/ANL Test Data.

FRAMATOME
TECHNOLOGIES

Free Span Axial Degradation "Area" vs. High Temperature Rupture



Temperature, °F

Tube Degraded Area /Limiting Flaw

FRAMATOME
TECHNOLOGIES

Meeting Summary

Any other issues?

NRC feedback?

- Severe Accident
  - Acceptance Criteria
  - Documentation Criteria (White Paper ?)
- ID Pitting
  - Additional Information

FRAMATOME TECHNOLOGIES