



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

50-305

April 4, 1997

LICENSEE: Wisconsin Public Service Corporation  
FACILITY: Kewaunee Nuclear Power Plant  
SUBJECT: SUMMARY OF MARCH 24, 1997, MEETING ON STEAM GENERATOR TUBE  
RE-SLEEVEING

On March 24, 1997, NRC staff members met in Rockville, Maryland, with representatives of Wisconsin Public Service Corporation (WPSC), Framatome Technologies, and ABB Combustion Engineering to discuss a proposal to repair degraded hybrid expansion joint (HEJ) steam generator (SG) tube sleeve assemblies at the Kewaunee Nuclear Power Plant by re-sleeving them. A list of meeting attendees is included as Enclosure 1, and a copy of the licensee's presentation is included as Enclosure 2.

The licensee opened the meeting by reviewing the status of the Kewaunee SG sleeve joints. Due to the limited success they had experienced with the laser weld repairs, the licensee needed another method to repair the degraded HEJ sleeve joints. The licensee had considered several different options before deciding to pursue the re-sleeving option.

A representative from Framatome Technologies gave a presentation on the sleeve removal and tube preparation aspects of the re-sleeving repair method. Basically, the tube is prepared by cutting and removing the HEJ sleeve below the upper joint, expanding the upper joint (either hydraulically or by rolling) to the original tube inner diameter, and whip cutting the tube in the tubesheet to relieve stresses.

A representative from ABB Combustion Engineering gave a presentation on the sleeve installation process. Once the tube is prepared, a new sleeve will be installed by welding at the upper joint and rolling at the lower joint in the tubesheet. This is conventional sleeve installation methodology.

The licensee closed the meeting by outlining their schedule for repairs. The licensee is currently conducting a performance demonstration of the re-sleeving process on 25 tubes in SG "A." This demonstration is scheduled to be completed by April 11, 1997. The licensee anticipates submitting a license amendment request by April 15, 1997, to add the re-sleeving option to the Technical Specifications. In addition, the licensee requested a follow-up meeting with the staff during the week of April 14, 1997, to discuss the results of the performance demonstration.

**NRC FILE CENTER COPY**

110046

11/1 DFOI

The NRC staff expressed its appreciation to the licensee for providing the presentation on its proposed re-sleeving repair option. The staff also agreed to support a follow-up meeting during the week of April 14, 1997, to discuss the results of the performance demonstration.

Original signed by:

Richard J. Laufer, Project Manager  
Project Directorate III-3  
Division of Reactor Projects III/IV  
Office of Nuclear Reactor Regulation

Docket No. 50-305

Enclosures: As stated

cc w/encls: See next page

DISTRIBUTION w/encls:

Docket File  
PD III-3 Reading  
PUBLIC  
OGC  
ACRS  
JGadzala, RI-Kewaunee

E-Mail

SCollins (SJC1)	BMcCabe (BCM)
FMiraglia (FJM)	RZimmerman (RPZ)
AThadani (ACT)	EAdensam (EGA1)
JRoe (JWR)	JCaldwell (JLC1)
GMarcus (GHM)	GHornseth (GPH)
DRoss (SAM)	JStrosnider (JRS2)
SDembek (SXD)	JSchapker (JFS)
TSullivan (EJS)	CCarpenter (CAC)
CBeardslee (CDB)	

DOCUMENT NAME: G:\KEWAUNEE\RESLEEVE.MTS

To receive a copy of this document, indicate in the box: "C" = Copy without enclosures "E" = Copy with enclosures

"N" = No copy \* see previous concurrence

OFFICE	PD33:LA	EMCB *	E	PD33:PM	E
NAME	CBoyle <i>cyb</i>	KWichman		RLaufer <i>RL</i>	
DATE	4/14/97	4/4/97		4/4/97	

OFFICIAL RECORD COPY

The NRC staff expressed its appreciation to the licensee for providing the presentation on its proposed re-sleeving repair option. The staff also agreed to support a follow-up meeting during the week of April 14, 1997, to discuss the results of the performance demonstration.

Original signed by:

Richard J. Laufer, Project Manager  
Project Directorate III-3  
Division of Reactor Projects III/IV  
Office of Nuclear Reactor Regulation

Docket No. 50-305

Enclosures: As stated

cc w/encls: See next page

DISTRIBUTION w/encls:

Docket File  
PD III-3 Reading  
PUBLIC  
OGC  
ACRS  
JGadzala, RI-Kewaunee

E-Mail

SCollins (SJCI)	BMcCabe (BCM)
FMiraglia (FJM)	RZimmerman (RPZ)
ATHadani (ACT)	EAdensam (EGA1)
JRoe (JWR)	JCaldwell (JLC1)
GMarcus (GHM)	GHornseth (GPH)
DRoss (SAM)	JStrosnider (JRS2)
SDembek (SXD)	JSchapker (JFS)
TSullivan (EJS)	CCarpenter (CAC)
CBeardslee (CDB)	

DOCUMENT NAME: G:\KEWAUNEE\RESLEEVE.MTS

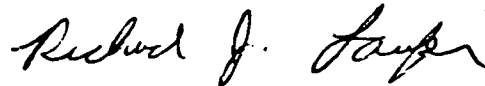
To receive a copy of this document, indicate in the box: "C" = Copy without enclosures "E" = Copy with enclosures

"N" = No copy \* see previous concurrence

OFFICE	PD33:LA	EMCB *	E	PD33:PM	E
NAME	CBoyle	KWichman		RLaufer	
DATE	4/14/97	4/4/97		4/4/97	

OFFICIAL RECORD COPY

The NRC staff expressed its appreciation to the licensee for providing the presentation on its proposed re-sleeving repair option. The staff also agreed to support a follow-up meeting during the week of April 14, 1997, to discuss the results of the performance demonstration.



Richard J. Laufer, Project Manager  
Project Directorate III-3  
Division of Reactor Projects III/IV  
Office of Nuclear Reactor Regulation

Docket No. 50-305

Enclosures: As stated

cc w/encls: See next page

Kewaunee Nuclear Power Plant  
Wisconsin Public Service Corporation

cc:

Foley & Lardner  
Attention: Mr. Bradley D. Jackson  
One South Pinckney Street  
P.O. Box 1497  
Madison, Wisconsin 53701-1497

Chairman  
Town of Carlton  
Route 1  
Kewaunee, Wisconsin 54216

Mr. Harold Reckelberg, Chairman  
Kewaunee County Board  
Kewaunee County Courthouse  
Kewaunee, Wisconsin 54216

Chairman  
Wisconsin Public Service Commission  
610 N. Whitney Way  
Madison, Wisconsin 53705-2729

Attorney General  
114 East, State Capitol  
Madison, Wisconsin 53702

U.S. Nuclear Regulatory Commission  
Resident Inspectors Office  
Route #1, Box 999  
Kewaunee, Wisconsin 54216

Regional Administrator - Region III  
U.S. Nuclear Regulatory Commission  
801 Warrenville Road  
Lisle, Illinois 60532-4531

Mr. Robert S. Cullen  
Chief Engineer  
Wisconsin Public Service Commission  
610 N. Whitney Way  
Madison, Wisconsin 53705-2729

Mr. M. L. Marchi  
Manager - Nuclear Business Group  
Wisconsin Public Service Corporation  
Post Office Box 19002  
Green Bay, Wisconsin 54307-9002

NRC MEETING WITH WISCONSIN PUBLIC SERVICE CORPORATION

KEWAUNEE NUCLEAR POWER PLANT

RE-SLEEVEING REPAIR OF HEJ STEAM GENERATOR TUBE SLEEVES

MARCH 24, 1997

NAME

AFFILIATION

Rich Laufer	NRC
Jack Strosnider	NRC
Gus Lainas	NRC
Geoff Hornseth	NRC
Ted Sullivan	NRC
Cheryl Beardslee	NRC
Steve Dembek	NRC
Jerry Schapker	NRC
Mark Marchi	Wisconsin Public Service Corporation
Sherry Bernhoft	Wisconsin Public Service Corporation
Craig Weiss	Wisconsin Power and Light Co.
Ken Willens	Yankee Atomic Electric Co.
Jeff Gorman	Dominion Engineering
Wayne Belden	Framatome Technologies
Charlie England	Framatome Technologies
David Stepnick	ABB
Jim Fulford	LIS

ENCLOSURE 1

# WPSC / NRC Meeting on Steam Generator Tube Re-Sleeving March 24, 1997

## Agenda

Introduction/ Purpose of Meeting

Mark Marchi- WPSC

Sleeve Removal and Tube Preparation

Wayne Belden- Framatome  
Technologies

Tube Re-Sleeving and Licensing Issues

David Stepnick- ABB/CE

Summary and Schedule Considerations

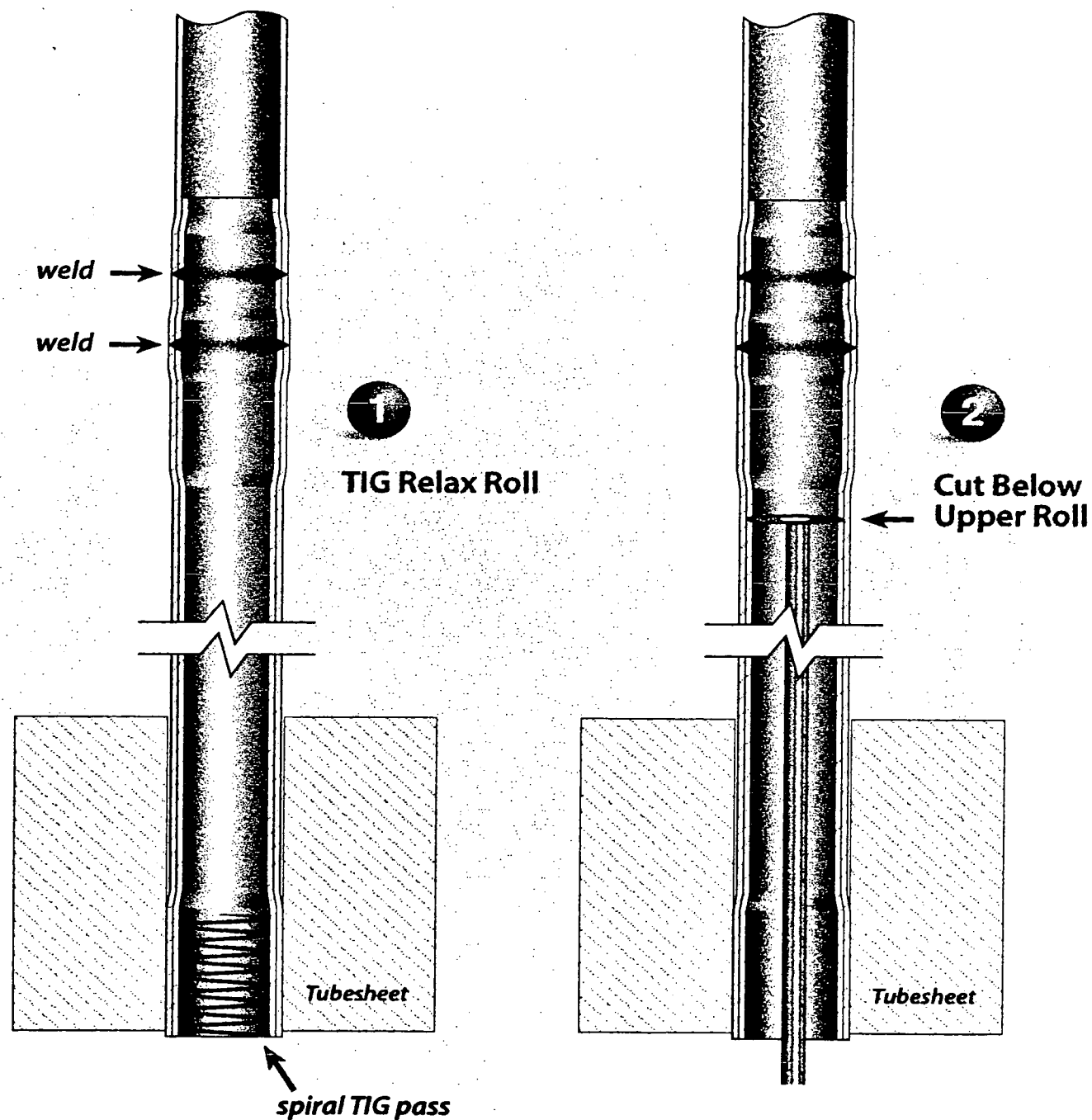
Sherry Bernhoft- WPSC

Enclosure 2

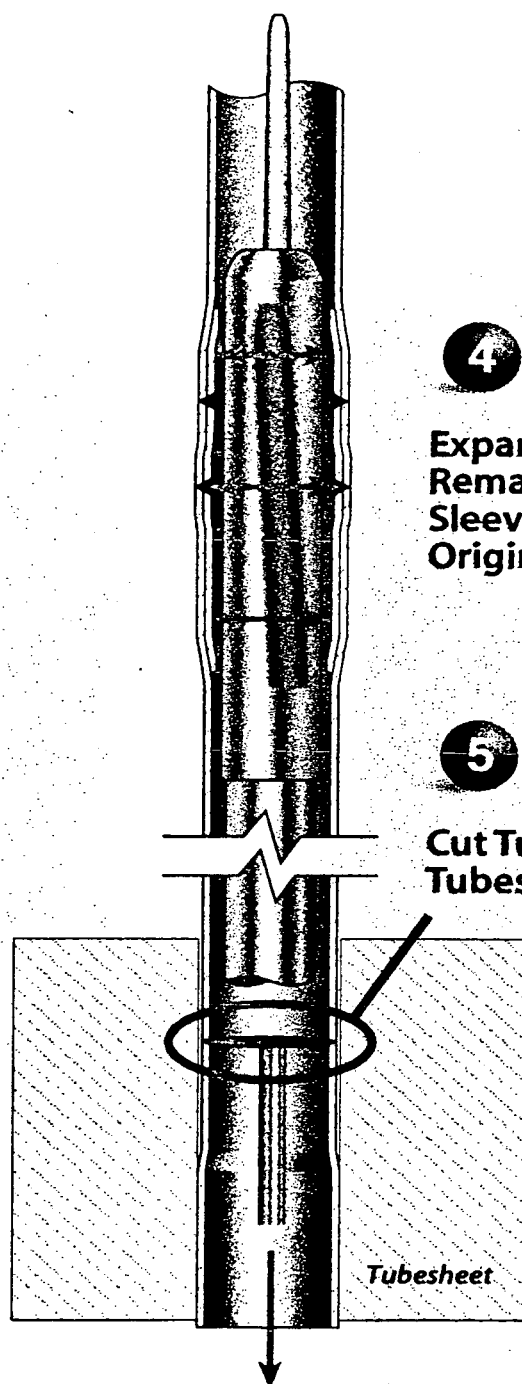
# KEWAUNEE RE-SLEEVE TUBE AND HEJ SLEEVE PREPARATION



# Sleeve Removal/New Sleeve Installation



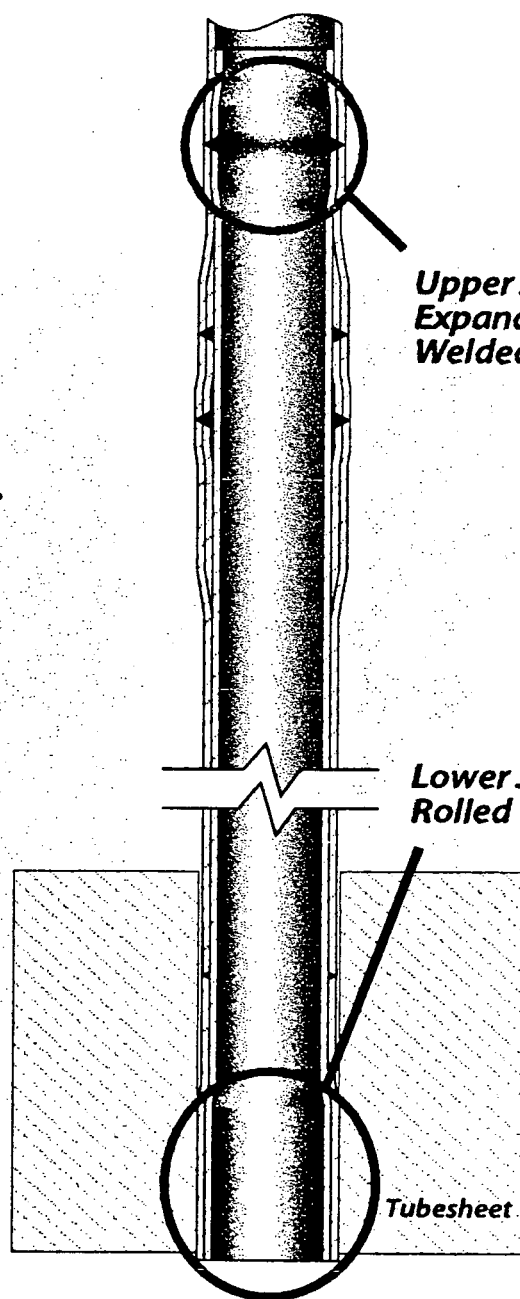
# Sleeve Removal/New Sleeve Installation



**4**  
Expand  
Remaining  
Sleeve/Tube to  
Original Tube I.D.

**5**  
Cut Tube in  
Tubesheet

**3** Remove Lower  
Sleeve Portion



*Upper Joint  
Expanded then  
Welded*

*Lower Joint  
Rolled*

**5** Install New  
Sleeve

## DISCUSSION OF PROCESS STEPS

- HEJ SLEEVE REMOVAL
  - TIG/Cut/Pull
  - 5” of HEJ left in tube
    - » Experience (16 Removed)
      - 6 tube/sleeve pulls
      - 10 sleeves removed in SG A
- EXPANSION
  - Target expanded ID (.775”)
  - Test Samples
  - Steam Generator Demonstration
    - » Scope 10 tubes + 15
      - Gauging
    - » Schedule
- CUT TUBE IN TS
  - Eliminate residual tensile stress in the tube for ABB-CE sleeve

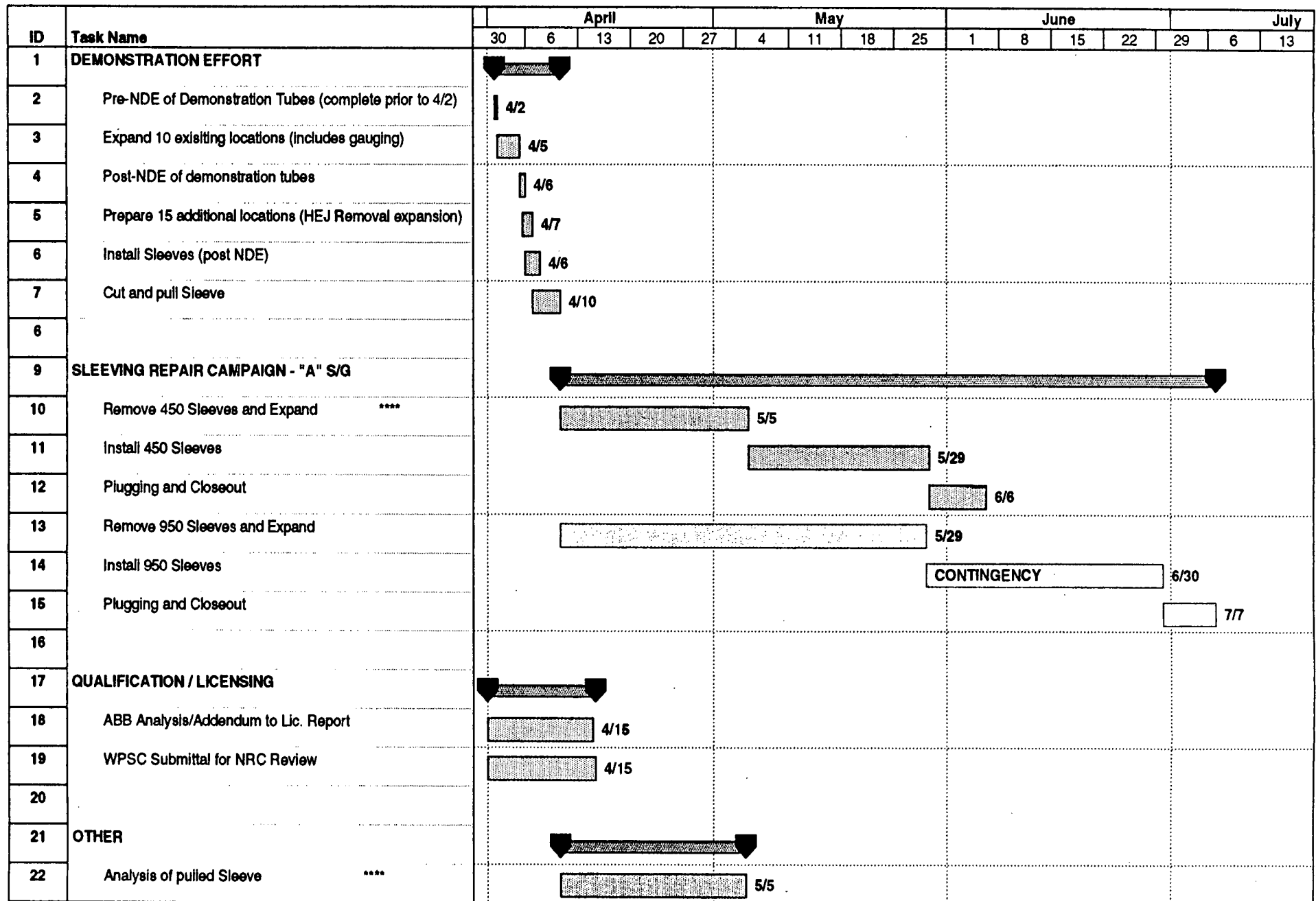
## WPSC SITE PROVING DEMO PLAN

- Expand and Gauge 10 tubes
- Remove sleeves and prep 15 more
  - Criteria
    - » DSI's
    - » Peripheral 36" boundary
    - » Row 2
    - » Existing Repair Weld Locations
- Bobbin on demo tubes
  - Before and after expansion process
    - » Impact on DSI's
- Plus Point on demo tubes
  - Before and After expansion process
    - » Hydraulic expansion region
      - Cracks, etc.
- Install ABB-CE sleeves
  - Post NDE for acceptance
- Pull a Lower Row Sleeve
  - Weld evaluation Acceptability

## QUESTIONS/ISSUES

- Can sleeve be installed?
  - Testing
  - Demonstration
- Crack/Defects in parent tube?
  - Expansion into tube circumferential cracks
  - Planned demonstration (ECT)
  - Load removed from degraded tube section
- Loose Parts from expansion process
  - Result of process
  - Later on?
- Fretting of Remnant on New Sleeve
  - Intimate contact
- TSP Loads - Effect on DSI's
  - HEJ plus repair 2000 lbs +
- Secondary Side Considerations
  - Neighboring tubes
  - FIV (small flow velocities)
  - Flow (<10% larger, locally)

# KEWAUNEE RE-SLEEVE PLANNED WPSC SITE SCHEDULE -- DRAFT



\*\*\*\* ACTIVITIES TO BE COMPLETE BY START OF SLEEVE INSTALLATION

# ABB/KEWAUNEE RE-SLEEVEING

March 24, 1997

# AGENDA

- **Re-Sleeving Design Concepts**
- ABB Tubesheet Sleeve
  - Design & Installation
- Licensing



## RE-SLEEVE DESIGN CONCEPTS

- Tube prepared for sleeving
  - HEJ sleeve section removed
  - HEJ upper end rolled to tube I.D.
  - Tube whip cut in tubesheet to relieve stresses
- Installation of ABB tubesheet sleeve
  - 39” long to span defect from RTZ to HEJ upper end

# ABB TUBESHEET SLEEVE DESIGN CONCEPTS

- Leaktight
- Low Residual Stresses
  - Tube expansion limited to .005"
- Corrosion Resistant (I690)
- Inspectable (100% UT/VT/ECT)
- Repairable (Reweld)
- Structural requirements of tube
- Pluggable

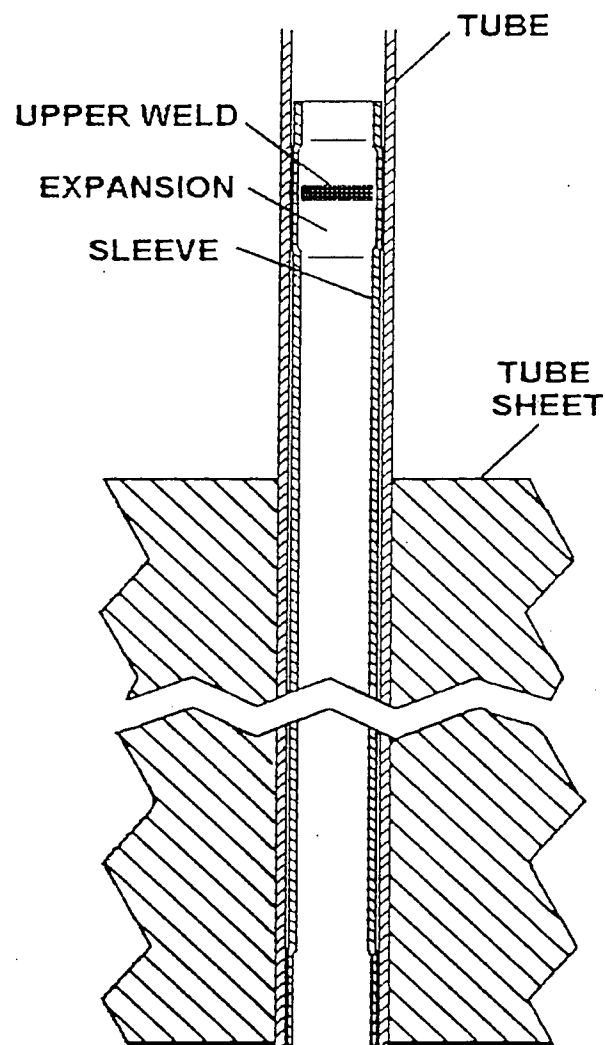
# AGENDA

- Re-Sleeving Design Concepts
- **ABB Tubesheet Sleeve**
  - **Design & Installation**
- Licensing

## ABB TUBESHEET SLEEVE DESIGN

- Leak tight I690 sleeve
- 27"/33"/39" in length
  - Based on T/S coverage and length of original HEJ sleeve
- Spans defects from RTZ to HEJ upper end
- Welded into tube above HEJ
- Rolled into tube below RTZ
- Fully inspected  
(U.T./V.T./ECT)

# ABB TUBESHEET SLEEVE DESIGN



# ABB TUBESHEET SLEEVE INSTALLATION STEPS

- Mark tube end
  - Soapstone or paint
- Brush/inspect tube I.D.
  - Centrifugal brush
  - Visual verification of cleanliness
- Swab tube I.D.
  - Cotton swab
- Insert/expand sleeve
  - Sleeve & tube end hardstop
  - Pressure controlled system
  - Elastomeric bladder

# ABB TUBESHEET SLEEVE INSTALLATION STEPS

- Weld upper joint
  - GTA process
  - Autogenous weld
  - Full pen thru sleeve/partial pen thru tube
- VT upper joint
  - CCD micro-chip camera
  - Surface condition examination
- UT upper joint
  - Enhanced techniques
  - A, B, B' and C-scan analysis

# ABB TUBESHEET SLEEVE INSTALLATION STEPS

- Roll lower joint
  - 2 Step process
  - Torque controlled structural
  - Size controlled flow
- ECT
  - Appendix H qualified
  - Plus Point exam
  - Submitted to NRC by ComEd in 1996



# AGENDA

- Re-Sleeving Design Concepts
- ABB Tubesheet Sleeve
  - Design & Installation
- **Licensing**

## ABB SLEEVING EXPERIENCE

- 1982 Welded sleeve development
- 1984 Field Installation of welded/welded sleeves
- 1991 Field installation of welded/rolled sleeves
- 1996 32nd field installation of welded sleeves
- 1996 > 10,000 sleeves installed to date

Plant	Hot Leg	Sleeve	Estimated EFPY of Sleeve Operation (2)																	
	Temp (F)	Type (1)	<1	1	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	TOTAL
Ringhals 2	610	STAW					16													
	600	STAW					571	599		59	16									1245
Ginna	601	STAW						51	178		183	198		408			104		36	1158
		PTAW							63		29	48		107						247
Prairie Island 1 (4)	590	STAW															73		27	100
		STHT			253		117		158					62						590
Kewaunee (4)	590	PTAW							16											16
Zion 1 (4)	594	STAW			911		61	124			445				128					1669
Zion 2 (4)	594	STAW	237			162	170				82									651
ANO 2 (4)	611	RTHT			627															627
Ringhals 3 (4)	610	RTHT									46									46
		SPHT									22									22
KRSKO (4)	619	RTHT		188			164													352
		SPHT		273			16													289
Byron 1 (4)	618	RTHT		3527																3527
Total				3988	1791	162	1099	774	415	59	823	246	0	577	128	0	177	0	63	10539
Cumulative Total				10302	6314	4523	4961	3262	2488	2073	2014	1191	945	945	368	240	240	63	63	

(3)

Notes:

(1) Sleeve Type designations and their totals are as follows:

		Totals
STAW	Standard Tubesheet sleeves where the welds are in the As Welded condition	4823
PTAW	Peripheral (Initially Curved) Tubesheet sleeves where the welds are in the As Welded condition	263
STHT	Standard Tubesheet sleeves where the upper weld has been Post Weld Heat Treated	560
RTHT	Roll Transition sleeves where the weld has been Post Weld Heat Treated	4552
SPHT	Support Plate sleeves where the welds have been Post Weld Heat Treated	311

(2) EFPY of operation is based either on data received from the plant or calculated from the load factor published in Nuclear Engineering International for the period during which the sleeves have been in place. Operating time is rounded to the nearest 0.5 EFPY as of 1 March 1997

(3) 16 Sleeves which ran for a year at Ringhals 2 before T hot was reduced are included in totals for 600 F

(4) Plants inspected with I-coil or Plus Point ECT probe

# ABB TUBESHEET SLEEVE LICENSING ISSUES

- Welded/welded sleeve
  - Report No. CEN-413-P
  - 1992 Kewaunee sleeve installation
- Welded/rolled sleeve
  - Report No. CEN-629-P
  - Contains enhanced NDE technique commitments
  - Limited to 30" long sleeve
  - Submitted to WPS on 3/20/97
  - Submitted to NRC by NSP & ComEd

## ABB TUBESHEET SLEEVE LICENSING ISSUES

- Reanalysis required for 39" sleeve
  - Structural for mechanical testing
  - Hydraulic for flow considerations
  - Due 3/28/97
  - Report form to WPS
- Preliminary Results show:
  - Additional mechanical testing is not required
  - Additional corrosion testing is not required