March 17, 2000

LICENSEE: Entergy Operations, Inc.

FACILITY: Arkansas Nuclear One, Unit 1

SUBJECT: ARKANSAS NUCLEAR ONE, UNIT 1, MEETING SUMMARY RE: FEBRUARY 16, 2000, MEETING TO DISCUSS APPROVED AND PROPOSED STEAM GENERATOR TUBE REPAIR TECHNIQUES

On February 16, 2000, representatives of the Nuclear Regulatory Commission (NRC) met with Entergy Operations, Inc. (Entergy or the licensee) to discuss steam generator repair techniques utilized during their Fall 1999 refueling outage and their plans to request NRC approval for additional alternate repair criteria for their next refueling outage in spring 2001. These proposed applications are in the planning stage and have not yet been submitted on the docket for NRC review. Enclosure 1 is a list of meeting attendees. Enclosure 2 is the licensee's handout used during the meeting.

The licensee summarized the overall condition of the steam generator tubes determined from inspections conducted during the last refueling outage. The licensee provided a status of their root cause investigations into the significance of the numerous indications observed in the upper role transition region of the re-roll repairs after one cycle of operation. Entergy indicated that they would be submitting an application to permit multiple re-roll repairs in the same steam generator tube. In addition, Entergy indicated that they are planning to submit two separate approaches to address the intergrannular attack observed on the outside diameter of affected steam generator tubes. The first approach will use a deterministic methodology similar to one previously approved by the NRC staff on a single-cycle basis. The second approach will use a risk-informed approach in an attempt to justify a permanent amendment.

/RA/

M. Christopher Nolan, Project Manager, Section 1
Project Directorate IV & Decommissioning
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-313

Enclosures: As stated (2)

cc w/encls: See next page

To receive a copy of this document, indicate "C" in the box						
OFFICE	PDIV-1/PM	C	PDIV-1/LA		PDIV-1/SC	C
NAME	C.Nolan MN		D.Johnson dlj		R.Gramm RG	
DATE	03/16/00		03/16/00		03/17/00	

DOCUMENT NAME: G:\PDIV-1\ANO1\MTS021600.wpd

OFFICIAL RECORD COPY

DISTRIBUTION FOR MEETING SUMMARY

Dated: March 17, 2000

HARD COPY
File Center
PUBLIC
PD# IV-1 Reading
OGC
ACRS

E-MAIL
J. Zwolinski/S. Black
S. Richards (clo)
T. Alexion
E. Sullivan
E. Murphy
L. Lund
J. Tsao
P. Milano
S. Long
P. Harrell

cc:
Executive Vice President
& Chief Operating Officer
Entergy Operations, Inc.
P. O. Box 31995
Jackson, MS 39286-1995

Director, Division of Radiation
Control and Emergency Management
Arkansas Department of Health
4815 West Markham Street, Slot 30
Little Rock, AR 72205-3867

Winston & Strawn
1400 L Street, N.W.
Washington, DC 20005-3502

Manager, Rockville Nuclear Licensing
Framatone Technologies
1700 Rockville Pike, Suite 525
Rockville, MD 20852

Senior Resident Inspector
U.S. Nuclear Regulatory Commission
P. O. Box 310
London, AR 72847

Regional Administrator, Region IV
U.S. Nuclear Regulatory Commission
611 Ryan Plaza Drive, Suite 400
Arlington, TX 76011-8064

County Judge of Pope County
Pope County Courthouse
Russellville, AR 72801

Vice President, Operations Support
Entergy Operations, Inc.
P. O. Box 31995
Jackson, MS 39286-1995

Wise, Carter, Child & Caraway
P. O. Box 651
Jackson, MS 39205

Mr. Craig G. Anderson
Vice President Operations, ANO
Entergy Operations, Inc.
1448 S. R. 333
Russellville, AR 72801

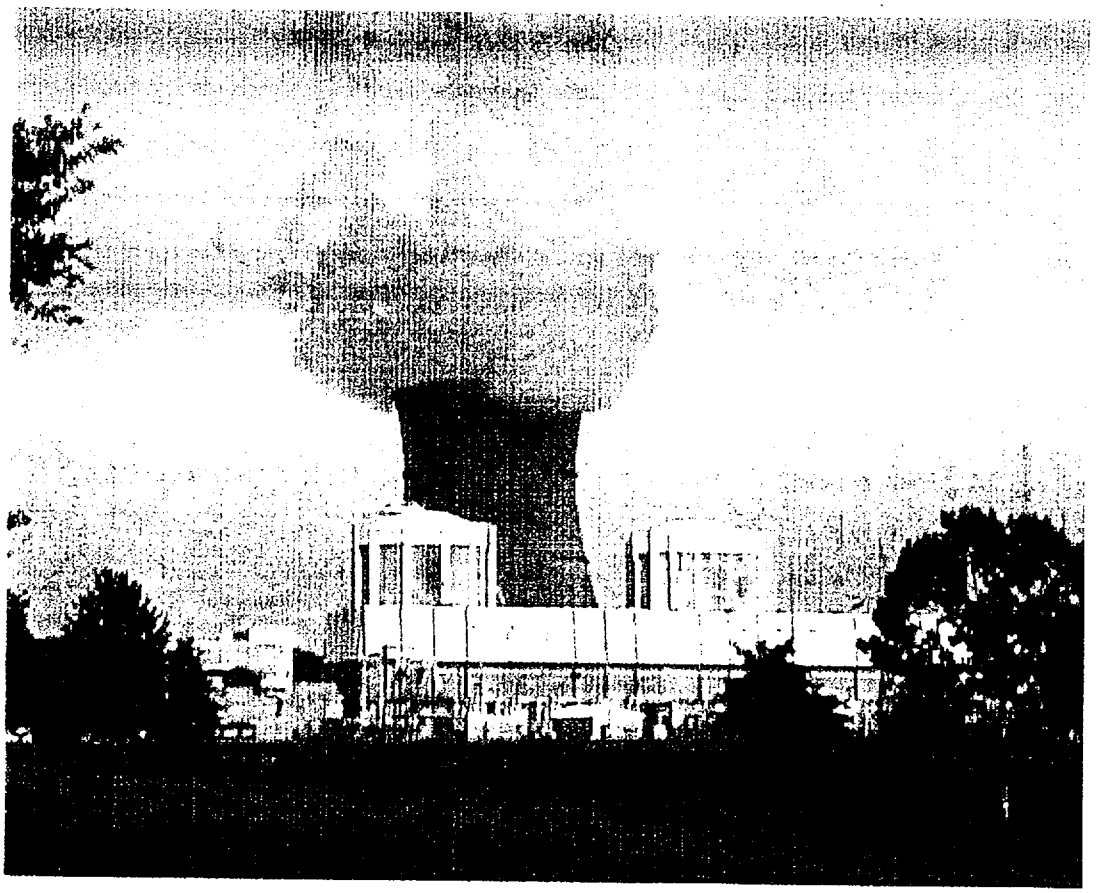
ATTENDANCE LIST

PUBLIC MEETING HELD ON FEBRUARY 16, 2000

Name	Organization
D. James	Entergy
R. Jones	Entergy
R. Harris	Entergy
M. Smith	Entergy
R. Lane	Entergy
D. Harrison	Entergy
J. Hathcote	Entergy
S. Brown	Framatome
E. Polstra	Framatome
D. Stellfox	Inside NRC
C. Nolan	NRC
R. Gramm	NRC
J. Tsao	NRC
S. Long	NRC
E. Sullivan	NRC
L. Lund	NRC
T. Alexion	NRC
E. Murphy	NRC

Arkansas Nuclear One
Unit-1
OTSG Issues

February 16, 2000



Enclosure 2

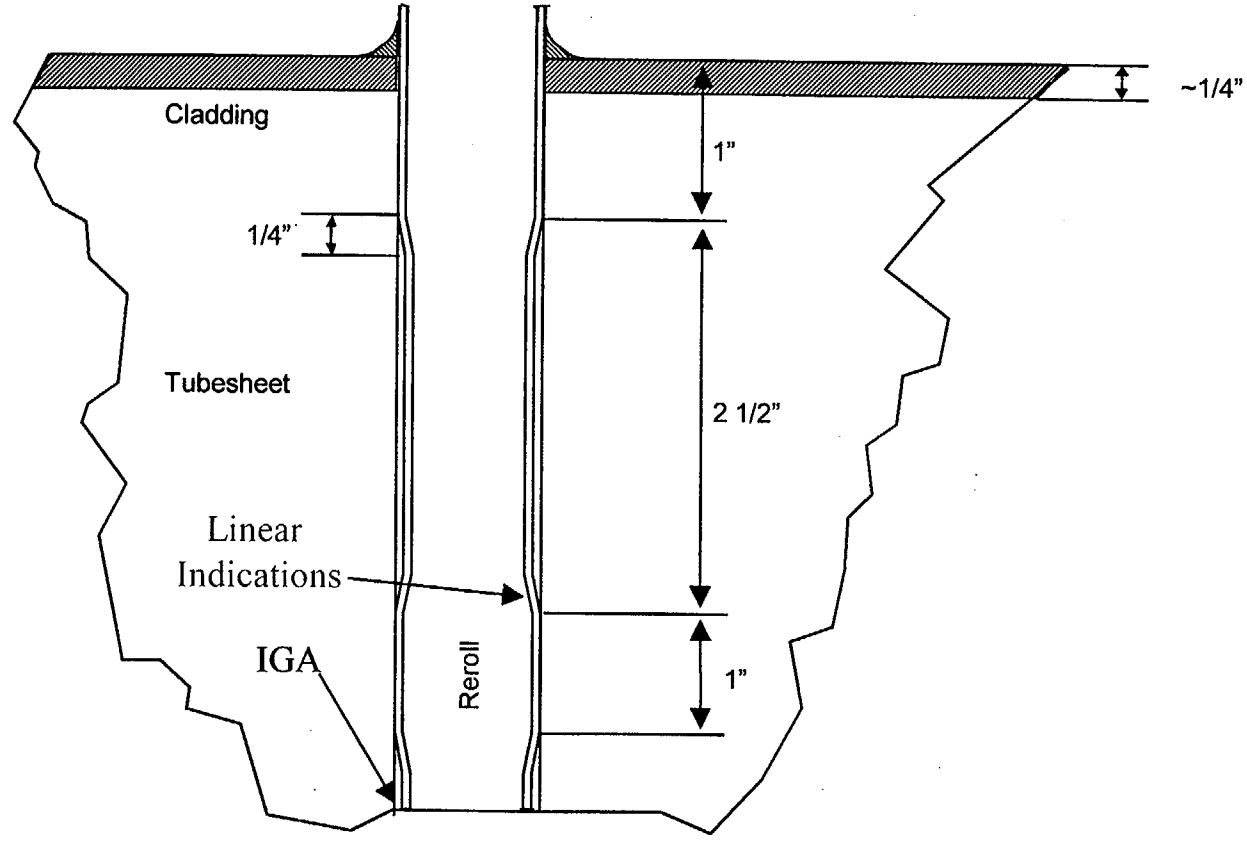
Arkansas Nuclear One - Unit 1
OTSG Issues

February 16, 2000

Purpose of Meeting

- Introduction.....Dale James
- Re-roll cracking.....John Hathcote
- Re-roll optimization.....John Hathcote
  - Joint integrity
- Upper tubesheet IGA..... John Hathcote
- Risk-informed approach.....Richard Harris
- Schedule.....Dale James

Upper Tubesheet Detail



Re-roll Cracking

- 3,118 re-rolls installed during 1R14 (4/98)
- 100% RPC exam performed in 1R15 (9/99)
  - Required per the qualification report
  - 353 crack-like indications detected in the upper transition
  - Classical PWSCC
  - Some extend into the 1" effective roll
  - None identified in the lower transition
- Potential contributors
  - Roller walk-out
  - Tooling configuration / geometry

Re-roll Cracking Investigation

- Statistical review of installed re-rolls
  - Bobbin profiles, torque and diameter feedback
  - Material properties, geometry parameters
- RSG re-roll history
- Rolled hardware performance (i.e. sleeves)
- Review tooling and installation process
  - Roller geometry, installation technique, torque delivery
- Comparison to other OTSG re-rolls
- Accelerated corrosion testing
- Complete in April

Re-roll Joint
Integrity / Optimization

Re-roll Joint Integrity

- PSC 2-98
  - Address potential higher axial tube loads (SBLOCA)
  - Complicating factors
    - Thermal hydraulic analysis
    - Calculating axial load and bore dilations
    - Determining joint strength
- Will the rolled joints meet the topical report criteria? - "No slippage"
- Preliminarily concluded some joints may not carry the newly analyzed SBLOCA loads

Re-roll Joint Integrity

- Initial conclusion based on conservative interpretation of springback an undilated load testing
  - Exclusion zone established where the 1" joint would not carry the load
  - No re-rolling was performed in this area during 1R15
- Developed justification for slippage
  - For SBLOCA no positive pri-to-sec pressure differential
- Recently concluded the 1" joint will not slip
- Re-roll topical revision will include results

Re-roll Optimization

- BWOG project
- Revision to BWOG generic topical
- Multiple re-rolls in the upper and lower tubesheets
- Additional testing being performed
  - Dilated condition
  - Leakage and pull out load

Upper Tubesheet IGA

IGA Background

- Present since late 70's
- No leakage observed
  - Includes > 450 existing IGA flaws
  - Includes numerous in-situ, lab and pulled tube results
  - Empirical correlation cannot be developed
- No growth observed
  - Several growth rate studies performed
  - No change in the compared parameters
    - Bobbin and plus-point volts
    - Axial and circ extents

Growth Rate Evaluation

- Currently implement three phases for assessing IGA growth
  - Population comparison
  - Individual flaw comparison
  - Assumption for next cycle growth (leakage)

1. Population comparison
   - 0.115" pancake axial and circ extents compared
   - 95% LCL must be below zero
   - Plus-point volts compared
   - The lower 1-sigma must be below zero
   - Not required for other ARCs (e.g. 95-05)

Growth Rate Evaluation

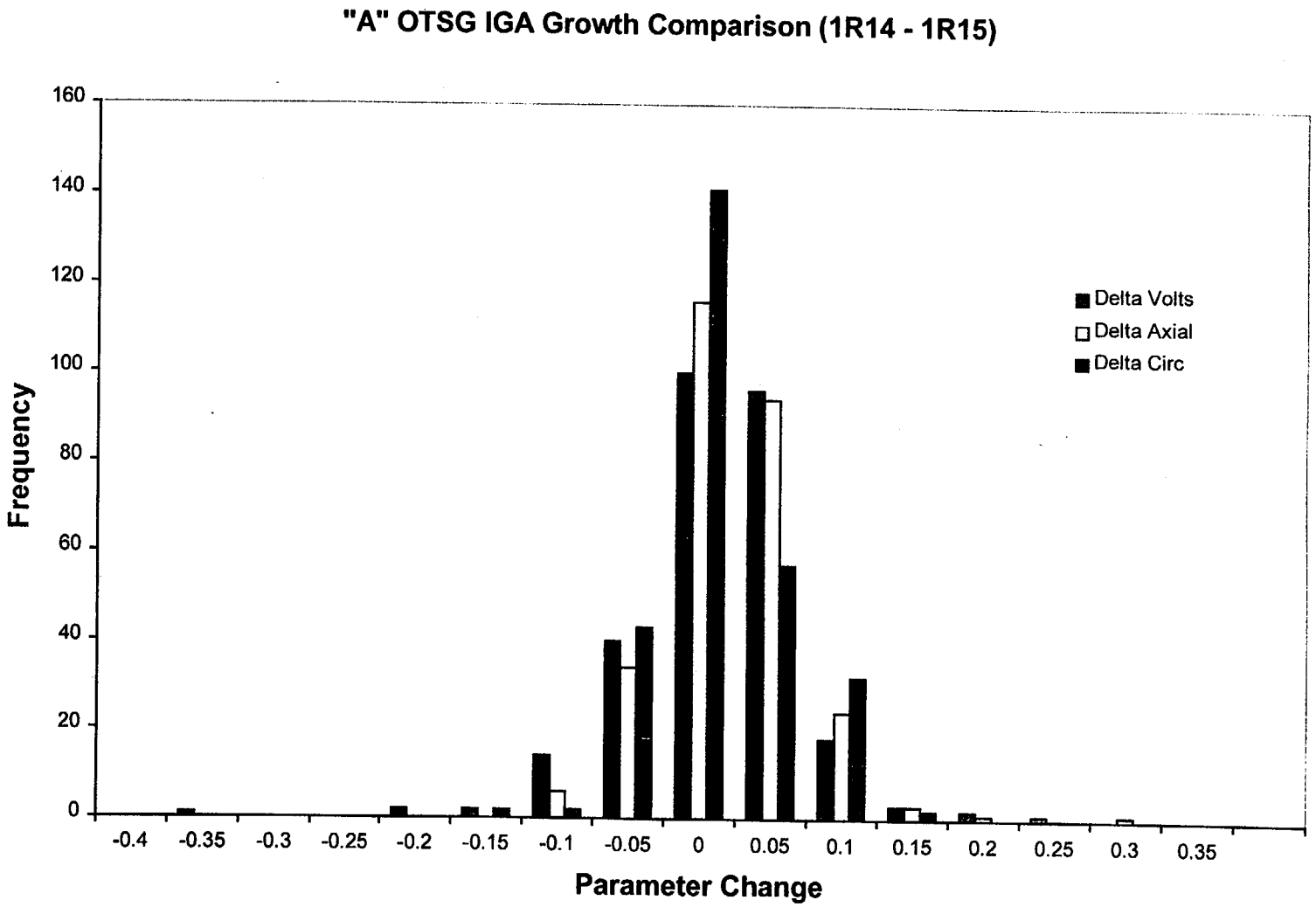
2. Individual flaw comparison

- 95% UCL values (volts, axial and circ extent) from the population comparison are added to the individual values and compared to established repair limits
  - 0.5" for axial and circ extent
  - 1.16 plus-point volts
  - Based on previous testing
- Delta parameter (e.g. 1R14-1R15) is added to the measured value and compared to the repair limits
- The tubes are repaired if any of the six comparisons exceed the repair limit

3. Assumption for next cycle growth

- The 95% UCL is added to the axial extents prior to conducting the leakage calculation

IGA Growth Comparison



IGA Growth Summary (1R14 - 1R15)

	OTSG A			OTSG B		
	Change in Voltage	Change in Axial Extent	Change in Circ Extent	Change in Voltage	Change in Axial Extent	Change in Circ Extent
Number of Indications	279	279	279	173	173	173
Average	-0.012	-0.002	-0.008	-0.016	-0.004	-0.015
Standard Error	0.004	0.003	0.003	0.005	0.003	0.003
t	1.97	1.97	1.97	1.97	1.97	1.97
95% UCL	-0.005	0.004	-0.002	-0.007	0.002	-0.009
95% LCL	-0.019	-0.008	-0.013	-0.025	-0.010	-0.022
1 Sigma Upper Limit	-0.008	N/A	N/A	-0.012	N/A	N/A
1 Sigma Lower Limit	-0.015	N/A	N/A	-0.021	N/A	N/A
Maximum Change	0.21	0.26	0.14	0.1	0.1	0.09
Minimum Change	-0.36	-0.13	-0.2	-0.22	-0.13	-0.12
Apparent Growth?	No	No	No	No	No	No

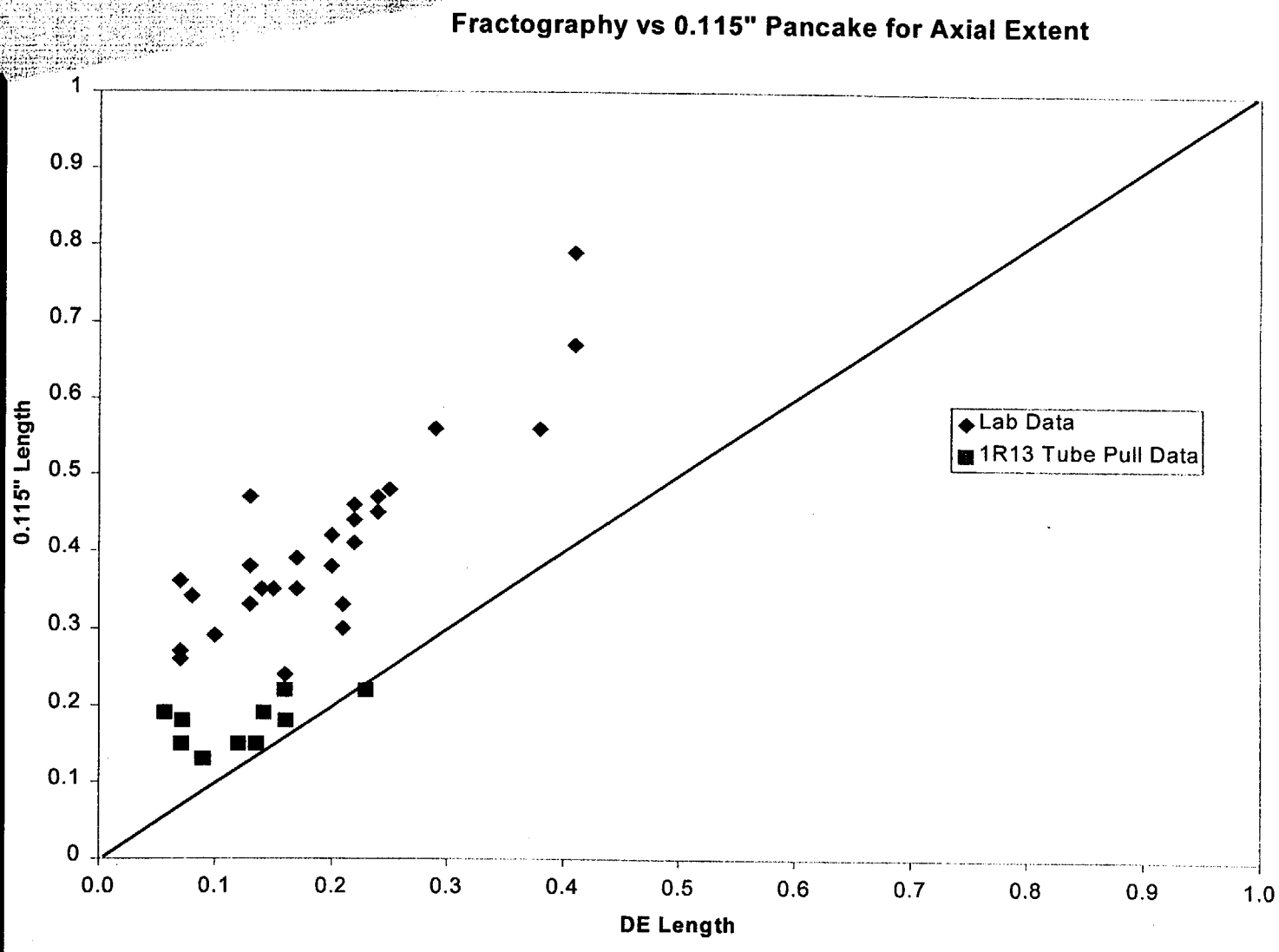
Proposed Growth Criteria

- Focus on individual flaw comparisons
  - Apply the six criteria
  - Compare to the repair limits
- Using baseline data
  - 1R14 or outage detected
- In-situ pressure test a sample of flaws exceeding the repair limit
- Operational assessment for leakage
  - Assess 95% UCL and individual change in axial extent
  - Apply greater of the two
  - Add 10% POD factor to population

Leakage Assessment

- Leakage evaluation
  - Assumption is made that some number of flaws will leak
    - High probability that none will leak (based on past experience)
  - Extents used to calculate leakage are based on ECT
    - Pulled tube and lab data demonstrates that the 0.115" pancake oversizes extent measurements (look ahead and fall behind)
  - The patches are chosen assuming each one has an equal chance of leaking
    - In reality the "small" patches have a negligible probability of leaking

Extent Sizing Comparison



Risk Informed Approach

Risk Informed Analysis

- Tube rupture risk contributors
  - Spontaneous SGTR occurring during normal ops
  - Pressure transient induced SGTR
  - Core damage induced SGTR
- Burst cannot occur
- No increase in frequency to any of the SGTR scenarios

Risk Informed Analysis

- Five principals established in RG 1.174

1. Meets current regulations
   - ASME code, GDC-19 and 10CFR100
2. Consistent with defense-in-depth philosophy
3. Maintains sufficient safety margins
   - Burst is precluded
   - Leakage is assessed programmatically (<1 gpm)

Risk Informed Analysis

4. Increase in risk is small

- No expected increase in risk
- Upper bound sensitivity analysis performed
  - Tube Rupture frequency not increased
  - No increase in CDF due to leakage < makeup flow (70 gpm)
  - Sequences considered:

    - ATWS
    - MSLB
    - MSSVs fail open
    - Excessive MFW
    - Turbine fails to Trip
    - TBVs fail open

  - Assume early sequences are Large to obtain increase in LERF
- Very small change in LERF (<1E-7) and CDF (<1E-6)
- Conclusion: **Not risk significant**

Risk Informed Analysis

5. Monitored using performance measurement strategies
   - Evaluate IGA as part of the SG integrity program
     - 100% bobbin and RPC examinations each outage
     - Repair if linear characteristics are developed
     - Perform operational assessments (evaluate leakage)
- Developing approach for licensing amendment
- Considering methodology for other damage mechanisms contained by the UTS

Schedule

- Re-roll cracking CAR complete - April
- Re-roll optimization submittal - July
- Upper tubesheet IGA
  - Deterministic management program submittal - April
  - Risk-informed TS change - April