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SUBJECT: Forwards preliminary SG info,consisting of data from SG tube rupture investigation. see Rpt

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102-02533-TRB/JRP
June 14, 1993

U. S. Nuclear Regulatory Commission
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Dear Sirs:

Subject: **Palo Verde Nuclear Generating Station (PVNGS)**
Unit 2
Docket No. STN 50-529
Preliminary Steam Generator Information
File: 93-056-026

The purpose of this letter is to provide you data from the PVNGS Unit 2 Steam Generator tube rupture investigation. Please note that this information is in preliminary form and has been marked as such. A summary list is also enclosed for your information.

Should you have any questions, please contact J. R. Provasoli at (602) 393-5730.

Sincerely,

Richard A. Bernier for
Thomas R. Bradish, Manager
Nuclear Regulatory Affairs

TRB/JRP/ap

Enclosure

cc: B. H. Faulkenberry
C. M. Trammell
K. E. Perkins
J. A. Sloan

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SUMMARY LIST
June 14, 1993
Revision A

IV. SUBSEQUENT ACTIVITIES
- A. ORIGINAL SCOPE OF ECT FOR UNIT 2
- B. ECT INITIAL RESULTS

MISCELLANEOUS
PRELIMINARY LAB RESULTS

TUBE NO.	R 117 C	40
	R 116 C	41
	R 29 C	24
	R 22 C	13
	R 103 C	156
	R 105 C	156
	R 117 C	144
	R 127 C	140

9306180024

PRELIMINARY

IV. SUBSEQUENT ACTIVITIES

A. ORIGINAL SCOPE OF ECT FOR UNIT 2

Original Scope of eddy current testing for Unit 2's 4th refueling outage was developed based on: Technical Specification Surveillance requirements, EPRI recommendations, and consideration of the type and location of previously identified flaws and/or indications. Previous tubing indications that had been identified in Palo Verde's SGs included:

- Axial cracking found at the top of the tubesheet in Unit 1.
- Axial cracking found at the 01H flow distribution ~~baffle~~ plate in Unit 2.
- Axial cracking found above the 09H free span in Unit 2.
- Wear at the cold leg corners, batwings, egg crate supports and vertical straps.
- Loose parts with and without associated wear.

Problems identified by other utilities, vendors, and the NRC have included:

- Circumferential and axial cracking at the tubesheet and/or tube supports.
- Denting and cracking next to the stay rods.
- Cracking in short radius bends.
- Crevice cracking or attack in non-expanded tubes.

PRELIMINARY

IV. SUBSEQUENT ACTIVITIES (cont.)

A. ORIGINAL SCOPE OF ECT FOR UNIT 2 (cont.)

The original scope included bobbin coil examinations on 100% of the tubes in each Unit 2 SG. Inspection was planned using the motorized rotating pancake coil (MRPC) for a minimum of 10% of the tubes at the expansion transition and first support locations on the hot leg side.

PRELIMINARY

IV. SUBSEQUENT ACTIVITIES (cont.)

B. ECT INITIAL RESULTS

The fourth refueling outage for Palo Verde Unit 2 began on March 14, 1993, due to a steam generator tube rupture. The original outage was scheduled to begin on March 20, 1993. The initial examination plan for both steam generators was a 100% full length bobbin examination with approximately 10% of the tubes to be tested using MRPC for the 01H and TSH intersections. The tubes were to be examined full length with the exception of some row 1, 2 and 3 tubes which were to be examined through the U-bend from both the hot and cold legs.

After the manways were removed, the secondary side of steam generator 22 was filled until the leaking tube could be identified. Visual examination confirmed that row 117 line 144 was the leaking tube. Eddy current probes and a Welch Allyn video probe were used to characterize the tube leak. Based on the information provided by the probes, an approximately 8-inch long mid-span axial indication located 34 inches above the 08H support was identified. A 2-inch long "fishmouth" rupture was found in this tube starting one inch above the start of the 8-inch axial indication.

The eddy current testing program planned for the outage was begun on 4/11/93. Initial testing results identified a number of tubes with indications of axial cracking, the majority of which were located in the upper area of the hot leg in SG #2. The location and impact of the indications are addressed later in this report.

PRELIMINARY

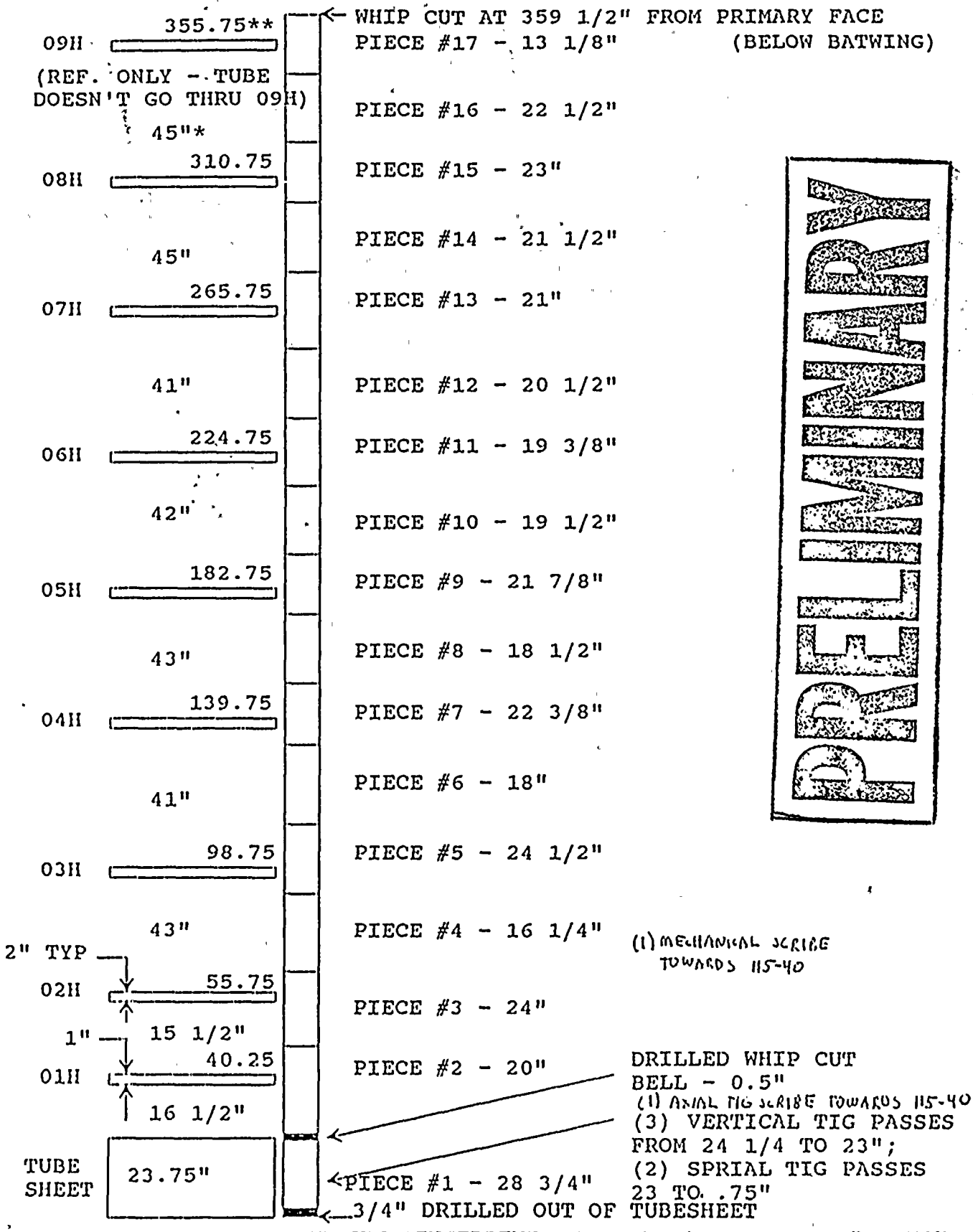
IV. SUBSEQUENT ACTIVITIES (cont.)

B. ECT INITIAL RESULTS (cont.)

As a result of the initial testing, the scope of testing in both generators was expanded. The ECT scope was systematically increased as additional flaws were detected in both generators. The details of the ECT program expansion, results, and level of detectability are discussed in Sections VI and VII of this report.

PRELIMINARY

TUBE 117-40



(1) MECHANICAL SCRIBE TOWARDS 115-40

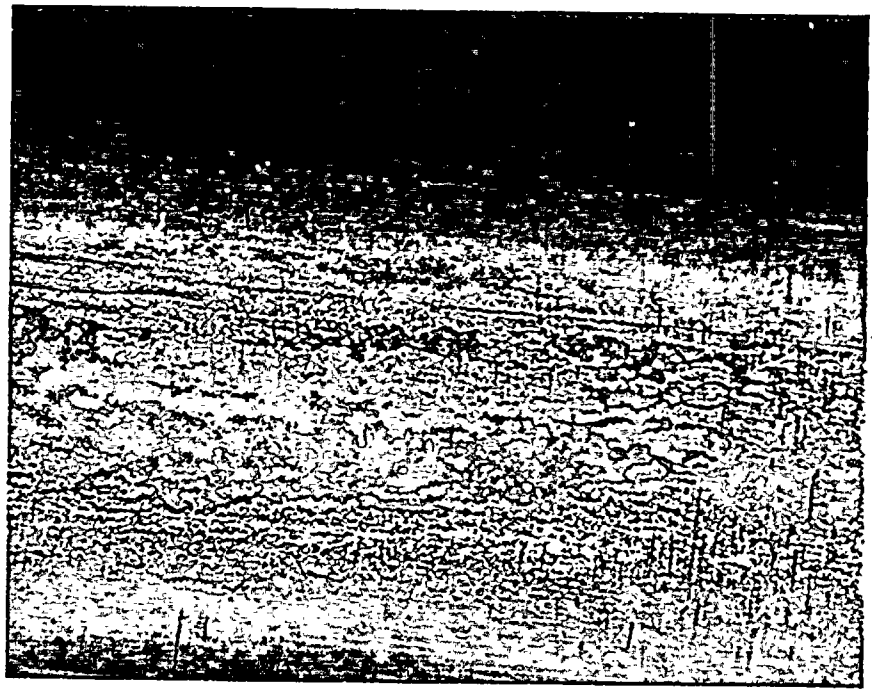
DRILLED WHIP CUT BELL - 0.5"
(1) AXIAL TIG SCRIBE TOWARDS 115-40
(3) VERTICAL TIG PASSES FROM 24 1/4 TO 23";
(2) SPRIAL TIG PASSES 23 TO .75"

* DISTANCES BETWEEN CENTERLINE OF TSP's (01H IS A 1" THICK BAFFLE PLATE AND ALL OTHERS ARE 2" THICK EGGCRATES)

** DISTANCE FROM PRIMARY FACE TO CENTERLINE OF TSP

NOTES: NOTCH IN TUBE SAMPLE IS ON TOP END (OPPOSITE TS)

PRELIMINARY



117-40 7.5X PC 15-16A

AN AREA OF SHALLOW IGA ON TUBE O.D. - THE MAXIMUM DEPTH WAS ABOUT 5% OF WALL.

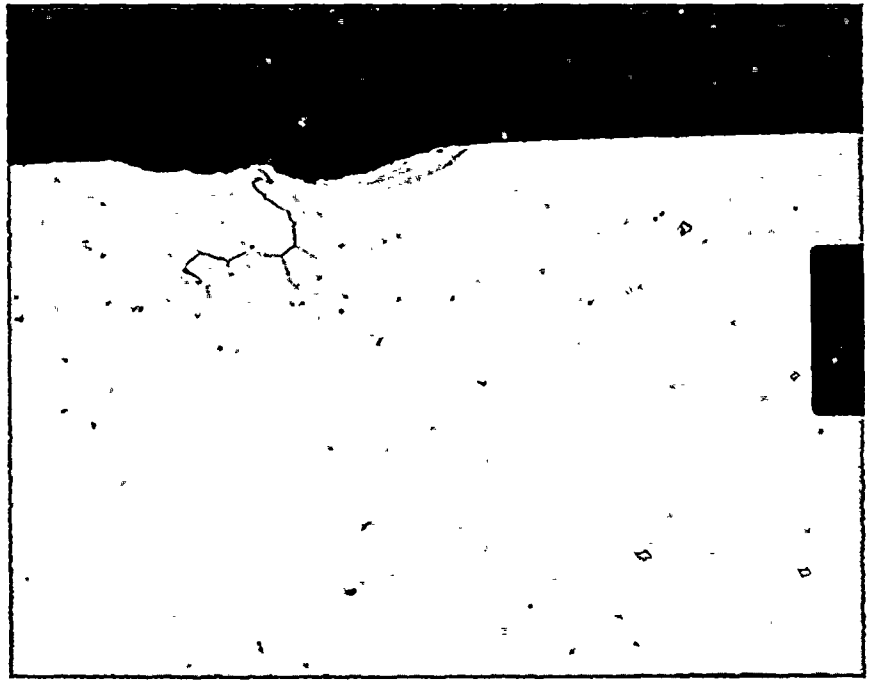
PRELIMINARY

P725 250 X

PV 117-40-17 B @ ~180°

GREY AREA IS "RIDGE" DEPOSIT BETWEEN TUBES 117-40 AND 115-40. THIS PHOTO WAS TAKEN AT THE THICKEST PORTION OF THE DEPOSIT, WHICH MEASURED 2.5 MILS.

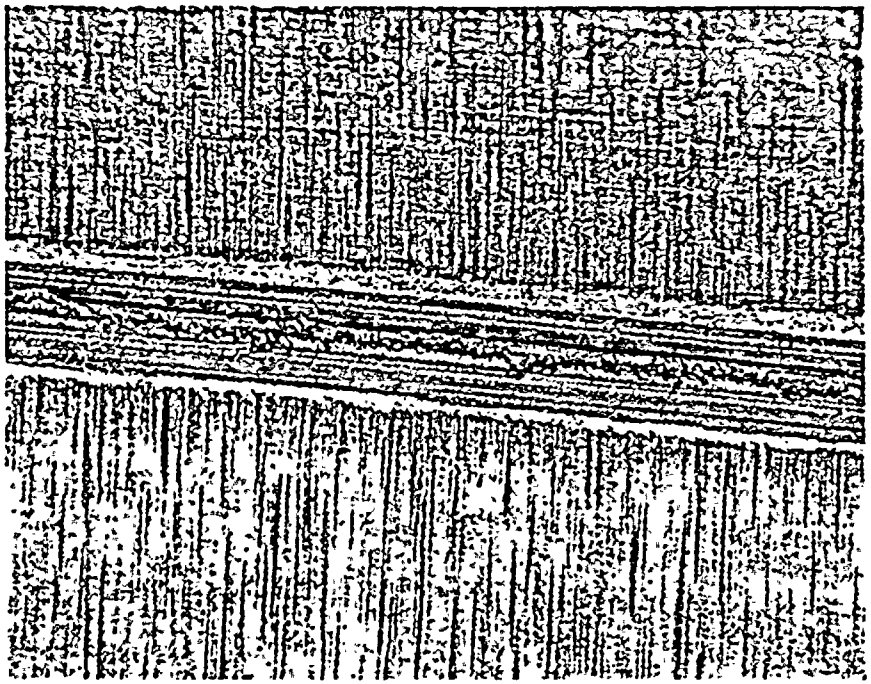
PRELIMINARY



F727 PV 117-40-16±2
250X 311°

PHOTO OF IGA/IGSCC UNDER 0.6 MIL SCRATCH.

PRELIMINARY

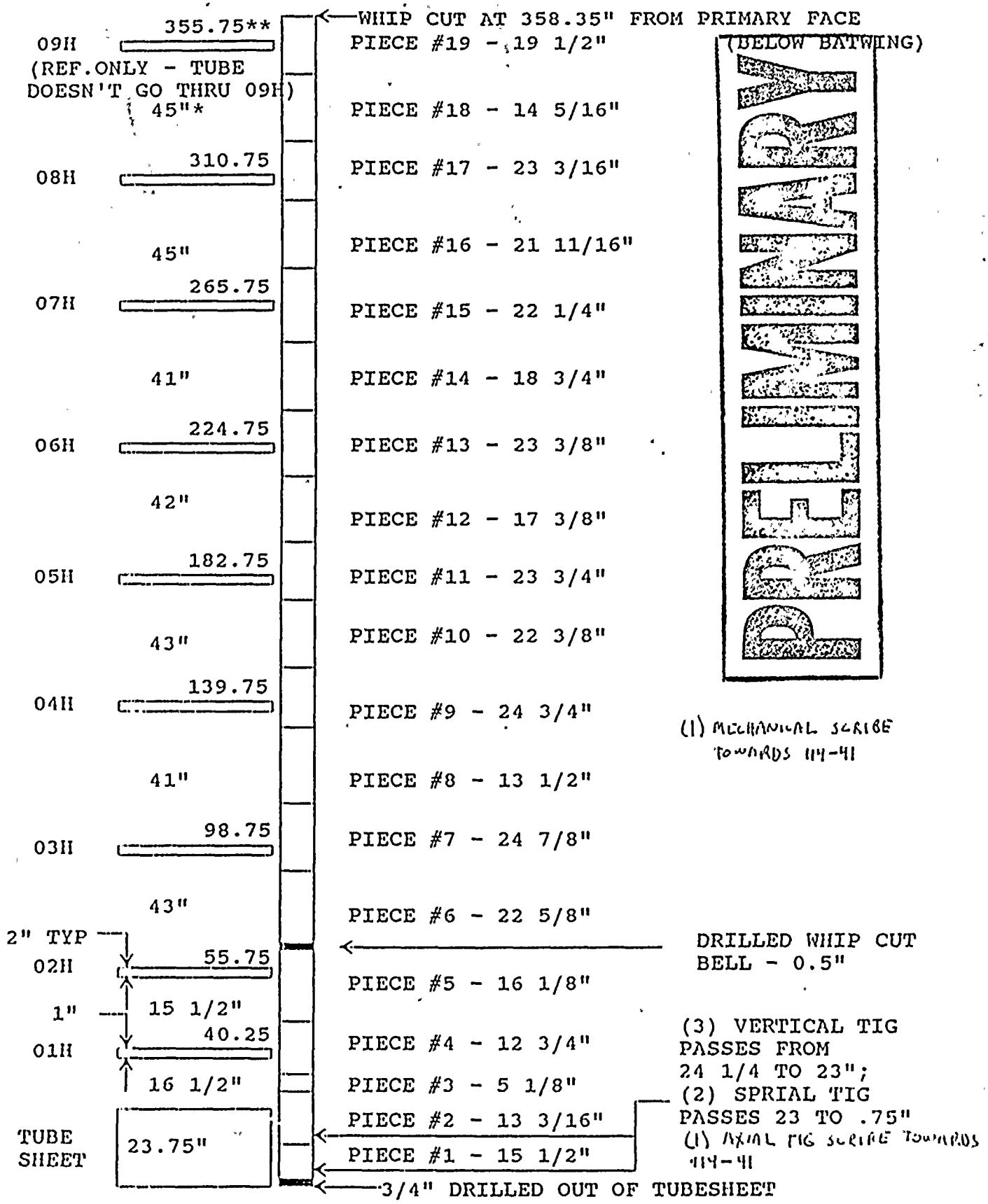


CBACW 117-40-16-5 F733
GROUP 8 2700 3-3/8" FROM TOP

LONG, SHALLOW SCRATCH WITH IGA/IGSCC AT BOTTOM. THE SCRATCH WAS APPROXIMATELY 0.6 MILS DEEP, WITH A FEW MILS ATTACK AT BOTTOM.

TUBE 116-41

REVISION 2

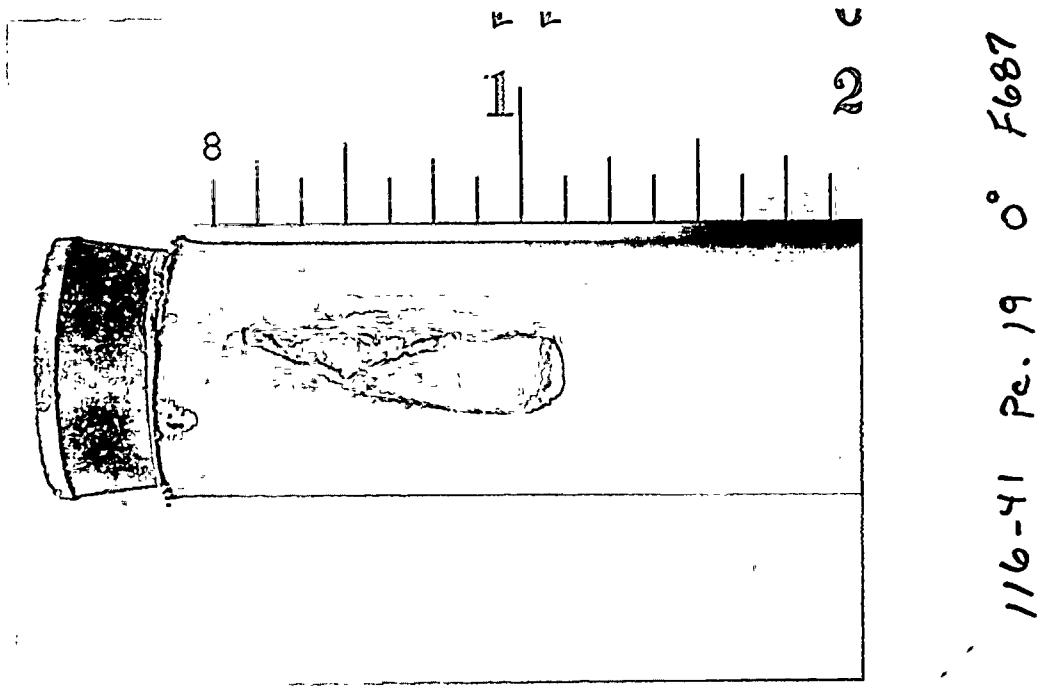


* DISTANCES BETWEEN CENTERLINE OF TSP's (01H IS A 1" THICK BAFFLE PLATE AND ALL OTHERS ARE 2" THICK EGGCRATES)

** DISTANCE FROM PRIMARY FACE TO CENTERLINE OF TSP

NOTES: NOTCH IN TUBE SAMPLE IS ON TOP END (OPPOSITE TS)

PRELIMINARY



116-41 Pc. 19 0° F687

WHIP CUT END OF TUBE 116-41, SECTION 19. SHOWING WEAR MARK CAUSED BY CONTACT WITH UPPER SCALLOP BAR. MAXIMUM WALL PENETRATION WAS APPROXIMATELY 50%.

(1)

SUMMARY OF PRELIMINARY DYE PENETRANT RESULTS AFTER DESCALING/SWELLING

As of 6/5/93

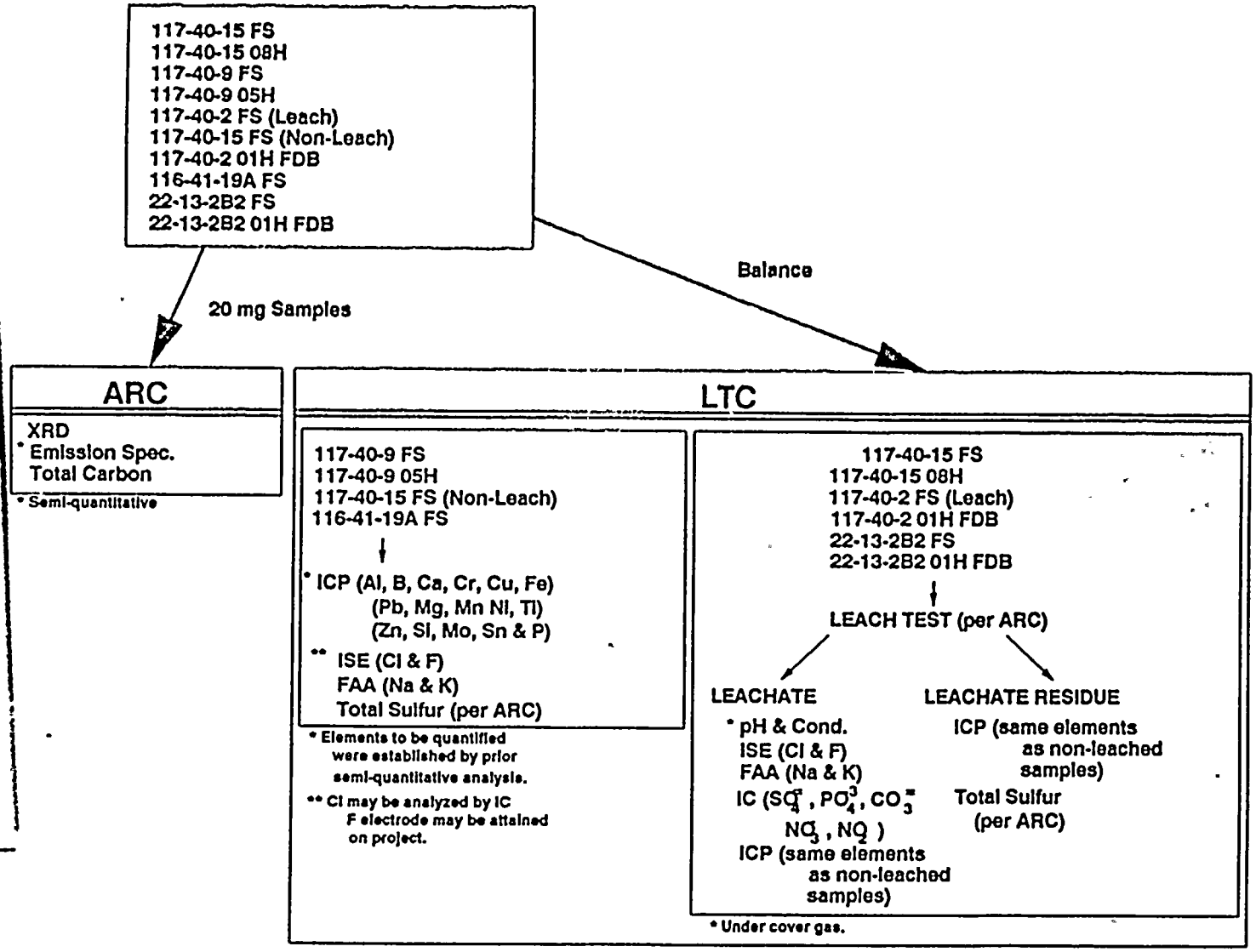
Tube No.	Section No.	Results: Crack Indications	Other Indications	Scratches Present	Remarks
117-40	17	Yes (50%)* (27%)*	Yes	Yes	Mixed IGA and IGSCC under axial deposit ridge over about 12 inches Multiple partial axial scratches with associated consistent cracking and/or IGA
	16	Yes (15%)* (10%)*	Yes	Yes	Three axial scratches (one partial length) – most with intermittent cracking; general light IGA Deeper IGA at spalled deposit regions
	15	Yes (10%)* (15%)*	Yes	Yes	Three axial scratches (one partial length) – most with intermittent cracking; general light IGA Deeper IGA at eggcrate wear marks; specimen to be incrementally ground
	14	Yes (5%)*	Yes	Yes	Multiple axial scratches – most with intermittent cracking; general light IGA
	13	Yes	No	Yes	Multiple axial scratches – one with intermittent cracking
	12	No	No	Yes	Multiple axial scratches; some possible minor wastage
	11	No	No	Yes	Multiple axial scratches; several minor wear marks
	10	N/A	N/A	N/A	Not tested; used for base metal characterization
	9	No	No	Yes	Multiple axial scratches
	8	Yes	No	Yes	Multiple axial scratches – one with a short crack; some possible minor wastage
	7	No	No	Yes	Multiple axial scratches; some possible wastage
	6	Yes	No	Yes	Multiple axial scratches – one with a short crack
	5	No	No	Yes	Multiple axial scratches; one minor wear mark
	4	No	No	Yes	Multiple axial scratches
	3	Yes	Yes	Yes	Multiple axial scratches – two with occasional minor cracking and/or IGA
	2	No	No	Yes	Two full length scratches – one intermittent; one partial length axial scratch
	1	N/A	N/A	N/A	Not tested
116-41	19	Yes (12%)*	Yes	Yes	Two partial length axial scratches with associated intermittent cracking and some minor IGA
	18	Yes (5%)*	Yes	Yes	One full length intermittent axial scratch with associated intermittent cracking and minor IGA
	17	Yes (5%)*	Yes	Yes	Two axial scratches with associated intermittent cracking and some minor IGA
	16	Yes	Yes	Yes	Minor cracks and IGA (more prominent near top end) associated with axial scratches
	15	No	Yes	Yes	Possible minor IGA at eggcrate gen. associated with wear marks; multiple axial scratches
	14	No	No	Yes	Tear-drop shaped patterns in circumferential band; one full length axial scratch
	13	Yes	No	Yes	Very minor crack just outside scratch; two full length axial scratches – one intermittent
	12	No	No	Yes	Two full and one partial length axial scratches – one intermittent
	11	No	Yes	Yes	Spiralling axial minor IGA patterns near top; three minor wear marks; one axial scratch
	10	No	No	Yes	One full & one partial length intermittent axial scratches
	9	No	No	Yes	One full & one partial length intermittent axial scratches
	8	No	No	Yes	Two full & two partial length axial scratches
	7	No	No	Yes	Rough surface over bottom half; one full & one partial length axial scratch
	6				
	5	No	No	Yes	Significant wear mark; rippled OD surface at one location; one full length axial scratch
	4	No	No	Yes	Minor wear marks; three intermittent axial scratches
	3	No	No	Yes	Two full length axial scratches
	2	N/A	N/A	N/A	Not tested
	1	N/A	N/A	N/A	Not tested

* Percentage in parentheses is maximum crack or IGA depth; revised maps will be sent Monday

PRELIMINARY

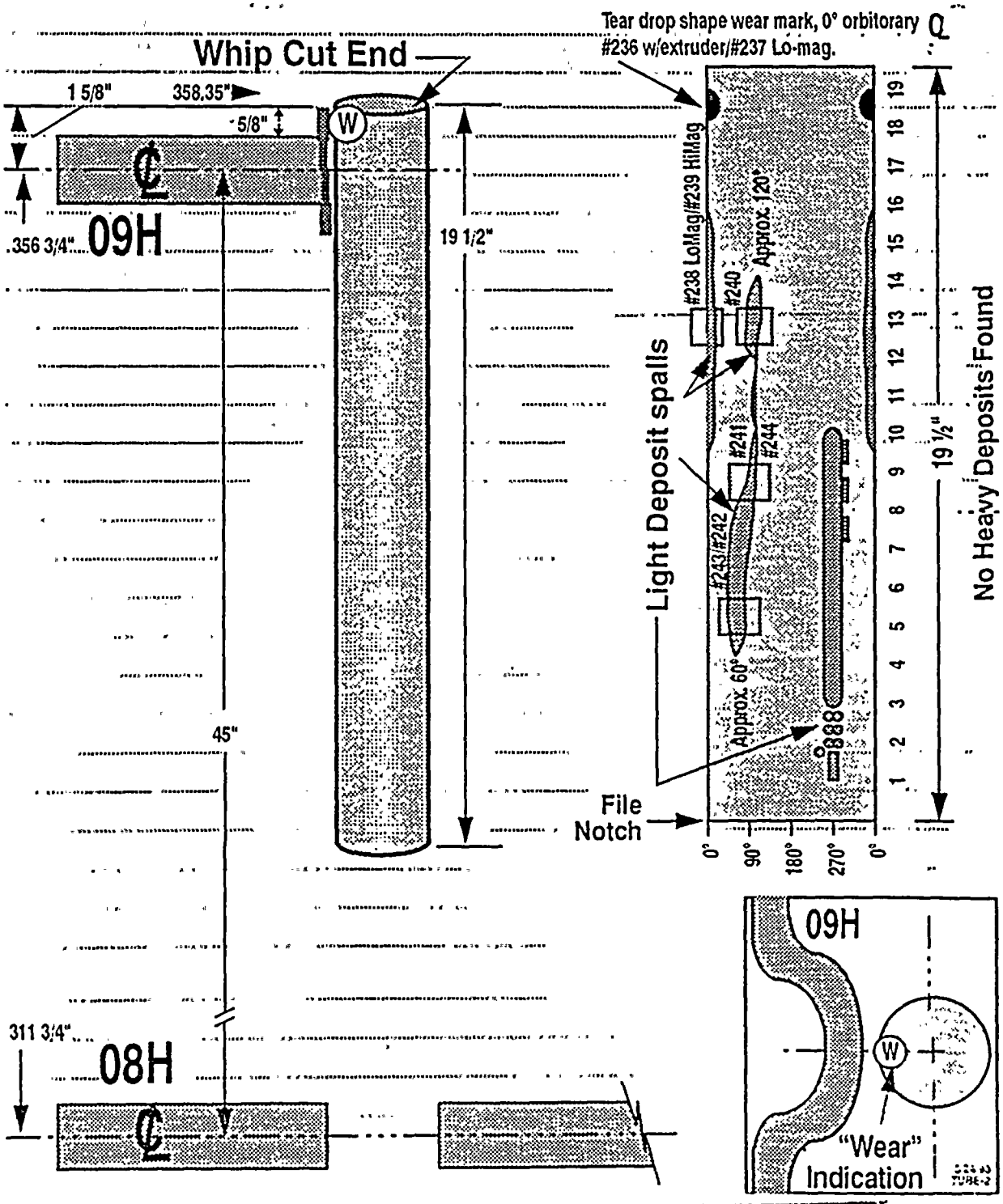
(31)

PALO VERDE STEAM GENERATOR TUBE DEPOSIT ANALYSES FLOWCHART



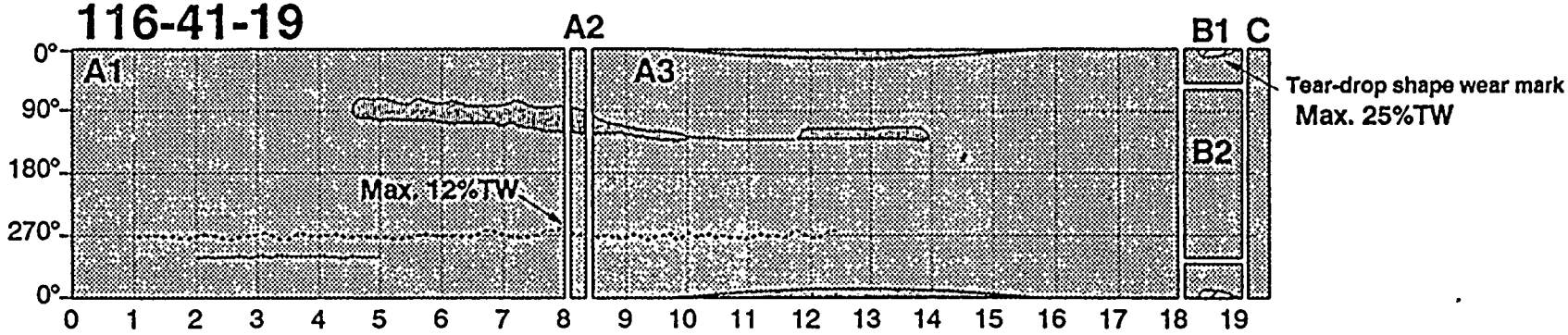
PROPRIETARY INFORMATION

Palo Verde Unit 2 Steam Generator 22 (B&W) Tube 116 - 41 Tube Section #19

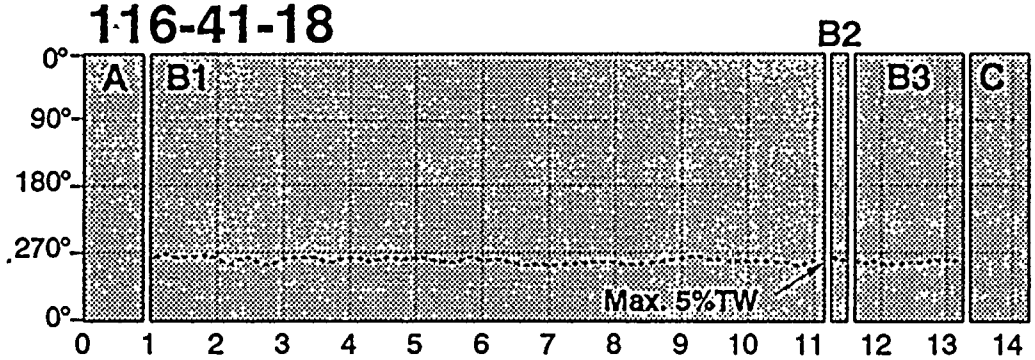


PRELIMINARY

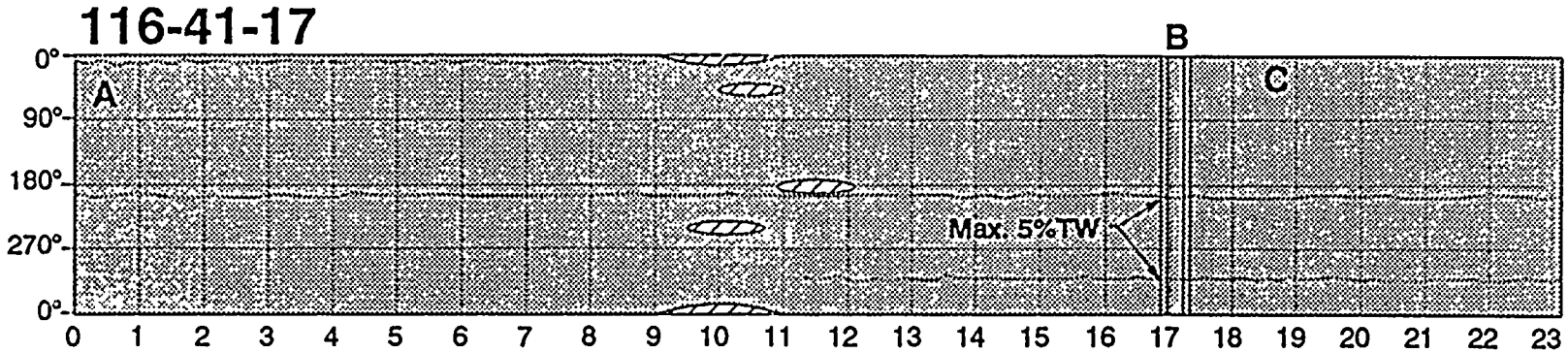
116-41-19



116-41-18



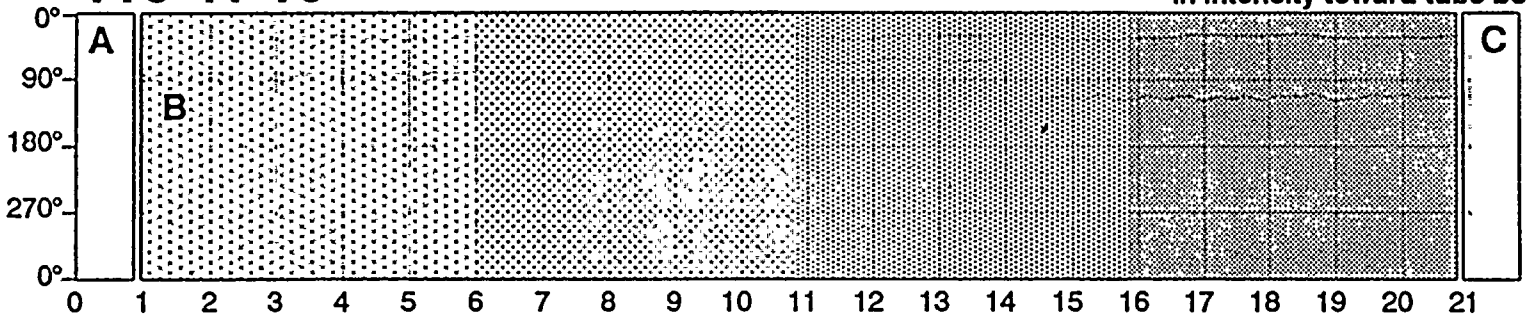
116-41-17



PRELIMINARY

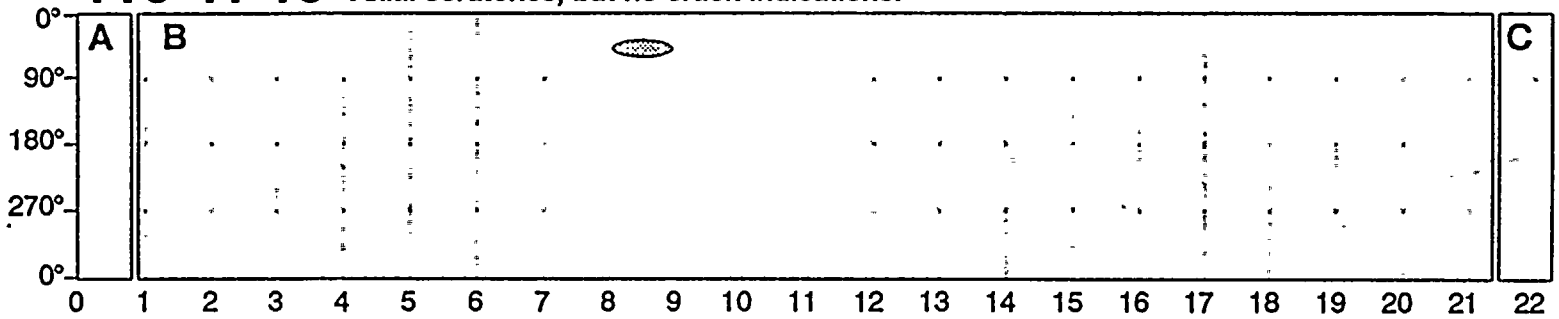
116-41-16

All IGA < 5% gradually diminishing in intensity toward tube bottom end.



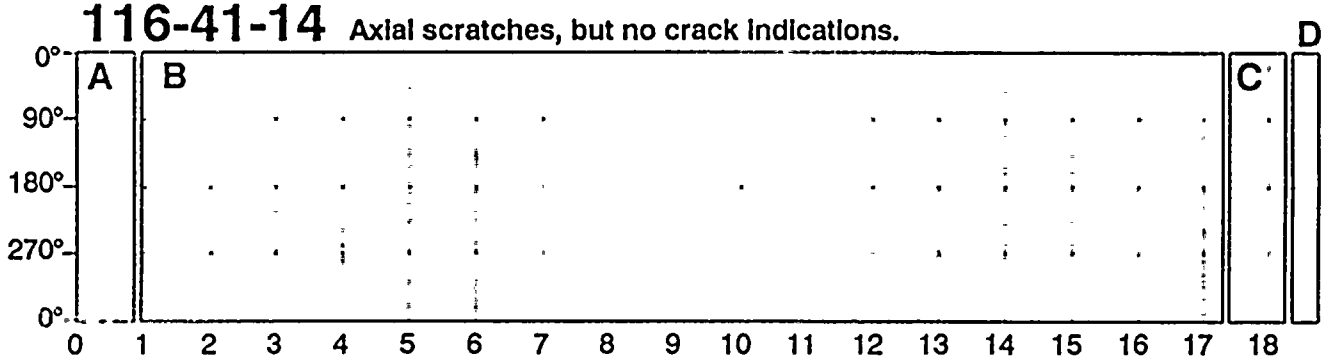
116-41-15

Axial scratches, but no crack indications.



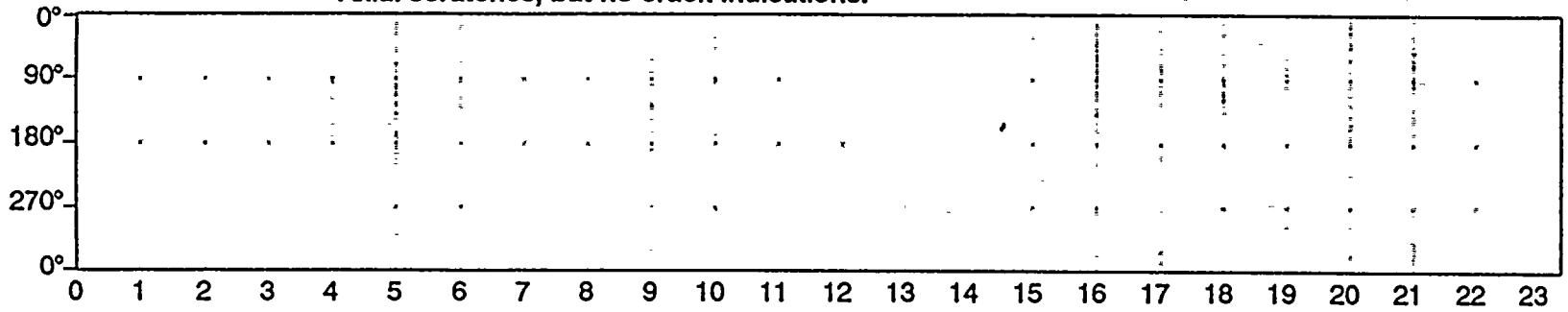
116-41-14

Axial scratches, but no crack indications.

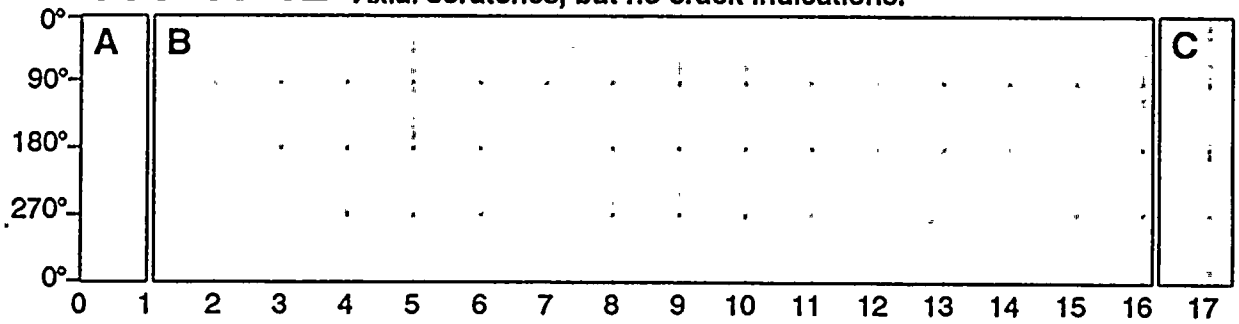


PRELIMINARY

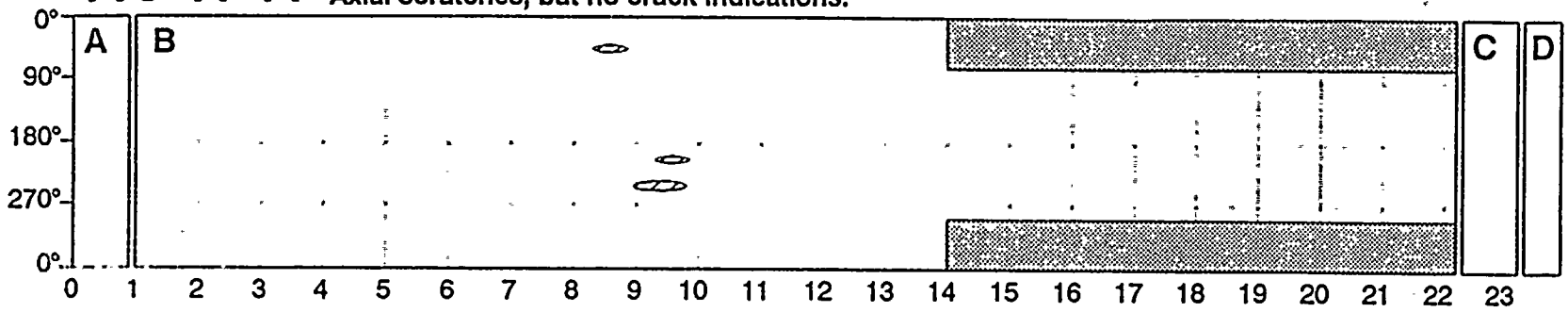
116-41-13 Axial scratches, but no crack indications.



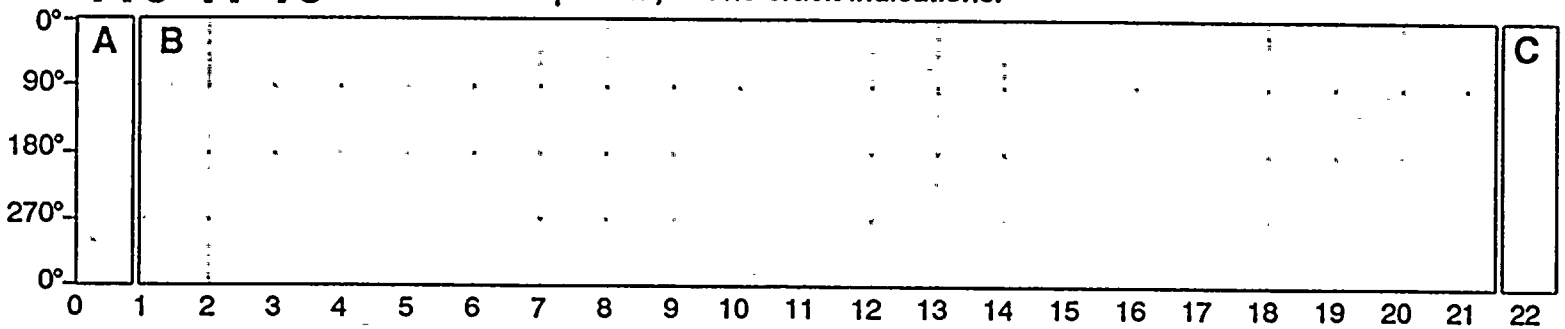
116-41-12 Axial scratches, but no crack indications.



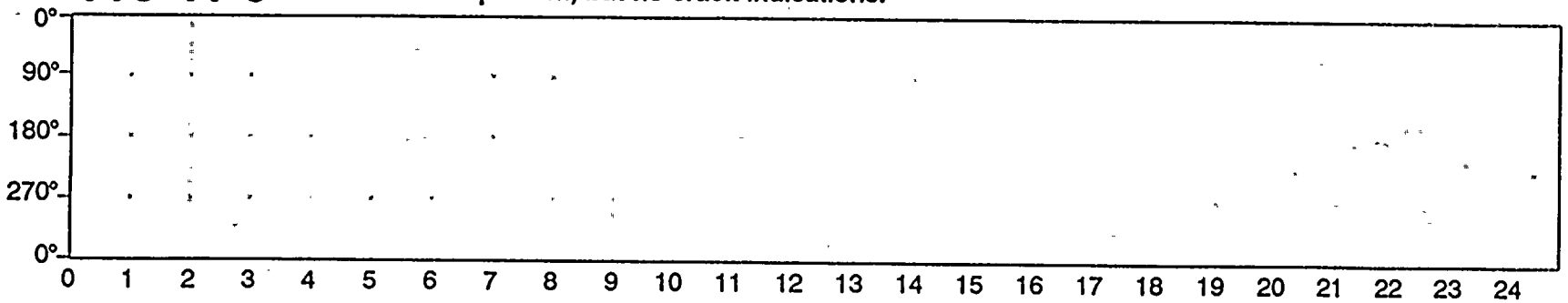
116-41-11 Axial scratches, but no crack indications.



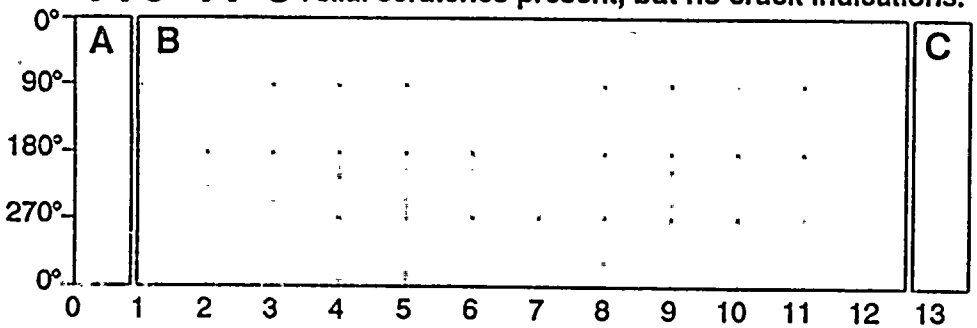
116-41-10 Axial scratches present, but no crack indications.



116-41-9 Axial scratches present, but no crack indications.

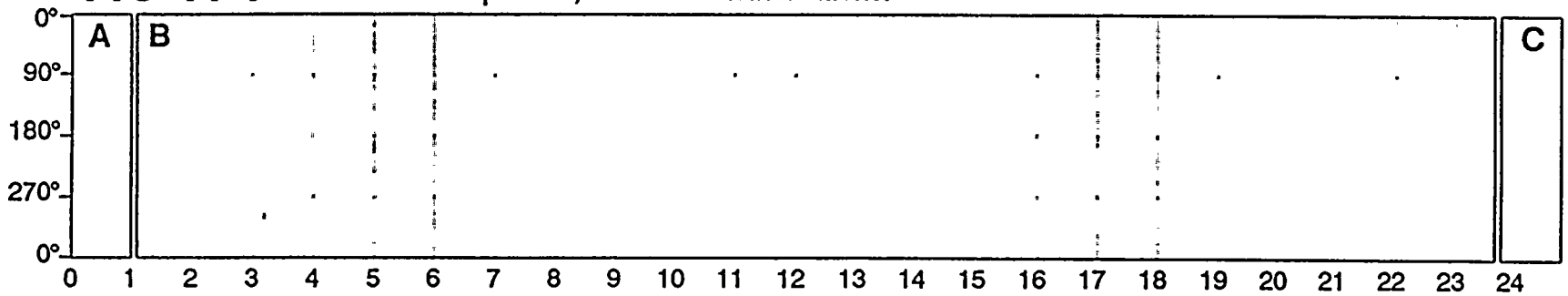


116-41-8 Axial scratches present, but no crack indications.

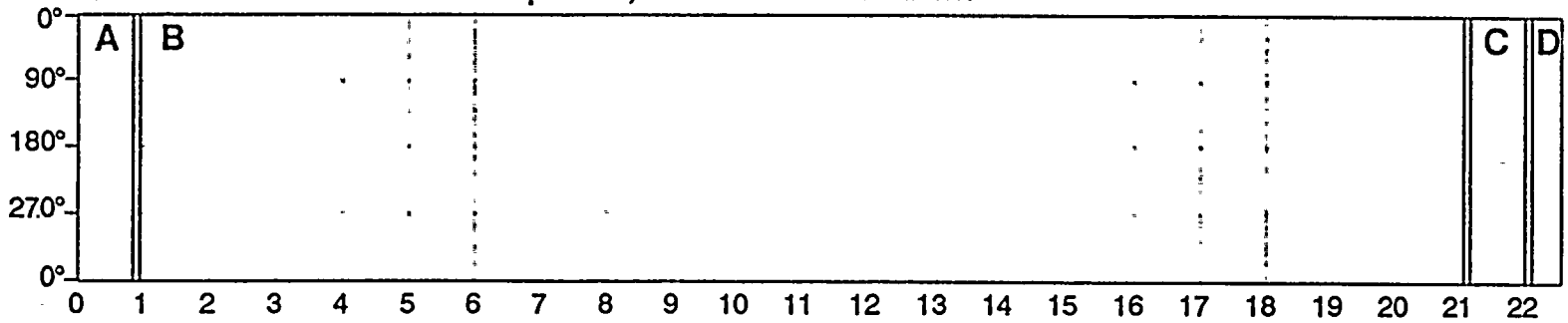


PRELIMINARY

116-41-7 Axial scratches present, but no crack indications.

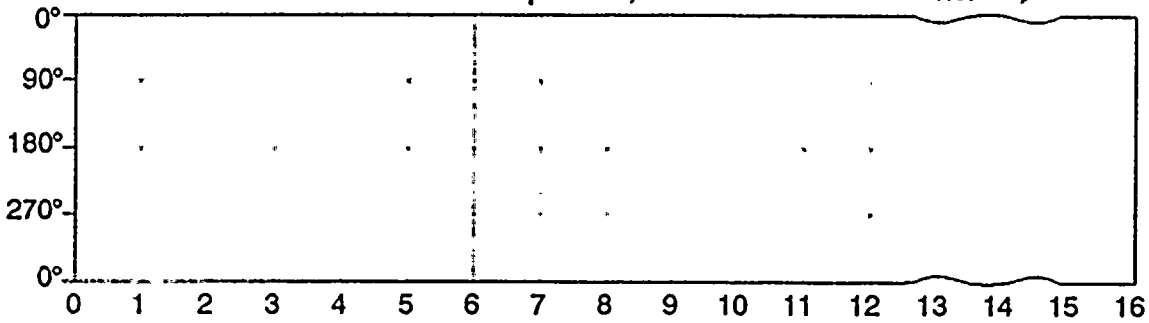


116-41-6 Axial scratches present, but no crack indications.

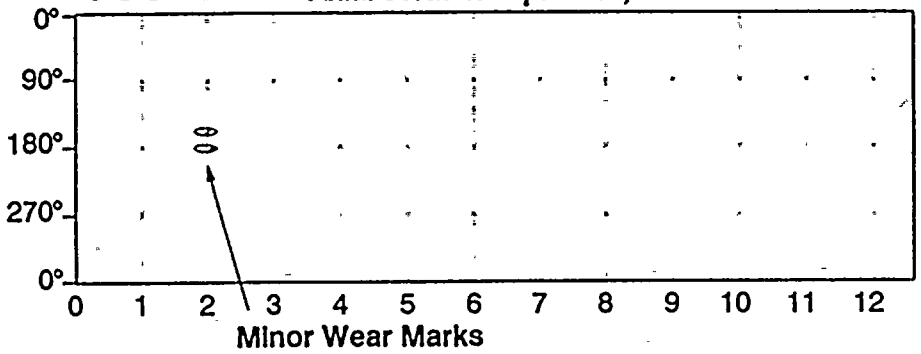


116-41-5 Axial scratches present, but no crack indications.

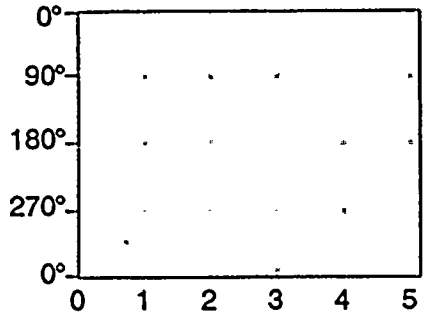
Area where tube OD was rippled.



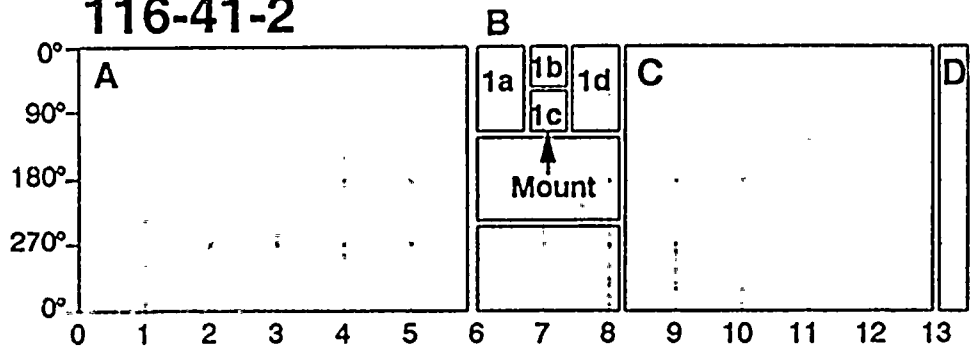
116-41-4 Axial scratches present, but no crack indications.



116-41-3 Axial scratches present, but no crack indications.



116-41-2 Axial scratches present, but no crack indications.



PRELIMINARY

10-Jun-93

TUBE SECTION 116-41

PRELIMINARY

EXAMINATION METHOD		PIECE NO. 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Nondestructive Examinations:																				
Receipt Inspections	Radiation Surveys	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
	Establish Tube Orientation	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Visual Inspections	Visual Examination		D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
	Macrophotography		D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Dimensional Inspections	OD Measurements		D		D	D										D	D	D	D	D
	ID Measurements		D		D	D										D	D	D	D	D
Eddy Current Inspections	Bobbin Coil ECT		D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
	MRPC ECT		D		D	D														D
	Rotating Field Probe ECT		D		D	D														D
X-Ray Radiography			D																	D
Helium Leak Test																				
Destructive Examinations:																				
Deposit Collection	Tube Swelling		D		D	D				D				D				D		D
	Scrape Deposits		D		D	D				D				D				D		D
Fluroescent Liquid Penetrant Inspections	Descale		D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
	Initial Fluroescent PT		D*																	
	Post Decsale Swell			N/A			D	D	D		D	D	D		D	D	D		D	D
	Post Swell Fluorescent PT		D*	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
SEM/EDS																				D
Metallography			D																	D
Microhardness																				D
SAM/XPS																				
Deposit Analyses	XRD																			1
	Emission Spec. (Semi-quant)																			1
	Perkin Elmer (Total C)																			1
	ISE (Cl & F)																			1
	ICP (Pb, S, et. al.)																			1
	Flame AA (Na)																			1
	Total S																			1
	Leachate																			
Tube Material Characterization	Bulk Chemistry																			
	Tensile Test																			
	Dual Etch		D																	
	Microhardness																			
	Modified Huey Test																			

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PRELIMINARY

EXAMINATION METHOD		TUBE SECTION 116-41-1

Nondestructive Examinations:

Receipt Inspections	Radiation Surveys	DONE
	Establish Tube Orientation	DONE
Visual Inspections	Visual Examination	NOT TO BE DONE
	Macrophotography	NOT TO BE DONE
Dimensional Inspections	OD Measurements	NOT TO BE DONE
	ID Measurements	NOT TO BE DONE
Eddy Current Inspections	Bobbin Coil ECT	NOT TO BE DONE
	MRPC ECT	NOT TO BE DONE
	Rotating Field Probe ECT	NOT TO BE DONE
X-Ray Radiography		NOT TO BE DONE
Helium Leak Test		NOT TO BE DONE

Destructive Examinations:

Deposit Collection	Tube Swelling	NOT TO BE DONE
	Scrape Deposits	NOT TO BE DONE
Fluroescent Liquid Penetrant Inspections	Descale	NOT TO BE DONE
	Initial Fluroescent PT	NOT TO BE DONE
	Post Decsale Swell	NOT TO BE DONE
	Post Swell Fluorescent PT	NOT TO BE DONE
SEM/EDS		NOT TO BE DONE
		NOT TO BE DONE
Metallography		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
Microhardness		NOT TO BE DONE
SAM/XPS		NOT TO BE DONE

Deposit Analyses	Anal. of Non Leached Deposit	NOT TO BE DONE
		NOT TO BE DONE
	Leachate & Residue	NOT TO BE DONE

Tube Material Characterization	Bulk Chemistry	NOT TO BE DONE
	Tensile Test	NOT TO BE DONE
	Dual Etch	NOT TO BE DONE
	Microhardness	NOT TO BE DONE
	Modified Huey Test	NOT TO BE DONE

PRELIMINARY

EXAMINATION METHOD		TUBE SECTION 116-41-2

Nondestructive Examinations:

Receipt Inspections	Radiation Surveys	DONE
	Establish Tube Orientation	DONE
Visual Inspections	Visual Examination	DONE, SEE CRACK MAPS
	Macrophotography	DONE
Dimensional Inspections	OD Measurements	DONE
	ID Measurements	DONE
Eddy Current Inspections	Bobbin Coil ECT	DONE, NDD
	MRPC ECT	DONE, NDD
	Rotating Field Probe ECT	DONE, NDD
X-Ray Radiography		DONE, NO DEFECTS NOTED
Helium Leak Test		NOT TO BE DONE

Destructive Examinations:

Deposit Collection	Tube Swelling	R/T ISOLATED BEFORE SWELL, UPPER SECTION ONLY SWELLED(BURST)
	Scrape Deposits	DONE
Fluroescent Liquid Penetrant Inspections	Descale	DONE
	Initial Fluroescent PT	DONE ON ID AFTER CLAM SHELL SECTION, NO DEFECTS
	Post Decsale Swell	NOT TO BE DONE
	Post Swell Fluorescent PT	DONE ON FLATTENED CLAM SHELL & BURST SECTIONS, NO DEFECTS
SEM/EDS		NOT TO BE DONE
		NOT TO BE DONE
Metallography		SECTION B2-1A FROM R/T, NO DEFECTS
		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
Microhardness		NOT TO BE DONE
SAM/XPS		NOT TO BE DONE

Deposit Analyses	Anal. of Non Leached Deposit	NOT TO BE DONE
		NOT TO BE DONE
	Leachate & Residue	NOT TO BE DONE

Tube Material Characterization	Bulk Chemistry	NOT TO BE DONE
	Tensile Test	NOT TO BE DONE
	Dual Etch	DONE, NORMAL MICROSTRUCTURE, NOT SENSITIZED
	Microhardness	NOT TO BE DONE
	Modified Huey Test	NOT TO BE DONE

PRELIMINARY

EXAMINATION METHOD		TUBE SECTION 116-41-3

Nondestructive Examinations:

Receipt Inspections	Radiation Surveys	DONE
	Establish Tube Orientation	DONE
Visual Inspections	Visual Examination	DONE, SEE CRACK MAPS
	Macrophotography	DONE
Dimensional Inspections	OD Measurements	NOT TO BE DONE
	ID Measurements	NOT TO BE DONE
Eddy Current Inspections	Bobbin Coil ECT	DONE, NDD
	MRPC ECT	NOT TO BE DONE
	Rotating Field Probe ECT	NOT TO BE DONE
X-Ray Radiography		NOT TO BE DONE
Helium Leak Test		NOT TO BE DONE

Destructive Examinations:

Deposit Collection	Tube Swelling	NOT TO BE DONE
	Scrape Deposits	NOT TO BE DONE
Fluroescent Liquid Penetrant Inspections	Descale	DONE
	Initial Fluroescent PT	NOT TO BE DONE
	Post Decsale Swell	N/A – TOO SHORT TO SWELL
	Post Swell Fluorescent PT	DONE, SEE CRACK MAPS
SEM/EDS		NOT TO BE DONE
		NOT TO BE DONE
Metallography		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
Microhardness		NOT TO BE DONE
SAM/XPS		NOT TO BE DONE

Deposit Analyses	Anal. of Non Leached Deposit	NOT TO BE DONE
		NOT TO BE DONE
	Leachate & Residue	NOT TO BE DONE

Tube Material Characterization	Bulk Chemistry	NOT TO BE DONE
	Tensile Test	NOT TO BE DONE
	Dual Etch	NOT TO BE DONE
	Microhardness	NOT TO BE DONE
	Modified Huey Test	NOT TO BE DONE

PRELIMINARY

EXAMINATION METHOD		TUBE SECTION 116-41-4

Nondestructive Examinations:

Receipt Inspections	Radiation Surveys	DONE
	Establish Tube Orientation	DONE
Visual Inspections	Visual Examination	DONE, SEE CRACK MAPS
	Macrophotography	DONE
Dimensional Inspections	OD Measurements	DONE
	ID Measurements	DONE
Eddy Current Inspections	Bobbin Coil ECT	DONE, NDD
	MRPC ECT	DONE, NDD
	Rotating Field Probe ECT	DONE, NDD
X-Ray Radiography		NOT TO BE DONE
Helium Leak Test		NOT TO BE DONE

Destructive Examinations:

Deposit Collection	Tube Swelling	DONE
	Scrape Deposits	DONE
Fluroescent Liquid Penetrant Inspections	Descale	DONE
	Initial Fluroescent PT	NOT TO BE DONE
	Post Decsale Swell	N/A
	Post Swell Fluorescent PT	DONE, SEE CRACK MAPS
SEM/EDS		NOT TO BE DONE
		NOT TO BE DONE
Metallography		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
Microhardness		NOT TO BE DONE
SAM/XPS		NOT TO BE DONE

Deposit Analyses	Anal. of Non Leached Deposit	NOT TO BE DONE
		NOT TO BE DONE
	Leachate & Residue	NOT TO BE DONE

Tube Material Characterization	Bulk Chemistry	NOT TO BE DONE
	Tensile Test	NOT TO BE DONE
	Dual Etch	NOT TO BE DONE
	Microhardness	NOT TO BE DONE
	Modified Huey Test	NOT TO BE DONE

PRELIMINARY

EXAMINATION METHOD		TUBE SECTION 116-41-5

Nondestructive Examinations:

Receipt Inspections	Radiation Surveys	DONE
	Establish Tube Orientation	DONE
Visual Inspections	Visual Examination	BADLY BOWED, BENT, HAS A SEVERE SCRAPE, SEE CRACK MAPS
	Macrophotography	DONE
Dimensional Inspections	OD Measurements	SCRAPE DETECTED, WALL THICKNESS VARIATIONS NOTED AT UPPER END
	ID Measurements	DONE
Eddy Current Inspections	Bobbin Coil ECT	DONE, NDD
	MRPC ECT	DONE, NDD
	Rotating Field Probe ECT	DONE, NDD
X-Ray Radiography		NOT TO BE DONE
Helium Leak Test		NOT TO BE DONE

Destructive Examinations:

Deposit Collection	Tube Swelling	DONE, WALL THICKNESS VARIATIONS LEAD TO "BULGES" TOP END
	Scrape Deposits	DONE
Fluroescent Liquid Penetrant Inspections	Descale	DONE
	Initial Fluroescent PT	NOT TO BE DONE
	Post Decsale Swell	N/A
	Post Swell Fluorescent PT	DONE, SEE CRACK MAPS
SEM/EDS		NOT TO BE DONE
		NOT TO BE DONE
Metallography		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
Microhardness		NOT TO BE DONE
SAM/XPS		NOT TO BE DONE

Deposit Analyses	Anal. of Non Leached Deposit	NOT TO BE DONE
		NOT TO BE DONE
	Leachate & Residue	NOT TO BE DONE

Tube Material Characterization	Bulk Chemistry	NOT TO BE DONE
	Tensile Test	NOT TO BE DONE
	Dual Etch	NOT TO BE DONE
	Microhardness	NOT TO BE DONE
	Modified Huey Test	NOT TO BE DONE

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PRELIMINARY

EXAMINATION METHOD		TUBE SECTION 116-41-6

Nondestructive Examinations:

Receipt Inspections	Radiation Surveys	DONE
	Establish Tube Orientation	DONE
Visual Inspections	Visual Examination	DONE, SEE CRACK MAPS
	Macrophotography	DONE
Dimensional Inspections	OD Measurements	NOT TO BE DONE
	ID Measurements	NOT TO BE DONE
Eddy Current Inspections	Bobbin Coil ECT	DONE, NDD
	MRPC ECT	NOT TO BE DONE
	Rotating Field Probe ECT	NOT TO BE DONE
X-Ray Radiography		NOT TO BE DONE
Helium Leak Test		NOT TO BE DONE

Destructive Examinations:

Deposit Collection	Tube Swelling	NOT TO BE DONE
	Scrape Deposits	NOT TO BE DONE
Fluroescent Liquid Penetrant Inspections	Descale	DONE
	Initial Fluroescent PT	NOT TO BE DONE
	Post Decsale Swell	DONE
	Post Swell Fluorescent PT	DONE, SEE CRACK MAPS
SEM/EDS		NOT TO BE DONE
		NOT TO BE DONE
Metallography		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
Microhardness		NOT TO BE DONE
SAM/XPS		NOT TO BE DONE

Deposit Analyses	Anal. of Non Leached Deposit	NOT TO BE DONE
		NOT TO BE DONE
	Leachate & Residue	NOT TO BE DONE

Tube Material Characterization	Bulk Chemistry	NOT TO BE DONE
	Tensile Test	NOT TO BE DONE
	Dual Etch	NOT TO BE DONE
	Microhardness	NOT TO BE DONE
	Modified Huey Test	NOT TO BE DONE

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EXAMINATION METHOD		TUBE SECTION 116-41-7

Nondestructive Examinations:

Receipt Inspections	Radiation Surveys	DONE
	Establish Tube Orientation	DONE
Visual Inspections	Visual Examination	DONE, SEE CRACK MAPS
	Macrophotography	DONE
Dimensional Inspections	OD Measurements	NOT TO BE DONE
	ID Measurements	NOT TO BE DONE
Eddy Current Inspections	Bobbin Coil ECT	DONE, NDD
	MRPC ECT	NOT TO BE DONE
	Rotating Field Probe ECT	NOT TO BE DONE
X-Ray Radiography		NOT TO BE DONE
Helium Leak Test		NOT TO BE DONE

Destructive Examinations:

Deposit Collection	Tube Swelling	NOT TO BE DONE
	Scrape Deposits	NOT TO BE DONE
Fluroescent Liquid Penetrant Inspections	Descale	DONE
	Initial Fluroescent PT	NOT TO BE DONE
	Post Decsale Swell	DONE
	Post Swell Fluorescent PT	DONE, SEE CRACK MAPS
SEM/EDS		NOT TO BE DONE
		NOT TO BE DONE
Metallography		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
Microhardness		NOT TO BE DONE
SAM/XPS		NOT TO BE DONE

Deposit Analyses	Anal. of Non Leached Deposit	NOT TO BE DONE
		NOT TO BE DONE
	Leachate & Residue	NOT TO BE DONE

Tube Material Characterization	Bulk Chemistry	NOT TO BE DONE
	Tensile Test	NOT TO BE DONE
	Dual Etch	NOT TO BE DONE
	Microhardness	NOT TO BE DONE
	Modified Huey Test	NOT TO BE DONE

PRELIMINARY

EXAMINATION METHOD		TUBE SECTION 116-41-8

Nondestructive Examinations:

Receipt Inspections	Radiation Surveys	DONE
	Establish Tube Orientation	DONE
Visual Inspections	Visual Examination	DONE, SEE CRACK MAPS
	Macrophotography	DONE
Dimensional Inspections	OD Measurements	NOT TO BE DONE
	ID Measurements	NOT TO BE DONE
Eddy Current Inspections	Bobbin Coil ECT	DONE, NDD
	MRPC ECT	NOT TO BE DONE
	Rotating Field Probe ECT	NOT TO BE DONE
X-Ray Radiography		NOT TO BE DONE
Helium Leak Test		NOT TO BE DONE

Destructive Examinations:

Deposit Collection	Tube Swelling	NOT TO BE DONE
	Scrape Deposits	NOT TO BE DONE
Fluroescent Liquid Penetrant Inspections	Descale	DONE
	Initial Fluroescent PT	NOT TO BE DONE
	Post Decsale Swell	DONE
	Post Swell Fluorescent PT	DONE, SEE CRACK MAPS
SEM/EDS		NOT TO BE DONE
		NOT TO BE DONE
Metallography		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
Microhardness		NOT TO BE DONE
SAM/XPS		NOT TO BE DONE

Deposit Analyses	Anal. of Non Leached Deposit	NOT TO BE DONE
		NOT TO BE DONE
	Leachate & Residue	NOT TO BE DONE

Tube Material Characterization	Bulk Chemistry	NOT TO BE DONE
	Tensile Test	NOT TO BE DONE
	Dual Etch	NOT TO BE DONE
	Microhardness	NOT TO BE DONE
	Modified Huey Test	NOT TO BE DONE

PRELIMINARY

EXAMINATION METHOD		TUBE SECTION 116-41-9

Nondestructive Examinations:

Receipt Inspections	Radiation Surveys	DONE
	Establish Tube Orientation	DONE
Visual Inspections	Visual Examination	DONE, SEE CRACK MAPS
	Macrophotography	DONE
Dimensional Inspections	OD Measurements	NOT TO BE DONE
	ID Measurements	NOT TO BE DONE
Eddy Current Inspections	Bobbin Coil ECT	DONE, NDD
	MRPC ECT	NOT TO BE DONE
	Rotating Field Probe ECT	NOT TO BE DONE
X-Ray Radiography		NOT TO BE DONE
Helium Leak Test		NOT TO BE DONE

Destructive Examinations:

Deposit Collection	Tube Swelling	DONE
	Scrape Deposits	DONE
Fluroescent Liquid Penetrant Inspections	Descale	DONE
	Initial Fluroescent PT	NOT TO BE DONE
	Post Decsale Swell	N/A
	Post Swell Fluorescent PT	DONE, SEE CRACK MAPS
SEM/EDS		NOT TO BE DONE
		NOT TO BE DONE
Metallography		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
Microhardness		NOT TO BE DONE
SAM/XPS		NOT TO BE DONE

Deposit Analyses	Anal. of Non Leached Deposit	NOT TO BE DONE
		NOT TO BE DONE
	Leachate & Residue	NOT TO BE DONE

Tube Material Characterization	Bulk Chemistry	NOT TO BE DONE
	Tensile Test	NOT TO BE DONE
	Dual Etch	NOT TO BE DONE
	Microhardness	NOT TO BE DONE
	Modified Huey Test	NOT TO BE DONE

PRELIMINARY

EXAMINATION METHOD		TUBE SECTION 116-41-10

Nondestructive Examinations:

Receipt Inspections	Radiation Surveys	DONE
	Establish Tube Orientation	DONE
Visual Inspections	Visual Examination	DONE, SEE CRACK MAPS
	Macrophotography	DONE
Dimensional Inspections	OD Measurements	NOT TO BE DONE
	ID Measurements	NOT TO BE DONE
Eddy Current Inspections	Bobbin Coil ECT	DONE, NDD
	MRPC ECT	NOT TO BE DONE
	Rotating Field Probe ECT	NOT TO BE DONE
X-Ray Radiography		NOT TO BE DONE
Helium Leak Test		NOT TO BE DONE

Destructive Examinations:

Deposit Collection	Tube Swelling	NOT TO BE DONE
	Scrape Deposits	NOT TO BE DONE
Fluroescent Liquid Penetrant Inspections	Descale	DONE
	Initial Fluroescent PT	NOT TO BE DONE
	Post Decsale Swell	DONE
	Post Swell Fluorescent PT	DONE, SEE CRACK MAPS
SEM/EDS		NOT TO BE DONE
		NOT TO BE DONE
Metallography		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
Microhardness		NOT TO BE DONE
SAM/XPS		NOT TO BE DONE

Deposit Analyses	Anal. of Non Leached Deposit	NOT TO BE DONE
		NOT TO BE DONE
	Leachate & Residue	NOT TO BE DONE

Tube Material Characterization	Bulk Chemistry	NOT TO BE DONE
	Tensile Test	NOT TO BE DONE
	Dual Etch	NOT TO BE DONE
	Microhardness	NOT TO BE DONE
	Modified Huey Test	NOT TO BE DONE

PRELIMINARY

EXAMINATION METHOD		TUBE SECTION 116-41-11

Nondestructive Examinations:

Receipt Inspections	Radiation Surveys	DONE
	Establish Tube Orientation	DONE
Visual Inspections	Visual Examination	DONE, SEE CRACK MAPS
	Macrophotography	DONE
Dimensional Inspections	OD Measurements	NOT TO BE DONE
	ID Measurements	NOT TO BE DONE
Eddy Current Inspections	Bobbin Coil ECT	DONE, NDD
	MRPC ECT	NOT TO BE DONE
	Rotating Field Probe ECT	NOT TO BE DONE
X-Ray Radiography		NOT TO BE DONE
Helium Leak Test		NOT TO BE DONE

Destructive Examinations:

Deposit Collection	Tube Swelling	NOT TO BE DONE
	Scrape Deposits	NOT TO BE DONE
Fluroescent Liquid Penetrant Inspections	Descale	DONE
	Initial Fluroescent PT	NOT TO BE DONE
	Post Decsale Swell	DONE
	Post Swell Fluorescent PT	DONE, SEE CRACK MAPS
SEM/EDS		NOT TO BE DONE
		NOT TO BE DONE
Metallography		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
Microhardness		NOT TO BE DONE
SAM/XPS		NOT TO BE DONE

Deposit Analyses	Anal. of Non Leached Deposit	NOT TO BE DONE
		NOT TO BE DONE
	Leachate & Residue	NOT TO BE DONE

Tube Material Characterization	Bulk Chemistry	NOT TO BE DONE
	Tensile Test	NOT TO BE DONE
	Dual Etch	NOT TO BE DONE
	Microhardness	NOT TO BE DONE
	Modified Huey Test	NOT TO BE DONE

PRELIMINARY

EXAMINATION METHOD		TUBE SECTION 116-41-12

Nondestructive Examinations:

Receipt Inspections	Radiation Surveys	DONE
	Establish Tube Orientation	DONE
Visual Inspections	Visual Examination	DONE, SEE CRACK MAPS
	Macrophotography	DONE
Dimensional Inspections	OD Measurements	NOT TO BE DONE
	ID Measurements	NOT TO BE DONE
Eddy Current Inspections	Bobbin Coil ECT	DONE, NDD
	MRPC ECT	NOT TO BE DONE
	Rotating Field Probe ECT	NOT TO BE DONE
X-Ray Radiography		NOT TO BE DONE
Helium Leak Test		NOT TO BE DONE

Destructive Examinations:

Deposit Collection	Tube Swelling	NOT TO BE DONE
	Scrape Deposits	NOT TO BE DONE
Fluroescent Liquid Penetrant Inspections	Descale	DONE
	Initial Fluroescent PT	NOT TO BE DONE
	Post Decsale Swell	DONE
	Post Swell Fluorescent PT	DONE, SEE CRACK MAPS
SEM/EDS		NOT TO BE DONE
		NOT TO BE DONE
Metallography		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
Microhardness		NOT TO BE DONE
SAM/XPS		NOT TO BE DONE

Deposit Analyses	Anal. of Non Leached Deposit	NOT TO BE DONE
		NOT TO BE DONE
	Leachate & Residue	NOT TO BE DONE

Tube Material Characterization	Bulk Chemistry	NOT TO BE DONE
	Tensile Test	NOT TO BE DONE
	Dual Etch	NOT TO BE DONE
	Microhardness	NOT TO BE DONE
	Modified Huey Test	NOT TO BE DONE

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PRELIMINARY

EXAMINATION METHOD		TUBE SECTION 116-41-13

Nondestructive Examinations:

Receipt Inspections	Radiation Surveys	DONE
	Establish Tube Orientation	DONE
Visual Inspections	Visual Examination	DONE, SEE CRACK MAPS
	Macrophotography	DONE
Dimensional Inspections	OD Measurements	NOT TO BE DONE
	ID Measurements	NOT TO BE DONE
Eddy Current Inspections	Bobbin Coil ECT	DONE, NDD
	MRPC ECT	NOT TO BE DONE
	Rotating Field Probe ECT	NOT TO BE DONE
X-Ray Radiography		NOT TO BE DONE
Helium Leak Test		NOT TO BE DONE

Destructive Examinations:

Deposit Collection	Tube Swelling	DONE
	Scrape Deposits	DONE
Fluroescent Liquid Penetrant Inspections	Descale	DONE
	Initial Fluroescent PT	NOT TO BE DONE
	Post Decsale Swell	N/A
	Post Swell Fluorescent PT	DONE, SEE CRACK MAPS
SEM/EDS		NOT TO BE DONE
		NOT TO BE DONE
Metallography		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
Microhardness		NOT TO BE DONE
SAM/XPS		NOT TO BE DONE

Deposit Analyses	Anal. of Non Leached Deposit	NOT TO BE DONE
		NOT TO BE DONE
	Leachate & Residue	NOT TO BE DONE

Tube Material Characterization	Bulk Chemistry	NOT TO BE DONE
	Tensile Test	NOT TO BE DONE
	Dual Etch	NOT TO BE DONE
	Microhardness	NOT TO BE DONE
	Modified Huey Test	NOT TO BE DONE

PRELIMINARY

EXAMINATION METHOD		TUBE SECTION 116-41-14

Nondestructive Examinations:

Receipt Inspections	Radiation Surveys	DONE
	Establish Tube Orientation	DONE
Visual Inspections	Visual Examination	DONE, SEE CRACK MAPS
	Macrophotography	DONE
Dimensional Inspections	OD Measurements	NOT TO BE DONE
	ID Measurements	NOT TO BE DONE
Eddy Current Inspections	Bobbin Coil ECT	DONE, NDD
	MRPC ECT	NOT TO BE DONE
	Rotating Field Probe ECT	NOT TO BE DONE
X-Ray Radiography		NOT TO BE DONE
Helium Leak Test		NOT TO BE DONE

Destructive Examinations:

Deposit Collection	Tube Swelling	NOT TO BE DONE
	Scrape Deposits	NOT TO BE DONE
Fluroescent Liquid Penetrant Inspections	Descale	DONE
	Initial Fluroescent PT	NOT TO BE DONE
	Post Decsale Swell	DONE
	Post Swell Fluorescent PT	DONE, SEE CRACK MAPS
SEM/EDS		NOT TO BE DONE
		NOT TO BE DONE
Metallography		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
Microhardness		NOT TO BE DONE
SAM/XPS		NOT TO BE DONE

Deposit Analyses	Anal. of Non Leached Deposit	NOT TO BE DONE
		NOT TO BE DONE
	Leachate & Residue	NOT TO BE DONE

Tube Material Characterization	Bulk Chemistry	NOT TO BE DONE
	Tensile Test	NOT TO BE DONE
	Dual Etch	NOT TO BE DONE
	Microhardness	NOT TO BE DONE
	Modified Huey Test	NOT TO BE DONE

PRELIMINARY

EXAMINATION METHOD		TUBE SECTION 116-41-15

Nondestructive Examinations:

Receipt Inspections	Radiation Surveys	DONE
	Establish Tube Orientation	DONE
Visual Inspections	Visual Examination	DONE, SEE CRACK MAPS
	Macrophotography	DONE
Dimensional Inspections	OD Measurements	DONE
	ID Measurements	DONE
Eddy Current Inspections	Bobbin Coil ECT	DONE, NDD
	MRPC ECT	NOT TO BE DONE
	Rotating Field Probe ECT	NOT TO BE DONE
X-Ray Radiography		NOT TO BE DONE
Helium Leak Test		NOT TO BE DONE

Destructive Examinations:

Deposit Collection	Tube Swelling	NOT TO BE DONE
	Scrape Deposits	NOT TO BE DONE
Fluroescent Liquid Penetrant Inspections	Descale	DONE
	Initial Fluroescent PT	NOT TO BE DONE
	Post Decsale Swell	DONE
	Post Swell Fluorescent PT	DONE, SEE CRACK MAPS
SEM/EDS		NOT TO BE DONE
		NOT TO BE DONE
Metallography		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
Microhardness		NOT TO BE DONE
SAM/XPS		NOT TO BE DONE

Deposit Analyses	Anal. of Non Leached Deposit	NOT TO BE DONE
		NOT TO BE DONE
	Leachate & Residue	NOT TO BE DONE

Tube Material Characterization	Bulk Chemistry	NOT TO BE DONE
	Tensile Test	NOT TO BE DONE
	Dual Etch	NOT TO BE DONE
	Microhardness	NOT TO BE DONE
	Modified Huey Test	NOT TO BE DONE

PRELIMINARY

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EXAMINATION METHOD		TUBE SECTION 116-41-16

Nondestructive Examinations:

Receipt Inspections	Radiation Surveys	DONE
	Establish Tube Orientation	DONE
Visual Inspections	Visual Examination	DONE, SEE CRACK MAPS
	Macrophotography	DONE
Dimensional Inspections	OD Measurements	DONE
	ID Measurements	DONE
Eddy Current Inspections	Bobbin Coil ECT	DONE, NDD
	MRPC ECT	NOT TO BE DONE
	Rotating Field Probe ECT	NOT TO BE DONE
X-Ray Radiography		NOT TO BE DONE
Helium Leak Test		NOT TO BE DONE

Destructive Examinations:

Deposit Collection	Tube Swelling	NOT TO BE DONE
	Scrape Deposits	NOT TO BE DONE
Fluroescent Liquid Penetrant Inspections	Descale	DONE
	Initial Fluroescent PT	NOT TO BE DONE
	Post Decsale Swell	DONE
	Post Swell Fluorescent PT	LIGHT IGA AT UPPER END, SEE CRACK MAPS
SEM/EDS		NOT TO BE DONE
		NOT TO BE DONE
Metallography		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
Microhardness		NOT TO BE DONE
SAM/XPS		NOT TO BE DONE

Deposit Analyses	Anal. of Non Leached Deposit	NOT TO BE DONE
		NOT TO BE DONE
	Leachate & Residue	NOT TO BE DONE

Tube Material Characterization	Bulk Chemistry	NOT TO BE DONE
	Tensile Test	NOT TO BE DONE
	Dual Etch	NOT TO BE DONE
	Microhardness	NOT TO BE DONE
	Modified Huey Test	NOT TO BE DONE

PRELIMINARY

EXAMINATION METHOD		TUBE SECTION 116–41–17

Nondestructive Examinations:

Receipt Inspections	Radiation Surveys	DONE
	Establish Tube Orientation	DONE
Visual Inspections	Visual Examination	DONE, SEE CRACK MAPS
	Macrophotography	DONE
Dimensional Inspections	OD Measurements	DONE
	ID Measurements	DONE
Eddy Current Inspections	Bobbin Coil ECT	DONE, NDD
	MRPC ECT	NOT TO BE DONE
	Rotating Field Probe ECT	NOT TO BE DONE
X–Ray Radiography		NOT TO BE DONE
Helium Leak Test		NOT TO BE DONE

Destructive Examinations:

Deposit Collection	Tube Swelling	DONE
	Scrape Deposits	DONE
Fluroescent Liquid Penetrant Inspections	Descale	DONE
	Initial Fluroescent PT	NOT TO BE DONE
	Post Decsale Swell	N/A
	Post Swell Fluorescent PT	LIGHT IGA ALONG WHOLE TUBE, SEE CRACK MAPS
SEM/EDS		NOT TO BE DONE
		NOT TO BE DONE
Metallography		SECTION B – DEEPEST IGP = 2 MILS = 5%TW
		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
Microhardness		NOT TO BE DONE
SAM/XPS		NOT TO BE DONE

Deposit Analyses	Anal. of Non Leached Deposit	NOT TO BE DONE
		NOT TO BE DONE
	Leachate & Residue	NOT TO BE DONE

Tube Material Characterization	Bulk Chemistry	NOT TO BE DONE
	Tensile Test	NOT TO BE DONE
	Dual Etch	NOT TO BE DONE
	Microhardness	NOT TO BE DONE
	Modified Huey Test	NOT TO BE DONE

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PRELIMINARY

EXAMINATION METHOD		TUBE SECTION 116-41-18

Nondestructive Examinations:

Receipt Inspections	Radiation Surveys	DONE
	Establish Tube Orientation	DONE
Visual Inspections	Visual Examination	DONE, SEE CRACK MAPS
	Macrophotography	DONE
Dimensional Inspections	OD Measurements	DONE
	ID Measurements	DONE
Eddy Current Inspections	Bobbin Coil ECT	DONE, NDD
	MRPC ECT	NOT TO BE DONE
	Rotating Field Probe ECT	NOT TO BE DONE
X-Ray Radiography		NOT TO BE DONE
Helium Leak Test		NOT TO BE DONE

Destructive Examinations:

Deposit Collection	Tube Swelling	NOT TO BE DONE
	Scrape Deposits	NOT TO BE DONE
Fluroescent Liquid Penetrant Inspections	Descale	DONE
	Initial Fluroescent PT	NOT TO BE DONE
	Post Decsale Swell	DONE
	Post Swell Fluorescent PT	LIGHT IGA ALONG WHOLE TUBE, SEE CRACK MAPS
SEM/EDS		NOT TO BE DONE
		NOT TO BE DONE
Metallography		SECTION B2 – 2 MIL DEEP (5%WT) IGP WHOLE CIRCUMFERENCE
		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
Microhardness		NOT TO BE DONE
SAM/XPS		NOT TO BE DONE

Deposit Analyses	Anal. of Non Leached Deposit	NOT TO BE DONE
		NOT TO BE DONE
	Leachate & Residue	NOT TO BE DONE

Tube Material Characterization	Bulk Chemistry	NOT TO BE DONE
	Tensile Test	NOT TO BE DONE
	Dual Etch	NOT TO BE DONE
	Microhardness	NOT TO BE DONE
	Modified Huey Test	NOT TO BE DONE

PRELIMINARY

EXAMINATION METHOD		TUBE SECTION 116-41-19

Nondestructive Examinations:

Receipt Inspections	Radiation Surveys	DONE
	Establish Tube Orientation	DONE
Visual Inspections	Visual Examination	TEAR-SHAPED, DEEP WEAR MARK AT TOP END, SEE CRACK MAPS
	Macrophotography	DONE
Dimensional Inspections	OD Measurements	WEAR MARK = 16 MILS DEEP
	ID Measurements	DONE
Eddy Current Inspections	Bobbin Coil ECT	09H+1.1=INA/27%
	MRPC ECT	09H+1.1= 0.6/0.3/VOL
	Rotating Field Probe ECT	DONE
X-Ray Radiography		DONE, ONLY WEAR MARK SEEN
Helium Leak Test		NOT TO BE DONE

Destructive Examinations:

Deposit Collection	Tube Swelling	DONE
	Scrape Deposits	DONE
Fluroescent Liquid Penetrant Inspections	Descale	DONE
	Initial Fluroescent PT	NOT TO BE DONE
	Post Decsale Swell	DONE
	Post Swell Fluorescent PT	DEEPER IGA PATCHES, LIGHT IGA ON WHOLE TUBE, SEE CRACK MAPS
SEM/EDS		DONE, WEAR MARK APPEARS TO BE MECHANICAL
Metallography		SECTION B-1A, NO EVIDENCE OF COLD WORK AT WEAR MARK
		SECTION A2 - DEEPEST IGP = 2 MILS = 5%TW
		NOT TO BE DONE
		NOT TO BE DONE
		NOT TO BE DONE
Microhardness		SECTION B-1A, NO HIGHER HARDNESSES NEXT TO WEAR MARK
SAM/XPS		NOT TO BE DONE

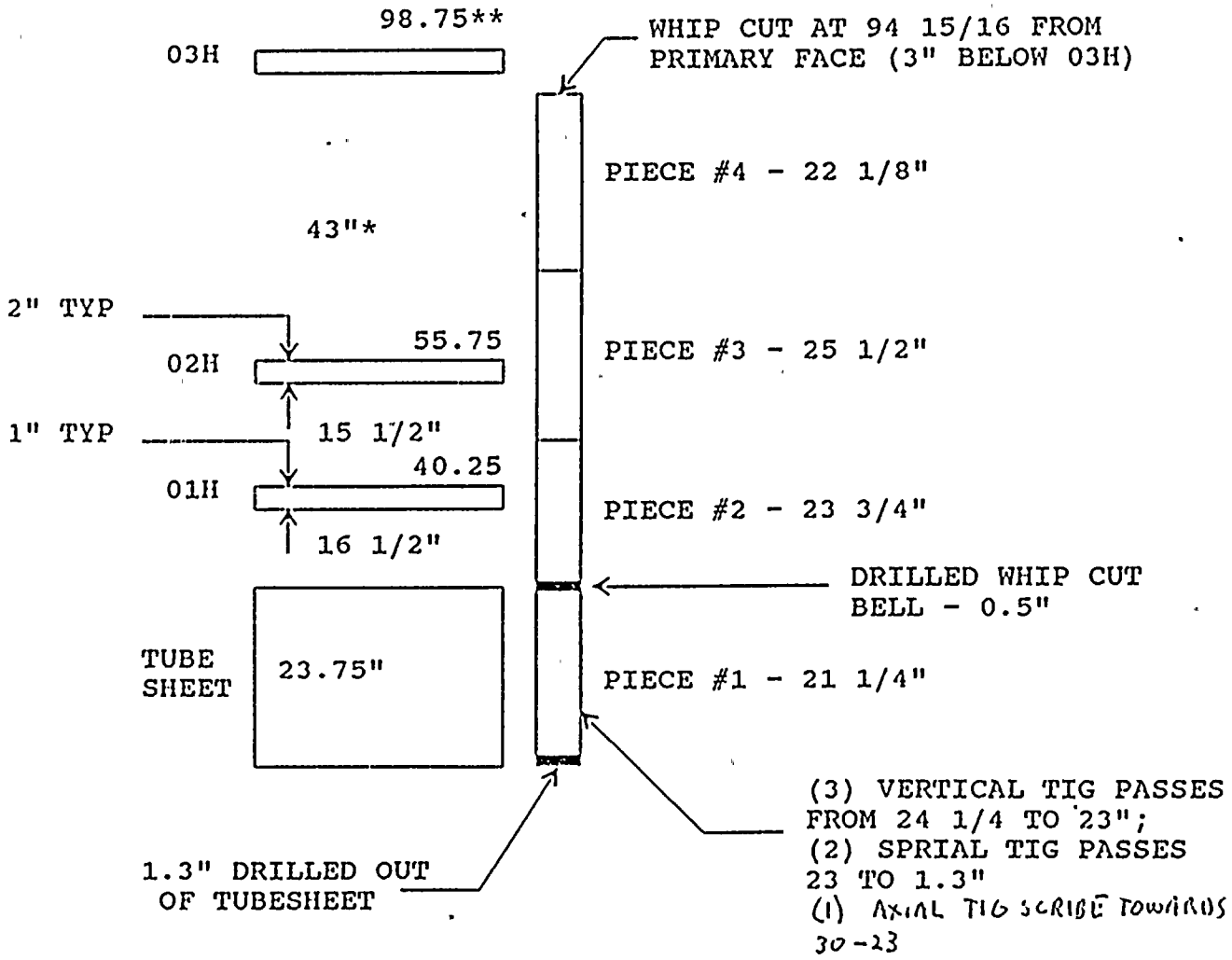
Deposit Analyses	Anal. of Non Leached Deposit	PENDING, FREE SPAN DEPOSIT
		NOT TO BE DONE
	Leachate & Residue	NOT TO BE DONE

Tube Material Characterization	Bulk Chemistry	NOT TO BE DONE
	Tensile Test	NOT TO BE DONE
	Dual Etch	NOT TO BE DONE
	Microhardness	NOT TO BE DONE
	Modified Huey Test	NOT TO BE DONE

PRELIMINARY

(5)

TUBE 29-24



* DISTANCES BETWEEN CENTERLINE OF TSP's (01H IS A 1" THICK BAFFLE PLATE AND ALL OTHERS ARE 2" THICK EGGCRATES)

** DISTANCE FROM PRIMARY FACE TO CENTERLINE OF TSP

NOTES: NOTCH IN TUBE SAMPLE IS ON TOP END (OPPOSITE TS)

PRELIMINARY

10-Jun-93

EXAMINATION METHOD		TUBE SECTION 22-13 PIECE NO. 1	2	3	4	5	TUBE SECTION 29-24 PIECE NO. 1	2	3	4
Nondestructive Examinations:										
Receipt Inspections	Radiation Surveys	D	D	D	D	D	D	D	D	D
	Establish Tube Orientation	D	D	D	D	D	D	D	D	D
Visual Inspections	Visual Examination		D	D	D	D		D	D	D
	Macrophotography		D	D	D	D		D	D	D
Dimensional Inspections	OD Measurements		D	D	D	D		D	D	D
	ID Measurements		D	D	D	D		D	D	D
Eddy Current Inspections	Bobbin Coil ECT		D	D	D	D		D	D	D
	MRPC ECT		D	D				D	D	
	Rotating Field Probe ECT		D	D	D	D		D	D	
X-Ray Radiography			D	D				D	D	
Helium Leak Test			D	D				D		
Destructive Examinations:										
Burst Testing	Tube Burst Testing		D	D				D		
	Stereovisual Inspection		D	D				D		
	Photography		D	D				D		
	Scrape Deposits		D	D				D		
SEM/EDS			1					1		
Metallography			1							
Microhardness										
SAM/XPS			1							
Deposit Analyses	XRD		1							
	Emission Spec. (Semi-quant)		1							
	Perkin Elmer (Total C)		1							
	ISE (Cl & F)		1							
	ICP (Pb, S, et. al.)		1							
	Flame AA (Na)		1							
	Total S		1							
	Leachate		1							
Tube Material Characterization	Bulk Chemistry									
	Tensile Test									
	Dual Etch		1*							
	Microhardness									
	Modified Huey Test									

* To be taken from non-swelled ring adjacent to burst section.

PRELIMINARY

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EXAMINATION METHOD		TUBE SECTION 29-24-1

Nondestructive Examinations:

Receipt Inspections	Radiation Surveys	DONE
	Establish Tube Orientation	DONE
Visual Inspections	Visual Examination	NOT TO BE DONE
	Macrophotography	NOT TO BE DONE
Dimensional Inspections	OD Measurements	NOT TO BE DONE
	ID Measurements	NOT TO BE DONE
Eddy Current Inspections	Bobbin Coil ECT	NOT TO BE DONE
	MRPC ECT	NOT TO BE DONE
	Rotating Field Probe ECT	NOT TO BE DONE
X-Ray Radiography		NOT TO BE DONE
Helium Leak Test		NOT TO BE DONE

Destructive Examinations:

Burst Testing	Tube Burst Testing	NOT TO BE DONE
	Stereovisual Inspection	NOT TO BE DONE
	Photography	NOT TO BE DONE
	Scrape Deposits	NOT TO BE DONE
SEM/EDS		NOT TO BE DONE
		NOT TO BE DONE
Metallography		NOT TO BE DONE
Microhardness		NOT TO BE DONE
SAM/XPS		NOT TO BE DONE

Deposit Analyses	Anal. of Non Leached Deposit	NOT TO BE DONE
		NOT TO BE DONE
	Leachate & Residue	NOT TO BE DONE

Tube Material Characterization	Bulk Chemistry	NOT TO BE DONE
	Tensile Test	NOT TO BE DONE
	Dual Etch	NOT TO BE DONE
	Microhardness	NOT TO BE DONE
	Modified Huey Test	NOT TO BE DONE

PRELIMINARY

EXAMINATION METHOD		TUBE SECTION 29-24-2

Nondestructive Examinations:

Receipt Inspections	Radiation Surveys	DONE
	Establish Tube Orientation	DONE
Visual Inspections	Visual Examination	DONE, SEE CRACK MAPS
	Macrophotography	DONE
Dimensional Inspections	OD Measurements	DONE
	ID Measurements	DONE
Eddy Current Inspections	Bobbin Coil ECT	01H+0.05 = 0.6/ /<98%
	MRPC ECT	01H+0.05 = NDD
	Rotating Field Probe ECT	DONE
X-Ray Radiography		DONE, NO DEFECTS NOTED
Helium Leak Test		DONE, NO LEAKS

Destructive Examinations:

Burst Testing	Tube Burst Testing	DONE, BURST PRESSURE = 9,662 PSI
	Stereovisual Inspection	DONE, SHORT AXIAL IGA CRACKS NEIGHBOR THE FRACTURE
	Photography	DONE
	Scrape Deposits	DONE
SEM/EDS		CRACK PROFILE PENDING
		EDS PENDING
Metallography		SECTION XXXX, PENDING
Microhardness		NOT TO BE DONE
SAM/XPS		NOT TO BE DONE

Deposit Analyses	Anal. of Non Leached Deposit	NOT TO BE DONE
		NOT TO BE DONE
	Leachate & Residue	NOT TO BE DONE

Tube Material Characterization	Bulk Chemistry	NOT TO BE DONE
	Tensile Test	NOT TO BE DONE
	Dual Etch	NOT TO BE DONE
	Microhardness	NOT TO BE DONE
	Modified Huey Test	NOT TO BE DONE

PRELIMINARY

EXAMINATION METHOD		TUBE SECTION 29–24–3

Nondestructive Examinations:

Receipt Inspections	Radiation Surveys	DONE
	Establish Tube Orientation	DONE
Visual Inspections	Visual Examination	DONE, SEE CRACK MAPS
	Macrophotography	DONE
Dimensional Inspections	OD Measurements	DONE
	ID Measurements	DONE
Eddy Current Inspections	Bobbin Coil ECT	DONE, NDD
	MRPC ECT	DONE, NDD
	Rotating Field Probe ECT	DONE, NDD
X–Ray Radiography		DONE, NO DEFECTS NOTED
Helium Leak Test		NOT TO BE DONE

Destructive Examinations:

Burst Testing	Tube Burst Testing	NOT TO BE DONE
	Stereovisual Inspection	NOT TO BE DONE
	Photography	NOT TO BE DONE
	Scrape Deposits	NOT TO BE DONE
SEM/EDS		NOT TO BE DONE
		NOT TO BE DONE
Metallography		NOT TO BE DONE
Microhardness		NOT TO BE DONE
SAM/XPS		NOT TO BE DONE

Deposit Analyses	Anal. of Non Leached Deposit	NOT TO BE DONE
		NOT TO BE DONE
	Leachate & Residue	NOT TO BE DONE

Tube Material Characterization	Bulk Chemistry	NOT TO BE DONE
	Tensile Test	NOT TO BE DONE
	Dual Etch	NOT TO BE DONE
	Microhardness	NOT TO BE DONE
	Modified Huey Test	NOT TO BE DONE

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PRELIMINARY

EXAMINATION METHOD		TUBE SECTION 29–24–4

Nondestructive Examinations:

Receipt Inspections	Radiation Surveys	DONE
	Establish Tube Orientation	DONE
Visual Inspections	Visual Examination	DONE, SEE CRACK MAPS
	Macrophotography	DONE
Dimensional Inspections	OD Measurements	DONE
	ID Measurements	DONE
Eddy Current Inspections	Bobbin Coil ECT	DONE, NDD
	MRPC ECT	NOT TO BE DONE
	Rotating Field Probe ECT	NOT TO BE DONE
X–Ray Radiography		NOT TO BE DONE
Helium Leak Test		NOT TO BE DONE

Destructive Examinations:

Burst Testing	Tube Burst Testing	NOT TO BE DONE
	Stereovisual Inspection	NOT TO BE DONE
	Photography	NOT TO BE DONE
	Scrape Deposits	NOT TO BE DONE
SEM/EDS		NOT TO BE DONE
		NOT TO BE DONE
Metallography		NOT TO BE DONE
Microhardness		NOT TO BE DONE
SAM/XPS		NOT TO BE DONE

Deposit Analyses	Anal. of Non Leached Deposit	NOT TO BE DONE
		NOT TO BE DONE
	Leachate & Residue	NOT TO BE DONE

Tube Material Characterization	Bulk Chemistry	NOT TO BE DONE
	Tensile Test	NOT TO BE DONE
	Dual Etch	NOT TO BE DONE
	Microhardness	NOT TO BE DONE
	Modified Huey Test	NOT TO BE DONE

PRELIMINARY

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Crack Depth Data 29-24-2B.2.2.b

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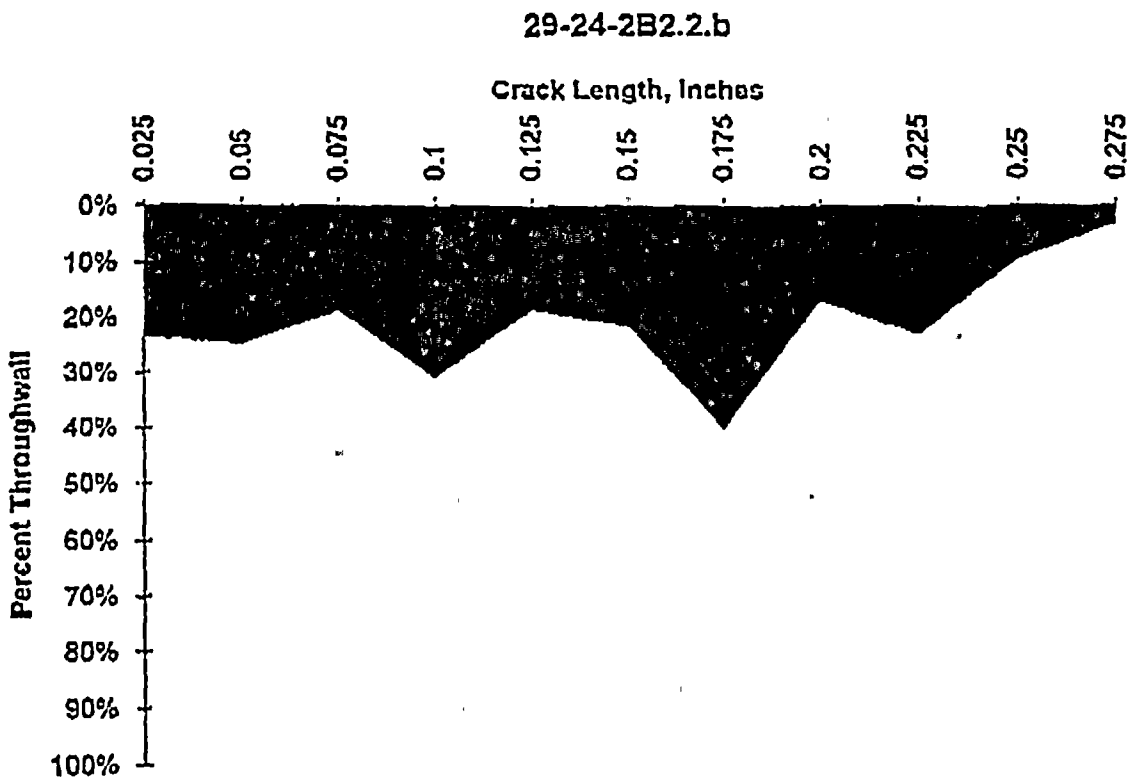
6/10/93

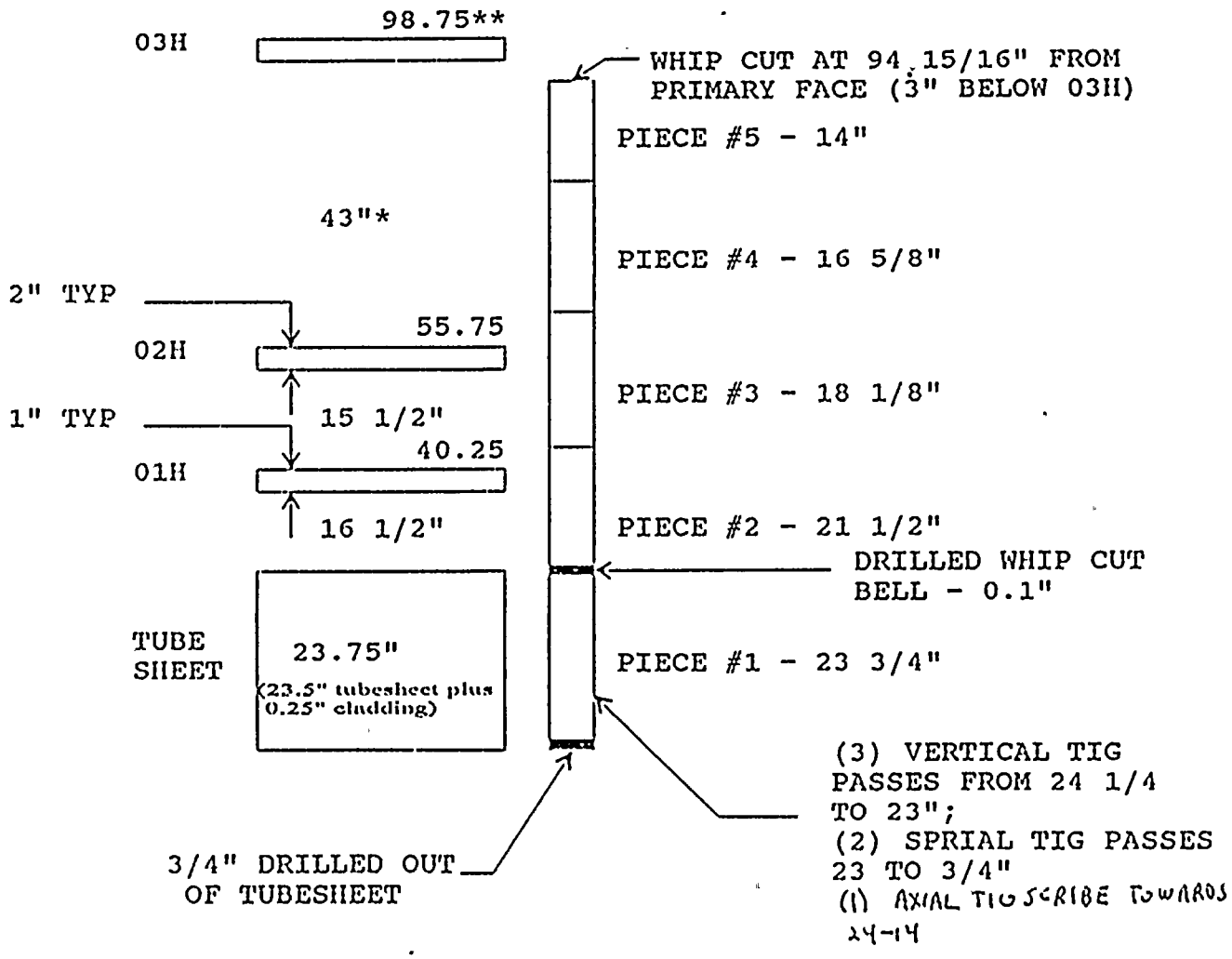
axial	%throughwall (assuming 43 mills)		depth , mil
0.025	23%	0.9375	10
0.05	25%	1	11
0.075	19%	0.75	8
0.1	31%	1.25	13
0.125	19%	0.75	8
0.15	22%	0.875	9
0.175	40%	1.625	17
0.2	17%	0.6875	7
0.225	23%	0.9375	10
0.25	9%	0.375	4
0.275	3%	0.125	1

AVG: 21%
MAX: 40%



PRELIMINARY

TUBE 22-13



* DISTANCES BETWEEN CENTERLINE OF TSP's (01H IS A 1" THICK BAFFLE PLATE AND ALL OTHERS ARE 2" THICK EGGCRATES)

** DISTANCE FROM PRIMARY FACE TO CENTERLINE OF TSP

NOTES: NOTCH IN TUBE SAMPLE IS ON TOP END (OPPOSITE TS)

PRELIMINARY

PALO VERDE STEAM GENERATOR TUBE DEPOSIT ANALYSES FLOWCHART

PRELIMINARY

117-40-15 FS
117-40-15 08H
117-40-9 FS
117-40-9 05H
117-40-2 FS (Leach)
117-40-15 FS (Non-Leach)
117-40-2 01H FDB
116-41-19A FS
22-13-2B2 FS
22-13-2B2 01H FDB

20 mg Samples

Balance

ARC

XRD
* Emission Spec.
Total Carbon

* Semi-quantitative

LTC

117-40-9 FS
117-40-9 05H
117-40-15 FS (Non-Leach)
116-41-19A FS

↓

* ICP (Al, B, Ca, Cr, Cu, Fe)
(Pb, Mg, Mn Ni, Ti)
(Zn, Si, Mo, Sn & P)
** ISE (Cl & F)
FAA (Na & K)
Total Sulfur (per ARC)

* Elements to be quantified were established by prior semi-quantitative analysis.

** Cl may be analyzed by IC
F electrode may be attained on project.

117-40-15 FS
117-40-15 08H
117-40-2 FS (Leach)
117-40-2 01H FDB
22-13-2B2 FS
22-13-2B2 01H FDB

↓

LEACH TEST (per ARC)

LEACHATE

* pH & Cond.
ISE (Cl & F)
FAA (Na & K)
IC ($SO_4^{=}$, PO_4^{3-}, $CO_3^{=}$
NO_3^-, NO_2^-)
ICP (same elements as non-leached samples)

LEACHATE RESIDUE

ICP (same elements as non-leached samples)
Total Sulfur (per ARC)

* Under cover gas.

10-Jun-93

EXAMINATION METHOD		TUBE SECTION 22-13 PIECE NO. 1	2	3	4	5	TUBE SECTION 29-24 PIECE NO. 1	2	3	4
Nondestructive Examinations:										
Receipt Inspections	Radiation Surveys	D	D	D	D	D	D	D	D	D
	Establish Tube Orientation	D	D	D	D	D	D	D	D	D
Visual Inspections	Visual Examination		D	D	D	D		D	D	D
	Macrophotography		D	D	D	D		D	D	D
Dimensional Inspections	OD Measurements		D	D	D	D		D	D	D
	ID Measurements		D	D	D	D		D	D	D
Eddy Current Inspections	Bobbin Coil ECT		D	D	D	D		D	D	D
	MRPC ECT		D	D				D	D	
	Rotating Field Probe ECT		D	D	D	D		D	D	
X-Ray Radiography			D	D				D	D	
Helium Leak Test			D	D				D		
Destructive Examinations:										
Burst Testing	Tube Burst Testing		D	D				D		
	Stereovisual Inspection		D	D				D		
	Photography		D	D				D		
	Scrape Deposits		D	D				D		
SEM/EDS			1					1		
Metallography			1							
Microhardness										
SAM/XPS			1							
Deposit Analyses	XRD		1							
	Emission Spec. (Semi-quant)		1							
	Perkin Elmer (Total C)		1							
	ISE (Cl & F)		1							
	ICP (Pb, S, et. al.)		1							
	Flame AA (Na)		1							
	Total S		1							
	Leachate		1							
Tube Material Characterization	Bulk Chemistry									
	Tensile Test									
	Dual Etch		1*							
	Microhardness									
	Modified Huey Test									

* To be taken from non-swelled ring adjacent to burst section.

PRELIMINARY

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EXAMINATION METHOD		TUBE SECTION 22-13-1

Nondestructive Examinations:

Receipt Inspections	Radiation Surveys	DONE
	Establish Tube Orientation	DONE
Visual Inspections	Visual Examination	NOT TO BE DONE
	Macrophotography	NOT TO BE DONE
Dimensional Inspections	OD Measurements	NOT TO BE DONE
	ID Measurements	NOT TO BE DONE
Eddy Current Inspections	Bobbin Coil ECT	NOT TO BE DONE
	MRPC ECT	NOT TO BE DONE
	Rotating Field Probe ECT	NOT TO BE DONE
X-Ray Radiography		NOT TO BE DONE
Helium Leak Test		NOT TO BE DONE

Destructive Examinations:

Burst Testing	Tube Burst Testing	NOT TO BE DONE
	Stereovisual Inspection	NOT TO BE DONE
	Photography	NOT TO BE DONE
	Scrape Deposits	NOT TO BE DONE
SEM/EDS		NOT TO BE DONE
Metallography		NOT TO BE DONE
Microhardness		NOT TO BE DONE
SAM/XPS		NOT TO BE DONE

Deposit Analyses	Anal. of Non Leached Deposit	NOT TO BE DONE
		NOT TO BE DONE
	Leachate & Residue	NOT TO BE DONE

Tube Material Characterization	Bulk Chemistry	NOT TO BE DONE
	Tensile Test	NOT TO BE DONE
	Dual Etch	NOT TO BE DONE
	Microhardness	NOT TO BE DONE
	Modified Huey Test	NOT TO BE DONE

PRELIMINARY

EXAMINATION METHOD		TUBE SECTION 22-13-2

Nondestructive Examinations:

Receipt Inspections	Radiation Surveys	DONE
	Establish Tube Orientation	DONE
Visual Inspections	Visual Examination	DONE, SEE CRACK MAPS
	Macrophotography	DONE
Dimensional Inspections	OD Measurements	DONE
	ID Measurements	DONE
Eddy Current Inspections	Bobbin Coil ECT	O1H-0.1 =1.1/NA/43%
	MRPC ECT	O1H-0.1 = 0.3/0.3/SAI
	Rotating Field Probe ECT	DONE
X-Ray Radiography		DONE, NO DEFECTS NOTED
Helium Leak Test		DONE, NO LEAKS

Destructive Examinations:

Burst Testing	Tube Burst Testing	DONE, BURST PRESSURE = 8,948 PSI
	Stereovisual Inspection	DONE, SHORT AXIAL IGA CRACKS NEIGHBOR THE FRACTURE
	Photography	DONE
	Scrape Deposits	DONE
SEM/EDS		CRACK PROFILE DONE (AVG= 31%TW, MAX = 56%TW)
		EDS PENDING
Metallography		PENDING
Microhardness		NOT TO BE DONE
SAM/XPS		PENDING

Deposit Analyses	Anal. of Non Leached Deposit	NOT TO BE DONE
	Leachate & Residue	PENDING, TSP AND NON-TSP REGIONS

Tube Material Characterization	Bulk Chemistry	NOT TO BE DONE
	Tensile Test	NOT TO BE DONE
	Dual Etch	PENDING
	Microhardness	NOT TO BE DONE
	Modified Huey Test	NOT TO BE DONE

PRELIMINARY

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EXAMINATION METHOD		TUBE SECTION 22-13-3

Nondestructive Examinations:

Receipt Inspections	Radiation Surveys	DONE
	Establish Tube Orientation	DONE
Visual Inspections	Visual Examination	DONE, SEE CRACK MAPS
	Macrophotography	DONE
Dimensional Inspections	OD Measurements	DONE
	ID Measurements	DONE
Eddy Current Inspections	Bobbin Coil ECT	02H+.75 = NDD
	MRPC ECT	02H+.75 = VOL(ID)
	Rotating Field Probe ECT	DONE
X-Ray Radiography		DONE, NO DEFECTS NOTED
Helium Leak Test		DONE, NO LEAKS

Destructive Examinations:

Burst Testing	Tube Burst Testing	DONE, BURST PRESSURE = 10,396 PSI
	Stereovisual Inspection	DONE, BURST FRACTURE WAS 100% DUCTILE
	Photography	DONE
	Scrape Deposits	DONE
SEM/EDS		NOT TO BE DONE
		NOT TO BE DONE
Metallography		NOT TO BE DONE
Microhardness		NOT TO BE DONE
SAM/XPS		NOT TO BE DONE

Deposit Analyses	Anal. of Non Leached Deposit	NOT TO BE DONE
		NOT TO BE DONE
	Leachate & Residue	NOT TO BE DONE

Tube Material Characterization	Bulk Chemistry	NOT TO BE DONE
	Tensile Test	NOT TO BE DONE
	Dual Etch	NOT TO BE DONE
	Microhardness	NOT TO BE DONE
	Modified Huey Test	NOT TO BE DONE

PRELIMINARY

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EXAMINATION METHOD		TUBE SECTION 22-13-4

Nondestructive Examinations:

Receipt Inspections	Radiation Surveys	DONE
	Establish Tube Orientation	DONE
Visual Inspections	Visual Examination	DONE, SEE CRACK MAPS
	Macrophotography	DONE
Dimensional Inspections	OD Measurements	DONE
	ID Measurements	DONE
Eddy Current Inspections	Bobbin Coil ECT	DONE, NDD
	MRPC ECT	NOT TO BE DONE
	Rotating Field Probe ECT	DONE, NDD
X-Ray Radiography		NOT TO BE DONE
Helium Leak Test		NOT TO BE DONE

Destructive Examinations:

Burst Testing	Tube Burst Testing	NOT TO BE DONE
	Stereovisual Inspection	NOT TO BE DONE
	Photography	NOT TO BE DONE
	Scrape Deposits	NOT TO BE DONE
SEM/EDS		NOT TO BE DONE
		NOT TO BE DONE
Metallography		NOT TO BE DONE
Microhardness		NOT TO BE DONE
SAM/XPS		NOT TO BE DONE

Deposit Analyses	Anal. of Non Leached Deposit	NOT TO BE DONE
		NOT TO BE DONE
	Leachate & Residue	NOT TO BE DONE

Tube Material Characterization	Bulk Chemistry	NOT TO BE DONE
	Tensile Test	NOT TO BE DONE
	Dual Etch	NOT TO BE DONE
	Microhardness	NOT TO BE DONE
	Modified Huey Test	NOT TO BE DONE

PRELIMINARY

EXAMINATION METHOD		TUBE SECTION 22-13-5

Nondestructive Examinations:

Receipt Inspections	Radiation Surveys	DONE
	Establish Tube Orientation	DONE
Visual Inspections	Visual Examination	DONE, SEE CRACK MAPS
	Macrophotography	DONE
Dimensional Inspections	OD Measurements	DONE
	ID Measurements	DONE
Eddy Current Inspections	Bobbin Coil ECT	DONE, NDD
	MRPC ECT	NOT TO BE DONE
	Rotating Field Probe ECT	DONE, NDD
X-Ray Radiography		NOT TO BE DONE
Helium Leak Test		NOT TO BE DONE

Destructive Examinations:

Burst Testing	Tube Burst Testing	NOT TO BE DONE
	Stereovisual Inspection	NOT TO BE DONE
	Photography	NOT TO BE DONE
	Scrape Deposits	NOT TO BE DONE
SEM/EDS		NOT TO BE DONE
		NOT TO BE DONE
Metallography		NOT TO BE DONE
Microhardness		NOT TO BE DONE
SAM/XPS		NOT TO BE DONE

Deposit Analyses	Anal. of Non Leached Deposit	NOT TO BE DONE
		NOT TO BE DONE
	Leachate & Residue	NOT TO BE DONE

Tube Material Characterization	Bulk Chemistry	NOT TO BE DONE
	Tensile Test	NOT TO BE DONE
	Dual Etch	NOT TO BE DONE
	Microhardness	NOT TO BE DONE
	Modified Huey Test	NOT TO BE DONE

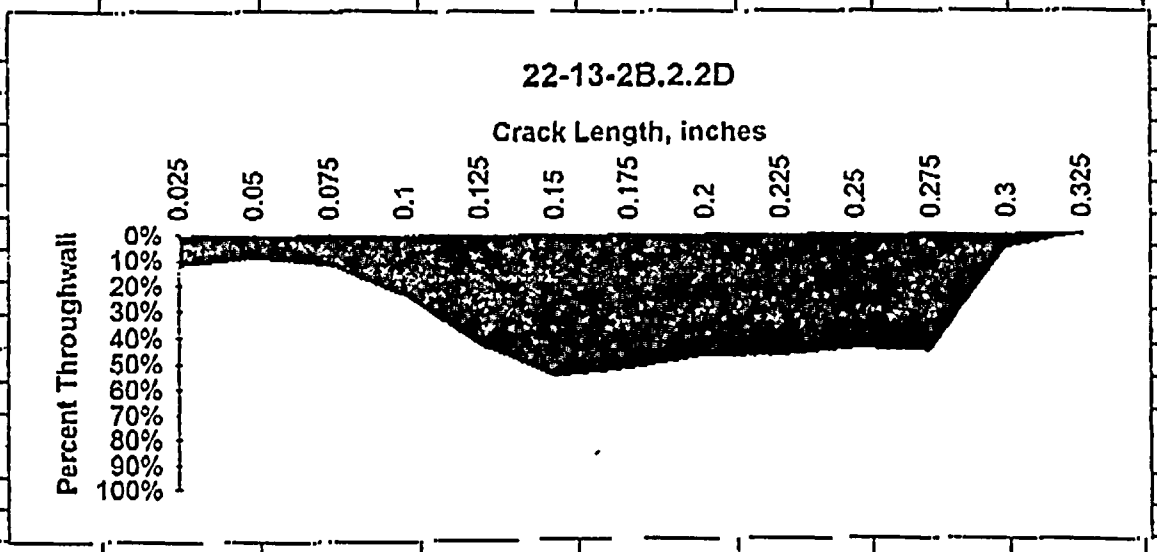
PRELIMINARY

Crack Depth Data 22-13-2B.2.2.d j:\alm\paloverd\crack\13b22d.xls

6/8/93

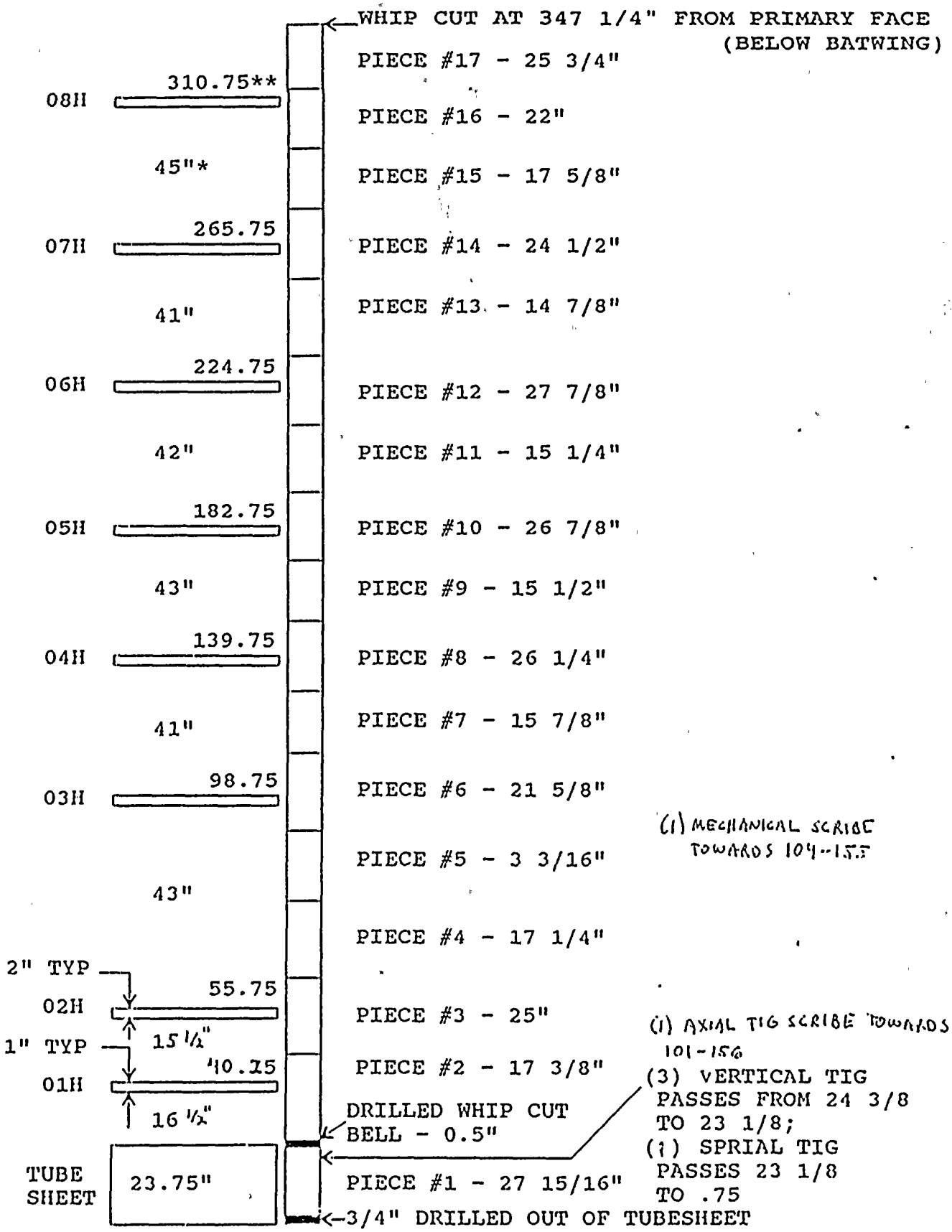
axial	%throughwall (assuming 43 mills)		depth
0.025	12%	0.5	5
0.05	9%	0.375	4
0.075	12%	0.5	5
0.1	25%	1	11
0.125	44%	1.75	19
0.15	56%	2.25	24
0.175	53%	2.125	23
0.2	48%	1.9375	21
0.225	48%	1.9375	21
0.25	45%	1.8125	19
0.275	47%	1.875	20
0.3	6%	0.25	3
0.325	0%	0	0

AVG: 31%
MAX: 56%



PRELIMINARY

TUBE 103-156 REVISION 2



* DISTANCES BETWEEN CENTERLINE OF TSP'S (01H IS A 1" THICK BAFFLE PLATE, ALL OTHERS ARE 2" THICK EGGCRATES)

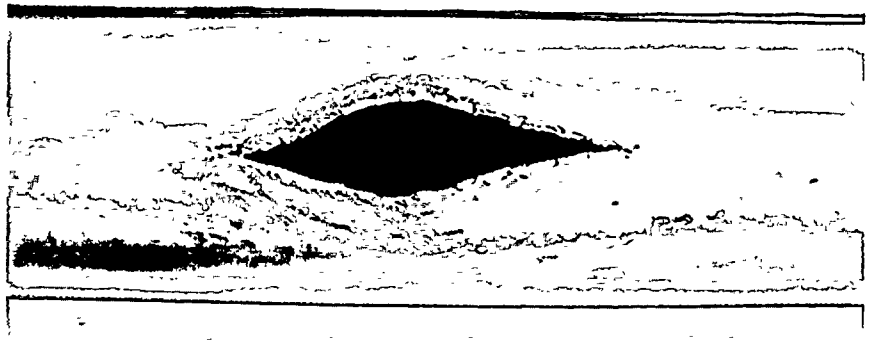
** DISTANCE FROM PRIMARY FACE TO CENTERLINE OF EGGCRATE

NOTE: NOTCH EACH IN TUBE SAMPLE IS ON TOP END (OPPOSITE TS)

PRELIMINARY

PRELIMINARY

TOP



7 103/132 #17 FRACTURE 2X

SHOWS LABORATORY BURST TEST.

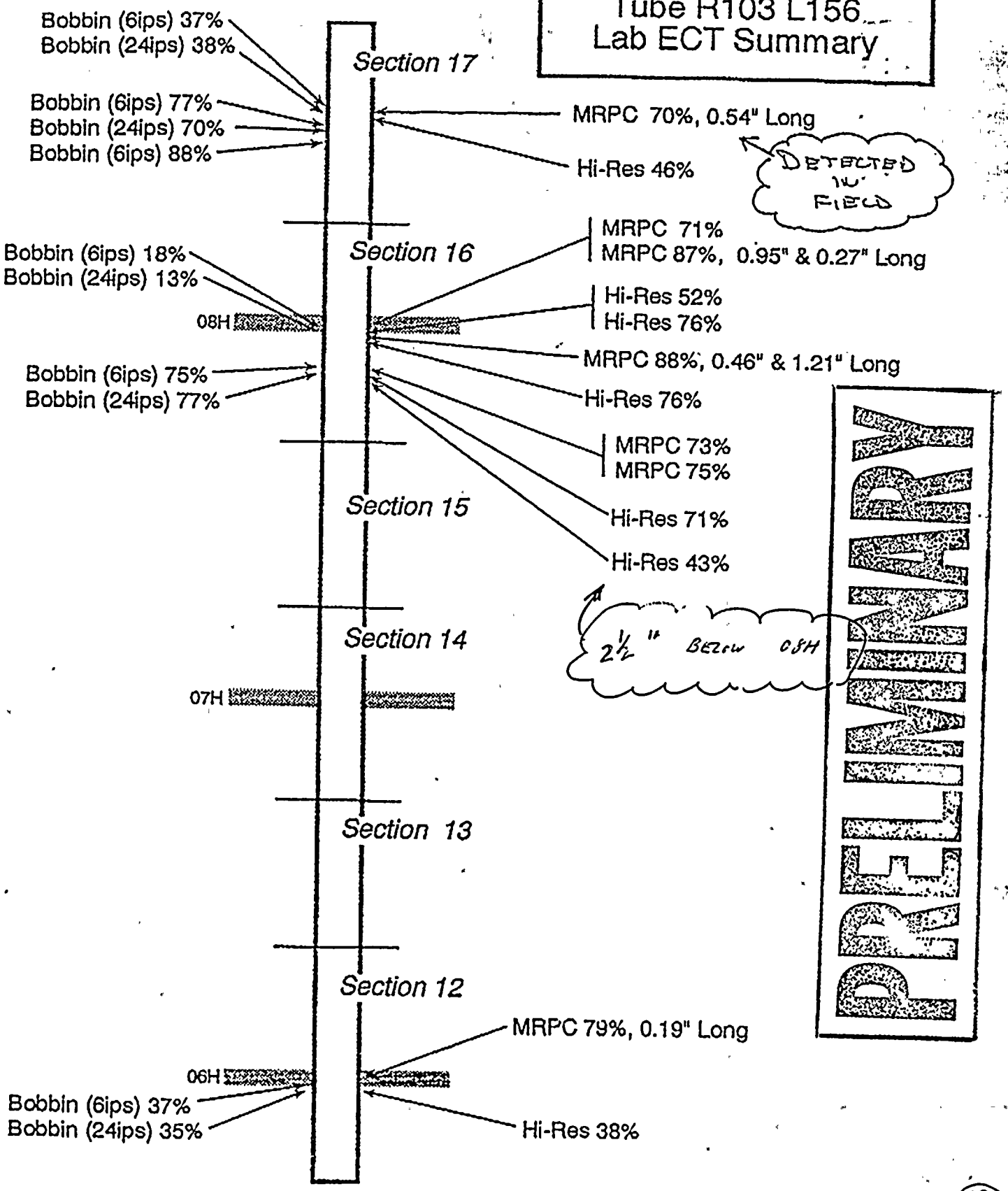
105-156

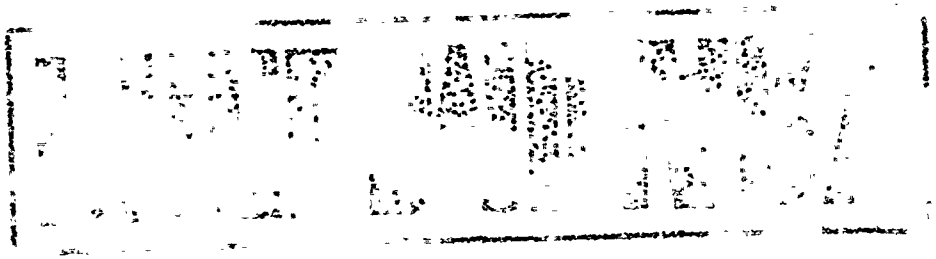
	6 in/sec percent thru wall	Bobbin location from end	24 in/sec Bobbin		Hi Resolution		MRPC		LXW
08H+	88%	7.86	38%	9.37	46%	9.10	70%	10.37	0.54 X 0.10
	77%	8.11	70%	8.59					
	36%	9.54							
				Seen by all coils 2 different locations					
				Coil					
08H	75%	10.34	77%	10.08 (9)	19%	10.08	88%	10.32	0.27 X 0.17
	18%	12.15	13%	11.54 (10)	48%	12.28	89%	13.91	0.95 X 0.19
				(11)	76%	12.24			
				(12)	71%	10.15			
07H	DNT	13.02	DNT	12.75	NDD		NDD		
06H	37%	10.80	35%	10.67	38%	10.56	79%	11.00	0.23 X 0.16
TSH	NDD		NDD		NDD		NDD		

PRELIMINARY

77

Steam Generator 22
Tube R103 L156
Lab ECT Summary





TUBE PULL CANDIDATES

TUBE NO. R 103-L 156

LOCATION OF FLAWS	AXIAL EXTENT	CIRC. EXTENT	EST % TW
TSH-0.14"	TSH-0.16" -- TSH-0.13"	1.3"	? SCI
06H+0.83"	06H+0.78" -- 06H+0.88"	0.2"	16
07H+1.0"to+36"	07H+1.0" -- 07H+36"	0.25"	PDP
07H+21"to+35"	07H+21" -- 07H+35"	0.25"	PLP
07H+1.0"to+36"	07H+1.0" -- 07H+36"	0.78"	DNTS
08H-0.95"	MULTIPLE WEAR 90 DEG. APART 08H-1.00" -- 08H-0.80"	0.25" EACH	22
08H+0.72"	08H+0.4" -- 08H+1.04"	0.2"	29
08H+14.38"to+25.50"	08H+14.38" -- 08H+25.5"	0.3"	PDP
08H+15.00"to+18.51"	08H+15" -- 08H+18.51"	0.2"	MAI
BW1+1.77"	BW1+1.55" -- BW1+2.01"	0.2"	17
BW1-1.76"	BW1-2.0" -- BW1-1.40"	0.2"	20

DIAMETER CHANGES:

06H+ 30.07 - POSSIBLE BULGE

TOP OF TUBESHEET SIGNAL = 48.77 VOLTS
BULGE SIGNAL = 3.75 VOLTS

% OF TUBE SHEET SIGNAL = 7.7%

PRELIMINARY

CUMULATIVE REPORT
04/93, ARIZONA PUBLIC SERVICE, PALO VERDE, UNIT 2

STEAM GENERATOR: 22
LOCATION: ALL
CRITERIA: ROW 103 COL 156

DATE: 04/30/93
TIME: 14:49:30

ROW	COL	DATE	LEG	EXAM EXTENT PROGRAM	EXAM EXTENT ACTUAL	REM	CAL	PROBE	LOCATION	CURRENT VOLTS	CURRENT MIL	CURRENT DEG	CURRENT %	CURRENT CH
103	156		H	01H-01H	01H-01H		00067	610RP					NDD	
			H	TSH-TSH	TSH-TSH		00067	610RP					NDD	
			H	TEH-TEC	-		99999	610UL					TPC	
			H	01H-02H	01H-02H		00109	610RC					NDD	
			H	05H-06H	05H-06H		00109	610RC					NDD	
			H	04H-05H	04H-05H		00109	610RC					NDD	
			H	03H-04H	03H-04H		00109	610RC					NDD	
			H	02H-03H	02H-03H		00109	610RC					NDD	
			H	TEH-TSH	TEH-TSH	RPI	00109	610RC	TSH- 0.14	2.46		3	SCI	1
			H	TSH-01H	TSH-01H	RPI	00109	610RC	TSH- 0.14	2.46		3	SCI	1
			H	TEH-TEC	TEH-TEC		00029	610UL	06H+ 0.83	0.66		0	16	P 2
			H	06H-07H	06H-07H		00109	610RC	06H+ 0.86	0.45		32	WAR	P 1
			H	TEH-TEC	TEH-TEC		00106	11412	06H+ 0.89	0.77		0	21	P 2
			H	TEH-TEC	TEH-TEC		00105	11812	06H+ 0.92	1.00		0	21	P 2
			H	06H-06H	06H-06H		00067	610RP	06H+ 0.99	0.75		0	WAR	P 1
			H	07H-08H	07H-08H		00109	610RC	07H+ 1.00TO+ 36.00	0.71		26	DNT	1
			H	07H-08H	07H-08H		00109	610RC	07H+ 1.00TO+ 36.00	1.09		86	PDP	11
			H	TEH-BW1	TEH-VS2		00103	630UC	07H+ 18.80to+ 22.2	1.58		170	NQI	P 1
			H	07H-08H	07H-08H		00109	610RC	07H+ 21.00TO+ 35.00	1.09		86	PLP	6
			H	TEH-TEC	TEH-TEC		00105	11812	08H- 0.95	0.76		0	17	P 2
			H	08H-BW1	08H-BW1		00109	610RC	08H- 0.95	0.70		165	WAR	P 1
			H	TEH-TEC	TEH-TEC		00106	11412	08H- 0.92	0.87		0	22	P 2
			H	08H-BW1	08H-BW1		00109	610RC	08H- 0.84	1.03		146	WAR	P 1
			H	TEH-TEC	TEH-TEC		00106	11412	08H+ 0.43	0.79		0	21	P 2
			H	TEH-TEC	TEH-TEC		00105	11812	08H+ 0.72	0.70		0	16	P 2
			H	07H-08H	07H-08H		00109	610RC	08H+ 0.79	0.31		0	WAR	P 1
			H	08H-BW1	08H-BW1		00109	610RC	08H+ 0.80	1.01		134	WAR	P 1
			H	07H-08H	07H-08H		00109	610RC	08H+ 0.80	0.80		0	WAR	P 1
			H	TEH-BW1	TEH-VS2		00103	630UC	08H+ 0.81	1.05		0	29	P 2
			H	08H-BW1	08H-BW1		00109	610RC	08H+ 0.81	1.04		164	WAR	P 1
			H	08H-BW1	08H-BW1		00067	610RP	08H+ 0.85	1.48		0	WAR	P 1
			H	08H-BW1	08H-BW1		00109	610RC	08H+ 14.38TO+ 25.50	0.89		81	PDP	11
			H	08H-BW1	08H-BW1	RPI	00109	610RC	08H+ 15.00TO+ 18.51	1.80		163	MAI	1
			H	08H-BW1	08H-BW1	RPI	00067	610RP	08H+ 16.39TO+ 19.22	0.57		129	SAI	P 1
			H	08H-BW1	08H-BW1		00067	610RP	08H+ 16.56to+ 28.9	1.46		0	PDP	11
			H	TEH-TEC	TEH-TEC		00105	812	08H+ 19.64	1.08		12	NBI	1
			H	TEH-TEC	TEH-TEC		00029	610UL	08H+ 20.36	0.22		151	NBI	1
			H	TEH-TEC	TEH-TEC		00106	412	08H+ 20.59	1.45		16	NBI	1
			H	08H-BW1	08H-BW1		00067	610RP	BW1- 2.15	1.44		0	WAR	P 1
			H	08H-BW1	08H-BW1		00109	610RC	BW1- 1.80	1.18		156	WAR	P 1
			H	TEH-TEC	TEH-TEC		00029	610UL	BW1- 1.76	0.72		0	[illegible]	P 2
			H	TEH-TEC	TEH-TEC		00105	11812	BW1- 1.74	0.47		[illegible]	[illegible]	P 2
			H	TEH-TEC	TEH-TEC		00106	11412	BW1- 1.70	0.20		[illegible]	[illegible]	P 2
			H	TEH-BW1	TEH-VS2		00103	630UC	BW1- 1.55	0.67		[illegible]	[illegible]	P 2
			H	08H-BW1	08H-BW1		00067	610RP	BW1+ 1.77 17	1.27		[illegible]	[illegible]	P 1

PRELIMINARY
CONAM INUCLEAR, INC.

80

CUMULATIVE REPORT
04/93, ARIZONA PUBLIC SERVICE, PALO VERDE, UNIT 2

STEAM GENERATOR: 22
LOCATION: ALL
:ITERIA: ROW 103 COL 156

DATE: 04/30/93
TIME: 14:49:30

ROW	COL	DATE	LEG	EXAM EXTENT PROGRAM	EXAM EXTENT ACTUAL	REM	CAL	PROBE	LOCATION	CURRENT VOLTS	CURRENT MIL	CURRENT DEG	CURRENT %	CURRENT CH
103	156		H	08H-BW1	08H-BW1		00109	610RC	BW1+ 1.92	8.04		172	WAR	P 1

NUMBER OF TUBES SELECTED FROM CURRENT OUTAGE: 1
NUMBER OF DATA RECORDS SELECTED FROM CURRENT OUTAGE: 46

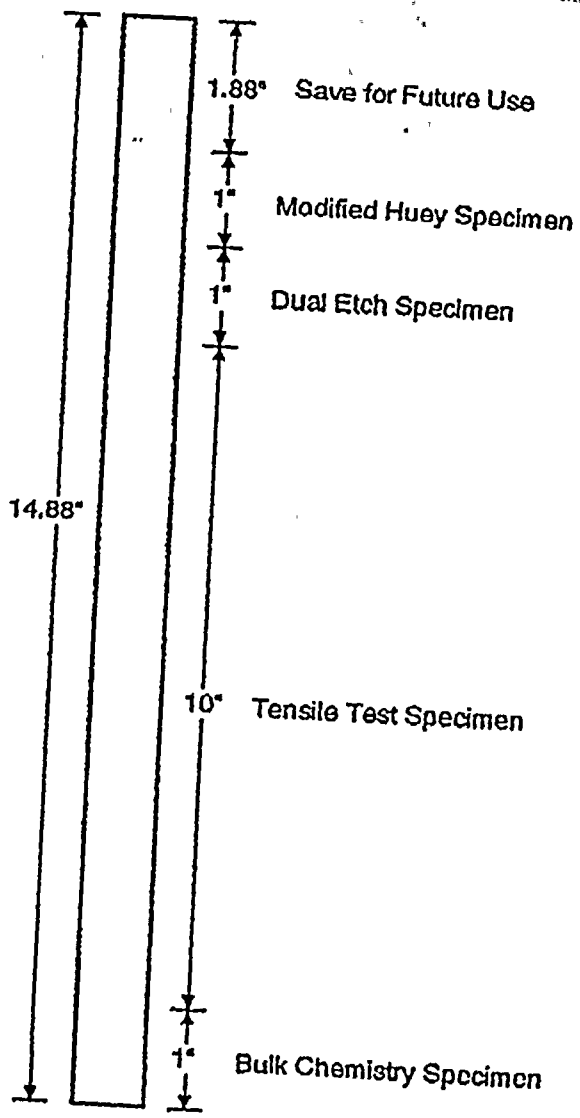
NO TREND ANALYSIS REQUESTED

REPORT OPTIONS:
Only examination results matching criteria are included

PRELIMINARY
CONAM NUCLEAR, INC.

Steam Generator 22 Tube R103 L156
Section 13

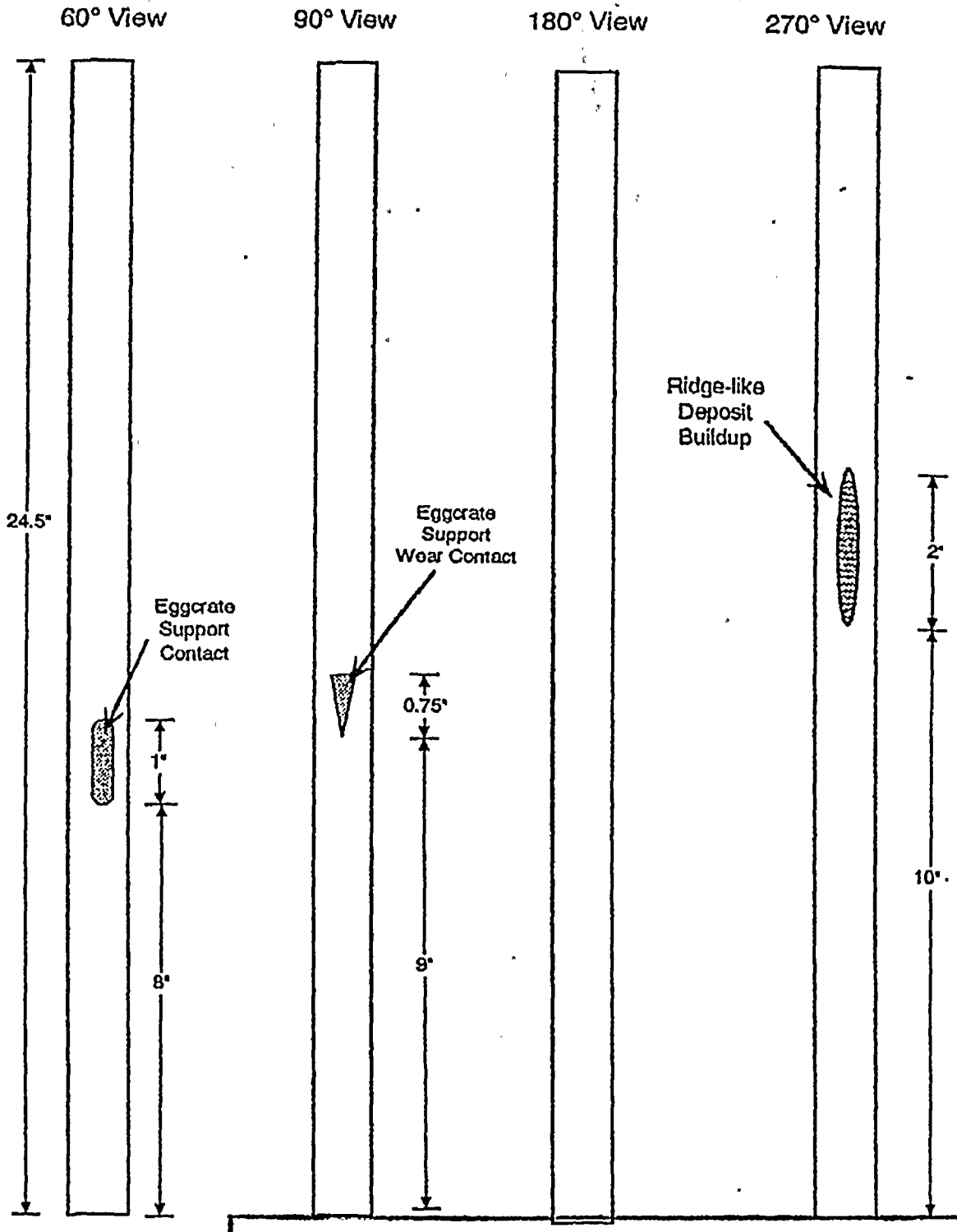
DRAFT



PRELIMINARY

Steam Generator 22 Tube R103 L156
Section 14

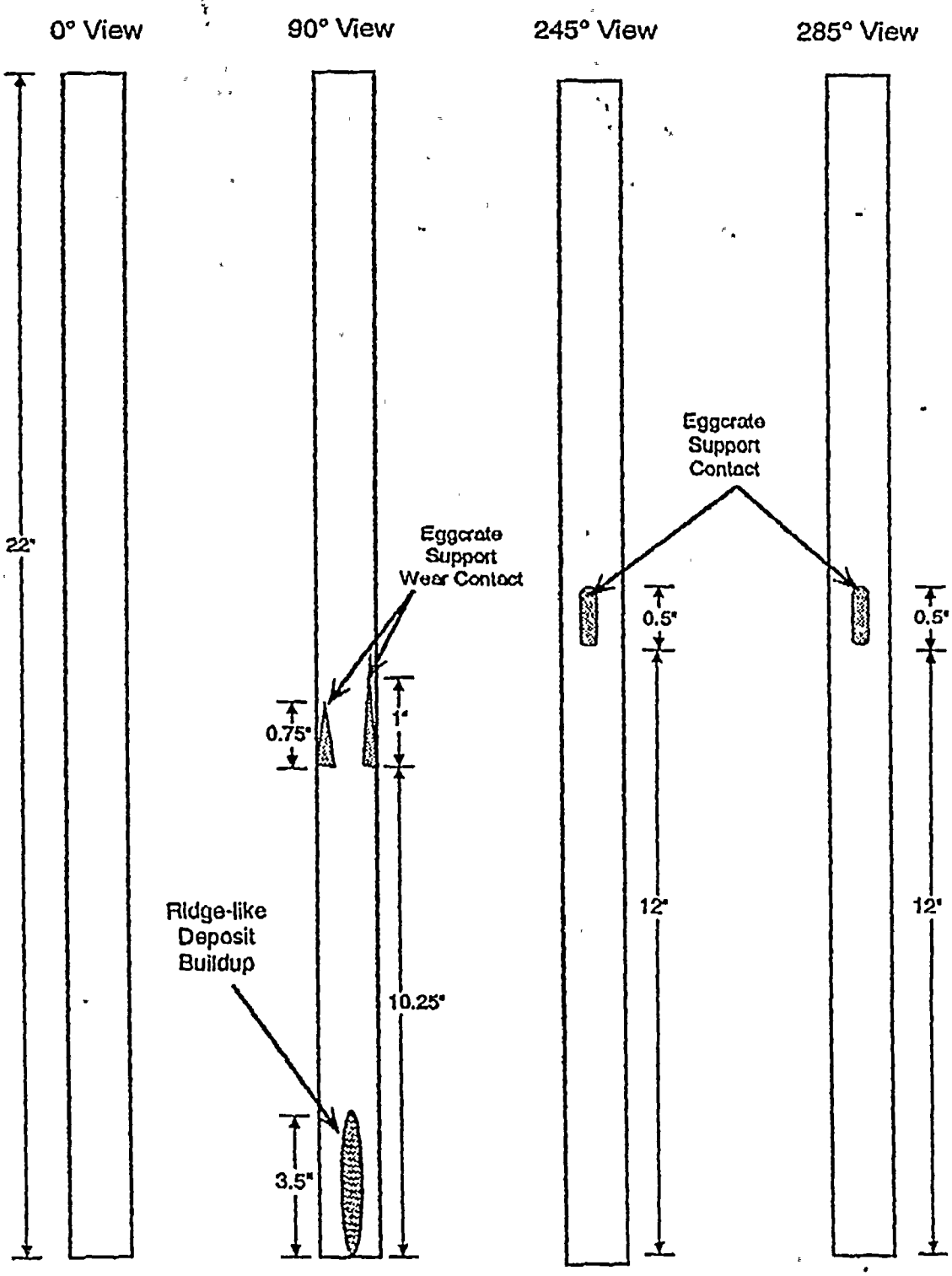
DRAFT



PRELIMINARY

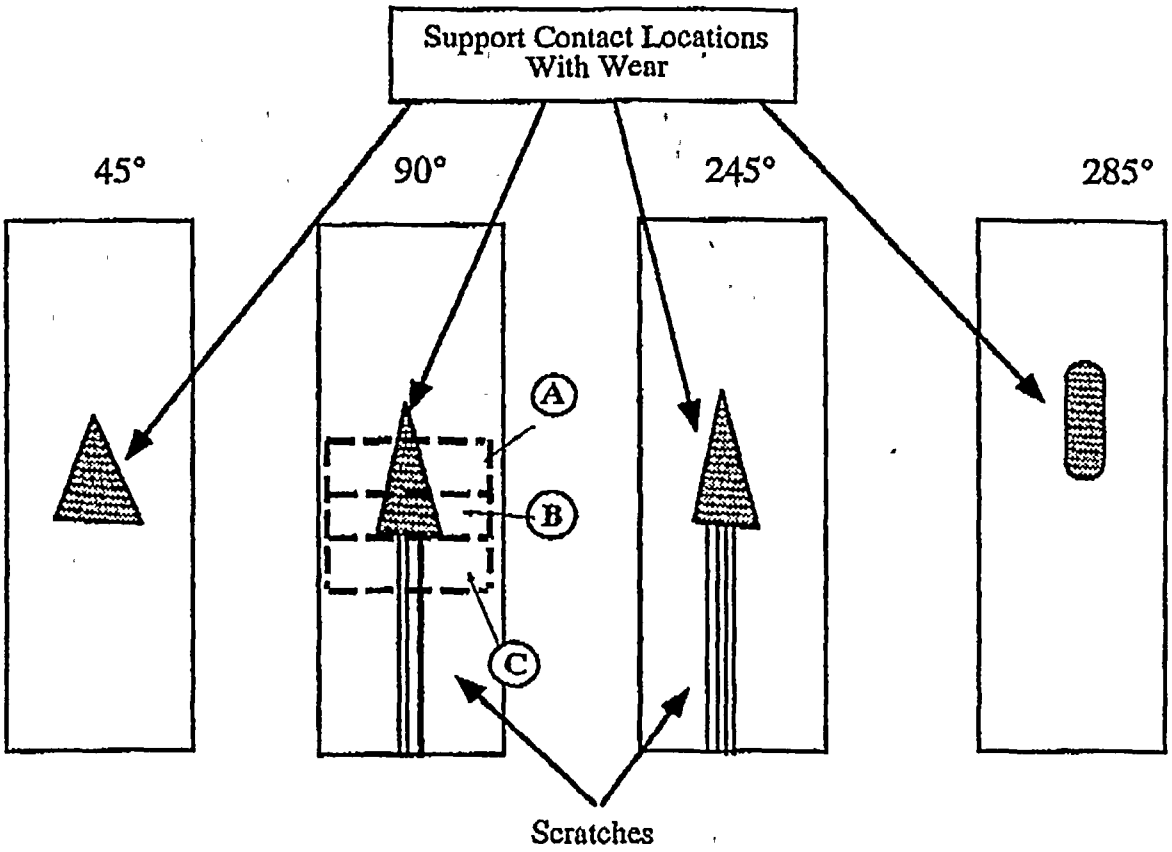
Steam Generator 22 Tube R103 L156
Section 16

DRAFT



PRELIMINARY

103/156 08H Support Descaled



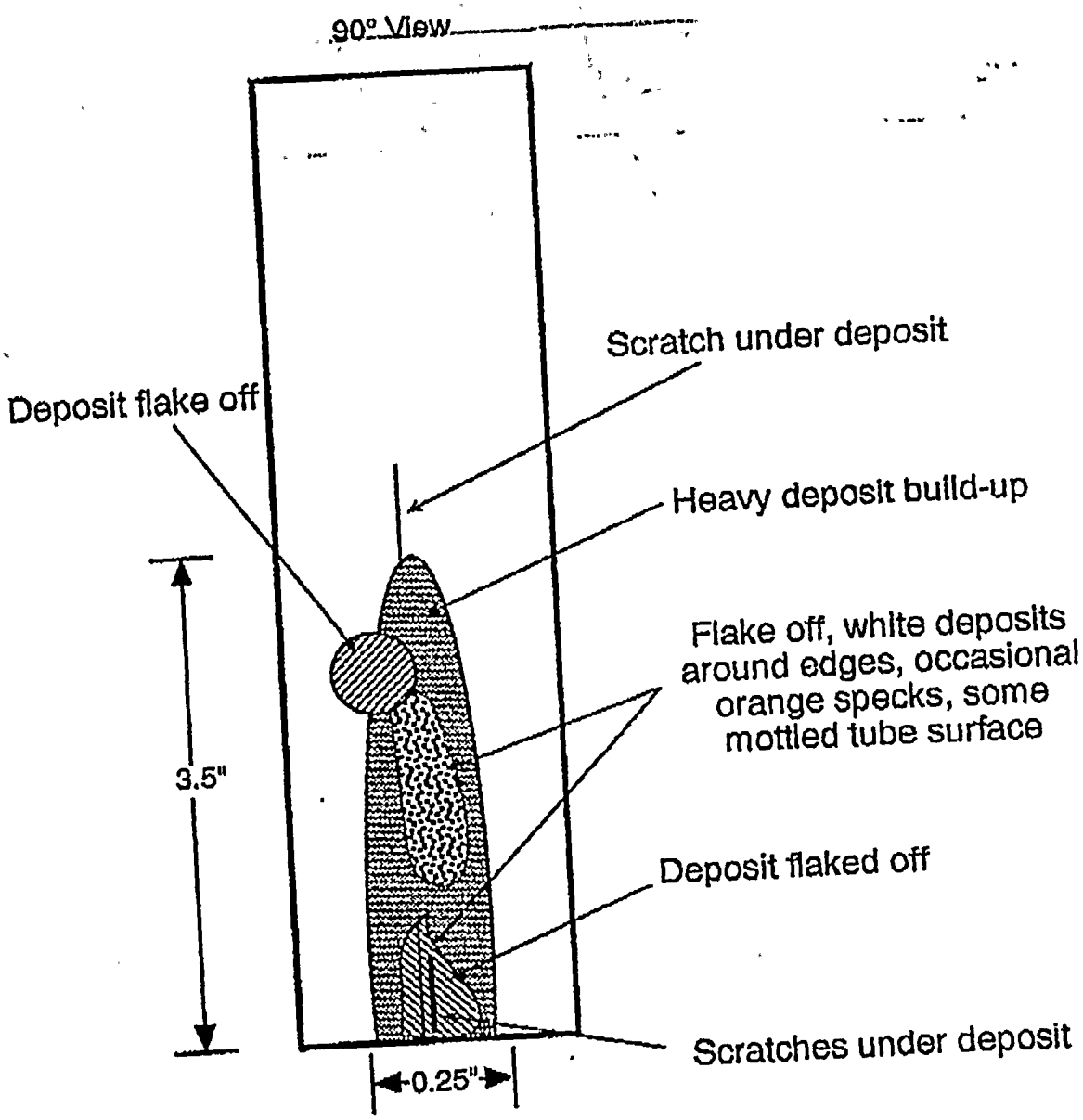
A- Transverse mount for SEM surface examination
B- Transverse mount for wear depth, corrosion, and hardness, to be Ni plated
C- Transverse mount for scratch depth and hardness section to be Ni plated

OBSERVATIONS:
- Scratches extend below the support location and not above the support
- Deepest strach about 1 mil deep
- Wear locations 6 mils deep

WORK IN PROGRESS
- Part A prepaired for SEM surface examination
- Parts B and C cut and ready for Ni plating

PRELIMINARY

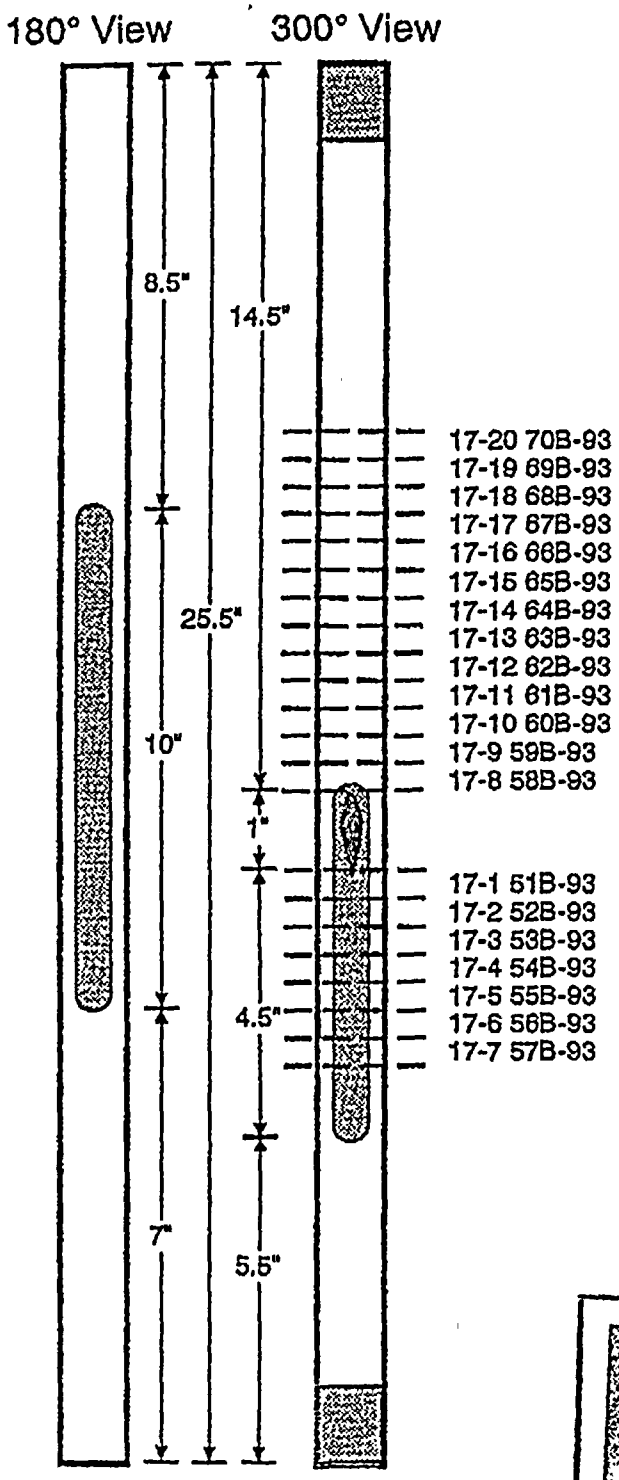
10~~6~~3/156 Section 16 (Lower Part)

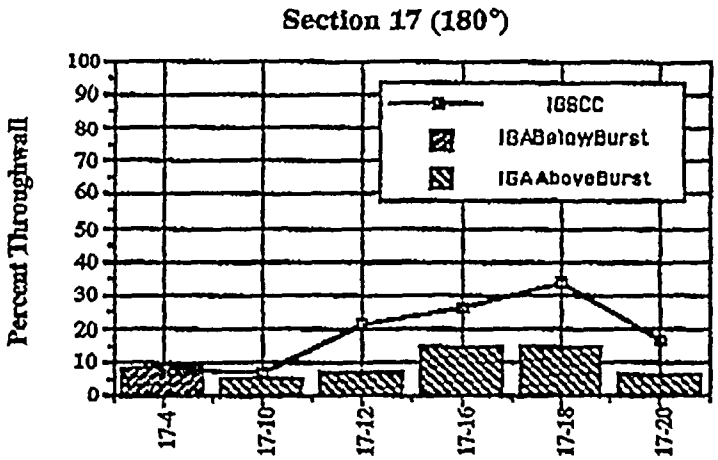


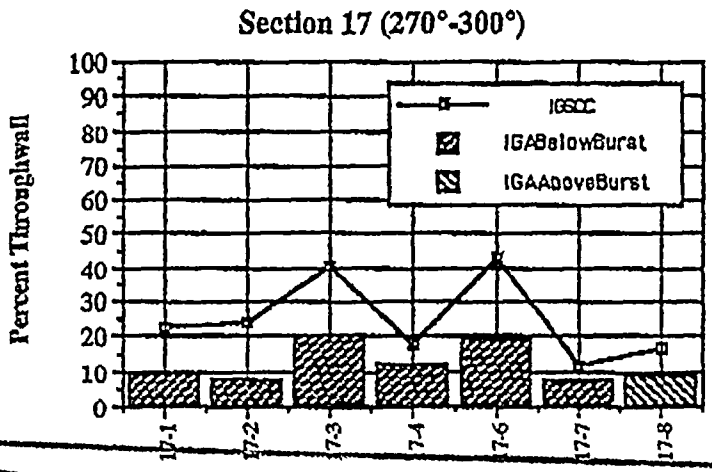
PRELIMINARY

DRAFT

Steam Generator 22
Tube R103 L156
Section 17







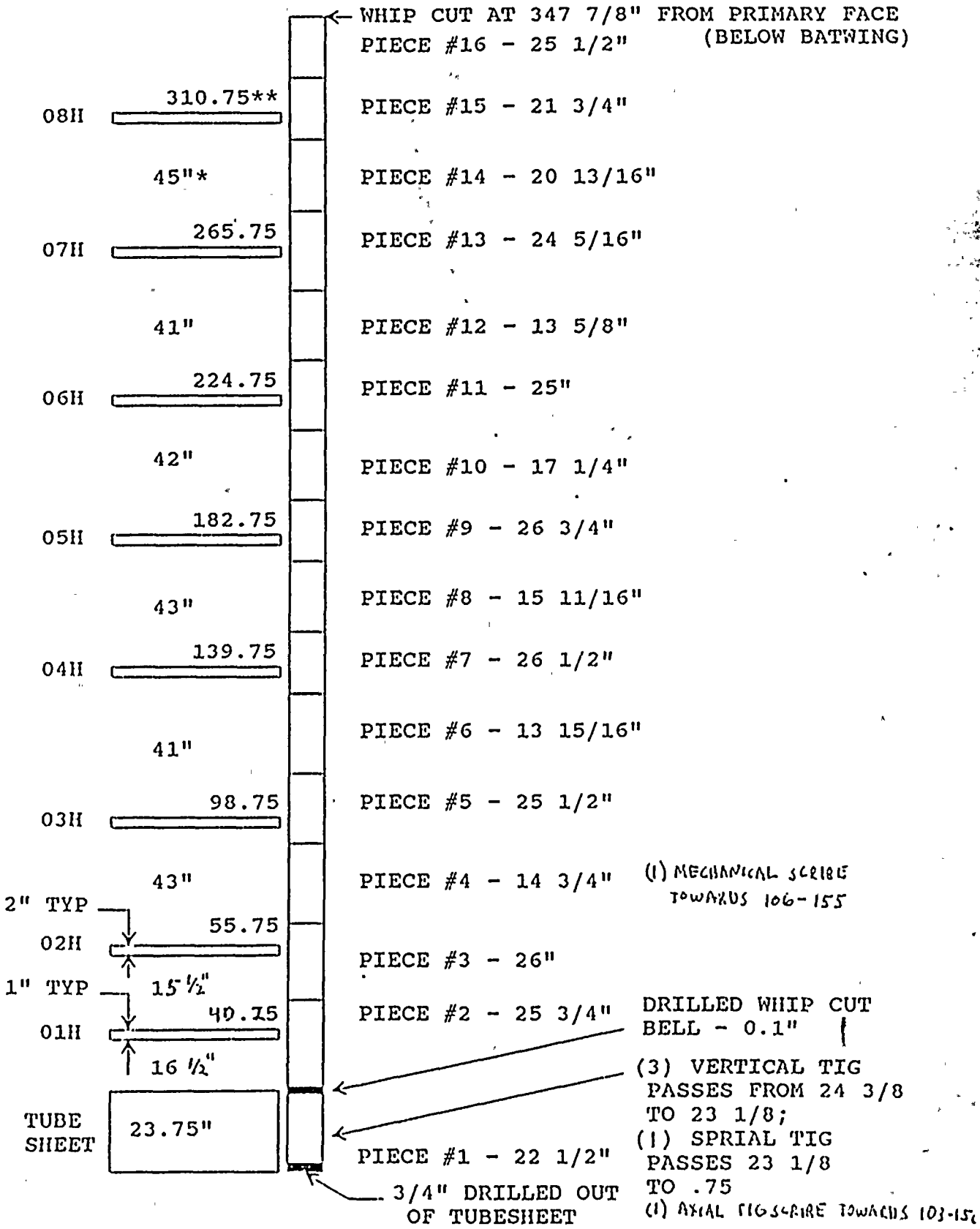
PRELIMINARY

Deposit

Burst Fitting

TUBE 105-156

REVISION 2



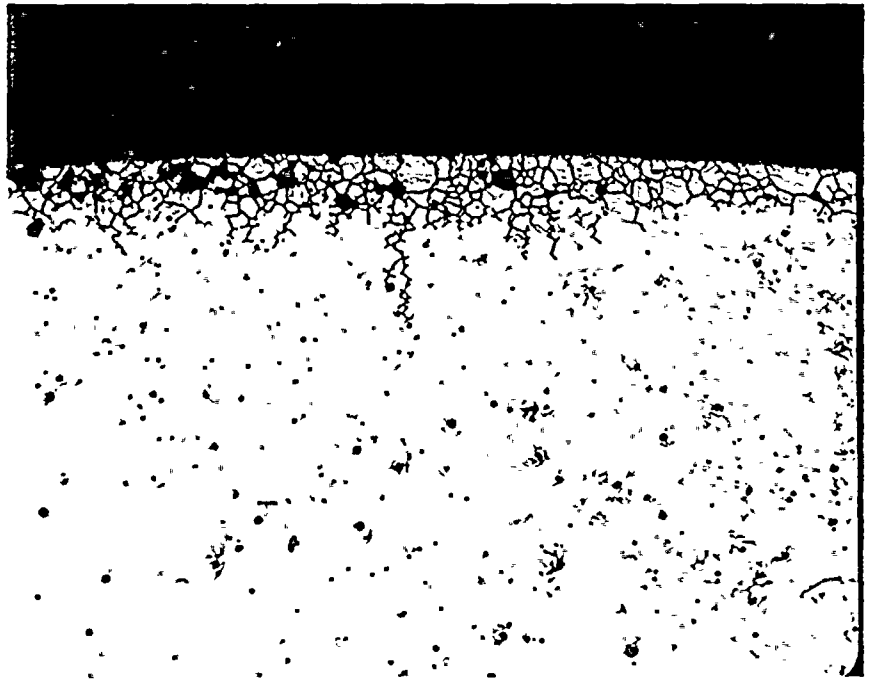
* DISTANCES BETWEEN CENTERLINE OF TSP'S (01H IS A 1" THICK BAFFLE PLATE, ALL OTHERS ARE 2" THICK EGGCRATES)

** DISTANCE FROM PRIMARY FACE TO CENTERLINE OF EGGCRATE

NOTE: NOTCH EACH IN TUBE SAMPLE IS ON TOP END (OPPOSITE TS)

PRELIMINARY

PRELIMINARY



105/156 SEC 16 10
W 90°

VIEW OF TUBE O.D. SHOWING BOTH IGA AND SHALLOW IGSCC. PVNGS U2 - SG #22 TUBE NO. 105/156 - SECTION 16. - 100X - W - 90 DEGREE.

TUBE PULL CANDIDATES

TUBE NO. R 105-L 156

LOCATION OF FLAWS	AXIAL EXTENT	CIRC. EXTENT	EST % TW
08H+0.72"	08H+0.70" -- 08H+1.0"	0.15"	11
08H+13.87"to+31.0"	08H+13"-- 08H+37.0"	0.25"	PDP
08H+21.54"to+25.62"	08H+21.5" -- 25.0"	0.25"	0-96% MAI

DIAMETER CHANGES:

NONE ABOVE TSH

PRELIMINARY

CUMULATIVE REPORT
04/93, ARIZONA PUBLIC SERVICE, PALO VERDE, UNIT 2

STEAM GENERATOR: 22
LOCATION: ALL
.ITERIA: ROW 105 COL 156

DATE: 04/30/93
TIME: 14:49:08

ROW	COL	DATE	LEG	EXAM EXTENT PROGRAM	EXAM EXTENT ACTUAL	REM	CAL	PROBE	LOCATION	CURRENT VOLTS	MIL	DEG	%	CH
105	156		H	TEH-TEC	-		99999	610UL					TPC	
			H	06H-07H	06H-07H		00108	610RC					NDD	
			H	05H-06H	05H-06H		00108	610RC					NDD	
			H	04H-05H	04H-05H		00108	610RC					NDD	
			H	03H-04H	03H-04H		00108	610RC					NDD	
			H	02H-03H	02H-03H		00108	610RC					NDD	
			H	01H-02H	01H-02H		00108	610RC					NDD	
			H	TSH-01H	TSH-01H		00108	610RC					NDD	
			H	TEH-TSH	TEH-TSH		00108	610RC					NDD	
			H	TEH-BW1	TEH-VS2		00103	630UC	08H+ 0.72	0.34		0	11	P 2
			H	08H-LB1	08H-LB1		00108	610RC	08H+ 0.76	2.50		138	WAR	P 1
			H	07H-08H	07H-08H		00108	610RC	08H+ 0.76	0.87		135	WAR	P 1
			H	08H-BW1	08H-LB1		00108	610RC	08H+ 13.87TO+ 31.41	2.68		76	PDP	11
			H	08H-BW1	08H-BW1		00031	610RP	08H+ 16.74to+ 37.3	0.06		0	PDP	11
			H	08H-LB1	08H-LB1	RPI	00108	610RC	08H+ 21.54TO+ 25.62	13.94		42	MAI	P 1
			H	TEH-TEC	TEH-TEC	RPI	00029	610UL	08H+ 24.28	4.14		67	84	1
			H	TEH-BW1	TEH-VS2	RPI	00103	630UC	08H+ 24.50	4.32		68	87	1
			C	09H-TEH	TEC-TEH		00097	610UL	08H+ 24.60	4.58		73	PID	1
			H	TEH-TEC	TEH-TEC	RPI	00029	610UL	08H+ 25.28	3.67		83	74	1
			H	TEH-BW1	TEH-VS2	RPI	00103	610UC	08H+ 25.51	3.26		78	81	1
			H	TEH-TEC	TEH-TEC	RPI	00029	610UL	08H+ 25.78	4.80		73	80	1
			H	TEH-BW1	TEH-VS2	RPI	00103	610UC	08H+ 25.85	4.64		59	91	1
			H	08H-BW1	08H-BW1	RPI	00031	610RP	08H+ 26.26to+ 30.6	3.49		46	SAI	1
			H	TEH-TEC	TEH-TEC	RPI	00029	610UL	08H+ 26.49	1.80		66	85	1
			H	TEH-BW1	TEH-VS5	RPI	00103	610UC	08H+ 26.58	2.00		49	96	1
			H	TEH-TEC	TEH-TEC	RPI	00029	610UL	08H+ 27.81	0.74		120	46	1
			H	TEH-TEC	TEH-TEC		00093	610UL	08H+ 27.81	4.91		71	PID	1
			H	TEH-BW1	TEH-VS2	RPI	00103	610UC	08H+ 27.88	0.78		117	51	1

NUMBER OF TUBES SELECTED FROM CURRENT OUTAGE: 1
NUMBER OF DATA RECORDS SELECTED FROM CURRENT OUTAGE: 28

NO TREND ANALYSIS REQUESTED

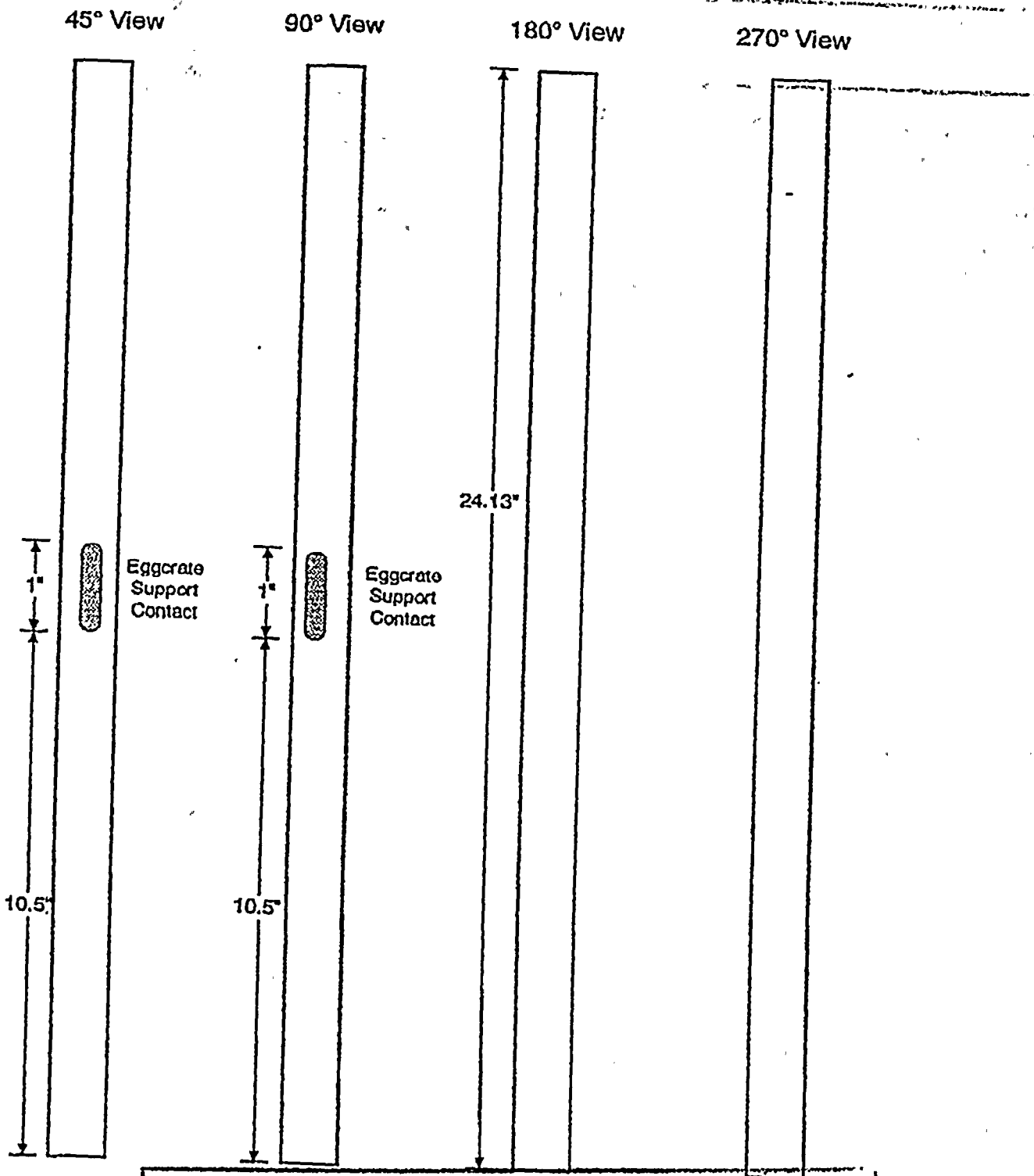
REPORT OPTIONS:
Only examination results matching criteria are included

PRELIMINARY
CONAM NUCLEAR, INC.

90

Steam Generator 22 Tube R105 L156
Section 13

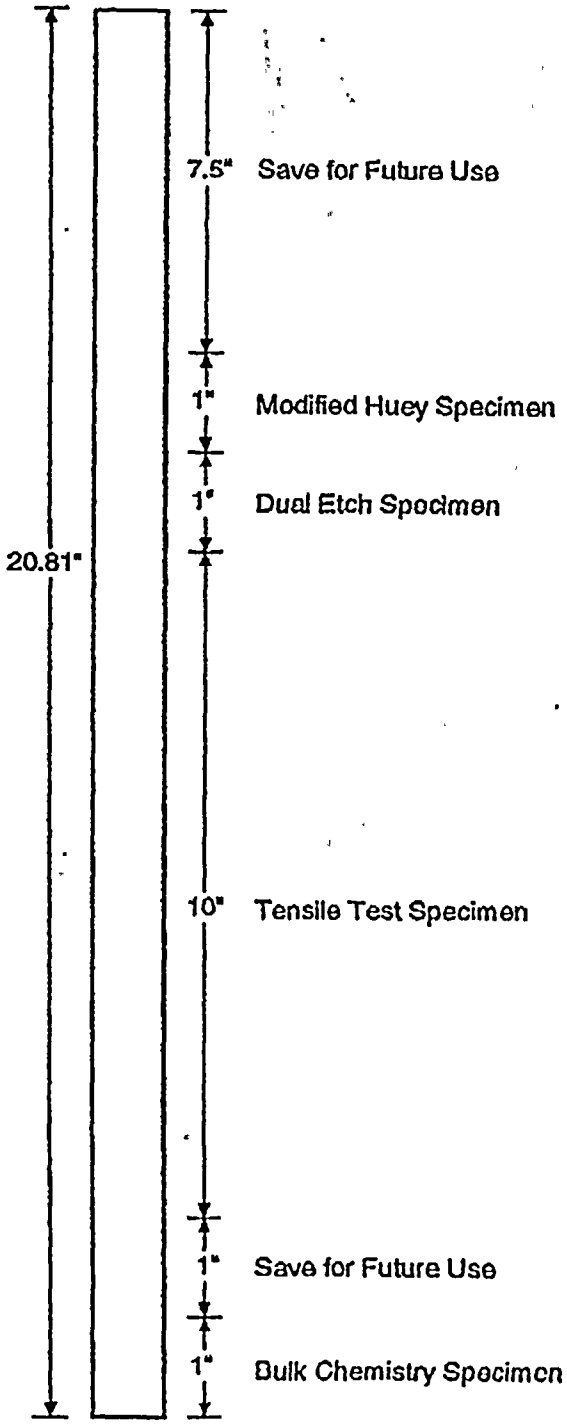
DRAFT



PRELIMINARY

Steam Generator 22 Tube R105 L156
Section 14

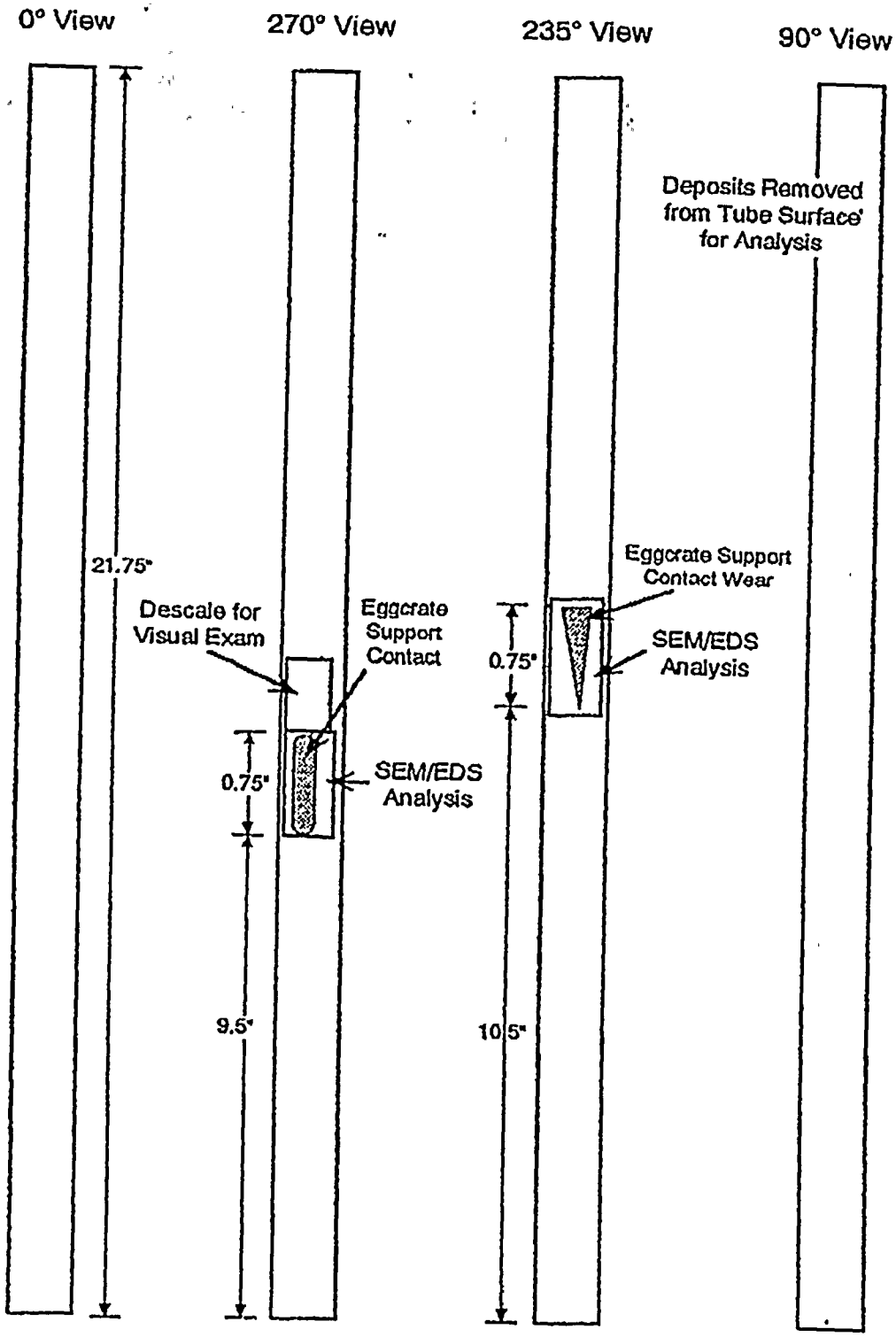
DRAFT



PRELIMINARY

Steam Generator 22 Tube R105 L156
Section 15

DRAFT



PRELIMINARY

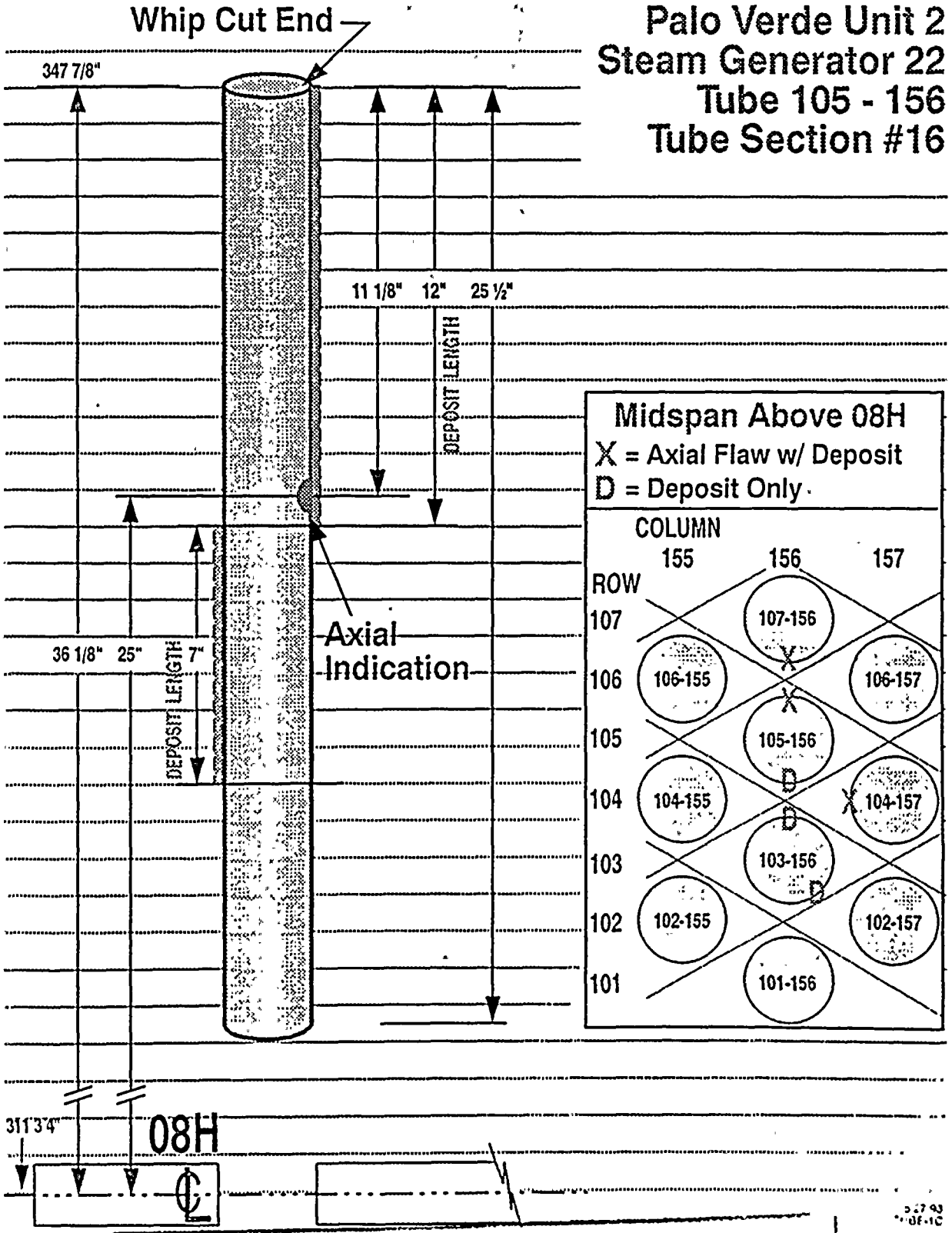
XRF/XRD Data

X-Ray Fluorescence Tube 105/156 (Surface Scrapings)

Section 15	wt.%
Fe3O4	88.07
Cu	2.52
NiO	0.75
ZnO	0.26
MnO	6.68
Cr2O3	0.13
MoO3	0.07
TiO	0.20
PbO	0.12
SnO2	0.08
SiO2	0.35
Al2O3	0.22
P2O5	0.03
SO3	0.17
Cl	0.10
K2O	0.05
CaO	0.08
MgO	0.17

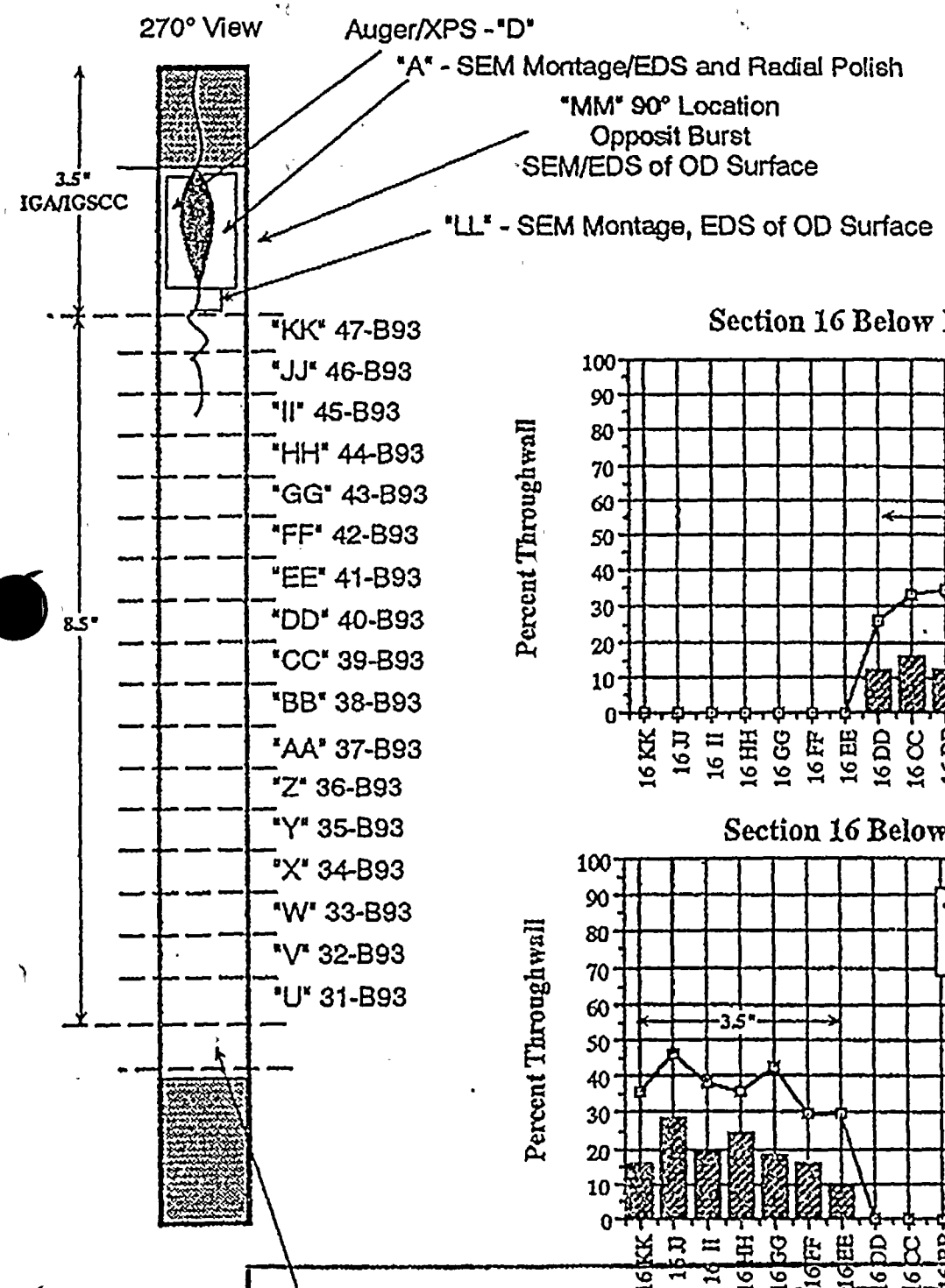
PRELIMINARY

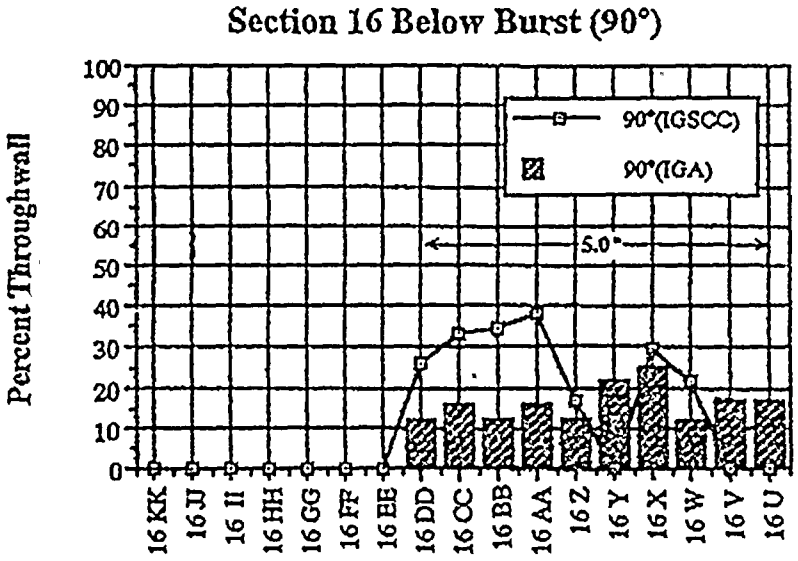
Palo Verde Unit 2
Steam Generator 22
Tube 105 - 156
Tube Section #16

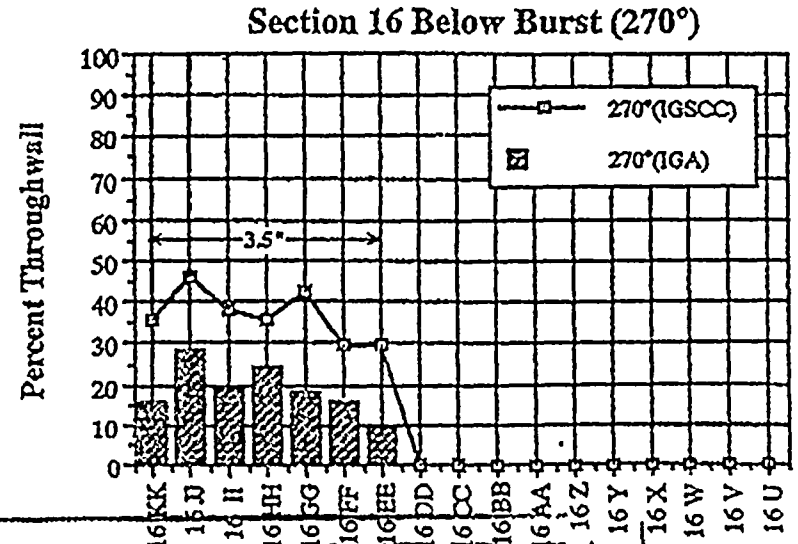


PRELIMINARY

Steam Generator 22
Tube R105 L156
Section 16 Burst Test Part



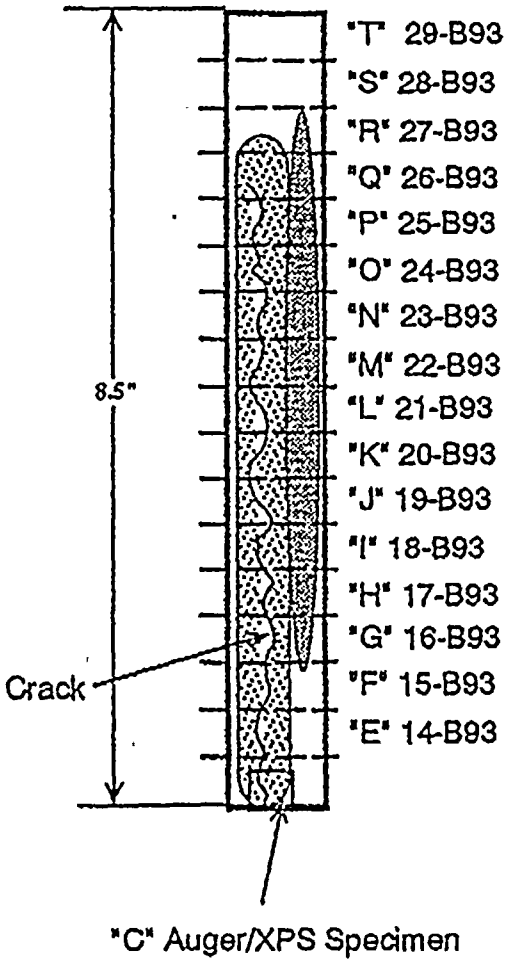




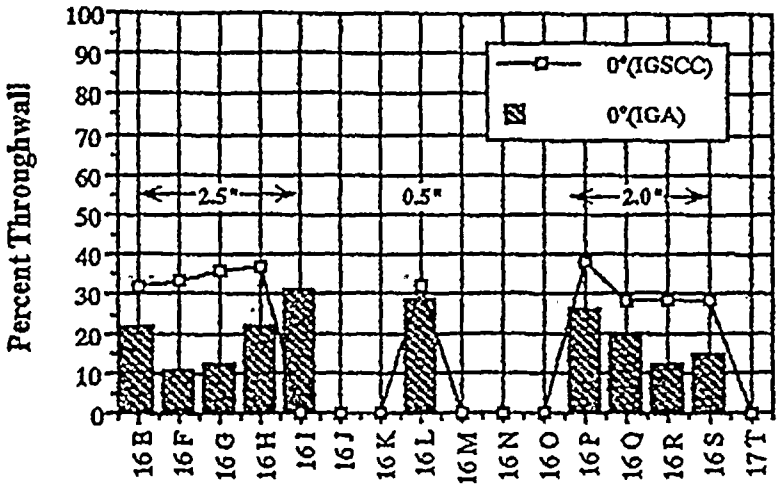
PRELIMINARY

Steam Generator 22
Tube R105 L156
Section 16 Upper Part

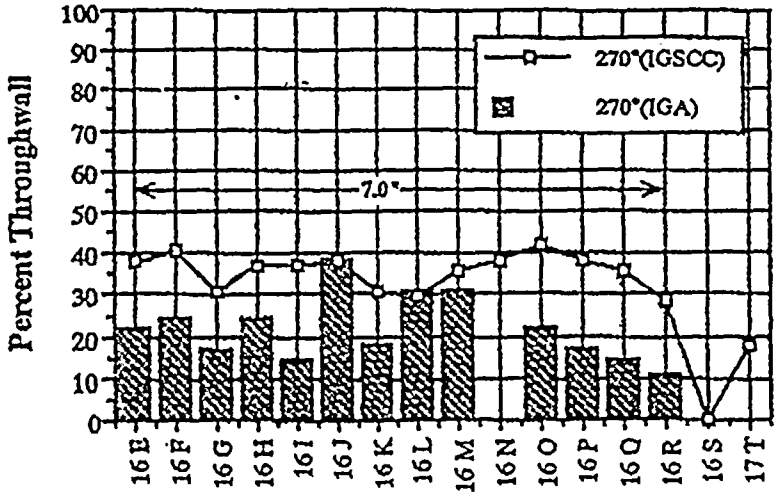
270° View



Section 16 Above Burst (0°)



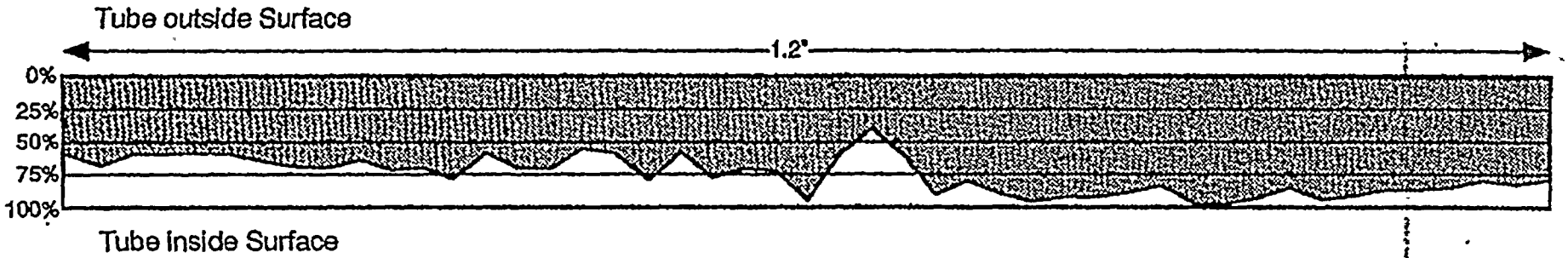
Section 16 Above Burst (270°)



Area of Deposits
Area of IGA/MAI

PRELIMINARY

Steam Generator 22
Tube R105 L156
Section 16 Burst Face Crack Depth Diagram



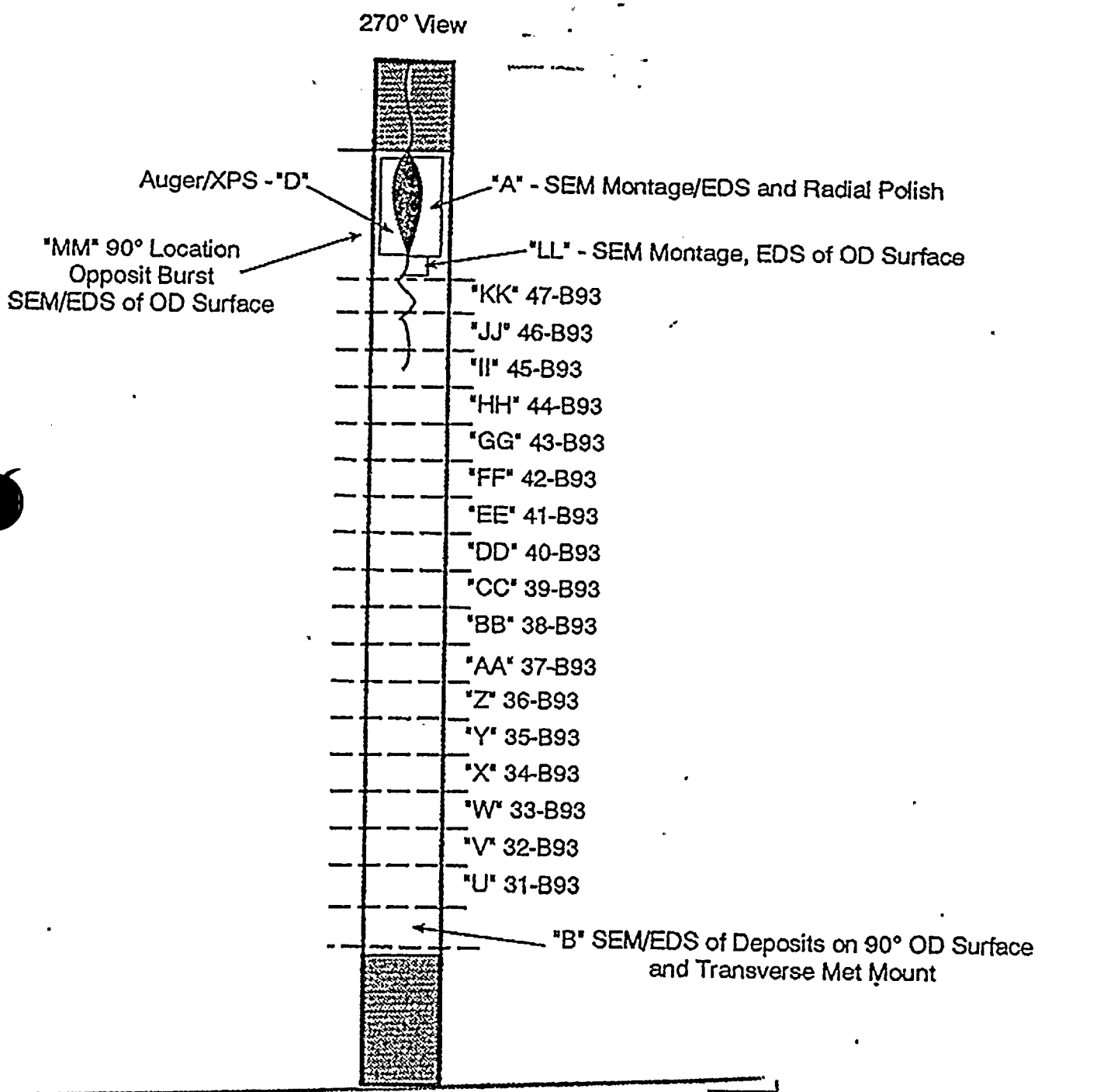
IGA/IGSCC

Ductile

Average Depth 77.2%
Max. Depth 98.2%

PRELIMINARY

Steam Generator 22
Tube R105 L156
Section 16 Burst Test Part



PRELIMINARY

Depth 105/156-16

Tube: 105/156 Section: 16 Below the Burst

Mount No.	Location	Measurment (in)	Mils	% Throughwall	Comments
16KK 47-B93	270°	0.65	6.5	15.5	IGA
	270°	1.50	15.0	35.7	IGSCC
16JJ 46-B93	270°	1.20	12.0	28.6	IGA
	270°	1.95	19.5	46.4	IGSCC
16II 45-B93	270°	0.80	8.0	19.0	IGA
	270°	1.60	16.0	38.1	IGSCC
16HH 44-B93	270°	1.00	10.0	23.8	IGA
	270°	1.50	15.0	35.7	IGSCC
16GG 43-B93	270°	0.75	7.5	17.9	IGA
	270°	1.80	18.0	42.9	IGSCC
	0°	0.75	7.5	17.9	IGA
16FF 42-B93	270°	0.65	6.5	15.5	IGA
	270°	1.25	12.5	29.8	IGSCC
16EE 41-B93	270°	0.40	4.0	9.5	IGA
	270°	1.25	12.5	29.8	IGSCC
16DD 40-B93	90°	0.50	5.0	11.9	IGA
	90°	1.10	11.0	26.2	IGSCC
16CC 39-B93	90°	0.65	6.5	15.5	IGA
	90°	1.40	14.0	33.3	IGSCC
	110°	1.10	11.0	26.2	IGA
16BB 38-B93	90°	0.50	5.0	11.9	IGA
	90°	1.45	14.5	34.5	IGSCC
16AA 37-B93	90°	0.65	6.5	15.5	IGA
	90°	1.60	16.0	38.1	IGSCC
19Z 36-B93	90°	0.50	5.0	11.9	IGA
	90°	0.70	7.0	16.7	IGSCC
	115°	0.60	6.0	14.3	IGA
	115°	1.15	11.5	27.4	IGSCC
16Y 35-B93	90°	0.90	9.0	21.4	IGA
16X 34-B93	90°	1.05	10.5	25.0	IGA
	90°	1.25	12.5	29.8	IGSCC
16W 33-B93	90°	0.50	5.0	11.9	IGA
	90°	0.90	9.0	21.4	IGSCC
16V 32-B93	90°	0.70	7.0	16.7	IGA
	45°	0.45	4.5	10.7	IGA
16U 31-B93	90°	0.70	7.0	16.7	IGA

PRELIMINARY

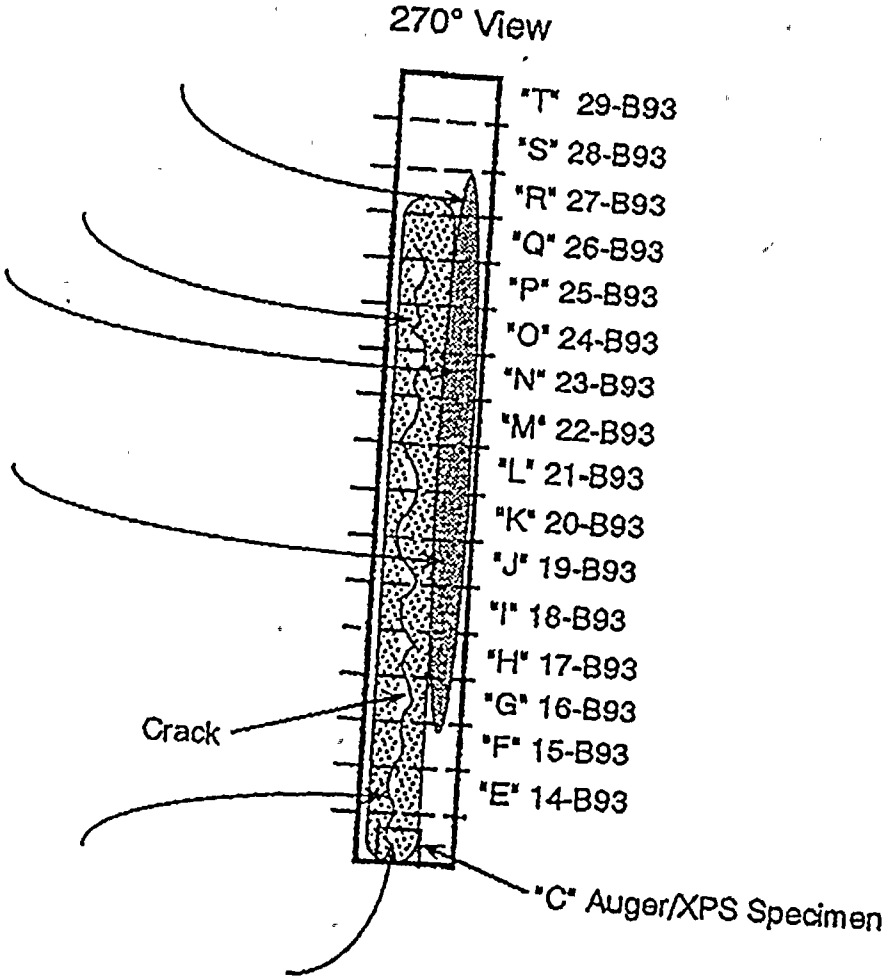
Depth 105/156-16

Tube: 105/156 Section: 16 Above the Burst

Mount No.	Location	Measurment (in)	Mils	% Throughwall	Comments
16E 14-B93	0°	0.45	4.5	10.7	IGA
	0°	1.40	14.0	33.3	IGSCC
	270°	1.00	10.0	23.8	IGA
	270°	1.70	17.0	40.5	IGSCC
16G 15-B93	0°	0.50	5.0	11.9	IGA
	0°	1.50	15.0	35.7	IGSCC
	270°	0.70	7.0	16.7	IGA
	270°	1.30	13.0	31.0	IGSCC
16H 17-B93	0°	0.90	9.0	21.4	IGA
	0°	1.55	15.5	36.9	IGSCC
	270°	1.00	10.0	23.8	IGA
	270°	1.55	15.5	36.9	IGSCC
16I 18-B93	0°	1.30	13.0	31.0	IGA
	250°	0.60	6.0	14.3	IGA
	250°	1.55	15.5	36.9	IGSCC
	300°	0.60	6.0	14.3	IGA
	300°	1.10	11.0	26.2	IGSCC
16J 19-B93	300°	1.20	12.0	28.6	IGSCC
	340°	1.60	16.0	38.1	IGA/IGSCC
16K 20-B93	315°	1.10	11.0	26.2	IGA
	315°	1.50	15.0	35.7	IGSCC
	280°	0.75	7.5	17.9	IGA
	280°	1.30	13.0	31.0	IGSCC
	225°	0.50	5.0	11.9	IGA
	225°	1.60	16.0	38.1	IGSCC
16L 21-B93	0°	1.20	12.0	28.6	IGA
	0°	1.35	13.5	32.1	IGSCC
	270°	1.25	12.5	29.8	IGSCC
	250°	0.90	9.0	21.4	IGA
	250°	1.30	13.0	31.0	IGSCC
16M 22-B93	315°	1.30	13.0	31.0	IGA
	270°	0.45	4.5	10.7	IGSCC
	225°	1.50	15.0	35.7	IGSCC
	200°	1.10	11.0	26.2	IGSCC

PRELIMINARY

Steam Generator 22
Tube R105 L156
Section 16 Upper Part



Area of Deposits

Area of IGA/MAI

PRELIMINARY

Depth 105/156-16

Tube: 105/156

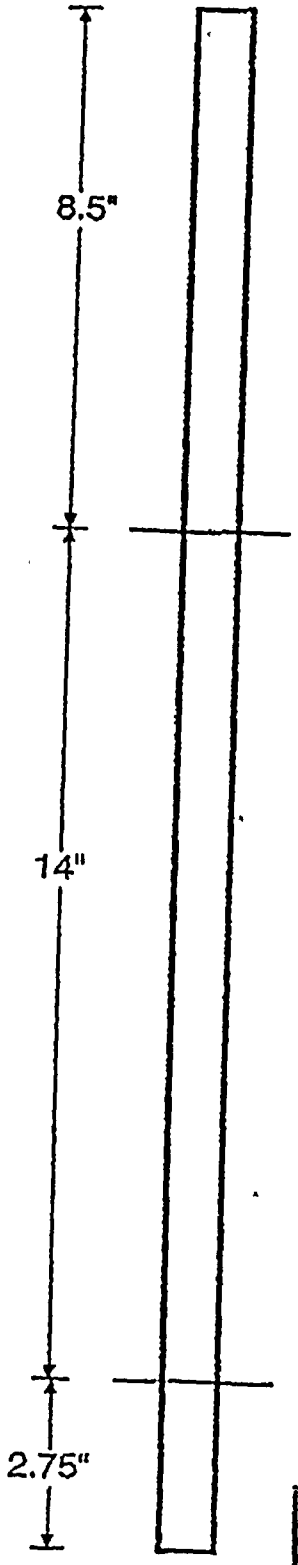
Section: 16 Above the Burst

Mount No.	Location	Measurment (in)	Mils	% Throughwall	Comments
16N 23-B93	270°	1.50	15.0	35.7	IGSCC
	225°	1.60	16.0	38.1	IGSCC
16O 24-B93	270°	1.75	17.5	41.7	IGSCC
	270°	0.90	9.0	21.4	IGA
16P 25-B93	0°	1.10	11.0	26.2	IGA
	0°	1.60	16.0	38.1	IGSCC
	270°	0.70	7.0	16.7	IGA
	270°	1.60	16.0	38.1	IGSCC
16Q 26-B93			0.0	0.0	
16R 27-B93	0°	0.50	5.0	11.9	IGA
	0°	1.20	12.0	28.6	IGSCC
	270°	0.45	4.5	10.7	IGA
	270°	1.20	12.0	28.6	IGSCC
16S 28-B93	0°	0.60	6.0	14.3	IGA
	0°	1.20	12.0	28.6	IGSCC
16T 29-B93	270°	0.75	7.5	17.9	IGSCC

PRELIMINARY

Steam Generator 22
Tube R105 L156
Section 16

DRAFT



Upper Part of Section 16

Lower Part of Section 16
Used for Burst Test

PRELIMINARY

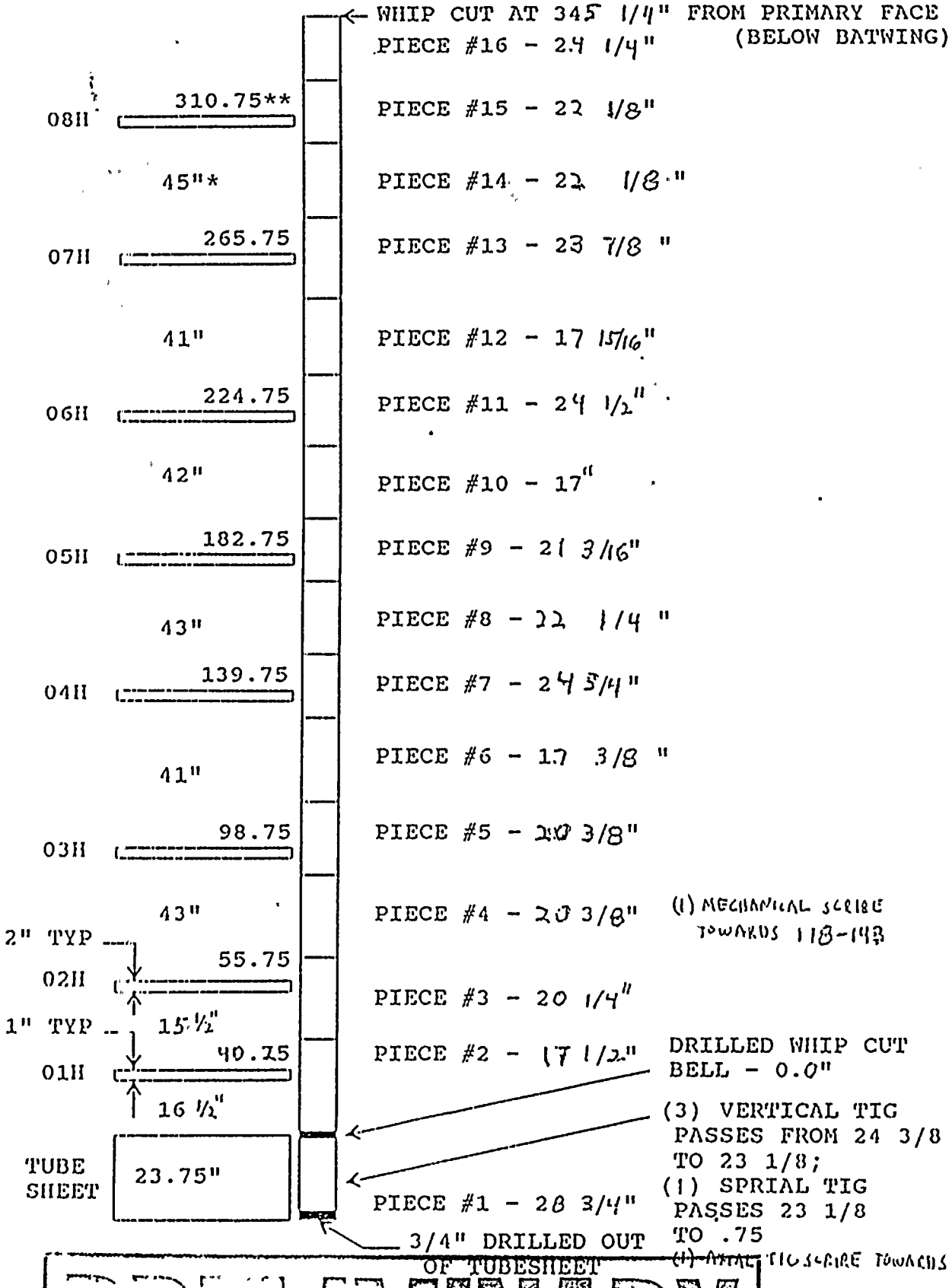
X-Ray Fluorescence Tube 105/156 (Surface Scrapings)

Section 16	wt.%
Fe_3O_4	61.26
Cu	4.1
NiO	2.46
ZnO	1.54
MnO	13.79
Cr_2O_3	0.26
MoO_3	0.1
TiO	0.7
PbO	0.18
SnO_2	0.13
SiO_2	10.13
Al_2O_3	0.76
P_2O_5	1.24
SO_3	0.16
Cl	0.12
K_2O	0.36
CaO	1.17
MgO	1.53

PRELIMINARY

TUBE 117-144

REVISION 2



* DISTANCES BETWEEN CENTERLINE OF TSPAS (OUTER IS A 1" THICK BAFFLE PLATE, ALL OTHERS ARE 2" THICK EGGCRATES)

** DISTANCE FROM PRIMARY FACE TO CENTERLINE OF EGGCRATE

NOTE: NOTCH EACH IN TUBE SAMPLE IS ON TOP END (OPPOSITE TS)

144

	6 in/sec Bobbin percent thru wall	location from end	24 in/sec Bobbin		Hi Resolution		MRPC		LXW
#16	91%	25.92	52%	25.87	46%	24.10	52%	28.72	2.56 X 0.18
	36%	24.58	16%	24.89	79%	24.28	78%	28.32	

PRELIMINARY

CUMULATIVE REPORT
04/93, ARIZONA PUBLIC SERVICE, PALO VERDE, UNIT 2

STEAM GENERATOR: 22
LOCATION: ALL
CRITERIA: ROW 117 COL 144

DATE: 04/30/93
TIME: 14:48:27

ROW	COL	DATE	LEG	EXAM EXTENT PROGRAM	EXAM EXTENT ACTUAL	REM	CAL	PROBE	LOCATION	CURRENT VOLTS	MIL	DEG	%	CH
117	144		H	07H-08H	07H-08H		00107	610RC					NDD	1
			H	06H-07H	06H-07H		00107	610RC					NDD	
			H	05H-06H	05H-06H		00107	610RC					NDD	
			H	04H-05H	04H-05H		00107	610RC					NDD	
			H	03H-04H	03H-04H		00107	610RC					NDD	
			H	02H-03H	02H-03H		00107	610RC					NDD	
			H	01H-02H	01H-02H		00107	610RC					NDD	
			H	TSH-01H	TSH-01H		00107	610RC					NDD	
			H	TEH-TSH	TEH-TSH		00107	610RC					NDD	
			H	-	-		99999	610UL					TPC	
			H	08H-BW1	08H-BW1		00018	610RP	08H+ 28.53to+ 43.4	0.08		0	PDP	11
			H	09H-BW1	08H-BW1	RPI	00107	610RC	08H+ 32.21TO+ 43.55	89.91		17	MAI	P 1
			H	TEH-09C	TEH-09C	RPI	00000	610UL	08H+ 33.17	1.49		106	58	1
			H	TEH-09C	TEH-09C	RPI	00000	610UL	08H+ 34.07	7.02		37	93	1
			H	08H-BW1	08H-BW1	RPI	00018	610RP	08H+ 34.54to+ 43.7	44.85		14	SAI	1
			H	TEH-BW1	TEH-BW1	RPI	00103	630UC	08H+ 35.80to+ 39.4	252.8		20	100	P 1
			H	TEH-09C	TEH-09C	RPI	00000	610UL	08H+ 36.32	321.1		17	100	1
			H	09C-TEC	TEH-TEC		00003	610UL	08H+ 37.39	313.0		17	PID	P 1
			H	TEH-09C	TEH-09C	RPI	00000	610UL	08H+ 39.00	1.12		72	81	1
			H	08H-BW1	08H-BW1		00018	610RP	08H+ 43.09	11.37		9	DNT	P 1
			H	08H-BW1	08H-BW1	RPI	00018	610RP	08H+ 43.92	1.45		76	MAI	P 1
			H	TEH-09C	TEH-09C	RPI	00000	610UL	09H- 0.79	3.24		84	62	P 1
			H	08H-09H	08H-BW1	RPI	00107	610RC	09H- 0.26	0.66		0	MAI	1
			H	TEH-BW1	TEH-BW1	RPI	00103	630UC	09H+ 0.29to+ 13.9	3.75		52	91	P 1
			H	09H-BW1	08H-BW1	RPI	00107	610RC	BW1- 1.66	1.31		149	SAI	P 1
			H	TEH-09C	TEH-09C	RPI	00000	610UL	BW1+ 0.37	3.83		40	96	P 1
			H	09H-BW1	08H-BW1	RPI	00107	610RC	BW1+ 0.49	4.37		77	MAI	P 1
			H	08H-BW1	08H-BW1	RPI	00018	610RP	BW1+ 0.62	1.79		88	SAI	P 1
			H	TEH-BW1	TEH-BW1	RPI	00103	630UC	BW1+ 0.66	4.54		32	97	P 1

NUMBER OF TUBES SELECTED FROM CURRENT OUTAGE: 1
NUMBER OF DATA RECORDS SELECTED FROM CURRENT OUTAGE: 29

NO TREND ANALYSIS REQUESTED

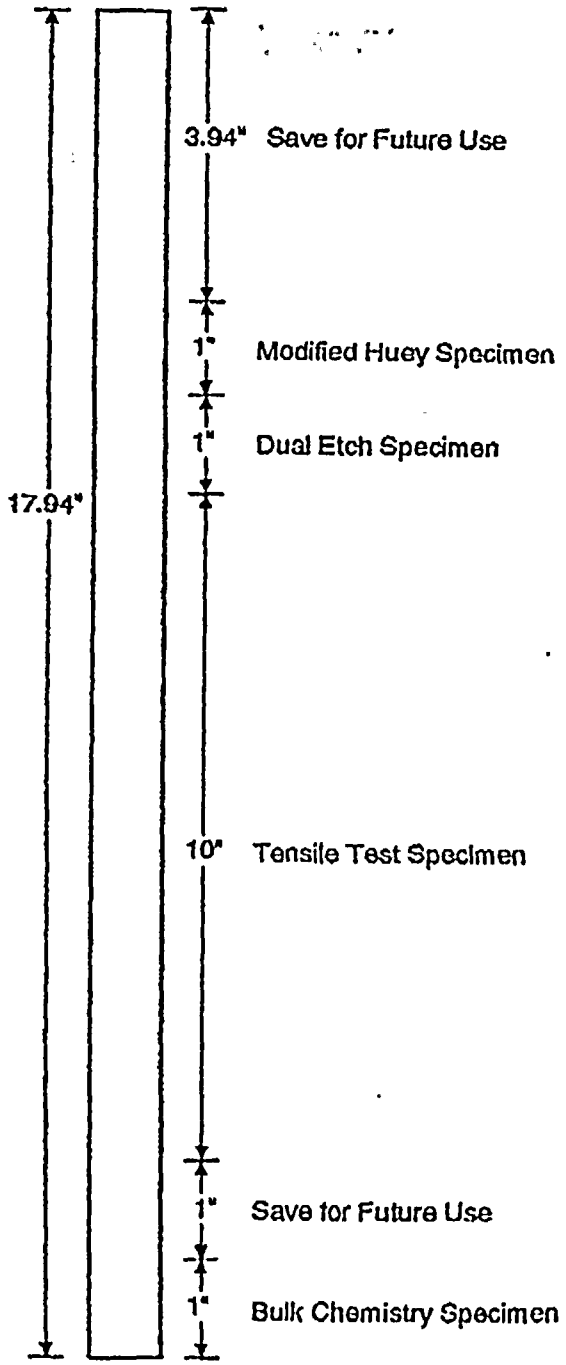
REPORT OPTIONS:
Only examination results matching criteria are included

PRELIMINARY

CONAM NUCLEAR, INC.

Steam Generator 22 Tube R117 L144
Section 12

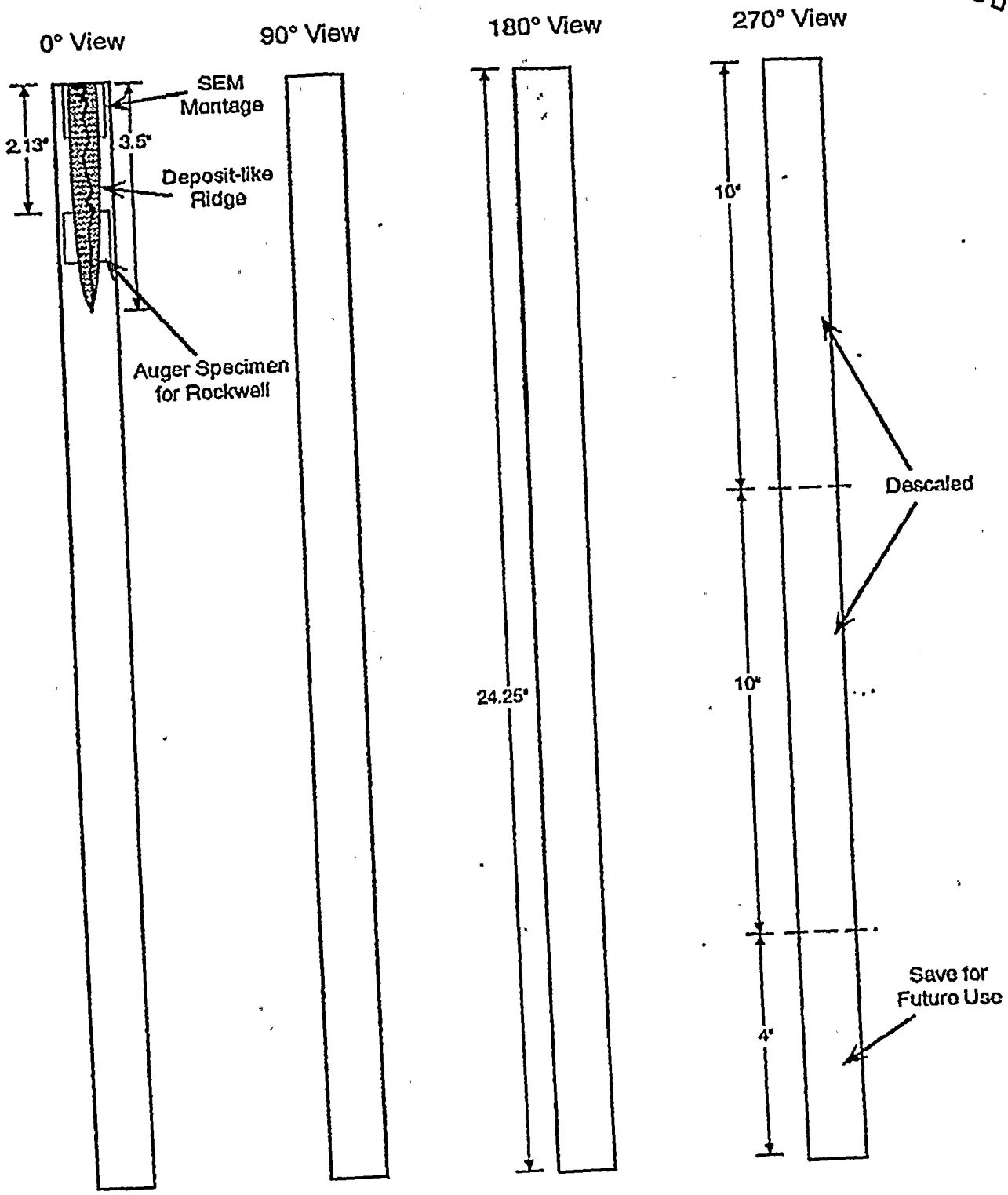
DRAFT



PRELIMINARY

Steam Generator 22 Tube R117 L144
Section 16

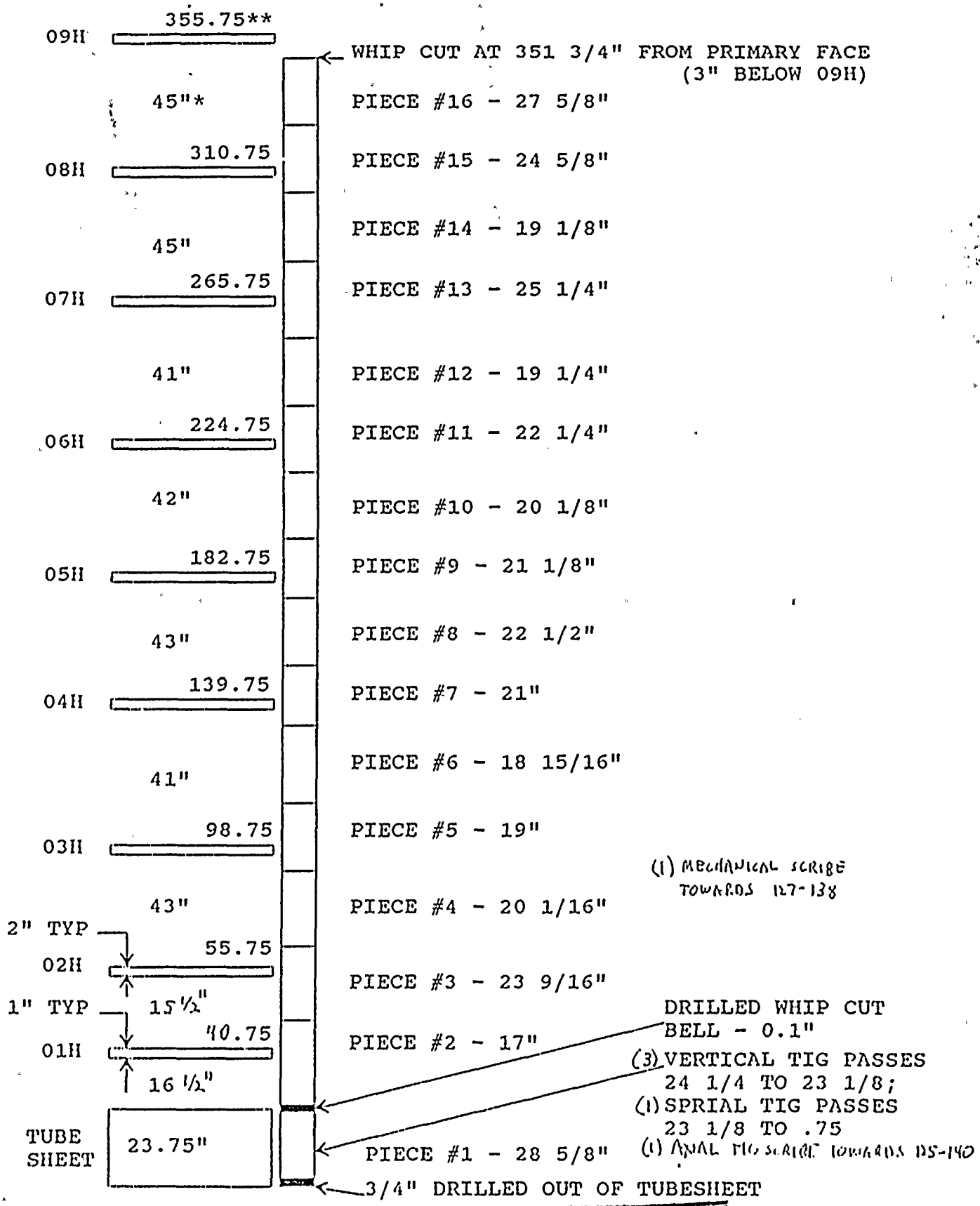
DRAFT



PRELIMINARY

TUBE 127-140

REVISION 2



* DISTANCES BETWEEN CENTERLINE OF TSP'S (01H IS A 1" THICK BAFFLE PLATE, ALL OTHERS ARE 2" THICK EGGCRATES)

** DISTANCE FROM PRIMARY FACE TO CENTERLINE OF EGGCRATE

NOTE: NOTCH EACH IN TUBE SAMPLE IS ON TOP END (OPPOSITE TS)

PRELIMINARY

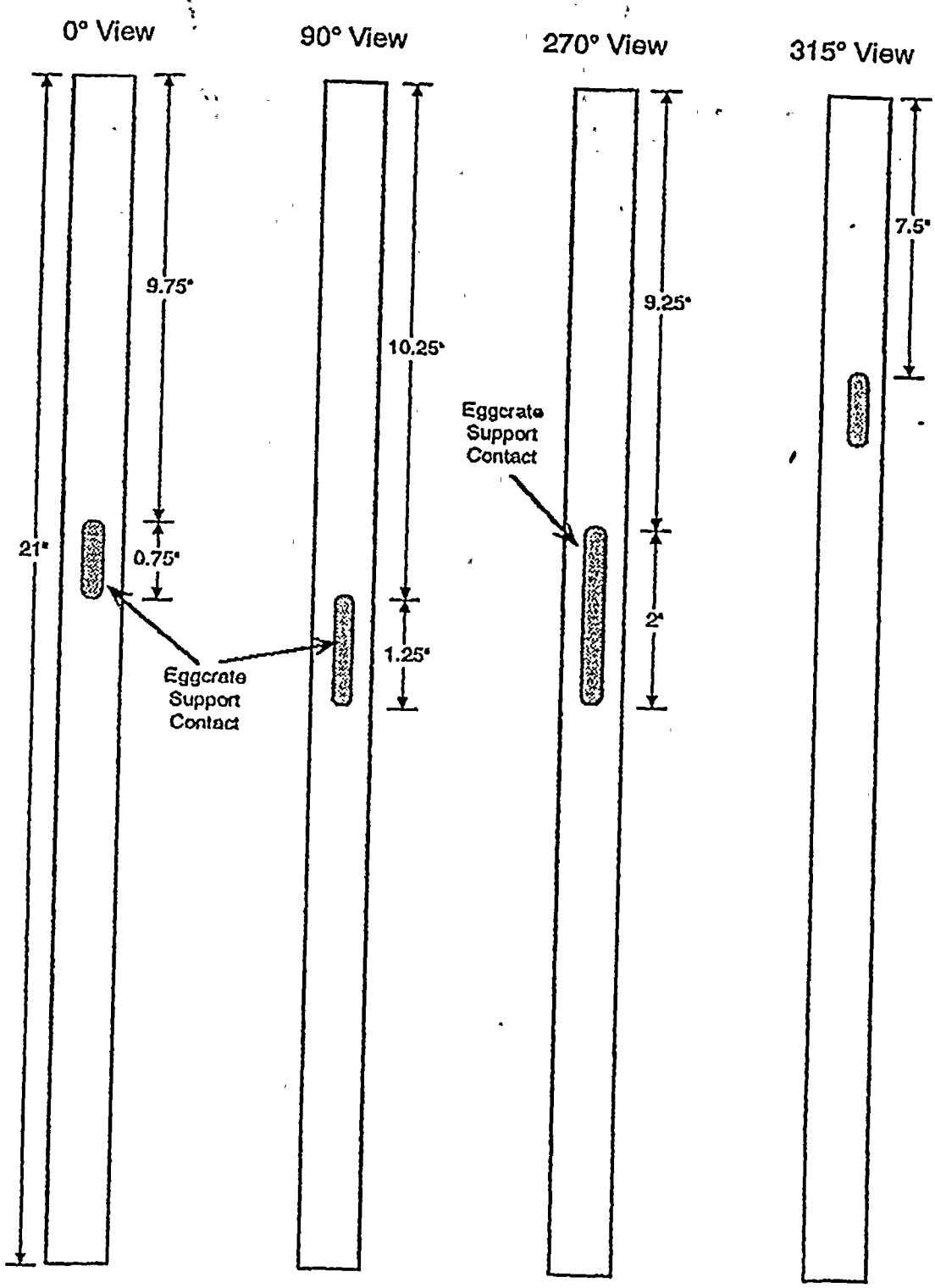
12[illegible]0

	6 in/sec percent thru wall	Bobbin location from end	24 in/sec Bobbin		Hi Resolution		MRPC		LXW
08H	61%	12.28	61%	12.52	70%	12.30	89%	12.02	0.38 X 0.18
07H	68%	12.81	69%	11.22	64%	12.58	85%	11.65	0.25 X 0.14
06H	NDD		NDD		NDD		NDD		
05H	NDD		NDD		NDD		NDD		

PRELIMINARY

Steam Generator 22 Tube R127 L140
Section 9

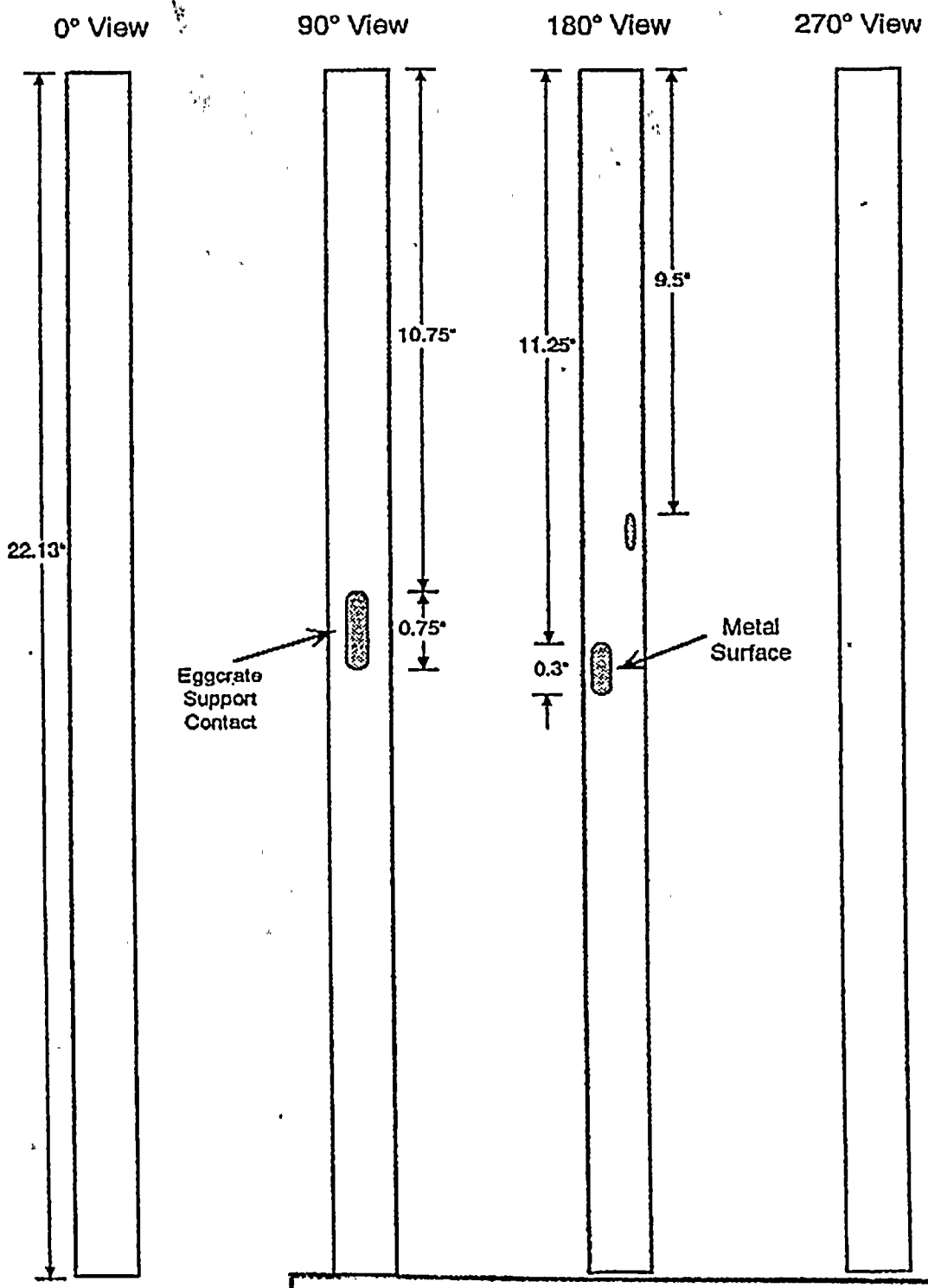
DRAFT



PRELIMINARY

Steam Generator 22 Tube R127 L140
Section 11

DRAFT

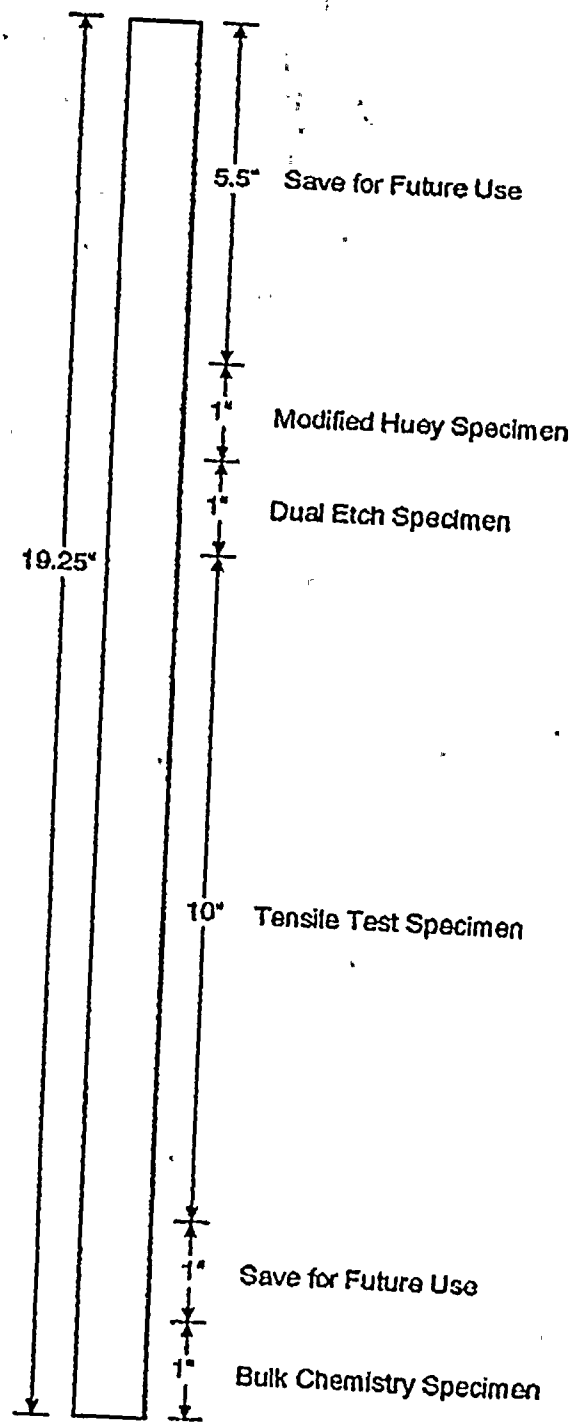


PRELIMINARY

114

Steam Generator 22 Tube R127 L140
Section 12

DRAFT

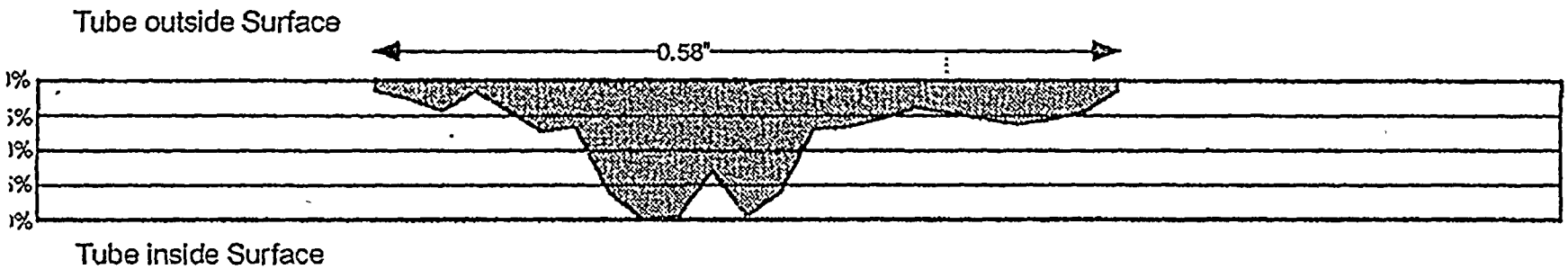


PRELIMINARY

PRELIMINARY

SCANNING ELECTRON MICROSCOPE PHOTO OF LABORATORY BURST TEST FRACTURE SURFACE AREA ABOVE ARROWS IS IGSCC

Steam Generator 22
Tube R127 L140
Section 13 Burst Face Crack Depth Diagram



IGA/IGSCC

Ductile

Average Depth 39.9%
Max. Depth 100%

PRELIMINARY

116

Depth Measurments

Tube: R127 L140

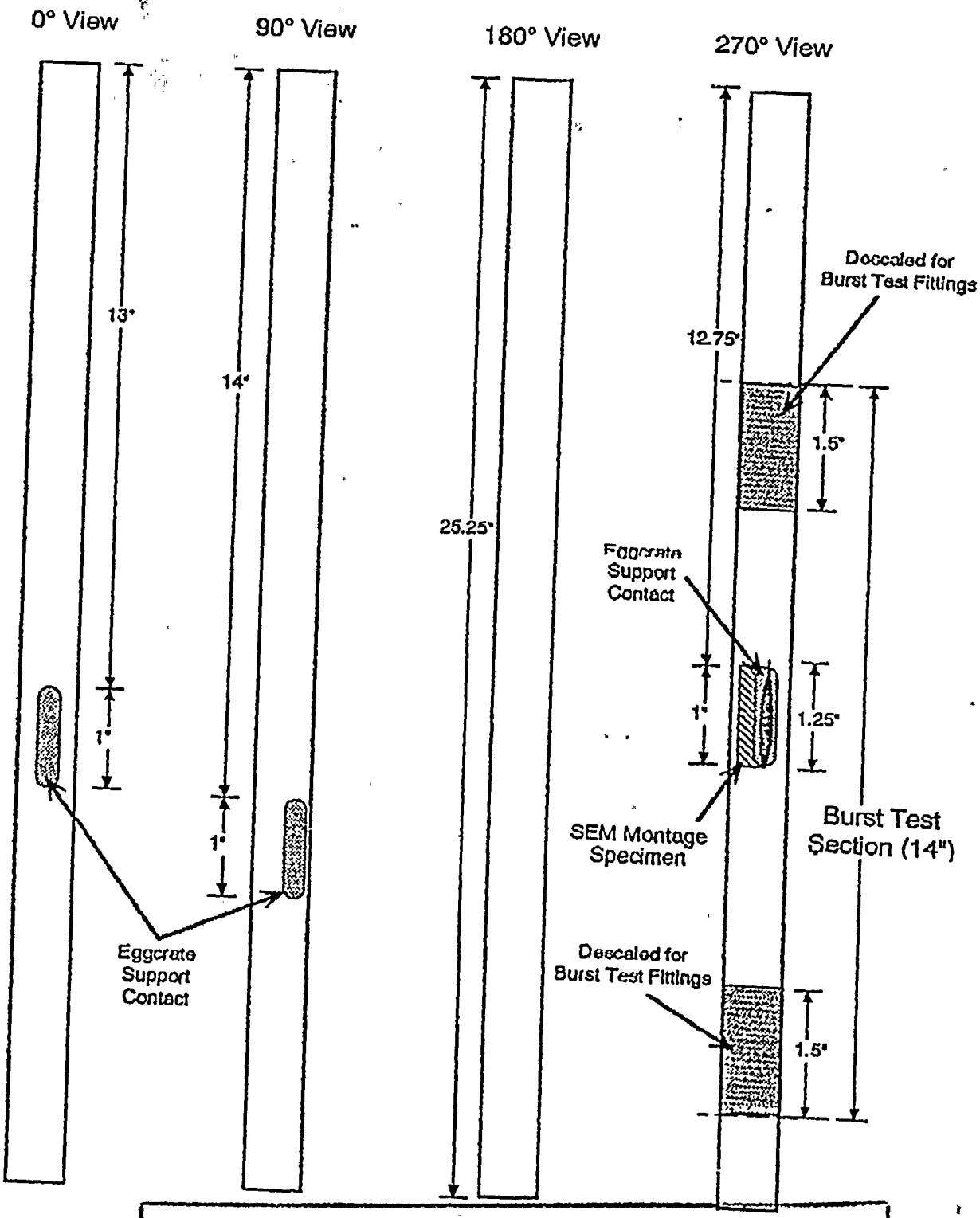
Section: 13 Burst (07H)

Location	Measurment (in)	Mils	% Throughwall
1	0.10	2.5	6.0
2	0.20	5.0	11.9
3	0.35	8.8	20.8
4	0.15	3.8	8.9
5	0.35	8.8	20.8
6	0.65	16.3	38.7
7	0.60	15.0	35.7
8	1.35	33.8	80.4
9	1.68	42.0	100.0
10	1.66	41.5	98.8
11	1.10	27.5	65.5
12	1.60	40.0	95.2
13	1.35	33.8	80.4
14	0.60	15.0	35.7
15	0.60	15.0	35.7
16	0.45	11.3	26.8
17	0.30	7.5	17.9
18	0.35	8.8	20.8
19	0.45	11.3	26.8
20	0.52	13.0	31.0
21	0.45	11.3	26.8
22	0.40	10.0	23.8
23	0.15	3.8	8.9
	Average Depth	16.8	39.9

PRELIMINARY

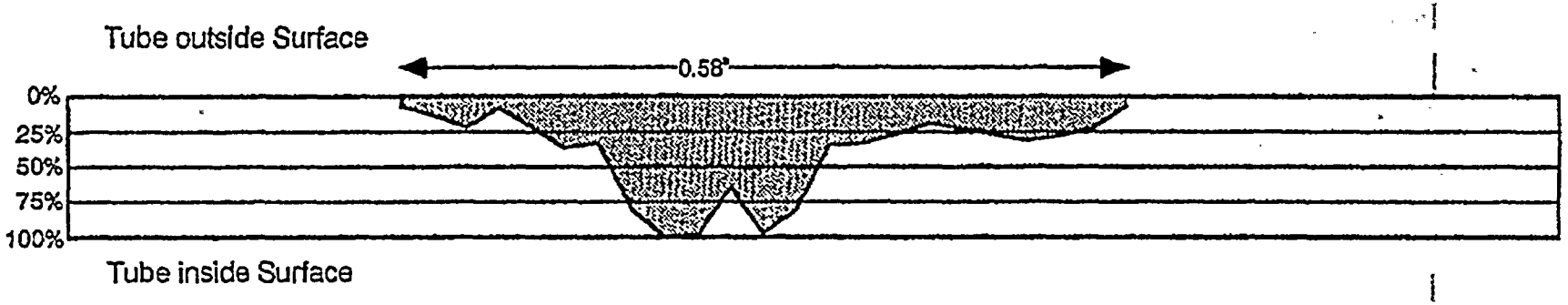
Steam Generator 22 Tube R127 L140
Section 13

DRAFT



PRELIMINARY

Steam Generator 22
Tube R127 L140
Section 13 Burst Face Crack Depth Diagram



IGA/IGSCC

Ductile

Average Depth 39.9%
Max. Depth 100%

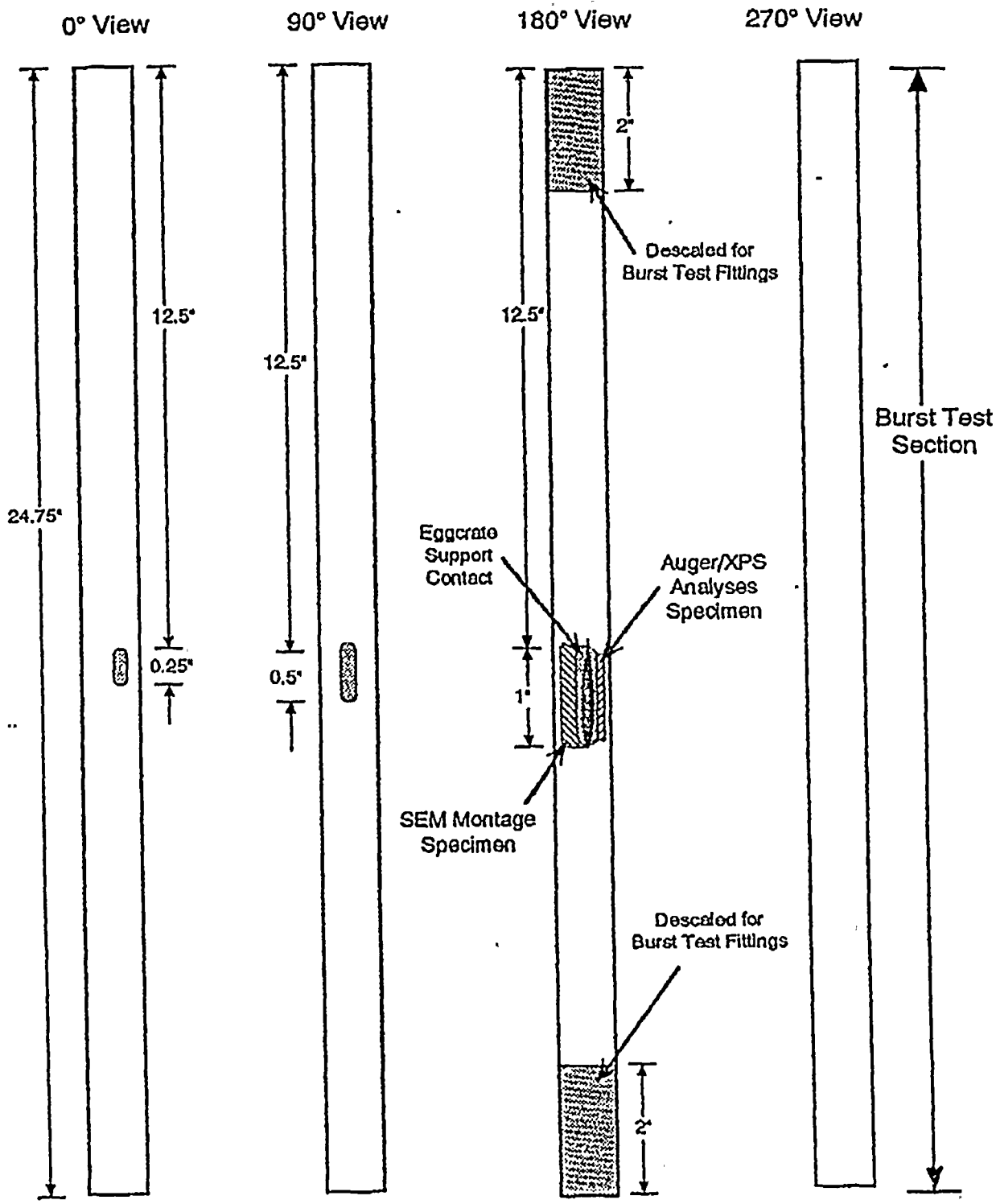
PRELIMINARY

DRAFT

(119)

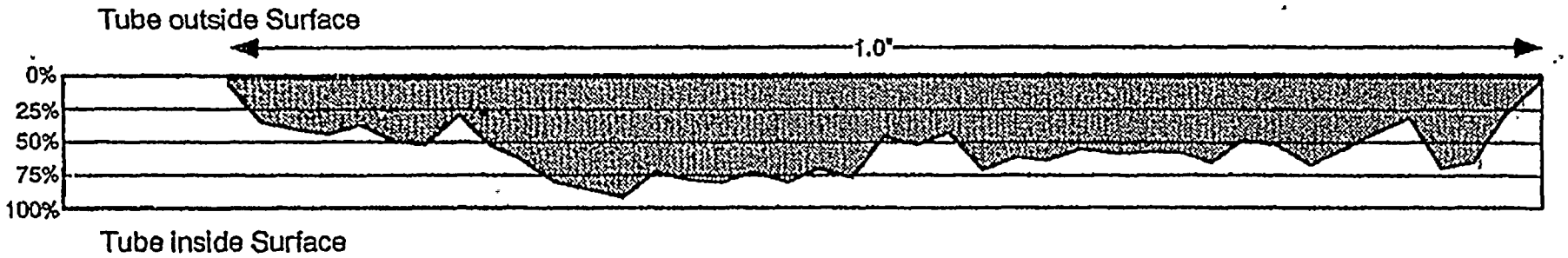
Steam Generator 22 Tube R127 L140
Section 15

DRAFT



PRELIMINARY

Steam Generator 22
Tube R127 L140
Section 15 Burst Face Crack Depth Diagram



IGA/IGSCC

Ductile

Average Depth 58%
Max. Depth 89.3%

PRELIMINARY

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