PDR

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

APR 12 1989

MEMORANDUM FOR: [redacted], Assistant Director for Systems
Division of Engineering & Systems Technology

FROM: Scott Newberry, Chief
Instrumentation & Control Systems Branch
Division of Engineering & Systems Technology

SUBJECT: SUMMARY OF MEETING WITH COMBUSTION ENGINEERING (CE) ON RTD BYPASS ELIMINATION

As the request of the C-E, a meeting was held on March 13, 1989 in Rockville, Maryland. The purpose of the meeting was to discuss the results of Salem project and licensing of future C-E projects with respect to RTD bypass elimination including setpoint methodology. The C-E's presentation outline is shown in Attachment 1 and a list of attendees is shown in Attachment 2.

The removal of the RTD bypass raises the technical concerns regarding RTD response time and setpoint analysis. Also, we expressed concerns regarding scoop mixing because the C-E scoop configuration is different from the Westinghouse scoop configuration.

Scott Newberry, Chief
Instrumentation & Control Systems Branch
Division of Engineering Systems Technology

cc w/enclosures:
L. Shao
H. Balukjian

Contact: S. Rhow (SICB/DEST), x20779

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Attachment 1

AGENDA

RTD BYPASS ELIMINATION MEETING

MONDAY, MARCH 13, 1989

1:00 - 3:00

NRC OFFICES

PURPOSE: DISCUSSION OF RESULTS OF SALEM PROJECT AND LICENSING OF FUTURE C-E PROJECTS

1:00 - 1:15 LICENSING ISSUES

- o RESPONSE TIME
- o TEMPERATURE MEASUREMENT
- o SETPOINT ANALYSIS

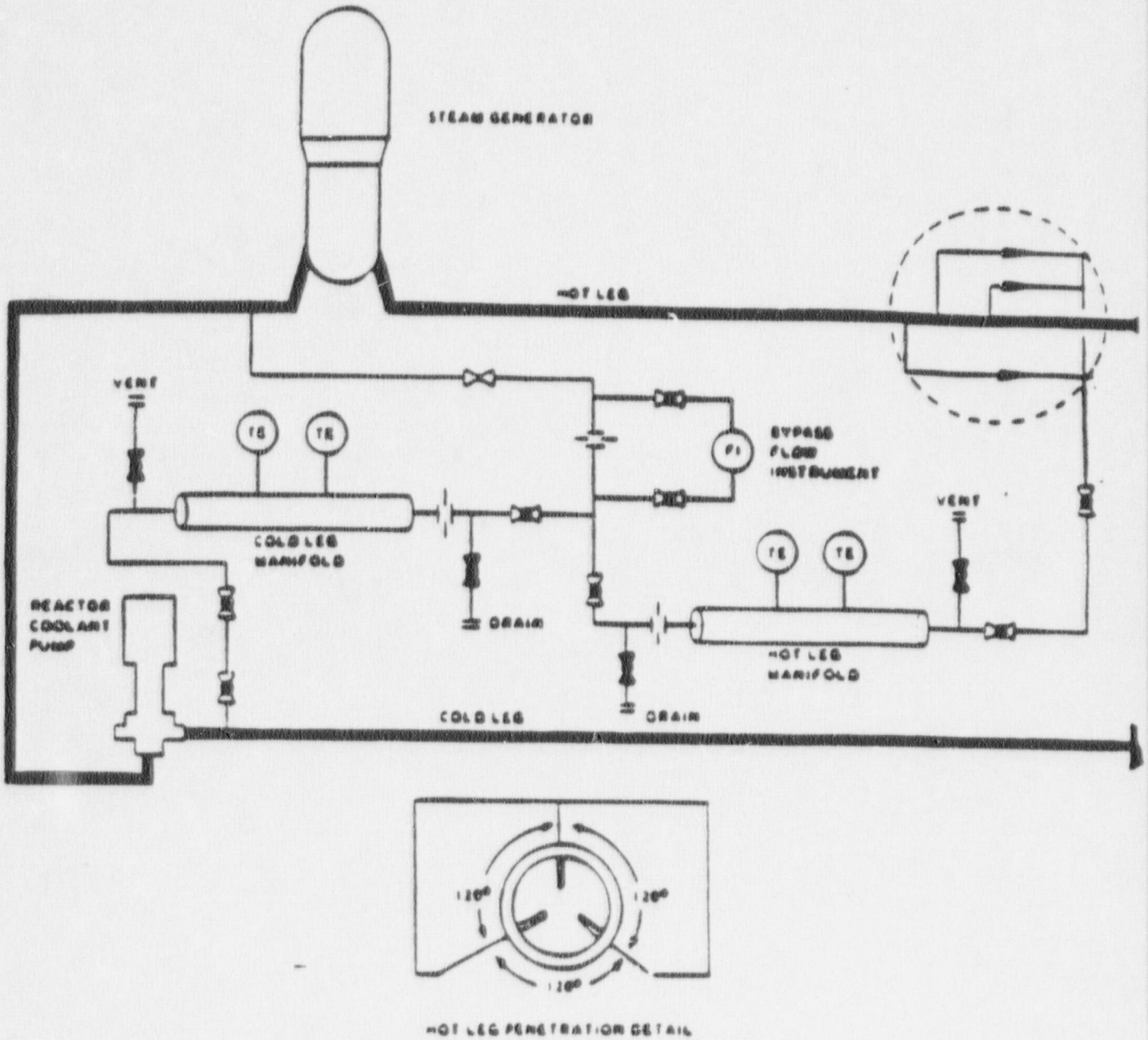
1:15 - 1:45 SALEM RESULTS

- o RTD RESPONSE TIME
- o ACCURACY - RTD/OVERALL
- o TEMPERATURE MEASUREMENT/SCOOP MIXING
- o ALARA

1:45 - 2:15 LICENSING OF FUTURE C-E PROJECTS

- o TEMPERATURE MEASUREMENT
- o ACCURACY COMPARISONS - BYPASS SYSTEM VS. NEW SYSTEM
- o SETPOINT METHODOLOGY

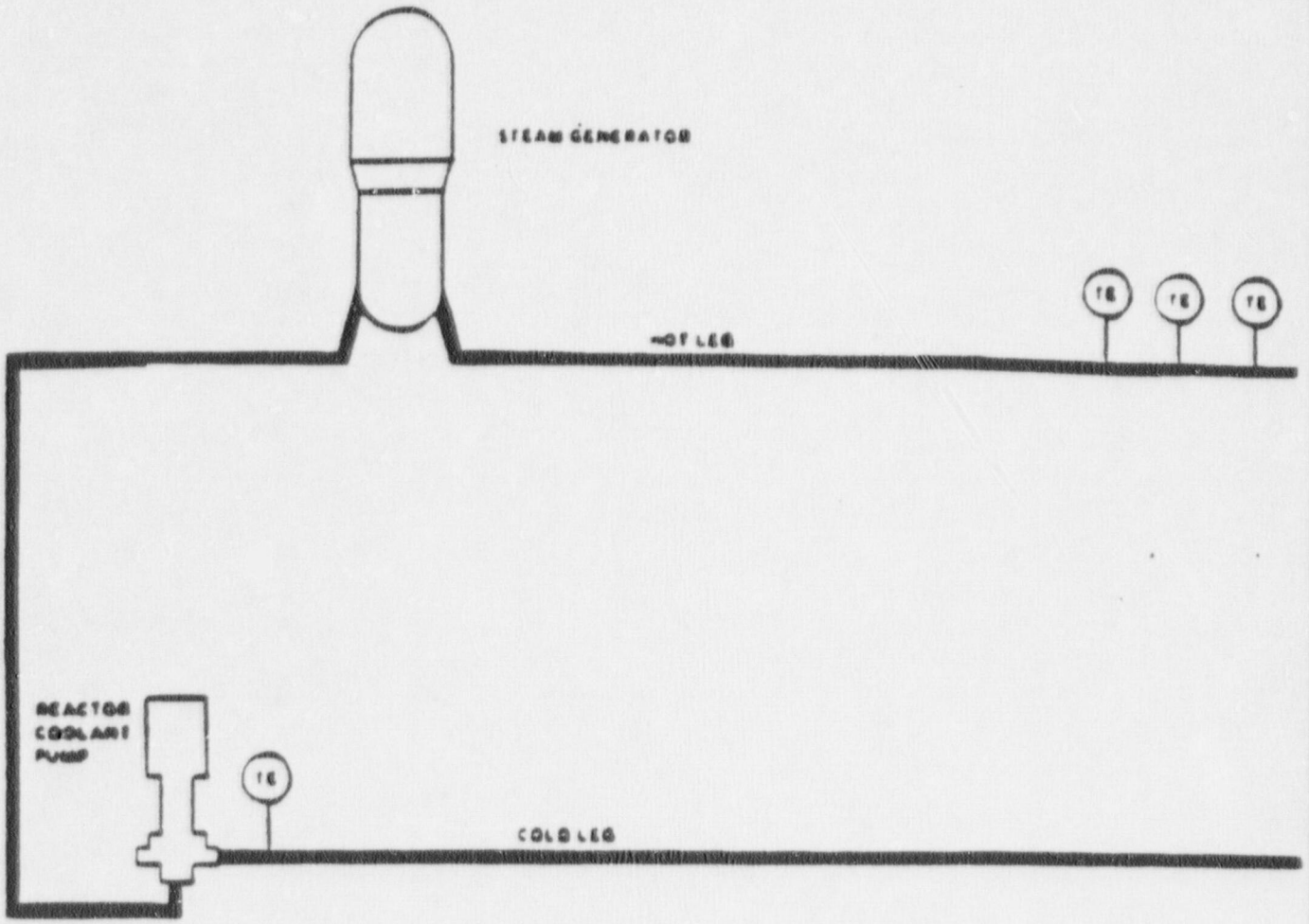
2:15 - 3:00 DISCUSSION



HOT LEG PENETRATION DETAIL

BEFORE

RTD BYPASS REMOVAL



AFTER

RTD BYPASS REMOVAL

LICENSING ISSUES

- RESPONSE TIME
- TEMPERATURE MEASUREMENT
- SETPOINT ANALYSIS

RESPONSE TIME

- RESPONSE TIME BEGINS WHEN THE TEMPERATURE REACHES TRIP CONDITION AT THE ENTRANCE TO THE HOT AND COLD LEG BYPASS LINES AND ENDS WHEN THE RODS ARE FREE TO FALL INTO THE CORE.

- RESPONSE TIME OF BYPASS LOOP SYSTEM WAS 6 SECONDS.

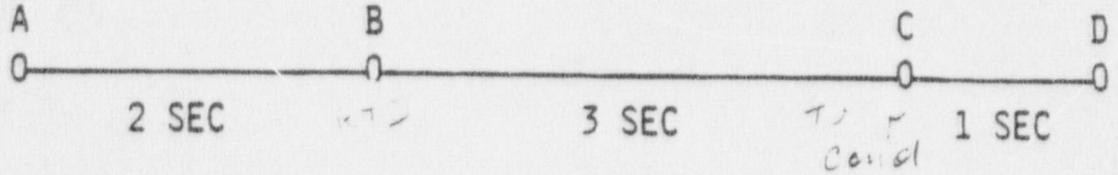
- NO CHANGE WITH REPLACEMENT SYSTEM, STILL 6 SECONDS.

- TECHNICAL SPECIFICATION REQUIREMENT NORMALLY INCLUDES ONLY THAT PORTION OF THE 6 SECONDS WHICH CAN BE TESTED.

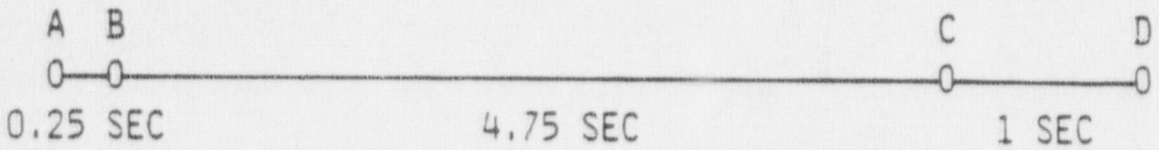
6 - 2 seconds

SALEM UNITS 1 AND 2
OVERTEMPERATURE DELTA T RESPONSE TIME

RESPONSE TIME WITH BYPASS LOOP SYSTEM



RESPONSE TIME WITH NEW SYSTEM



A MEASURED PARAMETER AT HOT LEG SCOOPS REACHES THE TRIP CONDITION

B MEASURED PARAMETERS AT THE SENSORS REACH THE TRIP CONDITION

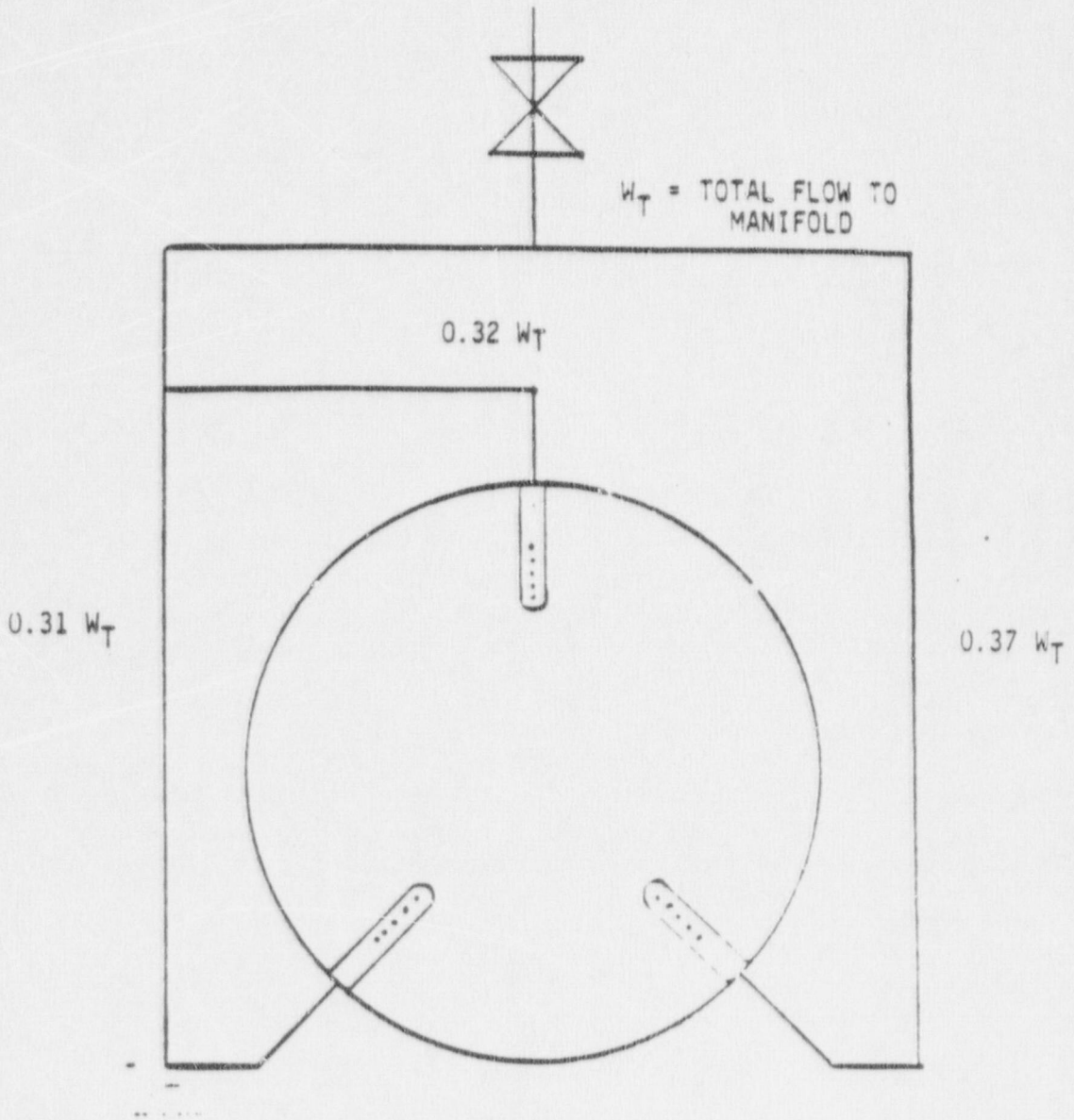
C OUTPUTS OF THE RTDS REACH THE TRIP CONDITION

D CONTROL RODS ARE FREE TO FALL INTO THE CORE

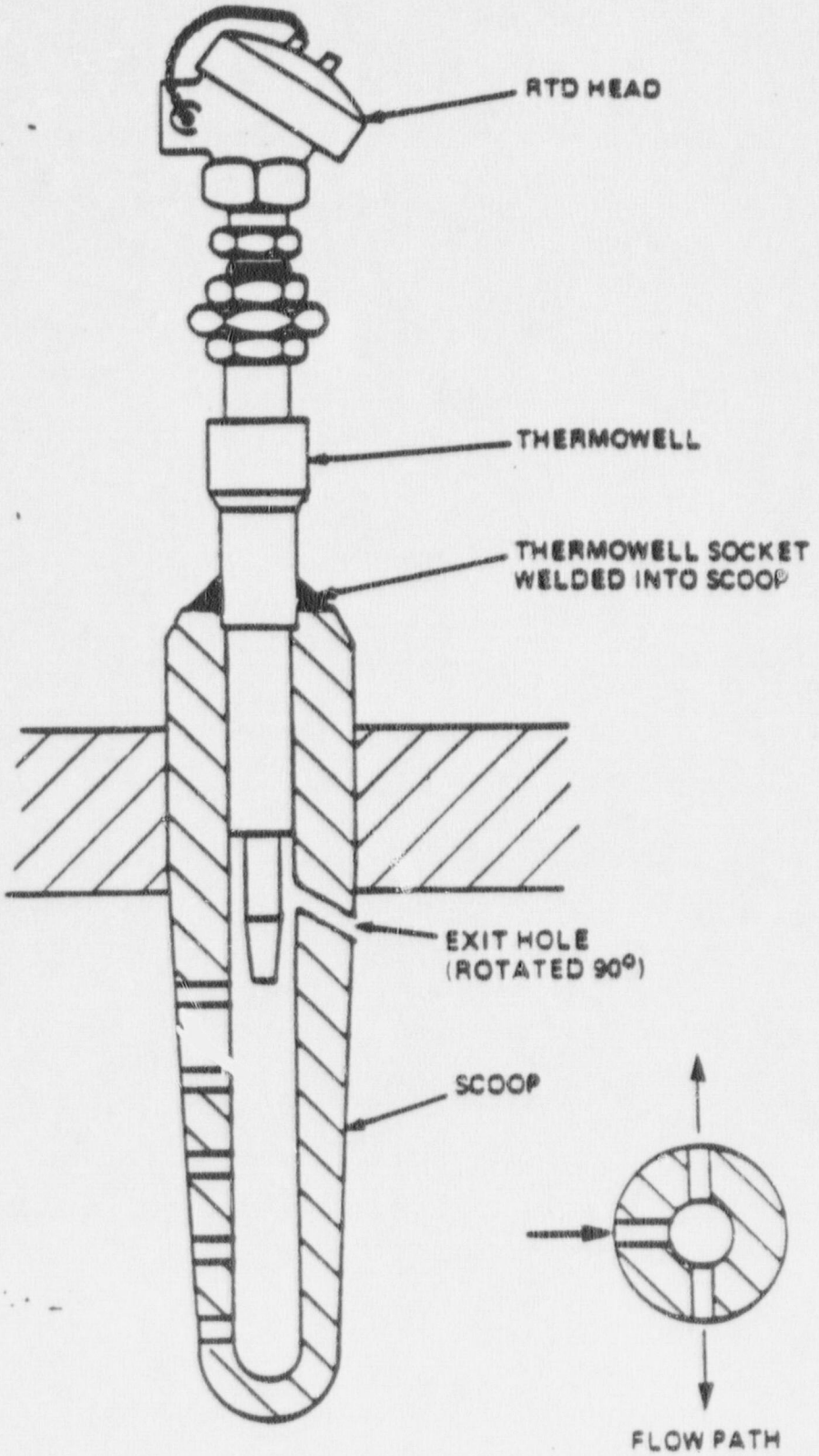
TEMPERATURE MEASUREMENT

- PROCESS MEASUREMENT ERROR - T HOT ONLY
  - HOT LEG STREAMING
  - HYDRAULIC BIAS (BYPASS SYSTEM)
  - SCOOP MIXING
- INSTRUMENT (RTD) ERROR
  - ACCURACY
  - DRIFT
- PROCESSING (RACK) ERROR
  - ACCURACY
  - DRIFT

HYDRAULIC BIAS IN BYPASS LOOP



ESTIMATE OF FLOW FROM EACH SCOOP TO RTD BYPASS LOOP


RTD HEAD
THERMOWELL
THERMOWELL SOCKET
WELDED INTO SCOOP
EXIT HOLE
(ROTATED 90°)
SCOOP
FLOW PATH

SETPOINT ANALYSIS

- DESIGN BASIS RESPONSE TIME OF 6 SECONDS IS UNCHANGED
- NEED TO COMPARE ACCURACIES OF NEW SYSTEM WITH OLD SYSTEM
  - TEMPERATURE MEASUREMENT
  - RTD ACCURACY AND DRIFT
  - RACK ACCURACY AND DRIFT

TIME RESPONSE

- PERFORMED BY ANALYSIS AND MEASUREMENT SERVICES.
- IN-SITU TEST USING LOOP CURRENT STEP RESPONSE.
- METHOD VERIFIES PROPER RTD TO THERMOWELL CONTACT.
- BOTH ELEMENTS TESTED.
- CONTACT BETWEEN RTD AND T/W RELIES SOLELY ON TAPER FIT.
- NO SOFT METAL OR "CONTACT FLUID" USED.

UNIT 1 RESULTS
(IN SECONDS)

	ELEMENT 1	ELEMENT 2
T/H LOOP 1	3.5	3.0
	3.4	3.9
	3.7	3.9
T/H LOOP 2	3.4	3.9
	3.7	3.3
	3.5	2.8
T/H LOOP 3	3.0	3.7
	3.5	3.8
	3.5	3.4
T/H LOOP 4	3.4*	3.9*
	3.4	3.8
	2.9	3.4
T/C LOOP 1	3.1	3.8
T/C LOOP 2	3.3	3.9
T/C LOOP 3	4.0	3.7
T/C LOOP 4	3.3	3.0

*AFTER REPLACEMENT.

REPLACED RTD

- ORIGINAL TESTED AT 6.6/9.3 SECONDS.
- ONE-OF-A-KIND DUE TO MINIMUM OVERHEAD CLEARANCE.
- FOUND TO HAVE A BENT TIP AND A WRONG LENGTH NIPPLE ADAPTER.
- THERMOWELL INSPECTED SATISFACTORILY.
- AS A PRECAUTIONARY MEASURE:
  - REMOVED THERMOWELL
  - INSPECTED SCOOP
  - REPLACED WITH NEW THERMOWELL/RTD
- TESTED SATISFACTORILY AT MODE 3.

UNIT 2 RESULTS

(IN SECONDS)

	ELEMENT 1	ELEMENT 2
T/H LOOP 1	1.7	2.2
	2.7	2.7
	2.3	2.6
T/H LOOP 2	2.8	2.7
	3.3	3.8
	3.4	3.4
T/H LOOP 3	2.3	2.2
	3.1	3.5
	2.2	2.2
T/H LOOP 4	3.6	3.5
	2.4	2.5
	2.4	2.6
T/C LOOP 1	3.0	3.8
T/C LOOP 2	2.9	3.8
T/C LOOP 3	2.7	3.0
T/C LOOP 4	3.4	2.9

SUMMARY

- RTD/THERMOWELL READILY MEET SPECIFIED TIME, 4.0 SECONDS

- ANALYZED TIME CONTAINS CONSERVATISM

  ± 10% LCSR ACCURACY
  + 10% DEGRADATION
  0.5 SECONDS RACK/BREAKER

RTD ACCURACY

- CHECKED DUPING POST INSTALLATION CROSS-CALIBRATION.
- BOTH ELEMENTS CHECKED.
- CROSS-CAL RESULTS INCLUDE M&TE'S.
- COMPARED AGAINST AVERAGE FOR A LOOP.

UNIT 1 RESULTS

- 32 ELEMENTS CHECKED.
- 27 ELEMENTS $\leq 0.2^{0}$ F.
- 3 ELEMENTS $> 0.2^{0}$ F, BUT $\leq 0.3^{0}$ F.
- 2 ELEMENTS $> 0.3^{0}$ F, BUT $\leq 0.4^{0}$ F.

UNIT 2 RESULTS

- 32 ELEMENTS CHECKED.
- 29 WITHIN $\leq 0.25^{\circ}$ F.
- 2 ELEMENTS $> 0.25^{\circ}$ F, BUT $\leq 0.4^{\circ}$ F.
- 1 ELEMENT $+ 0.54^{\circ}$ F.

REMAINING ISSUES ON RTD ACCURACY

- DRIFT (GENERIC ISSUE).

- UNIT 1 COMMITMENT
  - REPLACE TWO RTD'S
  - FOR NEXT TWO OUTAGES

- CONSIDERING RECALIBRATION OF ALL RTD'S - APRIL '89 OUTAGE.

SUMMARY

- RTD'S ARE AS ACCURATE AS CAN BE REASONABLY EXPECTED OUTSIDE LABORATORY CONDITIONS.

- T-HOT ACCURACY IMPROVED BY 3 PARALLEL RTD'S AND MV/I'S.

- RACK ACCURACY MAINTAINED EVEN WITH ADDITION OF T-HOT AVERAGER.

- BACK-UP ELEMENT AT EACH LOCATION TO MAINTAIN SYSTEM'S HIGH ACCURACY.

PROCESS MEASUREMENT ERROR

- MODIFICATION OF SCOOP RAISED CONCERN ON IMPACT TO T-HOT MEASUREMENT: THEREFORE, SALEM

- REVIEWED POST-MODIFICATION T-HOT AGAINST PRE-MODIFICATION T-HOT, AND

- ESTIMATED SCOOP BIAS (OF NEW SYSTEM) AGAINST HYDRAULIC BIAS (OF OLD SYSTEM) USING SALEM GENERATED DATA.

THOT PRE AND POST MODIFICATION

- COMPARED POST-MOD CALOMETRIC AGAINST MOST RECENT BEFORE MODIFICATION.

- COMPARED ENTHALPY RISE (DELTA H) RATHER THAN T-HOT.

  - T-HOT AFFECTED BY ROD POSITION.
  - DELTA T AFFECTED BY NON-LINEARITY IN C_p.

- ADJUSTED DELTA H TO 100% POWER.

- MASS FLOW DIFFERENCES.

  - BYPASS FLOW ELIMINATED.
  - S/G FIRST ROW PLUGGED (UNIT 2 ONLY).
  - RCP FLUID DENSITY DIFFERENCES.

- ADJUSTED POST-MOD DELTA H TO THE UNIT'S PRE-MOD MASS FLOW.

UNIT 1 RESULTS

- DELTA H PRE-MODIFICATION (100% POWER): 83.26 BTU/LB

- DELTA H POST-MODIFICATION (100% POWER): 83.09 BTU/LB

- DECREASE, 0.17 BTU/LB, EQUIVALENT TO -0.12^{0} F CHANGE IN T-HOT.

- WELL WITHIN ACCURACY OF DATA.

UNIT 2 RESULTS

- DELTA H PRE-MODIFICATION (100% POWER): 83.33 BTU/LB

- DELTA H POST-MODIFICATION (100% POWER): 84.02 BTU/LB

- FLOW DECREASE DUE TO S/G FIRST ROW PLUGGING: 0.75% (WESTINGHOUSE INFORMATION).

- INCREASE, + 0.69 BTU/LB, EQUIVALENT TO A + .48^{0} F RISE IN T-HOT.

- CHANGE, 0.8%, WITHIN ACCURACY OF CALOMETRIC (2.2%).

LOOP T-HOT DEVIATIONS*

	PRE-MOD	POST-MOD
LOOP 21	-1.70° F	-1.61° F
LOOP 22	+1.74° F	+1.96° F
LOOP 23	+0.15° F	- .39° F
LOOP 24	-0.21° F	+ .03° F

*COMPARED TO AVERAGE OF THE FOUR LOOPS.

SCOOP MIXING

- SCOOP MIXING RETAINED.
- COMBUSTION ENGINEERING TESTS SHOWED BIAS TOWARDS TOP HOLE TEMPERATURE.
- BIAS DEFINED AS:

  $$TRTD = TMIX + BIAS\ (T_{TOP\ HOLE} - TMIX)$$

- BIAS/ERROR ON ORIGINAL SCOOP MIXING NOT KNOWN.
- ANALYZED BIAS FOR MODIFIED SCOOP:

MEASURED BIAS	[*]
POSITION ERROR	
TEST UNCERTAINTIES	
ROUNDING OFF	
TOTAL	.25 → .15

- BASED ON REQUIRED INSTALLATION TOLERANCES, POSITION ERROR CAN BE ELIMINATED.
- ROUNDING OFF NUMBER ALSO ELIMINATED.
- MEASURED BIAS BROKEN DOWN INTO TWO COMPONENTS.

* CE Proprietary information. Refer to CE Report No. CEN-361-P submitted under Docket No. 50-272/50-311

0.4°F between hole & hole 1 1/4"

0.25 - 1

MEASURED BIAS

- THE [*] BIAS IS BROKEN DOWN AS FOLLOWS:

  CE SCOOP MODIFICATION
  FLOW MALDISTRIBUTION IN RCS [*]

- FLOW MALDISTRIBUTION COMPONENT IS BASED ON CONSERVATIVE ASSUMPTIONS ON RCS FLOW ACROSS FRONT OF SCOOP.

- IF PRESENT, IT WOULD EXIST BEFORE AND AFTER MODIFICATION.

- TO EVALUATE NET EFFECT OF MODIFICATION, THIS COMPONENT SHOULD BE OMITTED.

- SCOOP BIAS DUE TO CE MODIFICATION

  BEST ESTIMATE
  TEST UNCERTAINTIES
  TOTAL [*]

* CE Proprietary information. Please refer to CE Report No. CEN-361-P submitted under Docket No. 50-272/50-311

STREAMING

- SALEM UNIT 1 TOOK STREAMING DATA FOR 3 MONTHS.

- USED SPARE T-HOT RTD ELEMENTS.

- RESULTS TABULATED AND SKETCHED FOR READINGS ON FOUR DATES.

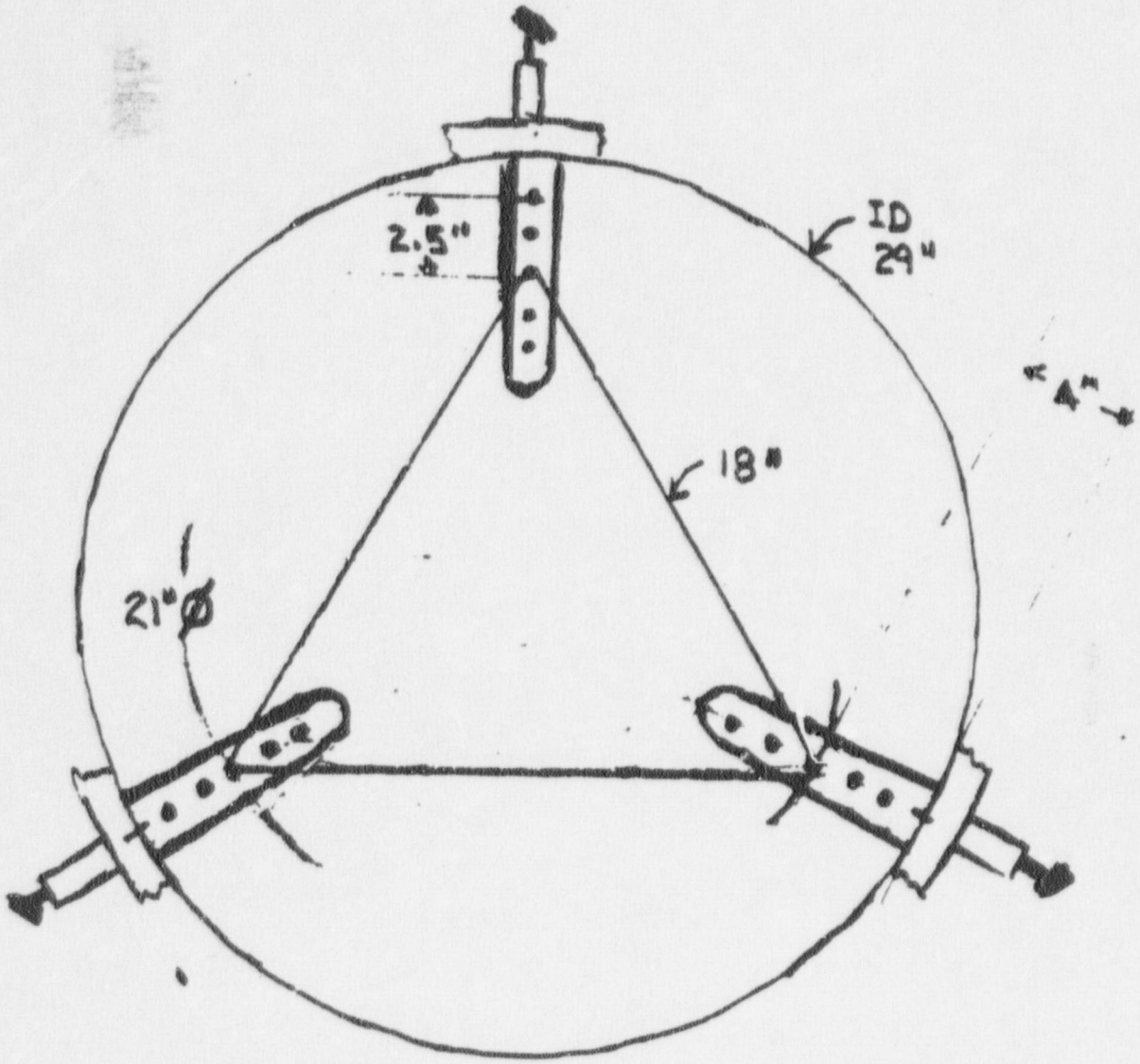
STREAMING (F°)

SCOOP**	3/21/88 READING	DELTA*	4/22/88 READING	DELTA*	5/18/88 READING	DELTA*	6/6/88 READING	DELTA*
1-1	605.09	+2.68	605.15	+2.65	605.33	2.58	604.88	2.26
1-2	596.24	-6.17	596.03	-6.47	596.06	-6.69	595.22	-7.4
1-3	604.64	+2.23	604.44	+2.44	605.24	+2.49	605.15	+2.54
2-1	604.55	+2.14	604.55	+2.05	604.52	1.77	604.14	1.57
2-2	603.62	+1.21	603.77	+1.27	604.40	1.65	604.07	1.45
2-3	600.50	-1.91	599.28	-2.72	600.17	-2.58	599.9	-2.72
3-1	605.15	+2.74	605.36	+2.86	607.04	+4.29	605.5	3.88
3-2	603.95	+1.54	604.13	+1.63	604.52	+2.77	604.01	1.39
3-3	600.95	-1.46	100.98	-1.52	600.65	-2.10	600.59	-2.03
4-1	603.89	+1.48	605.3	+2.8	605.15	+2.4	604.4	1.78
4-2	597.56	-4.85	597.68	-4.82	597.35	-5.39	598.64	-3.98
4-3	602.81	+0.40	602.66	+0.16	602.60	-0.15	603.82	+1.20
(TH) AVG.	602.41		602.50		602.75		602.62	

* THIS VALUE IS THE INDIVIDUAL SCOOP READING MINUS THE AVERAGE READING OF ALL TWELVE I-HOT'S (FOR THAT DAY'S READINGS).

** PREFIX IS THE LOOP NUMBER. SUFFIX IS THE SCOOP NUMBER.

HNTPRESENT



GRADIENT ESTIMATE

$$\frac{\text{HIGHEST SCOOP READING - LOWEST SCOOP READING}}{\text{DISTANCE BETWEEN SCOOP CENTER}}$$

SCOOP BIAS ESTIMATE

- GRADIENT ESTIMATED FOR EACH HOT LEG.
- RESULTS:

	HIGH °F	LOW °F	GRADIENT (°F/INCH)
LOOP 1	+2.5	-7.4	.55
LOOP 2	+2.1	-2.7	.27
LOOP 3	+4.3	-2.1	.35
LOOP 4	+2.4	-5.4	.43
AVG			.4° F/IN.

- $T_{TOP\ HOLE} - T_{MIX}$ = DISTANCE X GRADIENT = 1°F
- TEMPERATURE BIAS FOR SCOOP:

  BEST ESTIMATE: [*] x 1°F = [*]

  CONSERVATIVE ESTIMATE [*] x 1°F = [*]

- LOOP BIAS: MATHEMATICAL SUM OF THREE INDIVIDUAL SCOOP BIAS DIVIDED BY THREE.
- CONSERVATIVELY ASSUME SCOOP BIASES ARE ALL IN THE SAME DIRECTION: LOOP BIAS EQUALS SCOOP BIAS.

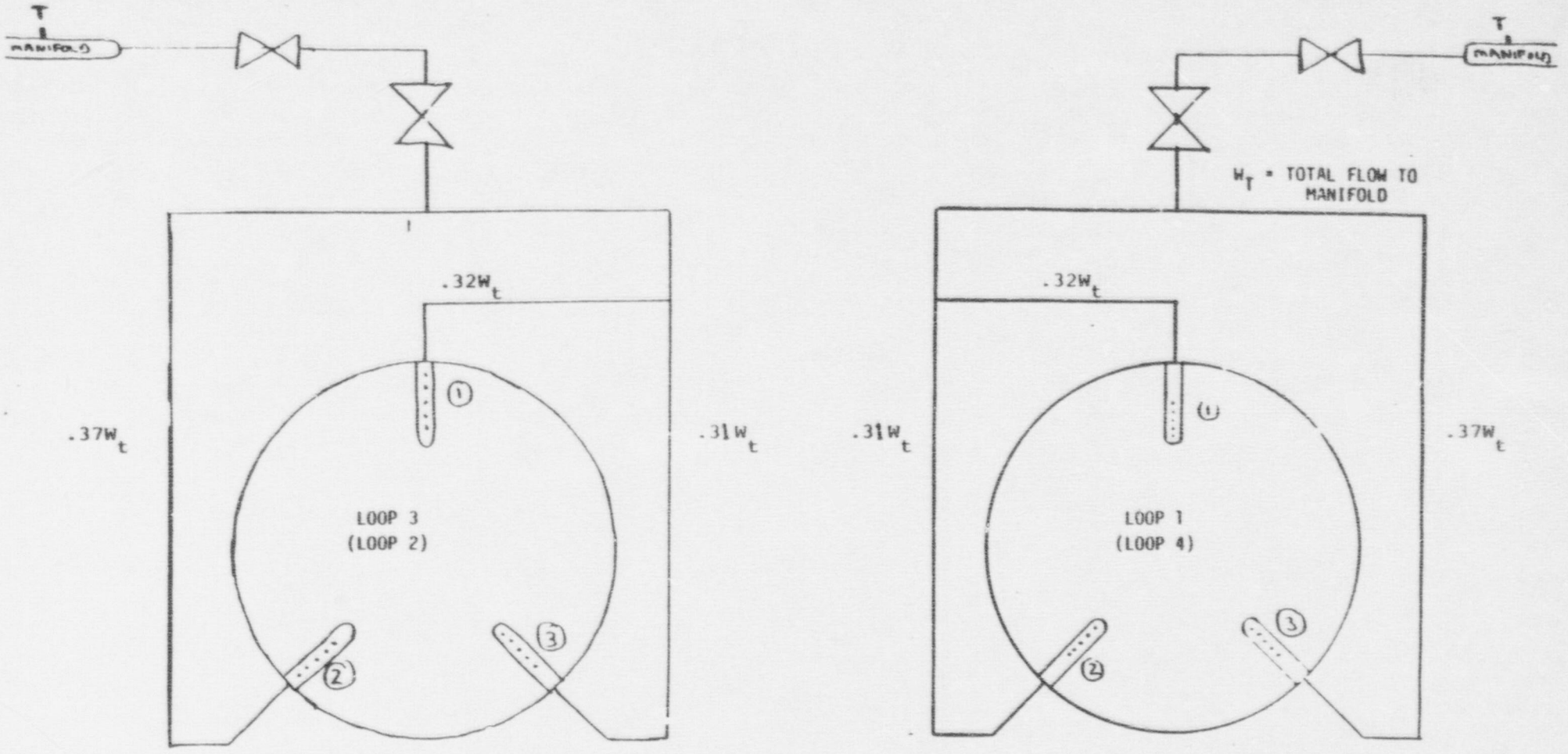
* Based on CE Proprietary information. Please refer to CE Report No. CEN-361-P submitted under Docket Nos. 50-272/50-311

HYDRAULIC BIAS

- CAUSED BY UNEQUAL EXTERNAL PIPING RUNS FROM SCOOPS TO COMMON JUNCTION POINT.
- ELIMINATED WITH REMOVAL OF BYPASS PIPING.
- TMANIFOLD FOR LOOP 1 OR 4 =

  0.32 (SCOOP 1) + 0.31 (SCOOP 2) + 0.37 (SCOOP 3)
- TMANIFOLD FOR LOOP 2 OR 3 =

  0.32 (SCOOP 1) + 0.37 (SCOOP 2) + 0.31 (SCOOP 3)
- T ACTUAL = $\frac{\text{SCOOP 1} + \text{SCOOP 2} + \text{SCOOP 3}}{3}$
- BIAS: TMANIFOLD - TACTUAL
- ASSUMPTION: POST-MOD, INDIVIDUAL SCOOP READINGS REFLECT PRE-MOD SCOOP TEMPERATURES.



HOT LEG COMPONENT ORIENTATION

(FLOW IS OUT OF THE PAGE)

HYDRAULIC BIAS RESULTS

° 3/21/88 READINGS:

	I MAN.		I ACT.		DELTA
LOOP 1	602.18	-	601.99	=	.19
LOOP 2	602.95	-	602.89	=	.06
LOOP 3	603.40	-	603.35	=	.05
LOOP 4	601.53	-	601.42	=	.11

° 6/8/88 READINGS:

	I MAN.		I ACT.		DELTA
LOOP 1	601.99	-	601.75	=	.24
LOOP 2	602.80	-	602.70	=	.10
LOOP 3	603.43	-	603.37	=	.06
LOOP 4	602.40	-	602.28	=	.12

° ON AN AVERAGE, THE HYDRAULIC BIAS WAS +0.12°F.
HIGHEST READING 0.24°F.

SUMMARY OF PROCESS MEASUREMENT ERROR

- PLANT DATA SHOWS NO NOTICEABLE CHANGE PRE-MOD TO POST-MOD.

- SALEM ESTIMATES OF SCOOP BIAS (ADDED) AND HYDRAULIC BIAS (ELIMINATED): COMPARABLE [*]°F VS .12°F.

- ESTIMATED SCOOP BIAS BASED ON INTERPOLATION AND EXTRAPOLATION OF GRADIENTS, BUT:

  - ASSUMES "CONSERVATIVE" BIAS FACTOR.
  - TAKES NO CREDIT FOR SCOOP BIASES CANCELING EACH OTHER.
  - USED GRADIENT FROM HIGHEST TO LOWEST SCOOP.

* Based on CE Proprietary information. Please refer to CE Report No. CEN-361-P submitted under Docket Nos. 50-272/50-311

ALARA

- Unit 1 done first
  - 122 man-rem
  - No major setbacks
  - Many small ones
  - Fuel fleas present
- Unit 2 done 1 year later
  - 52 man-rem
  - Lessons Learned applied
  - No surprises or setbacks
  - Fuel fleas present
- Demolition
  - Kept simple
  - Porta-Bands
  - No airborne problems
- Dose fields in area
  - Reductions met expectations
  - Reduced in half

ATTACHMENT 5

DOSE REDUCTION PREFORMANCE

LOCATION	PRE-MODIFICATION GENERAL AREA DOSE RATES mr/hr	POST-MODIFICATION GENERAL AREA DOSE RATES mr/hr
CATWALK AREA 104' EL.		
#11 RCP to #11 S/G	50 - 160	40 - 80
#13 RCP to #13 S/G	80 - 180	80 - 100
#12 RCP to #12 S/G	50 - 150	20 - 60
#14 RCP to #14 S/G	40 - 170	35 - 50

TABLE III

DOSE REDUCTION PERFORMANCE

LOCATION	PRE-MODIFICATION GENERAL AREA DOSE RATES mr/hr	POST-MODIFICATION GENERAL AREA DOSE RATES mr/hr
CATWALK AREA 104' el.		
#21 RCP to #21 S/G	50 - 120	10 - 22
#23 RCP to #21 S/G	50 - 100	16 - 30
#22 RCP to #22 S/G	30 - 80	6 - 25
#24 RCP to #24 S/G	25 - 100	6 - 20

LICENSING OF FUTURE CE PROJECTS

- TEMPERATURE MEASUREMENTS
- ACCURACY COMPARISONS
- SETPOINT METHODOLOGY

TEMPERATURE MEASUREMENT

- CE DESIGN RETAINS HOT LEG FLOW SAMPLING WHICH IS USED IN BYPASS LOOP SYSTEM TO ACCOUNT FOR FLOW STREAMING

- RETENTION OF FIFTEEN POINT FLOW SAMPLING BETTER ACCOMMODATES CHANGES IN HOT LEG TEMPERATURE PROFILE THAN THREE POINT (ONE IN EACH SCOOP) MEASUREMENT

PROCESS MEASUREMENT ACCURACY

- ACCURACY OF RTD'S IN REPLACEMENT SYSTEM IS BETTER THAN OR EQUAL TO ANY CURRENT BYPASS LOOP SYSTEM RTDS
- HAVING 3 PARALLEL PATH RTD'S AND LOW VOLTAGE AMPLIFIERS REDUCES THE T-HOT RTD ERROR OF THESE COMPONENTS BY $1/\sqrt{3}$ COMPARED TO THE SINGLE RTD AND LOW VOLTAGE AMPLIFIER IN THE BYPASS LOOP SYSTEM
- ELIMINATION OF BYPASS LOOP ELIMINATES HYDRAULIC BIAS
- ERROR DUE TO SCOOP BIAS IS COMPARABLE TO ERROR DUE TO HYDRAULIC BIAS IN BYPASS LOOP BASED ON SALEM SCOOP TEMPERATURE DATA
- COMPARISON OF HOT LEG TEMPERATURES BEFORE AND AFTER MODIFICATION AT SALEM UNITS 1 AND 2 SHOW GOOD AGREEMENT

ERROR COMPARISON - SALEM UNIT 1

- SCOOP BIAS ERROR [*] ^{o}F (ADDED)
  ASSUMPTIONS:
  1. ALL 3 SCOOP BIASES ARE ASSUMED TO BE IN THE SAME DIRECTION WHICH IS WORST CASE.
  2. GRADIENT BASED ON SALEM TEMPERATURE DATA
  3. BEST ESTIMATE IS SIGNIFICANTLY LESS [*] ^{o}F

- HYDRAULIC BIAS ERROR .12^{o}F (ELIMINATED)
  ASSUMPTIONS:
  1. FLOWS FROM EACH SCOOP CALCULATED FROM PIPING CONFIGURATION
  2. POST MOD SCOOP TEMPERATURE DATA USED TO EVALUATE PRE MOD HYDRAULIC BIAS

- ERROR REDUCTION FROM 3 PARALLEL RTDs .17^{o}F (REDUCTION)
  ASSUMPTIONS: WEED RTD ACCURACY OF 0.4^{o}F MULTIPLIED BY $1/\sqrt{3}$ TO OBTAIN ERROR FOR 3 PARALLEL RTDs. REDUCTION IS LARGER IF BYPASS RTD ERROR IS LARGER. ALSO, PSE&G USED LARGER ERROR FOR WEED RTD IN SALEM SETPOINT ANALYSIS.

- ERROR REDUCTION FROM 3 PARALLEL MV/I's WOULD FURTHER REDUCE ERROR

- NET RESULT USING CONSERVATIVE ESTIMATES IS LOWER ERROR IN NEW SYSTEM.

* Based on CE Proprietary information. Refer to CE Report No. CEN-361-P submitted under Docket Nos. 50-272/50-311

TEMPERATURE MEASUREMENT ACCURACIES

	SOURCE OF ERROR	IMPACT WITH CE REPLACEMENT SYSTEM
HOT LEG		
	• RTD ACCURACY	• EQUAL OR BETTER
	• PROCESS MEASUREMENT	• SCOOP BIAS ERROR INTRODUCED IS COMPARABLE TO HYDRAULIC BIAS ERROR ELIMINATED
	• RACK ERROR	• THREE PARALLEL RTDS AND MV/I'S REDUCE THE ERROR COMPARED TO SINGLE RTD AND MV/I
		• ADDED SUMMATOR HAS NO IMPACT
COLD LEG		
	• RTD ACCURACY	• EQUAL OR BETTER
	• PROCESS MEASUREMENT	• NOT AFFECTED
	• RACK ERROR	• NO CHANGE IN ELECTRONICS

SETPOINT METHODOLOGY

- IF CE CAN DEMONSTRATE THAT NEW SYSTEM IS MORE ACCURATE THAN OLD SYSTEM THEN EXISTING SETPOINT ANALYSIS REMAINS BOUNDING

- PSE&G WAS REQUIRED TO HAVE SETPOINT ANALYSIS REDONE DUE TO CHANGE IN WESTINGHOUSE METHODOLOGY SINCE LAST ANALYSIS

SETPOINT METHODOLOGY DILEMMA

- POTENTIAL SOLUTIONS
  - OPTION 1: COMBUSTION ENGINEERING GENERATES NEW SETPOINT ANALYSIS
  - OPTION 2: UTILITY GENERATES OWN TEMPERATURE SET POINT
  - OPTION 3: WESTINGHOUSE GENERATES NEW SETPOINT STUDY
  - OPTION 4: CE REPORT DEMONSTRATES EXISTING SETPOINT ANALYSIS BOUNDING

CE GENERATE SETPOINT ANALYSIS

- OPTION 1: COMBUSTION ENGINEERING WOULD GENERATE A NEW SETPOINT STUDY FOR TEMPERATURE RELATED CHANNELS

  - WOULD RESULT IN "MIXED BAG" SINCE CE WOULD NOT BE REDOING ENTIRE ANALYSIS

  - COULD RESULT IN SAME PROBLEMS LATER ON BUT IN REVERSE (I.E. WESTINGHOUSE DOING WORK ON SYSTEM COVERED BY CE ANALYSIS)

  - PRACTICAL CONSIDERATIONS
    - MAJOR FINANCIAL COMMITMENT FOR CE
    - SIGNIFICANT RISK FOR UTILITY
    - MAJOR REVIEW EFFORT FOR NRC

UTILITY GENERATES SETPOINT ANALYSIS

- OPTION 2: UTILITY COULD GENERATE SETPOINT STUDY FOR TEMPERATURE RELATED CHANNELS

  - WOULD AGAIN RESULT IN "MIXED BAG" UNLESS UTILITY CONTROLLED ENTIRE SETPOINT ANALYSIS

  - MOST UTILITIES HAVE RELIED ON NSSS EXPERTISE IN THIS AREA

WESTINGHOUSE GENERATES NEW SETPOINT STUDY

- OPTION 3: WESTINGHOUSE WOULD GENERATE A NEW SETPOINT STUDY FOR TEMPERATURE RELATED CHANNELS
  - MAINTAINS STANDARD PRODUCT
  - RECENT EXPERIENCE INDICATED PRICE AND SCHEDULE QUOTED FOR WESTINGHOUSE LICENSING SUPPORT OF CE PROJECT WERE UNACCEPTABLE TO UTILITY
  - CE FORCED OUT OF RTD BYPASS BUSINESS

CE REPORT DOCUMENTS IMPROVED ACCURACY

- OPTION 4: CE WOULD PROVIDE A REPORT DEMONSTRATING IMPROVED T-HOT ACCURACY
  - EXISTING SETPOINT ANALYSIS REMAINS BOUNDING
  - UTILITY AND NRC CAN DOCUMENT NO USQ
  - UTILITY CAN UPDATE SETPOINT STUDY AT CONVENIENT TIME AND/OR IN CONJUNCTION WITH FUTURE WESTINGHOUSE WORK

SUMMARY - SETPOINT METHODOLOGY

- OPTION 1: CE GENERATE SETPOINT STUDY
  - NOT PRACTICAL, UNDESIRABLE CONSEQUENCES
- OPTION 2: UTILITY GENERATE SETPOINT STUDY
  - PRACTICAL IF UTILITY CURRENTLY RESPONSIBLE FOR SETPOINT ANALYSIS, OTHERWISE PROBLEMS SIMILAR TO OPTION 1
- OPTION 3: WESTINGHOUSE GENERATE SETPOINT STUDY
  - MAINTAINS STANDARD PRODUCT BUT EFFECTIVELY FORCES CE OUT OF RTD BYPASS ELIMINATION BUSINESS
- OPTION 4: CE DOCUMENT ACCURACY, METHODOLOGY UPDATE DEFERRED
  - COMPETITION RETAINED, PLANT SAFETY DOCUMENTED

BENEFITS OF CE PRESENCE IN RTD BYPASS BUSINESS

- CE DESIGN PROVIDES SOME ADVANTAGES OVER WESTINGHOUSE DESIGN
  - SCOOP MIXING RETAINED - BETTER ABLE TO ACCOMMODATE CHANGES IN FLOW STREAMING OVER TIME
  - FSAR DESIGN BASIS RESPONSE TIME UNCHANGED - RESPONSE TIME FOR WESTINGHOUSE MODIFICATION AT MILLSTONE 3 CHANGED FROM 6 SECONDS TO 7 SECONDS
- CE'S IDEAS AND COMPETITIVE POSITION ON THE MODIFICATION HAVE HAD POSITIVE BENEFITS TO UTILITIES
  - REDUCED DRAIN DOWN TIME
  - BETTER RESPONSE TIME
  - LOWER PRICE
  - SIMPLER SYSTEM DESIGN

LICENSING OF FUTURE CE RTD PROJECTS

CE PROPOSES THE FOLLOWING LICENSING ACTIVITY FOR FUTURE CE RTD PROJECTS

- BASED ON SALEM TEMPERATURE PROFILE DATA CE WILL DEMONSTRATE THAT HYDRAULIC BIAS IN BYPASS LOOP IS COMPARABLE TO SCOOP BIAS IN REPLACEMENT SYSTEM.

- CE WILL DEMONSTRATE THAT ACCURACIES OF REPLACEMENT SYSTEM ARE IMPROVED COMPARED TO BYPASS SYSTEM. EXISTING SETPOINT ANALYSIS THEREFORE REMAINS BOUNDING

- UTILITY CAN HAVE SETPOINT ANALYSIS UPDATED AT CONVENIENT TIME, IF REQUIRED, BUT NOT AS A CONDITION FOR LICENSE CHANGE APPROVAL OF RTD BYPASS ELIMINATION

- IF ALL THE ABOVE CONDITIONS CAN BE MET THEN WESTINGHOUSE INVOLVEMENT NOT REQUIRED FOR LICENSING CE RTD BYPASS ELIMINATION PROJECT

Attachment 2

ATTENDEES

SALEM RTD BYPASS MOD. RESULTS

3/13/89

John J. Foy (Joe)	CE	Regional Service Manager
Robert B. Swartzwelder	PSE &G	Licensing
Joginder S. Ahluwalia	C-E	I & CE
John T. McGarry	CE	Mech.
Harold N. Trenka	PSE&G	Project Management
Charles B. Brinkman	C-E	Mgr. Washington Nuclear Operations
Robert P. Letendre	C-E	T&H
James Stone	NRR	PD 1-2
Jerry Mauck	NRR	I&C
Sang Rhow	NRR	I&C
Mike McCoy	NRR	SRXB