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New York Power Authority

John C. Brons
Senior Vice President
Nuclear Generation

August 22, 1985
IPN-85-44

U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Washington, D.C. 20555

Attention: Mr. Steven A. Varga, Chief
Operating Reactors Branch No. 1
Division of Licensing

Subject: Indian Point 3 Nuclear Power Plant
Docket No. 50-286
Steam Generator Eddy Current Testing Results

Dear Sir:

During the course of the ongoing Cycle 4/5 refueling outage, 100% of the steam generator tubes were eddy current tested. The eddy current testing and other steam generator inspection results were presented to members of your staff during an August 20, 1985 meeting. This letter serves to transmit the contents of that presentation.

Should you or your staff have any questions regarding this matter, please contact Mr. P. Kokolakis of my staff.

Very truly yours,

for J. Bullen

John C. Brons
Senior Vice President
Nuclear Generation

cc: Resident Inspector's Office
Indian Point Unit 3
U.S. Nuclear Regulatory Commission
P.O. Box 66
Buchanan, NY 10511

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INDIAN POINT 3
RESULTS OF STEAM GENERATOR INSPECTIONS
AGENDA

AUGUST 20, 1985

I. PURPOSE OF THE MEETING

II. EDDY CURRENT INSPECTION RESULTS

III. TUBE PULL RESULTS

IV. STEAM GENERATOR REPAIRS

V. CHEMISTRY SUMMARY

VI. CONCLUSIONS

INDIAN POINT 3

MEETING OBJECTIVES

- TO APPRISE NRC OF THE RESULTS OF CYCLE 4/5 STEAM GENERATOR INSPECTIONS AT INDIAN POINT 3.
- TO PROVIDE SUFFICIENT INFORMATION FOR NRC TO APPROVE UNIT STARTUP FOR CYCLE 5 OPERATIONS.

INDIAN POINT 3
OPERATING SUMMARY

- o RETURNED TO SERVICE FROM MIDCYCLE OUTAGE ON NOVEMBER 27, 1984.

- o OPERATED VERY RELIABLY UNTIL SCHEDULED UNIT SHUTDOWN FOR REFUELING ON JUNE 7, 1985.

  - UNIT OPERATED AT 98.7% AVAILABILITY

  - AT THE TIME OF THE REFUELING OUTAGE SHUTDOWN, THE UNIT WAS ON A RUN OF 79 DAYS OF CONTINUOUS OPERATION

- o ALL OF CYCLE 4 OPERATIONS (JAN. 84 - JUNE 85) WERE CONDUCTED WITH ZERO PRIMARY-TO-SECONDARY LEAKAGE.

INDIAN POINT 3

ECT PROGRAM

- 100% INSPECTION OF ALL TUBES AND SLEEVES TO SECOND TUBE SUPPORT PLATE, BOTH LEGS OF EACH STEAM GENERATOR.
- ABOUT 25% OF THE TUBES IN #33 STEAM GENERATOR TESTED FULL LENGTH FROM HOT LEG SIDE.
- GAUGING PROGRAM OF 800 TUBES ON HOT LEGS OF BOTH #32 AND #34 STEAM GENERATOR UP TO #6 TUBE SUPPORT PLATE.
- ALL TUBES INSPECTED WITH .740" NARROW FIELD, BOBBIN TYPE PROBE WHERE POSSIBLE.

INDIAN POINT 3
STEAM GENERATOR INSPECTION SUMMARY
COLD LEG SIDES

	31	32	33	34	TOTAL
NUMBER OF TUBES TESTED	1993	2316	2168	2318	8795
NUMBER OF SLEEVES TESTED	763	649	848	698	2958
NUMBER OF TUBES WITH INDICATIONS					
< 40%	79	82	74	106	341
≥ 40%	89	106	94	91	380

- NO INDICATIONS FOUND ON ANY SLEEVES
- SOME SMALL VOLUME (PIT) INDICATIONS CONTINUE TO BE BELOW THE LEVEL NEEDED FOR RELIABLE ECT DETECTION.

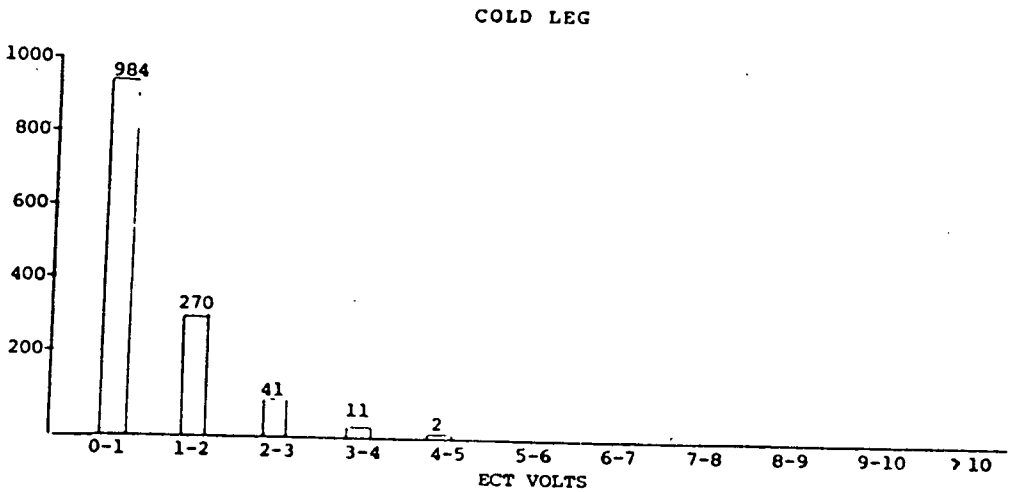
INDIAN POINT 3
STEAM GENERATOR INSPECTION SUMMARY
HOT LEG SIDES

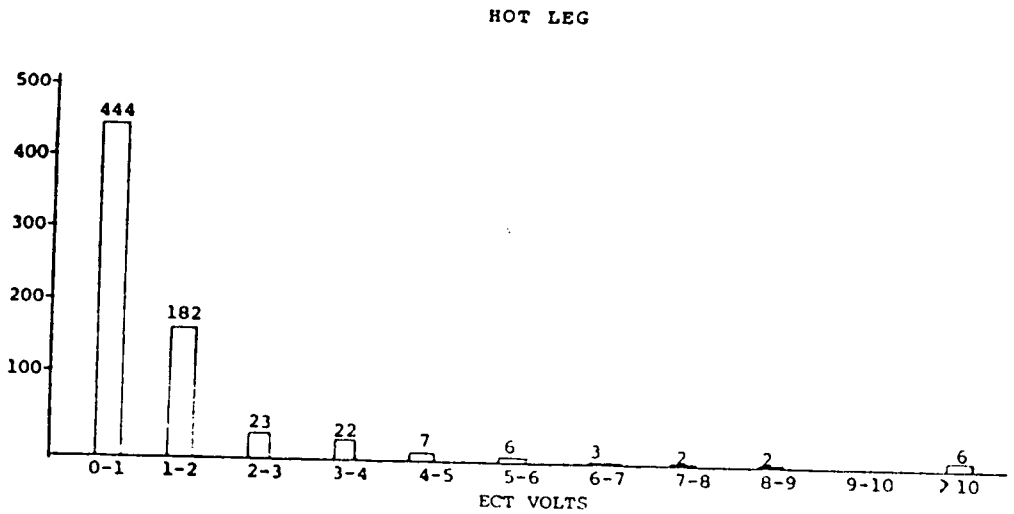
	31	32	33	34	TOTAL
NUMBER OF TUBES TESTED	2756	2965	3016	3016	11,753
NUMBER OF TUBES WITH INDICATIONS					
<40%	109	58	71	48	286
≥40%	42	39	69	27	177
NUMBER OF TUBES WITH PLUGGABLE RESTRICTIONS	0	1	1	2	4

- MOST HOT LEG INDICATIONS WERE NOT DETECTED DURING 1984 MIDCYCLE INSPECTION.
  - FOR SMALL VOLTAGE INDICATIONS THIS IS PROBABLY DUE TO A LARGER PROBE SIZE USED FOR THE LATEST INSPECTION. THIS CHANGE COULD ACCOUNT FOR 90% OF THE HOT LEG INDICATIONS.
  - FOR LARGE VOLUME INDICATIONS A HIGH RATE OF CORROSION AFFECTING A FEW TUBES (6) IS EVIDENT.

INDIAN POINT 3
INDICATION VOLTAGES

- AT INDIAN POINT 3, THE FOLLOWING DISTRIBUTION OF DEFECTS WERE LOCATED:





INDIAN POINT 3

ESTIMATE OF TUBE DEGRADATION GROWTH RATES

- DEGRADATION RATE ON THE COLD LEG CONTINUES TO BE SLOW. AVERAGE GROWTH WAS 4% OVER THE 6 MONTH OPERATING PERIOD FOR PRE-EXISTING FLAWS. (SAMPLE OF 580 TUBES)

- DEGRADATION RATE ON THE HOT LEG FOR PRE-EXISTING FLAWS WAS ALSO SLOW. AVERAGE GROWTH WAS 6% OVER THE 6 MONTH OPERATING PERIOD. (SAMPLE OF 45 TUBES)

- NEW FLAWS ON THE HOT LEG HAVE AN AVERAGE DEGRADATION OF 34% THROUGH WALL. GROWTH RATE FOR THESE FLAWS NEEDS TO BE ASCERTAINED AT NEXT INSPECTION ALTHOUGH IT IS NOT EXPECTED TO DIFFER SUBSTANTIALLY FROM THOSE GIVEN ABOVE SINCE PITTING IS THE PREDOMINANT CORROSION MECHANISM.

INDIAN POINT 3

STEAM GENERATOR TUBE PULL

- OBJECTIVE WAS TO PULL HOT LEG TUBES WITH INDICATIONS OF SIZES AND AMPLITUDES THAT BOUND THE DEGRADATION OBSERVED ON THE HOT LEG.

- TWO TUBES WERE SELECTED AS CANDIDATES WITH THE FOLLOWING FIELD ECT DATA:

R 30 C 46

81%	12.9" ATS	22.6V.

R 15 C 47

30%	6.0" ATS	.76V.
62%	5.6" ATS	5.5 V.
52%	5.2" ATS	3.7 V.
77%	4.9" ATS	13.8 V.

- THESE TUBES HAVE INDICATIONS WHICH ARE NOT TYPICAL OF MOST HOT LEG TUBES.

INDIAN POINT 3

DESTRUCTIVE ANALYSIS FINDINGS

- o PRINCIPAL CORROSION MECHANISM ON THE TUBES IS PITTING.
- o ONE LARGER INDICATION ON EACH TUBE IS DUE TO WASTAGE.
- o NO CRACKING WAS FOUND.
- o CHARACTERISTICS OF CORROSION DEPOSITS INCLUDE
  - CHROMIUM RICH OXIDE
  - SULFUR
  - COPPER
  - CHLORIDE NOT IDENTIFIED

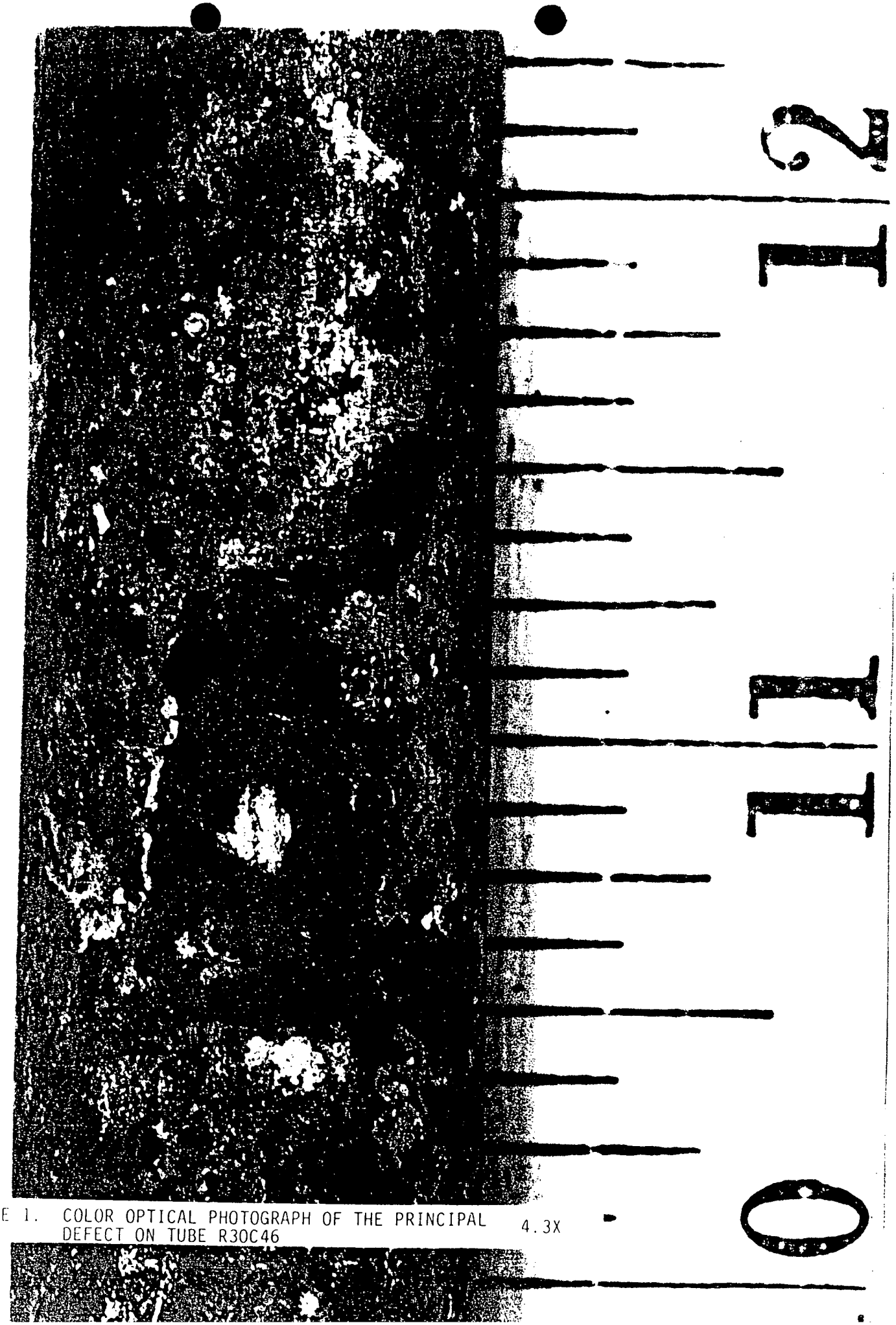
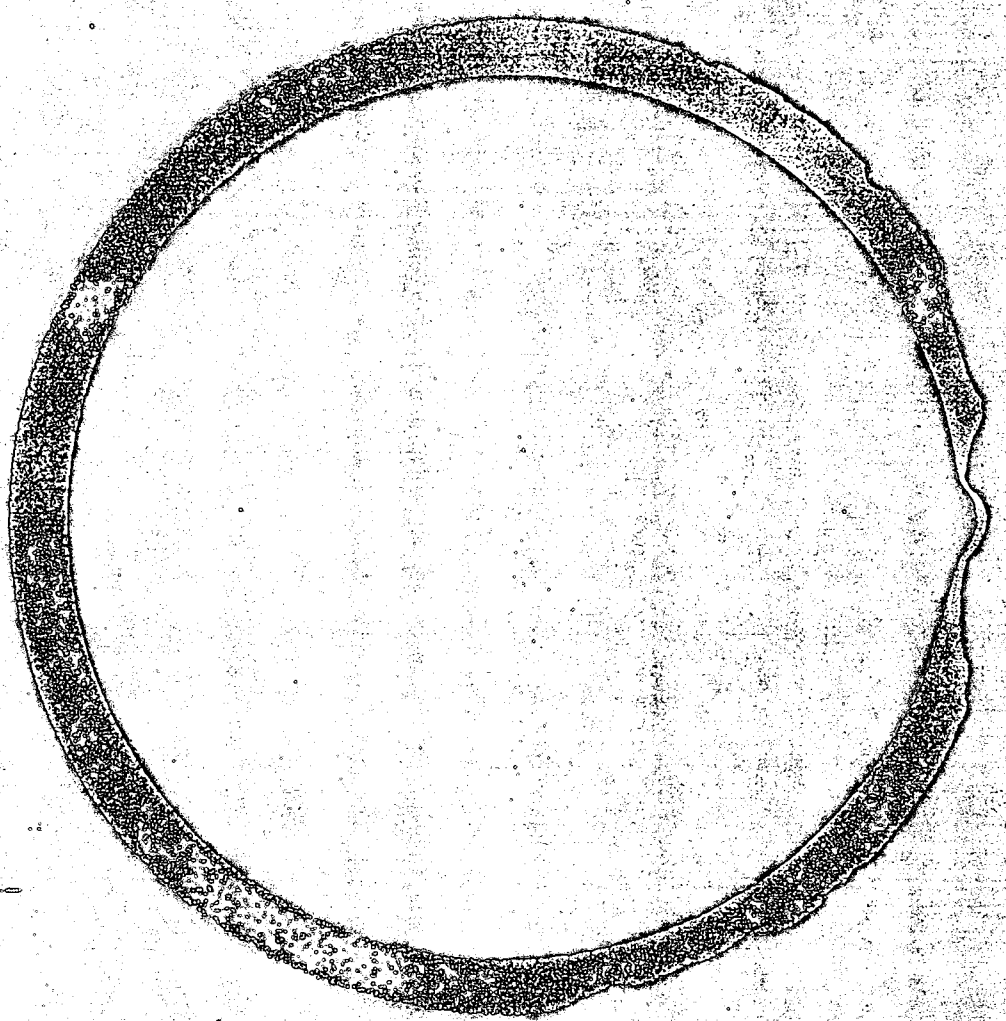


FIGURE 1. COLOR OPTICAL PHOTOGRAPH OF THE PRINCIPAL DEFECT ON TUBE R30C46 4.3X



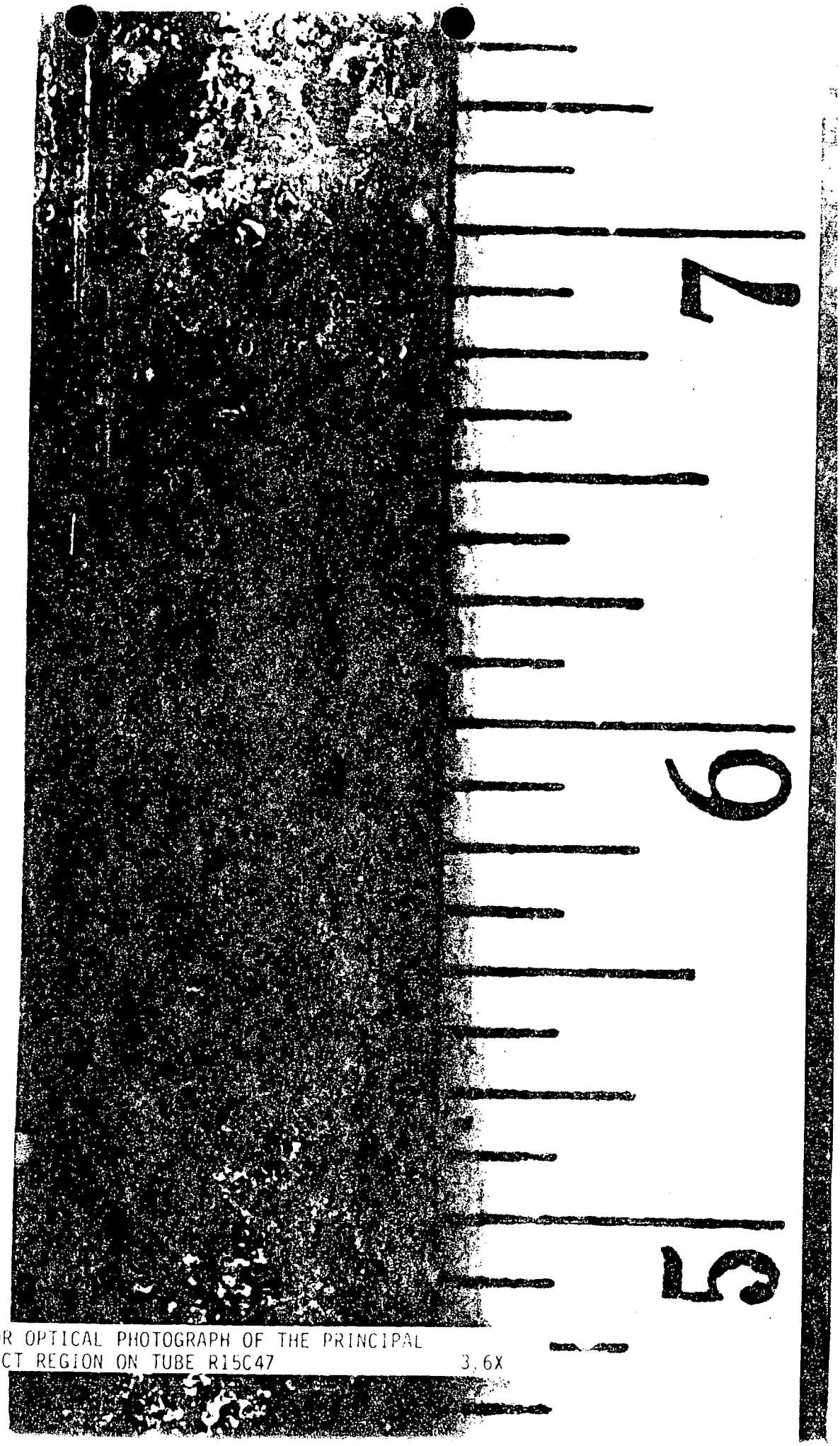
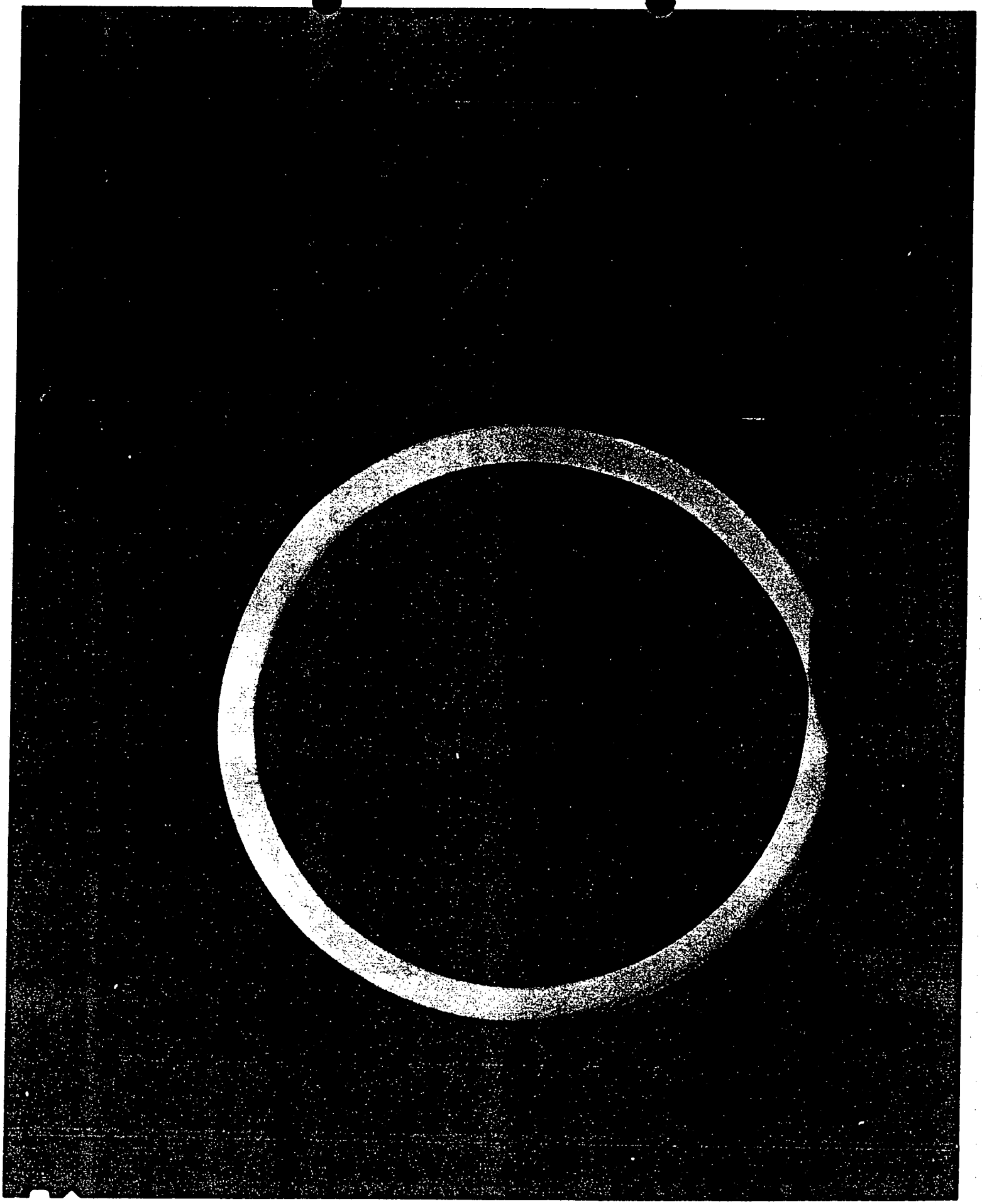


FIGURE 2. COLOR OPTICAL PHOTOGRAPH OF THE PRINCIPAL DEFECT REGION ON TUBE R15C47 3.6X



INDIAN POINT 3
TUBE PULL SUMMARY

- PREDOMINANT CORROSION MECHANISM ON THE TUBES IS PITTING.
- LARGE VOLTAGE ECT SIGNALS PROVED TO BE WASTAGE.
- CAUSE OF THE WASTAGE IS NOT KNOWN: MAY BE DUE TO CHLORIDE AND/OR SULFATE CONCENTRATING BELOW TUBE SCALE.

INDIAN POINT 3

SG TUBE INSPECTION CONCLUSIONS

- SG TUBE DENTING CONTINUES TO BE UNDER CONTROL. ONLY FOUR TUBES REQUIRED PLUGGING DUE TO DENTING.

- PITTING REMAINS THE PRIMARY CORROSION MECHANISM AT IP-3. ITS DETECTABILITY AND GROWTH RATE IS SUCH THAT CORRECTIVE ACTIONS CAN BE TAKEN IN TIME TO PREVENT PRIMARY-TO-SECONDARY LEAKAGE.

- SOME LOCAL WASTAGE HAS OCCURRED ON A FEW HOT LEG TUBES. THE CAUSE OF THIS PHENOMENON IS STILL UNDER INVESTIGATION.

INDIAN POINT 3

TUBE SLEEVING AND PLUGGING SUMMARY

	31	32	33	34	TOTAL
NUMBER OF TUBES SLEEVED	129	169	156	181	635
NUMBER OF TUBES PLUGGED	66	52	75	53	246
EQUIVALENT LEVEL OF TUBE PLUGGING	18.9%	11.9%	11.3%	10.4%	13.1%

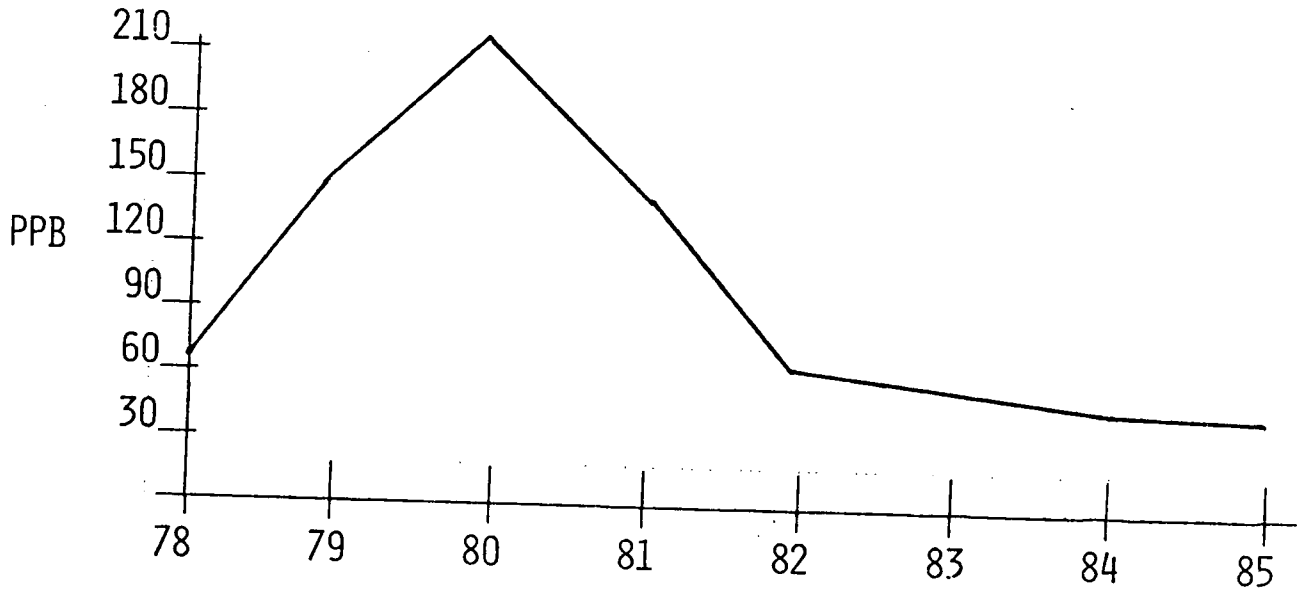
- SLEEVING WAS PERFORMED ON THE COLD LEG IN ALL TUBES THAT HAD INDICATIONS $\geq$20% WHERE POSSIBLE. ALL TUBES WHICH WERE NOT SLEEVED WERE PLUGGED WHEN INDICATIONS WERE $\geq$ 40%.
- SLEEVING WAS PERFORMED IN A SIMILAR MANNER AS IN 1982; THIS REPAIR METHOD WAS PREVIOUSLY APPROVED BY NRC AT THAT TIME.
- PRESENT APPROVED SG TUBE PLUGGING LIMIT IS 24% THEREFORE, THE EXTENT OF TUBE PLUGGING IS IN ACCORDANCE WITH THE PRESENT IP-3 TECHNICAL SPECIFICATIONS.

INDIAN POINT 3
STEAM GENERATOR SLEEVING ALARA

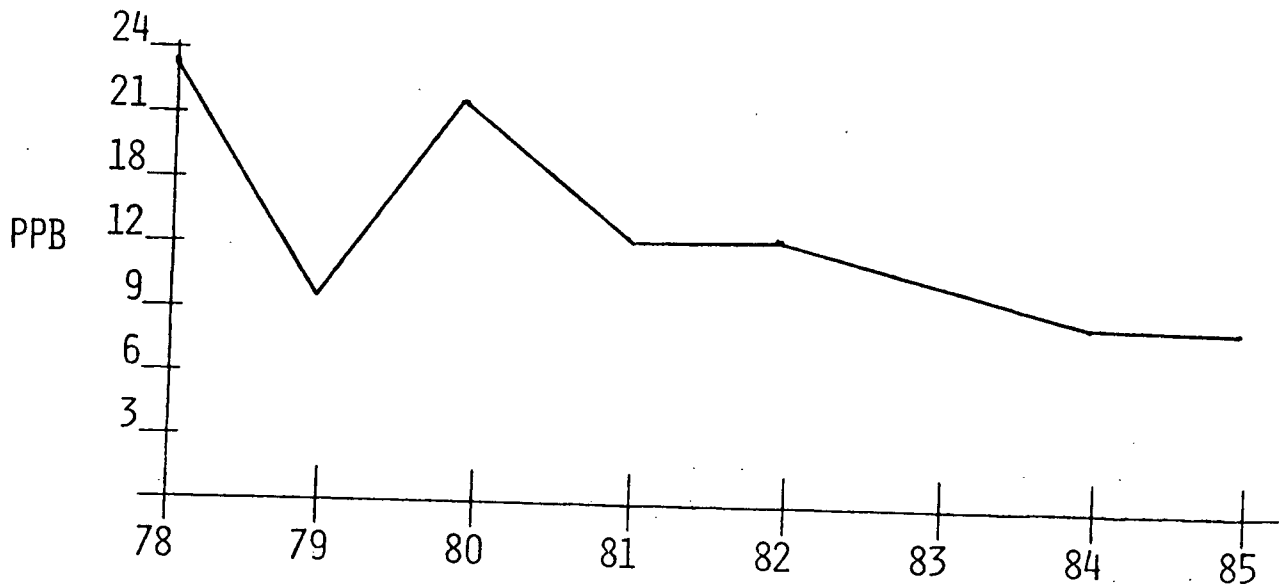
- SG SLEEVING PROGRAM UTILIZED TWO MAJOR METHODS OF REDUCING RADIATION EXPOSURE:
  - CHEMICAL DECONTAMINATION OF SG CHANNELHEADS
  - LEAD SHIELDING OF NOZZLES AND DIVIDER PLATE
- AVERAGE COLD LEG CHANNELHEAD RADIATION LEVELS REDUCED FROM 7.5 R/HR TO 1 R/HR.
- ESTIMATED SLEEVING PROGRAM MANREM WAS 250 MANREM. ACTUAL WAS 110 MANREM.

INDIAN POINT 3
NEW YORK POWER AUTHORITY
CHEMISTRY HISTORY

SG BLOWDOWN CHLORIDES



CONDENSATE PUMP DISCHARGE DISSOLVED OXYGEN



INDIAN POINT 3
CHEMISTRY SUMMARY

- SECONDARY WATER CHEMISTRY CONTINUED TO IMPROVE IN MOST AREAS.

- INSTANCES OF CONDENSER LEAKAGE HOWEVER, CONTINUED TO BE A PROBLEM.

- MODIFICATIONS BEING COMPLETED AT THIS REFUELING OUTAGE SHOULD RESULT IN SUBSTANTIAL IMPROVEMENT IN SECONDARY WATER CHEMISTRY BY:

  - REDUCING THE LEVEL OF IMPURITIES

  - REDUCING THE VARIABILITY OF SECONDARY CHEMISTRY

INDIAN POINT 3
IMPROVEMENTS MADE DURING
CYCLE 4/5 REFUELING OUTAGE
TOWARD IMPROVED CHEMISTRY

- CONDENSER REPLACED WITH TITANIUM TUBES AND IMPROVED DEAERATING CAPABILITIES.

- COPPER BEARING HIGH PRESSURE FEEDWATER HEATERS REPLACED WITH STAINLESS STEEL HEATERS.

- IMPROVEMENT IN MAKEUP WATER DEAERATOR AIR REMOVAL CAPABILITIES.

- FURTHER IMPROVEMENTS TO CONDENSATE STARTUP CLEANUP LOOP.

- USE OF COMBUSTION ENGINEERING'S PERIPHERAL STEAM GENERATOR SLUDGE LANCING PROCESS FOR IMPROVED SLUDGE REMOVAL.

INDIAN POINT 3

CYCLE 5 PLANT OPERATION

- CONDUCT MIDCYCLE STEAM GENERATOR EDDY CURRENT INSPECTION OF 100% OF ALL FOUR STEAM GENERATOR HOT LEGS THROUGH THE SECOND SUPPORT PLATE WITHIN 6 MONTHS OF POWER OPERATION.

- REPORT TO NRC ON THE RESULTS OF THAT INSPECTION WILL BE PROVIDED IN ACCORDANCE WITH IP-3 TECHNICAL SPECIFICATIONS.

- REPORT ON PROGRESS IN MEETING THE STEAM GENERATOR OWNERS GROUP WATER CHEMISTRY GUIDELINES AFTER A "BREAK-IN" PERIOD WITH THE IMPROVED BALANCE OF PLANT EQUIPMENT INSTALLED DURING THE CURRENT REFUELING OUTAGE.