

DUKE POWER COMPANY  
MCGUIRE NUCLEAR STATION - UNIT 1  
DUKE-NRC-W MEETING  
APRIL 29, 1982

INTRODUCTION

REVIEW OF MCGUIRE OPERATING HISTORY

SUMMARY OF PROPOSED OPERATING PLAN

JUSTIFICATION FOR PROPOSED OPERATING PLAN

- SIZE OF EXISTING DEFECTS (VOLUME/DEPTH)
- MAXIMUM ALLOWABLE DEFECT SIZE
- ACCELEROMETER RESULTS

ASSESSMENT OF EFFECTS OF PROPOSED OPERATING PLAN

- WEAR CONSIDERATIONS
- SAFETY CONSIDERATIONS

OPERATING OBJECTIVES PRIOR TO MODIFICATION

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## OPERATING/LICENSING SUMMARY

OCTOBER 30, 1981	DUKE INFORMED NRC OF RINGHALS TUBE LEAK
NOVEMBER 16, 1981	McGUIRE - SHUTDOWN FOR ECT NO INDICATIONS 'A' S/G (MAX. POWER 50%)
NOVEMBER 20, 1981	DUKE - NRC - <u>W</u> MEETING DISCUSS PLANS FOR McGUIRE
DECEMBER 2, 1981	MNS - SHUTDOWN FOR ECT NO INDICATIONS 'A' S/G (MAX. POWER 75%)
DECEMBER 29, 1981	DUKE DESCRIBED PLANS FOR OPERATION OF McGUIRE (OPERATION FOR SHORT PERIOD UP TO 100% POWER)
JANUARY 2, 1982	McGUIRE RETURNS TO POWER
JANUARY 15, 1982	TELECON DUKE - NRC - <u>W</u> UPDATED NRC ON STATUS
JANUARY 26, 1982	DUKE PROVIDED BASIS FOR OPERATION AT 50% TO 2/15/82
JANUARY 29, 1982	SUBMITTAL OF UPDATE ON OVERALL PROGRAM
FEBRUARY 12, 1982 FEBRUARY 18, 1982	DUKE REQUESTED EXTENSION TO OPERATE UNTIL 2/26/82

## OPERATING/LICENSING SUMMARY

FEBRUARY 22, 1982	NRC AUTHORIZATION TO OPERATE UNTIL 2/26/82
FEBRUARY 26, 1982	McGUIRE SHUTDOWN FOR ECT
MARCH 4, 1982	MEETING AT McGUIRE TO REVIEW PLANS FOR INSTRUMENTATION AND ECT
MARCH 6, 1982	ECT OF ALL 4 S/Gs 4 INDICATIONS IN 'C' S/G NOTED
MARCH 12, 1982	VISIT TO WESTINGHOUSE FACILITIES BY NRC - REVIEWED VARIOUS R&D PROJECTS
MARCH 16, 1982	DUKE JUSTIFICATION SUBMITTED FOR CONTINUED OPERATION AT 50% AND 75%
MARCH 19, 1982	McGUIRE RETURNED TO 50% POWER
APRIL 1, 1982	NRC EVALUATION OF DUKE PROPOSAL - 1500 HOURS AT 50%
APRIL 29, 1982	MEETING TO DISCUSS EXTENDING OPERATION / 75% OPERATION

POWER HISTORY (HOURS - 4/29/82)

<u>UNIT</u>	<u>≥ 50%</u>	<u>≥ 75%</u>	<u>≥ 90%</u>	<u>≥ 95%</u>
McGUIRE 1	2400	324	72	23
RINGHALS 3	3760	2180	1640	1375
ALMARAZ 1	3588	1551	1456	537

McGUIRE 1 - CURRENTLY OPERATING AT 50% POWER

HIGHLIGHT SUMMARYMcGUIRE UNIT 1

- NRC COMMENTS ON MARCH 16, 1982, SUBMITTAL IDENTIFIED FOUR MAJOR CONCERNS:

- UNCERTAINTY IN THE ESTIMATE OF THE VOLUME OF LARGEST EXISTING DEFECT
- INSUFFICIENT JUSTIFICATION FOR UPPER BOUND OF OF ALLOWABLE WEAR
- RESULTS OF DATA ANALYSIS FROM NEW TUBE VIBRATION MEASURING INSTRUMENTS
- UNCERTAINTY IN TUBE WEAR RATES FOR POWER LEVELS ABOVE 50 PERCENT

ADDITIONAL DATA TO SUPPORT PREVIOUS POSITION IS NOW AVAILABLE

- TWO MORE REMOVED TUBES HAVE BEEN EXAMINED
- DATA FROM TUBE VIBRATION MONITORING INSTRUMENTS HAS BEEN ANALYZED
- WEAR RATE ESTIMATES HAVE BEEN REEVALUATED
- ALMARAZ UNIT HAS RECEIVED A NEW STEAM GENERATOR INSPECTION

## ESTIMATE OF MAXIMUM EXISTING DEFECT SIZE

- PREVIOUS INSPECTION OF McGUIRE LOCATED FOUR TUBE WEAR DEFECTS
- LARGEST OF THESE DEFECTS IS MUCH TOO SMALL TO SIZE ACCURATELY
- SEVERAL METHODS USED TO ESTIMATE DEFECT VOLUME:
  - COMPARISON WITH EDDY CURRENT SIGNALS FROM LABORATORY PRODUCED DEFECTS
  - COMPARISON WITH EDDY CURRENT SIGNALS FROM FIELD DEFECTS
  - MEASUREMENT OF DEFECT GEOMETRY AND COMPARISON WITH REMOVED TUBES

UPPER BOUND ON EXISTING LARGEST DEFECT:

$$\text{VOLUME} = 4.0 \times 10^{-4} \text{ CUBIC INCHES}$$

BEST ESTIMATE OF DEFECT VOLUME IS LESS THAN  $1.5 \times 10^{-4}$  CUBIC INCHES

## MAXIMUM ALLOWABLE DEFECT SIZE

GOAL IS TO ESTABLISH ALLOWABLE ADDITIONAL WEAR BETWEEN STEAM GENERATOR INSPECTIONS

- PREDICTABLE RELATIONSHIP BETWEEN VOLUME AND DEPTH OF WEAR (SEE FIGURE 1)
- LARGE INCREASE IN VOLUME REQUIRED TO CREATE SIGNIFICANT DEPTH INCREASE
- VOLUMETRIC WEAR IS PROPORTIONAL TO TIME
- RECENT EDDY CURRENT EXAMINATION OF ALMARAZ INDICATES AVERAGE STEAM GENERATOR WEAR MUCH LOWER THAN PREVIOUSLY ESTIMATED

MAXIMUM ALLOWABLE DEFECT DEPTH ESTABLISHED AS 10 MILS, OR 23 PER CENT THROUGH WALL.

- NO LONG TERM EFFECT ON STEAM GENERATOR INTEGRITY
- CONSERVATIVE UPPER BOUND - ACTUAL WEAR EXPECTED TO BE MUCH LOWER

## TUBE VIBRATION MEASUREMENT PROGRAM

- DURING MARCH, 1982, ACCELEROMETERS INSTALLED IN TWO FRONT ROW TUBES AT MCGUIRE (FIGURES 2 AND 3)
- TUBE VIBRATION MEASURED AT VARIOUS POWER LEVELS FROM ZERO TO 75 PERCENT
- NO EVIDENCE OF FLUIDELASTIC INSTABILITY
- NO EVIDENCE OF LARGE AMPLITUDE DISPLACEMENT OR HIGH ACCELERATION
- TUBES APPEAR TO BE BUFFETED BY FLUID TURBULENT FORCES



## BENEFITS OF PROPOSED McGUIRE PROGRAM

- MAXIMIZE OPERATING POWER LEVEL FOR UNMODIFIED STEAM GENERATORS WHILE PREVENTING SIGNIFICANT TUBE DAMAGE
- DETERMINE RELATIONSHIP BETWEEN OPERATING POWER LEVEL, TUBE VIBRATION, AND TUBE WEAR
  - REDUCE COMPLEXITY OF REQUIRED MODIFICATION
  - INCREASE CONFIDENCE IN ABILITY OF INSTALLED INSTRUMENTATION TO DETECT DAMAGING TUBE VIBRATION
  - PROVIDE A BASIS FOR EVALUATING EFFECTIVENESS OF MODIFICATION USING INSTALLED TUBE VIBRATION INSTRUMENTATION

BENEFITS OF INFORMATION TO BE GAINED OUTWEIGH RISK OF SMALL AMOUNT OF ADDITIONAL TUBE WEAR.

## IMPACT OF OPERATING PLAN

- UPPER BOUND FOR ADDITIONAL WEAR IS  $8.89 \times 10^{-4}$  CUBIC INCHES
- UPPER BOUND FOR THROUGH WALL PENETRATION IS 10 MILS (23 PERCENT)
- NO SAFETY CONCERN
- NO TUBE PLUGGING TO BE REQUIRED
- UPPER BOUND DEFECT MUCH SMALLER THAN DEFECTS LEFT IN SERVICE AT ALMARAZ AND RINGHALS 3
- LONG TERM INTEGRITY OF STEAM GENERATOR TUBES NOT ADVERSELY AFFECTED

## CONCLUSIONS

- UPPER BOUND FOR MAXIMUM DEFECT IN MCGUIRE IS  $4 \times 10^{-4}$  CUBIC INCHES AFTER 324 OPERATING HOURS AT OR ABOVE 75 PERCENT POWER
- UPPER BOUND ON ADDITIONAL WEAR INCURRED DURING 30 DAYS AT 75 PERCENT RESULTS IN DEFECT DEPTH OF 10 MILS (23 PERCENT)
- NO EVIDENCE OF FLUIDELASTIC INSTABILITY OR LARGE AMPLITUDE VIBRATION AT 75 PERCENT POWER
- TUBE WEAR RATES ARE ZERO OR VERY SMALL AT POWER LEVELS UP TO AND INCLUDING 75 PERCENT
- THERE IS NO SAFETY CONCERN, NOR WILL THERE BE ANY LONG TERM ADVERSE EFFECTS, WITH OPERATION FOR 30 DAYS AT 75 PERCENT POWER

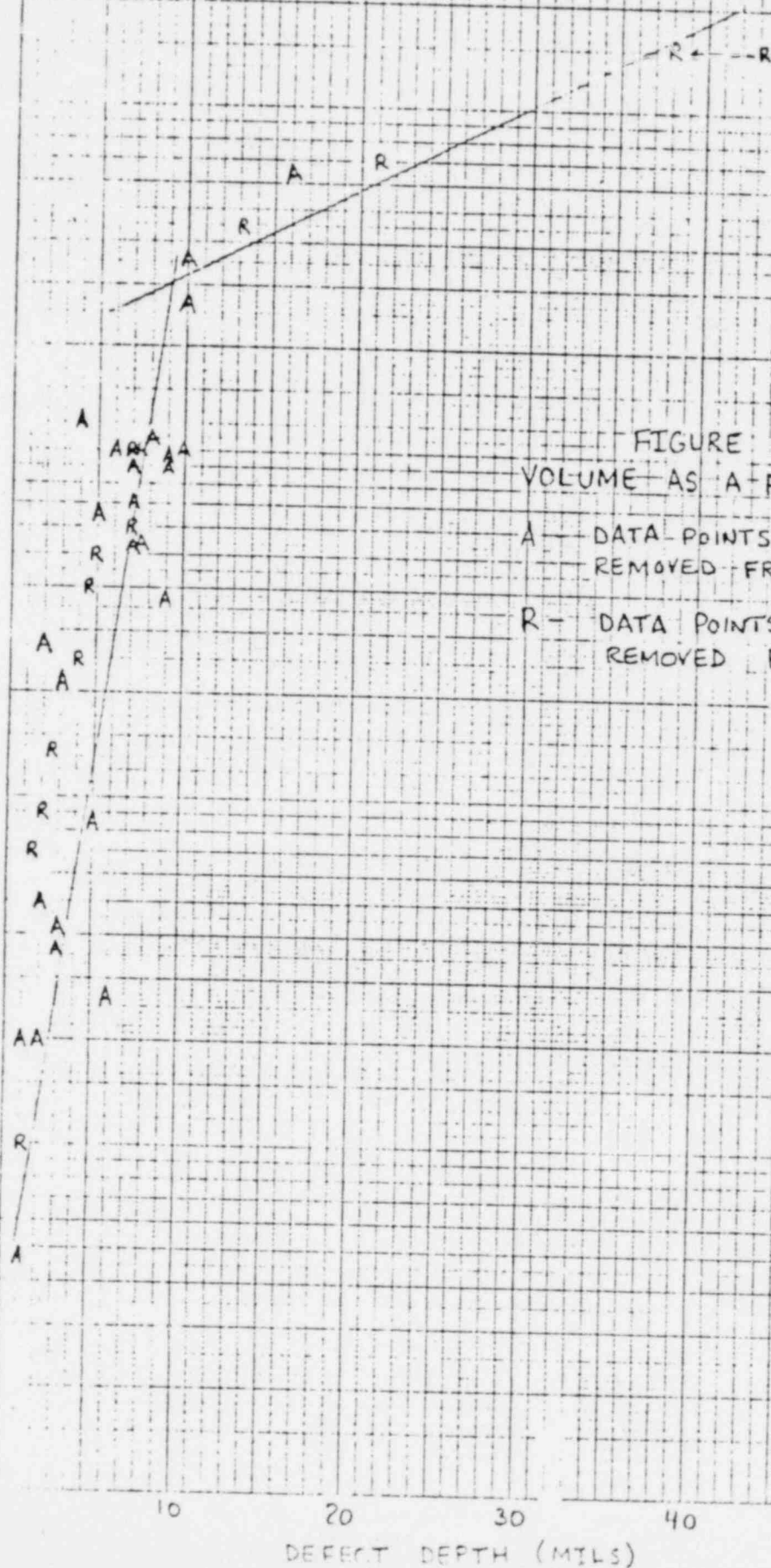


FIGURE 1  
VOLUME AS A FUNCTION OF MAX. DEPTH

A DATA POINTS FROM FOUR TUBES  
REMOVED FROM ALMARAZ ...

R - DATA POINTS FROM TWO TUBES  
REMOVED FROM RINGHALS

## FUTURE ACTIONS

~ MAY 15, 1982

INCREASE POWER TO 75%

JUNE 14, 1982

REDUCE POWER TO 50%  
(720 HRS AT 75%)~ JUNE 18, 1982  
(NLT JULY 4, 1982)

SHUTDOWN - ECT ALL S/G's

~ MID JULY

RETURN TO POWER  
(75% FOR ? HOURS DEPENDING  
ON RESULTS OF ECT, 50% UNTIL  
READY TO SHUTDOWN)

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SHUTDOWN, ECT

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RETURN TO POWER

CONTINUE OPERATE, SHUTDOWN, ECT AS LONG AS NECESSARY  
UNTIL MODIFICATION INSTALLED.