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Washington, D.C. 20545

DESIGNATED ORIGINAL

Certified By

*Peggy K. Matthews*  
12/22/82

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NOV 09 1982

Mr. Paul S. Check, Director  
CRBR Program Office  
Office of Nuclear Reactor Regulation  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555

Dear Mr. Check:

MEETING SUMMARY FOR CLINCH RIVER BREEDER REACTOR PLANT (CRBRP) NUCLEAR  
STEAM SUPPLY SYSTEM (NSSS) COMPONENT DEGRADATION MONITORING MEETING,  
NOVEMBER 8, 1982

The CRBRP project and the Nuclear Regulatory Commission staff held  
discussions on the component degradation monitoring program. The  
project committed to a component degradation monitoring program,  
which includes a loose parts monitoring system.

Enclosure 1 contains a listing of CRBRP project commitments on component  
degradation monitoring; Enclosure 2 is the meeting attendance list; and  
Enclosure 3 is the meeting agenda and the meeting handouts.

Sincerely,

*John R. Longenecker*

John R. Longenecker  
Acting Director, Office of the  
Clinch River Breeder Reactor  
Plant Project  
Office of Nuclear Energy

3 Enclosures

- cc: Service List
- Standard Distribution
- Licensing Distribution

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AGREEMENTS AND COMMITMENTS

1. The Project agrees to provide a description of the NSSS Loose Parts Monitoring system in the PSAR by December 15, 1982.

NOVEMBER 8, 1982 CRBRP PRESENTATION  
ON LOOSE PARTS MONITORING TO NRC

ATTENDANCE

W. Kelly  
S. Frye  
D. Elias  
D. Hicks  
W. G. Paul  
W. J. O'Bryant  
R. A. Becker  
A. Bice  
A. Kimmons  
T. L. King  
Bill Murphie  
Neil W. Brown  
David H. Moran

CRBRP-Project Office  
CRBRP-Project Office  
CRBRP-Project Office  
CRBRP-Project Office  
CRBRP-W  
CRBRP-W  
NRC/CRBRPO  
NRC/ACRS Staff  
CRBRP W  
NRC/CRBRPO  
DOE/Germantown  
WLLCO (GE)  
NRC/CRBRP

# **CLINCH RIVER BREEDER REACTOR PLANT**



**BRIEFING FOR**

**NUCLEAR REGULATORY COMMISSION  
CRBRP PROGRAM OFFICE**

**NSSS COMPONENT DEGRADATION  
MONITORING**

**NOVEMBER 8, 1982**

# **CRBRP NSSS COMPONENT DEGRADATION MONITORING**



**BRIEFING FOR**

**NUCLEAR REGULATORY COMMISSION  
CRBRP PROGRAM OFFICE**

## **INTRODUCTION AND SUMMARY**

**PRESENTED BY:**

**W. KELLY  
ENGINEERING,  
CRBRP PROJECT OFFICE**

**NOVEMBER 8, 1982**

**BRIEFING ON  
CRBRP NSSS COMPONENT  
DEGRADATION MONITORING  
FOR THE  
NUCLEAR REGULATORY COMMISSION  
CRBRP PROGRAM OFFICE**

**BETHESDA, MARYLAND  
NOVEMBER 8, 1982**

**AGENDA**

- **INTRODUCTION AND SUMMARY**
- **ACTION PLAN RESULTS AND  
RECOMMENDATIONS**
- **PROPOSED DESIGN APPROACH**
- **CONCLUSIONS**

**W. KELLY**

**W. O'BRYANT**

**W. O'BRYANT**

**W. KELLY**



## **SUMMARY**

- **AS A RESULT OF THE LPM DISCUSSIONS WITH THE NRC ON FEBRUARY 24, 1982, THE PROJECT UNDERTOOK A DETAILED REVIEW OF THE PLANT SYSTEMS AND COMPONENTS**
- **THE REVIEW INDICATED THERE WAS A POTENTIAL FOR GENERATION OF LOOSE PARTS**
- **THE PROJECT DETERMINED IT WOULD BE BENEFICIAL TO INCLUDE A COMPONENT DEGRADATION MONITORING PROGRAM IN THE CRBRP**
- **THE REVIEW ALSO INDICATED THAT DUE TO LOWER FLUID VELOCITIES, DETECTION CRITERIA WOULD NEED TO BE DEVELOPED FOR CRBRP**

**CRBRP'NSSS COMPONENT  
DEGRADATION MONITORING**

**BRIEFING FOR**

**NUCLEAR REGULATORY COMMISSION  
CRBRP PROGRAM OFFICE**



- **ACTION PLAN RESULTS AND  
RECOMMENDATIONS**
- **PROPOSED DESIGN APPROACH**

**PRESENTED BY:**

**W. O'BRYANT  
MANAGER,  
MAINTENANCE, OPERATIONS, & TEST  
WESTINGHOUSE-OR  
CRBRP PROJECT**

**NOVEMBER 8, 1982**



# **OUTLINE**

- **BACKGROUND**
- **ACTION PLAN**
- **ACTION PLAN RESULTS  
AND RECOMMENDATIONS**
- **PROPOSED DESIGN  
APPROACH TO IMPLEMENT  
THE RECOMMENDATIONS**

## **BACKGROUND**

**PREVIOUS PRESENTATION TO NRC ON FEBRUARY 24, 1982 ON TOPIC OF LOOSE PARTS MONITORING REQUIREMENTS FOR CRBRP NSSS.**

- **CRBRP POSITIONS DECLARED AT THAT TIME:**
  - **CRBRP INHERENT DESIGN FEATURES ALREADY PROVIDE PROTECTION REQUIRED BY REG GUIDE REQUIREMENTS**
  - **CRBRP DESIGN DOES NOT PRECLUDE THE ADDITION OF A LOOSE PARTS MONITORING SYSTEM**

## **BACKGROUND NRC RESPONSE**

- **SPECIFIC DESIGN CRITERIA FOR LMFBR MUST BE DEVELOPED FOR CRBRP INDEPENDENT OF LWR REGULATORY GUIDE 1.133**
- **CRBRP MUST DEMONSTRATE THAT LEVEL OF ASSURANCE OBTAINED BY LMFBRs IN CONTROLLING LOOSE PARTS IS COMPARABLE TO THAT AFFORDED BY CURRENT LWR TECHNOLOGY**
- **CRBRP SHOULD ALSO ADDRESS OTHER POTENTIAL DEGRADATION MECHANISMS SUCH AS CRUD DEPOSITION AND INCIPIENT FAILURE DETECTION FOR VIBRATING COMPONENTS**
- **CRBRP SHOULD CONSIDER THE UTILIZATION OF A COMPREHENSIVE NOISE DIAGNOSTIC PROGRAM**

## **ACTION PLAN**

- **ACTION PLAN TO BE CONDUCTED IN TWO PHASES:**
  - **PHASE I - DEVELOP THE BASIS FOR CRBRP COMPONENT DEGRATION MONITORING**
  - **PHASE II - DEVELOP DESIGN REQUIREMENTS AND EQUIPMENT SPECIFICATIONS**

## **PHASE I ACTION PLAN OBJECTIVES**

- **DETERMINE THE POTENTIAL FOR DEGRADATION MECHANISMS SUCH AS LOOSE PARTS, CRUD DEPOSITION AND VIBRATION TO OCCUR IN CRBRP NSSS HEAT TRANSFER SYSTEMS**
- **DETERMINE PLANT INSTRUMENTATION CAPABILITY TO DETECT THESE POTENTIAL DEGRADATION MECHANISMS**
- **DEMONSTRATE IMPROBABILITY OF DEGRADATION EVENT OCCURRENCE BASED ON INHERENT DESIGN FEATURES**
- **DEMONSTRATE LEVEL OF ASSURANCE COMPARABLE TO CURRENT LWRs WITH RESPECT TO DEGRADATION MECHANISMS**

## **PHASE I ACTION PLAN SCOPE**

- **PHASE I EVALUATIONS AND STUDIES DIVIDED INTO THREE MAJOR TASKS**
  - **SUSCEPTIBILITY AND SENSITIVITY OF COMPONENTS TO LOOSE PARTS, CRUD, VIBRATION, AND THE POTENTIAL TO GENERATE THEM**
  - **DEVELOPMENT OF SODIUM VELOCITY DISTRIBUTION CURVES AND LOOSE PART TRANSPORT MOBILITY CHARACTERISTICS BASED ON THREE GEOMETRIC CONFIGURATIONS, I.E., SPHERE, CYLINDRICAL ROD AND FLAT PLATE**
  - **SUSCEPTIBILITY OF DEGRADATION FROM CONSTRUCTION AND TEST ACTIVITIES**



# **PHASE I ACTION PLAN SCOPE BOUNDARIES**

- ALL NSSS SYSTEMS CONTAINING FLUID FLOW PATHS INVOLVED IN HEAT GENERATION AND HEAT TRANSPORT INCLUDING THE STEAM PLANT
- COMPRESSED GAS SYSTEMS DIRECTLY INTERFACING WITH SODIUM SYSTEMS
- AUXILIARY SUPPORT SYSTEMS ASSOCIATED WITH HEAT TRANSFER, SUCH AS
  - REACTOR COOLANT MAKEUP
  - DECAY HEAT REMOVAL
  - SPENT FUEL STORAGE

# **PHASE I**

## **ACTION PLAN SCOPE - COMPONENTS**

- PRIMARY CONTROL RODS
- SECONDARY CONTROL RODS
- FUEL ASSEMBLIES
- CORE FLOW PATH STRUCTURES
- REACTOR VESSEL INLET AND OUTLET NOZZLES AND PLENUMS
- REACTOR VESSEL UPPER INTERNAL STRUCTURE
- COLD LEG CHECK VALVES
- INTERMEDIATE HEAT EXCHANGER
- HEAT TRANSPORT SYSTEM MAIN SODIUM PUMPS
- IHTS EXPANSION TANKS
- PHTS AND IHTS FLOW PATH PIPING
- CORE VORTEX SUPPRESSOR PLATE
- REACTOR OVERFLOW VESSEL
- REACTOR OVERFLOW EXCHANGER

# **PHASE I**

## **ACTION PLAN SCOPE - COMPONENTS**

### **(CONT.)**

- DECAY HEAT REMOVAL EM PUMPS AND HEAT EXCHANGER
- COLD TRAPS
- COVER GAS PIPING AND VALVES
- FUEL STORAGE VESSEL (EVST)
- STEAM GENERATOR MODULES; SUPERHEATERS AND EVAPORATORS (SODIUM AND WATER SIDE)
- PROTECTED AIR COOLED CONDENSER
- PROTECTED WATER STORAGE TANK
- AUXILIARY FEEDWATER TURBINE
- AUXILIARY FEEDWATER PUMPS
- EVAPORATOR WATER DUMP TANK
- FLOWMETERS, NOZZLES AND ORIFICES
- VALVES (ALL TYPES)
- STEAM DRUM
- RECIRCULATION PUMP

## **PHASE I ACTION PLAN - REFERENCES**

- **REGULATORY GUIDE 1.20 - COMPREHENSIVE VIBRATION ASSESSMENT PROGRAM FOR REACTOR INTERNALS DURING TEST PROGRAM**
- **REGULATORY GUIDE 1.133 - LOOSE PART DETECTION PROGRAM FOR THE PRIMARY SYSTEM OF LWR**
- **REGULATORY GUIDE 1.68 - INITIAL TEST PROGRAM FOR WATER COOLED LWR**
- **LWR INCIDENT DATA - ALL LICENSE EVENTS ASSOCIATED WITH LOOSE PARTS, CRUD AND VIBRATION**
- **DOE/RECON INFORMATION FILES FOR DATA ON FOREIGN LMFBR INCIDENT DATA ADDRESSING LOOSE PARTS, CRUD AND VIBRATION FOR RAPSODIE, PHENIX, SNR-300 AND JOYO**
- **NUREG 0800, SECTION 4.4 - THERMAL AND HYDRAULIC DESIGN**
- **NUREG 0800, SECTION 3.9.2 - DYNAMIC TESTING AND ANALYSIS OF SYSTEMS, COMPONENTS AND EQUIPMENT**

# **DOMESTIC LMFBR DEGRADATION MONITORING**

## **EBR - II**

- PRESENTLY UTILIZING ACOUSTIC MICROPHONES IN REACTOR VESSEL HEAD AREA TO OBTAIN SODIUM NOISE CHARACTERISTICS
- PRESENTLY EVALUATING THE UTILIZATION OF ACCELEROMETERS ON STEAM GENERATORS TO OBTAIN FLOW INDUCED VIBRATION DATA

## **FFTF**

- PRESENTLY EVALUATING THE EFFECTIVENESS OF HIGH TEMPERATURE SODIUM-IMMERSIBLE MICROPHONES FOR LOOSE PARTS SURVEILLANCE OF THE UPPER REACTOR PLENUM (HEDL REPORT S/A 2461 DATED FEBRUARY 1982)
- NO LOOSE PARTS IN REACTOR PLENUM AREA IDENTIFIED TO DATE



# **PHASE I SUMMARY AND RECOMMENDATIONS**

- **ENHANCE THE CAPABILITY OF THE CRBRP NSSS DESIGN THROUGH DEGRADATION MONITORING TO DEMONSTRATE THAT THE LEVEL OF ASSURANCE FOR OPERATION OF THE PLANT IS COMPARABLE TO CURRENT LWRs WITH RESPECT TO DEGRADATION MECHANISMS**
- **PROVIDE ADDITIONAL CAPABILITY FOR THE DETECTION OF DEGRADATION MECHANISMS BEFORE THEY CAN HAVE A MAJOR IMPACT ON PLANT AVAILABILITY**
- **DEVELOP FOR CRBRP NSSS SYSTEM A COMPONENT DEGRADATION MONITORING PROGRAM**
- **PROVIDE THE CAPABILITY FOR CRBRP TO SATISFY THOSE APPLICABLE PORTIONS OF REGULATORY GUIDES ADDRESSING LOOSE PARTS MONITORING AND VIBRATION SENSING IN THE NSSS**



## **COMPONENT DEGRADATION MONITORING PROGRAM**

- **WOULD ENCOMPASS THE FOLLOWING ELEMENTS  
OF COMPONENT DEGRADATION MONITORING:**
  - **LOOSE PARTS MONITORING FOR MAJOR  
COMPONENTS OF PHTS, IHTS AND STEAM  
GENERATOR SYSTEMS**
  - **VIBRATION SENSING**
  - **PERIODIC SURVEILLANCE OF MAJOR  
COMPONENTS THROUGH INSERVICE  
INSPECTION ACTIVITIES**
  - **UTILIZATION OF PLANT PROCESS  
INSTRUMENTATION TO MONITOR FOR  
DEGRADATION OF PLANT PERFORMANCE**

## **LOOSE PARTS MONITORING SYSTEM GENERAL DESIGN CRITERIA**

- **SENSOR LOCATIONS WILL INCLUDE AS A MINIMUM, RV, PHTS PUMP, IHX, IHTS PUMP, SG MODULES, RV HEAD AND/OR UPPER PLENUM.**
- **SENSORS SHALL BE PROVEN STATE OF THE ART, CONSISTENT WITH LWR TECHNOLOGY, MODIFIED AS NECESSARY FOR CRBRP ENVIRONMENT AND SHALL BE REDUNDANT.**
- **SENSITIVITY (THRESHOLD ENERGY) SHALL BE ADEQUATE TO IDENTIFY ALL LOOSE PARTS THAT COULD POTENTIALLY RESULT IN DEGRADATION OF ABOVE COMPONENTS BY IMPACTING.**
- **SENSORS SHALL BE LOCATED TO DETECT LOOSE PARTS AT NATURAL COLLECTION POINTS FOR EACH OF THE ABOVE COMPONENTS.**
- **METHODS OF MOUNTING OF SENSORS SHALL BE EITHER BY DIRECT MOUNTING TO COMPONENTS/PIPING OR BY ATTACHMENT TO SUITABLE STANDOFFS.**
- **REGULATORY GUIDE 1.133 REQUIREMENTS SHALL BE UTILIZED, ACKNOWLEDGING DIFFERENCES BETWEEN LWR AND LMFBR TECHNOLOGY.**
- **SUITABLE AUDIBLE INDICATIONS/MONITORING OF THE PRESENCE OF LOOSE PARTS SHALL BE PROVIDED IN THE CONTROL ROOM, AND AT OTHER PLANT LOCATIONS AS APPROPRIATE.**

LOOSE PARTS MONITORING SYSTEM  
GENERAL DESIGN CRITERIA (CONTINUED)

- o A BASELINE NOISE SIGNATURE WILL BE ESTABLISHED FOR THE LOOSE PARTS MONITORING SYSTEM AND WILL BE MONITORED EITHER ON A CONTINUING OR PERIODIC BASIS.
- o THE LOOSE PARTS MONITORING SYSTEM SHOULD MEET THE REQUIREMENTS OF PARAGRAPH C.1.G, "OPERABILITY FOR SEISMIC AND ENVIRONMENTAL CONDITIONS" OF REG. GUIDE 1.133, REV. 1.
- o THE CRBRP PROJECT WILL UTILIZE REG. GUIDE 1.133 IN IMPLEMENTING A LOOSE PARTS MONITORING SYSTEM EXCEPT WHERE DIFFERENCES BETWEEN LWR AND LMFBR TECHNOLOGY REQUIRE DIFFERENT METHODS.

## **CONCLUSIONS**

- THE PROJECT IS COMMITTED TO IMPLEMENTING A COMPONENT DEGRADATION MONITORING PROGRAM FOR THE CRBRP
- THE PROGRAM WILL INCLUDE A LOOSE PARTS MONITORING SYSTEM WHICH WILL MONITOR THE PRIMARY HEAT TRANSPORT AND INTERMEDIATE HEAT TRANSPORT SYSTEMS INCLUDING THE STEAM GENERATORS
- SPECIFIC DESIGN REQUIREMENTS ARE EXPECTED TO BE ESTABLISHED WITHIN THE NEXT 18 MONTHS