



Department of Energy  
Washington, D.C. 20545  
Docket No. 50-537  
HQ-S:82:152

DEC 21 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 THE RELIABILITY PROGRAM MEETING, DECEMBER 20, 1982

The purpose of this letter is to summarize the resolution of items discussed between the Nuclear Regulatory Commission and the Clinch River Breeder Reactor Plant project on December 20, 1982.

Enclosure 1 is the list of attendees, Enclosure 2 is the agreements and commitments from the meeting, and Enclosure 3 is the handouts.

Any questions regarding the information provided or further activities can be addressed to A. Meller (FTS 626-6355) or E. Wittry (FTS 626-6099) of the Project Office Oak Ridge staff.

Sincerely,

John R. Longenecker  
Acting Director, Office of  
Breeder Demonstration Projects  
Office of Nuclear Energy

3 Enclosures

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LIST OF ATTENDEES  
RELIABILITY PROGRAM MEETING

December 20, 1982

<u>Name</u>	<u>Organization</u>
A. R. Meller	CRBRP-PO/PMC
S. Singh Bajwa	NRC (DL), NRR
Bill Horton	SAI - La Jolla
Stan Basin	SAI - Palo Alto, California
Bob Liner	SAI - McLean
George Clare	W-OR
Peter Gross	CRBRP-PO/DOE-OR
Dan Ujifusa	DOE - Germantown
Bryce Johnson	SAI - McLean/Palo Alto
Ed Wittry	CRBRP-PO
Tom King	NRC-CRBRP

RELIABILITY MEETING  
AGREEMENTS AND COMMITMENTS

December 20, 1982

Overall Program Document: The project will provide a document describing the overall program for ensuring reliability of the system. The document will include the following:

- . the overall purpose (goal) of the program and a summary description of how the goal is to be achieved;
- . the specific programs which support overall reliability and where they fit in the overall program (i.e., PRA, QA, various testing programs; etc.)
- . the elements of the organization responsible for reliability, including item by item responsibility, overall responsibility and lines of authority;
- . a schedule of accomplishment of the elements of the program relative to construction, fuel loading, power operation etc.

The document will allow the reader to determine what the overall program is and to identify the sub-programs and (associated documentation) which contribute to the overall program.

The document will be provided to NRC January 7, 1982.

**CRERP PROJECT**

**RELIABILITY PROGRAM**

- PROGRAM OBJECTIVES
- TECHNICAL FOCUS AND SCOPE
- PROGRAM ORGANIZATION

**G. H. CLARE**

**MANAGER OF LICENSING**

**HESTINGHOUSE - LEAD REACTOR MANUFACTURER**

## **CRISP PROJECT**

### **EARLY RELIABILITY PROGRAM OBJECTIVES WERE AMBITIOUS AND OPTIMISTIC**

- "DETERMINE WHICH EVENTS SHOULD BE INCLUDED IN THE DESIGN BASIS ENVELOPE," OR
- "PROVE THAT THE PROBABILITY OF EXCEEDING 100FPU00 GUIDELINES IS LESS THAN ONE CHANCE IN ONE MILLION PER REACTOR YEAR."
- EXTENSIVE QUANTITATIVE ANALYSIS
- STATISTICAL HARDWARE TESTING
- QUANTITATIVE RELIABILITY DESIGN REQUIREMENTS

## **CORP PROJECT**

**RELIABILITY PROGRAM OBJECTIVES WERE MODIFIED  
IN RESPONSE TO INTERNAL AND EXTERNAL INFLUENCES**

- INABILITY TO QUANTIFY MANY EFFECTS**
- POOR COST EFFECTIVENESS**
- NRC GUIDANCE (MAY 6, 1976)**

## CRERP PROJECT

### NRC's MAY 6, 1976 GUIDANCE TO THE PROJECT

- "ONE CHANCE IN ONE MILLION PER YEAR ... OBJECTIVE RATHER THAN A FIXED NUMBER WHICH MUST BE DEMONSTRATED"
- "NUMERICAL EVALUATIONS ... AS WELL AS THE SYSTEMATIC AND DISCIPLINED EVALUATIONS OF THE PLANT DESIGN ... ARE OF SIGNIFICANT VALUE ... THESE ACTIVITIES SHOULD BE CONTINUED."
- "THE PROBABILITY OF CORE MELT AND DISRUPTIVE ACCIDENTS CAN AND MUST BE REDUCED ... TO JUSTIFY THEIR EXCLUSION FROM THE DESIGN BASIS ..."
- SPECIFIC GUIDANCE ON REACTOR SHUTDOWN AND DECAY HEAT REMOVAL SYSTEMS

## CRBRP PROJECT

CURRENT RELIABILITY PROGRAM OBJECTIVE  
IS MODEST AND REALISTIC.

- "PROVIDE ADDITIONAL ASSURANCE THAT THE PROBABILITY OF EXCEEDING ... 10CFR100 IS ACCEPTABLY LOW." (GOAL: LESS THAN ONE CHANCE IN ONE MILLION YEARS)
  - \* RELIABILITY ENHANCEMENT
  - \* RELIABILITY VERIFICATION
- PROGRAM ACTIVITIES ARE TAILORED TO PRODUCE GREATEST BENEFIT IN PLANT RELIABILITY
- RELIABILITY (SAFETY FUNCTION) PROGRAM IS AUGMENTED WITH AVAILABILITY (POWER GENERATION) PROGRAM



## CRBRP PROJECT

THE FOCUS OF THE RELIABILITY PROGRAM IS  
DICTATED BY THE PLANT DESIGN

- THE REACTOR CORE IS THE ONLY SOURCE WITH POTENTIAL TO EXCEED 10CFR100 GUIDELINES
- LOSS OF CORE COOLABLE GEOMETRY IS NECESSARY PREREQUISITE FOR POTENTIAL LARGE RELEASE
- LOSS OF CORE COOLABLE GEOMETRY IS ONLY POSSIBLE WITH
  - 1) FAILURE TO SCRAM
  - 2) LOSS OF ABILITY TO REMOVE DECAY HEAT

NOTE: ABILITY OF CONTAINMENT SYSTEM TO MITIGATE DEGRADED CORE EVENTS IS NOT CONSIDERED IN THIS PROGRAM, IS TREATED ELSEWHERE.

## CRRP PROJECT

### THE RELIABILITY PROGRAM FOCUSSES ON TWO KEY SAFETY SYSTEMS

#### - REACTOR SHUTDOWN SYSTEM

- \* PLANT PROTECTION SYSTEM (ELECTRONICS)
- \* PRIMARY CONTROL ROD SYSTEM
- \* SECONDARY CONTROL ROD SYSTEM
- \* SUPPORT SYSTEMS (REACTOR VESSEL, INSTRUMENTS)

#### - SHUTDOWN HEAT REMOVAL SYSTEM

- \* MAIN HEAT TRANSPORT SYSTEMS (3 LOOPS)
- \* STEAM GENERATOR AUXILIARY HEAT REMOVAL SYSTEMS (3 LOOPS)
- \* DIRECT HEAT REMOVAL SERVICE (1 LOOP, QUASI-REDUNDANT)
- \* SUPPORT SYSTEMS (ELECTRIC, CONTROL, AUX COOLING, ETC.)

NOTE: ABILITY TO MANUALLY SCRAM OR DRIVE IN CONTROL RODS AND ABILITY TO REMOVE DECAY HEAT VIA BOP ARE NOT EMPHASIZED.

## CRBRP PROJECT

QUALITATIVE ASSESSMENTS ARE PERFORMED IN PARALLEL WITH OTHER  
DESIGN ACTIVITIES AT THE COMPONENT AND SYSTEM LEVELS

- RELIABILITY RELATED COMPONENTS LIST (RRCL) SPECIFIES THE  
REQUIRED ANALYSES
- COMPONENT: FMEA AND, IN SOME CASES, CCFA
- SYSTEM: RELIABILITY DESIGN SUPPORT DOCUMENT (RDSD), INCLUDING FMEA AND CCFA AT COMPONENT AND SYSTEM LEVELS
- DOCUMENTS ARE REQUIRED FOR DESIGN REVIEWS

## CCBRP PROJECT

TESTS CONFIRM DESIGNS MEET PERFORMANCE REQUIREMENTS, DEMONSTRATE  
MARGINS AND ALLOW STUDY OF HUMAN INTERFACES

- PLANT PROTECTION SYSTEM
- PRIMARY AND SECONDARY SHUTDOWN SYSTEMS
- MAIN SODIUM PUMPS/DRIVES
- STEAM GENERATORS
- EM PUMPS
- SMALL LIQUID METAL VALVES
- CONTROL ROOM MOCK-UP

NOTE: EMPHASIS IS ON FIRST-OF-A-KIND COMPONENTS

## CRERP PROJECT

QUANTITATIVE RELIABILITY ASSESSMENTS PROVIDE  
INSIGHT INTO SYSTEM/COMPONENT IMPORTANCE

- RELIABILITY BLOCK DIAGRAMS
- FAILURE/REPAIR RATES BASED ON AVAILABLE DATA PLUS  
ENGINEERING JUDGEMENT
- CONSERVATIVE INITIATOR ASSUMPTIONS
- INPUT AND OUTPUT REVIEWED BY COGNIZANT DESIGNERS

## CRBRP PROJECT

### RELIABILITY PROGRAM ORGANIZATION REFLECTS ORGANIZATIONAL RESPONSIBILITIES FOR DESIGN AND PROCUREMENT

- PROJECT OFFICE SETS OVERALL PROGRAM POLICY, REVIEWS AND APPROVES RELIABILITY ACTIVITIES, ESTABLISHES TOP LEVEL BUDGETS, MILESTONES, CO-ORDINATES LRM/A&E FUNCTIONS

- WESTINGHOUSE - LRM MANAGES RM (AI, GE, W-RM) ACTIVITIES, REVIEWS AND APPROVES RM RELIABILITY DOCUMENTS, PRODUCES SYSTEMS LEVEL DOCUMENTS

- RM's PERFORM QUALITATIVE ASSESSMENTS FOR HARDWARE WITHIN SCOPE, REVIEW QUANTITATIVE ASSESSMENT INPUT AND OUTPUT, PERFORM TESTS FOR HARDWARE WITHIN SCOPE

- W-RM PERFORMS QUANTITATIVE RSS ASSESSMENT

- GE PERFORMS QUANTITATIVE SIRS ASSESSMENT

- BURNS & ROE (A&E) REVIEWS QUANTITATIVE ASSESSMENT INPUT AND OUTPUT



## **CRERP PROJECT**

**ALL RELIABILITY PROGRAMS ARE WELL INTEGRATED IN  
THE OVERALL TECHNICAL MANAGEMENT DISCIPLINE**

- RHEAS, CCFAS AND RDSOs ARE REQUIRED FOR DESIGN REVIEWS**
- DESIGNERS REVIEW QUANTITATIVE ANALYSIS INPUT AND OUTPUT**
- SINGLE TEST PROGRAM SUPPORTS DESIGN AND RELIABILITY**
- AVAILABILITY**

BRIEFING ON CRBRP RELIABILITY PROGRAM

SCIENCE APPLICATIONS, INC.

PREPARED BY:

B. JOHNSON

W. HORTON

S. BASIN

R. YODER

E. RUMBLE

DECEMBER 20, 1982





## PURPOSE OF REVIEW

The NRC Staff has determined that a Reliability Program is necessary in order to ensure the continuing high reliability of systems in CRBRP which have a potential impact on public risk. The purpose of this review is to ascertain the adequacy of the applicants' proposed Reliability Program.



## CRBRP SYSTEMS REVIEWED

The allocation of Reliability Program resources may vary between the categories listed below:

- Operating Systems
  - Support Normal Function of Plant
- Systems Which Respond to Faults in Operating Systems
  - Example: DHRS
- Systems Which Mitigate Accidents
  - Example: Containment

} Standby  
or  
Backup



## PHILOSOPHIES OF RELIABILITY

### OWNER VS REGULATOR

#### REGULATOR

Must ensure that Reliability Program  
is adequate for protecting public

#### OWNER

Must protect public as well as consider  
the financial impact of operation



## CRBRP CANDIDATE SYSTEMS FOR RELIABILITY REVIEW

### SELECTION PROCEDURE

1. Tabulate front-line systems associated with large inventories of radioactive material (potentially can exceed 10CFR100 guidelines).
2. Select from the list developed in #1 above those front-line systems for which high reliability is required due to their potential impact on public risk.
3. Identify support systems for front-line systems in #2 above.



## SYSTEMS SELECTED FOR REVIEW

### FRONT LINE SYSTEMS

REACTOR	}	5
INTERNALS		
CORE RESTRAINT		
FUEL		

HEAT TRANSPORT	}	2
VESSEL/PHTS/IHTS		
SGS		
RHRS		

### ENGINEERING SAFETY SYSTEMS

RSS - 1

CONTAINMENT/CONTAINMENT ISOLATION - 3

LINERS/GUARD VESSELS/CATCH PANS - 6

### AUXILIARY FRONT-LINE SYSTEMS

NEW/SPENT FUEL - 4

\*Numbers are relative order of importance with regard to reliability resource allocation



## SYSTEMS FOR REVIEW (CONTINUED)

<u>SUPPORT SYSTEMS</u>	<u>RELATIVE IMPORTANCE*</u>
ELECTRIC POWER	
ONSITE	2
OFFSITE	7
AUXILIARY SUPPORT SYSTEMS	
HVAC	1
CHILLED WATER	1
SERVICE WATER	1
DIESEL AUXILIARY SYSTEMS	2
FIRE PROTECTION	7
RECIRCULATION GAS COOLING	1
INSTRUMENTATION AND CONTROL	
FRONT-LINE SYSTEM CONTROL	2
SUPPORT SYSTEM CONTROL	1
PLANT CONTROL	7
MONITORING SYSTEMS	2
HUMAN FACTORS	
INSPECTION AND TESTING	1
MAINTENANCE	1
PROCEDURES	1
MANAGEMENT	1

\* With regard to reliability resource allocation of front line systems



## MAIN CRITERIA FOR RELIABILITY REVIEW

- Existence of adequate reliability documentation
- Existence of an overall reliability measure of the plant. (Not a design requirement)
- Existence of overall reliability program which provides a means of assuring continual plant compatibility with reliability measure.
- Existence of front-line and support system programs which support the overall program
- Appropriate reliability resource allocation
- Means of feedback and implementation of reliability information



## CHARACTERISTICS OF RELIABILITY PROGRAM

- A reliability organization with appropriate authority and responsibility
- An appropriate analytical program
- An appropriate experimental or test program
- Proper coordination between analytical and test programs
- Use of standard or accepted techniques and appropriate reliability data
- Appropriate reliability procedures for procurement, construction and operation





## FRONT-LINE AND SUPPORT SYSTEM RELIABILITY PROGRAMS

- Quantitative measures compatible with the overall measures
- Mechanisms for reliability tradeoff at system and component level
- Appropriate reliability information transfer
- Definition of performance requirements
- Assurance of continuing program continuity
- An auditable reliability program

