Stello
Taylor
Rehm
Murley
~~Beckjord~~
Murray
EDO R/F

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

September 1, 1987

OFFICE OF THE
COMMISSIONER

MEMORANDUM FOR: Samuel Chilk, Secretary

FROM: Frederick M. Bernthal

SUBJECT: COMTR 87-3 -- ACRS COMMENTS ON THE ADVANCED NOTICE OF PROPOSED RULEMAKING: DEGREE REQUIREMENTS FOR SENIOR OPERATORS

Thoughtful people will continue to disagree on this issue. It is therefore especially important that the Commission now have the benefit of the full public airing of views that will be afforded by publication of the proposed rule. I thus do not believe that the Commission should revisit the issue at this time. ACRS comments on the Commission's contemplated rulemaking on degreed SRO's should and will be addressed during the usual notice and comment period once the NPR is published. I would note, however, that ACRS has apparently failed to appreciate fully the distinction between training and education. To my knowledge, no one has argued that a baccalaureate degree provides training essential to SRO performance.

Commissioner Carr notes that the Commission's goals should be clearly identified in the proposed rule. I agree. In particular, the arguments in support of providing a conduit for experienced operators into upper management, as well as those for enhancing professional regard for the role of senior operator should be fully articulated.

cc: Chairman Zech
Commissioner Roberts
Commissioner Carr
Commissioner Rogers
ACRS
EDO

Cy: Ross
Speis
Kelber
Burda
Sheron/Minners
Coffman
Morris/Rosztoczy
Marcus
Telford
DiPalo
File (O&M-OCM)

# ADVANCE NOTICE OF PROPOSED RULEMAKING

Published May 1986

- AFTER JANUARY 1, 1991
  - BACCALAUREATE DEGREE IN ENGINEERING OR PHYSICAL SCIENCE REQUIRED FOR SOs
  - OTHER DEGREES ACCEPTED ON A CASE-BY-CASE BASIS
  - DEGREE EQUIVALENCY UNACCEPTABLE
- ONE OF TWO YEARS OF REQUIRED NUCLEAR PLANT EXPERIENCE MUST BE AT GREATER THAN TWENTY PERCENT POWER
- SOs LICENSED PRIOR TO JANUARY 1, 1991 WOULD BE GRANDFATHERED
- ONE RE-EXAMINATION FOR SO APPLICANTS WHO APPLY JUST PRIOR TO JANUARY 1, 1991
- CONCURRENT POLICY STATEMENT TO ENCOURAGE UTILITIES TO ESTABLISH A DEGREE PROGRAM FOR REACTOR OPERATORS

## Enclosure 4 to the Minutes of CRGR Meeting No. 141
## Proposed Resolution for USI A-45, "Shutdown Decay Heat Removal Requirements"

TOPIC

W. Minners (RES) and R. Woods (RES) presented for CRGR review the proposed resolution for USI A-45, "Shutdown Decay Heat Removal Requirements." This proposal calls for the USI to be subsumed into (i.e., to be effectively addressed by) the Individual Plant Examinations to be performed by the licensees, as specified in the IPE Generic Letter that was reviewed and endorsed by the Committee at Meeting No. 134. Copies of the briefing slides used by the staff to guide their presentation and the discussions of this matter at this meeting are enclosed (see attachment to this enclosure).

BACKGROUND

The package submitted for review by CRGR in this matter was transmitted by memorandum dated June 9, 1988, E. S. Beckjord to E. L. Jordan; that review package included the following documents:

1. Draft memorandum (undated), V. Stello, Jr. to the Commissioners, "Shutdown Decay Heat Removal Requirements (USI A-45)," and attachments as follows:

   a. Enclosure A - Draft Report NUREG-1289, dated April 1988, "Regulatory and Backfit Analysis: Unresolved Safety Issue A-45, Shutdown Decay Heat Removal Requirements"

   b. Enclosure B - Draft Report NUREG-1292, dated October 1987, "Shutdown Decay Heat Removal Analysis: Summary Report"

   c. Enclosure C - Proposed Federal Register Notice, "Shutdown Decay Heat Removal Requirements"

   d. Enclosure D - Draft Letter from E. S. Beckjord to Congressional Oversight Committees regarding this proposed USI resolution

CONCLUSIONS/RECOMMENDATIONS

As a result of their review of this issue, including the discussions with the staff at this meeting and the background provided by their earlier review of the IPE Generic Letter at Meeting No. 134, the Committee recommended in favor of issuing the proposed resolution for USI A-45, subject to modifications to emphasize to the Commission that the external event aspect of USI A-45 is not addressed by subsuming this issue into the IPEs (the IPEs are not intended to address external events - external events will be addressed separately at a later time after development and approval of appropriate methodology).

RECOMMENDED FINAL RESOLUTION OF USI A-45
"SHUTDOWN DECAY HEAT REMOVAL REQUIREMENTS"

PRESENTED TO THE
COMMITTEE TO REVIEW GENERIC REQUIREMENTS
JULY 14, 1988

ROY WOODS, SENIOR TASK MANAGER
DIVISION OF REACTOR AND PLANT SYSTEMS
OFFICE OF NUCLEAR REGULATORY RESEARCH

Attachment to Enclosure 4

## SUMMARY

- UNRESOLVED SAFETY ISSUE (USI A-45) APPROVED DEC. 24, 1980 (SECY-80-325)

- KEY QUESTIONS:

  - DO CURRENT REGULATIONS PROVIDE SUFFICIENT ASSURANCE THAT RISK FROM DHR FAILURES IS ACCEPTABLY LOW?

  - ARE IMPROVEMENTS TO DHR FUNCTION IN OPERATING PLANTS COST-BENEFICIAL?

- KEY CONCLUSIONS:

  - DHR FAILURES ARE SIGNIFICANT CONTRIBUTORS TO CORE DAMAGE FREQUENCY FROM SB-LOCAs, TRANSIENTS

  - VULNERABILITIES AND CORRECTIVE ACTIONS, COST/BENEFIT RATIOS ARE PLANT SPECIFIC

  - DEDICATED DHR SYSTEM NOT COST BENEFICIAL

  - DESIGNS NOT COMPARED TO "CURRENT" DBA-BASED REQUIREMENTS

- KEY ASSUMPTIONS:

  - CDF GOAL OF 1E-05 SELECTED BY STAFF FOR THIS APPLICATION
  - CONSISTENT WITH A-44 AND A-49

# USI A-45 SCOPE

- SIX CASE STUDIES, DHR FAILURE RELATED PRA'S (SUMMARIZED IN ENCLOSURE B)

- LIMITED TO SYSTEMS NEEDED TO RESPOND TO TRANSIENTS AND SMALL-BREAK LOCAs

- EVALUATED SUCH SYSTEMS' VULNERABILITY TO FIRE, FLOOD, SEISMIC, INSIDER SABOTAGE

# CONTENT OF REGULATORY ANALYSIS

a

- APRIL, 1988 DRAFT REVISION DESCRIBES SIX ALTERNATIVES AND PROPOSES RESOLUTION WITH ALT. # 2 (PLANT-SPECIFIC ANALYSIS)

ALTERNATIVE 1 - NO ACTION

COULD BE ACCEPTABLE <u>IF</u> NRC ANALYSIS
RESULTS ARE OVERLY CONSERVATIVE
(EPRI/WOG: POINT BEACH)

ALTERNATIVE 2 - LIMITED SCOPE PRAs

SEVERE ACCIDENT PROGRAM IPEs

ALTERNATIVE 3 - SPECIFIED SYSTEMS MODIFICATIONS

USIs AND GIs

ALTERNATIVE 4 - DEPRESSURIZATION AND COOLING

PWR - FEED AND BLEED
BWR - CONTAINMENT VENTING

ALTERNATIVE 5 - DEDICATED HOT SHUTDOWN CAPABILITY

ALTERNATIVE 6 - DEDICATED COLD SHUTDOWN CAPABILITY

# TECHNICAL FINDINGS

- FREQUENCY OF CORE DAMAGE DUE TO DHR FUNCTION FAILURE [$P(CM)_{DHR}$] AVERAGES 2 TO 3 x $10^{-4}$ PER R-YR (INCLUDES INTERNAL AND EXTERNAL CAUSES)

- SUPPORT SYSTEM FAILURES (E.G., EMERGENCY POWER, SERVICE WATER, COMPONENT COOLING) CONTRIBUTE SIGNIFICANTLY TO $P(CM)_{DHR}$

- REDUNDANCY CONCERNS AND CONSIDERABLE SHARING OF SYSTEMS, PARTICULARLY AT SUPPORT SYSTEM LEVEL FOR SOME PLANTS

- CONCERNS WITH OVERALL GENERAL ARRANGEMENT OF EQUIPMENT FROM A SAFETY VIEWPOINT, E.G., LACK OF INDEPENDENCE, SEPARATION & PHYSICAL PROTECTION OF REDUNDANT SAFEGUARD TRAINS

- FIRE, FLOOD, SEISMIC, SABOTAGE RISK CONCERNS

- <u>RELATIVE IMPORTANCE OF VULNERABILITIES IS PLANT-SPECIFIC</u>

- <u>EFFECTIVENESS OF CORRECTIVE ACTIONS IN REDUCING $P(CM)_{DHR}$ IS PLANT SPECIFIC</u>

## REG. ANALYSIS

## DIFFERENT APPROACHES TO VALUE-IMPACT ANALYSIS

- VALUE-IMPACT ANALYSIS PERFORMED 3 WAYS:

  A. VALUE TERM: AVERTED DOSE TO POPULATION
  IMPACT TERM: COST OF IMPLEMENTATION

  B. VALUE TERM: SAME AS METHOD A
  IMPACT TERM: COST OF IMPLEMENTATION LESS AVERTED ONSITE COSTS

  C. SAME AS METHODS A & B PLUS THE SAVINGS FROM SPECIAL CONSIDERATIONS (E.G., SABOTAGE, MORATORIUM, RESOLUTION OF OTHER GENERIC ISSUES, UNQUANTIFIABLES)

- RESULTS:

  - METHOD A - ALTERNATIVES 2, 3 & 4 MAY BE COST-EFFECTIVE

  - METHOD B - ALTERNATIVES 2, 3 & 4 MAY BE MORE COST-EFFECTIVE

## REG. ANALYSIS (CONT'D)

## DIFFERENT APPROACHES T __ ALUE-IMPACT ANALYSIS

- ALTERNATIVES 2, 3, & 4 DO NOT MEET THE STAFF'S CDF GOAL OR REDUCE SABOTAGE RISK

- METHOD C - ALTERNATIVES 5 & 6 MAY BE COST-EFFECTIVE AND REACH CDF GOAL

° STAFF ENDORSES ALTERNATIVE 2, PLANT-SPECIFIC ANALYSES, ON FOLLOWING BASES:

- A-45 CASE STUDIES SHOWED:

  - MANY RISK CONTRIBUTORS ARE PLANT-SPECIFIC
  - ONLY WAY TO IDENTIFY DHR VULNERABILITIES IS THRU PLANT-SPECIFIC EXAMINATIONS
  - EFFECTS OF CORRECTIVE ACTIONS ARE PLANT-SPECIFIC
  - CDF AT MANY PLANTS ABOVE STAFF-SELECTED GOAL

- USE OF "METHOD C" (CREDIT FOR "MORATORIUM AVOIDANCE" ETC.) GOES BEYOND VALUE/IMPACT METHODS PREVIOUSLY USED FOR USIs/GSIs

## IMPLEMENTATION DETAILS

(ALTERNATIVE 2)

- NRC PROPOSES TO REQUIRE A PLANT-SPECIFIC EXAMINATION TO IDENTIFY VULNERABILITIES TO SEVERE ACCIDENTS (THE IPE PROGRAM)

- IPE WILL INCLUDE, BUT NOT BE LIMITED TO, DHR FAILURE RELATED CORE DAMAGE EVENTS

- SEPARATE, DEDICATED "A-45" EXAMINATION WOULD BE REDUNDANT

- WE CONCLUDE THAT A-45 SHOULD BE SUBSUMED INTO IPE

    - INSIGHTS GAINED FROM SIX CASE STUDIES AND EPRI-WOG ANALYSIS (PLUS NRC/SANDIA REVIEW, SEE APPENDIX D TO ENCLOSURE A) WILL BECOME EXAMPLE FOR LICENSEES.

## NUMARC/EPRI/WOG POINT BEACH PRA

(APPENDIX D TO ENCL A)

(SUMMARY OF MARCH 31, 1988 MEETING WITH NUMARC)

- NRC REVIEWED FOR TWO REASONS:

  1) ANSWER POSSIBLE CLAIM THAT ALTERNATIVE 1 IS JUSTIFIABLE

     - IF NUMARC PRA IS CORRECT, AND

     - IF PB IS A "BOUNDING" PLANT
       (THEN ALT. 1 WOULD BE ACCEPTABLE)

     - WE ARE NOT CONVINCED THAT EITHER OF THE ABOVE ARE CORRECT

  2) EXAMPLE OF NRC REVIEW OF AN IPE, HIGHLIGHTS DIFFERENCES BETWEEN NRC AND INDUSTRY:

     - METHODS

     - NUMERICAL ASSUMPTIONS

EPRI/WOG STUDY RESULTS

(NSAC - 113)

| SOURCE OF RISK | CORE DAMAGE NRC | FREQUENCY PER YEAR EPRI/WOG (RF)* | REVISED NRC (R |
|---|---|---|---|
| INTERNAL | 1.4E-4 | 2.6E-6 (54) | 2.5E-5 (6) |
| SEISMIC | 6.1E-5 | 7.4E-6 (8) | 4.1E-5 (1.5) |
| FIRE | 3.2E-5 | 6.3E-8 (500) | 2.2E-5 (1.5) |
| INTERNAL FLOOD | 7.7E-5 | 1.0E-8 (7700) | 9.8E-7 (79) |
| EXTERNAL FLOOD | 1.9E-8 | 1.0E-8 (2) | - - |
| WIND | 4.0E-6 | 1.0E-8 (400) | 1.7E-7 (24) |
| LIGHTNING | 5.8E-8 | 1.0E-8 (6) | - - |
| TOTAL | 3.1E-4 | 1.0E-5 (31) | 9E-5 (3.5) |

*REDUCTION FACTOR COMPARED TO "NRC"

# <u>CDF GOAL FOR APPLICATION TO A-45</u>

- MUST ANSWER QUESTION - IS DHR FAILURE RELATED CDF HIGH ENOUGH TO JUSTIFY REQUIRING PLANT SPECIFIC ANALYSIS?

- STAFF CURRENTLY CONSIDERING PROPOSING MORE GENERAL USE OF OVERALL $10^{-4}$/RY YR CDF*

- BELIEVE DHR FAILURE RELATED CDF 1/3 TO 1/2 OF OVERALL CDF

- THEREFORE, NEED TOTAL DHR FAILURE RELATED CDF $3x10^{-5}$

- TO ACHIEVE THAT, NEED QUANTIFIABLE DHR FAILURE RELATED CDF $1x10^{-5}$ (OPERATOR ERRORS, ACTS OF COMMISSION...)

- INTENDED <u>ONLY</u> FOR A-45. NOT IMPLIED THAT IPE SHOULD ADOPT.

- COMPATIBLE WITH STAFF'S A-44 AND A-49 GOALS

*CONSISTENT WITH LARGE RELEASE CDF OF $10^{-6}$/RY FOR EXAMPLE IF 1:10 RATIO BETWEEN CMF AND CDF, AND 1:10 RATIO BETWEEN LARGE RELEASE FREQ AND CMF

## OVERVIEW OF ALTERNATIVES ON GENERIC BASIS - PWR

## (COST PER P-REM - AVERAGE SITE)

| | EXTENT OF IMPROVEMENT | | | | COST OF IMPROVEMENT | | COST PER PERSON-REM | |
|---|---|---|---|---|---|---|---|---|
| | P(CM) | | POPN. DOSE | | | | ($ PER P-REM) | |
| ALTERNATIVE | INITIAL VALUE | % REDUCTION | INITIAL VALUE | % REDUCTION | GROSS IMPACT $ | NET IMPACT $ | OFFSITE W/GROSS IMPACT | OFF + ONSITE W/NET IMPACT |
| 2 | 2.2E-4 | 75% | 3.7E3 | 62% | 9.4E6 | 5E6 | 4100 | 2180 |
| 3 | 2.2E-4 | 10% | 3.7E3 | 11% | 0.56E6 | -0.52E6 | 1370 | NO COST |
| 4 | 4.8E-4 | 61% | 8.3E3 | 61% | 7E6 | -6.2E6 | 1390 | NO COST |
| 5 | 4.8E-4 | 94% | 8.3E3 | 94% | 66E6 | 46E6 | 8400 | 5830 |
| 6 | 5.7E-4 | 95% | 9.9E3 | 94% | 94E6 | 70E6 | 10,140 | 7520 |

Note:

Alt. 2 & 3 Assume FGB
Alt. 4, 5 & 6 Assume No FGB
Alt. 6 Assumes + 20% for Cold Shutdown

## OVERVIEW OF ALTERNATIVES ON GENERIC BASIS - BWR

## (COST PER P-REM - AVERAGE SITE)

| | EXTENT OF IMPROVEMENT | | | | COST OF IMPROVEMENT | | COST PER PERSON-REM | |
|---|---|---|---|---|---|---|---|---|
| | P(CM) | | POPN. DOSE | | | | | |
| ALTERNATIVE | INITIAL VALUE | % REDUCTION | INITIAL VALUE | % REDUCTION | GROSS IMPACT $ | NET IMPACT $ | OFFSITE W/GROSS IMPACT ($ PER P-REM) | OFF + ONSITE W/NET IMPACT ($ PER P-REM) |
| 2 | 2.2E-4 | 54% | 2.3E4 | 45% | 13E6 | 9E6 | 1260 | 870 |
| 3 | 2.2E-4 | 4% | 2.3E4 | 4% | 0.28E6 | -0.12E6 | 300 | NO COST |
| 4 | 2.67E-4 | 30% | 2.7E4 | 31% | 1.1E6 | 2.7E6 | 120 | NO COST |
| 5 | 2.67E-4 | 84% | 2.7E4 | 84% | 80E6 | 69E6 | 3460 | 3020 |
| 6 | 3.56E-4 | 84% | 3.6E4 | 84% | 84E6 | 73E6 | 2690 | 2260 |

Note:
Alt. 2 & 3 Assume Cont. Vent
Alt. 4, 5 & 6 Assume No Cont. Vent
Alt. 6 Assumes + 20% for Cold Shutdown

**PWR Core Melt Probability by Vulnerability -**
**Base Case with Recovery**

| Generalized Comparable Vulnerabilities | Plant A | | Plant B | | Plant C | | Plant D | |
|---|---|---|---|---|---|---|---|---|
| | Prob. | Cont. | Prob. | Cont. | Prob. | Cont. | Prob. | Cont. |
| AFWS Turbine Pump | 7E-6 | 2% | 5E-6 | 2% | 8E-7 | 1% | 7E-6 | 4% |
| Station Batteries | 4E-6 | 1% | 5E-7 | | 3E-6 | 4% | 2E-5 | 9% |
| Diesel Generators | 4E-7 | | | | 1E-6 | 2% | 5E-6 | 3% |
| LT Station Blackout | 4E-5 | 12% | 8E-7 | | | | | |
| Pump Common Mode | 2E-5 | 5% | 1E-5 | 4% | 2E-6 | 2% | 3E-6 | 1% |
| Valve Common Mode | 1E-5 | 3% | | | | | 2E-5 | 11% |
| HPIS & RWST Valves | | | 4E-6 | 2% | | | 6E-6 | 3% |
| Recirculation Switchover | 2E-5 | 7% | | | 9E-7 | 1% | | |
| LPI/R System | 2E-5 | 5% | 8E-6 | 3% | | | 1E-5 | 6% |
| LP Pump Cooling | 1E-5 | 4% | | | | | | |
| CCW System | 2E-6 | 1% | | | | | | |
| Service Water System | | | 1E-6 | 1% | | | | |
| SIS & Manual Actuation | | | 4E-6 | 2% | 2E-7 | | 5E-6 | 3% |
| Seismic Cab. & Racks | 5E-5 | 16% | | | | | 6E-5 | 33% |
| Seismic RWST & CST | 1E-5 | 3% | 1E-5 | 6% | 1E-5 | 17% | 1E-5 | 8% |
| Spray Fire Header Rupt. | 8E-5 | 25% | | | | | | |
| Fire AFW Pump Room | 1E-5 | 4% | | | | | | |
| Fire 4160 Sw Gear Rm | 2E-5 | 6% | | | | | | |
| Fire Cable Spreading Room | | | 8E-5 | 32% | 4E-5 | 59% | 6E-6 | 3% |
| Wind Chimney Collapse | | | 2E-5 | 10% | | | | |
| Wind DG Exhaust Stack | 4E-6 | 1% | | | | | 5E-6 | 3% |
| Flood Safety Systems | | | 5E-5 | 19% | 3E-6 | 4% | 7E-6 | 4% |
| Lightning DC Power | 1E-7 | | | | 2E-7 | | 2E-7 | |
| Unspecified Vulnerabilities | 1E-5 | 4% | 5E-5 | 19% | 6E-6 | 8% | 2E-5 | 10% |
| Total Core Melt Prob. | 3.1E-4 | | 2.4E-4 | | 7.4E-5 | | 1.8E-4 | |

PWR Internal and Special Emergency Core Melt Probabilities

| Initiating Event | Plant A | | Plant B | | Plant C | | Plant D | |
|---|---|---|---|---|---|---|---|---|
| | Prob. | % of Total | Prob. | % of Total | Prob. | % of Total | Prob. | % of Total |
| Internal | 1.4E-4 | 45 | 7.1E-5 | 32 | 1.4E-5 | 19 | 8.8E-5 | 49 |
| Seismic | 6.1E-5 | 19 | 7.3E-6 | 3 | 1.3E-5 | 18 | 7.3E-5 | 41 |
| Fire | 3.3E-5 | 10 | 7.5E-5 | 33 | 4.4E-5 | 59 | 5.8E-6 | 3 |
| Internal Flood | 7.7E-5 | 25 | NA | | NA | | NA | |
| External Flood | 1.9E-8 | | 4.6E-5 | 20 | 3.2E-6 | 4 | 7.2E-6 | 4 |
| Extreme Wind | 4.0E-6 | 1 | 2.4E-5 | 11 | 1.6E-8 | | 5.3E-6 | 3 |
| Lightning | 5.8E-8 | | 2.6E-6 | 1 | 2.0E-7 | | 1.8E-7 | |
| TOTAL | 3.13E-4 | | 2.36E-4 | | 7.48E-5 | | 1.79E-4 | |
| | | | | | | | | |
| Internal | 1.4E-4 | 45 | 7.1E-5 | 32 | 1.4E-5 | 19 | 8.8E-5 | 49 |
| Special Emergency | 1.7E-4 | 55 | 1.6E-4 | 68 | 6.0E-5 | 81 | 9.1E-5 | 51 |

BWR Vulnerabilities and Proposed Modifications

| Plant E | | Plant F | |
|---|---|---|---|
| Vulnerability | Modification | Vulnerability | Modification |
| Failure of 2 of 3 Diesel Generators | Add a 4th Diesel Generator | Failure of both Diesel Generators | Add a 3rd Diesel Generator |
| Failure of both Station Batteries and subsequent failure to flash the DG fields | Add Dedicated Battery to at least 1 DG or add 3rd Station Battery | Failure of both Station Batteries and subsequent failure to flash the DG fields | Add Dedicated Battery to at least 1 DG or add 3rd Station Battery |
| Failure of Diesel Generator Jacket Cooling | Additional DG Cooling Water Pump or crosstie the existing Cooling Water Lines | Failure of RB Closed Cooling Water System due to FTO of 2 NC MOVs | Add Bypass Line with NC Manual Valve |
| Failure of 125 VDC Circuit Breaker Control Power | Automatic transfer of Loads or Battery Chargers | Flow Diversion failure of RB Closed Cooling Water System | Add a second Isolation MOV that automatically closes in an accident |
| Fire in Control Room or Cable Spreading Room | Enhance procedures for operating the Safe Shutdown Pump | Flow Diversion failure of RB Service Water System due to failure of an Isolation MOV | Add Automatic Actuator to another Blocking MOV to prevent loss of 2 Cooling Loops |
| Seismic Failure of Station Batteries | Seismically qualify and upgrade Battery Racks and Supports | Fires in Cable Expansion Room | Add a one-hour Fire Barrier around HPCI & RBSW Power Cables |
| Seismic Failure of 4160 VAC Buses | Add Seismic Restraints at top of Bus Cabinets | External Flood | Develop Procedures for Safe Shutdown for very high flood crests |
| | | Seismic Event | Add or strengthen supports & braces to several important components |

BWR Internal and Special Emergency
Core Melt Probabilities

| Initiating Event | Plant E Probability | Plant E % of Total | Plant F Probability | Plant F % of Total |
|---|---|---|---|---|
| Internal | 9.9E-5 | 50 | 2.9E-4 | 66 |
| Seismic | 8.3E-5 | 42 | 8.1E-5 | 18 |
| Fire | 1.3E-5 | 7 | 1.1E-5 | 3 |
| Internal Flood | NA | | NA | |
| External Flood | 9.8E-8 | | 5.0E-5 | 12 |
| Extreme Wind | 1.4E-7 | | 3.8E-6 | 1 |
| Lightning | 1.7E-6 | 1 | 1.8E-6 | |
| TOTAL | 2.0E-4 | | 4.4E-4 | |
| Internal | 9.9E-5 | .50 | 2.9E-4 | 66 |
| Special Emergency | 1.0E-4 | 50 | 1.5E-4 | 34 |

## Enclosure 5 to the Minutes of CRGR Meeting No. 141
## Proposed NRC Bulletin on Thimble Tube Thinning

### TOPIC

C. E. Rossi (NRR) presented for CRGR review a proposed NRC Bulletin requesting that licensees/permitees for Westinghouse-designed PWRs (1) establish an inspection program to monitor incore neutron monitoring system thimble tube integrity, and (2) implement this program by inspecting the thimble tubes at the next (or first) refueling outage. Copies of the briefing slides used by the staff to guide their presentation and the discussions of this matter at this meeting are enclosed (see attachment to this enclosure).

### BACKGROUND

The package submitted for CRGR review in this matter was transmitted by memorandum dated July 8, 1988, J. H. Sniezek to E. L. Jordan; that package included the following documents:

1. Proposed NRC Bulletin, "Thimble Tube Thinning in Westinghouse Reactors"

2. Summary of Proposed Bulletin (in accordance with Section IV.B of the CRGR Charter)

### CONCLUSIONS/RECOMMENDATIONS

As a result of their review of this matter at this meeting, the Committee recommended in favor of issuing the proposed bulletin, subject to minor modifications and clarifications (to be coordinated with the CRGR staff), as follows:

1. Modify the wording of the proposed bulletin under "Purpose:" to specify that licensees establish and implement a program to monitor and confirm thimble tube integrity.

2. Reconsider the appropriateness of the completion schedules specified in the draft bulletin for licensees who have not yet done any inspections, in particular for such licensees who are now in a cold shutdown condition that is expected to last long enough to allow such inspections to be completed before restart. If for any reason (e.g., an increase in the rate or number of thimble tube degradations reported) the staff determines that the specified completion schedules must be accelerated such as to result in mandated shutdowns or delayed restarts, the bulletin should come back to CRGR for further review.

3. Include explicitly in the bulletin recognition of licensees who already have thimble tube monitoring programs, and include a provision that allows such licensees to continue inspections on the schedules already established in their programs.

4. Under "Reporting Requirements," include an explicit reminder of the reporting requirements in Part 50.72 and 50.73 of the regulations, as they apply to instances of thimble tube degradation that may be (or already have been) noted by licensees in the prescribed inspections.

5. Expand the sentence encouraging licensees to work collectively to address this issue, e.g., encourage workshops for sharing information and experience, and for jointly developing appropriate acceptance criteria and inspection frequencies).

6. In the last sentence of the first paragraph under "Description of Circumstances," delete the words following "...facility's design basis..." and substitute instead the phrase "...during flux mapping operations or a transient event."

SLIDE 1
7/14/88

# NRC BULLETIN

## THIMBLE TUBE THINNING IN WESTINGHOUSE REACTORS

COMPLIANCE PROBLEM

- o WESTINGHOUSE DESIGNED NUCLEAR POWER REACTORS ARE NOT ENTIRELY IN COMPLIANCE WITH GDC 14 WHICH STATES THAT THE RCS PRESSURE BOUNDARY SHALL BE DESIGNED TO HAVE AN EXTREMELY LOW PROBABILITY OF:

  ABNORMAL LEAKAGE

  RAPIDLY PROPAGATING FAILURE

  GROSS RUPTURE

SYSTEM PROBLEM

- o THINNING OF INCORE NEUTRON MONITORING SYSTEM THIMBLE TUBES (PART OF RCS PRESSURE BOUNDARY)

CAUSE

- o FLOW INDUCED VIBRATION

SIGNIFICANCE

- o POTENTIALLY NON-ISOLABLE LEAK OF REACTOR COOLANT THAT MAY NOT DRAIN TO CONTAINMENT SUMP
- o AREA EQUIVALENT TO 3 THIMBLE TUBES RESULTS IN A LOCA
- o AREA EQUIVALENT TO 8 THIMBLE TUBES MAY RESULT IN AN EVENT THAT DOES NOT SATISFY LOCA ACCEPTANCE CRITERIA

GENERIC APPLICATIONS

- o ALL WESTINGHOUSE DESIGNED NUCLEAR POWER REACTORS THAT UTILIZE BOTTOM MOUNTED INSTRUMENTATION ARE BELIEVED TO BE EXPERIENCING THIMBLE TUBE THINNING

SLIDE 2
7/14/88

ACTIONS REQUESTED

- ESTABLISH AND IMPLEMENT AN INSPECTION PROGRAM TO MONITOR THIMBLE TUBE INTEGRITY

ACTION SCHEDULE

- IMPLEMENT INSPECTION PROGRAM AT NEXT (OR FIRST) REFUELING OUTAGE THAT BEGINS 90 DAYS AFTER THE RECEIPT OF THE BULLETIN

REPORTING REQUIREMENTS

- LETTER CONFIRMING THAT THE INSPECTION PROGRAM HAS BEEN ESTABLISHED AND IMPLEMENTED

REPORTING SCHEDULE

- LETTER MUST BE SUBMITTED WITHIN 30 DAYS OF THE COMPLETION OF THE NEXT (OR FIRST) REFUELING OUTAGE THAT BEGINS 90 DAYS AFTER THE RECEIPT OF THE BULLETIN

COST TO ADDRESSEES

- COST TO INDUSTRY OVER THE NEXT 40 YEARS IS CONSERVATIVELY ESTIMATED TO BE $15,900,000

RADIOLOGICAL EXPOSURE

- ESTIMATED TO BE MINIMAL (ON THE ORDER OF 100 PERSON-MILLIREM PER INSPECTION)

BURDEN TO NRC

- ESTIMATED TO BE 50 PERSON-HOURS

SLIDE 3
7/14/88

# SUMMARY OF OPERATIONAL EXPERIENCE

## DOMESTIC FACILITIES

- o 23 FACILITIES (INCLUDING ONE 14-FOOT CORE) ARE KNOWN TO HAVE DETECTED THIMBLE TUBE THINNING
- o 4 KNOWN CASES OF THIMBLE TUBE LEAKS (LEAKS HAVE TYPICALLY OCCURRED WHILE EITHER INSERTING OR RETRACTING THE PROBE DURING FLUX MAPPING)
- o THESE LEAKS HAVE BEEN SMALL - CLOSURE OF MANUAL ISOLATION VALVE HALTED LEAK AND FACILITY CONTINUED TO OPERATE
- o PROBLEMS WITH THIMBLE TUBES TYPICALLY HAVE NOT BEEN REPORTED TO THE NRC

## FOREIGN FACILITIES

- o APPROXIMATELY 53 FACILITIES (INCLUDING FOURTEEN 14-FOOT CORES) ARE KNOWN TO HAVE DETECTED THIMBLE TUBE THINNING
- o APPROXIMATELY 12 KNOWN CASES OF THIMBLE TUBE LEAKS

## 12-FOOT VERSUS 14-FOOT CORES

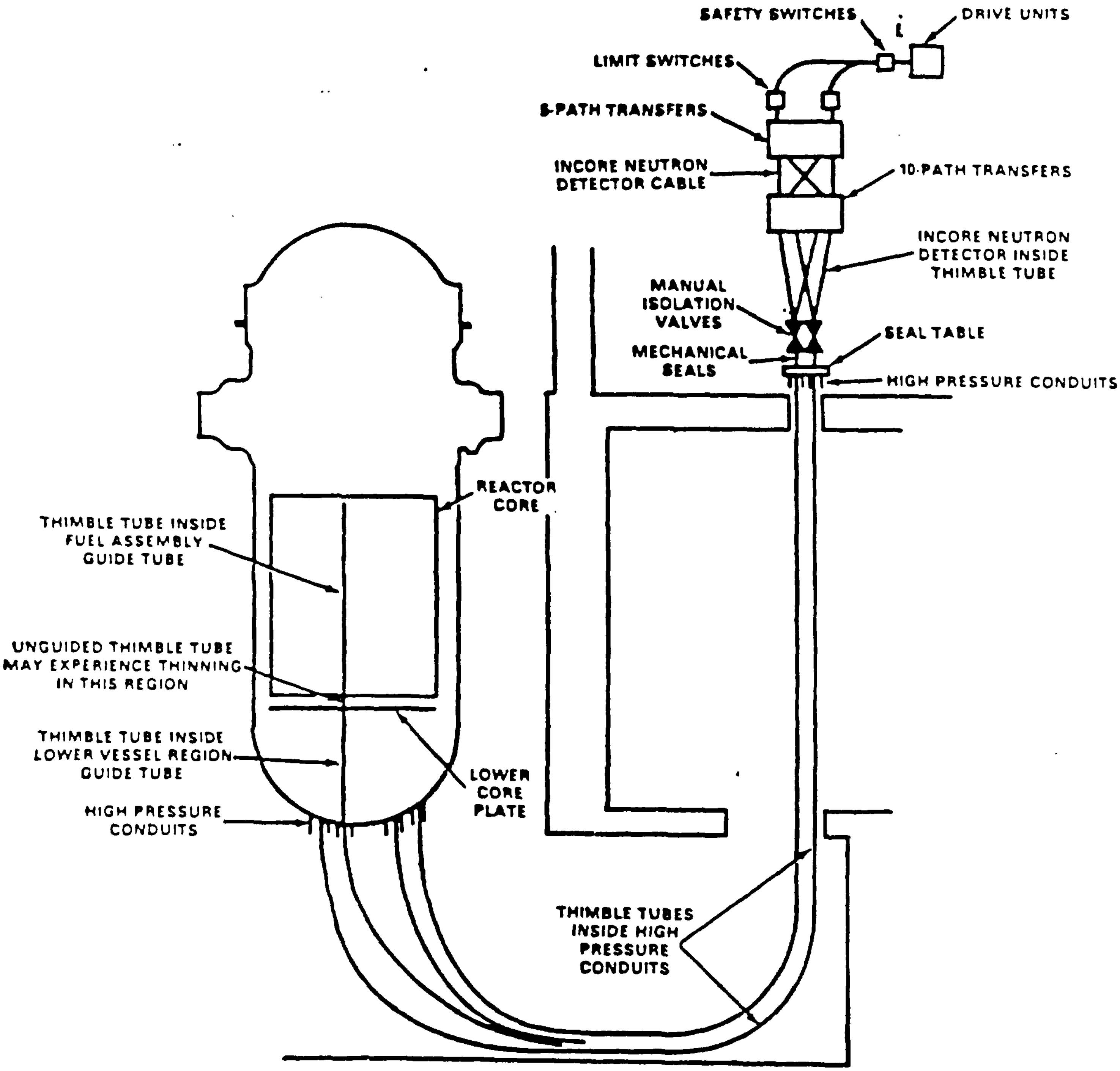
- o THINNING OF THIMBLE TUBES IN 14-FOOT CORES APPEARS TO BE FASTER THAN IN 12-FOOT CORES
- o SOUTH TEXAS IS THE ONLY 14-FOOT CORE IN THIS COUNTRY
    1) LICENSEE HAS ESTABLISHED PROGRAM TO MONITOR THIMBLE TUBE INTEGRITY
    2) LICENSEE HAS COMMITTED TO INSTALL AUTOMATIC ISOLATION VALVES AT FIRST REFUELING

SLIDE 4
7/14/88

SUMMARY OF ECT INSPECTIONS AT D.C. COOK UNIT 2

- 12 THIMBLE TUBES HAD INDICATIONS OF < 10% THRU WALL WEAR
- 15 THIMBLE TUBES HAD INDICATIONS OF 10% TO 40% THRU WALL WEAR
- 4 THIMBLE TUBES HAD INDICATIONS OF 40% TO 50% THRU WALL WEAR
- 8 THIMBLE TUBES HAD INDICATIONS OF 50% TO 60% THRU WALL WEAR
- 19 THIMBLE TUBES HAD INDICATIONS OF > 60% THRU WALL WEAR
  (OF THESE, 8 HAD INDICATIONS OF > 90% THRU WALL WEAR)

## TYPICAL WESTINGHOUSE INCORE NEUTRON MONITORING SYSTEM



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