Docket File
52-003

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

March 28, 1996

APPLICANT: Westinghouse Electric Corporation

PROJECT: AP600

SUBJECT: SUMMARY OF MEETING TO DISCUSS THE MAAP4 BENCHMARKING AND THERMAL-HYDRAULIC UNCERTAINTY ISSUE RESOLUTION PLAN FOR AP600 DESIGN

The subject meeting was held on February 29, 1996, between representatives of Westinghouse and the Nuclear Regulatory Commission (NRC) staff at the NRC's Rockville, Maryland, office. The purpose of the meeting was to discuss recent NRC comments on the Westinghouse MAAP4 Benchmarking plan along with review of Thermal-Hydraulic Uncertainty programmatic objectives for design certification of the AP600. This meeting was part of an ongoing effort to resolve thermal-hydraulic (T/H) uncertainty as outlined in a letter to Westinghouse on August 14, 1995, and supplemented by a letter from the staff on January 18, 1996, expressing concerns about changes in the plan direction.

Background

The general treatment of AP600 passive system reliability in the plant probablistic risk assessment (PRA) and a more specific assessment of the T/H uncertainties in beyond design basis analyses of PRA success criteria has been under active consideration by Westinghouse and the staff since June of 1994. In a July 27, 1995, presentation by Westinghouse, an issue resolution plan was proposed. The plan involved: (1) selecting a small set of sequences which bound the T/H response for all other success sequences analyzed using the MAAP4 code; (2) analyzing the bounding sequences using an approved emergency core cooling system evaluation model (NOTRUMP with Appendix K requirements) to show a peaking cladding temperature of less than 2200°F, and; (3) performing a benchmarking comparison of the MAAP4 calculations with NOTRUMP results for selected sequences to show appropriateness of MAAP4 analyses in identifying the bounding sequences. The NRC response to this plan was provided in a letter dated August 14, 1995, in which the staff agreed, with some additional conditions, that the proposed Westinghouse plan could be used to satisfactorily resolve the outstanding passive system reliability issues.

On December 8, 1995, Westinghouse documented their plan for benchmarking the MAAP4 computer code. In addition, this document also provided a written summary of the overall Westinghouse plan for closing out T/H uncertainty issues for the AP600 design. The staff noted numerous deficiencies in the MAAP4 benchmarking plan details. However, the staff's biggest concern was that Westinghouse appeared to be altering the overall methodology agreed to by the staff in the August 14, 1995, letter.

In a letter dated January 18, 1996, the staff provided comments on the December 8, 1995, benchmarking submittal from Westinghouse. The purpose of the February 29, 1996, meeting was primarily for Westinghouse to respond to the staff's comments in the January 18, 1996, letter.

Highlights of the meeting are summarized below:

Westinghouse reviewed the recent history of the T/H uncertainty interactions with the staff. Westinghouse acknowledged that their plan had "evolved" from the August 14, 1995, resolution path. As a result of the staff's comments in the January 18, 1996, letter, Westinghouse has modified the approach documented in their December 8, 1995, submittal. Some key points contained in the newest Westinghouse approach are summarized below:

- T/H uncertainty in the PRA will be addressed separately from MAAP4 benchmarking.

- Benchmarking of MAAP4 will be performed by comparing key parameters and phenomenology against a comparable NOTRUMP analysis of 12 select MAAP4 baseline cases. These cases cover a range of break size, locations, and limited hardware availability assumptions.

- T/H uncertainty will be addressed in a two step process

  - Westinghouse will determine the low-margin accident scenarios (primarily core uncovery sequences) which are risk significant to the focused PRA.

  - Those sequences that are identified as potentially risk significant will be further assessed with NOTRUMP sensitivity studies. Details of the analyses to be performed were not provided. These details would be discussed in subsequent meetings

The new plan did not include the use of Appendix K, DBA like, analyses on the bounding success sequences. In addition, Westinghouse does not plan to perform any MAAP4 benchmarking against AP600 test data. Both of these evaluations were elements of the original plan and conditions discussed in the staff's August 14, 1995, letter.

During the meeting, Westinghouse did note that the limiting success sequences chosen from the MAAP4 analyses would be justified by an AP600 plant response and phenomenological discussion on why the sequences were limiting. The staff reinforced the importance of this approach and stated that the NRC's primary interest is the actual behavior of the AP600 design in beyond design basis scenarios - not MAAP4 behavior. Westinghouse must therefore document and justify what they expect the AP600 behavior to be in the limiting success sequences. This justification should explain why the MAAP4 results "make sense" in consideration of engineering, testing results, NOTRUMP, and any other resources which may be applicable.

Westinghouse will need to provide additional clarification on the sensitively analyses that will be applied to limiting sequences. The staff raised a concern as to what criteria would be used to determine limiting sequences. The staff also stated that the Westinghouse plan needs to address the long term cooling analysis uncertainties. The current plan stops at stable IRWST injection.

Summary

The staff had no immediate objections to the scope and objectives of the revised approach to resolving MAAP4 benchmarking and T-H uncertainty issues for the AP600 design. The staff committed to further consider the information presented by Westinghouse and provide a written response to their latest plan. There was no agreement as to when this response from the staff would be provided to Westinghouse, although it was stated that preparation, of the supplemental draft safety analysis report, which is to be issued by April 30, 1996, would take precedence over the T-H uncertainty plan assessment.

Attachment 1 is the list of meeting attendees. Attachment 2 contains handouts provided by Westinghouse during the meeting to supplement the presentation and discussions.

original signed by:

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Docket No. 52-003

Attachments: As stated

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MEETING ON MAAP4 BENCHMARKING AND THERMAL-HYDRAULIC UNCERTAINTY RESOLUTION FOR THE AP600
FEBRUARY 29, 1996

MEETING ATTENDEES

NAME	ORGANIZATION
DEBRA OHKAWA	WESTINGHOUSE
CINDY HAAG	WESTINGHOUSE
BRIAN MCINTYRE	WESTINGHOUSE
MICHAEL WILLIS	WESTINGHOUSE
BRUCE MONTY	WESTINGHOUSE
JIM SCOBEL	WESTINGHOUSE
TERRY SCHULZ	WESTINGHOUSE
BOB OSTERRIEDER	WESTINGHOUSE
SEUNG OH	EPRI
CHARLES THOMPSON	DOE
GIOVANNI PICCINI	ENEC
GARY HOLAHAN	NRC
ROBERT JONES	NRC
TIM COLLINS	NRC
ALAN LEVIN	NRC
DON MCPHERSON	NRC
RALPH CARUSO	NRC
WALT JENSEN	NRC
JOE STAUDENMEIER	NRC
GIUSEPPE MARELLA	ANPA
CONSTANTINE TZANOS	ANL
MIKE SNODDERLY	NRC
RALPH ARCHITZEL	NRC
TOM KENYON	NRC
BILL HUFFMAN	NRC

Attachment 1

HANDOUTS PRESENTED

AT THE FEBRUARY 29, 1996, MEETING

ON MAAP4 BENCHMARKING AND

THERMAL-HYDRAULIC UNCERTAINTY RESOLUTION

FOR THE AP600

Attachment 2

MAAP4 BENCHMARKING
AND
T&H UNCERTAINTY RESOLUTION
FOR AP600

February 29, 1996
Rockville, MD

Debra Ohkawa
Westinghouse Electric Corporation
Monroeville, PA

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AGENDA

- Review / Preview
- PRA and Success Criteria Overview
- Benchmarking Plan
  - Purpose
  - Key Models
  - Comparison to NOTRUMP
  - Comparison to OSU
- T&H Uncertainty Plan
- How Westinghouse Addresses 5 Points from NRC August 14, 1995 Letter
- Summary

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REVIEW OF JULY 27 MEETING

Westinghouse's Mission

To provide a higher level of comfort that AP600 success criteria have been defined "robustly," so that PRA results are not significantly impacted by:

- T/H uncertainty in the behavior of the passive systems
- MAAP4's simplified models

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REVIEW OF JULY 27 MEETING
(Continued)

Basis for NOTRUMP Case Selection

- The cases are the most limiting, and are the only ones with core uncovery
- The cases represent a range of break sizes
  - 0.5"
  - 2.0"
  - 4.0"
  - 8.75"
- The cases represent a variety of break locations
  - Hot Leg
  - Cold Leg
  - DVI Line
- The cases include CMT or accumulator actuation
- The cases include the most important sequence in respect to CDF

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REVIEW OF JULY 27 MEETING
(Continued)

NOTRUMP and MAAP4 Assumptions for Comparison

- NOTRUMP analyses will be performed with DBA-like assumptions
  - Appendix K decay heat (1971 ANS + 20%)
  - 102% Initial Power
  - Initial water temperatures at Tech Spec maximums
  - ADS Minimum Valve Area
  - IRWST line maximum resistances
  - Maximum Tech Spec peaking factors
- MAAP4 analyses will be performed with only 2 changes made to previous MAAP4 runs
  - Appendix K decay heat (1971 ANS + 20%)
  - 102% Initial Power

MAAP4 input changes are limited so that applicability to MAAP4 analyses previously performed for PRA will be clear

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REVIEW OF JULY 27 MEETING
(Continued)

Comparison of NOTRUMP / MAAP4 Results

1. NOTRUMP (and LOCTA) calculation of PCT must meet the 2200°F criterion for all four cases

   This will close the T/H uncertainty issue.

2. System responses from NOTRUMP and MAAP4 will be compared:

   - RCS Pressure
   - Break Flowrate
   - CMT Flowrate
   - CMT Level
   - Accumulator Flowrate
   - IRWST Flowrate
   - RCS Inventory Mass
   - Core Mixture Level
   - Peak Clad Temperature
   - ADS FLOW RATE

   Differences in the responses will be investigated and explained (see next viewgraph)

   This will be the MAAP4 benchmarking effort.

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MAJOR NRC COMMENTS ON JULY 27 PLAN

<u>Based on August 14 Letter and Meetings with NRC</u>

- The NRC cannot concur on the sufficiency of the number of cases or the selection of cases without the identification of the important phenomena

- Westinghouse needs to provide basis for why MAAP4 is good enough to have chosen the most limiting cases

- PRA sensitivities that support the resolution of T&H uncertainty need to consider the <u>focused</u> PRA rather than the baseline PRA

- Comparison of MAAP4 and NOTRUMP should be done with exactly the same set of analysis assumptions

- MAAP4 needs to be compared to data from tests

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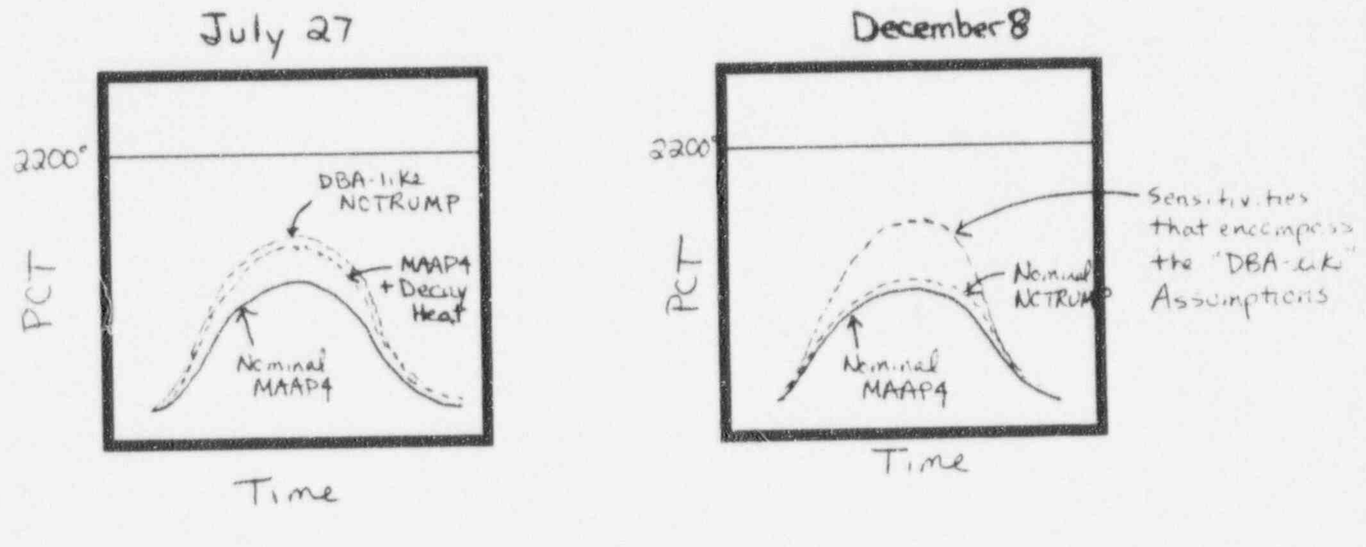
DECEMBER 8 PLAN

- Definition of Key Models
  - Importance (as seen from MAAP4 analyses)
  - Reason for Concern (as seen from MAAP4 limitations)
  - Parameters

- Re-adjusted Case Definitions
  - To better exhibit key models
  - To address 3 types of core uncovery

- Added "OSU Assessment"

- T&H Uncertainty Resolution Changed



- Clean set of success criteria analyses to be based on benchmarked parameter file and final AP600 design

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COMMENTS ON NOTRUMP ASSUMPTIONS AND T&H UNCERTAINTY RESOLUTION

- "Westinghouse has assumed that ... Appendix K inputs provide sufficient margin to bound the effects of passive system thermal hydraulic uncertainties on the PRA success criteria.... Westinghouse must justify why the use of Appendix K inputs and models is sufficient to bound the thermal hydraulic uncertainties for all AP600 PRA sequences." (August 14, 1995)

- "In an August 14, 1995, letter from the NRC to Westinghouse, the staff approved the Westinghouse bounding approach provided five concerns could be satisfied. The plan approval received high level review and concurrence within the NRC." (January 18, 1996)

- "Since passive systems rely on natural forces such as gravity and stored energy to perform their functions, the net driving forces are small compared to active systems and are subject to large uncertainties - especially when considering multiple system failure scenarios contained in the PRA." (Jan 18)

- "The MAAP4 sensitivity study of the few parameters indicated in the report, including the sensitivity study using LOCTA to show the effect of varying the core peaking factors, appear to be too limited in scope, and do not necessarily cover the T/H uncertainty." (Jan. 18)

  - Core peaking factors
  - Minimum and maximum accumulator flowrate
  - Minimum and maximum IRWST flowrate
  - Maximum ADS flowrate
  - 1971 ANS + 20% Decay Heat

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MAJOR ISSUES TO BE DISCUSSED TODAY

- Need more MAAP4 benchmarking cases
- T&H uncertainty issues cannot be resolved solely with MAAP4
- Proposed OSU Assessment is not acceptable

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PRA OVERVIEW

- The purpose of a PRA is to quantify the core-damage frequency (CDF) and large-release frequency (LRF), while gaining insights into any risk-significant vulnerabilities of the plant

- The PRA does not justify the safety of the design, it determines whether the risk from the design is acceptable

- Accident sequences should be defined as "success" based on what is expected to happen

  - Making a success criterion overly conservative (requiring more equipment) can potentially mask risk-significant vulnerabilities in the plant

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SUCCESS CRITERIA

- The "success criteria" in a PRA refers to a minimum set of equipment that is needed to prevent core damage

- Some of the AP600 success criteria definitions are supported by MAAP4 analyses

- MAAP4 baseline cases are the limiting cases for a range of accidents

  - The most restrictive set of hardware assumptions
  - The most restrictive break location and size

- AP600 success criteria definitions have evolved

  - They are more conservative (more equipment is required).
  - They provide more T&H margin.
  - They are simpler.

- Success sequences with PRHR are not based on MAAP4 analyses

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REVIEW OF MAAP4 CASES

There are two basic accident scenarios.

Automatic ADS

- Initiating Event
- No startup feedwater
- No PRHR
- **No accumulators**
- **1 CMT**
- 2 stage 4 ADS
  (on lo-lo CMT level)
- 1 IRWST line
- Containment isolation failure

Manual ADS

- Initiating Event
- No startup feedwater
- No PRHR
- **1 accumulator**
- **No CMTs**
- 2 stage 4 ADS
  (operator action)
- 1 IRWST line
- Containment isolation failure

Example results from hot leg breaks are provided.

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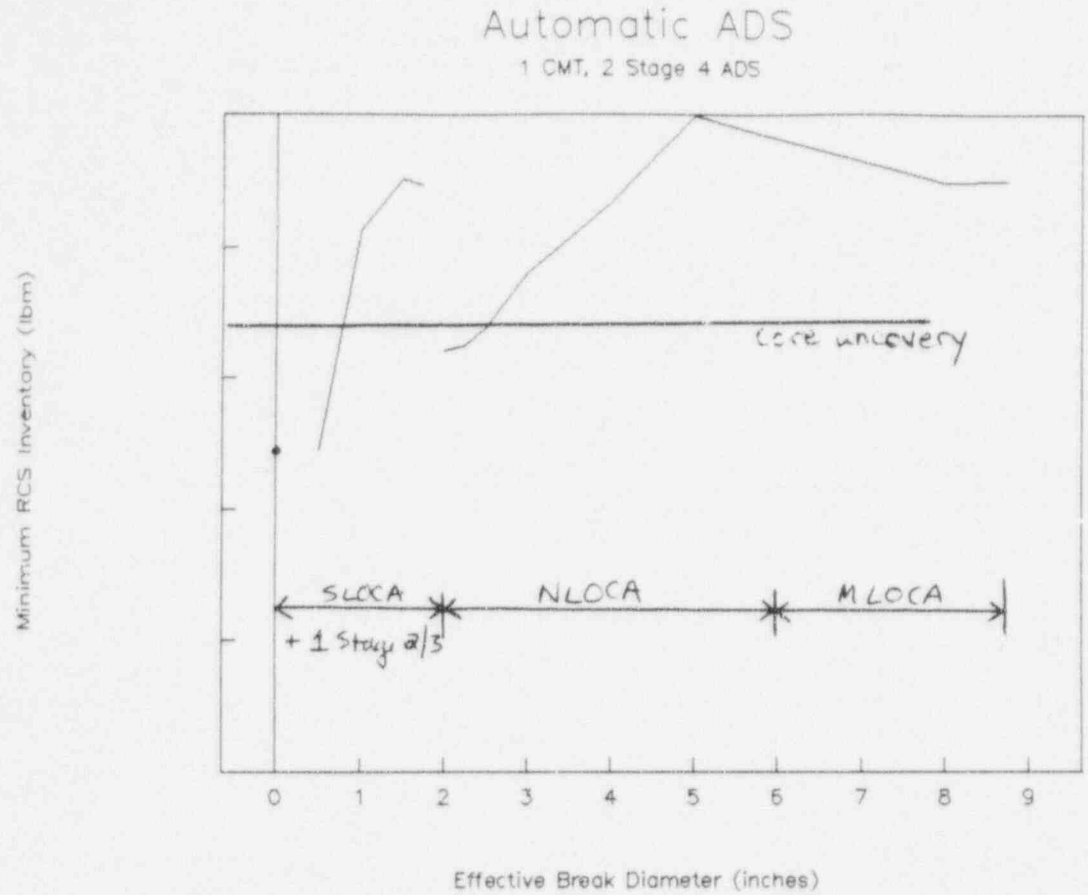
Automatic ADS
1 CMT, 2 Stage 4 ADS
Minimum RCS Inventory (lbm)
Effective Break Diameter (inches)
0 1 2 3 4 5 6 7 8 9
Core uncovery
SLOCA
+ 1 Stage 2/3
NLOCA
MLOCA

OBSERVATIONS FROM AUTOMATIC ADS CASES

- The CMT is an effective safety feature of the AP600 plant
  - 1 CMT contains a large amount of water that is able to provide make-up for the Transients and LOCAs of interest
  - The CMT level setpoints have been defined to provide ADS actuation in time to get IRWST gravity injection to cool the core
- CMTs have a recirculation and a draining phase of injection
  - Recirculation of the CMTs occurs for a longer period of time in the smaller breaks
- Most cases do not experience core uncovery
- Core uncovery can occur in Transients and Small LOCAs
  - The depth and duration of core uncovery are limited
  - Maximum uncovery of 30% for 500 seconds
- Core uncovery occurs at the small end of the NLOCA spectrum
  - The depth and duration of core uncovery are limited
  - Maximum uncovery of 10% for 100 seconds

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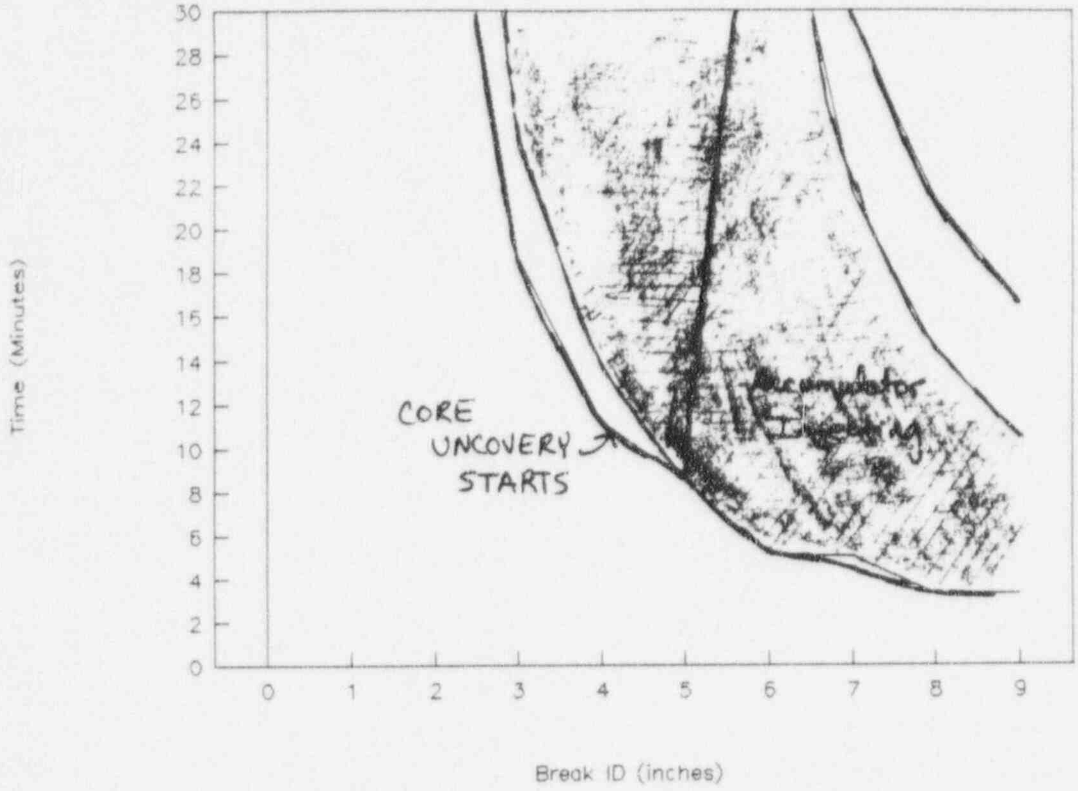
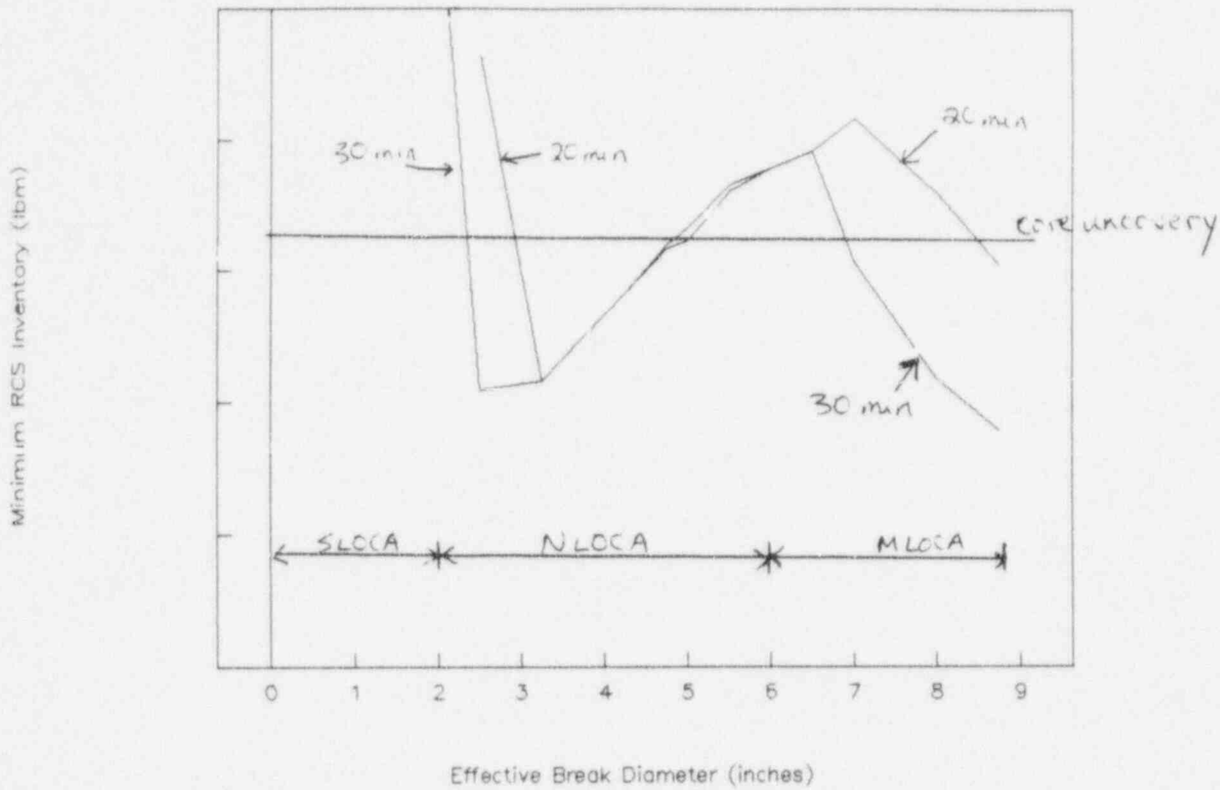
Manual ADS

1 Accumulator, 2 Stage 4 ADS



Manual ADS

1 Accumulator, 2 Stage 4 ADS



20 min and 30 min refers to operator action time to open ADS

OBSERVATIONS FROM MANUAL ADS CASES

- Because there is no CMT, the response of the plant is dependent on the depressurization due to the break and operator action time

- Transients and SLOCAs are slow-acting, and have small to no inventory loss before the operator action is anticipated

- For NLOCAs, the core uncovers before accumulators can inject

  - RCS pressure decreases after core uncovery, allowing accumulator injection

  - Accumulator injection is relatively slow

  - Accumulator injection limits the depth of uncovery

  - Duration of core uncovery is a function of operator action time

- For MLOCAs, the accumulators inject and empty before the core uncovers

  - Depth and duration of core uncovery is a function of operator action time

  - Hot leg break location is a significant factor at the largest breaks

MAAP4 BENCHMARKING PURPOSE

- To support the baseline PRA success criteria
- To focus on MAAP4's ability to
  - Track inventory losses and gains
  - Predict the system depressurization
- To demonstrate the ability of MAAP4 to predict the correct trend
  - As break size changes
  - As break location changes
  - As another tank (CMT or accumulator) is credited
- Nominal assumptions in MAAP4 and NOTRUMP

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Table 1 Key MAAP4 Models Used in Success Criteria Analysis		
Model	Importance Concerns	Parameters of Interest
Core Uncovery and Heatup	• The peak core temperature is used to determine whether a sequence is defined as "success" or "damage." • MAAP4's core model does not simulate the hot pin; therefore MAAP4's peak temperature prediction needs to be compared to a more detailed model. • Approximately half of the success criteria analyses result in partial core uncovery. They are primarily manual ADS scenarios that rely on operator action.	• Core mixture level • Peak core temperature • Decay heat
ADS Stage 4	• Credited in full depressurization cases to depressurize the RCS so that IRWST gravity injection can occur. 2 out of 4 stage 4 ADS lines is the success criterion for all full depressurization cases.	• ADS liquid flow rate • ADS vapor flow rate • RCS pressure
CMT	• CMT provides cooling and inventory make-up for LOCAs • CMT level determines the time of ADS actuation	• CMT injection flow rate • CMT recirculation flow rate • CMT level • Time CMT recirculation transitions to CMT injection • Time CMT low level setpoints are reached
IRWST Injection	• IRWST injection is the mechanism for long-term cooling in the full depressurization cases • IRWST injection recovers the core, or keeps the core from uncovering • IRWST injection is sensitive to the ΔP between containment and the RCS.	• IRWST injection flow rate • RCS pressure • Containment pressure • Core mixture level
Break	• Inventory loss through the break determines whether core is covered • System depressurization defines break size ranges for LOCA categories • Location of break at bottom of hot leg was a major consideration in defining success criteria, particularly for larger breaks	• Liquid break flow rate • Vapor break flow rate • RCS water inventory • RCS pressure
RCS Natural Circulation	• MAAP4's VPSEP model can have an impact on: - whether the break location is covered with water - the end of CMT recirculation and the start of CMT injection	• Liquid break flow rate • Vapor break flow rate • Time CMT recirculation transitions to CMT injection
Accumulator (1)	• The accumulator injection prevents core uncovery for larger (> 6") breaks. • The accumulator injection plays a role in limiting the PCT for breaks around 3" to 5" • The accumulator and CMT share the DVI line, and interaction between the tanks must be considered. • The MAAP4 accumulator model is isothermal.	• Accumulator injection flow rate • Core mixture level • RCS pressure

Table 1 Key MAAP4 Models Used in Success Criteria Analysis		
Model	Importance Concerns	Parameters of Interest
ADS Stage 1 - 3 (2)	• For high pressure scenarios, credited to reduce pressure so that stage 4 ADS can open • Credited in partial depressurization cases to depressurize the RCS below RNS shutoff head. • Location is at top of pressurizer, and entrainment of water into pressurizer could affect depressurization capability	• ADS liquid flow rate • ADS vapor flow rate • Pressurizer inventory • RCS pressure
SG Heat Transfer	• Heat transfer to SGs plays a role in Transients and SLOCAs; RCS inventory loss starts or increases when SGs dry out	• SG heat transfer
PRHR	• ADS success criteria with the PRHR operable are not directly supported by MAAP4 analyses.	Not Applicable

Notes:

(1) Interaction between accumulator and CMT will not be shown in MAAP4 / NOTRUMP comparison. The MAAP4 / OSU assessment will address this issue.

(2) The MAAP4 / NOTRUMP comparison will only examine ADS Stage 1 - 3 as a precursor to ADS Stage 4. The behavior of ADS 1 -3, by itself, can be seen through the MAAP4 / OSU assessment.

BENCHMARKING
CASES FOR COMPARISON TO NOTRUMP

Automatic ADS Actuation

0.5" hot leg break
2.0" hot leg break
5.0" hot leg break
8.75" hot leg break
0.5" hot leg break with 1 CMT, 1 Accumulator
2.0" hot leg break with 2 CMTs
2.0" hot leg break with delayed ADS

Manual ADS Actuation

3.0" hot leg break
6.0" hot leg break
8.75" hot leg break
8.75" cold leg break
DVI line break

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COMPARISON TO TEST DATA

- NRC stated in August 14, 1995 letter that comparison to test data should be performed

- Westinghouse has concerns about the added value

  - Establishing values for MAAP4 OSU parameter file would not show validity of MAAP4 AP600 parameter file

  - OSU "PRA" test scenarios are counted as failure in the PRA

  - Although two OSU tests experience core uncovery, they do not necessarily exercise the phenomena that are of interest

  - Data from "PRA" test scenarios were not documented in the OSU Test Analysis Report

- In December 8, 1995 plan, Westinghouse proposed an "OSU assessment" to compare MAAP4 AP600 results with OSU test data

  - Focus on a few parameters (primarily mass flow rate predictions)

  - Provide a <u>higher level of comfort</u> that MAAP4 predicts similar trends

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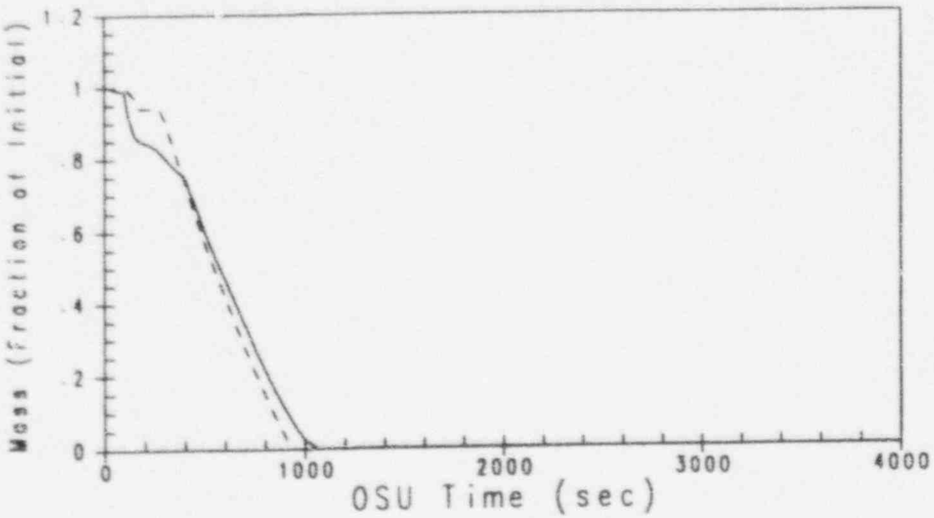
CMT #1 Mass Inventory

Comparison of AP600 MAAP4 Results to OSU Test SB26

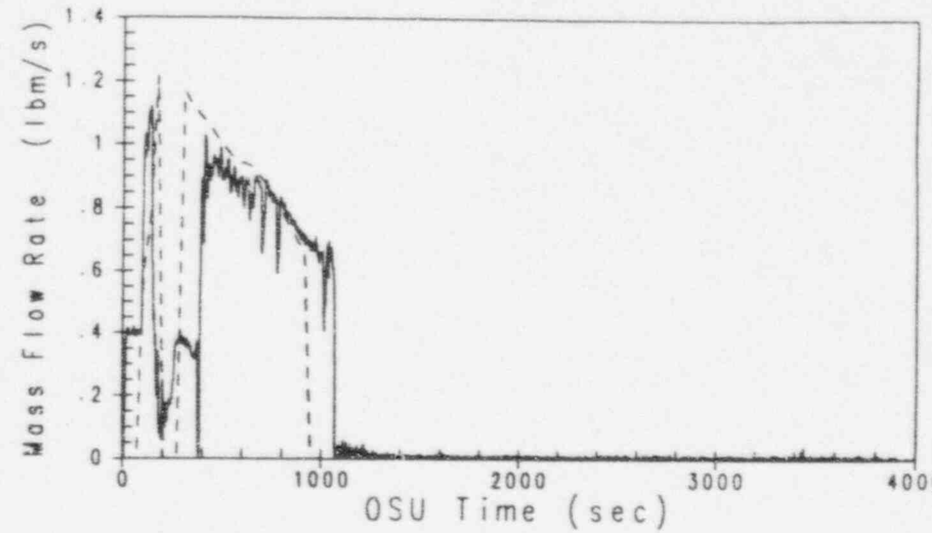
———	AMCMT1B	1	0	0 CMT1 fluid mass
- - - -	MWMT	1	0	0 MAAP4 CMT1



CMT #1 Injection Flowrate

Comparison of AP600 MAAP4 Results to OSU Test SB26

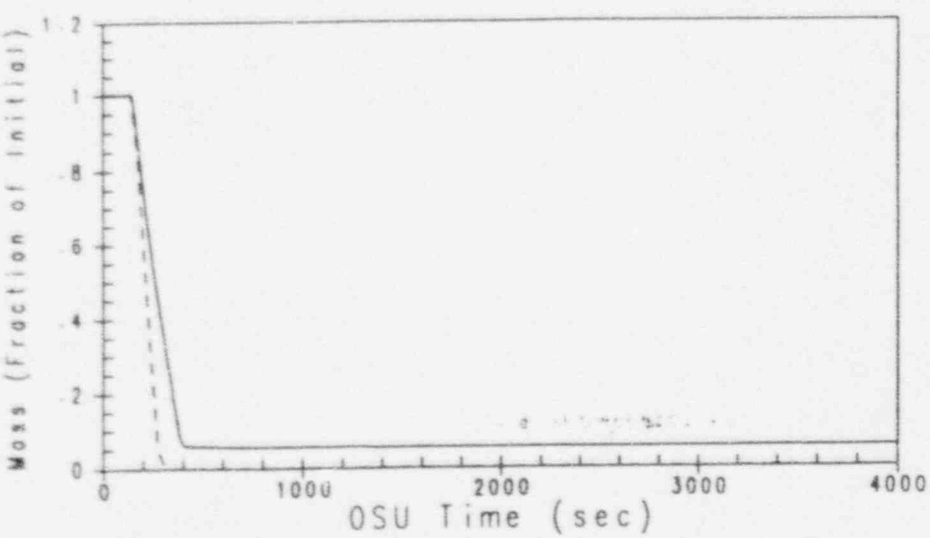
———	WWTDVIL1	1	0	0 CMT1 mass flow out
- - - -	WWMT	1	0	0 MAAP4 Scaled CMT1



Total Accumulator Mass Inventory

Comparison of AP600 MAAP4 Results to OSU Test SB26

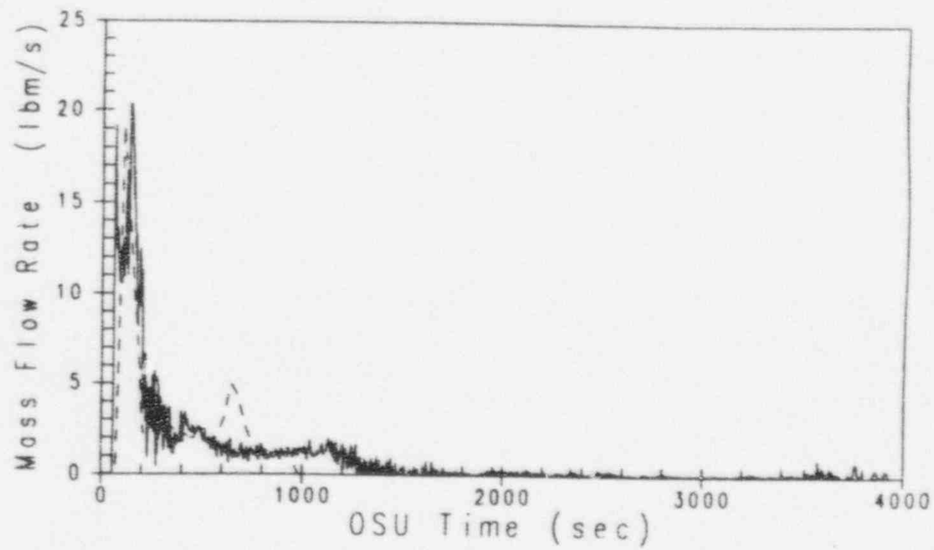
———	MTH0C007	1	0	0 ACC 1 fluid mass
- - - -	MACUM	0	0	0 MAAP4 Accums



Liquid Flowrate from ADS Stages 1,2,3

Comparison of AP600 MAAP4 Results to OSU Test SB26

———	ADS13LR	1	0	0 ADS123 liq flow out
- - - -	WWRV	0	0	0 MAAP4 Scaled ADS Liq



COMPARISON TO TEST DATA (Continued)

- In January 18, 1996 NRC comments, the proposed "OSU assessment" was rejected
  - Distortions in loop response due to the reduced size of the test facility
  - Appropriate scaling ratios change as a function of time
  - Response of OSU fuel rod simulators does not represent AP600 fuel rods
  - Initial conditions cannot be scaled
  - Test scenarios should not be expected to provide global coverage of phenomena that might be encountered in the multiple failure PRA sequences
- No comparison between MAAP4 and test data is planned

MAAP4 BENCHMARKING SUMMARY

- MAAP4 to NOTRUMP comparison will be performed for 12 cases
- Parameters of interest are defined to compare the system response
  - Differences in the responses will be investigated and explained
- There is no plan to tune MAAP4
  - Identical responses are not expected nor necessary to support MAAP4 as a scoping tool for PRA
  - If a MAAP4 parameter needs to be changed, it will be done in a systematic manner that either changes the value for all cases, or is based on phenomena that are specific to a set of cases
- Applicability of NOTRUMP to the PRA scenarios is an outstanding issue to be discussed later
- MAAP4 will not be compared to OSU tests

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T&H UNCERTAINTY

Purpose: To determine whether uncertainty in the T&H performance of passive systems has an acceptable impact on the focused PRA

- T&H uncertainty concerns will be addressed separately, after MAAP4 benchmarking

- Two major components to the plan

  1) PRA sensitivity to the focused PRA to determine if there are risk-significant, low-margin accident scenarios

  2) T&H analyses to examine risk-significant, low-margin accident scenarios

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T&H UNCERTAINTY
(PRA SENSITIVITY)

Purpose: To determine if the low-margin accident scenarios are risk-significant to the <u>focused</u> PRA

- Applicable event tree paths will be evaluated to further define the frequency of the low-margin scenarios
  - Number of CMTs and accumulators
  - Break size
  - Break location
  - Operator action time
  - Credit for additional operator actions not considered

- Determine if focused PRA CDF and LRF goals can be met if low-margin sub-sequences are counted as failure

- From this sensitivity, determine if the low-margin sequences are risk significant

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T&H UNCERTAINTY
(T&H ANALYSES)

- If there are risk-significant, low-margin sequences, further T&H analyses will be performed with NOTRUMP
- The NOTRUMP analyses will consider the uncertainty associated with the small net driving forces of passive systems
- Further details of the NOTRUMP analyses can only be discussed after it is known which accident scenario will be examined.

Summary of 5 Outstanding Issues from NRC's August 14, 1995 Letter

"In general, the staff considers that the approach described and laid out by Westinghouse [on July 27, 1995] to be acceptable provided that Westinghouse can address the following specific staff concerns:"

Item	NRC Statement	How it is Addressed
1.	Demonstrate that MAAP4 is adequate to provide an understanding of all the important T/H phenomena associated with AP600, in sufficient detail to identify the worst case PRA sequences.	There are 12 MAAP4 benchmarking cases. They have been identified to confirm the capability of MAAP4 to predict trends. The cases have also been selected to address key models. The selection of key models is based on 1) issues found to be important in the MAAP4 analyses, and 2) a review of the limitations of the MAAP4 code.
	Do not limit to NOTRUMP comparison.	The MAAP4 benchmarking plan of comparison to NOTRUMP is sufficient to support the use of MAAP4 as a scoping tool for PRA support.
	Should also include comparison against actual experiments - Ensure that experiments exhibit all the important phenomena that are associated with significant PRA sequences.	There are no tests that will exhibit all the important phenomena in the PRA sequences.
	Should also compare against counter-part calculations of small-break LOCA that were prepared using NOTRUMP and WCOBRA/TRAC (discussed in RAI 440.25)	The referenced NOTRUMP and WCOBRA/TRAC comparison is outdated and would not be a good comparison basis.

Summary of 5 Outstanding Issues from NRC's August 14, 1995 Letter

"In general, the staff considers that the approach described and laid out by Westinghouse [on July 27, 1995] to be acceptable provided that Westinghouse can address the following specific staff concerns:"

Item	NRC Statement	How it is Addressed
2.	Justify the process used to select the worst case sequences for NOTRUMP analysis, and explain why the success of these ensures that all other PRA sequences would be expected to succeed if analyzed using the same DBA-like analyses.	Explained in February 29, 1996 meeting.
	Define and justify a more systematic analysis approach for demonstrating the validity of the PRA Appendix A baseline sequence selection.	Definition is contained in the benchmarking plan; justification will be completed in revised PRA Appendix A documentation.
	Include T/H uncertainties in the focused PRA.	Low margin sequences in the focused PRA will be more closely examined in a T&H uncertainty document. Core uncovery cases will either be assumed as core damage, or further defense of their validity (including consideration of T&H uncertainty) will be provided.
	Demonstrate that any additional event tree success paths in the focused PRA are not affected by T/H uncertainty.	The focused PRA sensitivity to T&H uncertainty will use MAAP4 as a scoping tool to further refine the applicable event tree paths. MAAP4 will be used within the framework for which it was benchmarked.

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Summary of 5 Outstanding Issues from NRC's August 14, 1995 Letter

"In general, the staff considers that the approach described and laid out by Westinghouse [on July 27, 1995] to be acceptable provided that Westinghouse can address the following specific staff concerns:"

Item	NRC Statement	How it is Addressed
3.	Justify why the use of Appendix K inputs and models is sufficient to bound the thermal hydraulic uncertainties for all AP600 PRA sequences. The conservatism of Appendix K is based on single failure system response, and the thermal hydraulic parameter variations with multiple failures could be significantly different.	Open item, requiring further discussions between Westinghouse and the NRC.
4.	With the low margin success sequences set to failure, demonstrate that the focused PRA meets the criteria of 1.0E-4 per reactor year for CDF and 1.0E-6 per reactor year for LRF. (SECY-95-132)	Addressed in one of the sub-points of item 2. The specified CDF and LRF goals for the focused PRA will be met.
5.	Describe the systematic programs which will be implemented to identify and account for potential passive system failure mechanisms (e.g., clogged strainers, foreign material from maintenance activities, etc.)	This item is not related to PRA activities. It is being addressed by other parts of passive system reliability.

SUMMARY

- The MAAP4 benchmarking and T&H uncertainty issues continue to evolve as Westinghouse and the NRC exchange ideas

- The MAAP4 benchmarking plan has been separated from T&H uncertainty resolution

- The MAAP4 benchmarking plan is a comprehensive set of cases for comparison to NOTRUMP

- The framework for T&H uncertainty resolution is established; the details will require further discussion.

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