Westinghouse Electric Corporation Energy Systems

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NTD-NRC-94-4152
DCP/NRC0076
Docket No.: STN-52-003

May 31, 1994

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

ATTENTION: R. W. BORCHARDT

SUBJECT: PRESENTATION MATERIALS FROM THE MAY 25, 1994 MEETING ON AP600 PASSIVE CONTAINMENT COOLING SYSTEM ANALYSES

Dear Mr. Borchardt:

Attached are presentation materials used during the May 25, 1994 meeting at the Westinghouse offices in Rockville, MD to discuss AP600 Passive Containment Cooling System analyses. The following materials are attached:

Attachment 1 Presentation material, May 25, 1994 meeting

The Westinghouse Electric Corporation copyright notice is also attached.

Please contact Brian A. McIntyre on (412) 374-4334 if you have any questions concerning this transmittal.

N. J. Liparulo, Manager
Nuclear Safety Regulatory And Licensing Activities

/nja

Attachment

cc: R. Hasselberg, NRC
T. Kenyon, NRC (w/o attachments)
L. Shotkin, NRC (w/o attachments)
B. McIntyre, Westinghouse (w/o attachments)
P. A. Boehnert, ACRS

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ATTACHMENT TO WESTINGHOUSE LETTER
NTD-NRC-94-4152

NRC / Westinghouse Meeting on PCCS

Overview and Status of Westinghouse AP600 PCCS Test Analysis and SSAR

May 25, 1994

Agenda

1. Content of Westinghouse June 30, 1994 Report
2. NRC PCCS Review Schedule - Information Needs
3. Schedule of W/NRC Meetings and Reports
4. Objectives and Schedule for PCCS Work Plan
5. Plans for Next Meeting
6. Discussion of NRC Severe Accident information needs
7. Discussion of Detailed PCCS Work Plan
8. Wrap-up and Action Items

1. Content of Westinghouse June 30, 1994 Report

Content of Westinghouse June 30, 1994 Report

- **Report:**
"Confirmation of PCCS DBA Bases in SSAR"

Objectives

- Show appropriate margins are retained to demonstrate that AP600 containment DBA pressure response has equal or more design margin relative to current operating plants.

- Demonstrate clear connection from SSAR Rev. 0 containment DBA models to current code version.

- Demonstrate that uncertainties in code usage are bounded appropriately.

Schedule

- Report will be issued by Westinghouse to NRC on June 30, 1994

Content of Westinghouse June 30, 1994 Report

- WGOTHIC Relative to SSAR Rev. 0

  - WGOTHIC_S Version 1.1 re-run of SSAR Rev. 0 calculation; to demonstrate effect of new heat and mass transfer models on SSAR DBA pressure response

  - WGOTHIC_S Version 1.1 calculation; to quantify significant conservatism due to boundary conditions and initial conditions in SSAR Rev. 0

Table of Contents (handout)

Content of Westinghouse June 30, 1994 Report

Conclusions

A report content has been presented which is expected to provide AP600 DBA PCCS information on a schedule that is consistent with DSER needs.

A report will be issued by June 30, 1994 that will demonstrate that AP600 SSAR Rev. 0 DBA containment analyses remain conservative relative to WGOTHIC upgrades.

Subsequent SSAR Rev. 0 lumped parameter model calculations of confirmatory LST are planned.

2. NRC PCCS Review Schedule - Information Needs

NRC PCCS Review Schedule - Information Needs

- RAI Status
- Status of Future RAIs from NRC

PCCS TEST ANALYSIS RAI SUMMARY

RAI #	SUBJECT
480.2	Mechanistic Heat/Mass Transfer Correlations[3]
480.4	Dry Shell LST and SST Data[3]
480.8	Natural Circulation of Air in the PCCS[3]
480.9	HT to Internal Structures and Mixing in the Containment[3]
480.10	Jet Discharge: Location/Orientation/Scaling[3]
480.11	1/8 Scale Facility Instrumentation[3]
480.12	1/8 Scale Facility Test Matrix[3]
480.13	Westinghouse Scaling Approach[1]
480.14	Mechanistic Correlations in WGOTHIC[1]
480.15	WGOTHIC Validation Using Test Data[1]
480.16	WGOTHIC Numerics[1]
480.17	External Film Pattern/Water Distribution Tests[2]
480.18	Degree of "Rain" in the AP600 Containment[3]
480.32	Hydrogen Control-Prediction of Hydrogen Distribution[3]
951.2	WGOTHIC Condensation Model[3]
480.66	Margin between max calc. and design containment pressure
480.67	HT coefficient sensitivity to node size near the wall
480.68	Postulated break size for subcompartment analysis
480.69	Use of TMD code for M&E releases
480.71	Testing of containment heat transfer

[1] To be further addressed in WCAP-13246, Rev. 1
[2] To be addressed further in an RAI revision, and in some cases a supplemental report.
[3] Complete

Discussion

3. Schedule of W/NRC Meetings and Reports

Schedule of W/NRC Meetings and Reports

- Schedule Item from March 17, 1994 NRC Meeting

  - Westinghouse/NRC agreed to an overall SER information exchange process from March 1994 through issuance of WGOTHIC WCAP in May 1995

- Schedule Item from March 16, 1994 ACRS Meeting

  - Added September 1994 ACRS meeting on PCCS scaling based on SASM methodology

- "Draft Information Exchange Schedule In Support of AP600 PCCS Review" resulting from weekly telecons

  - Moved "Mid-stage 2 WGOTHIC" meeting ahead from Sep 9, to late July, 1994

  - Added August 1994 "PCCS Scaling and Phenomena" meeting

  - Added November 1994 end-stage 2 WGOTHIC meeting

Conclusions

A schedule of meetings and reports has been presented that meets NRC information needs that have been identified to date.

Westinghouse is committed to continued open dialog on schedules and content as the most effective way to proceed with the AP600 Design Certification process.

4. Objectives and Schedule for PCCS Work Plan

- For each category of the detailed PCCS work plan, the objective, content, and schedule status are given.

- Informational slides on certain topics are also discussed under the relevant work plan category.

Objectives and Schedule for W PCCS Work Plan

- **WGOTHIC Programming**

Objectives
Support the development of an efficient PCCS analysis tool with clear documentation in a controlled process.

Develop graphics and post-processing module (convenience code) upgrades following same stringent QA requirements as for solver.

Task Content
Analytical model upgrades for the solver module

Supporting upgrades for graphics and post-processing modules

Some separate effects validation is also included under this heading

Schedule
See following slide on code versions.

Objectives and Schedule for W PCCS Work Plan

Currently Planned WGOTHIC Versions

Module	Version	Upgrade	Status
Solver WGOTHIC_S	1.0	• Baseline code consistent with GOTHIC 3.4d • Wall-wall radiant H.T. • Colburn force convection • McAdams free convect.	Configured
	1.1	• Mixed convection • p/P_{BM} in mass transfer • Entrance effect multiplier • Flat plate correlation • error corrections NAI GOTHIC WGOTHIC	Configured
	1.2	• Liquid film enthalpy transport with 2 layer film • Dimensionless group printout	Expected to be configured by mid-June
	1.3	• Consistency with graphics/preprocessor upgrades (no analytical model changes)	In progress

Module	Version	Upgrade	Status
Preprocessor WGOTHIC_P	1.0	• Baseline code consistent with GOTHIC 3.4d.	Configured
	2.0	• Add Clime table input capability.	Verified. Configuration in progress
	2.1	• Add Clime plot options	In progress
		• NSAPLOT, MOVIE	
Graphics WGOTHIC_G	1.0	• Baseline code consistent with GOTHIC 3.4d.	Configured
	1.1	• Add Clime plot options	In progress
		• NSAPLOT, MOVIE	

Usage of WGOTHIC Code Versions

- WGOTHIC Preprocessor and Graphics Version Releases

  - Westinghouse QA process ensures that WGOTHIC_P and WGOTHIC_G correctly process input and output to correctly execute WGOTHIC_S and accurately process data

  - Both WGOTHIC_P and WGOTHIC_G are considered to be convenience codes for input and output processing. They have no impact on specific analytical models or methodology

  - Westinghouse has no plans to submit specific additional information beyond this meeting for the convenience codes

Usage of WGOTHIC Code Versions (continued)

- **WGOTHIC Solver Version Releases**
  - Version 1.1

    Configured

    (Through configuration control at this point, will be able to clearly show the effect on LST predictions of adding film enthalpy transport separate from H&MT correlation upgrades)

  - Version 1.2

    Film enthalpy transport is a negligible effect for AP600 calculations due to small dome area over which this mechanism is active

    Film enthalpy transport is active over a larger fraction of the LST, so inclusion of this model is expected to allow clear demonstration that all other significant phenomena are modelled correctly in the computer code

    Film enthalpy transport needed to accurately model transient tests, including blind test

    Version 1.2 expected to be configured during June 1994

    Will include status of results during November meeting

The W Code Development Process

- **Summary of NTD QA Program (WCAP-9565) Software Development Process**

Consistent with NQA 2a Part 2.7 which emphasizes maintaining formal documentation at each step of development

Functional Specification (functional group calc note)
Design Specification (programmer's calc note)
Verification / Validation
Formal review and signoff of specifications and documentation
Configuration
Release to users (any constraints identified)
Error reporting

Configuration control is performed by a dedicated group which is responsible for maintaining configured code versions

Objectives and Schedule for W PCCS Work Plan

The W Code Development Process (continued)

The following NTD QA procedures apply to WGOTHIC development

DP 3.7.1 Computer Software Development Process
DP 3.7.2 Verification and Validation of Computer Programs
DP 3.7.3 Configuration Control of Computer Programs
DP 3.7.4 Software Error Reporting and Resolution
DP 3.7.5 Dedication and Installation of External Computer Programs (followed for configuration control of incoming NAI GOTHIC versions)

Objectives and Schedule for W PCCS Work Plan

The W Code Development Process (continued)

- **Relationship of WGOTHIC to EPRI's GOTHIC Code**

GOTHIC Qualification Report documents a large set of qualification cases developed by EPRI / NAI to demonstrate the modelling capability of GOTHIC

8 standard theoretical problems

13 tests at 6 different facilities (including CVTR)

Westinghouse will reference the CVTR cases in June 30 report to support blowdown modelling

WGOTHIC differs in the addition of PCCS correlations that are exercised similar to other heat transfer options, such as Uchida heat transfer coefficient option

PCCS correlation subroutines serve to provide energy and mass source terms for control volumes similar to other GOTHIC subroutines

The W Code Development Process (continued)

- **Relationship of WGOTHIC to EPRI's GOTHIC Code** (continued)

WGOTHIC upgrades are verified not to adversely impact NAI qualification cases since NQA 2a Part 2.7 requires demonstration that upgrades do not affect previously released code

Initial WGOTHIC release reran every GOTHIC Qualification Report case - documented in baseline calc note

For subsequent versions, reran a selected set of the most sensitive cases - calc note

GOTHIC error reports are filed with NAI for resolution

Westinghouse incorporates into WGOTHIC any error corrections issued by NAI, according to severity level

Helps all GOTHIC users to benefit of error notification/correction

The W Code Development Process (continued)

• Relationship of WGOTHIC to EPRI's GOTHIC Code (continued)

Westinghouse supports longer term code consistency

- Mutually exchange information with NAI on code usage

- Present summaries of lessons learned at GOTHIC Advisory Group meetings

- Westinghouse participates in "GOTHIC Tailored Collaboration Program" wherein NAI performs code upgrades and adds useful models

- Tailored collaboration program has provided an industry Design Review on GOTHIC

Future WGOTHIC upgrades

- Westinghouse may incorporate future GOTHIC code upgrades and error corrections into WGOTHIC without explicit notification to NRC as long as AP600 PCCS Design Certification submittals are not adversely impacted

  Such upgrades are required to follow explicit QA procedures

  QA process includes steps to demonstrate that previous code results are not invalidated, including
  - EPRI/NAI qualification cases
  - Submitted AP600 PCCS validation cases

Objectives and Schedule for W PCCS Work Plan

The W Code Development Process (continued)

- **Relationship of WGOTHIC to EPRI's GOTHIC Code** (continued)

Conclusions

WGOTHIC upgrades have no adverse impact on previously developed GOTHIC qualification cases

Several processes and activities are expected to continue to keep GOTHIC and WGOTHIC on equal footing

Processes are in place to prevent future non-AP600 WGOTHIC upgrades from adversely impacting AP600 PCCS Design Certification submittals

Objectives and Schedule for W PCCS Work Plan

- **WGOTHIC Test Analysis**

Objectives
See next page for LST specifics

Content
See next page for LST specifics

Schedule
Subdivided LST model input is complete and calc note under review

Initial runs have begun. Preliminary results will be discussed in the July 1994 meeting on code comparisons to test data

LST TASKS and OBJECTIVES

Task	Node Type	Test	Code Version	Objective
A	Lumped	Baseline	Version 1.0	V&V WCAP-13246 & SSAR, Revs. 0
B	Lumped	Baseline	Version 1.1	Supports DSER and shows net effect of new models. It will justify the acceptability of the SSAR REV 0 models with respect to the correlation upgrades.
C	Subdivided	Phase 2/3	Version 1.2	Show phenomena are modelled correctly and all the important phenomena are modelled, therefore will show that final step for SASM is complete. (Two tests will be run and detailed local comparisons made.)
D	Lumped	Phase 2/3	Version 1.2	Show effect of noding and momentum equation on pressure. Demonstrate that using lumped model is acceptable for vessel pressure response by comparison to "C" and to measured data.
E	Lumped	Blind	Version 1.2	Add confidence to the modelling techniques by performing blind prediction.
F	Lumped	Phase 2/3	Version 1.0	Demonstrate that SSAR Rev 0 remains conservative including confirmatory tests. Same cases as "C".

Objectives and Schedule for W PCCS Work Plan

- **Wind Tunnel**

Objectives
Identify effects of terrain, buildings, and wind turbulence on PCCS performance

Develop bases for boundary conditions used within WGOTHIC (pressure boundary condition)

Evaluate PCCS effluent recirculation due to wind and thermal inversions (temperature, humidity boundary condition).

Identify any plant site constraints relative to terrain or buildings

Objectives and Schedule for W PCCS Work Plan

- **Wind Tunnel (continued)**

Schedule

Wind Tunnel Tests Phases 1, 2, and 4 are completed

Wind Tunnel Test data reports on Phases 1 and 2 have been issued to the NRC

Wind Tunnel Test data reports on Phases 4A and 4B are undergoing final review before being issued

Wind Tunnel Phase 3 has been eliminated based on literature study. Effluent recirculation report is expected to be sent by end of May 1994

Other evaluations begin in fiscal year 1995

Objectives and Schedule for W PCCS Work Plan

- **Scaling**

Objectives

- Provide scaling rationale for applying LST and separate effects tests results to full scale AP600

Phenomenological model development (ongoing; intermediate results have been presented to NRC and ACRS)

Formal top down scaling report per Appendix D of NUREG/CR-5809 has been added to address NRC information needs

- Top down scaling gives dimensionless Π groups which typically encompass ratios of the usual dimensionless numbers

- Π groups are used to demonstrate that important phenomena for plant are represented in tests and to identify any distortions due to scale

Overview of Severe Accident Scaling Methodology

(SASM)

Objectives

Demonstrate that

- all important phenomena have been addressed, and relative importance is correctly ranked

- the test database is appropriate to validate WGOTHIC

- factors affecting AP600 PCCS performance have been clearly identified

Benefits

- Assures experimental and analytical methods used to resolve issues are comprehensive, auditable, systematic, and traceable

- Demonstrates that all important features of an issue are fully addressed

- Allows certification process to focus on phenomena of greatest importance to PCCS performance

Overview of SASM (continued)

Key Points

Component I

Problem specification and concurrent PIRT development

Break problem into
systems
subsystems
:
:
processes (fluxes) ---> time constant
(Component II)

PIRT (Phenomena Identification and Ranking Table) is major outcome

Iteration with subsequent steps updates PIRT until SASM objectives have been met for application to AP600

Overview of SASM (continued)

Key Points

Component II

Develop time constants and time ratios (or Π groups) to quantify and rank important phenomena

Generally, may iterate with PIRT to modify relative ranking based on outcome of this component

Allow relating tests to AP600 - show that important phenomena in prototype are properly represented in tests

Overview of SASM (continued)

Key Points

Component IV

Incorporates into WGOTHIC the correlations / models necessary to accurately predict tests and AP600

Closure of SASM iteration is primarily based on a successful comparison of WGOTHIC to test database, which when complete:

- demonstrates that SASM process has identified the important phenomena in calculational process so the PIRT would then be complete

- validates WGOTHIC for use on full scale AP600

Overview of SASM (continued)

WGOTHIC Role

WGOTHIC is the computer code selected for analysis of the AP600 Design Basis Analysis containment pressure response, based on the following characteristics

- → ability to predict stratification
- → flexibility to model important phenomena
- → good experience with other PCCS designs
- → extensive, high quality V&V of base GOTHIC

A conservative AP600 analysis methodology has been submitted (SSAR Rev. 0) based on WGOTHIC validated with separate effects tests and integral tests (SST, Baseline LST)

Overview of SASM (continued)

WGOTHIC Role (continued)

Subsequent LST test analyses and further phenomenological model development pointed to upgrades that would improve test agreement:

- refined correlations to more accurately model ranges of parameters in AP600 geometry

- liquid film enthalpy transport (to address practical problem of modeling subcooled liquid film heat transfer on LST dome for the Blind Test)

- subdivided formulation with finer nodes

Completion of defined work scope is expected to demonstrate incorporation of all phenomena important in PCCS performance evaluations

This will indicate successful completion of the SASM iterative scaling process for PCCS Design Basis Analysis

Overview of SASM (continued)

Westinghouse Approach

- First iteration of SASM report (tasks 2662OW6001-4) will provide a complete application of SASM to one of the most important regions relative to PCCS performance:

"Internal containment above operating deck"

- Second iteration of SASM report (task 2662OW6005) will complete the scaling for all other regions of importance for containment DBA, including downcomer-baffle regions

The *preliminary* breakdown of the final report consists of the following "modules":

- → **Internal, above deck**
- → **Internal, below deck, closed compartments**
- → **Internal, below deck, open compartments**
- → **Internal, below deck, break compartment**
- → **External, riser**
- → **External, downcomer**

- Westinghouse experience with previous PCCS design and test program and existing studies by other authors will help form basis of phenomena selection and ranking. This will be clearly documented as part of SASM reports.

Objectives and Schedule for W PCCS Work Plan

- **Scaling** (continued)

Schedule

Bottom up statuses and reports	April - December 1994
SASM report iteration 1 to NRC	June 27, 1994
NRC opportunity to provide comments	August 12, 1994
SASM report iteration 2 to NRC	September 9, 1994

Objectives and Schedule for W PCCS Work Plan

- **Phenomenological Models**

Objectives

- Develop phenomenological models required to model AP600 PCCS performance

  Define correlations used in computer code

  Define appropriate boundary conditions for PCCS performance calculations

Schedule

- Status of heat and mass transfer models provided at ACRS meeting on March 16, 1994

- Reports on "Liquid Film Model Validation" and "Radiation Heat Transfer through Fog in the PCCS Air Gap" issued to NRC

- Other reports will be issued as they are completed

- Water coverage report has been moved ahead to better address NRC needs on schedule of information

Objectives and Schedule for W PCCS Work Plan

- **Phenomenological Models (continued)**

Water Distribution Test Status

All tests (Phases I, II, and III) are completed

Test Data reports have been issued to NRC

Data will be factored into phenomenological report on water film

- summary of test data bases for SSAR Rev. 0 WGOTHIC boundary condition assumptions on water coverage fractions

- liquid film stability

- evaluation of effect of hot containment surface on room temperature water coverage test results

Objectives and Schedule for W PCCS Work Plan

- **PCCS SSAR Evaluations**

Discussion

5. Plans for Next Meeting

Plans for Next Meeting

- Topic: Detailed review of Westinghouse and NRC code comparisons to LST

- Scheduled for July 1994

- Suggested Agenda

  - Discuss test measurements - methods and data

  - Show status of subdivided WGOTHIC test predictions compared to LST

  - Discuss status of NRC code comparisons to LST

- Comments

  - Westinghouse planned work scope for subdivided model
    - ★ Phase 2 Test #212.1 (Stepped transient)
    - ★ Phase 3 Test #222.1 (Blowdown)

  - Data comparisons in similar formats would make most effective use of meeting time

Suggested Data Comparison Formats

Handouts

Suggested LST Data Comparison Format

Westinghouse Plans

Lumped Parameter runs

Pmeas vs Ppredict to show conservative underestimate of total heat removal

Subdivided

Detailed comparisons to test data will be made to demonstrate agreement with test data to meet stated objectives

Attached format shows information on code results that Westinghouse will bring to July meeting, along with appropriate detailed printouts

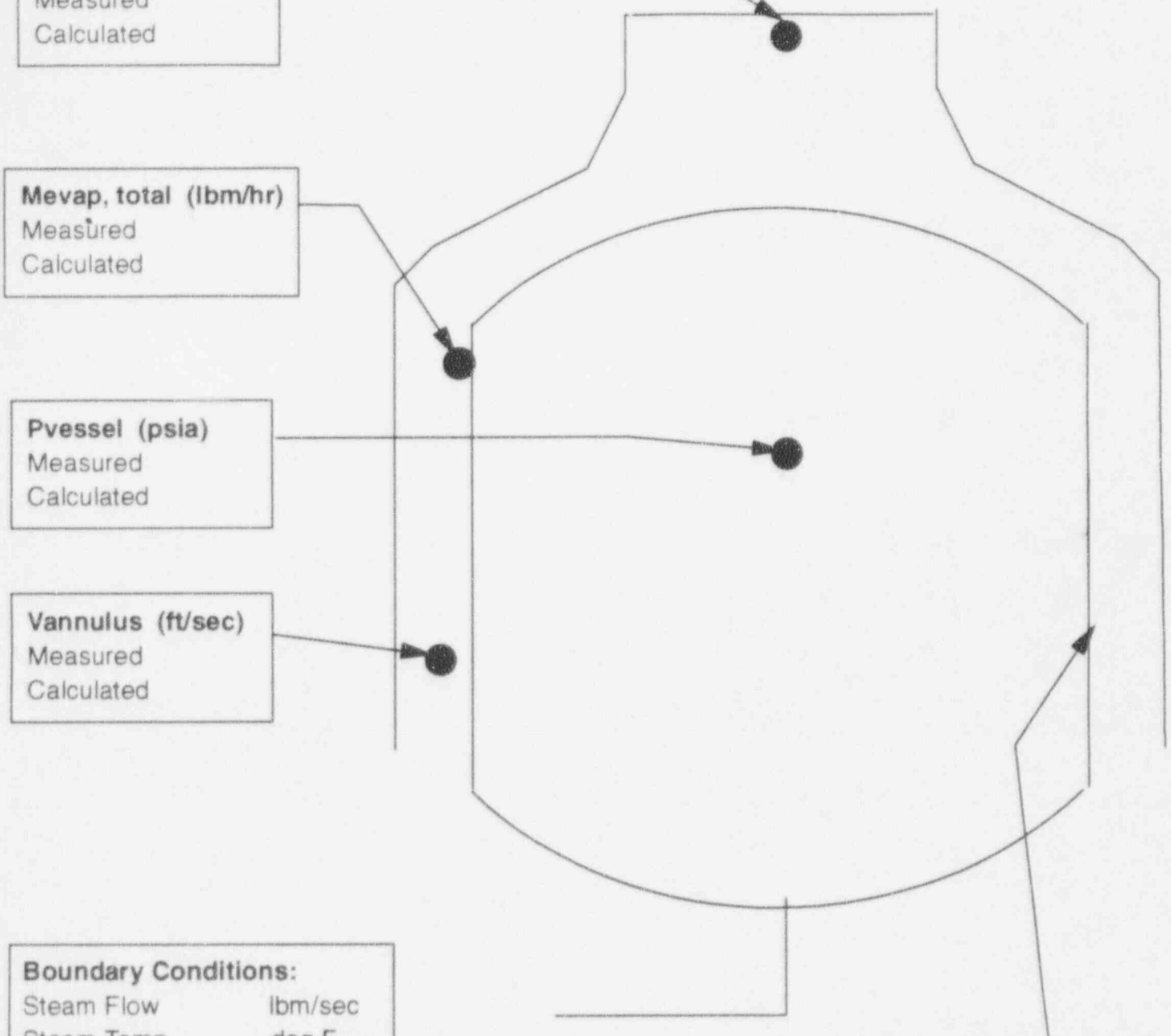
Steady State Data Comparisons

Tout (degF)
Measured
Calculated

Mevap, total (lbm/hr)
Measured
Calculated

Pvessel (psia)
Measured
Calculated

Vannulus (ft/sec)
Measured
Calculated



Boundary Conditions:

Steam Flow	lbm/sec
Steam Temp	deg F
Steam press	psia
Pambient	psia
Tin(ambient)	deg F
Humidity	%
Water flow	lbm/hr
Water temp	deg F
Water coverage	frac

Other Input
Kloss

Axial Distributions

Measured vs Calculated
Plots of:

T(z), wall
T(z), internal node
Pair at measurement locations

Transients

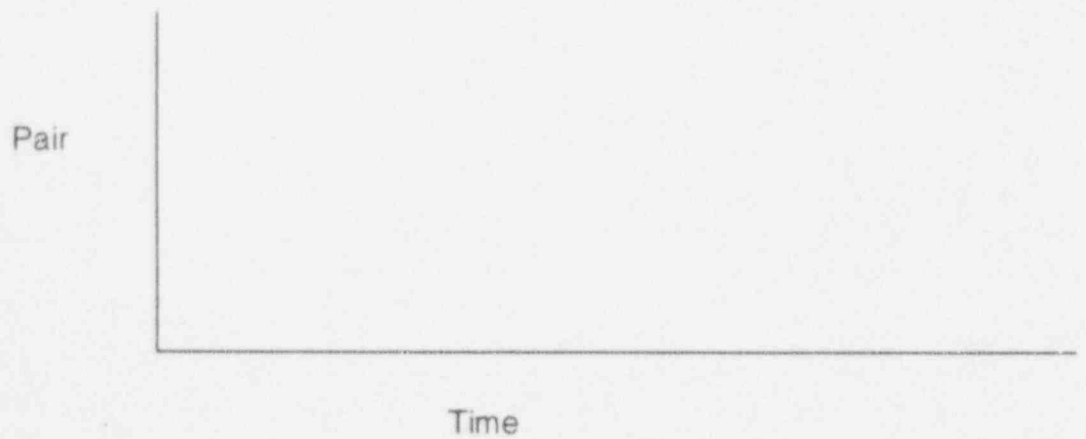
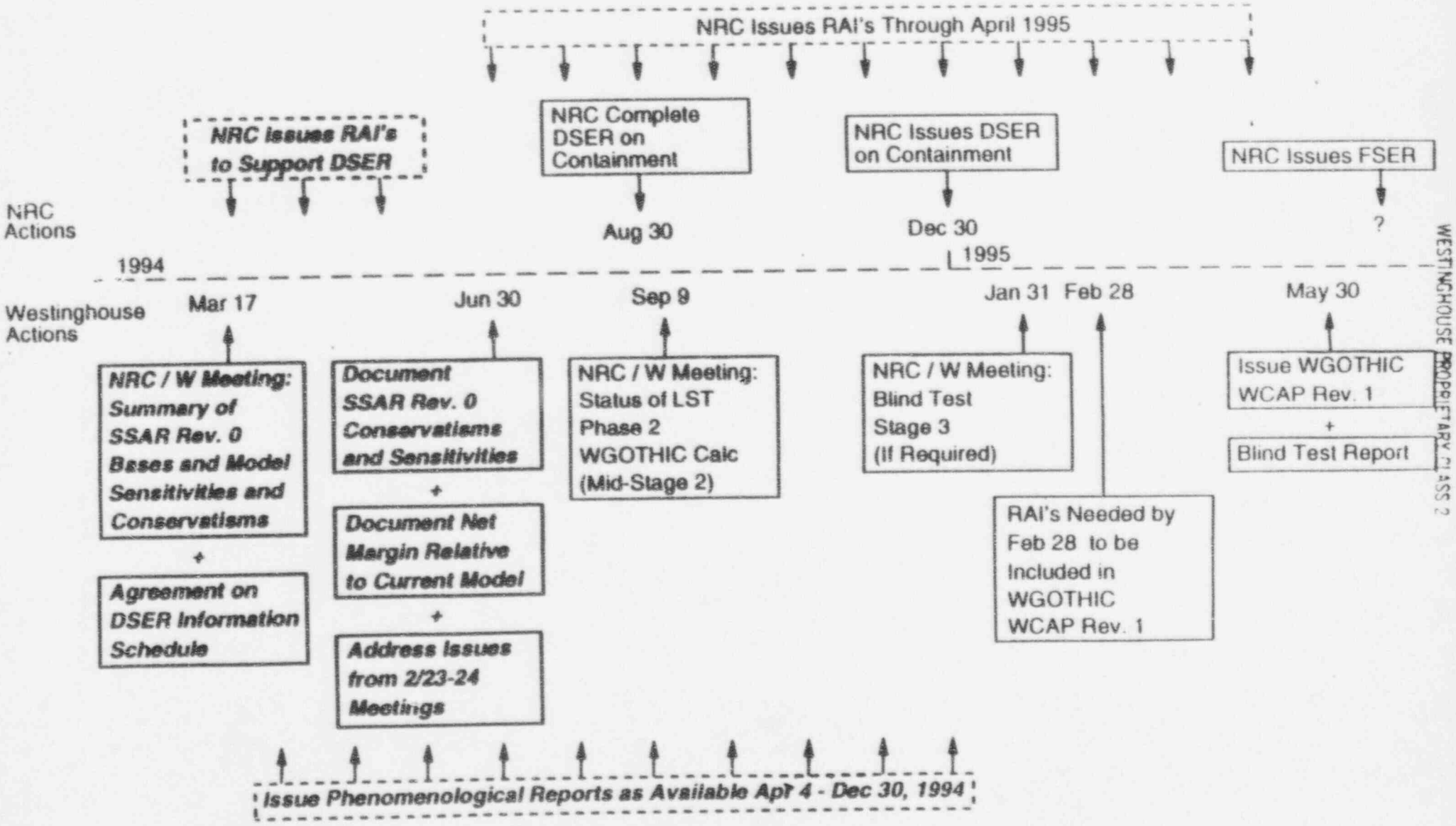


Table 7-1
Draft Information Exchange Schedule In Support of AP600 PCCS Review

FORMAT	DATE	TOPICS/AGENDA ITEMS	
Telecons	Weekly	- PCCS Analysis schedule - NRC review status, information needs	- Suggested agenda items forwarded prior to telecons - Format similar to test schedule phone calls
Meeting	Early May, 1994	- DSER/FSER supporting information plans - WGOTHIC development	- PCCS analysis work plans - DSER information exchange schedule/content - Schedule for resolution of technical issues - TOC for June 30, 1994 report - TOC for scaling report - Summary of WGOTHIC development - Relationship to EPRI GOTHIC development programs
Report	June 30, 1994	SSAR Bases for PCCS DBA	
Meeting	July 1994	- PCCS Computer Code Validation (Mid Stage 2) - SSAR Containment DBA	- WGOTHIC validation results and status - NRC CONTAIN validation results and status - Review status and future data needs
Report	July 1994	Phenomenological Report	Document containment surface wetting basis with respect to requirements and film stability (26620W6106)
Report	July 1994	Draft PCCS scaling report	SASM Component I
Report	August 1994	Phenomenological Report	Convective heat transfer basis with respect to laminar/turbulent flow (26620W6102)
Meeting	August 1994	- PCCS Scaling - PCCS Phenomena - Schedules	- Top down scaling results - Bottom up scaling results - NRC comments on phenomena (bottom up) reports - NRC comments on PCCS scaling report
ACRS mtg.	LATE September 1994	PCCS Scaling	
Report	EARLY September 1994	PCCS scaling report	Incorporation of NRC comments
Report	October 1994	Phenomenological Report	Condensation and evaporation mass transfer basis with respect to laminar/turbulent, inclined plane (26620W6103,26620W6104)
Meeting	November 1994	- WGOTHIC model review - Discussion of remaining issues, schedule	Model review prior to start of blind test prediction calculations (End of Stage 2)
Report	December 1994	Phenomenological Report	Internal transient and stratification processes (26620W6201, 26620W6301)

(from March 17 Presentation)

Proposed NRC / Westinghouse Information Exchange Schedule to Support NRC Safety Evaluation Report Needs.



JUNE 30th REPORT

AP600 CONTAINMENT DSER REPORT SCHEDULE

AND PRELIMINARY OUTLINE

PRELIMINARY

1.0 Revised AP600 LOCA Analysis with WGOTHIC

1.1 Objective

The objective of this step is to calculate the revised pressure/temperature transient for the AP600 Design with improved WGOTHIC models using a consistent version of the SSAR Rev. 0 input deck. The results of this analysis should be lower than those presented in the SSAR.

2.0 Revised LST Analysis with WGOTHIC

2.1 Objective

The objective of this step is to demonstrate that the revised code version is conservative and improves the predictions with respect to the large scale tests.

3.0 AP600 Model/Design Conservatism

3.1 Objective

The objective of this step is to highlight the significant factors affecting conservatism included in the analysis

4.0 Demonstration of Model/Design Conservatism

4.1 Objective

The objective of this step is to demonstrate the margin to the design limits that is retained by the use of the input and boundary conditions identified in step 3.0.

5.0 Validation of WGOTHIC

5.1 Objective

The objective of this step is to provide confidence that the code can predict the large scale tests. It is limited to the cases in Section 2.

6.0 Main Steamline Break

6.1 Objective

To demonstrate that the steamline break analyses presented in the AP600 SSAR remain conservative when reanalyzed with the revised code version.

PRELIMINARY

7.0 Prepare DSER Report

7.1 Objective

The objective of this report is to provide the NRC with enough information that they can feel comfortable with the conservatism associated with the AP600 Containment analysis and to provide confidence in the WGOTHIC code to predict these types of transients.

It is intended to demonstrate that the original analysis bounds the new analysis with the improved WGOTHIC version and that there remains substantial conservatism in the resultant transient.

8.0 Report Outline

- 8.1 Introduction
  - 8.1.1 AP600 containment design overview
  - 8.1.2 PCCS design overview
  - 8.1.3 WGOTHIC code overview
- 8.2 SSAR Analysis
  - 8.2.1 Analysis methodology
  - 8.2.2 Original LOCA analysis results
  - 8.2.3 Main steamline break results
- 8.3 AP600 vs. Current Designs and Assumptions
  - 8.3.1 AP600 design vs. current plants
    - 8.3.1.1 power to volume
    - 8.3.1.2 # penetrations
    - 8.3.1.3 fewer pipes to break
  - 8.3.2 Input conservatisms
    - 8.3.2.1 Decay heat
    - 8.3.2.2 Primary side volumes
    - 8.3.2.3 Initial conditions
    - 8.3.2.4 etc. from NRC presentation
  - 8.3.3 Discussion of transient
  - 8.3.4 Code sensitivities
    - 8.3.4.1 Data transmitted to NRC from presentation

PRELIMINARY

8.4 Demonstration of conservatism

8.4.1 Compare results of with and without modelling/input conservatisms

8.4.2 Comparison of code predictions with test data to demonstrate appropriateness of code.

8.5 Conclusions

8.5.1 Design features of the AP600 containment with PCCS result in improvements in ability to meet safety goals relative to operating plants.

8.5.2 Assumptions made in the analysis are conservative

8.5.3 Amount of total conservatism is significant

8.5.4 The original SSAR analysis is very conservative and bounds the reanalysis using the same model and the modified code.