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DCP/NRC1463
May 31, 2000

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

ATTENTION: J. N. WILSON

SUBJECT: AP1000 PRE-APPLICATION REVIEW ITEMS

Dear Mr. Wilson:

Per the request in your letter on May 10, 2000, we have identified five fundamental assumptions to be evaluated in phase two of the Nuclear Regulatory Commission's (NRC) pre-application review of the AP1000 standard plant design. These items are summarized below and are deemed critical to the determination of whether to submit a design certification application for the AP1000 design in the near future. In addition, a summary description of the information (i.e. report, analysis, etc.) that Westinghouse plans to provide to the NRC during the phase two review is identified for each of the five items along with Westinghouse's expectations related to each item.

Item 1 — The AP1000 Design Certification Application will reference sections of the AP600 Design Control Document (DCD) that do not change for the AP1000.

To reach agreement on this item, Westinghouse and the NRC should agree on the scope of the AP600 DCD that can be retained for the AP1000. This will determine the scope of the NRC review of the AP1000 DCD submitted for Design Certification. It is expected that at the conclusion of phase two, the NRC and Westinghouse will agree on the revised Table of Contents for the DCD and delineate the sections that can be retained from the AP600 DCD.

W Deliverable: Table of Contents of AP1000 Design Control Document

W Expectation: Agreement on the Table of Contents for the DCD, including a determination of the sections that can be retained from the AP600 DCD that will not be subject to re-review. It is our expectation that the NRC will also agree that corresponding portions of NUREG-1512, "Final Safety Evaluation Report Related to Certification of the AP600 Standard Design" will not change materially.

Item 2 — The AP1000 Design Certification Application will not require additional tests to be performed by the applicant.

In NUREG-1512, "Final Safety Evaluation Report Related to Certification of the AP600 Standard Design," the NRC states that the requirements of 10 CFR Part 52 have been interpreted to require that a passive plant vendor must develop and perform design certification test programs of a sufficient scope. This includes both separate-effects and integral-systems experiments to provide data to assess the computer codes used to analyze plant behavior over the range of normal operating conditions, transient conditions, and accident sequences.

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It is our position that the AP600 test program meets the requirements of 10 CFR Part 52 for the AP1000. Westinghouse proposes to provide a report to the NRC staff to permit the NRC staff to evaluate this conclusion. The AP1000 Analysis Plan and Scaling Assessment of AP600 Test Program is a single report that will be provided to the NRC staff for their review. Its format will be based on WCAP-14141, AP600 Test and Analysis Plan. Its scope and content is described in more detail in Attachment 1.

W Deliverable: AP1000 Analysis Plan and Scaling Assessment of AP600 Test Program

W Expectation: NRC determination whether the AP600 test program meets the requirements of Part 52 for the AP1000.

Item 3 —The AP1000 Design Certification Application can utilize the AP600 analysis codes with limited modifications.

As part of the design certification application for the AP600, Westinghouse performed extensive code development and validation activities to develop analysis tools suitable for performing Chapter 15 accident analyses for the AP600. The NRC and the Advisory Committee on Reactor Safeguards (ACRS) have performed extensive reviews of the code development and validation programs for each of the computer codes developed for the AP600. It is our position that these codes are suitable for use in performing accident analyses for the AP1000. It is recognized that certain limitations of the codes were identified in NUREG-1512. In these cases, the acceptability of the codes for the AP600 is based, in part, on the large safety margins provided by the AP600. Westinghouse will address the limitations identified in NUREG-1512 for the AP600 computer codes used for safety analysis and will demonstrate the appropriateness of their use for the AP1000. Westinghouse will provide an assessment of the applicability of each code and will identify code changes to address the most significant comments documented in NUREG-1512. This assessment will be provided as part of the AP1000 Analysis Plan and Scaling Assessment of AP600 Test Program Report discussed under item 2.

In addition, to assist the staff in their consideration of this item, Westinghouse will provide a report that assesses the AP1000 passive core cooling system design margins with respect to safety injection performance characteristics. The relative margin between the performance of the AP600 and the AP1000 passive core cooling system features will be assessed during the minimum core inventory time period at the start of IRWST injection following a small LOCA. This assessment will address the relative performance margins in the IRWST injection paths and the ADS stage 4 vent paths. The line resistances of these paths will be used together with consistent boundary conditions to provide a simple calculation of the comparative injection and venting flow rates. The purpose of this evaluation is to provide a simple estimate of the relative margin of the AP1000 as compared to the AP600. The report will present the important inputs, boundary conditions and calculated results and will discuss the meaning and significance of the results. This report is not meant to replace any of the Chapter 15 accident analyses that would be provided as part of the AP1000 Application for Design Certification. It is provided for informational purposes to assist the staff and ACRS to assess the margin of safety that will be provided by the AP1000 passive safety systems for the particular phase of the LOCA events that is most sensitive to the code limitations outlined in NUREG-1512.

W Deliverable: AP1000 Analysis Plan and Scaling Assessment of AP600 Test Program (See Item 2)
AP1000 Passive Core Cooling System Design Margins Assessment

W Expectation: NRC determination that the AP600 analysis codes including the proposed changes are adequate for analyzing the AP1000.

Item 4 — The AP1000 Design Certification Application can utilize the AP600 PRA supplemented with a sensitivity study to meet the requirements for a plant-specific PRA.

The Code of Federal Regulations specifies in 10 CFR Part 52.47 that an application for design certification must contain a design-specific probabilistic risk assessment. It is our position that the probabilistic risk assessments performed for the AP600, supplemented with a sensitivity study, is sufficient to meet the requirements of 10CFR52.47(a)(1)(v) for the AP1000 Design Certification Application.

The objective for this issue is to provide the NRC with sufficient information such that the staff can conclude that the Westinghouse approach with regards to satisfying the requirements of 10CFR52.47(a)(1)(v) is acceptable. Westinghouse proposes that the scope of the PRA sensitivity study that will be submitted as part of the AP1000 Application for Design Certification should be agreed to during the phase two review. Westinghouse will propose a Table of Contents for this study and an explanation of what will be included in the study. Attachment 2 provides a description of the elements proposed to be included in the AP1000 PRA.

One of the goals of the AP1000 PRA sensitivity study is to demonstrate that the AP1000 success criteria are the same or similar to the AP600. Toward this end, an analysis of LOCA accident sequences that were determined to reflect the broad spectrum of phenomena important to the AP600 success in the level 1 PRA will be completed for the AP1000. Westinghouse proposes that, in phase two, the analyses from the MAAP4 Benchmarking Report (WCAP-14869) will be performed for the AP1000 using the MAAP4 code with the intent of demonstrating that the AP1000 plant response to these sequences is similar to the AP600 response. These analyses will provide a level of confidence to the NRC that the PRA level 1 success criteria for LOCA are achieved at the increased power level of the AP1000.

W Deliverable: Table of Contents for the AP1000 PRA Sensitivity Study
AP1000 Level 1 PRA LOCA Success Sequences Analysis Report

W Expectations:

1) NRC determination that the AP600 PRA supplemented with a suitable sensitivity study meets the requirements for the AP1000 plant-specific PRA; and
2) Agreement that the analysis results provided in the AP1000 Level 1 PRA LOCA Success Sequences Analysis Report are sufficient to conclude that the AP1000 Level 1 success criteria for LOCA is the same as for the AP600.

Item 5 — The AP1000 Design Certification Application can defer selected design activities to the COL applicant.

The AP1000 Design Certification application will include less design detail than that provided in the AP600 Design Certification application. The General Arrangement, structural configuration, equipment and piping layout are substantially the same; However, qualification analyses will be deferred to the Combined License applicant. This affects the design detail available during Design Certification in the following areas:

Seismic analyses	(DCD Sections 2 and 3.7)
Structural design	(DCD Section 3.8)
Piping design	(DCD Section 3.6 and 3.9)

The objective in phase two for this issue is for Westinghouse and NRC to agree on the level of detail necessary for Westinghouse to provide in an application for Design Certification for the AP1000. In phase two, Westinghouse will provide markups of the above listed sections of the AP600 DCD. These markups will show the level of information proposed for the AP1000 DCD. The AP1000 DCD will retain the methodology and design criteria for the COL applicant that references an AP1000 plant. Where the AP600 DCD contained results of analyses, the AP1000 DCD will identify information to be provided by the Combined License applicant. COL requirements will be proposed similar to those employed in the DCD for other certified standard plant designs (i.e. System 80+).

Attachment 3 summarizes the Westinghouse approach to the level of detail that will be provided in the applicable sections of the DCD and the items to be included in the phase two reviews.

W Deliverables:

Draft DCD Sections 2, 3.6, 3.7, 3.8, and 3.9 and the seismic analysis for hard rock. These drafts will be markups of the AP600 SSAR showing changes in strike out / redline format. It is expected that these sections would be nearly the final form for the AP1000. The changes from AP600 would primarily be items deferred to the COL applicant.

W Expectations:

1) NRC concurrence with the level of detail to be included in the AP1000 application.
2) Identification of significant issues to be addressed during Design Certification.
3) NRC agreement on the scope and content of the new COL commitments.

Finally, at the conclusion of the phase two review effort, Westinghouse seeks an estimate of the lead times, schedule milestone intervals and fee estimates of the review effort for an AP1000 Design Certification Application.

We would like to discuss these five fundamental assumptions and our planned deliverables with the key NRC staff reviewers at the June 5, 2000 meeting at the NRC. At that meeting, the cognizant Westinghouse engineers will describe our plan for each item, so that the NRC staff can provide feedback as to the acceptability of this plan. Subsequent to that meeting, Westinghouse requests the NRC to provide a milestone schedule and fee estimate for the phase two review effort. Note also the this schedule and estimate should include interactions with the ACRS necessary to receive their approval of these five items discussed in this letter.

Please contact me if you have any questions concerning this request.

Very truly yours,

M. M. Corletti
Advanced Plant Safety & Licensing

cc: W. E. Cummins – Westinghouse
J. W. Winters – Westinghouse
H. A. Sepp – Westinghouse
R. A. Matzie – Westinghouse
H. J. Bruschi – Westinghouse
~~C. B. Brinkman – Westinghouse~~

Attachment 1 to DCP/NRC1463

AP1000 Analysis Plan and Scaling Assessment of AP600 Test Program Report

Attachment 1 to DCP/NRC1463

AP1000 Analysis Plan and Scaling Assessment of AP600 Test Program Report

The AP1000 Analysis Plan and Scaling Assessment of AP600 Test Program Report is a single report that will be provided to the NRC staff for their review. Its format will be based on WCAP-14141, AP600 Test and Analysis Plan. The following is a description of the proposed AP1000 report:

I. Background/Purpose

- Description of process to support application of analysis codes currently approved for 600 Mw (i.e. AP600) passive plant design for 1000 MW uprating.

II. AP1000 Design

- Brief description of AP1000 design.
- Summary of major differences (i.e. core power, containment height, reactor vessel length, pressurizer etc.) in physical scale between AP600 and AP1000.
- Sketches/Layout drawings highlighting key physical dimensions to support PIRT and scaling assessments.

III. Important Thermal-Hydraulic Phenomena for Modeling AP1000 Performance

- Brief summary of important (i.e. high ranked) AP600 phenomena by transient and phase of transient.
- Results of expert reviews of AP600 PIRTs for application to AP1000.
- Reconciliation of expert review comments for AP1000.
- PIRT tables for AP1000 and summary of high ranked phenomena.
- Discussion and assessment of differences (if any) between AP600 and AP1000 PIRTs.

IV. Testing

- Brief summary of AP600 test program.
- SBLOCA, LBLOCA, Non-LOCA Transient
  - OSU, SPES-2, CMT, ADS, and PRHR Tests.
- Containment
  - LST, SST, Air Flow, Water Distribution, Water Film Formation, Wind Tunnel, Heated Flat Plate, and Univ. of Wisconsin Condensation Tests.
- Discussion of sufficiency of existing data bases for code validation of high ranked phenomena for AP1000. Sources of test data will be identified for important phenomena.
- Describe approach that no new testing is required as scaling analysis will justify application of AP600 test database to AP1000.

V. Scaling

- Approach of scaling effort for AP1000.
  - SBLOCA scaling will focus on ADS and transition to IRWST injection phases of transient. These phases were most important and unique to AP600. Therefore, they will receive the most scaling attention in AP1000.
  - AP600 LBLOCA behaves as conventional plant for which code validation exists; passive features do not play an important role. The break provides the depressurization and the accumulators recover the plant. AP1000 is expected to behave similarly and therefore, as with AP600, testing and scaling are not required.
  - Containment scaling will focus on limiting large break event (steam line break or cold leg LOCA).
  - Non-LOCA transient scaling will focus on the CMT and PRHR as they are unique to the passive plant design.

- Results in matrix or tabular format of high ranked phenomena, key scaling groups addressing this phenomena, numerical scaling ratios of test facility relative to AP600 and AP1000.
- Discussion of differences in scaling results relative to AP600 and AP1000.
- Identify where important phenomena are adequately scaled and suitable for code validation and identify where scaling is distorted and therefore not adequate for code validation without compensating conservative treatment.
- Document scaling equations, derivation of scaling groups, and key reference values used to numerically evaluate scaling groups for AP1000 in an Appendix. In an effort to improve scaling efficiency and usefulness in some cases, scaling equations from AP600 may be recast or combined to reduce the number of scaling groups that are needed to be evaluated.

VI. Code/Model/Correlation Validation

- Approach to code validation effort. Validate only new or re-ranked phenomena based upon AP1000 PIRT.
- Summary of models, correlations to address important phenomena.
  - NOTRUMP
  - WCOBRA-TRAC
  - WGOTHIC
  - LOFTRAN
- Results of code validation effort. Identify where test database is not adequate for code validation purposes and bounding/conservative modeling approach taken.
- Document models, correlations, and code comparison tests in Appendix.

AP1000 Probabilistic Risk Assessment Development Process

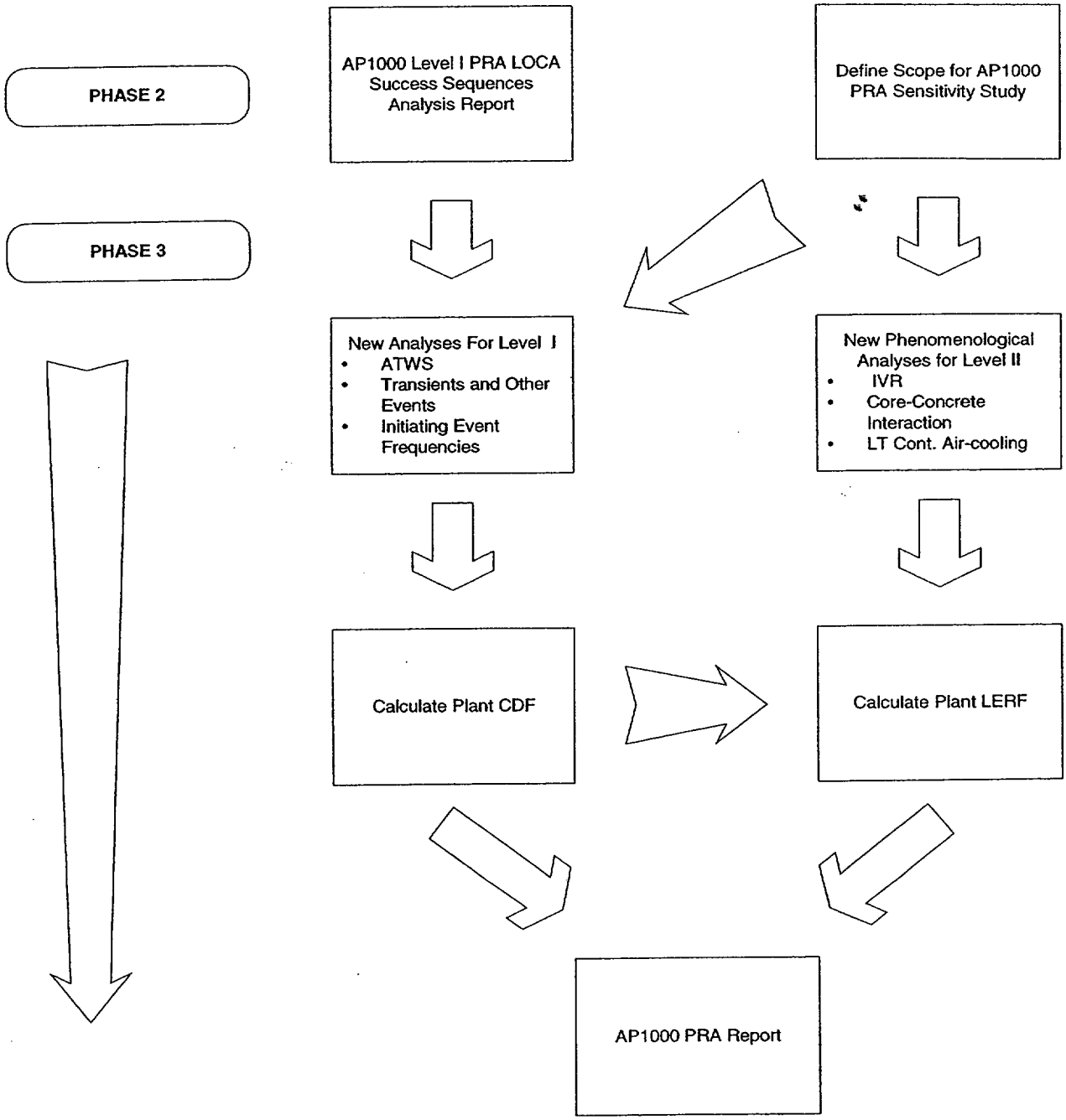

Figure 1. AP1000 PRA Analysis Approach

Attachment 3 to DCP/NRC1463

Summary of Level of Detail in AP1000 Design Control Document

Seismic Analyses (DCD Sections 2 and 3.7)

10CFR52 requires identification of site parameters for the design and an analysis and evaluation of the design in terms of these parameters. Westinghouse will identify the site parameters for the AP1000 to the same level of detail as identified for AP600 in DCD Chapter 2 and in ITAAC 5.0.

The AP1000 DCD will include key structural dimensions for the AP1000 similar to those included in Figure 3.7.2-12 for AP600.

The AP1000 DCD will defer seismic analyses of the nuclear island to the COL applicant. Chapter 2 Appendices 2A, 2B and 2C of the AP600 Design Certification which included the results of parametric analyses to justify selection of four design soil profiles will not be included in the AP1000 DCD. Analyses and evaluation will be provided in phase two for a hard rock site. The results of these analyses are intended in phase two to provide NRC with an understanding of the effect of the AP1000 configuration changes on the seismic results previously provided for the AP600. Additional review of these analyses may be deferred to the review of the AP1000 Design Certification Application.

Structural Design (DCD Section 3.8)

Structural design criteria and methodology will be the same as for AP600. Key structural dimensions will be included in Section 3.7. The AP1000 containment configuration will be shown in Section 3.8.2. To demonstrate feasibility, Westinghouse proposes to assess a few critical items in the Design Certification Application using seismic results from the AP1000 hard rock analyses. These assessments will be available for NRC review during the review of the Design Certification Application and could include:

Containment vessel preliminary design for internal pressure, external pressure and SSE (DCD 3.8.2)
- Containment vessel Service Level C and ultimate pressure (DCD 3.8.2)
- Shield building roof (DCD 3.8.4)
- Nuclear island basemat (DCD 3.8.5)
- Nuclear island stability (DCD 3.8.5)

Westinghouse and NRC should agree in phase two on the above list of items that would need to be considered during the Design Certification phase.

The COL applicant will be responsible for completing the structural design using the results of their seismic analyses.

Piping Design (DCD Section 3.6 and 3.9)

Extensive detail was provided and reviewed in the AP600 Design Certification. The methodology and acceptance criteria will be identical for the AP1000. AP1000 layout is similar to the AP600. The AP600 piping design and analyses are sufficient to demonstrate both feasibility and method of implementation for the AP1000. The COL applicant will be responsible for completing the piping design, including leak before break evaluation and pipe rupture hazard evaluation.