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201 West Duke Building
Box 90743
Duke University,
Durham NC 27708

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To: Annette L. Vietti-Cook
Secretary, U.S. Nuclear Regulatory Commission
Washington, D. C. 20555-0001
ATTN: Rulemakings and Adjudications Staff

Subject: Public Comment on **RIN 3150-AH56**
Proposed Design Certification Rule -- AP1000 Design Certification

Ref: Federal Register April 18, 2005 (Volume 70, Number 73)
Proposed Rules. Pages 20062-20080.

The comment below is in response to the opportunity provided for public comment on the proposed rulemaking to amend 10 CFR Part 52 to certify the AP1000 standard plant design, which appeared in the referenced Federal Register notice. I am making these comments as a member of the public, unaffiliated with any organization.

COMMENT by Dr. S. G. Sterrett, Assistant Professor, Duke University

In spite of the diligence of the NRC and the responsiveness of the applicant on a large number of design issues, the proposed rule granting design certification to the AP1000 as submitted should not be approved, for the following three reasons:

1. The AP1000 DCD (Design Control Document) referenced in the proposed rule does not meet the requirement of 10 CFR Part 52 that the plant design be complete except for site-specific elements and other specified exemptions.

Example: The applicant did not provide, and the NRC staff did not ask for, evidence showing that the auxiliary systems have been, or, even, that they can be, designed to provide the flows, pressures and temperatures claimed in the design descriptions in the applicant's submittal under the challenging layout constraints set for the AP1000 (i.e., keeping the same building "footprint" as the AP600).

The ability of important components such as large relief valves to operate according to their design parameters is dependent on the layout of the inlet piping and the discharge piping. The applicant's DCD does not indicate that the associated design calculations regarding flows achieved in auxiliary systems have been

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performed to substantiate the claims in the DCD. The NRC-authored FSER (NUREG-1793) did not address this aspect of the design, yet it does not fall under any exemption the NRC granted (It does not fall under the "Design Acceptance Criteria" exemption nor is it a site-specific element). Such flows, though they are features of auxiliary reactor systems (e.g., main steam (steam generator) relief valve flow) are inputs to the safety analyses.

Since such design information is crucial to the conclusions of the safety analysis, this information is required per 10 CFR Part 52, under which design certification of the AP1000 is sought (specifically, the requirements in 10 CFR 52.47(b)(2) for content of applications). The tendency among some NRC staff[1] to mistakenly regard this kind of information as "as built" indicates a lack of appreciation of the significance of this design information to plant safety. This is not "as built" versus "as designed" information[2]; it is design work crucial to plant safety and it is part of a complete plant design.

2. The fundamental question of the appropriateness of the process used to derive the AP1000 design from the AP600 design has not been given sufficient attention in the NRC's review.

In its evaluation of the applicant's QA (Quality Assurance) program, the NRC evaluated the QA procedures for conformance to 10CFR50 Appendix B. However, the fundamental question of how the AP1000 design was generated from the AP600 design was not broached. The applicant indicated that "a continuous QA program" was used spanning the AP600 and AP1000 design activities, and the cover sheet of the applicant's DCD identifies "change review" as the basis for the AP1000 DCD.

The change review process was devised to apply to proposed changes to the AP600 design during the AP600 design process. It is inappropriate to apply it to the activity of producing a new plant design from the AP600. The NRC appears to have reviewed the acceptability of the QA procedure governing the generation of the AP1000 DCD for its use *as a change review process.* The NRC never addressed the question of whether

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[1] This issue was raised in a letter to the ACRS ("AP1000 Fluid Systems Design and QA Procedures", July 30, 2003. Letter from Susan G. Sterrett to ACRS Subcommittee on Future Plant Designs.) The ACRS did not disagree with the point, but considered it a staff matter (transcript of meeting of ACRS Subcommittee on Future Plant Designs held at Monroeville, PA on July 17th and 18th, 2003). The letter that the NRC staff subsequently sent to me in response ("Response to Concerns About the AP1000 Design Certification", April 20, 2004. From James E. Lyons, Program Director, New, Research and Test Reactors Program, Division of Regulatory Improvement, Office of Nuclear Reactor Regulation, Nuclear Regulatory Commission, to Susan G. Sterrett, Assistant Professor, Duke University) incorrectly assumed that design calculations showing that the correct flows, temperatures and pressures can be achieved was an exemption covered under the DAC (Design Acceptance Criteria), which it is not. Nor should it be; DAC are only appropriate for piping structural criteria.

[2] Since ITAACS are for "as built" verification, it is inappropriate to appeal to ITAACS to ensure that the system is properly designed; ITAACS are not meant to relieve the designer of the plant of performing crucial system design work.

using this change review process to derive a *new* plant design, the AP1000, *from* the AP600, was appropriate.

I fear that Westinghouse is attempting to invent a loophole to avoid appropriate QA procedures, and the NRC has not challenged them on it. I understand that there are Westinghouse QA procedures for proposing new plant designs, there are Westinghouse QA procedures for uprating operating plants, and there are (less involved) Westinghouse QA procedures for reviews of proposed changes to plant designs. The QA procedures for a new plant design and for uprating operating plants address significant changes to major plant parameters and so require steps not included in a change review; they involve coordination with many other design disciplines and groups at a level beyond those involved in a change review. By (inappropriately) treating the AP1000 as a *revised AP600* rather than as a new plant design or an uprating of an existing plant design, the applicant managed to avoid both the QA requirements for design of new plants and the QA requirements for design of upratings.

Besides this omission by the NRC staff being a regulatory error, the situation is of concern; below are two major problems that could affect plant performance and safety:

--- Because the detailed design of the AP1000 is not yet performed, it is nowhere specified which specific details are inherited from the AP600 but need to be changed for compatibility with other changes made for the AP1000. Westinghouse has stated that the AP600 design details will be used in the AP1000 to the extent possible, and much of the AP1000 design makes reference to AP600 documentation. There is the danger of making the false inference that if a system configuration has not changed between the AP600 and the AP1000, the fluid system performance has not changed either. This is not always true, because a system temperature or pressure in one system can affect fluid system performance in another. If the AP1000 is to be regarded as developed by making design changes to the AP600, the kind of fluid systems review called for is one at least as comprehensive as the kind of review required for an extended power uprating. (The NRC has stated that the AP1000 is not an uprating[3], but, were it treated as an uprated version of the AP600, the AP1000 would be about a 70% uprating, which is much larger than any uprating approved to date.) Even though the systems at issue are auxiliary systems, the situation impacts plant safety, since the conclusions of the safety analysis are dependent upon the auxiliary fluid systems performing as described in the system design descriptions in the AP1000 DCD.

-- The NRC never addressed the question of whether the AP600 reports and documents referenced in the AP1000 DCD were verified *as applicable to* the AP1000. The authors and verifiers of the AP600 reports wrote and verified them *specifically for the AP600*. The general issue of how applicability of AP600 re-

[3] In "Response to Concerns About the AP1000 Design Certification", April 20, 2004. From James E. Lyons, Program Director, New, Research and Test Reactors Program, Division of Regulatory Improvement, Office of Nuclear Reactor Regulation, Nuclear Regulatory Commission, to Susan G. Sterrett, Assistant Professor, Duke University.

ports and documents to the AP1000 was determined is an important QA issue but was not adequately addressed in the NRC's review. If the decision that an AP600 report is to be referenced for the AP1000 is not made by the design group that authored the report, the decision effectively bypassed QA procedures and the very important checks and balances between engineering and management.

3. The accelerated schedule for the AP1000 requested by the applicant led to cutting regulatory corners.

Example (i): The decision by the NRC not to require that Westinghouse build and test a prototype of a major valve used in accident mitigation (the ADS 4th stage squib valve, an explosively-actuated valve), even though no valve of the type and size used in the AP1000 design has ever been built, much less tested, was made under the schedular pressures of the accelerated AP1000 schedule. There was no reason not to require it; the design applicant simply preferred not to expend the time and money involved in building and testing a prototype.

Example (ii): The question of the effect of heat of solar radiation on the performance of the AP 1000 Passive Containment Cooling System (PCS) has not been resolved. The AP1000 safety analysis and the test design of prototype scale models used to validate PCS performance assumed that the temperature of a concrete building in direct sunlight cannot exceed the surrounding air temperature, which is false. The effect is especially marked for plants in southern latitudes. This design issue has not been resolved; it has only been dismissed without a quantitative study.

Further information on this example:

--- The AP1000, unlike operating PWRs, uses the outside air as the ultimate heat sink, and so is fundamentally different from operating PWRs, which use a large body of water as the ultimate heat sink and transfer the heat to the ultimate heat sink via cooling towers. In the AP1000, the PCS is relied upon to transfer heat to the outside air in the event of a design basis accident. The PCS uses the water in the PCS storage tank located at the top of the concrete shield building and relies upon air flow through the air passageways between the steel containment and the surrounding concrete shield building, to cool and depressurize the containment in the event of an accident. Since the heat of solar radiation can cause the temperature of objects to exceed that of the surrounding air, the effect of solar radiation on the temperature of the concrete building is relevant to the accident analyses. The configuration is proprietary and so not available to the public; however, the concrete thickness of the conical roof section of the concrete shield building is stated in the DCD as 18 inches, which is not thick enough to justify dismissing the concern as irrelevant to PCS heat removal capability for all latitudes.

In some climates, there are configurations for which the temperature rise in concrete due to heat of solar radiation occurs not only during a daily cycle, but can

cause the temperature to continue to build up day after day. The temperature rise due to solar radiation is dependent on surface properties of the concrete, especially color. Hence the surface properties of the concrete shield building might be relevant to the efficacy of the PCS to remove the heat during an accident. The temperature rise is also dependent upon geographical latitude. Hence geographical latitude ought to be a site parameter, unless it can be shown that the PCS is effective at all geographical latitudes, even when heat of solar radiation is taken into account.

The issue was discussed by the ACRS at its very last meeting on the AP1000[4], but the effect was not quantified. In their letter to the Commissioners[5], the ACRS expressed confidence that the effect was covered by design margins, without performing a quantitative analysis. The basis for this confidence is unclear; without a quantitative analysis or testing, it is not possible to determine for what latitudes, if any, the AP1000 PCS heat removal capability is significantly affected. This letter, too, was written under the tight schedular constraints imposed by the accelerated schedule for AP1000 design certification.

Example (iii): The schedule for AP1000 design certification was further accelerated by granting Final Design Approval (FDA) before the Final Safety Evaluation Report (FSER) was made available to the public. Thus all public input on the NRC's Final Safety Evaluation Report prior to the NRC granting FDA was eliminated.

Respectfully submitted,

Susan G. Sterrett.

Susan G. Sterrett
Assistant Professor, Philosophy
Box 90743, Duke University
Durham NC 27708
[redacted]

[4] At the July 7th, 2004 full ACRS committee meeting, I presented a memo tabulating the issues I had raised about the AP1000 design certification review that remained unresolved. ("NRC Response to Concerns About AP1000 Design Certification" Memo from Susan G. Sterrett to ACRS Members; John P. Segala, AP1000 Project Manager; and James E. Lyons, Program Director, New, Research and Test Reactors Program. July 8, 2004. [actually presented at July 7th ACRS Full Committee Meeting] 4 pgs.)

[5] "Report on Safety Aspects of the Westinghouse Electric Company Application for Certification of the AP1000 Passive Plant Design", July 20, 2004. From Mario V. Bonaca, Chariman, Advisory Committee on Reactor Safeguards to The Honorable Nils J. Diaz, Chariman, Nuclear Regulatory Commission.