January 11, 1984

MEMORANDUM FOR: Thomas M. Novak, Assistant Director for Licensing
Division of Licensing

FROM: James P.Knight, Assistant Director for
Components & Structures Engineering
Division of Engineering

SUBJECT: INPUT TO SER SUPPLEMENT - WNP-2 DESIGN REVERIFICATION PROGRAM

Reference:
1. Memorandum from D.E. Eisenhut to R. Vollmer, "WNP-2 Design Verification Program", dated October 31, 1983
2. Letter from G. C. Sorensen to H. Denton, "WNP-2 Design Reverification Program", dated September 27, 1983
3. Letter from C. S. Carlisle to J. B. Martin, "Technical Audit Associates, Inc., Evaluation of the WNP-2 Plant Verification Programs", dated October 19, 1983

In response to your memo of October 31, 1983 (Reference 1), the Mechanical Engineering Branch has reviewed the WNP-2 Design Reverification Program of References 2 and 3. We have reviewed the information pertaining to the components, piping systems and their supports design reverification, as well as the system interaction reverification for pipe break and jet impingement evaluation. The MEB did not review or address areas specifically related to the QA process.

Attached is our evaluation of the WNP-2 Design Reverification Program to be included in the next Supplement to the SER.

Original Signed By:
James P. Knight

James P. Knight, Assistant Director for
Components & Structures Engineering
Division of Engineering

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Attachment: As stated

cc: See page 2.

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| SURNAME | RLi/vgt | HBrammer | RBosnak | JPKnight | | | |
| DATE | 1/ /84 | 1/9/84 | 1/9/84 | 1/ /84 | | | |

cc: w/attachment
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## WNP-2 Design Reverification Program

THe WNP-2 Design Reverification program was carried out by WPSS personnel who had not been involved in the WNP-2 project. The independent management assessment and the adequacy of the program was done by the Technical Audit Association (TAA). The purpose of the program was to reverify that WNP-2 was designed to meet the regulatory requirements committed to in the Final Safety Analysis Report. The WNP-2 design requirements for safety systems were reviewed to ensure that they are complete and clearly documented and that they were correctly reflected in the detailed design documents used during construction.

In a letter from G. C. Sorensen to H. R. Denton dated September 27, 1983, the applicant transmitted its final report on the WNP-2 Design Reverification Program (Reference 1). The applicant has also transmitted the final report of TAA, "An Independent Evaluation of the Plant Verification Program at the Washington Nuclear Power Station No. 2," dated October 19, 1983 (Reference 2).

## Program Scope

The following piping systems were reviewed in depth: the high pressure core spray system (HPCS), the residual heat removal (RHR) system and the reactor feedwater (RFW) system. The major areas of review were as follows:

1. Review of HPCS
   a. 34 component design reverifications,
   b. piping system and support design review,
   c. piping system, pipe supports and equipment supports as-built reverifications,

2. Review of RHR system
   a. 30 component design reverifications,
   b. piping system and support design review
   c. piping system, pipe supports and equipment supports as-built reverification,

3. Review of RFW system
   a. 30 component design reverifications,
   b. RFW pump and heat exchanger nozzle loads and hanger loads review,
   c. 6 mechanical component as-built inspections.

In addition, the applicant has also performed the following five studies: 1) fire protection system design review and as-built inspection, 2) pipe breaks, missile, jet impingement, falling objects and flooding effect evaluation for the HPCS, RHR and RFW systems, 3) environmental qualification of safety-related equipment, 4) wall and floor slab structural loads design review and 5) Class IE instrument racks seismic design review and as-built inspection.

Approximately 3,500 documents were examined during the process of the WNP-2 Design Reverification Program. The Supply System and their

contractors expended approximately 15 man-years of review effort. Approximately 2.2 man-years were expended by TAA in overviewing the program.

Results of Design Reverification Program

Formal potential finding reports (PFR) were issued whenever apparent deficiencies or concerns were identified by the reviewer. As a result of this approach 165 PFR's were issued. However, a number of PFR's were issued because of a lack of either complete information or an adequate understanding of the process or technical approach used in the design. A Findings Review Committee (FRC) composed of senior engineers evaluated the 165 PFR's and determined that 40 of them were resolved and declared invalid based on subsequent information such as described above.

Of the 125 valid PFR's, the FRC further determined that 26 were classified as findings and the remaining 99 were classified as observations. The 26 findings are listed and categorized by type of error or deficiency in Table 1-2 of Reference 2. All the observations and findings were evaluated for root cause and for generic issues or trends as described in Sections 3.2, 3.3, 3.4 and 3.5 of Reference 2. As a result of the WNP-2 Design Reverification Program, the Supply System has initiated 21 comprehensive corrective action plans which include correction of identified errors or deficiencies as well as their potential generic implications. The applicant is committed to complete implementation of all the corrective action plans.

Conclusions by TAA

TAA performed its own independent evaluations and analyses of the total list of 125 PFR's using three separate ways of classifying and sorting them. The first consisted of classifying the PFR's by underlying cause (such as basic design error/inadequate checking; failure to satisfy vendor interface requirements; failure to follow procedures, etc.). Fourteen causes were used for this analysis. With all PFR's classified in this way, TAA was able to observe if any causes appeared more frequently than others, indicating a possible generic weakness in the design process.

In addition to this analysis for common cause, TAA also classified all PFR's as to whether there were possible safety implications, indications of hardware change, or significant reductions in design margin.

Finally, TAA sorted PFR's according to FRC disposition, namely, not evaluated for generic implication; action deferred until more PFR's received; generic problems disposed of by Corrective Action Plan; and determined to be non-generic, i.e., a unique or isolated failure.

TAA used these independent evaluations and classifications to cross-check and test the adequacy of FRC, Project, and Burns and Roe assessments and dispositions.

TAA's conclusions on the WNP-2 Design Reverification Program pertaining to the Mechanical Engineering Branch review scope are as follows:

1. The unequivocal attitude regarding quality of the principal Supply System executive was an essential influence in assuring the performance of a credible design reverification program. The policies established by the chief executive were satisfactory for performing the design reverification.

2. Adequate measures were taken to assure that the reviewers were free of conflict-of-interest because of no prior participation in WNP-2 design.

3. The FRC was composed of an adequate number of experienced professionals with appropriate diversity in technical disciplines to permit sound judgments on potential findings.

4. The samples selected and the depth and diversity of the reviews conducted were adequate to permit a credible conclusion on the total WNP-2 design.

5. An effective program to test system interactive effects was conducted as a part of the three system review.

6. Potential findings with possible generic implications were effectively analyzed, and generic problems were appropriately resolved. All findings resulting from the review were closed, either by completed corrective action or by acceptable corrective action plans.

7. TAA concludes that FSAR commitments have been effectively carried forward into design documents and into the plant.

8. TAA concludes that the Design Reverification Program revealed a weakness in the design process of pipe break target evaluation. However, an adequate corrective action program has been put in place to correct this weakness. This program should be pursued aggressively until completed.

9. TAA concurs with the Supply System's conclusion stated on page 1-16 of its Final Assessment Report (Reference 1) that "The overall design process was conservative and produced a safe plant conforming to FSAR and regulatory requirements."

10. TAA believes that the three system sample as extended into generic and system interactive issues adequately evaluates the WNP-2 design. It concludes that the depth to which the Supply System pursued and closed questions raised during the total design reverification process gives adequate confirmation that the WNP-2 design is acceptable.

Staff Evaluation of WNP-2 Design Reverification Program

The staff reviewed the information provided in References 1 and 2 to determine whether our conclusions support those of TAA and whether the generic conclusions reached by TAA were appropriate. On November 29, 1983, a meeting was held at the NRC offices in Bethesda, Maryland to discuss the conclusions of References 1 and 2, the implementation of Supply System's corrective action plans and the status of RHR piping system and support review. The applicant stated that the review of RHR piping system and supports was completed and six PFR's, all classified as observations, were issued. No corrective action plan was required and all areas of design and construction reviewed were acceptable. The applicant also stated that detailed results of the RHR piping system and supports will be formally documented in an RHR Addendum to Reference 1 by December 31, 1983. With respect to the corrective action plans in the areas of Mechanical Engineering Branch review, the applicant stated that all the corrective action plans have been completed except the evaluation of the effect of postulated pipe breaks. In Reference 1, the applicant identified PFR's PB-2, 6 and 7 which addressed that there had been an inadequate target identification for the original Burns & Roe, Inc., evaluation of the effect of pipe break. It was determined that the target evaluation procedures used in the original pipe break study were not adequate and should be revised, specifically, the procedure originally used by Burns and Roe to identify targets did not account for the whipping effects of the broken pipe. In a letter dated December 9, 1983 (Reference 3), the applicant stated that the pipe break analyses for all piping systems both inside and outside containment including a final walk down of the WNP-2 have been completed using the revised pipe break target evaluation procedures discussed in Reference 1 for PFR's PB-2, 6 and 7. One unprotected safety related target, a cable associated with the Post Accident Sampling System (PASS), has been identified and the corrective action will be to move the cable to a location out of the jet impingement zone. Presently, a proposed WNP-2 licensing condition (Licensing Condition 13, Chemical Engineering Branch) requires the PASS system to be operational by 5% power. The applicant stated that the corrective action described above will be completed prior to 5% power. In the interim the affected cable will remain de-energized until moved.

Based on its review of the information of References 1, 2 and 3 and contingent upon the satisfactory resolution of the item noted above, the staff found that the WNP-2 Design Reverification Program provided an in-depth review of the design process, analysis methods and construction activities for the WNP-2 facility. The staff believes that the conclusions reached by TAA were reasonably justified and that the generic aspects were resolved in an appropriate manner. Based on the conclusion by TAA, the staff concludes that the depth to which the Supply System pursued and closed questions raised during the total design

reverification process gives adequate confirmation that the WNP-2 design meets the commitments made in the Final Safety Analysis Report.

## References

1. Letter from G. C. Sorensen to H. Denton, "WNP-2 Design Reverification Program", dated September 27, 1983.

2. Letter from C. S. Carlisle to J. B. Martin, "Technical Audit Associates, Inc., Evaluation of the WNP-2 Plant Verification Programs", dated October 19, 1983.

3. Letter from G. C. Sorensen to A. Schwencer, "Nuclear Project No. 2 Pipe Break Analysis", dated December 9, 1983.