



Westinghouse
Electric Corporation

Energy Systems

Box 355
Pittsburgh Pennsylvania 15230-0355

NSD-NRC-97-5170
DCP/NRC0903
Docket No.: STN-52-003

Jun 1, 1997

U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

ATTENTION: MR. R. M. GALLO

SUBJECT: RESPONSE TO A NOTICE OF NONCONFORMANCE

REFERENCE: Letter, R. M. Gallo to N. J. Liparulo, "NRC Inspection No. 99900404/97-01",
dated May 2, 1997

Dear Mr. Gallo:

This transmittal provides the Westinghouse response to the Reference letter which addresses the results of an inspection of AP600 design control quality assurance activities at the Westinghouse Energy Center on April 17, 1997. Two nonconformances were identified with respect to our oversight of work performed at INITEC as well as a concern, or unresolved item, with other AP600 technical cooperation agreement participants. The Reference letter requested specific information regarding the identified nonconformances and unresolved item. The attachment provides the detailed response.

As indicated in the exit interview and in a subsequent telephone communication on May 12, 1997, Westinghouse believes that the corrective actions implemented in response to the calculation error found in INITEC's basemat structural analysis were appropriate and consistent with our quality program. In response to topics discussed in the July 11-14, 1994 Audit of the Structural Design, Westinghouse identified the error as a condition adverse to quality and implemented the corrective actions. Subsequent to receipt of the Reference letter, we implemented significant additional corrective actions including enhancements to the AP600 procedures. To confirm the integrity of the AP600 design deliverables, a design assurance review has been initiated as indicated in the response to the unresolved item. The attachment identifies the actions we have taken or are planning to take.

We believe that the additional actions, identified in the responses to the nonconformances and unresolved item, provide suitable resolution. In several areas the corrective action implementation is still ongoing with actions being taken by Westinghouse and the AP600 technical cooperation agreement participants to improve the methods and controls applied to the design program. All of the corrective actions will be completed prior to the end of August, 1997.

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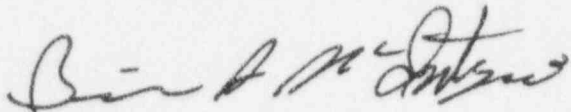
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June 9, 1997

Please contact me or Bob Tupper on 412/374-5219 if you have any questions concerning this transmittal.

A handwritten signature in dark ink, appearing to read "Brian A. McIntyre". The signature is fluid and cursive, with the first name "Brian" being more prominent than the last name "McIntyre".

Brian A. McIntyre, Manager
Advanced Plant Safety and Licensing

Attachment

cc: T. R. Quay, NRC/NRR/DRPM
R. P. McIntyre, NRC/NRR/PSIB/DISP
R. A. Gramm, NRC/NRR/DRCH/HQMB
S. C. Black, NRC/NRR/DRCH/HQMB
N. J. Liparulo, Westinghouse (w/o Attachment)

Nonconformance 99900404/97-01-01

1. *Westinghouse did not identify, analyze, document, and correct conditions adverse to quality as required by the AP600 Quality Assurance program. During a July 1994 NRC structural audit of the nuclear island foundation mat, errors were identified in calculations performed by INITEC that resulted in significant re-design of the AP600 foundation basemat. The findings described in the August 24, 1994, NRC "Summary of Audit of the AP600 Structural Design" report were not identified as a condition adverse to quality requiring or receiving quality assurance participation in verifying that appropriate corrective action is documented and implemented.*
2. *Westinghouse did not adequately determine and document the root cause of INITEC's basemat calculation errors nor evaluate the impact of such a condition adverse to quality on completed or related INITEC AP600 design deliverables and activities.*

Westinghouse Response

Background:

The AP600 Quality Assurance Program Plan, WCAP-12600, affirms the commitments established in the Westinghouse Quality Assurance Plan, WCAP-8370, Revision 12A, for the AP600 program during the period of time spanned by the INITEC basemat calculation error. As described in this Plan, Section 4.6, identified design deficiencies are controlled as design changes in accordance with written procedures. During the development stage of an AP600 document, an identified error is treated as a design change and is controlled in accordance with the quality assurance procedure specific to the document in which the error is identified. This results in a revision to the design document incorporating the appropriate corrective action. The corrective action may also impact other design documents which are then changed in accordance with their controlling procedures. This plan was followed for correcting INITEC calculation 1010-CCC-0001.

The identified error in the basemat calculation was controlled as a design change resulting in the revision of the calculation in accordance with the governing INITEC quality assurance procedure. In this manner, the error received the appropriate level of attention and corrective action, including additional technical oversight, as described in Attachment A to this response. This error would have been corrected by INITEC when the next revision of the calculation was performed.

As the AP600 design progresses and matures, design documents are placed under configuration control as described in AP600 Program Operating Procedure, AP-3.2 "Design Configuration Change Control for the AP600 Program". Errors identified at this stage are further subjected to criteria described in this procedure which may result in the initiation of a corrective action document requiring quality assurance participation in verifying that appropriate corrective action is implemented and documented.

Corrective Action

Westinghouse and INITEC activities associated with the basemat calculation are noted on Attachment A to this response. Areas noted include an identification of the error, cause, determination of the extent of the error, corrective action, action to prevent recurrences and Westinghouse oversight. Two of these areas, cause and determination of the extent of the error, were identified for further evaluation in a Westinghouse audit of INITEC in May 1997. The areas were reviewed by a technical specialist on the audit team and the following conclusions were reached:

The error was the result of an isolated occurrence related to the verifications process. The INITEC verification document showed a checklist from both the Quality Assurance group and the technical reviewer. Between the two reviewers there were 29 documented and resolved comments; however, the error in the application of the load was not detected. INITEC feels, and the audit team agreed, that this misapplication of units of load was an implementation error caused by limited experienced manpower resources at the time (1992) and the use of a verifier that was not truly independent of the work being performed.

The error in 1010-CCC-001, Revision A, related to the improper units used to define shear area reinforcement. A review of calculations made in 1995 for the same part of the basemat (1010-CCC-005, Rev. 0) confirmed that INITEC was using the correct procedure to calculate shear. This error was not in a formula or design methodology guide that was used by an engineer for multiple calculations. The error was mathematical in nature and was limited to the manual addition of loads. Subsequent revisions of this calculation used a verified postprocessor. Therefore, the error was determined to be an isolated occurrence.

Additional calculations were checked in the Westinghouse overview. This check confirmed that the units error was an isolated occurrence.

The May 1997 audit confirmed that INITEC followed through on their corrective action which consisted of revising the calculation and strengthening their verification efforts by adding experienced personnel to their staff as well as providing additional training. The audit team concluded that:

INITEC has implemented an improved verification program with the addition to their staff of a qualified technical expert devoted solely to independent verification. It was observed that the new verifier has the qualifications and understanding of the design process and verifies the methodology as well as the accuracy of the calculation. INITEC has given the QA training to him, as well as others, and it is documented in their files.

Action to Prevent Recurrence

In order to provide further assurance that conditions adverse to quality are being properly controlled and corrected on the AP600 program, Westinghouse has initiated the following corrective actions.

1. Design deficiencies (errors) will be subject to the criteria for initiation of a corrective action document requiring quality assurance participation in the corrective action process.

2. The criteria for initiating a corrective action document requiring quality assurance participation in the corrective action process will be clarified and expanded to address the following conditions:

- a. External audit issue - a finding or observation identified by an external organization during an audit or inspection, that requires a response.
- b. External technical issue - a finding or observation identified by an external organization during a technical audit or review, that requires a response, and which, upon further Westinghouse review, indicated an error or deficiency in the design.
- c. Internal assessment finding - a finding identified by an internal assessment that requires a response.
- d. Licensing basis document inconsistency - an error or deficiency that impacts the SSAR, PRA or CDM which, upon further Westinghouse review, indicated an error or deficiency in the design.
- e. Deviations related to quality procedures - recurrence of deviations in relation to approved quality procedures and/or lingering absence of appropriate procedures or work practices which should be performed in accordance with applicable quality standards.
- f. Condition adverse to quality for which it is desired to determine the cause and identify action to preclude recurrence.

3. A specific AP600 Program Operating Procedure on corrective action will be generated.

4. The new corrective action procedure will be extended to all program participants.

5. Training in the corrective action procedure will be provided to program participants.

Schedule

Westinghouse will complete the committed actions by August 29, 1997

ATTACHMENT A
to Nonconformance 99900404/97-01-01

1.0 Identification of error

In response to the July 11-14, 1994 structural audit, Westinghouse sent a letter to NRC (DCP/NRC0175) on August 2, 1994, indicating agreement with the NRC comments made at the meeting and outlining a plan of action. Because the error occurred in a document prepared by a subcontractor, INITEC, Westinghouse identified the error to INITEC for corrective action under their quality assurance program (Ref. FOK/INI0181 dated August 3, 1994.)

2.0 INITEC's initial response is documented in a letter to Westinghouse (Ref. INI/FOK0175 dated February 15, 1995). INITEC's response was evaluated in the following areas:

Cause: INITEC identified that the error was one of the incorrect implementation of units of load. Due to the lack of engineers familiar with the computer model output, INITEC took exception to their own procedures, which resulted a failure to have a truly independent verifier.

Extent of possible errors: Based on INITEC's analysis of the error and revised calculation process as well as our own overview of other calculations, the error was found to be an isolated occurrence and did not extend to other parts of INITEC's calculations.

Corrective action: In response to the notice from Westinghouse, INITEC revised and reissued the calculation 1010-CCC-001 and revised the basemat drawings in accordance with their quality assurance procedures.

Action to preclude recurrence: To enhance the verification process, INITEC increased their staff to provide for a truly independent verifier. The May 1997 audit also observed evidence of training for verification of calculations.

INITEC supplemented their initial response with additional documentation (Ref. INI/FOK0608 dated June 6, 1997) as requested by the May 1997 Westinghouse audit team.

3.0 Westinghouse Oversight:

As part of its technical oversight responsibility and in response to the INITEC error, Westinghouse did the following:

Issued, in November 1994, a letter to active suppliers reinforcing the need to follow QA procedures for verification of design calculations.

Retained a structural specialist from Bechtel to review the structural design and calculations related to the basemat. Results have been reported in a letter to NRC dated May 6, 1997 (DCP/NRC0847).

Increased the Westinghouse staff to provide additional technical oversight of the AP600 suppliers.

Nonconformance 99900404/97-01-02

Westinghouse did not provide appropriate QA oversight of design activities performed by INITEC. After the basemat calculation errors were identified by the NRC in July 1994, Westinghouse did not evaluate or assess the impact of the errors on other work performed by INITEC. Specifically:

- 1. Westinghouse failed to adequately evaluate or assess INITEC's annual performance, as required by WCAP-8370, Part B, Section 7.3, "Supplier Performance Evaluation" for a supplier of AP600 design deliverables that had been the subject of an adverse NRC audit finding.*
- 2. In its February 1995 triennial audit of INITEC, Westinghouse failed to conduct an evaluation of INITEC's response to Westinghouse's August 3, 1994, letter, and any associated corrective actions taken. The letter to INITEC described the basemat design calculation issues identified by the NRC during the July 1994 structural design audit.*

Westinghouse Response

Background:

The annual performance of INITEC was reviewed by Westinghouse Quality Assurance and the responsible Westinghouse engineering manager as part of the reviews of the performance of all active AP600 design organizations during the week of January 2, 1995 (ref. PQA-95-13). During these reviews, Quality Assurance identifies suppliers who are due for re-audit based on the triennial audit requirement, and solicits input from Engineering about the status of all active AP600 suppliers, their quality and scope of work, and any other factors that would justify more frequent audits. At that time, it was determined that an audit of INITEC should be performed in 1995. INITEC was due in 1995 for a supplier audit, having been previously audited in March 1992. It was noted in PQA-95-13 that re-audit in the early part of the year was warranted based on the volume of work performed since the last audit. The audit (WES-95-211) was performed in February, 1995.

In preparation for the February 1995 audit, the AP600 manager of Plant Engineering noted that NRC had technical questions about the nuclear island basemat analysis. Since concerns regarding calculation 1010-CCC-001 (then Revision A) had been identified, the Plant Engineering group identified an action plan to address these concerns, including performing an independent and expert technical evaluation of the calculation. Based on review of the issues involved and the understanding that this issue was already being addressed in the technical arena, it was determined that the review of calculation 1010-CCC-001 would assess whether there were any deficiencies inherent in INITEC's design control measures that contributed to the concerns identified.

During audit WES-95-211, calculation 1010-CCC-001 Revision A was reviewed. It was noted that the calculation was at an "alpha" revision level and therefore not yet under configuration control. The calculation cover sheet identified it as a preliminary document conditioned on the validation of preliminary input data. The calculation further identified that the version of ANSYS used was not validated at the time of the report. No deficiencies within INITEC's design control program or in meeting the requirements of NQA-1 were identified for this document. At the time of the audit, Westinghouse Quality Assurance had not received INITEC letter INI/FOK0175 documenting INITEC's response to Westinghouse's August 3, 1994 letter, nor did it surface during the audit.

Corrective Action:

A follow-up Westinghouse audit of INITEC was conducted in May, 1997 (WES-97-171.) This audit evaluated the corrective action outlined in INITEC letter INI/FOK0175. The audit team consisted of a technical specialist, two members of the Energy Systems Business Unit Quality Systems organization, and an engineer from the AP600 project group. The audit included a comprehensive review of basemat calculations 1010-CCC-001 and 1010-CCC-005. The audit team noted INITEC has implemented an improved verification program with the addition to their staff of a qualified technical expert devoted solely to independent verification. It was observed that the technical expert has the qualifications and understanding of the design process and verifies the methodology as well as the accuracy of the calculation. The audit team also noted that INITEC did not document their evaluation of the extent of the condition, although they reported it as an isolated occurrence. Based on the audit team's review of the conditions surrounding the error, it was found to be an isolated occurrence. INITEC was requested to document their own evaluation of the extent to which the error may exist in other calculations. Their documentation (Ref. INI/FOK0608 dated June 6, 1997) confirmed that their evaluation isolated this error to this single occurrence.

Actions to Prevent Recurrence:

In order to further assure the adequacy of supplier performance evaluations and improve the integration of the performance evaluation results with the audit planning process, Westinghouse is taking the following actions for the AP600 program:

1. A comprehensive supplier performance evaluation checklist will be developed to enhance implementation of the procedure requirements for performance evaluations. The checklist will include the following:
 - Results of open items from prior Westinghouse audits
 - Results of technical oversight of the supplier including identification of design errors
 - Results of audits of the supplier from other sources (if available)
 - Status of other committed corrective actions
2. The performance of all active suppliers will be reassessed for 1997 using the new performance evaluation checklist. This evaluation will be completed and documented prior to the next supplier audit or August 29, 1997.
3. Training on the subject of performance evaluation and audit planning will be provided prior to the next supplier audit or August 15, 1997.

Schedule

Westinghouse will complete the committed actions by August 29, 1997.

Unresolved Item 99900404/97-01-03

Based on the nonconformances identified above, the NRC is concerned that these quality assurance deficiencies may have introduced a level of uncertainty on the acceptability of design deliverables provided by AP600 technical cooperation agreement participants. Of particular concern to the NRC, is Westinghouse's failure to recognize and appropriately address a condition adverse to quality, requiring a root cause evaluation and determination and appropriate corrective actions, even when such a condition was identified by an NRC audit and resulted in re-design of the AP600 foundation basemat.

Westinghouse's failure to address this design and quality assurance program deficiency in a timely manner has raised the issue of whether this is an isolated case and that other design deliverables provided by AP600 technical cooperation agreement participants do in fact possess the level of integrity in design verification and quality assurance necessary to satisfy the design certification provisions of 10CFR Part 52.

NRC requests that Westinghouse:

(1) determine and evaluate the impact of these nonconformances on completed or related design deliverables and/or activities performed by all AP600 technical cooperation agreement participants

Westinghouse Response

The following three separate activities were undertaken:

1. Based on recent INITEC performance findings and the findings of the quality assurance audit, Westinghouse performed a detailed management review of the INITEC activities on June 3, 1997. The purpose of the review was to evaluate whether the actions identified for INITEC were appropriate for conditions. The reviewing group included the team that audited INITEC in May 1997, Westinghouse QA management, Westinghouse engineering management, and the Westinghouse lead reviewer for INITEC structural deliverables. There were two areas reviewed where improvements were needed; improving the accuracy of their verification process and initiating and following up on corrective actions. The verification process has been significantly augmented with additions to their staff and additional training. Improvements in the corrective action portion of the INITEC program will be defined in response to the May 1997 Westinghouse audit findings and will be monitored by a Westinghouse QA engineer. The review concluded that the actions completed, plus those identified for INITEC from the audit, were sufficient actions at INITEC, and some additional activities would be initiated at Westinghouse.
2. Westinghouse commissioned an independent audit of the Westinghouse Quality Program and quality assurance oversight of technical cooperation participants as applied to AP600 design activities. This audit, completed on May 30, 1997, was performed by individuals completely independent of the AP600 quality assurance function with the lead auditor being an outside contractor. The audit identified three findings and four recommendations for program improvement which are currently being addressed. The overall assessment of the audit was that the oversight of design activities on the AP600 was effective both from a quality assurance standpoint and from a technical standpoint and in accordance with WCAP-8370, 10CFR50 Appendix B and NQA-1.

3. A comprehensive evaluation is being conducted of the methods and degree of oversight provided for all technical cooperation agreement participants performing engineering tasks at their facilities. The results of this evaluation will be used to identify any necessary changes or corrective actions.

(2) identify the steps taken that it has taken, or intends to take, to demonstrate that other design deliverables provided by AP600 technical cooperation agreement participants do in fact achieve the level of integrity in design verification and quality assurance necessary to satisfy the design certification provisions of 10 CFR Part 52

Westinghouse Response

A design assurance review will be initiated to assess a sample of safety related design work which is part of the AP600 licensing basis from each of the international design participants. The purpose of this review is to demonstrate, with reasonable assurance, that the design deliverables provided, achieve the required level of integrity in design verification and quality assurance.

The review team, lead by Dr. William LaPay, will be composed of technical experts not directly involved in the AP600 design work. As part of the assessment, technical specialists will perform an independent check for accuracy of deliverables supplied. In addition, an assessment will be made of the adequacy and integrity of the original design and the design verification provided by the document originator. This will include interviews with the designer and verifier. This design review program will take between one and two months to complete. A summary report will be prepared by August 29, 1997.

(3) provide a list of all AP600 technical cooperation agreement participants and a description of their AP600 work scope and involvement

At the present time only BATAN and BPPT in Indonesia have technical cooperation agreements with Westinghouse for the AP600. All other design organizations, including INITEC, are under subcontracts with Westinghouse. A list of all international design participants and their scope of work is provided below.

AP600 International Design Participants

<u>Participant</u>	<u>Work Scope and Involvement</u>
Ansaldo	Layout and structural design of selected areas of containment. Selected structural analysis. Layout and design for piping and equipment inside containment. Selected piping analysis. Fluid systems, man-machine interface, and NSSS component design tasks.
BATAN	Pipe stress analysis for selected ANSI/ASME B31.1 piping segments.
BPPT	Control logic development for selected systems. Piping in selected portions of the auxiliary building and the turbine island.
ENSA	Perform analysis in the area of reactor vessel, pressurizer, primary component supports, core makeup tank, accumulator tank.
ENUSA	Design and analysis support in the areas of fixed incore detectors, transient analyses, fuel storage racks, and reactor control rods.
INITEC	Layout and structural design of the auxiliary building, and turbine building, design and analysis of the nuclear island basemat. Piping layout and design of piping in areas 1 and 2 of auxiliary building.
NNC	Transient analysis of the AP600 using the WCOBRA/TRAC computer code.
Tecnom	Provide engineering support in the areas of function based task analyses, emergency operating procedures and severe accident guidelines.
UTE-I/EA	Perform layout and piping analysis work for selected areas/systems in the containment. Design turbine pedestal and containment penetrations.