ORGANIZATION:	ABB Combustion Engineering, Inc. Windsor, Connecticut
REPORT NO.:	99900401/94-01
CORRESPONDENCE ADDRESS:	Mr. C. B. Brinkman, Acting Director Nuclear Systems Licensing ABB Combustion Engineering, Inc. 1000 Prospect Hill Road P.O. Box 500 Windsor, Connecticut 06095-0500
ORGANIZATIONAL CONTACT:	John Pasquenza, Director Nuclear Systems Quality Assurance (203) 285-2696
NUCLEAR INDUSTRY ACTIVITY:	ABB Combustion Engineering Nuclear Systems (ABB-CE) is engaged in the supply of System 80+ advanced reactor designs to utilities. ABB-CE also furnishes engineering services and nuclear replacement parts and equipment for commercial nuclear power plants.
INSPECTION CONDUCTED:	February 14 through 18, 1994

SIGNED: Richard P. McIntyre — 5/6/94

Richard P. McIntyre, Team Leader — Date
Reactive Inspection Section No. 1
Vendor Inspection Branch (VIB)

APPROVED: Richard P. McIntyre for — 5/9/94

Uldis Potapovs, Chief — Date
Reactive Inspection Section No. 1
Vendor Inspection Branch (VIB)

INSPECTION BASES:	10 CFR Part 50, Appendix B and 10 CFR Part 21
INSPECTION SCOPE:	To determine if quality activities performed as part of the design of the System 80+ Advanced Light Water Reactor (ALWR) were conducted under the appropriate provisions of the ABB-CE 10 CFR Part 50, Appendix B, quality assurance program, as implemented by the most recent Quality Assurance Program Description (CENPD-210A, Revision 7A) that has been approved by the NRC.
PLANT SITE APPLICABILITY:	None

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1 INSPECTION SUMMARY

1.1 Nonconformances

1.1.1 Contrary to Criterion IV of Appendix B to 10 CFR Part 50, "Procurement Document Control," ABB-CE failed to specify the applicable quality level, quality assurance program requirements, and 10 CFR Part 21 requirements on purchase order (PO) 9100100 to Duke Engineering Services Incorporated (DESI), and PO 920195 to ABB Impell Corporation (ABB-Impell), for safety-related engineering services performed from November 25, 1991, through December 23, 1993, and February 21, 1992, through November 12, 1992. In addition, ABB-CE failed to have a PO in place to Stone and Webster Engineering Corporation (SWEC) for safety-related engineering services performed from mid-1992 through September 1, 1993. (94-01-01)

1.1.2 Contrary to Criterion VII of Appendix B to 10 CFR Part 50, "Control of Purchased Material, Equipment and Services," ABB-Combustion Engineering Nuclear Systems (ABB-CE) did not perform an audit to verify implementation of Stone and Webster Engineering Corporation's quality assurance program supporting the engineering services provided in accordance with ABB-CE purchase order 9309380. (94-01-02)

1.2 Unresolved Item

The inspectors identified that ABB-CE had not performed independent design verification as described in their QA Topical Report and referenced in Chapter 17 of CESSAR-DC for the System 80+ design to date. Also, ABB-CE had not developed system design specifications. ABB-CE stated that independent design verification is to be performed and system design specifications are to be developed after the detailed design and contract award for a System 80+ from a U.S. utility. The inspectors did determine, based on the review of safety analyses and calculations, that, even though independent design verification had not been performed, the overall technical content of the calculations appeared to be well documented and technically adequate.

The decision of deferring design verification was originally delineated in internal ABB-CE correspondence D-NE-87-031 (dated June 26, 1987) and further documented in the ABB-CENP System 80+ Quality Assurance Plan, 18386-QO-001. In particular, design activities performed to support design certification of the ABB-CE System 80+ ALWR had been exempt from the scope of ABB-CE design control procedure QPI 0304, "Design Analysis" and QPI 0306, "Design Verification."

Subsequent to the inspection, numerous conference calls and meetings were held with ABB-CE staff to discuss the NRC staff's concerns with ABB-CE's lack of independent verification of design calculations. In a letter dated April 26, 1994, ABB-CE described its proposed design verification process for design basis events. ABB-CE committed to perform design verification for the System 80+ Standard Plant for all non-repetitive safety analyses, both limiting and non-limiting, with the level of design verification being consistent with the safety significance of the analyses. Specifically, these non-repetitive safety analyses include all the design basis events analyses presented in

chapters 5, 6, and 15; analyses that set safety-related design parameters, including those described in the Certified Design Material; and an Appendix 6B analysis performed to verify the System 80+ capability to safely handle a hypothetical small break LOCA-boron dilution event.

The NRC staff finds the approach described in the April 26, 1994, letter acceptable and will review the implementation of your actions during a future inspection at ABB-CE. (94-01-03)

2 STATUS OF PREVIOUS INSPECTION FINDINGS

No previous inspections have been conducted in this area.

3 INSPECTION FINDINGS AND OTHER COMMENTS

3.1 Quality Assurance Program

The Quality Assurance program (QA plan) for the Design Certification of the System 80+ Advanced Light Water Reactor is described in the "ABB-CENP System 80+ Quality Assurance Plan," Plan No. 18386-QO-001, that was prepared for Department of Energy Contract No. 92791. This plan implements, as appropriate to the contract scope, the QA program described in Combustion Engineering Topical Report CENPD-210-7A, the latest revision. CENPD-210-7A is the ABB-CE QA topical report that has been reviewed and approved by the NRC and meets Appendix B of 10 CFR Part 50 (Appendix B). The Department of Energy Contract states that the Contractor shall establish, implement and maintain a quality assurance program that meets NQA-1-1983, Quality Assurance Program for Nuclear Facilities.

The QA plan describes the implementation, as appropriate, of each of the 18 criteria of Appendix B. This is done by describing the requirement or by reference to an ABB Combustion Engineering Nuclear Systems (ABB-CE) Quality Program Requirements (QPR) Manual (QPM-1) and ABB Combustion Engineering Nuclear Systems Quality Program Instructions (QPI-1.1).

The QPR document, which describes the quality program requirements to implement the CENPD-210-7A, is applicable to all activities affecting quality performed by ABB-CE personnel, except those assigned to the Newington Operation and Electro-Mechanics. Newington Operations and Electro-Mechanics have no responsibility for the System 80+. Each QPR principally addresses one of the eighteen criteria of Appendix B and describes the ABB-CE requirements for that criterion. The QPI document contains implementing instructions for the quality assurance program defined in the QPR. The QA plan describes those QPI's not applicable to the System 80+ project.

3.2 Instructions, Procedures, and Drawings

The quality requirements utilized for the System 80+ project are contained in the following ABB-CE documents reviewed by the inspection team:

- Quality Program Requirements (QPR)

  - QPR 0200, "Quality Assurance Program"
  - QPR 0300, "Design Control"
  - QPR 0500, "Instructions, Procedures and Drawings"

- Quality Program Instructions (QPI)

  - QPI 0301, "Quality Class"
  - QPI 0302, "Design Output Documents"
  - QPI 0303, "Design Input"
  - QPI 0305, "Design Interface Control"
  - QPI 0307, "Drawing Control"
  - QPI 0308, "Specifications"
  - QPI 0311, "Safety Analysis Reports"
  - QPI 0313, "Computer Software"
  - QPI 0401, "Procurement Document Control"
  - QPI 0701, "Supplier Evaluation and Control"
  - QPI 1701, "Quality Assurance Records"
  - QPI 1801, "Internal Compliance Audits"
  - QPI 1802, "Supplier Audits"

3.3. Document Control

Document control is prescribed by QPR 0600, "Document Control," and numerous QPI's such as: 0302, "Design Output Documents;" 0305, "Design Interface Control;" 0307, "Drawing Control;" 0308, "Specifications;" 0311, "Safety Analysis Reports;" and 0401, "Procurement Document Control."

The team reviewed the System 80+ Project file system and the drawing file system and found that drawings and documents were readily retrievable and that copies of drawings could be readily produced. Design documents such as calculations are generally still in department "discipline" files at this point in time, but will be eventually turned over to the project files. In addition, ABB-CE is in the process of establishing a central filing system for all documents. System 80+ documents in the Project files are filed by document number and by a central file number (CDCC). However, it was not evident how the overall project documentation was configured, i.e., the project files did not appear to be readily retrievable by system nomenclature or CESSAR-DC chapter number.

3.4 Quality Assurance Records

Quality Assurance records are prescribed in QPR 1700, "Quality Assurance Records," and numerous QPI's such as: 0301, "Quality Class;" 0302, "Design Output Documents;" 0305, "Design Interface Control;" 0307, "Drawing Control;" 0308, "Specifications;" 0311, "Safety Analysis Reports;" 0312, "Design Reports;" 0313, "Computer Software;" 0401, "Procurement Document Control;" 0701, "Supplier Evaluation and Control;" 1701, "Quality Assurance Records;" 1801, "Internal Compliance Records;" and 1802, "Supplier Audits."

The team reviewed the drawing file and project file and found the drawing records and project file records in good order and retrievable. Records of internal audits, System 80+ records, QPR and QPI records, and training records were acceptable.

3.5 Design Control

3.5.1 Review of Safety Analyses and Design Calculations

The team reviewed 13 design calculation files which were prepared by ABB-CE to support the loss of coolant accident (LOCA) and transient analyses as presented in CESSAR-DC Chapters 5, 6, 15 and 19. The calculational files reviewed are listed below.

- Chapter 5 - Reactor Coolant System
  - 00000-FS-C-045 (Rev.02), "Overpressure Protection Calc (3931 MWT)"
  - 00000-FS-C-123 (Rev.00), "Natural Circulation Cooldown (3931 MWT)"
- Chapter 6 - ECCS and LOCA
  - A-S80+-FE-0011 (Rev.00), "Post-LOCA Long Term Cooling Analysis (3992 MWT)"
  - A-S80+-FE-0013 (Rev.00), "Analysis of Boron Dilution During Small Break LOCA"
  - SS-TML-045 (Rev.00), "ALWR Large Break Analysis"
- Chapter 15 - Transient Analysis
  - 00000-FS-C-003 (Rev.01), "Verification of CESEC Models for Licensing Analysis"
  - 00000-FS-C-032 (Rev.01), "CESEC-III Basedeck"
  - 00000-FS-C-119 (Rev.00), "Steam Line Break Analysis"
  - 00000-FS-C-067 (Rev.02), "Feedwater Line Break"
  - 00000-FS-C-115 (Rev.00), "Loss of Condenser Vacuum"
  - 00000-FS-C-055 (Rev.01), "SGTR with Stuck Open ADV and LOOP"
  - 00000-FS-C-066 (Rev.00), "Verification of Cool for SGTR Design and Safety Analysis"
- Chapter 19 - Severe Accident Analysis
  - 00000-FS-C-100 (Rev.01), "ATWS Analysis (3931 MWT)

The team's review consisted of verifying that input data and assumptions were properly documented and that independent review was performed. The methods used by the team involved review of calculational methods, review of calculations for randomly selected design parameters used for computer input, examination of computer outputs stored in microfiches for accuracy, consistency checks of calculational results and write-ups presented in the CESSAR-DC, and discussion with ABB-CE technical staff for document retrieval and control.

The majority of material included in calculational files was in a typed form and well organized. Information presented in a hand written form was clearly written and easy to read. The calculational files contained complete information to support the design and analysis presented in CESSAR-DC. The information includes input parameters to computer, the technical basis for the input parameters, discussion of the assumptions and methods used for analyses, analytical results including result summary and microfiches, and CESSAR-DC writeups to reflect the analytical results. The input parameters used in the analyses and the associated technical bases could be traced to the ABB-CE data book, which references ABB-CE "internal" design memos, P&IDs and design descriptions. The input parameters reviewed were consistent with information used from the data book.

The justifications for the assumptions used in analyses were documented and assumptions were consistent with the SRP guidance and requirements of 10 CFR Part 50, Appendix K. The computer codes used in the analysis were listed and it could be determined that either the computer codes were previously approved by NRC or used in the licensing applications previously approved by NRC. The CESSAR-DC writeups are consistent with the analytical results from the microfiches.

Based on the team's review, it appears that ABB-CE has provided appropriate oversight to support the technical results of analyses presented in the CESSAR-DC. However, the team identified the following observations during the review of design calculations and system analyses for the CESSAR-DC:

- The majority of the design parameters included in the data book included the references to where they were obtained. However, a small fraction of the design parameters included no technical bases or source references. This could potentially cause difficulty during the performance of the independent design review.

- Several numerical inconsistencies were identified in the calculational files. In one case, the reference for the data used for analysis was cited incorrectly. On another case, outdated design data was used to prepare input to the computer codes. In both cases, the team concluded that the use of the incorrect design data will not have significant impact on the results presented in the calculational files.

- CESSAR-DC, Section 15.1.5, lists the overpower setpoint as 115% of the rated power. The team determined that in a steam line break (SLB) calculation, an overpower setpoint of 121% of the rated power was used. The use of a higher overpower setpoint will result in a lower required shutdown margin for a post-trip SLB event, which is not conservative. However, considering the fact that the calculated available shutdown margin is -0.8% delta rho, the staff concludes that the calculated shutdown margin is sufficient to compensate for the use of the higher overpower setpoint and is not a significant safety concern.

The observations discussed above do not constitute any significant safety concerns.

3.5.2 Independent Design Verification

ABB-CE had not performed independent design verification as described in the QA Topical Report CENPD-210-7A and referenced in Chapter 17 of CESSAR-DC for the System 80+ design, as of the date of the inspection. The decision of deferring design verification was originally delineated in internal ABB-CE correspondence D-NE-87-031 (dated June 26, 1987) and further documented in the ABB-CENP System 80+ Quality Assurance Plan, 18386-QO-001. In particular, design activities performed to support design certification of the ABB-CE System 80+ ALWR had been exempt from the scope of ABB-CE design control procedure QPI 0304, "Design Analysis," and QPI 0306, "Design Verification."

The calculational files were "technically reviewed" and signed by the group supervisors, and ABB-CE acknowledged that the "technical review" consisted only of an overall reasonableness check and a review of specific areas that the group supervisors deemed to be important to safety. No design verification activity utilizing the Design Verification Checklist (QPF 0306-1) had been performed by independent reviewer(s) as required by procedure QPI 0306.

ABB-CE stated that design verification is to be performed and system design specifications are to be developed after the detailed design and contract award for a System 80+ design from a U.S. utility. The inspectors did determine, based on the review of safety analyses and calculations that, even though independent design verification had not been performed, the overall technical content of the calculations appeared to be well documented and technically adequate. This issue is identified as an Unresolved Item (94-01-03).

3.5.3 Review of Safety Depressurization System

The team performed a review of the safety depressurization system (SDS), as described in CESSAR-DC Chapter 6.7, Amendment N, to verify that its specific configuration, functions, structures and components, and its specific values or ranges of values chosen for controlling parameters as reference bounds for its design are adequately supported in the applicable design input calculations or analyses. As part of this review, the team also conducted an evaluation to ascertain if these calculations or analyses had been derived or developed in accordance with the applicable ABB-CE procedures.

The team requested copies of all analyses and/or calculations that have been performed to support the information contained in CESSAR-DC Chapter 6.7, for SDS. Copies of the following design analyses were provided:

- 00000-FS-091, Rev. 00, "Rapid Depressurization Function"
- 00000-FS-C-092, Rev. 00, "SDS Valve & Valve Operator data"
- 00000-FS-C-093, Rev. 00, "RCGV System Flow Rate"
- 00000-FS-C-123, Rev. 00, "Natural Circulation Cooldown Analysis"
- 00000-FS-C-145, Rev. 00, "TLOFW Analysis"

The SDS is comprised of 2 subsystems, namely, the rapid depressurization system (RDS) and the reactor coolant gas vent system (RCGV). Analyses Number

00000-FS-091, Rev. 00, 00000-FS-C-092, Rev. 00, 00000-FS-C-093, Rev. 00, and 00000-FS-C-123, Rev. 00, contain the preliminary design assumptions and calculations, and provide the conceptual design bases for the RDS portion of the SDS; and 00000-FS-C-145, Rev. 00, contains the background design information for the RCGV portion.

Review of these calculations by the team established the comprehensiveness of the assumptions and derivations contained in them and, within the context of preliminary or conceptual design, it was confirmed that they constitute documented evidence of the design integrity of the System 80+ SDS described in CESSAR Chapter 6.7. The team recognizes that ABB-CE System 80+ is an evolutionary design based on earlier CE System 80 designs. However, during the review of the calculations and/or analyses that have been performed to support the information contained in CESSAR Chapter 6.7, for SDS, the team could not readily identify those portions of the system design criteria that were based on the earlier CE System 80 design.

3.6 System 80+ Computer Code Modeling

The inspection team reviewed several base input decks developed for System 80+ safety calculations and also reviewed some analyses performed using the input decks.

Calculation file SS-TML-059 Rev. 00, which documents the development of the CE-FLASH input deck used for LBLOCA blowdown calculations in the 3800 MWt System 80+ configuration was reviewed. Differences between the 3800 MWt deck and the 3912 MWt deck are documented in the 3912 MWt blowdown calculations and were also reviewed. No independent design verification of the calculational notebook and the input deck were performed. Only a supervisory technical review was performed. The calculational notebook appeared to be well documented and clearly written. Some small differences between the calculation notebook and the actual input deck numbers were discovered. These small differences were seen in parameters such as elevations and flow areas and were not expected to greatly impact code results. Examination of the calculation notebook also revealed that hydraulic diameters were incorrectly calculated in regions of non-circular cross section such as the downcomer annulus. These hydraulic diameters were calculated assuming that the flow area has a circular cross section. This also was not expected to impact greatly on the calculated results. It is expected that an independent verification of the calculational file and input deck would have discovered these small errors.

The inspection also looked at the LBLOCA analysis A-S80+-FE-0006 which documented input deck changes made to run the 3992 MWt Blowdown analysis and included the blowdown analysis itself. Again the document was clearly written and documented. In order to determine the extent of the supervisory review that was performed the inspectors interviewed the supervisor for the LOCA calculations that were performed. He stated that supervisory review was performed by daily interaction with the group members. In general the less experienced analysts receive more supervision. Errors that are discovered are analyzed to determine the significance of analysis results in order to determine whether they need to be rerun. The CE-FLASH small break and

transient input decks were also reviewed and determined to be well documented and clearly presented.

Code changes to several ABB-CE analysis codes were also reviewed by the inspection team in order to determine change control for the computer codes. Since these analysis codes are also used for operating reactors, all code changes were independently verified. Code changes were reviewed for CE-FLASH, CESEC and COAST. ABB-CE does a line-by-line independent verification of computer code changes. The testing of the changes, including acceptance criteria is well planned and documented. The independent reviewer comments included in the change packages indicate that an extensive check was made of code changes and test results.

The inspection team also reviewed a small sample of Chapter 6 and 15 calculations performed by SWEC and DESI. These calculations had been independently verified. The SWEC calculation reviewed was "EAB, LPZ and Control Room Doses following LOCA." The DESI calculations reviewed were "System 80+ Liquid Radwaste Tank Failure" and "Containment Hydrogen Recombiner Design Basis LOCA Hydrogen Control." These calculations were well documented and clearly written.

3.7 Control of Suppliers

ABB-CE had utilized the engineering services of Duke Engineering & Services, Inc., ABB Impell Corporation and Stone and Webster Engineering Corporation to support the development of the ABB-CE System 80+ design. The companies had performed a variety of safety-related services and provided information in support of the NRC review of the CESSAR-DC. In addition both DESI and SWEC had performed in the capacity of "Chapter Champions" for Chapters 8, 11, 12, 13 (DESI) and 10 (SWEC) of the ABB-CE CESSAR-DC.

3.7.1 Duke Engineering & Services

The inspectors determined through discussion with ABB-CE management and through review of records and documents that DESI had been performing safety-related engineering services during the period of November 25, 1991, through December 23, 1993. The inspectors reviewed purchase order (PO) 9100100, supplement 0, dated November 25, 1991, to DESI for engineering services in support of the System 80+ design. This PO was designated Quality Class 3 (non-safety-related). Supplements 1 through 3 were issued to change various contract parameters but maintained the Quality Class 3 designation. Supplement 4, issued on December 23, 1993, changed the purchased service to Quality Class 1 (safety-related) and invoked the applicable QA and 10 CFR Part 21 requirements. ABB-CE had performed an audit of DESI November 16 through 17, 1993, and had placed DESI on the ABB-CE Approved Suppliers List (ASL), effective November 17, 1993.

The inspectors concluded that ABB-CE had not correctly specified the applicable QA requirements and 10 CFR Part 21 requirements, and had incorrectly specified the quality level of the work to be performed as Quality Class 3, on PO 9100100, supplements 0 through 3. This was identified as an example of Nonconformance (94-01-01).

3.7.2 Stone and Webster Engineering Corporation

The inspectors determined through discussion with ABB-CE management and through review of records and documents that SWEC had been performing safety-related services from mid 1992 through September 1, 1993. SWEC indicated that they had issued their first calculation in January of 1993 with the majority being issued since June of 1993. The inspectors reviewed PO 9309380, supplement 0, dated September 1, 1993, to SWEC for engineering services supporting the System 80+ design certification. This PO was designated Quality Class 1, safety-related, and invoked the applicable QA and 10 CFR Part 21 requirements.

The inspectors concluded that ABB-CE had failed to place a purchase order with SWEC, correctly specifying the applicable QA requirements and 10 CFR Part 21 requirements, for the safety-related services that SWEC had performed from mid-1992 through September 1, 1993. This was identified as an example of Nonconformance (94-01-01).

3.7.3 ABB Impell Corporation

The inspectors determined through discussion with ABB-CE management and through review of records and documents that ABB-Impell had been performing safety-related services during the period of February 21, 1992, through December 29, 1993. The inspectors reviewed PO 9201995, supplement 0, dated February 21, 1992, to ABB-Impell for engineering services in support of System 80+ design. This PO was designated Quality Class 3 (nonsafety-related). Supplements 1 through 4 were issued to change various contract parameters but maintained the Quality Class 3 designation. Supplement 5, issued on December 29, 1993, changed the purchased service to Quality Class 1 (safety related), and invoked the applicable QA and 10 CFR Part 21 requirements. ABB-CE had previously performed an audit of ABB-Impell November 9 through 12, 1992, and had placed ABB-Impell on the ABB-CE ASL, effective November 12, 1992.

The inspectors concluded that ABB-CE had not correctly specified the applicable QA requirements and 10 CFR Part 21 requirements, and had incorrectly specified the quality level of the work to be performed as Quality Class 3, to ABB-Impell on PO 9201995, supplements 0 through 4. This was identified as an example of Nonconformance (94-01-01).

3.8 Quality Assurance Audits

3.8.1 External Audits

ABB-CE had performed an audit of DESI November 16 through 17, 1993, and used it as a basis to place DESI on the ABB-CE ASL, effective November 17, 1993. The audit, and ASL placement, supported supplement 4 to PO 9100100, issued on December 23, 1993, which changed the purchased engineering service to Quality Class 1 (safety-related) and invoked the applicable QA and 10 CFR Part 21 requirements. ABB-CE had not identified any deficiencies during the audit. The inspectors reviewed the audit report and concluded that the audit appeared to have adequately verified implementation of the quality assurance program DESI used in support of the engineering services provided per PO 9100100.

ABB-CE had performed an audit of ABB-Impell on November 9 through 12, 1992, and used this as a basis to place ABB-Impell on the ABB-CE ASL, effective November 12, 1992. The audit, and ASL placement, supported supplement 5 to PO 9201995, issued on December 29, 1993, which changed the purchased engineering service to Quality Class 1 (safety-related) and invoked the applicable QA and 10 CFR Part 21 requirements. ABB-CE had identified two deficiencies and three observations which appeared to have been adequately dispositioned by ABB-Impell and ABB-CE. The inspectors reviewed the audit report and concluded that the audit appeared to adequately verify implementation of the quality assurance program ABB-Impell used in support of the engineering services provided per PO 9201995.

ABB-CE had placed SWEC on the ABB-CE ASL, effective August 26, 1993, based on SWEC holding an ASME certificate and on review of a Boston Edison led NUPIC audit and an ABB-CE review of SWEC's QA program. In addition, on September 1, 1993, ABB-CE had placed PO 9309380, supplement 0, dated September 1, 1993, to SWEC for engineering services supporting the System 80+ design certification. This PO was designated Quality Class 1, safety-related, and invoked the applicable QA and 10 CFR Part 21 requirements.

Quality Assurance Program Description CENPD-210A, revision 7A, states that the program was based on and is responsive to the requirements of ANSI/ASME NQA-1, "Quality Assurance Program Requirements for Nuclear Facilities (1983 Edition with Addenda 1a (1983))," and Regulatory Guide 1.28, "Quality Assurance Program Requirements (Design and Construction)," revision 3. ANSI/ASME NQA-1, Supplement 18S-1, "Supplementary Requirements for Audits," states in section 4 that "auditing shall begin as early in the life of the activity as practical and shall be continued at intervals consistent with the schedule for accomplishing the activity" and "objective evidence shall be examined to the depth necessary to determine if these elements are being implemented effectively." Regulatory Guide 1.28, "Quality Assurance Program Requirements (Design and Construction), dated August 1985, Section 3.2, External Audits, states that audits should be implemented in accordance with Supplement 18S-1 of NQA-1-1983, that the triennial period begins when an audit is performed and that audit may be performed when the supplier has completed sufficient work to demonstrate that its organization is implementing a quality assurance program that has the required scope for purchases placed during the triennial period. Criterion VII of Appendix B to 10 CFR Part 50 states, in part, that the effectiveness of the control of quality by contractors and subcontractors shall be assessed by the applicant or designee at intervals consistent with the importance, complexity, and quantity of the product or service.

The inspectors discussed the status of the implementation audit of SWEC in support of PO 9309380 with ABB-CE who initially indicated that SWEC was not on the ABB-CE 1994 External Audit/Evaluation Schedule. The inspectors determined that the results of the SWEC safety-related engineering services were highly important to the System 80+ project, that the results of the service purchased through PO 9309380 had been received by ABB-CE since September 1993 and provided to the NRC as a portion of information supporting CESSAR-DC review. The inspectors concluded that consistent with the importance and complexity of the SWEC service, ABB-CE should have either performed an implementation audit or had scheduled one to be performed on a date commensurate with the

importance and complexity of the service. Prior to completion of the inspection, ABB-CE provided a revision of the ABB-CE 1994 External Audit/Evaluation Schedule, dated February 17, 1994, that indicated that SWEC was scheduled to be audited in April of 1994.

Although SWEC had been placed on the ABB-CE ASL on August 26, 1993, and ABB-CE had immediately accepted the safety-related engineering services in support of the ongoing System 80+ development and had provided the results of this service to the NRC as part of the CESSAR-DC review, ABB-CE had not performed an audit to verify that the SWEC QA program was being adequately implemented in support of the engineering services. This was identified as a nonconformance to Criterion VII of Appendix B of 10 CFR Part 50. (94-01-02)

3.8.2 Internal Audits

QPI 1801 prescribed ABB-CE's procedures for the conduct of internal compliance audits required to verify compliance with the ABB-CE QA program. The team reviewed the internal audits performed by ABB-CE QA in 1993 for each engineering discipline (fluid systems, nuclear reactors, mechanical, start-up, instrumentation and controls, and nuclear design graphics). Each of these six programmatic audits of the various engineering disciplines reviewed processes or documents for the System 80+ project.

The QA audit team generated 15 corrective action requests (CARs) as a result of these audits, though none of them were directly related to the System 80+ project. These CARs identified conditions adverse to quality primarily in the areas of records, training, and design controls. All CARs were responded to in a timely manner with adequate causes, corrective actions, and measures to prevent recurrence identified by the recipient. In each case, the QA auditor evaluated the proposed corrective actions, verified their implementation (when applicable), and closed the CAR. The instructions for documenting, evaluating, and verifying corrective action were delineated in QPI 1601. In addition to the internal compliance audits, ABB-CE Nuclear Power, Newington Operations (Newington), performs an independent quality audit of ABB-CE in the fourth quarter of each year. The team reviewed the 1993 audit which generated four findings and four observations. ABB-CE responded to Newington with adequate corrective actions to prevent recurrence and Newington deemed the responses acceptable and closed out the findings.

Paragraph 3.18.1 of the System 80+ QA Plan 18386-QO-001, Revision 3, stated that an audit shall be performed at least once prior to issuance of the FSER to verify compliance with this QA plan. At the time of the inspection, ABB-CE had not performed an audit of the System 80+ project in accordance with the QA plan. However, an internal compliance audit had been scheduled for February 1994, to include applicable portions of criterions 1 through 7 and 16 through 18 of NQA-1, per the audit plan.

The ABB-CE QA Department issued a memorandum which evaluated and summarized the CARs generated during the previous year as required by QPI 1601. ABB-CE QA issued a second memorandum which reviewed and compared internal audit report results from the previous year to the prior year to identify undesirable trends and recurring problems as required by QPI 1801. The team

further noted that ABB-CE QA issued monthly highlight reports to R. E. Newman, President, ABB-CE Nuclear Systems, summarizing the status and accomplishments of various areas within the QA department. The team viewed these monthly and annual reports as effective methods of analyzing the effectiveness of the QA program and communicating the results with management.

3.8.3 Integrated Reviews

Paragraph 3.3.3.1 of the System 80+ QA Plan 18386-QO-001, Revision 3, stated that multi-disciplinary reviews (integrated reviews) would be conducted periodically by teams appointed by project management and the results of these reviews would be documented. ABB-CE had performed three integrated reviews with 5 to 6 dedicated individuals who reviewed the CESSAR-DC page by page primarily to assure technical and editorial consistency within the safety analysis report. These reviews did not, however, verify the adequacy or accuracy of the design inputs used to generate the CESSAR-DC. ABB-CE also indicated to the team that it is planning to perform an additional integrated review prior to finalization of the safety analysis report.

In 1989, coincident with its first submittal to the NRC for design certification, ABB-CE performed its first integrated review of the CESSAR-DC. The review team consisted of a chairman, a DESI representative, two ABB-CE engineers, and a licensing representative. ABB-CE stated that the review team created a list of comments identified as either inconsistencies, missing items, and inadequate or inappropriate engineering detail. The results of these reviews were not documented and were, therefore, not available for review by the team.

In 1991, ABB-CE performed their second integrated review of the CESSAR-DC after its final planned submittal of the CESSAR-DC was submitted to the NRC staff. The team consisted of six senior engineering representatives with at least ten years related nuclear experience, including engineers from DESI, SWEC, Florida Power and Light, Ebasco, and two from ABB-CE. The team created a database of comments after reviewing items with the entire team to determine their validity and assign category and responsibility. The comments were categorized as one of the following: editorial, inconsistency, technical, additional information, or design suggestions. The database was not maintained, however, to assure that each of the comments was incorporated or at least addressed. The team reviewed several of the comments and compared them to the latest revision of CESSAR-DC and found the majority of them to be incorporated. The team noted that many of the comments were technical in nature and concluded that this review was an effective method to assure consistency and technical accuracy within the CESSAR-DC.

The third integrated review was conducted by ABB-CE in 1993 prior to the deadline commitment to the NRC for making final revisions to the CESSAR-DC. The review team did not utilize a database to collect comments due to the short schedule developed for completion of this task. The team members simply marked up the affected pages of the CESSAR-DC during an independent review and then met periodically with the affected CESSAR-DC "Chapter Champion" to address the comments. The responsible "Chapter Champion" would then incorporate the inputs into the applicable CESSAR-DC chapter as necessary.

The "Chapter Champion" concept was created by ABB-CE to respond to the draft SER in September 1992. Each chapter of the CESSAR-DC was assigned a champion responsible to assure the technical adequacy and consistency of the chapter's content. Another result of this review was the creation of "road maps" by the chapter champions, including cross-references between chapters within the CESSAR-DC and cross-references from the CESSAR-DC table of contents to their respective ITAAC numbers, including parameters and assumptions. The team reviewed and utilized these "road maps" during the inspection and considered them an effective management tool.

The team confirmed that ABB-CE had performed three integrated reviews of CESSAR-DC information for technical and editorial consistency. Although these reviews were comprehensive and effective in identifying technical, editorial and context inconsistencies, the team noted that they did not extend beyond the information contained in the CESSAR-DC and design calculation input or assumptions were not examined or reviewed.

4 PERSONNEL CONTACTED

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