U. S. NUCLEAR REGULATORY COMMISSION

OFFICE OF NUCLEAR REACTOR REGULATION

Report No.:	99901256/1999201
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Nuclear Industry Activity:	Manufacture of medium-voltage Type HK and vacuum circuit breakers and 600-V K-Line circuit breakers
Dates of Inspection:	September 27-30, 1999
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Enclosure 2

1. INSPECTION SUMMARY

On September 27-30, 1999, the NRC conducted an inspection at Asea Brown Boveri (ABB) Power Transmission & Distribution (T&D) Company, Inc., Distribution Systems Division, located in Florence, South Carolina, where ABB manufactures medium-voltage Type HK circuit breakers and vacuum circuit breakers and 600-volt-rated K-Line (metal-enclosed) circuit breakers. The inspection evaluated the ABB quality assurance (QA) program and its implementation in the design, qualification, and manufacture of these breakers and its program for implementation of 10 CFR Part 21. As part of the NRC circuit breaker task action plan, this inspection followed up on issues identified during an inspection at the Donald C. Cook Nuclear Generating Station (D.C. Cook) where ABB Service Company was performing breaker refurbishment services. Also, the inspection followed up on an inspection of ABB/Combustion Engineering, Nuclear Power (CENP), Windsor, Connecticut, which was performed to evaluate the actions taken to correct the failure of retrofit ABB vacuum circuit breakers at Baltimore Gas & Electric (BG&E) Company's Calvert Cliffs Nuclear Power Plant (Calvert Cliffs). The Calvert Cliffs issue will be pursued further in a future inspection at the ABB Service Company's Product Development Center (PDC) in Cleveland, Ohio, where the vacuum interrupters and their operating mechanisms made by ABB T&D, Florence, were converted for retrofit into existing GE Magne-Blast switchgear at Calvert Cliffs. The inspectors observed different circuit breakers in various stages of manufacture and testing and identified problems with the implementation of the ABB quality assurance program relative to 10 CFR Part 21, and to Criteria III, V and XVI of Appendix B to 10 CFR Part 50.

The inspectors also reviewed the actions taken to correct inspection findings identified in NRC Inspection Report 99901256/93-01, reviewed the manufacturing and repair records of two 4.16-kV, HK type circuit breakers that ABB had supplied to American Electric Power Company (AEP) for installation at D.C. Cook.

1.2 Violations and Nonconformances

1.2.1 Unresolved Item 99901256/1999201-01: Contrary to the requirements of 10 CFR 21.51, ABB T&D Co.'s Part 21 evaluation and notification files were determined to be incomplete, pending the vendor's location of the missing records (Section 3.1.3)

1.2.2 Unresolved Item 99901256/1999201-02: Contrary to 10 CFR 21.21(d)(4), not all required information was included in all notifications that were made pursuant to 10 CFR 21.21(d)(1), pending vendor location of complete correspondence. (Section 3.1.3).

1.2.2 Nonconformance 99901256/1999201-03: Contrary to the requirements of 10 CFR Part 50, Appendix B, Criteria III and V, ABB failed to properly change a factory specification. Also, the change was implemented without informing users. (Section 3.2.b)

1.2.3 Nonconformance 99901256/1999201-04: Contrary to the requirements of 10 CFR Part 50, Appendix B, Criterion XVI, ABB failed to take corrective action committed to for a previous violation in that ABB failed to maintain its subscription to NUREG-0040. Also, until the first day of the inspection, ABB had not posted its Part 21 procedures per §21.6(a) or the alternative notice allowed by §21.6(b). (Sections 2.1 and 3.1.1)

2.0 STATUS OF PREVIOUS INSPECTION FINDINGS

2.1 Violation 99901256/93-01-01 (Closed) Contrary to the requirements of 10 CFR 21.21(a), ABB T&D had failed to update its procedures adopted pursuant to the regulation since the substantial revision to Part 21 that became effective on October 29, 1991. Contrary to the requirements of 10 CFR 21.6(a), ABB T&D had failed to post the current revision of 10 CFR Part 21. During this inspection, the inspectors determined that the Part 21 procedures had been appropriately updated; although they contained some weaknesses as discussed in Section 3.1 below. When observed during this inspection, the current revision of Part 21 was posted along with Section 206 of ERA-1974 as required by §21.6(a). The ABB T&D procedures adopted pursuant to the regulation were not posted, but instead, as permitted by §21.6(b), there was a notice posted that described the procedures and stated where the procedures could be viewed as well as the title of the person to whom reports were to be made. However, the notice was dated September 27, 1999, the date the inspection began, and ABB admitted that neither the notice nor their Part 21 procedures had been posted previously; although, when inspected, the posting did contain at least the minimum elements required by §21.6; therefore the violation was considered corrected. Nevertheless, because neither the procedures, nor the notice had been posted prior to the inspection, and because ABB apparently had not followed through on all of their commitments for corrective action after the previous NRC inspection, the inspectors concluded that this constituted inadequate corrective action contrary to the requirements of Criterion XVI, "Corrective Action," of 10 CFR Part 50, Appendix B. Accordingly Nonconformance 99901243/ 1999201-04 was cited.

2.2 Nonconformance 99901256/93-01-02 (Open): Contrary to the requirements of Criterion V, of 10 CFR Part 50, Appendix B, ABB Circuit Breaker Division was not properly implementing its quality assurance procedures. The following examples were cited:

2.2.1 (Closed) Contrary to Paragraph 3.5 of ABB T&D Quality Assurance Procedure (QAP) 2.5, two nuclear safety-related suppliers had not been audited since 1991. During this inspection, the inspectors determined that current ABB procedures addressed supplier qualification and no further instances of untimely or missing supplier audits were noted; although one audit report reviewed in connection with another issue was of a broad-based programmatic audit and did not document supplier control of the specific attributes of interest of the supplied item. (See Section 3.4 of this report.)

2.2.2 (Closed) Contrary to Paragraph 4.4.9 of ABB's QAP 4.3, "Procurement Documentation Control System - General," Revision 1, dated October 29, 1992, ABB had purchased items from two vendors which were not listed on the Approved Vendors List and used the items in assembling nuclear safety-related circuit breakers. During review of material procurements in support of the manufacture of HK and K-Line breakers for D.C. Cook, the inspectors found no further instances of use of unauthorized sources. Disposition of the material in question and affected breakers was addressed during the previous inspection. The inspectors agreed that after this length of time with no reported failures attributable to material from the unauthorized vendors, ABB's position that final testing and successful service was evidence that the material in question was ultimately of acceptable quality was reasonable.

2.2.3 (Open) Contrary to Paragraph 3.1 of ABB's QAP 4.3, "Procurement Documentation Control System - General," Revision 1, dated October 29, 1992, ABB had not documented an evaluation to support the basis for inclusion of all vendors on its approved vendors list. This nonconformance was not reviewed during this inspection.

2.2.4 (Closed) Paragraphs 3.1.2 and 3.2.1 of ABB's QAP 7.1, "Receiving Inspection-Components," Revision 1, dated October 29, 1992, referenced "QAP 6.5," and paragraph 3.2.4.2 referenced "QAP 16.2." QAP 6.5 and QAP16.2 did not exist and therefore could not be followed. The inspectors determined that QAP 6.5 had been issued originally on April 12, 1992; therefore, it was in existence at the time of the previous inspection. Paragraph 3.2.4.2 of Revision E0 (current) of QAP 7.1 now referenced QAP 15.1, "Nonconforming Material."

2.2.5 (Closed) Contrary to Paragraph 6.2 of ABB's QAP 2.4, "Inspection and Test Personnel Qualification," Revision 1, dated October 29,1992, the log book in which job descriptions and certifications of qualifications of personnel were required to be recorded did not exist. The inspectors verified that in accordance with current procedures, these records are now kept in an electronic database.

3.0 FINDINGS AND OBSERVATIONS/REPORT DETAILS

3.1 Implementation 10 CFR Part 21

a. Inspection Scope:

The inspectors reviewed ABB's procedures adopted pursuant to 10 CFR 21.21(a), records required by §21.51, and examined the postings per §21.6. In addition, in order to evaluate ABB's identification of potential Part 21 issues under its quality assurance program, the inspectors reviewed ABB's procedures relating to nonconforming material under Criterion XV of 10 CFR Part 50, Appendix B, including handling customer complaints and equipment returned for repair/correction of problems, and procedures for corrective action under Criterion XVI of Appendix B.

b. Findings and Observations:

3.1.1 Posting per 10 CFR 21.6

ABB had properly posted Section 206 of the Energy Reorganization Act of 1974 and the latest version of 10 CFR Part 21 (1995) as required by §21.6(a), but had not posted the procedures adopted pursuant to §21.21(a); nor had they ever been posted according to the cognizant QA engineer. In addition, as allowed by §21.6(b), in lieu of the procedures, ABB had posted a notice that described the procedures and the regulation, stated where the procedures may be viewed (because the regulation was itself posted), and directed that reports be made to the QA manager. However, the notice was dated September 27, 1999, the first day of the NRC inspection and the QA engineer admitted that no such notice had been posted in lieu of the procedures previously.

The previous inspection had not identified the lack of posted procedures per §21.6(a) or the lack of the alternative notice allowed by §21.6(b), but apparently in posting the latest version of Part 21, and in preparation for this inspection, ABB discovered that neither the procedures nor an alternate notice was posted. Therefore, as posting each page of the procedure in the locked glass case used for the Part 21 posting was impractical, ABB prepared and posted the alternate notice as described above.

In reviewing the posted notice, the inspector noted that the description of the procedures was little more than a statement of their purpose. Without explaining the expectations of ABB management with regard to reporting by employees of problems identified during manufacturing, inspection and testing, or reported from the field, which could adversely affect basic components (safety-related equipment) supplied to NRC-licensed facilities, the notice was not conducive to meaningful compliance. After discussing this with ABB, the inspectors noted that the QA Engineer made the posted notice considerably more effective by revising it to state the kinds and sources of information relating to potential deficiencies or concerns about Class 1E and/or "N"-designated (nuclear) items that should be reported by employees and that they should be reported to the "Total Quality Manager" or the QA Engineer.

As part of the corrective action for the violation identified in the 1993 NRC inspection report in which ABB had not posted the latest version of Part 21 and had not updated its procedures to reflect the latest version, ABB had committed to subscribing to the NRC's quarterly publication NUREG-0040, "NRC Licensee Vendor and Contractor Inspection Status Report," in which revisions to Part 21 were published in addition to their being published in the *Federal Register*. However, the ABB Florence facility did not have NUREG-0040, nor were they receiving it, nor were they aware of it. If ABB Florence had ever subscribed to NUREG-0040, they had not maintained the subscription. As stated in Section 2.1, this was inadequate corrective action contrary to Criterion XVI of 10 CFR Part 50, Appendix B, and was cited as Nonconformance 99901256/1999201-04.

3.1.2 Procedures Adopted Pursuant to 10 CFR 21.21(a)

ABB's Part 21 procedures were contained in QAP 15.5, "Reporting Product Defects." The latest revision, Revision E01, was issued July 30, 1999. The inspectors determined that the procedures contained all the provisions required by §21.21(a) to be included in procedures adopted pursuant to the regulation. In addition, the inspectors found that the procedures were strengthened significantly by inclusion of other provisions to implement and explain in terms relevant to ABB Florence other Part 21 requirements such as, for example, notifying affected licensees or purchasers in accordance with §21.21(b) of deviations that ABB determines it cannot evaluate in accordance with §21.21(a)(1). However, the procedure also contained some weaknesses such that in certain cases, following the procedures verbatim without reference to Part 21 itself could lead ABB or allow ABB to fail to meet certain requirements of Part 21 that are not explicitly required by the regulation to be included in the procedures adopted to implement it. These weaknesses were discussed with the vendor as described in the following observations:

- The Part 21 reporting process was uniquely strengthened by including the procedures adopted pursuant to the regulation, QAP 15.5, within the group of procedures established pursuant to Criterion XV, "Control of Nonconforming Material," of 10 CFR Part 50, Appendix B. However, this advantage was diminished because QAP 15.5 did not reference the other relevant Criterion XV (and also Criterion XVI, Corrective Action") procedures such as QAP 15.1, "Nonconforming Materials" (covers nonconformance reports (NCRs)); QAP 15.2, "Production Stop Notice,"QAP 15.4, "Returned Goods Authority"; or QAP 16.1, "Corrective and Preventive Action," as prescribing activities in which potential deviations and/or failures to comply in basic components already or previously supplied to NRC-licensed facilities may be identified. QAP 15.5 also did not address other external sources of information on potential deviation or failures to comply in shipped basic components (e.g., NRC generic communications, 10 CFR Part 21 notifications or other vendor product bulletins, etc.).

- Weak procedural coordination and interface was not conducive to program effectiveness. QAPs 15.1, 15.2 and 15.4 did not provide for screening of documentation relating to nonconforming material for potential Part 21 applicability (or referring to QAP 15.5 to do so), whether information indicating the existence of potential deviation or failures to comply in shipped basic components was internal or external. QAP 16.1, governed documentation and tracking of corrective action by Corrective Action Requests (CARs). Paragraph 16.1.3.8 stated that the QA manager will determine the impact [*of the problem documented in the CAR*] on products supplied to nuclear utilities in accordance with 10 CFR Part 21. This cross reference was a programmatic strength, but the lack of any reference to Part 21 screening on the CAR form or the Corrective Action Summary Log form was not conducive to consistent implementation of this provision. QAP 16.1 also governed the Internal Complaint Review Process (ICRP) and the Customer Complaint Review Process (CCRP), but the guidance for neither process mentioned screening for Part 21 applicability. Sources of potential Part 21 issues would include ABB tests, inspections, audits, surveillances, commercial-grade surveys or source verifications, which would be captured under QAP 15.1 (NCRs) or QAP 16.1 (ICRP), from information received from the field (e.g., customer/user problems), captured under QAP 15.4 (RGA) and QAP 16.1 (CCRP); or other outside sources (e.g., NRC generic communications, 10 CFR Part 21 notifications or other vendor product bulletins,).

- In terms of corrective action incidental to the discovery of deviations and/or failures to comply (in addition to reporting requirements), ABB did not cross reference the other procedures mentioned above (and also QAP 15.3, "Scrap Procedure") in QAP 15.5 for disposition of the actual material in question, i.e., basic components with deviations and/or failures to comply that may have been identified initially under the Part 21 program itself, in parallel with the process of their being evaluated per 10 CFR 21.21(a)(1), reported to the NRC per 10 CFR 21.21(d) or reported to affected licensees or purchasers per 10 CFR 21.21(b).

- Specific detailed observations on the content of QAP 15.5 itself were as follows:

  The stated purpose of QAP 15.5 (Paragraph 15.5.1) was to define a system for evaluating and reporting deviations and failures to comply with the "Atomic Energy Act of 1954, as amended, or the Energy Reorganization Act of 1974 (10 CFR Part 21)"; whereas the list in 10 CFR Part 21 of those things with which something may fail to comply does not include the Energy Reorganization Act of 1974 or 10 CFR Part 21 itself, but does include "any rule, regulation, order, or license of the Commission" which were omitted from the QAP 15.5 statement of purpose.

  The scope of QAP 15.5 defined in Paragraph 15.5.2 contained a good working definition of basic components in stating that the procedure is applicable to Class 1E, i.e., safety-related equipment (which it defined correctly) and services, but did not equate them to or even use the term "basic component". However, subsequent paragraphs referred to basic components without explaining that they are safety-related equipment and services; i.e., without explaining the special meaning of this otherwise non-descriptive term within the context of 10 CFR Part 21.

  Paragraph 15.5.3.1 acknowledged that ABB was a supplier of basic components and cited the requirement in 10 CFR 21.21(a)(1) for evaluation of deviations or failures to comply within 60 days of discovery, but the procedure did not explain the special meaning and specific elements of this term or refer to its definition in §21.3. Paragraph 15.5.3.1 also cited the §21.21(a)(2) requirement for an interim report within 60 days, but did not state that it must be submitted, if required, within 60 days of discovery as well.

  Paragraph 15.5.3.2 provided for informing purchasers or affected licensees when ABB determined that it could not "perform the evaluation to determine if a defect exists," which implemented §21.21(b). Although §21.21(a) does not at present explicitly include this provision among those things required to be included in Part 21 procedures, this provision made the procedure much more effective because it addresses the vast majority of cases for any supplier of basic components except perhaps the NSSS suppliers of the affected plant types, affected architect/engineers or affected licensees themselves, who would be expected to be capable of performing such an evaluation. However, the added strength was diminished because the language used did not clearly state the requirement in §21.21(b) to inform purchasers or affected licensees of the deviation or failure to comply in question, not just that it cannot perform an evaluation, which is of secondary importance, being merely the reason why the matter is being referred to the affected licensees or purchasers. Although explaining a deviation itself was implied by the phrase: "...so that purchasers or affected licensees may evaluate the deviation", the paragraph did not include failures to comply.

  This observation is not intended in any way to discourage including things in the Part 21 procedures that are requirements of Part 21, but not specifically required to be in procedures. On the contrary; all applicable Part 21 provisions

must be complied with and some might otherwise be overlooked without direct reference to the regulation itself unless included in the procedures. Rather, the observation was only intended to convey the caution that in adapting the language of Part 21 to more recognizably reflect the specific circumstances and common terminology of a particular organization, which may be more conducive to meaningful compliance, the procedure must still accurately reflect the intent of the Part 21 provisions it is intended to implement, if not restating them verbatim. Otherwise, an incorrectly or ambiguously worded procedure, if followed strictly as written without reference to Part 21 itself, could allow or even mislead the organization into violating or failing to meet certain Part 21 requirements.

Paragraph 15.5.3.3 apparently was intended to implement §21.21(a)(3) in a manner relevant to the ABB Power T&D Company by designating the "President of ABB Power Distribution Company or his designated representative" as the director or responsible officer that §21.21(a)(3) requires be notified of a defect or failure to comply associated with a substantial safety hazard within five working days of completion of the evaluation. However, the paragraph did not state that any so-called designated representative must him or herself also be a director or responsible officer as defined in Part 21; nor did it specifically designate an alternate who is also a director or responsible officer. Further, it was not clear to the inspectors that the title "President of ABB Power Distribution Company" as stated in the procedure was exactly consistent with the corporate name or organization. Finally, the paragraph failed to mention informing the designated director or responsible officer of failures to comply associated with substantial safety hazards in addition to defects.

Paragraph 15.5.3.4 implemented §21.21(d) and included the provision of §21.21(d)(5) for reporting by a designated representative (not necessarily another director or responsible officer). This was a strength, although the specific addressees for NRC notification were not given or referenced.

Section 15.5.4.1 was a significant strength, first, in that the first paragraph recognized the diverse sources of supply (other ABB divisions and outside vendors) for manufacturing ABB Power T&D Florence products and took the initiative to assign ABB Florence with the responsibility for coordinating the evaluation, notification and resolution with the NRC and the customer of problems identified in the field with ABB Florence products. However, while assuming this responsibility is commendable, the inspectors cautioned ABB that some of its suppliers (to the extent that they may supply basic components) as well as its customers (to the extent that they may use or also supply basic components) continue to be subject to Part 21 requirements. The second paragraph prescribed cooperation among the ABB Florence engineering, QA and operations departments in performing evaluation, an important concept. The third paragraph acknowledged the same responsibilities as the first, but for products from outside vendors. However, it was not made clear that for those commercial-grade items that ABB dedicates, assuming Part 21 responsibilities as the dedicating entity is required by §21.21(c)

Paragraph 15.5.4.5 was a significant strength in that it recognized the need to determine when a defect is identified in a product whether any similarly affected basic components could have reached purchasers or NRC-licensed facilities; although it should have included deviations and failures to comply as well.

Paragraph 15.5.4.6 provided some clarification of ABB's implementation of §21.21(a)(3) and §21.21(d) that was somewhat ambiguous in Paragraphs 15.5.3.3 and 15.5.3.4 respectively; although it did not provide for alternate directors or responsible officers to whom reports of defects or failures to comply related to substantial safety hazards may be reported in order to assure the ability to comply with §21.21(a)(3) should the primary designated officer not be available.

Paragraph 15.5.6.1 under QA responsibilities assigned ABB Florence QA the lead in performing evaluations of deviations to identify defects. Germane, but not mentioned was the evaluation of failures to comply to determine if they are related to substantial safety hazards.

Paragraph 15.5.6.3 established Part 21 record requirements. It required the QA manager to maintain a file "representing the product defect", but records of evaluation of and/or notifications sent to purchasers or affected licensees of deviations and/or failures to comply, per se, as required by 10 CFR 21.51 were not mentioned. In addition, although the QA manager stated that it was ABB's practice to maintain such files indefinitely, the §21.51 requirements to maintain records relating to evaluation and notification of deviations and failures to comply for a minimum of 5 years and to maintain records of the purchasers of basic components for a minimum of 10 years after delivery were also not mentioned.

Section 15.5.8 provided guidance for addressing and documenting during performance of §21.21(a)(1) evaluations (called "potential defect investigations") the types of information required by §21.21(d)(4) to be included as a minimum in notifications to the NRC required by §21.21(d)(1). However, many of the subparagraphs in Section 15.5.8 described information related to defects only and, except for 15.5.8.6 and 15.5.8.7, did not include failures to comply. Because this was the only section in which any specific evaluation guidance was provided, the inspector looked for, but did not find in the procedures, an explanation or examples of failures to comply relevant to ABB's scope of activities (e.g., seismic requirements, license technical specifications, etc.). Also absent as evaluation guidance was an explanation of deviations as departures from technical requirements in procurement documents that could be considered defects due either to their creation of substantial safety hazards or their leading to violation of license technical specification safety limits (e.g. exceeding core thermal limits due to loss of cooling capability. etc.).

The procedure also did not explain that for purposes of identifying deviations, technical requirements need not be explicitly included or referenced in procurement documents, but could be considered to be invoked implicitly. For example, specifications in published technical data upon which applications engineers rely in specifying equipment by type or model would be presumed to

be invoked by the procurement documents. Specifications, standards or other procurement document requirements certified to in certificates of conformance issued by ABB with the supplied equipment or parts could even more clearly be presumed to be invoked in the procurement documents.

In response to the discussion of the forgoing observations by the inspectors, ABB committed to revise its Part 21 procedures accordingly and also to improve procedural interfaces by revising its procedures relating to control of nonconforming material, corrective action, and complaints or returns from the field to ensure that problems identified under those procedures are effectively screened for potential Part 21 applicability.

3.1.3 Records of Part 21 Evaluations and Notifications

The inspectors requested the ABB T&D Part 21 evaluation and notification files for the previous five years as this is the minimum retention requirement in §21.51. Requested especially were any that may have resulted in no outside notifications. ABB explained that its official Part 21 evaluation and notification files were kept at the Switchgear Division facility in Sanford, Florida, so Sanford faxed copies to Florence for the NRC inspectors' review. The group of files produced was represented as complete, i.e., all evaluations and notifications, dating back to 1993. However, without a log of all Part 21 issues, and without screening all potential source documents such as NCRs, CCRPs, RGAs, CARs, etc., the inspectors could not verify that all problems or issues that would have required at least a Part 21 applicability screening, if not an actual evaluation and possible notification, were captured in the evaluation files presented. Therefore, the review was limited to determining whether the evaluations reviewed were technically sound and whether all required notifications were made and included all required information.

The group of Part 21 evaluation and notification files reviewed included 1 file from 1993, 3 from 1994, 4 from 1995, 2 from 1996, and 1 from 1997. The files are required by §21.51 to include evaluation records and any customer notifications. The inspectors found that some included lists of affected customers and that all the records asserted that the NRC and affected customers had been informed; so an assessment of the rationale for not making a report was rendered moot. However, in two cases, as discussed below, copies of the actual letters that, according to annotations in the evaluation record, had been sent to affected customers and the NRC were not present. Therefore, the inspectors could not verify that the notifications were timely or that they contained all the information required by §21.21(d)(4). In addition, in seven cases, there were no records of the evaluations that resulted in the Part 21 notifications. The 1993 file contained a record of evaluation and a copy of a notification letter to the NRC. The NRC notification was typical of most of the others in that it stated that a copy of it was being sent to affected customers, so that the NRC notification presumably also represented the notification to customers. There were no instances among the files reviewed of notifications to purchasers or affected licensees only per §21.21(b) of unevaluated deviations or failures to comply. The lack of records of evaluations in seven Part 21 files was an apparent violation of 10 CFR 21.51(a)(1); so ABB undertook to locate the missing records.

Among the two files with records of evaluation, but no copies of the notifications, the record of the evaluation of a report of oversized control wiring lugs found on ABB breakers at Southern California Edison's San Onofre Nuclear Generating Station had a margin annotation indicating that the issue was reported to the NRC and "distribution list", presumably affected customers, on May 10, 1995. As discussed further below, the evaluation record itself was not dated (completion date), but it stated that the defect had been discovered on March 14, 1995. Therefore, it appeared (but could not be confirmed without copies of the notification letters) that the 60-day maximum evaluation period requirement of §21.21(a)(1) had been met. The record was signed by the Vice President and General Manager, but his signature was not dated, so it could not be verified whether any director or responsible officer (or in particular, the "President of ABB Power Distribution"[sic] as required by QAP 15.5 had been notified of the results of the evaluation (i.e., existence of a defect in basic components supplied to an NRC-licensed facility, namely San Onofre, at least) within the 5 working days required by §21.21(a)(3). The fact that this file did not include the notifications was a violation of 10 CFR 21.51(a)(2). In addition, the lack of completion dates on the records of evaluation (and the lack of a requirement for this in QAP 15.5) would make it difficult to determine precisely within 60 days of the discovery date that was present in one case until what date the record must be retained as a minimum.

In another instance, the file on cracked and broken secondary disconnect strips, discovered in June 1995 (no exact date, also at San Onofre) contained a copy of a cover letter giving a point of contact and indicating that a Part 21 notification was attached. The cover letter, dated September 19, 1995, had an annotation indicating that it accompanied "all Part 21 reports" and that they were mailed on September 21, 1995. The record of evaluation was again not dated, nor were the review signatures, however, if the evaluation took the full 60 days from an assumed discovery date of 30 June, 1995, and if the director or responsible officer was notified of the defect five working days later, then it appeared, but could not be verified, that the notifications required by §21.21(d) had been sent within the time limit specified in §21.21(d)(3)(ii). However, since the actual notification was not on file, this was another example of the violation of 10 CFR 21.51(a)(2). ABB undertook to locate the missing notifications.

Finally, not all of the notifications reviewed contained all of the information required by §21.21(d)(4). For example, a notification to the NRC, dated June 28, 1995, did not indicate the date the information was obtained [21.21(d)(4)(v)], nor did it indicate the number and location of all affected basic components [21.21(d)(4)(vi)]. This was the case with at least two other notifications as well.

c. Conclusions

The inspectors concluded that the ABB Part 21 procedures complied with §21.21(a). The inspectors further concluded that the ABB program for implementation of 10 CFR Part 21 was strengthened significantly by locating the procedures among those addressing nonconforming material and by including provisions in the procedures to implement other Part 21 requirements in terms meaningful to ABB employees. However, related procedures were not well cross-referenced and the Part 21 procedures themselves contained some weaknesses such that in certain cases, following them verbatim without reference to Part 21 itself could lead or allow ABB to violate Part 21.

On the basis of ABB's failure to have a complete Part 21 posting until the first day of this inspection and its apparent failure to have obtained and/or maintained a subscription to NUREG-0040 as committed to as part of the corrective action for a previous Part 21 violation, the inspectors concluded that ABB's corrective action for that previous violation was inadequate and thereby constituted a nonconformance with respect to the requirements of Criterion XVI, "Corrective Action," of 10 CFR Part 50, Appendix B. Accordingly, Nonconformance 99901256/1999201-04 was cited.

On the basis of ABB's Part 21 evaluation records and notifications files presented for review not containing some of the required documents, the inspectors concluded that ABB T&D's Part 21 records did not meet the requirements of 10 CFR 21.51. The inspectors attributed this in part to the weaknesses in the Part 21 procedure regarding documentation and retention of documentation, as well as inconsistent compliance with some of those documentation-related procedural provisions that did exist. However, the inspectors further concluded that there were no identified defects or failures to comply associated with substantial safety hazards that did not appear to have been reported either to the NRC or to purchasers and affected licensees; although not all the notifications could be verified and not all of them were complete. Finally, the inspectors concluded that with regard to the records reviewed, ABB's technical corrective actions appeared to be reasonably appropriate and complete. The lack of complete Part 21 files contrary to 10 CFR 21.51 was cited as Unresolved Item 99901256/1999201-01, pending the vendor's location of the missing records. The lack of complete information in several of the notifications contrary to 10 CFR 21.21(d)(4) was cited as Unresolved Item 99901256/1999201-02, pending vendor location of complete correspondence.

3.2 Manufacture of Circuit Breakers for D.C. Cook

3.2.1 Review of Records for Breaker Serial No. CCN 0108001-010897

a. Inspection Scope:

In order to evaluate the effectiveness of ABB T&D QA controls over its manufacturing process, the inspectors reviewed the procurement, manufacture, testing, shipment and repair process for new Type HK circuit breakers. Recent purchases by AEP for D.C. Cook of two ABB 4.16-kV Type 5HK 250 breakers were used as a vehicle for this review. Areas covered included handling of incoming customer procurement documents, review of original specifications, the material requirements planning (MRP) process, preparation of "Job Packs," purchased parts, raw materials and services, process controls, and final testing. With regard to purchased materials, the inspectors focused on supplier documentation (certificates of conformance (CoCs), certified material test reports, packing lists. etc.) and dedication of commercial-grade Items (CGIs). The dedication review focused on receipt inspection and testing and final testing, including selection of critical characteristics, verification methods and acceptance criteria, supplier audits/surveys, and CoCs to the customer.

b. Findings and Observations

AEP issued PO No. 66132-040-7x, dated March 31, 1997, to ABB Power T&D Company, Columbus, Ohio (local sales office) for one ABB, 4.16-kV, Type 5HK250, Model 03, 250 MVA, 2000 amp, circuit breaker. The PO specified that the breakers should meet the same specifications as the original breakers supplied in 1971, and indicated that it was a nuclear safety-related procurement, imposed a QA program based on 10 CFR Part 50, Appendix B, and stated that 10 CFR Part 21 was applicable. The ABB Columbus sales office passed the PO to ABB T&D, Sanford where the original specifications were researched and verified. This information was then given to the ABB T&D Circuit Breaker Division in Florence. ABB Florence prepared job pack No. CCN 0108001-010897. The job pack serves as a shop traveler which follows the breaker throughout production and testing and contains QA/QC records, bill of material, etc. The breaker was completed and successfully tested on August 21, 1997. It was shipped to DC. Cook on August 29, 1997 with a CoC of that date. On January 28, 1998, AEP notified ABB, Florence of the following problems it found with the breaker:

1. All three arc chutes had cracks, misaligned bundles and mixed hardware.

2. The phase 2 primary disconnect finger had bare copper visible in one area.

3. Cadmium plating was damaged and worn on several bolt heads.

4. Phase 2 lower lead assembly was marred at pivot point.

5. Control relay was out of adjustment (improper gap).

6. Racking mechanism is out of adjustment.

7. Miscellaneous hardware and other materials found packed with the breaker.

As a result of these findings, ABB Florence issued returned goods authorization (RGA) No. 43803 to AEP to return breaker Serial No. CCN 0108001-010897 for repair. ABB performed a receipt inspection and confirmed the AEP findings. ABB's explanations and/or corrective actions were as follows:

1. ABB repaired and replaced the arc chutes as necessary.

2. ABB replaced the deficient contact finger. The ABB Returned Goods Supervisor (RGS) explained that the bare copper area on the Phase 2 primary disconnect finger did appear to have been scraped such that the copper was showing through the silver plating. Discussions of this condition with ABB staff confirmed that the apparent wear pattern was not really consistent with that expected on a breaker that had been simply racked in and out many times which would typically be less severe, more even (affecting all the fingers) and more of a burnished silver rather than scraped appearance. It would also not be consistent with a new breaker. Rather, the location, orientation, shape and size of the bare area suggested damage when being racked in not exactly straight, without lubrication of the primary disconnects or damage by mishandling. ABB also allowed that

the affected finger might not have been adequately plated, although the wear pattern was less consistent with that explanation. The inspectors also explored the possibility that an old or used finger might have been installed on the breaker, but the way that replaced parts from breakers returned for repair are segregated (mostly scrapped and recycled), the way new materials were handled and the way the assembly process is organized made this scenario very unlikely.

3. Some bolt heads did have some distortion of the finish during assembly. The RGS said that the chromate finish appeared to be slightly blistered, but the bolts still had their zinc coating. ABB did not replace the bolts because their condition did not affect the function or reliability of the circuit breaker, particularly in their relatively clean and dry nuclear plant environment.

4. The center phase lower lead assembly was confirmed to have a gouge on it. The RGS demonstrated that how during assembly, the movable bridge (moving main contact arm) may have accidentally fallen forward, and caused the gouge. ABB failed to identify this deficiency during the final inspection. ABB replaced this part.

5. With regard to the insufficient gap between the control device lever and the limit switch crank, the inspectors learned that ABB engineers had reduced the allowable range of this from 0.060-0.090" to 0.010"-0.090" for manufacturing flexibility and to avoid an excessive gap which might lead to improper operation of the control device. However, the inspectors found that the change had been effected by the cognizant product engineer simply writing what he called an "errata" for the 5HK instruction book (IB 6.2.1.7D) and instructing the factory workers to use the new gap without changing the governing factory specification (TD 6931) through the engineering change notice process and without informing customers. This issue is also discussed in section 3.2.2 of this report.

6. ABB had determined that the out-of-adjustment condition of the racking mechanism was that the gap between the manual trip bell crank assembly (Part #191725K02) and the blocking lever extension (part # 192294B00) was large enough to defeat the rack-out interlock which is intended to prevent racking the breaker out without tripping it. The necessary adjustments were made.

7. The records indicated that ABB had successfully retested breaker and shipped it back to D.C. Cook.

On August 26, 1998, DC. Cook notified ABB that it received the recently repaired breaker with shipping damage. ABB authorized D.C. Cook to return the breaker again using RGA 43942. The reported shipping damage was unique because the outside container did not exhibit any obvious signs of damage though one side of its contents had indeed suffered some damage. The RGS showed the inspector a similarly damaged breaker and explained that during transhipment, a heavy weight had been placed on one side of the breaker carton which caused one side of the breaker's insulation barrier to buckle without obvious visible damage to its carton. ABB believed the same thing had happened to D.C Cook's breaker. ABB repaired breaker, retested it and returned it to Cook once again. The damage was as follows:

1. The fiber-glass insulation barrier assembly directly behind the front cover was cracked in the top right hand corner.

2. The strap which attached two insulating pole structures (called "chair moldings") was cracked. Damaged chair moldings were replaced.

3. The epoxy attaching the flux shield to the inter-phase barriers had separated. ABB re-expoxyed and sealed the flux shield.

4. ABB replaced the bent front panel.

c. Conclusions

On the basis of review of the manufacturing and testing records for 5HK250 breaker serial number CCN0108001-010897; inspection of the returned goods area, procedures and process; inspection of the material receiving, production and testing areas and process; review of material procurement, receipt and inspection documentation; interviews with ABB personnel and examination of equipment and parts; the inspectors concluded that the breaker had been manufactured with some quality deficiencies, but that they had been adequately corrected. The inspectors further concluded that when the breaker was returned to AEP it suffered damage during shipment which ABB also corrected satisfactorily. However, the inspectors were not convinced that ABB had fully determined the root causes of some of the deficiencies (where possible) and hence, had not yet formulated preventive measures as applicable. The inspectors also concluded that ABB could improve its records handling practices in some areas as the documents associated with the repairs (as well as some others) were not readily retrievable.

With regard to the change to the control device gap, the inspectors concluded that it had been instituted without properly changing the controlling design and/or manufacturing drawing (Factory Specification TD-6931) through the engineering change notice (ECN) process prescribed in Standard Practice Procedures 600-070, "Design Control and Review" (Revision 3) and 600-050, Engineering Change Notices" (Revision 8); nor had ABB notified its customers of the change at the time of the inspection. The manner in which the change to the control device gap specification was instituted was contrary to Criterion III, "Design Control," of 10 CFR Part 50, Appendix B and to the governing ABB procedures; hence, also contrary to Appendix B Criterion V, "Instructions, Procedures and Drawings" and cited as Nonconformance 99901256/1999201-03.

3.2.2 Review of Records for Circuit Breaker Serial No. CCN 0547002-010798

a. Inspection Scope:

The inspectors reviewed the requirements that AEP imposed in its purchase order (PO) 66147-062-8x, dated May 13, 1998, to ABB Power T&D Company, Field Marketing Office (Columbus, Ohio) for one 4.16-kV Type 5HK250, 2000-ampere-rated circuit breaker, and all records associated with manufacturing, testing, and subsequent repair of the breaker supplied under that PO.

b. Findings and Observations:

PO 66147-062-8x specified Model No. 6 35 222-888-03 (00) (16) (34) (64) for the 5HK breaker and required ABB to provide a Certificate of Conformance (CoC) with the customary identifying information, e.g., PO No., Item No., description, and shop order number, attesting to the new circuit breaker's being qualified to the same requirements as those supplied under ABB's original D.C. Cook shop order, No. 33-44322, dated December 1971.

After reviewing the original order, Sanford placed an order for the breaker on Florence. On June 3, 1998, ABB Florence prepared what it calls a "Job Pack" (No. CCN 547002-010798). According to the manufacturing records, assembly of this breaker commenced on June 29, and the breaker was completed on July 02, 1998. A quality-control check list dated June 30, 1998, documented the satisfactory results of the quality control inspection of the breakers' eleven subassemblies. A medium-voltage test data sheet, dated July 24, 1998, documented successful completion of production testing prescribed by the current effective edition of Standard C37.09 of the American National Standards Institute (ANSI) and the Institute of Electrical and Electronic Engineers, Inc. (IEEE).

ABB, Florence, issued a CoC, dated July 24, 1998, certifying, that the breaker met the AEP PO requirements as well as the applicable industry standards. According to the records, an AEP QA inspector was supposed to inspect the breaker and discuss quality issues on the previously supplied 5HK250 (No. CCN 010897). On July 31, 1998, the 4-kV HK circuit breaker was released for shipment by the AEP representative. Upon receiving the breaker at D.C. Cook, AEP performed a receipt inspection and identified the following adverse findings:

1. The gap between the breaker's control relay lever and the limit switch crank was 0.010" instead of between 0.060" and 0.090" as specified in IB 6.2.1.7D, "Installation/ Maintenance Instructions Medium-Voltage Power Circuit Breakers,"(See Section 3.4)

2. The upper phenolic support between the phase 2 and phase 3 pole structures (chair moldings) appeared to be cracked.

3. The "angle iron" under the breaker frame was held with only one loose bolt and appeared to be bent.

4. The breaker had a locking device installed on it which was not on the original breaker.

5. The breaker appeared to have sustained shipping damage.

AEP completed the required information on a serialized Returned Goods Authority form provided by ABB and returned it along with the breaker to the Florence factory. Upon receipt of the breaker, ABB Florence issued Warranty Work Order No. CFR 0779 to repair the breaker. The Florence Returned Goods Department inspected the breaker and documented the following conditions:

1. The control device gap was confirmed to be 0.010" instead of 0.060" - 0.090". As discussed above regarding the other D.C. Cook breaker, the NRC inspectors determined that the factory had set the gap in accordance with the so-called "errata" for IB 6.2.1.7D, dated October 9, 1998.

2. The upper phenolic spacer between the phase 2 and phase 3 chair moldings was confirmed to be cracked, but it was the only one found to be damaged. ABB believed that the spacer was cracked during shipment. Once cracked, the spacer became loose and no longer maintained pole spacing and alignment. The cracked spacer was replaced.

3. The so-called angle iron under the frame (actually called the interference bracket) was confirmed as being held by only one of its two bolts which was loose. The bracket is a safety device to prevent a 4-kV rated breaker from being inserted into switchgear of a different voltage class. The loss of the other mounting bolt allowed the interference bracket to swing to one side making it appear to be bent. ABB properly re-fastened the bracket.

4. The breaker was confirmed to have a locking device installed on it which allows for the installation of a pad lock to prevent unauthorized operation of the breaker. The provision for a locking device is standard. ABB could only suppose that AEP had removed the padlocks and locking devices on the original breakers when they were installed in 1970s; so that the present D.C. Cook staff were not aware that the breakers normally came with locking devices.

After completing repairs on the breaker, ABB Florence issued a revised CoC dated October 9, 1998, certifying that breaker Serial No. CCN0547002 - 010798 met all the applicable requirements. ABB Sanford, Florida issued another CoC dated November 5, 1998, again certifying that the breaker had been manufactured in accordance with the requirements of the original AEP PO. The repaired breaker was returned to D.C. Cook.

c. Conclusions

On the basis of the manufacturing and repair records, interviews with factory workers, examination of the facilities and review of procedures, the inspectors concluded that the new breakers that ABB had manufactured and shipped to D.C. Cook did have some deficiencies in quality and workmanship and one had suffered damage, apparently from shipping and/or handling. As discussed in Section 3.2.1 above, the inspectors further concluded that the improperly instituted change in the control device gap set by the factory workers in accordance with the instructions by the cognizant engineer constituted a nonconformance with respect to Criterion III, "Design Control" of 10 CFR Part 50, Appendix B, because, in effect, a design change had been instituted without proper (and documented) engineering review and approval and without proper (and documented) design verification. The change was also contrary to Criterion V, "Instructions, Procedures and Drawings," because the change was made in manner not authorized by ABB procedures. Accordingly, Nonconformance 99901256/1999201-03 was cited.

With respect to the disposition of non-conforming material, either rejected during production or removed from breakers returned for repair, the inspectors concluded that these parts appeared to be consistently dispositioned in accordance with standard industry practice. Damaged or substandard production parts were captured (with a few exceptions due to sampling) and either reprocessed to meet standards if possible or, like damaged, substandard or worn parts from relatively new breakers under warranty returned for repair, deficient parts would be scrapped and the material recycled.

Finally, the inspectors concluded that breakers that have been in service for some time are sent to one of the ABB Service Company or other repair shops for repair or refurbishment. The factory did not apparently suffer from lack of timely availability of new materials and purchased parts, nor was their any significant time pressure to fill orders because of backlog or excessive work load. The factory had suffered some degradation of quality, but appeared to be genuinely concerned with improving and maintaining high quality as well as with customer perception of quality.

3.3 Replacement Parts for the D.C. Cook Breaker Refurbishment Project

a. Inspection Scope:

Using the D.C. Cook circuit breaker refurbishment project as a vehicle for review, the inspection of ABB T&D's spare and replacement parts business included review of records and interviews with cognizant personnel and touched on the following areas:

- Handling of customer orders and translation of customer requirements into job packs and procurement documents for purchased parts, materials and services
- Procurement and dedication of commercial-grade items; including selection of critical characteristics, verification methods, acceptance criteria, sampling and traceability
- Subsupplier Audits and Commercial-Grade Surveys
- Receipt Inspection and testing, handling of nonconforming material
- Manufacturing, in-process and final inspection and testing

b. Findings and Observation:

During the review of receipt inspection records for selected purchased parts, the inspectors found the following:

- On the QC Receipt Inspection Card for gear blanks for closing spring charging ratchet wheels, the concentricity of the hole with the perimeter was not specified to be checked during receipt inspection, yet the outside diameter was a finished dimension; so if the center hole is not centered, then tooth cuts could be shallow on one side, too deep on the other.

- On the QC Receipt Inspection Card for Arc Chutes which are relatively complex parts, there was no requirement to check them against applicable drawings

- The receipt inspection card for needle bearings had no direction to remove lubricant or preservative they come packed in and to repack them with Anderol 757.

- On each QC receipt inspection card, critical characteristics, verification methods and acceptance criteria needed to be hand written. The inspector was concerned that this process was conducive to the omissions noted and not conducive to effective, consistent control of purchased material. The vendor acknowledged the observed deficiencies, initiated corrective action, and agreed to consider developing standard cards (perhaps computer generated) with preprinted attributes, acceptance criteria, etc. for each type of part or raw material inspected. Then only the actual inspection results, measurements, etc. would be handwritten. This would also alleviate the need to have engineering verify the pre-positioned information on each new card.

- Electrical and performance testing of relatively complex subcomponents like the control devices, auxiliary switches, and Ryobi closing spring charging motors was being done at Florence only when those items were installed in finished breakers. For spare and replacement items, ABB had, in effect, been taking credit for sampling, i.e., the performance of the parts installed in finished, tested breakers. However, even at what amounted to a 60-80% rate, the inspectors questioned the appropriateness of sampling with such relatively complex items. ABB thought that they could in addition, take credit for verification of certain electrical and performance-related critical characteristics. However, the NRC inspectors' review of the report of the recent audit (January 15, 1999) of Ryobi, for example, ABB's new supplier of the small universal (electric drill) motor and geared drive assemblies, found it to be a broad-based programmatic audit that did not document that Ryobi controlled the critical characteristics of interest, e.g., insulation resistance, winding resistance, current draw, torque, speed, heat, etc.

For example, some of the components for the D.C. Cook breaker refurbishment project were purchased by ABB T&D Florence from ABB T&D, Coral Springs, Florida, on Florence PO No. PCO 1716, dated August 13, 1999, as follows:

- Five Type SS-14 Power Shield® solid-state over-current trip units (Part No. 60990 T 010 N)
- Five SS-14, 600A, trip units, non-safety-related part no. 609902T 010N
- Five SS-13, 600A, long-time and instantaneous, "NSR" part No.609902 T012

ABB Coral Springs then forwarded this PO to ABB, Allentown, Pennsylvania, where the components were manufactured. ABB Allentown built the trip units shipped them to ABB Florence. ABB Florence receipt inspectors verified that the parts received met the PO requirements. ABB Sanford issued a CoC to ABB Florence certifying that the trip units meet or exceed the requirements of the relays that were originally manufactured and supplied to D.C. Cook in 1971. Based on this information, ABB Florence issued its own CoC certifying that the trip units meet DC Cook's PO requirements.

The review of final breaker testing revealed that the factory test parameters were from the production testing section of ANSI/IEEE Standard C37.09-1979 that used values in Table 8 from C37.06 for *indoor* switchgear equipment. Accordingly, for 250 Vdc nominal control power equipment, for example, closing spring release coils were at tested at **200** Vdc and 280 Vdc, trip coils at 140 Vdc and 280 Vdc. However, in the IBs used by customers (usually in Table 4) control component voltage ranges equivalent to the *outdoor* values from the standard were given, i.e., **180**-260 Vdc closing, 140-260 tripping. Similarly, nominal 125-Vdc components were tested at 100 (vice 90) Vdc closing. The inspectors were concerned that key personnel in customer organizations, particularly those responsible for developing acceptance and maintenance procedures, may not know this and believe that the factory test voltages are the same as (or more instead of less conservative than) those given in the IBs; even though customers presumably have the standards cited by the ABB CoCs as well as the test reports which are provided to customers.

In reviewing manufacturing process controls, the inspectors learned, as discussed previously, that the specification for crank arm-to-lever gap on HK control devices had been changed from that specified in 5HK Instruction Book IB 6.2.1.7D as 0.060"-0.090" to 0.010"-0.090'. However, this gap in Factory Specification TD-6931 for 5HK Model "03", dated 3-20-67, Revision 3, dated 3-16-84 was 0.005-0.030" (had been 1/16" to 1/32" before). The 0.010"-0.090" specification, in use in the factory for some time, was documented in a so-called "errata" presumably intended to be published eventually for IB 6.2.1.7D. As discussed above, the factory workers had been instructed to use the specification in the errata instead of properly changing the factory specification using the engineering change notice (ECN) process as required by Standard Practice Procedures 600-070, "Design Control and Review," Revision 3, (original issue5/21/85) and 600-050, "Engineering Change Notices," Revision 8 (original issue 8/13/90). This change had been in effect for some months, yet users had not been notified.

c. Conclusions

The inspectors concluded that the spare and replacement parts QA controls had suffered some degradation and could benefit from some updating of the processes, including some automation. The inspectors further concluded that the dedication of the more complex spare and replacement parts was weak in that only those components going into completed breakers or breaker mechanisms were subjected to electrical and performance testing, that taking credit for sampling for such components was not appropriate, and that QA supplier audits or surveys were not sufficiently detailed or critical characteristic and item specific to rely on for verification of the critical characteristics in question.

Changing the IB by errata (which would normally be used for correction of an error), rather than by a formal revision or interim change was inappropriate because the change was intentional. As discussed above, it lacked proper design review and verification contrary to Criterion III of 10 CFR Part 50, Appendix B. Being instituted contrary to ABB QA and engineering procedures, the change was also a nonconformance with respect to Criterion V of Appendix B.

3.4 Observation of Manufacturing

a. Inspection Scope

The inspectors observed part manufacturing and breaker assembly for 4-kV Type HK breakers, medium-voltage vacuum breakers (e.g., Type VHK(X) for direct retrofit into HK switchgear), and low-voltage, metal-enclosed K-Line breakers, including in-process production inspections and testing. Also examined were vacuum interrupter element and breaker operating mechanism subassemblies called "modular assemblies" (in the terminology of ANSI/IEEE Standard C37.59), designated VHK(R) [for retrofit], used for building special conversion breakers designed for replacement of other manufacturers' air-magnetic type breakers using existing unmodified switchgear. These included the type supplied to the ABB Service Company Product Development Group, Cleveland, Ohio, which, under the nuclear QA and dedication procedures of ABB/Combustion Engineering-Nuclear Power (Windsor, Connecticut), is providing the converted vacuum breakers for replacement of GE Type AMH-4.16 (Magne-Blast horizontal drawout) breakers at the Calvert Cliffs Nuclear Plant.

b. Observations and Findings

The inspectors observed some of the endurance testing that each medium-voltage breaker manufactured in the plant undergoes for a minimum of 250 cycles of breaker opening and closing operations. However, the inspectors observed that during the production testing of a non-nuclear Type 5VHK-R250, 1200A, breaker (JOB NO. F131098-001), the maximum-voltage closing test was performed at 260 Vdc instead of 280 Vdc (for 250-Vdc nominal control power), as specified in ANSI/IEEE Standard C37.09 and C37.06 and as given in Table 4 of IB 6.2.7.7-4C. The test personnel acknowledged this observation, but were unable to provide a satisfactory explanation for testing at the lower voltage. ABB initiated efforts to resolve this discrepancy.

c. Conclusions

The inspectors concluded that in general, observed manufacturing process were well controlled and test records reviewed were found satisfactory except for the test voltage issue with a 4-kV VHK-R breaker intended for non-nuclear safety-related service.

3.5 Review of Medium-Voltage and K-Line Design Changes

a. Inspection Scope

During the 1999 meeting of the ABB Circuit Breaker Users Groups sponsored by the Nuclear Maintenance Applications Center (NMAC) of the Electric Power Research Institute (EPRI), ABB Service Company personnel stated that during the development of ABB's medium-voltage vacuum type circuit breakers, certain parts in the K-Line (low-voltage breaker) mechanisms that were being adapted for use in the vacuum breakers had failed prematurely due the increased stresses from greater mechanical loads caused by the greater operating forces in the vacuum breakers resulting from the

associated stronger closing and opening springs. The ABB Service Company personnel explained that as a result of these failures, ABB Florence upgraded the design and manufacturing of the affected parts (e.g., larger cross sections in parts such as mechanism latches, but with the same form, fit and function, i.e., physically interchangeable) to give these parts more strength and durability for the more severe application. The upgrades were reportedly made to all affected K-Line parts, regardless of application, for standardization.

The implication of this revelation was that the new design parts would be suitable for all types of breakers in which they could be used, but that the corresponding parts of the old design could fail prematurely if misapplied and used in a K-line mechanism installed in a vacuum breaker. The inspectors were concerned that this situation could become more probable with the increasing retrofits of conversion vacuum breakers into nuclear plant switchgear. For example, conventional medium-voltage air or air-magnetic circuit breakers of other manufacturers (particularly GE Magne-Blast) are increasingly being replaced with typically higher interrupting capacity and lower maintenance vacuum or SF6 gas circuit breakers which have been converted for retrofit into unmodified existing switchgear. The ABB Type VHK(R) unit ("R" for retrofit) being used for the Calvert Cliffs Magne-Blast replacement project (horizontal-drawout, Type AMH), has also been adapted to replace vertical-lift Magne-Blasts at Fort Calhoun. The VHK(R) is not a complete breaker, but rather consists only of the vacuum interrupting elements, the mechanism and the basic frame on which they are mounted. This configuration is called a modular assembly by ANSI/IEEE Standard C37.59-1991 which is the industry standard that governs the conversion or adaptation of such modular assemblies for use as replacements of conventional air or air-magnetic circuit breakers.

In addition, ABB has developed the Type VKH(X) breaker as a direct vacuum type replacement for its air-magnetic HK models, again using unmodified existing switchgear. Therefore, the inspectors (and the users groups as well) were concerned that with wider and wider usage of breakers with ABB vacuum interrupters and adapted K-Line mechanisms, and because the parts in question have the same part numbers and the visual differences are subtle and may not be obvious to the inexperienced eye, it could be possible for users who also have K-Line breakers in their plants to inadvertently co-mingle the older and newer designs of the affected parts, or in some other manner allow old parts to be used in an unsuitable application. The inspectors had discussed this issue with ABB Florence previously and reviewed the issue in detail, including the actual design changes and examination of the parts in question during this inspection.

The inspectors also reviewed ABB's reconciliation of design changes with breaker qualification. A principal example was use of closing spring charging motors from the Ryobi Company when the previous motors made by Ametek were no longer available.

b. Findings and Observations

With regard to the K-Line parts upgrades, using old and new design parts to illustrate, ABB stated that these upgrades were not made as a result of failures as implied by certain ABB Service Company personnel. Rather, ABB explained that they were developed to obviate many of the manufacturing tolerance issues associated with the intricate breaker operating mechanism. ABB stated that the changes were also made to

increase the design margin in the endurance limit of the K-line operating mechanism for all applications. ABB Florence denied that there had been any such failures of the type described by ABB Service Company during the adaptation of the parts for use in vacuum breakers. ABB stated that correctly manufactured older K-line parts should work in all applications as specified and design tested by ABB, but recommended that the optimized parts be used for all new breakers and refurbishment programs because they have superior endurance than the previous ones. ABB stated its intention to resolve the apparent misunderstanding of the history of the parts and also to impart this information to EPRI/NMAC for dissemination to the users groups.

c. Conclusions

The inspectors concluded that the design changes were improvements for more efficient manufacturing and for enhanced durability, but that the older designed parts were not necessarily to premature failure as long as used as designed. The inspectors further concluded that using older design parts in the K-Line type mechanisms of vacuum breakers was possible, but unlikely, that experienced technicians would likely recognize the differences, and that even if they were used inadvertently, they should function satisfactorily, but may not last as quite long as the newer designs. It had not been proved (nor should it be expected) that older design parts would last the entire service life of a vacuum breaker if misapplied.

4.0 PARTIAL LIST OF PERSONS CONTACTED

ABB Power T&D Company, Circuit Breaker Division

+ Jon S. Rennie, Plant Manager,
* Shannon Soupiset, P.E., Director of Engineering
* Robert Behl, Engineer
* Byron Powell, Engineer
* Marty Trivette, Engineer
+ * Scott Bridges, Quality Assurance Manager (Total Quality Manager)
+ * Richard Lubin, Senior Quality Assurance Engineer
+ Daniel Hickman, Manufacturing Manager
+ * Thomas Woodfin, Manager of Components
+ * John Southerland, Purchasing Manager
+ Robert Dietrich, QA Consultant (Former ABB QA Manager)
* Davis Ringley, Customer Service
+ * Jill Heiden, Manager of Human Resources
+ Donald Ruedinger, Plant Accountant
J. Parrott, Qaulity Control Inspector
K. Smith, Quality Assurance Inspector
J. Widdows, Quality Assurance Inspector

+ Attended entrance meeting
* Attended exit meeting

5.0 LIST OF ITEMS OPENED, CLOSED AND DISCUSSED

Opened:

99901256/1999201-01	URI	Unresolved Item: 10 FR 21.21(d)(4), incomplete information in notifications made pursuant to 10 CFR 21.21(d)(1), pending vendor location of missing records
99901256/1999201-02	URI	Unresolved Item: 10 CFR 21.51, incomplete records of Part 21 evaluations and notifications, pending vendor location of complete correspondence
99901256/1999201-03	NON	Nonconformance: 10 CFR Part 50, Appendix B, Criteria III and V, Improperly effected change in specifications
99901256/1999201-04	NON	Nonconformance: 10 CFR Par 50, Appendix B, Criterion XVI, Inadequate corrective action for previous violation

Closed:

99901256/93-01-01	VIO	Violation: 10 CFR 21.21(a), Part 21 procedures not updated to reflect major revision in Part 21 in 1991, 10 CFR 21.6, Latest version of Part 21 not posted
99901256/93-02-01	NON	Nonconformance: 10 CFR Part 50, Appendix B, Criterion V, failure to follow QAP 2.5, not all required supplier audits performed
99901256/93-02-02	NON	Nonconformance: 10 CFR Part 50, Appendix B, Criterion V, failure to follow QAP 4.3, procurement from vendors not on approved vendor list
99901256/93-02-04	NON	Nonconformance: 10 CFR Part 50, Appendix B, Criterion V, inadequate procedure, QAP 7.1, referenced QAPs 6.5 and 16.2 which did not exist and therefore could not be followed.
99901256/93-02-05	NON	Nonconformance: 10 CFR Part 50, Appendix B, Criterion V, failure to follow QAP 2.4, required log book to record qualification certifications not established

Not Reviewed:

99901256/93-02-03	NON	Nonconformance: 10 CFR Part 50, Appendix B, Criterion V, failure to follow QAP 4.3, lack of required evaluation documentation of basis for inclusion of some vendors on approved vendors list

Discussed: None

may constitute minor violations of 10 CFR Part 21, pending your ability to produce the missing records and more complete correspondence. Therefore they were cited as Unresolved Items in the enclosed report.

In accordance with 10 CFR Part 2.790 of the NRC "Rules of Practice," a copy of this letter and its enclosures and your response will be placed in the NRC's Public Document Room (PDR). To the extent possible, your response should not include personal, private, proprietary or safeguards information so that your response can be placed in the PDR without redaction. However, should you find it necessary to include such information, you should clearly identify that which you desire not be placed in the PDR and provide the justification for withholding from public disclosure as delineated in 10 CFR 2.790.

The responses requested by this letter and the enclosed Notice of Nonconformance are not subject to the clearance procedures of Office of Management and Budget as required by the Paperwork Reduction Act of 1980, Public Law No. 96-511.

Should you have any questions concerning this inspection, please contact Mr. Kamal Naidu at 301-415-2980/krn@nrc.gov or Mr. Stephen Alexander at 301-415-2995/sda@nrc.gov.

Sincerely,
/ / [original signed by Richard Correia]
Theodore R. Quay, Chief
Quality Assurance, Vendor Inspection,
Maintenance and Allegations Branch
Division of Inspection Program Management
Office of Nuclear Reactor Regulation

Enclosures: 1. Notice of Nonconformance
2. Inspection Report No. 99901256/1999201

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