U. S. NUCLEAR REGULATORY COMMISSION

REGION I

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Licensee:	North Atlantic Energy Service Corporation
Facility:	Seabrook Generating Station, Unit 1
Location:	Post Office Box 300 Seabrook, New Hampshire 03874
Dates:	August 3 - 7, 1998
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EXECUTIVE SUMMARY

Seabrook Generating Station Unit 1
NRC Inspection Report 50-443/98-09

An inspection was conducted on August 3 - 7, 1998, using the guidance of Temporary Instruction (TI) 2515/137, Inspection of Medium-Voltage and Low-Voltage Power Circuit Breakers, dated March 1998. The inspection team comprised Region I and Headquarters personnel.

Maintenance

- The areas where circuit breakers were located were clean, well maintained and adequately lighted. The physical condition of the switchgear was good. The breaker refurbishment room was well-equipped and provided a good environment for performing breaker refurbishment work. The technicians performing breaker refurbishment were knowledgeable and familiar with the refurbishment procedure. (M2.1)

- The breakers at Seabrook had performed well during the past five years. The breaker refurbishment program at Seabrook Station was good. (M2.2)

- The licensee's practice of using reduced-control-voltage testing was good. The preventive maintenance and refurbishment procedures for medium-voltage breakers was generally good with the exception of the lubrication instructions. Most vendor recommendations had been incorporated and deviations from vendor recommendations were adequately justified. However, the lubrication instructions in both preventive maintenance and refurbishment procedures were not sufficiently specific to ensure consistent and appropriate breaker lubrication. (M3.1)

- The maintenance procedures for low-voltage breakers were clear, and detailed. Data sheets for completed maintenance provided a good record of the results of all measurements made and the breaker condition at time of maintenance. However, Seabrook had large number of maintenance procedures for low-voltage breakers making coordination among procedures cumbersome. (M3.2)

- Work Requests and Adverse Condition Reports (ACR) associated with breaker corrective maintenance were well documented. Corrective actions were appropriate and timely. Root cause and apparent cause evaluations were thorough, of good quality, and contained appropriate recommendation for corrective actions. (M4.1)

- The licensee's Operating Experience Review (OER) Program to review industry events and problems was generally adequate, and their actions in response to those events were appropriate. However, the licensee's OER reviews for some Information Notices (IN) were narrowly focused, without considering the generic implication of the INs. (M6.1)

- The licensee's vendor interface program in response to GL 83-28, Section 2.2, Part 2, and GL 90-03 had been ineffective in the past. However, this program had been improved significantly as a result of licensee's self-assessment audit findings. (M6.2)

- Commercial-grade dedication at Seabrook for breaker maintenance was limited to breaker lubricant. There was inconsistency of critical characteristics and verification instructions in the breaker lubricant dedication package. (M6.3)

- The licensee had completed a thorough, broad-in-scope self-assessment audit for the medium-voltage and low-voltage breakers, resulting in significant improvement in their breaker vendor interface program. The self-assessment audit report was of good quality. The self-assessment program was effective. (M7.1)

- The control circuit voltage drop calculations were conservative and were generally thorough and of good quality. The input data and assumptions were technically sound. (M8.1)

- The recently-developed circuit breaker tracking system (database) at Seabrook Station provided good information of the circuit breakers. This database could be a valuable tool to the licensee in tracking and determining the status of any medium-voltage or low-voltage circuit breaker at Seabrook Station. This initiative was judged to be a program strength. (M8.2)

REPORT DETAILS

Summary of Plant Status

Seabrook Station operated at 100% power during the inspection period.

Introduction

This inspection was to determine the adequacy of licensee programs, procedures, equipment and supporting documentation for the maintenance of medium-voltage and low-voltage power circuit breakers. The overall scope of the inspection was defined in Temporary Instruction (TI) 2515/137, "Inspection of Medium-Voltage and Low-Voltage Power Circuit Br ··ers," dated March 1998. The 5 kV circuit breakers at Seabrook Station were Type HK manufactured by Asea Brown Boveri (ABB), the 480 V circuit breakers were K-line Type by ABB or Type DS manufactured by Westinghouse Electric Corporation.

In June 1998, the licensee performed a self-assessment audit of their breaker program, also using the guidelines provided by TI 2515/137. The assessment of this audit was discussed in Section M7.1.

II. Maintenance

M2 Maintenance and Material Condition of Facilities and Equipment

M2.1 Walkdown of Switchgear Areas and Circuit Breaker Refurbishment Room

a. Inspection Scope (TI 2515/137)

The team performed a walkdown of several switchgear areas to observe the physical condition of switchgear located is those areas. The team also toured the circuit breaker refurbishment room to assess the refurbishment conditions for medium-voltage and low-voltage circuit breakers. In addition, the team interviewed the technicians to assess their knowledge of breaker refurbishment activities.

b. Observations and Findings

The safety-related switchgear rooms contained safety-related switchgear for 125 Vdc, 480 Vac, and 4160 Vac systems. The team found that all rooms were clean, well maintained and adequately lighted, with no broken or missing parts on switchgear components. The team noted no deficiency tags in the safety-rela ed switchgear rooms. However, the team did notice a deficiency tag (#1-HO-P-31B, incorrect spring size) on cubicle 1-A44 (4160 MC Feeder) in the non-essential switchgear room. The team later found out that this deficiency had been entered into their corrective action process.

The team found that the circuit breaker refurbishment room was clean, well organized, well lighted, and well equipped, including ample work benches, storage, machine tools, and basic test equipment. The team noted that a 13.8 kV circuit breaker, serial number 50 749B-1-01622, was undergoing refurbishment during the

tour. The team also noted that the appropriate procedure (LS 0559.04, "13.8 kV Circuit Breaker Refurbishment," Revision 0) was being used for the refurbishment. Parts of the circuit breaker were methodically laid out on the work bench for reassembly.

The technicians appropriately answered the team's questions regarding circuit breaker adjustments, contact replacement, and circuit breaker lubrication. The team found the technicians knowledgeable of breaker refurbishment activities and familiar with the refurbishment procedure.

c. Conclusions

The team concluded that the areas where safety and nonsafety breakers were located were clean, well maintained and adequately lighted, and that the physical condition of the switchgear was good. The team also concluded that the breaker refurbishment room was well-equipped and provided a good environment for performing breaker refurbishment work. The technicians performing breaker refurbishment were knowledgeable and familiar with the refurbishment procedure.

M2.2 Material Condition of Circuit Breakers

a. Inspection Scope (TI 2515/137)

The team reviewed circuit breaker failure records to assess the material condition of the circuit breakers and to determine if any trends or generic performance problems existed at Seabrook Station. The team also reviewed the status of the circuit breaker refurbishment program.

b. Observations and Findings

The team reviewed licensee's records for circuit breaker failures over the past five years and found no indication of any particular trend or generic performance problems. The records showed that there were no in-service breaker failures over the past five years. However, the team did notice that the licensee had identified conditions where improper closure springs were incorrectly installed by the manufacturer on four 4160 Vac circuit breakers and where two circuit breaker springs had been incorrectly interchanged on several circuit breakers by the manufacturer (ABB Services Inc.). The team determined that in both cases, the licensee had performed thorough operability determinations to show these conditions did not render the circuit breakers inoperable and had initiated a plan to review and correct other similar breakers at Seabrook Station. This issue was also documented in inspection report 98-01.

The team reviewed the safety-related circuit breakers list and found that 63 of a total population of 122 safety-related circuit breakers had been refurbished as of the date of this inspection. The team also found that the licensee had refurbished 43 out of a total population of 132 nonsafety-related circuit breakers. The licensee stated that the refurbishment of the remaining circuit breakers would be completed

by refueling outage (RO) #7, scheduled to begin in November 2000. The licensee also stated that for those breakers that had not yet been refurbished, their performance was being monitored in addition to the normal preventive maintenance program and that Seabrook had a very good breaker performance record with no in-service breaker failures (confirmed by NRC review as discussed in Section 4.1). Based on the percentage of the breakers that had been refurbished, the team concluded that the licensee's breaker refurbishment program was good. In addition, the licensee had developed a program, including procedures and training, to provide in-house refurbishment for their medium-voltage and low-voltage breakers.

c. Conclusions

The team concluded that the reviewed circuit breaker failures at Seabrook Station did not indicate a trend or generic performance problem, and that the breakers had performed well during the past five years. The team also concluded that the breaker refurbishment program at Seabrook Station was good.

M3 Maintenance Procedures and Documentation

M3.1 Maintenance Procedures for Medium-Voltage Circuit Breakers

a. Inspection Scope

The team reviewed the preventive maintenance and refurbishment procedures for safety-related medium-voltage circuit breakers (ABB Type 5HK) to determine the adequacy of these procedures.

b. Observations and Findings

The team found that, in general, medium-voltage preventive maintenance procedures LX0558.01, "4.16 kV Breaker Inspection, Testing, and Preventive Maintenance," (Revision 00, Change 13) was comprehensive and incorporated vendor-recommended preventive maintenance actions. In most cases, deviations from vendor recommendations were justified. For example, the procedure c[illegible]d breaker response time testing, but the licensee had determined that this testing was better suited to determining adequate breaker response for fast-bus transfers than for diagnosing or trending breaker conditions in general.

Of particular note was that procedure LX0558.01 provided for reduced-control-voltage testing for close and trip functions. The procedure prescribed (consistent with the vendor manual) 90 Vdc for breaker closing (spring release coil) and spring charging motor closing, and 70 Vdc for the breaker tripping. These voltages were below the worst-case calculated available voltage when those actions were required to perform the breakers' safety functions. In addition, the 70-Vdc value for tripping provided some margins for conditions of mechanical binding in the tripping mechanism components. The team considered the reduced-control-voltage testing a good practice.

Although the medium-voltage breaker maintenance procedures were generally good, the team identified some concerns:

- The licensee had established a 5-year preventive maintenance interval for medium-voltage beakers. This interval was not consistent with the ABB recommendation of 2-years (or 400 operations) for motor load breakers. The licensee issued an ACR to evaluate the appropriateness of the 5-year periodicity in light of vendor manual criteria.

- The team questioned some test values and acceptance criteria for breaker periodic electrical testing. For example, in the case of insulation resistance testing, the licensee had established the acceptance criterion at 5 megohms. The licensee had changed this to a more appropriate figure (i.e., 100 megohms), but had not changed it in all places in the revision of the procedure originally reviewed. The licensee agreed to reevaluate its test practices and acceptance criteria and bring these issues up for discussion with the EPRI/NMAC-sponsored Medium-Voltage ABB Breaker Users Group.

- Procedure LX0558.01 did not specify how to measure the 1/32" maximum allowable gap in the pole synchronization measurement of Step 8.10.4.

- Procedure LX0558.01 was vague regarding contact inspection criteria.

- With regard to lubrication, procedure LX0558.01 specified (Step 8.33 lubricating the primary and ground disconnects with NO-OX-ID as is appropriate, but for the mechanism (Step 8.34), it merely stated "LUBRICATE as necessary all mechanism parts, bearings, pins, etc....with Anderol L757..." While Anderol 757 is the appropriate lubricant for the mechanism, the instructions did not explain that most bearings were not lubricated during preventive maintenance because the breakers must be completely disassembled, as is normally only done during overhaul, in order to lubricate the bearing. Detailed guidance was not provided as to the specific locations that should be checked and lubricated during preventive maintenance.

- Procedure LS0558.04, "4.16 kV Breaker Refurbishment", (Revision 00, Change 07), was used for in-house ABB 5HK breaker refurbishment. It contained a statement under Section 1.2, "Discussion," that "Cleaning and lubricating of parts may be performed at any convenient time during the procedure." However, there were no instructions for lubrication during the reassembly of the breaker mechanism. Other specific lubrication instructions comprised Step 4.7.1.1, arc chute pivot fingers, Step 4.10.15 (jack shaft section) to "CLEAN and LUBRICATE pivot points as necessary," Step 4.11.4, to clean and lubricate the racking mechanism hasp, Step 4.11.9 to lubricate the racking mechanism itself and Step 4.12.10.11 to clean and lubricate truck wheel hub pins (Axel) as necessary. In no case was the method or type of lubricant specified.

The team determined that the lubrication instructions in both preventive maintenance and refurbishment procedures were not sufficiently specific to ensure consistent and appropriate breaker lubrication. The licensee issued an ACR to evaluate and resolve the above concerns.

c. Conclusions

The licensee's practice of using reduced-control-voltage testing was good. The preventive maintenance and refurbishment procedures for medium-voltage breakers was generally good with the exception of the lubrication instructions. Most vendor recommendations had been incorporated and deviations from vendor recommendations were adequately justified. However, the lubrication instructions in both preventive maintenance and refurbishment procedures were not sufficiently specific to ensure consistent and appropriate breaker lubrication.

M3.2 Maintenance Procedures for Low-voltage Power Circuit Breakers

a. Inspection Scope (TI 2515/137)

The team reviewed the preventive maintenance procedures for the low-voltage power circuit breakers. The procedures were compared to the maintenance section of the manufacturer's instruction manuals. The procedures were reviewed in light of good industry practice for breaker maintenance, as well as specific guidance in NRC Temporary Instruction (TI) 2515/137.

b. Observations and Findings

The team noted that Seabrook Station had 18 procedures for low-voltage circuit breakers preventive maintenance and refurbishment. The team selected three procedures for review as follows:

1. The team's review of Procedure LX0557.02, "60 Month PM of 480 V US Breakers", Revision 01, Changes 12 and 13 noted that the procedure included the maintenance and testing requirements from the vendor manual and from NMAC Maintenance Guide, Volume 1, Low-voltage Circuit Breakers, Part 1, ABB K-Line (NP-7410-V1P1). Additionally, the procedure was revised to include industry experience. The team also noted that the breaker closing and tripping operations were tested at 90 and 70 volts respectively, which were below the worst-case calculated voltage.

   The team identified several minor discrepancies in the procedure as follows:

   - Step 4.5.4 stated to use a wet rag without providing any guidance of what material to be used to wet the rag;

   - Step 4.10.2 stated "or if visual inspection warrants without providing any guidance what to look for. The vendor's manual provided guidance (oxidation, pitting evidence of burning ....) for this:

- Step 2.2.3 specified 500 volts megger. The procedure (Change 13) required megger at 1000 volts;

- Step 4.3.5 specified the values for 52X and 52Y coils reversed;

- Step 4.20.5 stated "...or any breaker adjustments were made" without providing guidance.

The licensee issued an Adverse Condition Report (ACR) to correct the procedures. The licensee also recognized that some of identified discrepancies also apply to other procedures.

The team also reviewed a sample of test records for the testing specified in this procedure and found the tests appropriate.

2. The team reviewed Procedure LS 0557.08, "480 volt Unit Substation Inspection, Testing and PM," Revision 01, Change No. 07, dated June 9, 1998, and found it adequately addressed inspection, maintenance of buses, insulators, connections, transformers, lightning arresters, cubicles. However, the team noted that the megger testing voltage and acceptance criterion was not consistent with that of 480 volt breakers. The licensee prepared another ACR to evaluate and resolve this minor discrepancy.

3. The team's review of Procedure LX0557.24, "Cleaning, Inspection, and Lubrication of Reactor Trip Switchgear," Revision 0, Change 03 noted that this procedure had included the maintenance and testing requirements from the vendor manual, NMAC Maintenance Guide for Low-Voltage Circuit Breakers, and Westinghouse DS Breakers (NP-7410-V1P4). The team also noted that the preventive maintenance (PM) of reactor trip breakers (RTB) were performed every 18 months.

   The team also identified three discrepancies in the areas of insulation resistance and contact resistance measurements, and lack of specific instruction on breaker lubrications. The licensee issued two ACRs to correct these minor discrepancies.

The team observed that Seabrook had a large number (18) of maintenance procedures for low-voltage breakers. This had created coordination problems among procedures. For example, megger testing at 1000 volts with an acceptance criterion of greater than 100 megohms was specified on certain procedures for 600 volt breakers (LS0557.19, Revision 00, Change 02; LS0557.28, Revision 00, Change 03; LX 0557.02, Revision 01, Change 13, LS 0557.17, Revision 00, Change 01), while other procedures for 600 volt breakers require megger testing at 500 volts with an acceptance criterion of greater than 1 megohms (LX0557.13, Revision 01, Change 04; LS0557.18, Revision 00, Change 10; LX0557.02, Revision 01, Change 12). There was no technical justification given for the difference.

The team's interview with licensee's maintenance personnel indicated that: 1) all reactor trip breakers were overhauled by Westinghouse; and 2) other low-voltage breakers were overhauled by ABB Service Inc. or by Seabrook in-house personnel.

c. Conclusions

The team concluded that, in general, the preventive maintenance program was good. The maintenance procedures for low-voltage breakers were clear, and detailed. The completed maintenance incorporated sign-offs on individual steps by craft personnel and overall by the supervisor. Data sheets provided a good record of the results of all measurements made and the breaker condition at time of maintenance. The team observed that Seabrook had large number of preventive maintenance procedures for low-voltage breakers making coordination among procedures cumbersome.

M4 Maintenance Staff Knowledge and Performance

M4.1 Corrective Actions for Circuit Breaker Deficiencies and Root Cause Evaluations

a. Inspection Scope (TI 2515/137)

The team reviewed the licensee's corrective maintenance records for circuit breaker deficiencies to determine whether the corrective actions were appropriate and timely. The team also reviewed root cause evaluations to determine the adequacy of the evaluations.

b. Observations and Findings

The team reviewed the list of Circuit Breaker Problem History at Seabrook for the past five years and selected the corrective maintenance associated with the following five work orders (WO):

- W.O. #97W000943 - Tie bar between the two poles on CB 1 and 3 are loose. (ACR 95-448)
- W.O. #98W000269 - 125 VDC breaker has closing spring spacers in the incorrect position. (ACR 98-350)
- W.O. #98W001294 - 480 Volt breaker that supplies power to battery charger tripped. (ACR 98-1138)
- W.O. #94W001873 - 480 Volt breaker fails to close at 90 V dc.
- W.O. #95W001994 - Perform inspection of specified breakers to determine if lubricant hardening is occurring as detailed in IN 95-22.

The team found that the cause determinations, immediate corrective actions, and long term corrective actions for all five cases were appropriate and that all corrective actions were accomplished in a timely manner. The team found that appropriate post-maintenance testing was performed to ensure breaker operability when work had been completed.

The licensee stated that there had been no in-service failures for medium-voltage and low-voltage circuit breakers. The team confirmed this statement through reviews of the Circuit Breaker Problem History list and several ACRs, which did not identify any in-service breaker failures.

The licensee stated that they did not have recent medium-voltage and low-voltage circuit breaker failures that necessitated a formal root cause analysis. The team reviewed a root cause analysis for a high-voltage breaker issue to evaluate Seabrook Station's root cause analysis process. The team found that the root cause analysis was thorough and well documented. The team also reviewed twelve apparent cause evaluations and two operability determinations for medium-voltage and low-voltage circuit breakers and found that they were thorough, well documented and contained appropriate recommended corrective actions.

c. Conclusions

The team concluded that the reviewed work requests and ACRs were well documented. Corrective actions were appropriate and timely. The team's review indicated that there had been no in-service circuit breaker failures at Seabrook Station. The team also concluded that the root cause evaluation and apparent cause evaluations were well documented, thorough, and contained appropriate recommended corrective actions.

M6 Maintenance Organization and Administration

M6.1 Operating Experience Review (OER) Program for Power Circuit Breakers

a. Inspection Scope (TI 2515/137)

The team reviewed Procedure OE 7.1, "Operating Experience Review Program," Revision 3, which provided guidance for review of NRC generic communications among other types of industry operating experience information. To assess the implementation of this program, the team reviewed the licensee's actions in response to NRC Information Notices (INs) and Bulletins listed in TI 2515/137 applicable to the type of switchgear at Seabrook Station.

b. Observations and Findings

For low-voltage switchgear, the team reviewed licensee responses to INs 80-31, 8-06, 85-58, 85-64, 87-61, 89-29, 89-45, 91-29, 95-22, 96-44, 96-44 Sup 1, and 98-03, applicable generically and/or specifically to ABB K-Line breakers. For reactor trip switchgear, the team reviewed licensee responses to INs 83-08, 83-18, 85-93, 87-35, 88-44, 93-85, 95-19, 96-44, 96-44, sup 1, and 97-69, applicable to Westinghouse DS-416 breakers. For medium-voltage switchgear, the team reviewed licensee responses to INs 83-50, 84-46, 87-41, 88-42, 88-75s, 89-86, 91-78, 95-22, 96-46, and 97-53, applicable generically and/or specifically to ABB HK breakers.

The team found that generally the licensee had adequately addressed the issues discussed in the applicable INs. For example, INs 87-41 and 89-86 dealt with missing close latch anti-shock springs on some ABB medium-voltage breakers. The files indicated that the licensee had conducted inspections of these breakers and had taken appropriate corrective action. In most cases, procedures also reflected use of this information where the licensee determined it to be applicable. For example, preventive maintenance procedures for ABB 4.16-kV breaker (Type 5HK), now designated procedure LX0558.01, had been revised (in a previous version) to include instructions for checking the tightness of closing spring charging motor mounting bolts in response to IN 87-41 which also discussed this problem in addition to the missing close latch springs.

However, there were cases where the licensee's reviews were narrowly focused, and did not consider generic applicability of the problems discussed in the INs. In these cases, the review conclusions stated that the INs were "not applicable" based solely on that the particular breaker(s) used as examples of the problems in the INs, were not being used at Seabrook Station. The licensee did not consider the potential implications of the IN for breakers that were used at Seabrook.

For example, IN 84-46 (on breaker position verification) was generically applicable to breakers that can be racked out, but was narrowly evaluated. The team determined that the practice of functionally testing breakers once returned to the connected position (requires running the load) was required in most cases by licensee post-maintenance procedures. This was routinely performed by operations to restore system operability (by system operating procedures) after tag-outs are cleared. The team determined that there could be instances at Seabrook in which a breaker is moved to the test or disconnect position for some reason and when returned to the connect position might not be functionally tested by running its load because procedures did not specifically require this in all cases, regardless of why the breaker was disconnected, plant conditions permitting. It appeared that the message of the IN was not fully realized and addressed. The licensee agreed to evaluate this issue and incorporate into their procedures if determined to be necessary. Similar issues discussed in IN 83-50 were addressed for breaker-cubicle electrical interfaces, but although not specifically mentioned in the IN, mechanical interfaces were not considered.

In reviewing the OER procedures, the team found that Procedure OE 7.1, "Operating Experience Review Program," Rev.3, did not include instructions to the reviewers to conduct more detail review for generic implications. These missing instructions might have caused the IN reviews to be narrowly focused.

c. Conclusions

The team concluded that the licensee's OER Review Program to review industry events and problems was generally adequate, and that their actions in response to those events were appropriate. However, the licensee's OER review program procedure did not require review for generic applicability of the issues discussed in the IN, resulting in reviews for some IN applicability narrowly focused, without considering the potential implication of some INs for Seabrook switchgear equipment.

M6.2 Vendor Interface Program

a. Inspection Scope (TI 2515/137)

The team reviewed procedures for maintaining vendor manuals, procedures for reviewing, evaluating and dispositioning vendor technical information, and procedures for maintaining periodic contact with vendors of key safety-related equipment outside the NSSS (Nuclear Steam Supply System) scope of supply. For historical background, the team reviewed the licensee's responses to NRC Generic Letter (GL) 83-28, "Generic Implications of the Salem ATWS Event," Item 2.2, Part 2 (non-NSSS vendor interface) and to GL 90-03, "partial Relaxation of GL 83-28 Provisions" and its Supplement 1 (included safety-related switchgear and diesel generators among examples of key safety-related equipment).

The team examined the licensee's circuit breaker vendor manual binders in which the various vendor technical documents (e.g., technical manuals, technical bulletins) related to a particular piece or type of equipment are supposed to be filed. The team also reviewed the licensee's evaluations for applicability to Seabrook and disposition of vendor technical information and bulletins. Finally, the team examined the manner in which the licensee either incorporated vendor technical information in its breaker operating and maintenance procedures or had justifications for deviating from vendor recommendations.

b. Observations and Findings

For safety-related medium-voltage switchgear (ABB Type 5HK breakers at Seabrook), and Seabrook's ABB K-Line breakers used in safety-related low-voltage applications, there are no generic vendor technical bulletins. All updates to technical information for ABB breakers, switchgear, and associated components have been promulgated by Asea-Brown-Boveri Power Transmission & Distribution Company and its predecessors, Brown-Boveri Company (BBC), Gould-ITE, and ITE-Imperial Company, in the form of revisions to the instruction books, maintenance and surveillance guides and renewal parts bulletins.

In its response to GL 83-28, Section 2.2, Part 2, the licensee committed to adopt the same industry group-sponsored Vendor Equipment Technical Information Program (VETIP) that had been established by many other licensees. The industry group reference publication had been developed in response to GL 83-28, Item 2.2, Part 2. In its response to GL 90-03, the licensee cited its VETIP and also its intended participation in the industry group's then newly established (but now defunct) equipment failure history database.

Vendor Technical Manuals

In preparation for this inspection, the licensee performed a major self-assessment in areas related to breaker maintenance. In this area, the licensee found that many vendor manuals and/or their latest revisions were not in vendor manual binders. At the time of this inspection, this had largely been corrected with a few exceptions

noted by the team. For example, in Seabrook Vendor Manual G122-11 (FP 31123) for ABB 5HK 4.16-kV breakers, the ABB maintenance and surveillance manual, MS 3.2.1.9-1D, which covers both the switchgear and various types of medium-voltage breakers, was filed in Section I for the switchgear, but not in Section II for the breakers, nor was it referenced in Section II. This could cause maintenance and surveillance requirements for breakers to be missed. The team also identified two more discrepancies, one related to the torque value for 3/8 inch bolts in the switchgear, the other related to the preventive maintenance intervals (two years vs five years). The licensee issued two ACRs to evaluate and to resolve these minor discrepancies.

Periodic Re-contact With Vendors of Key Safety-Related Equipment

The team found that the VETIP had been using form letters (with some followup phone calls) for periodic re-contact of breaker vendors to ensure receipt of all applicable technical information and manual revisions, etc., but this approach had not been fully effective for breakers in the past. The principal reason for this was that appropriate locations, facilities or personnel had not always been contacted. In addition, the team found that in many cases, the correspondence had been addressed to the manufacturers of the parent components of interest. Consequently, the builder of switchgear cabinets, for example, might not have all the latest information on all the subcomponents in the cabinet, e.g., protective relays, which often come from other manufacturers. However, the most recent component-based correspondence with the Nuclear Quality Assurance Manager at ABB T&D, Switchgear Division in Sanford, Florida, had substantially improved results.

c. Conclusions

The team concluded that the licensee's vendor interface program for medium-voltage and low-voltage breakers in response to GL 83-28, Section 2.2, Part 2, and GL 90-03 had been ineffective in the past. However, this program had been improved significantly as a result of licensee's self-assessment audit findings.

M6.3 Breaker Maintenance Support - Dedication of Commercial-Grade Items and Services

a. Inspection Scope (TI 2515/137)

The team reviewed the licensee's procedures for dedication of commercial-grade items and services with emphasis on those used in support of breaker maintenance. The team reviewed selected dedication files to assess program implementation.

b. Observations and Findings

The team found that for safety-related breaker maintenance not performed in-house, the licensee had been using qualified service facilities, ABB Service Company and Westinghouse Nuclear Services Division, with approved 10 CFR Part 50, Appendix B, quality assurance programs. For breaker spare parts, all were being

purchased from the original equipment manufacturers. However, the licensee purchased some lubricants for safety-related breakers as commercial-grade items and dedicated them for safety-related use. Among these were Anderol 757 and NO-OX-ID, used for mechanical and sliding electrical parts respectively in ABB breakers. The team found some deficiencies in the dedication of these lubricants. Specifically, the dedication package for NO-OX-ID identified the critical characteristics of the lubricant in its technical evaluation. One of the characteristics required the container of the lubricant to be sealed. However, the acceptance instructions did not include this or a method for verification of it. The team noted that, at the time of the inspection, this package had not yet been used to accept any product. All of the lubricant on site had been supplied by an approved vendor. There was also some ambiguity regarding shelf life and so-called "pot life" of the grease once the container was opened and in use, but the team did not discover any unused lubricant that appeared to be degraded. The licensee issued an ACR to evaluate and resolve both issues.

c. Conclusions

Commercial-grade dedication at Seabrook for breaker maintenance was limited to breaker lubricant. There was an inconsistency of critical characteristics and verification instructions within the NO-OX-ID dedication package. However, the team concluded that this minor deficiency had not resulted in the use of substandard or degraded lubricant in safety-related breakers.

M7 Quality Assurance in Maintenance Activities

M7.1 Self-Assessment Audit

a. Inspection Scope (TI 2515/137)

The team reviewed a recently-completed self-assessment audit for the medium-voltage and low-voltage circuit breakers to determine the adequacy of the audit and the effectiveness of the licensee's self-assessment program in the breaker maintenance area.

b. Observations and Findings

In preparation for the NRC breaker inspection, the licensee completed a self-assessment audit for the medium-voltage and low-voltage breakers program in June 1998. The audit team consisted of seven team members, two from Millstone Station, one from Duke Engineering and Services, and the remaining were Seabrook personnel, including the audit team leader The audit results were documented in Seabrook Audit and Evaluation Assessment Report No. 98-AE-010, "Medium and Low Voltage Circuit Breaker Program," dated July 7, 1998. The audit covered procedure adequacy, vendor manuals and vendor communications, preventive maintenance and refurbishment frequencies, compliance with the Maintenance Rule, breaker lubrication, and retrievability of breaker maintenance history records.

The team reviewed the self-assessment audit report and determined that the audit was thorough and broad-in-scope, and resulted in substantial findings and observations including recommendations that required further management attention. The team also found that the audit report was of good quality, the findings were clearly stated, properly documented in ACRs and assigned tracking numbers, and had been entered into the licensee's corrective actions program for resolution. The team noted that as a result of the audit's findings, the vendor manual program for the medium-voltage and low-voltage breakers, which had been weak as indicated in the audit's findings, had been significantly improved. The improvement was confirmed by the team during this inspection. The vendor manuals used by the team during the inspection had been properly updated.

c. Conclusions

The team concluded that the licensee had completed a thorough, broad-in-scope self-assessment audit for the medium-voltage and low-voltage breakers. The self-assessment audit report was of good quality. The team determined the self-assessment program to be effective. As a result of the self-assessment audit's findings, the vendor interface program for the medium-voltage and low-voltage breakers had been significantly improved. The team considered the licensee's self-assessment program to be effective.

M8 Miscellaneous Maintenance Issues

M8.1 Control Circuit Voltage Drop Calculations

a. Inspection Scope (TI 2515/137)

The team reviewed the licensee's control circuit voltage drop calculations to determine whether breaker operation was assured at minimum operating voltage as specified in the vendor's manual or minimum calculated voltage, whichever is the lowest.

b. Observation and Findings

The team reviewed Calculation No. 9763-3-ED-00-66-F, "Control Circuit Voltage Drop," Revision 03, dated October 2, 1997, to verify that electrically-operated breakers (both medium-voltage and low-voltage) were operable at the calculated minimum available voltage at the closing and trip coils. The design basis of the calculation was loss of offsite power with loss of coolant accident (LOOP/LOCA). The equipment operability was verified at the battery end voltage of 105 volts. The calculation was performed to determine the maximum allowable control circuit length using # 14 AWG conductor or allowable control circuit cable resistance in order to maintain minimum allowed voltage at different coils in the circuit breakers. The allowable minimum voltages at the coils were:

Breaker Type	Close coils	Trip coils
ABB- HK (4160V)	90 Vdc	70 Vdc
ABB - K-Line (480V)	100 Vdc	70 Vdc

The calculation also assumed a minimum voltage under a worst-case scenario at the medium-voltage and low-voltage switchgear to be 102.8Vdc. When the installed length exceeded the allowed length, a field modification was performed to reduce the excessive voltage drop by (1) paralleling conductors or (2) use of higher gauge wires. The team reviewed several circuits for length verification and found them acceptable.

The team identified three minor concerns which was addressed by the licensee during the inspection. The team noted that the closing coil voltage for the medium-voltage electrically operated breakers is above 90 volts except for breakers node nos. A71 and A52. The closing coils voltage for the breaker node nos. A71 and A52 are calculated to be 87.93 Vdc and 89.93 Vdc respectively. The licensee recalculated the closing coil voltage for breaker at node no A52 by using the actual voltage drop between the distribution panel and the switchgear and found it to be 90.58 Vdc. The licensee issued ACR No.98-2191 to address the concern of not testing the breaker at node No. A71 at calculated minimum voltage of 87.93 volts. This is not a safety issue since a vendor letter dated June 2, 1998, confirmed that the closing coil will operate at 70 Vdc. The team's concern was resolved.

The minimum allowable voltage for the trip coils was 70 volts and the breaker trip coils were tested at 70 Vdc and the circuit length for the trip coils was usually less than that of closing coils and hence the team did not have any concern for the operation of trip coils.

The team found that the calculations were conservative and were generally thorough and of good quality. The input data and assumptions were technically sound.

c. Conclusions

The team concluded that the licensee's control circuit voltage drop calculations were conservative and were generally thorough and of good quality. The input data and assumptions were technically sound. One breaker with calculated control voltage below the vendor-specified minimum voltage was appropriately justified and documented to be operable.

M8.2 Circuit Breaker Tracking System

a. Inspection Scope (TI 2515/137)

Seabrook Station had developed a database program to track various facets of circuit breaker status. At the time of this inspection, the database program, which used Microsoft-Access was in the approval process. The team observed the licensee's database program to determine what attributes of medium-voltage and low-voltage circuit breakers were being tracked and if the database program could be a valuable circuit breaker tracking tool.

b. Observations and Findings

The team observed the licensee's Microsoft-Access-database program and found that all medium-voltage and low-voltage circuit breakers at Seabrook Station had been entered into the system and could be tracked by their serial numbers. The database program provides as a minimum the following attributes for each circuit breaker:

- Circuit Breaker Manufacturer and Type
- Work History (When last refurbished and refurbishment schedule)
- Circuit Breaker Location (past and present)
- Refurbishment Document Number
- Circuit Breaker Current and Voltage Rating
- Preventive Maintenance (PM) Schedule (including when most recent PM was completed)
- Date Circuit Breaker Went Into Service
- Current Load Receiving Power from the Circuit Breaker

The team found that appropriate attributes for each breaker were included in the database. The team noted that the breaker information entry and retrieval were easily accomplished when using the database program. Data modifications could also be accomplished easily, however, this could only be performed by authorized personnel. The team determined that the presentation of circuit breaker information on the computer screen was good, and that this database could be a valuable tool to the licensee in tracking and determining the status of any medium or low voltage circuit breaker at Seabrook Station.

c. Conclusions

The team concluded that the recently developed circuit breaker tracking system (database) at Seabrook Station provided good information on the circuit breakers and that this database could be a valuable tool to the licensee in tracking and determining the status of any medium-voltage or low-voltage circuit breaker at Seabrook Station. The team considered this activity a strength.

X1 Exit Meeting Summary

The inspector met with the licensee personnel at the conclusion of the inspection on August 7, 1998, and summarized the scope of the inspection and the inspection results. No proprietary materials were reviewed during this inspection. The licensee acknowledged the inspection findings at the meetings.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

A. Abrahamovich,	Audits and Evaluation
G. Boissy,	Assistant Station Director
S. Buchwald,	Oversight Supervisor
T. Cooper,	Electrical Maintenance Manager
B. Cox,	CM Supervisor
B. Draybridge,	Director of Services
P. Falman,	System Engineering Supervisor
T. Feigenbaum,	Executive Vice President and Chief Nuclear Officer
H. Halliday,	Maintenance Analyst
M. Heon,	Electrical Maintenance Supervisor
G. Jasinski,	Senior Maintenance Engineer
K. Letourneau,	Senior Electrical Engineer
M. Makowicz,	Corrective Action Manager
J. Marchi,	Audit Manager
G. McDonald,	Oversight Manager
K. Mullen,	System Engineer
T. Nichols,	Condition-Based Maintenance Manager
M. O'Keefe,	Safety Engineering Supervisor
M. Ossing,	Senior Project Engineer
J. Pescher,	Regulatory Compliance Manager
C. Rickett,	MA Support Supervisor
D. Rhallene,	Training Specialist
B. Roach,	Benchmarking Supervisor
E. StPierre,	Operation Manager
R. Sherwil,	Planning, Scheduling and Outage Manager
J. Summa,	Condition-Based Maintenance Supervisor
M. Tancrede,	Maintenance Technician
M. VanDoorne,	Maintenance Training Supervisor
J. Vargas,	Director of Engineering
J. Warnock,	PE Supervisor
R. White,	Mechanical Engineering Manager

NRC

R. Lorson	Senior Resident Inspector

INSPECTION PROCEDURES USED

TI 2515/137 Inspection of Medium-Voltage and Low-Voltage Power Circuit Breakers

ITEMS OPENED, CLOSED AND DISCUSSED

None

LIST OF ACRONYMS USED

ABB	Asea Brown Boveri
ac	Alternating Current
ACR	Adverse Condition Report
ATWS	Anticipated Transient Without Scram
CB	Circuit Breaker
CFR	Code of Federal Regulations
dc	Direct current
EPRI	Electric Power Research Institute
GL	Generic Letter
IN	Information Notice
kV	Kilovolt
LOCA	Loss of Coolant Accident
LOOP	Loss of Offsite Power
MCC	Motor Control Center
NMAC	Nuclear Maintenance Application Center
NRC	Nuclear Regulatory Commission
NSAL	Nuclear Service Advisory Letter
NSSS	Nuclear Steam Supply System
NUTAC	Nuclear Task Action Committee
OE	Operating Experience
OER	Operating Experience Review
PM	Preventive Maintenance
RO	Refueling Outage
RTB	Reactor Trip Breaker
TI	Temporary Instruction
TS	Technical Specifications
UFSAR	Updated Final Safety Analysis Report
Vac	Volts Alternating Current
Vdc	Volts Direct Current
VETIP	Vendor Equipment Technical Information Program
WO	Work Order