UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555

June 18, 1992

NRC INFORMATION NOTICE 92-44: PROBLEMS WITH WESTINGHOUSE DS-206 AND DSL-206 TYPE CIRCUIT BREAKERS

Addressees

All holders of operating licenses or construction permits for nuclear power reactors.

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to alert addressees to a problem with DS-206 and DSL-206 type circuit breakers manufactured by the Westinghouse Electric Corporation (Westinghouse) which could cause these breakers to fail to open when required. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this information notice are not NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances

The following describes three Westinghouse DS-206 circuit breaker failures.

On September 3, 1990, the Commonwealth Edison Company, licensee for the Byron Nuclear Power Station (Byron), reported that while performing a surveillance test, the 2C reactor containment fan cooler low speed fan circuit breaker failed to open. Attempts to manually open the circuit breaker failed. The licensee replaced the failed circuit breaker and sent it to Westinghouse for a failure analysis.

On November 30, 1990, operators at the South Texas Project Electric Generating Station (STPEGS), Unit 1, were unable to open the electrical auxiliary building Supply Fan 11B breaker from the control room, by the local hand switch, or by the manual trip pushbutton; eventually, they opened it using an insulated push rod within the breaker cubicle.

On March 31, 1992, the Arizona Public Service Company, licensee for the Palo Verde Nuclear Generating Station, reported that during a surveillance test, when an operator tripped a Unit 3 reactor trip breaker (RTB) from the control room, it remained in an intermediate position with its "A" and "C" poles connected and the "B" pole disconnected.

Discussion

Westinghouse examined the DS-206 circuit breaker that failed to open at Byron and determined that the probable cause of the failure was the improper adjustment of its contacts. Westinghouse issued Technical Bulletin NSD-TB-91-06-RO, "DS-206 and DSL-206 Breakers - Mechanical Friction Of Main Contact Assemblies," (Attachment 1), advising its customers that if the contact adjustment procedures in the technical bulletin were not followed, the breaker might only partially open because of excessive friction in the main contact assemblies.

STPEGS personnel could not duplicate the malfunction which had occurred on the DS-206 type electrical auxiliary building supply fan breaker and did not immediately perform a root cause analysis.

Licensee and Westinghouse personnel inspected the DS-206 type reactor trip breaker that failed to open at Palo Verde and determined that its main contacts in the "A" and "C" poles were misaligned. They observed the mechanical alignment of the arcing contacts to be outside the tolerances in Westinghouse's specification. The "B" pole insulating link was twisted and was binding on the poleshaft lever. These misalignments cause inadequate compression of the main contact springs and reduce the opening force. They also determined that the pivot blocks in the moving contacts had not been lubricated as recommended in the Westinghouse technical bulletin. An additional significant contributing factor was that the reset spring on the poleshaft (which assists in completing the opening sequence) was found to be elongated and weakened, probably the result of repeatedly detaching and attaching the springs before performing undervoltage trip attachment surveillance tests in a manner not recommended by Westinghouse. Therefore, this failure could have resulted from the combined effect of the misalignments, the weakened reset spring and incorrect lubrication. They also determined that Palo Verde personnel had not incorporated the recommendations contained in NSD-TB-91-06-RO into their maintenance procedures.

In the technical bulletin, Westinghouse provided detailed steps on how to inspect and adjust the stationary and moving (main and auxiliary) contacts without causing the insulating links to twist and bind and on how to verify clearances in the stationary contacts and specified lubricating pivot blocks. The Westinghouse cover letter for the bulletin advised that if contact adjustment procedures given in the bulletin are not followed, then the potential exists for the DS- and DSL-206 breakers to partially open due to excessive friction in the main contact assemblies. However, the technical bulletin advised performing these steps upon finding difficulty in electrically opening the breaker. NRC staff discussions with Westinghouse personnel indicate that the inspection recommendations are applicable to all DS- or DSL-206 type circuit breakers, even if no difficulties have been experienced, and in particular, if the licensee has replaced the poleshaft or performed other maintenance activities involving replacement of major components, such as contacts (main or arcing), on site.

NRC Generic Letters 83-28, "Required Actions Based on Generic Implications of Salem ATWS Events," and 90-03, "Relaxation of Staff Position in GL 83-28, Item

2.2 of Part 2, 'Vendor Interface for Safety Related Components'," address the need for licensees to obtain and incorporate vendor technical information that applies to their facilities into plant procedures to ensure that safety-related equipment is operated and maintained properly.

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact one of the technical contacts listed below or the appropriate Office of Nuclear Reactor Regulation (NRR) project manager.

Charles E. Rossi, Director
Division of Operational Events Assessment
Office of Nuclear Reactor Regulation

Technical contacts: Thomas Koshy, NRR
(301) 504-1176

Kamalakar Naidu, NRR
(301) 504-2980

Stephen Alexander, NRR
(301) 504-2995

Attachments:
1. Westinghouse Technical Bulletin NSD-TB-91-06-RO
2. List of Recently Issued NRC Information Notices

NSD Nuclear Services Division

# Westinghouse Technical Bulletin

An advisory notice of a recent technical development pertaining to the installation or operation of Westinghouse-supplied Nuclear Plant equipment. Recipients should evaluate the information and recommendation, and initiate action where appropriate.

P.O. BOX 355, Pittsburgh, PA 15230

| | | | |
|---|---|---|---|
| Subject: DS-206 AND DSL-206 BREAKERS - MECHANICAL FRICTION OF MAIN CONTACT ASSEMBLIES | | | Number: NSD-TB- 91-06-RO |
| System(s): ALL PLANT SYSTEMS | | | Date: 9/24/91 |
| Affected Plants: ALL PLANTS WITH W TYPE DS-206 AND DSL-206 AIR CIRCUIT BREAKERS | | | S.O.(s): VARIOUS |
| References: SEE BELOW | Affects Safety Related Equipment: Yes ☒ No ☐ | | Sheet: 1 of 7 |

## REFERENCE

Westinghouse Instruction Bulletin I.B. 33-790, "Instructions for Low-Voltage Power Circuit Breaker Types DS and DSL."

## APPLICATION

This Technical Bulletin applies to circuit breakers manufactured or refurbished with recertification by Westinghouse Electric Corporation for the utility. Westinghouse does not recommend, nor does Westinghouse accept responsibility or liability for the application of this technical information to any circuit breakers purchased from or provided by any other supplier, including salvage brokers, commercial dedication agents and re-manufacturing companies.

## INTRODUCTION

All customers with Westinghouse Type DS-206 and/or DS-206L size air circuit breakers are advised that if the contact adjustment procedures given in the referenced Instruction Bulletin are not followed, then the potential exists for the breaker to only partially open due to excessive friction in the main contact assemblies.

Individual main contact springs are provided in each of the three upper stud assemblies to provide the normal opening forces when the breaker is tripped.

Additional Information, if Required, may be Obtained from the Originator. Telephone 412- 829-3757 or (WIN) 244-3757

Originator

C. G. Geis, RCS Power Systems Engineering

J. J. Jelovich, Mgr., RCS Power Systems Engineering

Approval

L. R. Benson

Domestic Customer Projects

Severe binding between the moving parts of the main contact assembly may prevent the contacts from fully opening and clearing the normal or fault currents through the breaker.

## BACKGROUND INFORMATION

Three Type DS-206 air circuit breakers at a nuclear power plant failed to open fully on demand through the electrical trip circuitry. These malfunctions were attributed to excessive friction of the various main contact assembly parts.

Subsequent investigation by the utility and Westinghouse revealed that the primary cause of the malfunctions was various combinations of friction and misalignment between the main moving contact assemblies and their connections to the breaker.

## POTENTIAL SAFETY IMPACT

DS-206 and DSL-206 size air circuit breakers are known by Westinghouse to be used in both Balance of Plant and on some non-Westinghouse Reactor Trip applications.

The larger size breakers such as the DS-416 have additional opening springs in each pole base assembly and therefore have additional force to open the larger size breakers in the event that they develop similar friction forces. Therefore, the DS-416, DSL-416, DS-420, DS-532, and DS-632 size breakers are not affected by this bulletin.

## RECOMMENDED INSPECTION INTERVAL

Inspections and tests in this bulletin provide clarification and expansion on the material previously provided in the referenced instruction bulletin and should be performed if difficulties have been experienced with electrical opening of a breaker.

## RECOMMENDED INSPECTION PROCEDURE

### CAUTION

THESE INSTRUCTIONS MUST BE PERFORMED BY PERSONNEL TRAINED IN HANDLING/ SERVICING THE DS TYPE CIRCUIT BREAKER. POTENTIAL DANGER OF ELECTROCUTION OR OTHER SERIOUS INJURY EXISTS.

The purpose of this inspection is to determine if an installed DS-206 breaker is an acceptable assembly.

1. Remove the breaker from service and fully withdraw the breaker out onto its extension rails or to a suitable work bench.

**CAUTION**

BEFORE PROCEEDING, ENSURE THE BREAKER IS OPEN AND THAT ITS CLOSING SPRINGS ARE DISCHARGED. IF THE CLOSING SPRINGS ARE NOT DISCHARGED, THE POTENTIAL DANGER OF SERIOUS INJURY EXISTS.

2. Remove the three arc chutes, four barriers and front panel to allow visual examination of the main contact assemblies.

3. Place breaker levering mechanism in the "connected position".

4. Disconnect the reset/opening spring from the pole shaft pin on the right side of the breaker (see Item 19 on Figure 14) and lay the spring down on the breaker base plate.

5. Manually charge the closing springs and close the breaker.

6. Visually inspect the faces between the main stationary contact fingers and the leading edge of the vertical stationary contact bar on each phase. See dimension B in the attached figure. Record whether the faces are under-parallel ($x < y$), parallel ($x = y$), or over-parallel ($x > y$).

7. Manually trip the breaker and record whether the arcing contacts parted. There must be a visual air gap between moving and stationary arcing contacts.

8. If contacts were found to be under-parallel in Step 6, adjust the contacts as follows:

   a. Loosen the locking nut and turn the adjusting nut of each insulating link in the clockwise direction (when looking at the breaker from the front), until the stationary main contact and the vertical face of the stationary upper stud are parallel ($X = Y$).

   b. To prevent binding between the insulating link and pole shaft lever, firmly hold the link while tightening the insulating link locking nut. Note that this nut is self-locking type.

9. Repeat Steps 5 and 7 to verify parting of arcing contacts.

10. If contacts part, then proceed to Step 15.

11. If the arcing contacts do not part, obtain additional opening force margin by inspecting the individual main contact assemblies and adjusting each (as required) per the following general information:

    a. Adjust the spring force on the arcing contacts by adjusting the self-locking nuts so that the dimension of 3.12 to 3.14 inches is obtained between the inside surfaces of the flat washers on the spring ends (see Figures 37 and 38 in the referenced instruction book).

    b. Lubrication of the rubbing surfaces between the main moving contact arms and;

        b-1. The hinge spacers at the bottom of each contact arm. Use the special conductive graphite grease, Westinghouse P/N 53701AN between the spacers and the main moving contact arms.

        b-2. The pivot block/tie bar connections to the main moving contact arms. Use the Molykote BR2 Plus grease, Westinghouse P/N 53701QB on the 1/2 inch shaft ends that connect the pivot blocks to the main moving contact arms.

    The hinge spring adjustments and the moving arcing contact mounting bolts should be loosened to allow for daubing the greases in between the rubbing surfaces using a small brush or cotton swab. Adjust the contact springs per paragraph 11c below and torque the arcing contact mounting bolts to between 18 and 21 ft- lbs.

    Manually, move the moving contact assemblies through their normal range of motion to insure the lubricant is worked into the joints. Wipe off excess lubricant that may make its way out of the joints.

    NOTE: ENSURE THE GREASE DOES NOT GET ON THE INSULATING MATERIAL OF THE POLE BASES OR INSULATING LINKS.

    c. Adjust the spring force on the hinge springs at the bottom of each moving contact assembly. Two different hinge spring designs exist and are presently in use in DS-206 size breakers.

c-1) The original design is as shown in Figures 37 and 47 of the reference instruction bulletin and requires adjustment of the self-locking nut until the inside surfaces of the flat washers contact the hinge bearing tubes (see item 3 in figure 47). This compresses the hinge spring to insure good electrical contact between the moving arms (item 5 in figure 47) and the bushings attached to the stationary hinge contact (item 2 in figure 47). This adjustment can be checked by measuring the inside surfaces of the flat washers on the spring ends. It should be between 2.95 and 2.98 inches.

c-2) The new design is similar to that shown in figures 39 and 48 for the DS-416 size breaker. This design uses a TAPERED hinge spring and requires the self-locking nut to be adjusted until the outside surfaces of the flat washers on the spring ends measure between 2.51 and 2.54 inches.

d. The individual pole shaft connections to the insulating link assemblies should move freely without lubrication. Adjustment of the main contact spring tension may result in the insulating links turning and creating excessive friction at this joint. The locking nuts should be loosened and then re-tightened while holding the insulating link from turning per the instructions in Steps 8a and 8b above.

e. Adjust the stationary arcing contacts per Step 12 to ensure minimum friction between the stationary and moving arcing contacts.

12. Stationary arcing contact readjustment may be necessary to minimize the drag or friction during the opening of the breaker.

Per the attached figure, the individual stationary arcing contacts should be adjusted using the following information:

a. The moving contact assembly center line should visually line up with the center line of the stationary contact assembly within plus/minus 1/16 inch. If this cannot be achieved by loosening and moving the individual contact assemblies, then new assemblies should be installed.

b. The 0.020 minimum dimension A should not exceed 0.070 since this may result in excessive compression of the arcing contact springs.

c. The adjustment of the stationary contacts should be such that the moving contact and the stationary contact rubbing surfaces are parallel to each other and touch each other with line contact over the 1/2 inch length.

13. If arcing contacts still do not part, obtain additional opening force margin by adjusting the contacts of each pole assemble as follows:

a. Loosen the locking nut and turn the adjusting nut of each insulating link an additional full turn (six flats) in the clockwise direction (when looking at the breaker from the front).

NOTE: DO NOT OVER ADJUST. THE MAIN MOVING CONTACT ARM MUST NOT CONTACT THE STATIONARY CONTACT ARMS EXCEPT AS SHOWN IN THE FIGURE.

b. To prevent binding between the insulating link and pole shaft lever, firmly hold the link while tightening the insulating link locking nut. Note that this nut is self-locking type.

14. Repeat Steps 5 and 7 to verify parting of arcing contacts. If contacts still do not part, contact Westinghouse.

15. Re-connect the reset/opening spring to the pole shaft pin. With this spring connected, check for full motion of the pole shaft and the auxiliary switch linkage.

16. Reinstall the arc chutes, barriers and front panel.

17. Place the levering mechanism to the "removed position".

18. Put the breaker back into service following normal plant maintenance procedures.

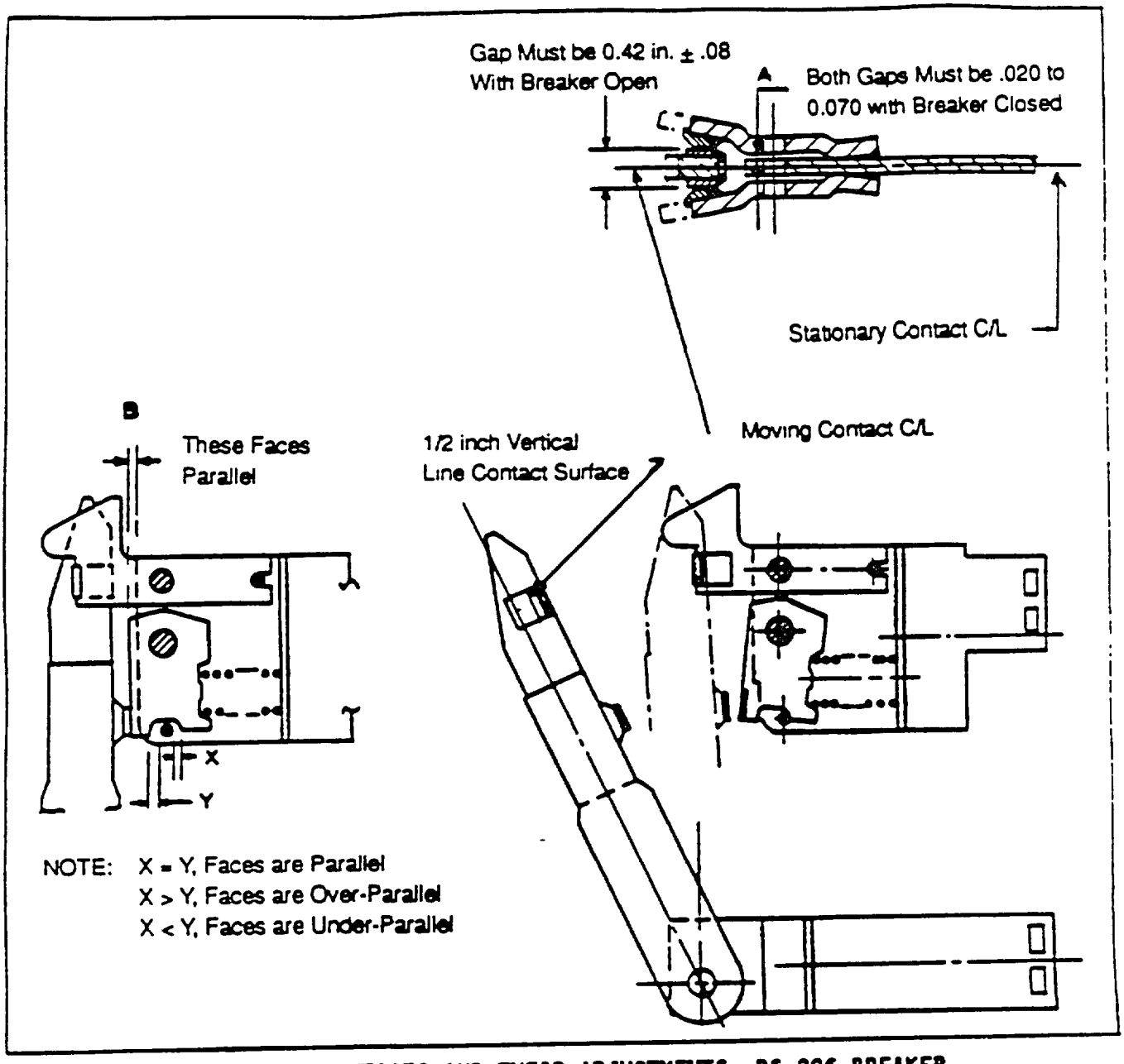


FIGURE 1: CONTACTS AND THEIR ADJUSTMENTS, DS-206 BREAKER

LIST OF RECENTLY ISSUED
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| Information Notice No. | Subject | Date of Issuance | Issued to |
|---|---|---|---|
| 92-43 | Defective Molded Phenolic Armature Carriers Found on Elmwood Contactors | 06/09/92 | All holders of OLs or CPs for nuclear power reactors. |
| 92-42 | Fraudulent Bolts in Seismically Designed Walls | 06/01/92 | All holders of OLs or CPs for nuclear power reactors. |
| 92-41 | Consideration of the Stem Rejection Load in Calculation of Required Valve Thrust | 05/29/92 | All holders of OLs or CPs for nuclear power reactors. |
| 92-40 | Inadequate Testing of Emergency Bus Undervoltage Logic Circuitry | 05/27/92 | All holders of OLs or CPs for nuclear power reactors. |
| 92-39 | Unplanned Return to Criticality during Reactor Shutdown | 05/13/92 | All holders of OLs or CPs for nuclear power reactors. |
| 92-38 | Implementation Date for the Revision to the EPA Manual of Protective Action Guides and Protective Actions for Nuclear Incidents | 05/12/92 | All holders of OLs or CPs for nuclear power reactors, non-power reactors and materials licensees authorized to possess large quantities of radioactive material. |
| 92-37 | Implementation of the Deliberate Misconduct Rule | 05/08/92 | All Nuclear Regulatory Commission Materials Licensees. |
| 92-16, Supp. 1 | Loss of Flow from the Residual Heat Removal Pump during Refueling Cavity Draindown | 05/07/92 | All holders of OLs or CPs for nuclear power reactors. |

OL = Operating License
CP = Construction Permit

2.2 of Part 2, 'Vendor Interface for Safety Related Components'," address the need for licensees to obtain and incorporate vendor technical information that applies to their facilities into plant procedures to ensure that safety-related equipment is operated and maintained properly.

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact one of the technical contacts listed below or the appropriate Office of Nuclear Reactor Regulation (NRR) project manager.

Original Signed by
Charles E. Rossi

Charles E. Rossi, Director
Division of Operational Events Assessment
Office of Nuclear Reactor Regulation

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(301) 504-1176

Kamalakar Naidu, NRR
(301) 504-2980

Stephen Alexander, NRR
(301) 504-2995

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need for licensees to obtain and incorporate vendor technical information that applies to their facilities to ensure that safety-related equipment is operated and maintained properly.

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NRC Generic Letters 83-28, "Required Actions Based on Generic Implications of Salem ATWS Events," and 90-03, "Relaxation of staff position in GL 83-28, item 2.2 of Part 2, 'Vendor Interface for Safety Related Components'," address the need for licensees to obtain and incorporate vendor technical information that applies to their facilities to ensure that safety-related equipment is operated and maintained properly.

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Kamalakar Naidu, NRR (301) 504-2980
Stephen Alexander, NRR (301) 504-2995

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NRC Generic Letters 83-28 and 90-03 address the need for licensees to obtain and incorporate vendor technical information that applies to their facilities to ensure that safety-related equipment is operated and maintained properly.

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Licensee and Westinghouse personnel inspected the DS-206 type reactor trip breaker that failed to open at Palo Verde and determined that its stationary and moving contacts in the "B" pole were misaligned. They observed the mechanical alignment of the moving arcing contacts to be outside the tolerances in Westinghouse's specification. The "B" pole insulating link was distorted. They also determined that the linkages had not been lubricated as recommended by Westinghouse. Therefore, this failure could have resulted from the combined effect of the misalignments and the use of an incorrect lubricant. They also determined that Palo Verde personnel had not incorporated the recommendations contained in NSD-TB-91-06-RO into their maintenance procedures.

In the technical bulletin, Westinghouse presented detailed steps on how to inspect and align the stationary and the moving contacts, on how to adjust contacts without causing the insulating link to bind, and how to verify clearances in the stationary contacts. The technical bulletin advised performing these steps only upon finding difficulty in electrically opening the breaker. However, NRC staff discussions with Westinghouse personnel indicate that the inspection recommendations are applicable to all circuit breakers, even if no difficulties have been experienced, and in particular, if the licensee replaced the poleshaft on site.

The NRC expects each licensee to obtain and incorporate vendor technical information that applies to its facilities to ensure that safety-related equipment is operated and maintained properly. This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact the technical contact listed below or the appropriate Office of Nuclear Reactor Regulation (NRR) project manager.

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