

September 11, 2002

Laurence Patterson
Quality Assurance Manager
Cutler-Hammer Nuclear Programs
130 Commonwealth Drive
Warrendale, Pennsylvania 15086

SUBJECT: BREAKER SWITCH FAILURE AT COLUMBIA GENERATING STATION

Dear Mr. Patterson:

We request your comment on the enclosed draft information notice concerning a breaker switch failure at Columbia Generating Station. The failure involved Cutler Hammer Type DHP-Vacuum Retrofit breakers with "Sure-Close" coupling to the mechanism-operated cell switches, which failed to change state as designed.

Sincerely,

/RA/

William D. Beckner, Program Director
Operating Reactor Improvements Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Enclosure: As stated

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, DC 20555-0001

[date]

NRC INFORMATION NOTICE 2002-XX: FAILURE OF SAFETY-RELATED CIRCUIT
BREAKERS AT COLUMBIA GENERATING
STATION

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 inform addressees of failures of circuit breaker external auxiliary switches because of inadequate maintenance of the associated switchgear. 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 in this information notice are not NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances

On February 14, 2002, at the Columbia Generating Station, the licensee initiated a required plant shutdown because of a mechanical problem in an emergency diesel generator (EDG) output circuit breaker. Although the breaker was capable of closing and connecting the EDG to its safety bus, its cubicle-mounted auxiliary contacts, called mechanism-operated cell (MOC) switches, failed to change state as designed. The licensee determined that the MOC switch failures associated with this breaker and other breakers of this type resulted in failure of various electrical distribution system control functions, including some non-safety loads not being removed from the EDG bus following an accident signal.

On June 29, 2001, during a refueling outage at the same plant, after breaker replacement, a standby service water pump breaker MOC switch failed to reposition during breaker closure. This failure recurred on November 19, 2001. A MOC switch contact prevented the pump discharge valve from opening after a pump start, rendering the service water system and supported systems, such as EDGs, inoperable.

Discussion

The licensee believes the failure was caused by excessive resistance in the linkage between the breaker and the MOC switches. The licensee had not performed periodic maintenance on this switchgear, including the breaker cell housing. Over time, dirt and dust accumulated and grease hardened to increase the resistance in the linkage mechanism.

Enclosure

During the preceding refueling outage, ending in July 2001, the licensee replaced 22 safety-related 4160-volt circuit breakers, exchanging older design Westinghouse Type DHP-350 (air-magnetic) breakers with newer design Cutler Hammer Type DHP-VR (vacuum retrofit) breakers. The older design breaker develops large forces to move its high-inertia mechanisms. The "Sure-Close" mechanism of the newer design breaker develops smaller forces to move its lower-inertia mechanisms. The operating mechanism of the DHP-350 is strong enough to operate even a poorly maintained directly-coupled MOC switch linkage. In the DHP-VR, the "Sure-Close" mechanism operates the MOC switches independently of the breaker's main contacts so that external device drag won't stall the main contacts. However, the "Sure-Close" mechanism was not designed with sufficient external output force margin to reliably overcome the excessive drag of poorly maintained MOC switch linkages. (for an explanation of "Sure-Close" operation, see "DHP -VR SURE CLOSE Mechanism: A Kinematic System Solution for Medium Voltage Circuit Breaker MOC Auxiliaries Operation," U. S. Patent 5,856,643, Ronald E. Vaill, available from Cutler-Hammer Nuclear Programs).

The vendor tested the "Sure-Close" device through 5,000 cycles without a problem using a well-maintained MOC switch linkage assembly. The Columbia Generating Station experience illustrates that the newer design breakers, in which the "Sure-Close" mechanisms operate the MOC switches, depend more heavily on the state of maintenance of the linkage than do the older design breakers coupled directly to the MOC switches.

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 project manager from the NRC's Office of Nuclear Reactor Regulation (NRR).