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Nuclear Department

September 16, 1983

Director of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
7920 Norfolk Avenue
Bethesda, Maryland 20014

Attention: Mr. Steven A. Varga, Chief
Operating Reactors Branch 1
Division of Licensing

Gentlemen:

FRANKLIN RESEARCH CENTER REVIEW
OPERATIONAL VERIFICATION PROGRAM FOR WESTINGHOUSE
DB-50 REACTOR TRIP BREAKERS
NO. 1 AND 2 UNITS
SALEM GENERATING STATION
DOCKET NOS. 50-272 AND 50-311

PSE&G hereby transmits its responses to comments raised by the Franklin Research Center (FRC) on the operational verification program for Westinghouse DB-50 reactor trip breakers. (See Attachment 1). These responses were prepared with the assistance of Westinghouse.

In accordance with the Confirmatory Order of May 6, 1983, the intent of this program is to determine life cycle and replacement intervals for undervoltage trip attachments (UVTAs) and to verify the adequacy of the maintenance and surveillance programs for the reactor trip breakers. The UVTA test phase has been completed by Westinghouse, and the data are now being analyzed. Confidence levels on replacement intervals, sources of bias, and factors that influence service life will be addressed after receipt of the test results.

Should you have any questions, please contact us.

Sincerely,

E. A. Liden
Manager - Nuclear
Licensing and Regulation

Attachment

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Director of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission

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CC: Mr. Donald C. Fischer
Licensing Project Manager

Mr. James Linville
Senior Resident Inspector

TITLE:

RESPONSE TO FRANKLIN RESEARCH CENTER
COMMENTS REGARDING OPERATIONAL
VERIFICATION PROGRAM FOR WESTINGHOUSE
DB-50 REACTOR TRIP BREAKERS.

REFERENCES:

- I. SUMMARY OF TEST PROGRAM FOR DB-50 REACTOR
TRIP BREAKER UNDERVOLTAGE AND SHUNT TRIP
ATTACHMENTS, PSE&G LETTER TO USNRC DATED
MAY 31, 1983.

1. FRC GENERAL COMMENT

While the title of the test program states applicability to both shunt and undervoltage trip attachments (UVTAs), the bulk of the cycling is applied to the UVTA. The UVTA is cycled 2500 times and the shunt is cycled 600 times. The test program should contain representative cycling caused by each tripping mode expected during operation (i.e., shunt trip, UVTA deenergize to trip, and UVTA trip-free, see Item 3 below).

PSE&G RESPONSE

The emphasis of the test program is on the ability of the UVTA to perform its function and to determine its lifetime and maintenance requirements. The shunt trip device was cycled 600 times to reflect its actual lifetime expected operations and those operations' effect on the UVTA. A future test program is planned which will address qualification of the shunt trip device.

Trip-free operation is discussed in the response to FRC Comment 3.

2. FRC GENERAL COMMENT

Maintenance performed during testing must be representative of that to be implemented during operation. It appears that 200 cycles between inspection of the UVTA during the test would be conservative with respect to the number of operations expected between maintenance periods during operation if such maintenance were performed at each refueling outage. During operation of the reactor trip circuit breakers, opening and closing cycles from all sources (UVTA, shunt trip, or manual trip) should be counted as a UVTA cycle. Each time the circuit breaker opens and closes, the UVTA is either partially or fully cycled.

PSE&G RESPONSE

Conservative maintenance intervals/procedures will be developed based on the results of the test program. In the test program each breaker cycle (closing and opening) was considered as a UVTA cycle.

3. FRC GENERAL COMMENT

Nowhere in the program is trip-free cycling of the UVTA discussed. During operation and testing, some trip-free operations are expected to occur when the device is deenergized and closing of the circuit breaker is attempted. The trip-free operation may cause different wear phenomena on the latch components than other operating modes. Addition of a representative number of trip-free cycles to the test program should be considered.

PSE&G RESPONSE

Trip-free operation of the breaker is rare and insignificant compared to shunt trip operations. Additionally, Westinghouse has indicated that trip-free operations would not cause wear which is different from the shunt trip operation that is being introduced during the test. Thus, the shunt trip testing adequately models both trip-free and shunt trip operations.

4. FRC GENERAL COMMENT

A general description of the acceptance criteria for the program should be given. For example, what reduction in UVTA output force is considered to be significant? A general description of how the test results will be translated into practical replacement criteria should be given. For example, the UVTA will be replaced after XXX operations of the circuit breaker if 2500 operations of the UVTA are achieved without significant degradation in output force during the test program.

PSE&G RESPONSE

The test program is designed only to gather information. The results of the test program will be used to develop replacement and maintenance requirements. There are many possible outcomes from the test; therefore it is not practical to describe how the results will be interpreted. Final conclusions will be justified by the test results.

5. SECTION I. OF REFERENCE I

I. PURPOSE

To verify that the DB-50 circuit breaker undervoltage and shunt trip attachments are suitable for reactor trip switchgear service and have adequate design margin by obtaining data which:

- 1) Documents the forces required to trip the circuit breaker, and
- 2) Demonstrates the cyclic performance characteristics of the undervoltage and shunt trip attachments.

FRC SPECIFIC COMMENT TO SECTION I-2

This clause is interpreted as meaning demonstration of changes (or lack thereof) in performance characteristics as the number of operations of the devices is increased.

PSE&G RESPONSE

The FRC interpretation of this clause is correct.

6. SECTION II OF REFERENCE I

II. SELECTION OF TEST SAMPLES

Two undervoltage trip attachments (UTAs) will be selected based on the following prerequisites to assure that they are representative samples:

- a. Each UTA will be subjected to a 100% dimensional inspection of ten critical parts.
- b. Each UTA will be tested on a go-no-go basis 25 times with zero failures. This screening would eliminate testing of devices which could be susceptible to infant-mortality.

FRC SPECIFIC COMMENT TO SECTION II

The reason for choosing to test only two samples should be amplified. While doing a dimensional check of ten critical components reduces the variations in the UVTAs, it will not eliminate all of the variations that could be expected in the assembled device. It is FRC's understanding that the frame of the device is not one of the ten critical components to be inspected. However, slight variations in bending and drilling of the front portion of the frame will make a considerable difference in the mating of critical portions of the latch. Further evaluation supporting the choice of the sample size is suggested. In addition, the device should be randomly selected from a production batch to reduce the probability of selecting a sample not representative of the remainder of the batch.

PSE&G RESPONSE

UVTA's are not produced in what would normally be termed a "production batch." The devices are produced on demand to fill specific orders. The quantities produced are therefore small (around 16 units maximum per order from PSE&G) and if 16 are considered a "production batch", then 12.5% of a batch is being tested.

It was decided that two devices would be sufficient to show the operating characteristics. The actual test program used 4 UVTAs. Two UVTA's were tested and lubricated every 200 operations. The other two were lubricated once, before any testing, and then cycled to determine wear characteristics and performance with no additional lubrication.

The frame of the UVTA was not considered to be one of the critical parts because field service information on the devices has not identified any problems with misalignment of the UVTA. Any wear which has been experienced to date would contribute to trip-free operation of the device and not sticking in the energized position.

8. SECTION III PARAGRAPH 2 OF REFERENCE I

The circuit breakers tested will be inspected in accordance to the type DB-50 circuit breaker instruction manual prior to testing. If adjustments are required to the as-received condition of the breakers, these will be documented. During the tests, the breakers and trip attachments will be inspected and maintained in accordance with the instruction manual and technical bulletin NSD-TB-83-02.

FRC SPECIFIC COMMENTS TO SECTION III PARAGRAPH 2

The maintenance of the circuit breaker should be representative of that which will be performed during actual operation. Maintenance during the tests should not be more frequent than it will actually be performed during the life of the equipment. The number of operations of the circuit breaker between performance of maintenance during the test should be conservative with respect to the number of cycles between performance of maintenance during actual operation.

PSE&G RESPONSE

The test procedure calls for inspection and measurement every 200 cycles. The breaker mechanism is to be lubricated if the inspection indicates that it is necessary. Lubrication intervals will be recorded during the test.

9. SECTION III PARAGRAPH 3 REFERENCE I

Identification of the test breakers and electrical characteristics of the undervoltage and shunt trip coils will be documented. The trip bars of the test breakers will not include overcurrent trip pads.

FRC SPECIFIC COMMENTS TO SECTION III PARAGRAPH 3

The electrical characteristics of the UVTA change with coil temperature. During testing, the testing should be performed so that properties are measured at approximately the same coil temperature each time.

PSE&G RESPONSE

Since testing was done at constant intervals and the same tests were done at approximately the same times within those intervals, the coil temperature variations were considered to have no significant affect on recorded characteristics. This point, however, will be addressed further as part of the final analysis of the test data.

10. FRC GENERAL COMMENT
SECTION IV

Many of the parameters measured in this section IV will vary from reading to reading. Multiple measurements should be taken and the average and range of values used for comparison to subsequent readings. This applies to trip voltages, timing values, and distances between trip tabs and trip bars.

PSE&G RESPONSE

Although the person taking measurements may have taken more than one reading and averaged the results, the log book only lists one recorded value. The effects of taking multiple readings will be discussed in the final analysis.

11. FRC GENERAL COMMENT
SUBSECTION I.b.2

Determining the power required by the shunt trip coil could cause damage to the coil if it is energized for a significant period. The coils on the UVTA and shunt trip are identical. However, the UVTA operates at 48 Vdc and the shunt trip operates at 125 Vdc.

PSE&G RESPONSE

This was taken into account to avoid coil damage.

12. FRC GENERAL COMMENT

The method of measuring the various forces should be described. For example, the force required to lift the trip bar could be measured by static pull via spring scale or load cell. Also, it appears that the output of the UVTA and shunt trip will be measured two different ways since Subsection 5 states that the force will be measured by adding weights to the trip bar until no tripping occurs. If two different methods are used, the resulting data should be compared for consistency.

PSE&G RESPONSE

Load cells were used to determine the force required to trip the breaker and the output force of the UVTA. Weights were used to determine the maximum trip bar load that the UVTA is capable of moving far enough to trip the breaker. The different measurement techniques were used to establish different performance characteristics.

13. FRC GENERAL COMMENT

The indicated order described indicates that after each 200 cycles the circuit breaker (FRC assumes this includes the UVTA) is maintained and then trip forces are measured. It is suggested that after every 200 cycles the force tests be performed prior to maintenance. If apparent degradation occurs, the test should be repeated after maintenance to determine if the problem was corrected by the maintenance. If significant degradation is observed after a period of cycling, the number of cycles in the subsequent period should be reduced to determine how long the maintenance is effective.

The measurements described in this section should also be made repeatedly at each testing and the average and range of readings compared. On page 5, additional forces and timing tests are described. The reason for choosing variable length periods between tests is not indicated. The opening time of the circuit breaker should also be determined for tripping by the shunt trip attachment at the same intervals as the UVTA. This will provide information as to whether an increase in trip time is the result of the degradation of the circuit breaker or the UVTA. An alternative would be to time circuit breaker operation by shunt trip only if a significant increase in tripping time occurs for the UVTA trip.

PSE&G RESPONSE

After every 200 cycles measurements were taken, the breaker was maintained, and then the measurements retaken to determine the effectiveness of the maintenance. Breaker timing was not expected to vary significantly after 200 cycles. Any degradation which did occur in any of the measured characteristics will be evaluated. If further testing is indicated by the results then additional testing will be performed. Furthermore, if a significant increase in tripping time occurs, it will be determined whether the UVTA is the cause.

14. FRC GENERAL COMMENT

The reason for operating the shunt trip significantly fewer times than the UVTA is not clear. It is suggested that a more representative number of shunt trip operations be performed and that they be more evenly spaced throughout the test program. As indicated above, testing of forces and timing should occur before maintenance.

PSE&G RESPONSE

Six hundred cycles of the shunt trip was considered to be representative of actual breaker lifetime operations. The cycling of the shunt trip device was not distributed more evenly because of the difficulty in determining the cause of wear. The shunt trips were done in large blocks of operations so that the wear affects would be more apparent if they exist at all.

15. FRC GENERAL COMMENT

It is suggested that the UVTAs be closely inspected for wear and potential failure mechanisms at the conclusion of the test and that disassembly be considered.

PSE&G RESPONSE

One UVTA was used as a control sample with only initial characteristic measurements performed. At the conclusion of the test, wear phenomena will be evaluated against the control sample and various metallurgical examinations will be done on the test specimens. Disassembly will be part of the final analysis.