LBP-86-41

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

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ATOMIC SAFETY AND LICENSING BOARD

Before Administrative Judges:

Morton B. Margulies, Chairman
Gustave A. Linenberger, Jr.
Dr. Oscar H. Paris

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In the Matter of GEORGIA POWER COMPANY, et al. (Vogtle Electric Generating Plant, Units 1 and 2)	Docket Nos. 50-424-OL 50-425-OL (ASLBP No. 84-499-01-OL) December 23, 1986

CONCLUDING PARTIAL INITIAL DECISION

Appearances

Bruce W. Churchill, and David R. Lewis, Esqs., Shaw, Pittman, Potts & Trowbridge, Washington, D.C., and James E. Joiner, Charles W. Whitney, Kevin C. Greene, and Hugh M. Davenport, Esqs., Troutman, Sanders, Lockerman & Ashmore, Atlanta, Georgia, for the Applicants.

Douglas C. Teper, Raymond Tingle, and Daniel Feig, Atlanta, Georgia, for the Intervenor, Georgians Against Nuclear Power.

Bernard M. Bordenick, and Lee Dewey, Esqs., Bethesda, Maryland, for the Nuclear Regulatory Commission Staff.

I. INTRODUCTION

This is the second and concluding partial initial decision issued by the Board in this proceeding. In it the Board decides the remaining Intervenor contention in Applicants' favor. The Board concludes that licenses authorizing operation of the Vogtle Electric Generating Plant, Units 1 and 2 (VEGP) should be issued, subject to condition.

In our first partial initial decision issued August 27, 1986, we detailed the development of this contested application proceeding for operating licenses for VEGP. The application process resulted in an evidentiary hearing, from March 11 through March 14, 1986, at Waynesboro, Georgia on Intervenor's (Georgian Against Nuclear Energy or GANE) three contentions, by which denial of Applicants' (Georgia Power Company, et al.) application is sought. Nuclear Regulatory Commission Staff (Staff) has been a party throughout the proceeding.

Of the three contentions the first two were disposed of in our partial initial decision in Applicants' favor. Contention 7 alleged that Applicants have failed to assure that the ground water below VEGP will not be contaminated by a spill of radioactive water and Contention 10.1 alleged that Applicants have failed to assure that certain polymer materials, to be employed in components of VEGP that perform safety related functions, are environmentally qualified.

The third and remaining contention, Contention 10.5 alleges that Applicants have failed to assure that certain models of solenoid valves that are used to perform safety related functions in the VEGP are environmentally qualified. The Board deferred ruling on the contention

in its August 27, 1986 decision because of the issuance on August 25, 1986 of Board Notification 86-18. Therein, the Staff stated that it had requested from Applicants additional information regarding Applicants' main steam line break analysis; BN 86-18 further stated that the Staff questioned the methodology used for the qualification of ASCO valves that were the subject of the contention. Staff promised to inform the Board promptly of the final resolution of these matters. Owing to the then unanswered questions from the Staff, we withheld our decision on Contention 10.5. In issuing our partial initial decision on the other two contentions, we stated that we retained jurisdiction over Contention 10.5, the only contested issue yet to be decided in the proceeding.

Under date of September 15, 1986 Staff issued Board Notification 86-19, which stated that the Staff had been provided additional information by Applicants that answered Staff's concerns. Staff stated that based on such information it found the valves to be acceptably qualified.

On October 8, 1986 Dr. Howard M. Deutsch filed a GANE submittal titled SUPPLEMENTAL INFORMATION that addressed the two above identified Board Notification issuances as well as other matters alleged to pertain to Contention 10.5. No reopening of the record was requested by the parties. The extra record Board Notification issuances and the Deutsch submittal were reviewed by the Board. They did not provide any relevant, material information that contradicted the evidentiary record.

The Board did not consider them to provide any reasons for inquiring further or to reopen the evidentiary record.[1]

The Board in reviewing the evidentiary record on Contention 10.5, decided that certain matters were not dispositively dealt with on hearing. We wrote to the parties by letter of October 24, 1986 inquiring, as pertinent, whether certain cited temperatures provided meaningful margins that would provide confidence that the three subject model valves had been satisfactorily qualified.

This prompted a response by Applicants on October 28, 1986 which provided newly obtained information on computed post accident temperature values that was site specific to the Vogtle facility. Also, it provided probative information on the precision and uncertainty of the temperature margins that was formulated subsequent to the closing of the record on August 5, 1986. The Board viewed this information as having a significant bearing on the involved safety issue. By Memorandum and Order of November 6, 1986, the Board reopened the record for the limited purpose of considering Applicants' newly provided information along with any other to be furnished by affidavit by the other parties in support or opposition. Answers were appropriately filed by Staff and GANE and a response was submitted by Applicant.

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1 Dr. Deutsch again submitted the same information along with additional comments after the evidentiary record was subsequently reopened on November 6, 1986. We reviewed all of the information submitted by Dr. Deutsch in his October 8, 1986 filing and discuss it under II. Findings of Fact, paragraph II.56 et seq.

Based on the responses to the Board, we concluded as to the matter it inquired of that there was no genuine issue of material fact as to the methodologies employed to establish the subject values and margins; that Applicant and Intervenor differed on the conclusion reached; that the Board had no reason to inquire further as to the position of the parties; and that no useful purpose would be served in hold an oral hearing on the matter. As a result of the foregoing, the Board, by Memorandum and Order of December 8, 1986 directed that the record be closed.

In our partial initial decision of August 27, 1986, we had found that it resolved a major segment of the case making it appealable at that time. On September 8, 1986 notices of appeal were filed by Intervenor GANE and by Campaign for a Prosperous Georgia, a former intervenor that had withdrawn from the proceeding.[2] On September 12, 1986, the Chairman of the Atomic Safety and Licensing Appeal Panel appointed an Appeal Board for the proceeding. By letter dated September 18, 1986, Applicants brought to the attention of the Appeal Board having jurisdiction over the matter and this Board information involving XLPO insulation containing vinyl acetate that was at variance with testimony they had provided at the evidentiary hearing on Contention 10.1. It was

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2 The Appeal Board dismissed the appeal of Campaign for a Prosperous Georgia because of its prior withdrawal from the proceeding. ALAB-851, 24 NRC ____ (October 17, 1986). The Commission has declined to review the matter. Memorandum for Board and Parties from Secretary of the Commission (December 2, 1986).

Applicants' opinion that the additional information should not change the conclusions reached by us. The matter is presently pending before the Appeal Board which has jurisdiction over the Contention 10.1 by virtue of the appeal.

We do not view these circumstances as precluding this Board from taking up the last unresolved issue before it and issuing a concluding partial initial decision. As a condition precedent to the issuance of any operating licenses, it would first have to be initially determined by appropriate authority that the changed information contained in Applicants' letter of September 18, 1986, pertaining to XLPO insulation that contains vinyl acetate, does not lead to a conclusion that is inconsistent with that of this Board on Contention 10.1. We had found that Applicants have provided adequate assurance that certain polymer materials to be employed in components to the VEGP that perform safety related functions are environmentally qualified.

Attached as an appendix is a list of persons providing testimony.

II. FINDINGS OF FACT

Environmental Qualifications - Contention 10.5

1. Contention 10.5 challenges the adequacy of the environmental qualification testing performed upon those models of solenoid valves manufactured by the Automatic Switch Company (ASCO) that are to be used in the VEGP to perform safety related functions. The contention is based upon a 1983 Board Notification (BN 83-128, discussed below) issued by the Staff and cited by Intervenors for the proposition that numerous ASCO valves had performed improperly during certain qualification tests.

Intervenors state that the Staff cautioned against using ASCO valves in any application where conditions could be more severe than those reported in qualification reports. Further, Intervenors related valve failure to exposure of the valves to temperatures in excess of 340°F. Applicants' motion for summary disposition presented the nature of and the results from all of the test programs to which ASCO valves were subjected. Intervenors did not respond to Applicants' motion. The motion addressed the contention issues and presented what Applicants reported as satisfactory test results from all of the test programs. The Board denied the motion, however, because it found that there were certain issues that had been inadequately addressed. The issues identified by the Board in denying Applicants' summary disposition motion are as follows:

(1) Whether any type of failure of any of the tested valve models can result in an unsafe configuration of the valves and/or dampers they control.

(2) Unspecified basis for knowing how long each type of tested valve must remain functional after the initiation of an accident, and for knowing at any time during plant lifetime whether each such valve is capable of its required post accident performance.

(3) Whether moisture leakage into the solenoid housing of any valve specimen can endanger VEGP operation.

(4) Whether manufacturer's specifications regarding valve parameters have been properly considered in evaluating test program results, and the extent to which test duration can induce valve leakage.

(5) The extent to which test results on specific model specimens might be invalidated because of as-manufactured differences between test specimens and production specimens to be used in VEGP.

2. The Discussion section below first deals with the evidentiary materials and factual findings for all of the test programs; next the results for each valve are reviewed against VEGP conditions; then each of the above individual issues is discussed. Applicants presented the prefiled testimony of the following witnesses who appeared as a panel: George J. Baenteli, George Bockhold, Jr., Stephen J. Cereghino, William V. Cersarski and Harold J. Quasny (hereinafter Baenteli, et al., ff. Tr. 517). Staff's prefiled testimony was sponsored by its witness Amando Masciantonio (Masciantonio, ff. Tr. 550). GANE offered the prefiled testimony of Howard M. Deutsch, who appeared as a witness (Deutsch, ff. Tr. 371). The Board has reviewed the professional qualifications of Applicants' and Staff's witnesses and finds them to be appropriate to the subject matter covered. With respect to the GANE testimony presented by Deutsch, specific Board comments are given in later paragraphs.

Discussion

3. Paragraph II.B.2 of our Partial Initial Decision discusses the environmental qualification of nuclear power plant equipment. That treatment, being applicable to this contention as well, is repeated here for convenience.

4. The purpose of environmental qualification at a nuclear power plant is to demonstrate that equipment used to perform a necessary safety function is capable of maintaining functional operability under all service conditions postulated to occur during its installed life. The qualification program must also demonstrate that the equipment in

question is capable of the specific length of operating time required following an accident. Environmental qualification is normally achieved by subjecting a representative piece of equipment to a test program that simulates the expected environmental and service conditions the equipment will see during its installed life, followed by exposure to a simulation of design basis accident environment during or after which the equipment is required to operate. Exposure to the radiation generated by the normal operation of a nuclear plant represents an environmental condition that plant components and equipment must be qualified to endure. The higher radiation doses associated with a design basis accident are not of concern with respect to dose rate effects, since accident radiation effects can be readily simulated. The regulatory requirements for environmental qualification are stated in General Design Criterion 1 and 4 of Appendix A and in Sections III, XI and XVII of Appendix B to 10 CFR Part 50. Specific requirements for environmental qualification of electric equipment important to safety are stated in 10 CFR 50.49. Masciantonio, ff. Tr. 550, at 5-7.

5. Contention 10.5 concerns the environmental qualification of ASCO solenoid valves used to perform safety functions at VEGP. Four models have been identified for such service; their ASCO designations are models NP-8316 (A-16), NP-8320 (A-20), NP-8321 (A-21), and 206-381-6RF (A-6RF). Baenteli et al., ff. Tr. 517, at 5. These valves direct the operation of air-operated process valves and dampers in safety related fluid and HVAC systems by controlling air flow to the air operators on these valves or dampers. By either venting or providing

air to the air operator on the process valve or damper, the ASCO solenoid valve enables that valve or damper to close or open. Table 10.5-1 of the Applicants' testimony lists each of the safety related air-operated valves or dampers at VEGP controlled by an ASCO solenoid valve and describes the function performed by that valve or damper. Baenteli, et al., ff. Tr. 517 at 7-10.

6. The safety function of each ASCO solenoid valve is to vent the operator of the air-operated valve or damper with which it is associated to allow that valve or damper to move to its safety related position. All of the ASCO solenoid valves employed in safety related functions at VEGP are of the normally closed design. This means that when de-energized, which is its safety related position, the solenoid valve blocks the supply of instrument air and vents the air operator of the process valve or damper. The process valves and dampers that are controlled by ASCO solenoid valves are arranged so that the process valve or damper will assume its safety related position, either open or closed, when the air operator is vented. Id. at 8-9.

7. Environmental qualification testing has been performed upon ASCO solenoid valves in two separate generic qualification testing programs, most recently by ASCO and Westinghouse acting jointly and earlier by Isomedix, Inc. on behalf of ASCO. Id. at 19. In addition, Franklin Research Center (FRC) has conducted testing on ASCO solenoid valves in a qualification methodology research test sponsored by the Nuclear Regulatory Commission, Office of Nuclear Regulatory Research.

Masciantoni, ff. Tr. 550, at 3, 11. Each of these test programs is now described.

Testing by Westinghouse/ASCO

8. In 1980 and 1981, Westinghouse and ASCO jointly conducted an environmental qualification testing program for various ASCO solenoid valves. Results of that effort are given in report number AQ8-67368/Rev. 1, August 19, 1983. The test program included two model A-16 valves with ethylene propylene elastomers, two model A-20 valves with ethylene propylene and viton elastomers, one model A-21 valve with a viton elastomer, and one model A-6RF valve with an ethylene propylene elastomer. All were representative of the ASCO solenoid valves used at VEGP. Baenteli et al., ff. Tr. 517, at 19-20. This program was conducted in accordance with the Institute of Electrical and Electronics Engineers ("IEEE") Standard 323-1974, "IEEE Standard for Qualifying Class IE Equipment for Nuclear Power Generating Stations"; IEEE Standard 344-1975, "IEEE Recommended Practices for Seismic Qualification of Class IE Equipment for Nuclear Power Generating Stations"; and IEEE Standard 382-1972, "IEEE Trial-Use Guide for Type Test of Class 1 Electric Valve Operators for Nuclear Power Generating Stations". Additionally, the qualification program was performed in accordance with the methodology set forth in WCAP-8587, "Methodology for Qualifying Westinghouse WRD-Supplied NSSS Safety-Related Electrical Equipment", which has been accepted by the NRC Staff. Id at 21-22.

9. The tests comprising the qualification program consisted of initial performance tests; thermal, mechanical, pressurization, and

normal environment radiation aging tests; vibration aging tests; operating basis earthquake simulation, and resonance search tests; safe shutdown earthquake simulation; design basis event environmental radiation exposure; and high energy line break (HELB) environmental testing. During the course of the tests, valve performance was monitored. While certain anomalies in performance were observed, evaluation of those anomalies demonstrated that they do not affect the qualification of the valves for use at VEGP. The model A-6RF valve and the model A-20 valve (both having ethylene propylene elastomers) successfully completed all phases of the qualification testing. Id. at 22-23.

10. The solenoid core of the model A-20 valve with viton elastomers would not shift when first cycled following the design basis event environmental radiation testing until the operating voltage was increased from 102 V ac to 125 V ac. This occurred because of adherence of the viton dynamic seal to the brass seating surface as a result of viton degradation caused by radiation exposure. As a result, ASCO considers model A-20 valves with viton elastomers to be qualified to the test levels used in the joint Westinghouse/ASCO program only for those applications where the valves are not required to shift position following exposure to gamma doses in excess of 20 megarads. While VEGP does use A-20 valves with viton elastomers in safety related applications, none of these applications would require the valve to shift position after exposure to radiation in excess of 20 megarads. Id. at 24.

11. One of the two model A-16 valves with ethylene propylene elastomers completed a sufficient portion of the HELB environmental testing to simulate operation for more than one year after a design basis accident, which is the length of time that Westinghouse's generic specifications require the valves to be able to operate after such an accident. It then experienced performance problems prior to the completion of the full 30 day HELB test period. In the HELB environmental testing, a period of 3.65 days at 265°F following the second transient simulated one year of actual post-accident service. The model A-16 valve would not actuate at the minimum dc voltage (90 V dc) when energized thirteen days into the test. When the voltage was increased to 125 V dc, the valve actuated and continued to require at least 100 V dc to actuate for the remainder of the thirty day test period. Id. at 24-25. Later inspection of the valve revealed that the increase in the voltage needed to actuate the valve had resulted from moisture and chemical spray entering the valve solenoid enclosure and over time reducing the coil insulation resistance. This moisture entered the solenoid housing through the conduit nipple opening through which the electrical leads provide electric power to the solenoid. In the test, that opening was not required to be leak tight and thus was not hermetically sealed. The seal for the conduit opening is not part of the valve; the conduit seal is supplied by Applicants rather than by ASCO, and Applicants are responsible for its leak tight integrity. Further, Applicants state that moisture entering the solenoid housing of any of the ASCO solenoid valves at VEGP cannot prevent that valve from

performing its safety related function. Id. at 25-28. We agree; for if moisture caused the solenoid of any valve to fail, such a failure would put that valve and the valve or damper it controls into a safe configuration.

12. The other model A-16 valve with an ethylene propylene elastomer performed successfully before, during, and after the HELB environmental testing. Upon disassembly after the full 30 day HELB testing period and the final operational check, the diaphragm of the valve was found to be stuck to the valve body, which caused a tear in the diaphragm. This sticking of the diaphragm was stated as not representing a test failure because it occurred after successful completion of the HELB testing and final operational tests. Moreover, the 30-day testing period to which the valves were subjected in the HELB testing simulated approximately eight years of service after a design basis event, which provided a considerable margin over the one year period that Westinghouse generically specifies that the valves be operational following a design basis event. Id. at 28.

13. In the HELB environmental testing, the model A-21 valve, which had resilient seats made of viton elastomers, would not shift to its de-energized position on the twelfth day of the test period. While the model A-21 valve did not successfully fully complete the full 30-day HELB environmental testing, the 12-day period that the valve continued to operate after exposure to accident conditions represented in excess of a year of post-accident operation at VEGP. Therefore, those test results do provide a basis for concluding that the A-21 valve is

qualified for use at VEGP. However, ASCO restricts their qualification to applications where the valves will not be required to shift position following exposure to gamma doses in excess of 20 megarads. Id. at 28-30.

14. The joint Westinghouse/ASCO testing program qualified the ASCO model A-16, A-20 and A-6RF solenoid valves to the Westinghouse specified generic HELB environmental extremes of (a) a peak temperature of 420°F, (b) pressure of 57 psig, and (c) a chemical spray of 2500 ppm boron buffered with sodium hydroxide to a pH of 10.5. Id. at 30. Based upon the NRC Staff's evaluation of the Franklin tests (discussed later), Westinghouse subsequently modified the temperature profile to which it considers the model A-16 valve to be qualified to reflect a peak temperature of 400°F. Id. at 48-49, also see ¶ II.29, infra.

Testing by Isomedix, Inc.

15. As reported in Isomedix Test Report AQS21678 Rev. A, July 1979, Isomedix, Inc. performed qualification testing for ASCO on several models of ASCO solenoid valves. The test valves included one model A-16, one model A-20, and one model A-21. ASCO also tested a model A-6F valve, which differs from the A-6RF valves used at VEGP only in that it has metallic rather than resilient seats. The models A-16, A-20 and A-21 had resilient seats of ethylene propylene. The testing program was based upon IEEE 323-1974, IEEE 382-1972, IEEE 344-1975, and IEEE 382-ANSI N278.2.1 (Draft 3, Rev. 1 June 1977) "Draft American National Standard for the Qualification of Safety Related Valve Actuators." Id. at 31-32.

16. In this testing program, Isomedix thermally aged the test valves at a temperature of 268°F for twelve days to simulate a design life of four years. During that thermal aging, the valves were continuously energized except for five minutes once every six hours when they were cycled by being de-energized. The valves were then radiation aged and wear aged. Next, the valves underwent seismic simulation, vibration endurance testing, and design basis event environmental radiation exposure. Finally, Isomedix exposed the valves to simulated LOCA conditions. Those conditions included a peak temperature of 346°F and peak pressure of 110 psig that were imposed for approximately three hours. The performance of the valves was observed throughout the tests. As in the Westinghouse/ASCO testing program, certain anomalies occurred in valve performance. Evaluation of those anomalies has shown that they do not call into question the qualification of the valves tested for use at VEGP. The model A-16, A-20 and A-6F valves performed satisfactorily. The model A-21 valve initially utilized by Isomedix in the test program developed excessive seat leakage (50 standard cubic feet per hour) both in the energized and de-energized states after seven days of the thermal aging portion of the test procedure. The cause of the excessive leakage was determined to be dirt in the valve that came from piping attached to the valve as part of the test set-up. Because the source of the performance problems with the model A-21 valve was externally introduced contaminants resulting from a deficiency in the test apparatus, ASCO substituted another model A-21 valve in the test. Id. at 33-34.

17. This new model A-21 valve was thermally aged at 295°F for 100 hours and was cycled every 2 hours. Isomedix chose this higher temperature and lower thermal aging period to accelerate the test program. After approximately 60 hours of this thermal aging, the valve started leaking in the energized state, but it shifted properly and had no leakage in the de-energized state. Isomedix determined that the seat leakage resulted from the softening and resultant degradation of valve elastomer material caused by the higher temperature of 295°F used in the thermal aging. Normal 140°F ambient temperature would not cause noticeable softening of this material. As the valve performed its safety function, the thermal aging continued and the other tests were conducted on this valve in the same manner as on the other test valves. As a result of the seat leakage encountered during thermal aging, ASCO reduced the specified maximum operating pressure differential at which the model A-21 valve can operate from 200 psig to 150 psig. This change resulted in a 25% load reduction on the resilient seat. Id. at 34-35.

18. At the end of the LOCA simulation, the coil of the model A-21 valve had an insulation resistance of less than one megohm, as a result of spray solution in the solenoid enclosure having degraded the coil insulation. The spray solution entered the solenoid enclosure as a result of a breakdown of the plastic covering on the flexible electrical conduit through which the electrical leads to the solenoid passed. That conduit was qualified for peak temperatures of only 120°F. Isomedix concluded that the coil would have been satisfactory except for the adverse effect of the spray solution, which condition resulted from the

use of an unqualified conduit and not from any problem with the model A-21 valve itself. Id. at 35. As noted previously, moisture entering the solenoid housing of any of the ASCO solenoid valves used at VEGP cannot prevent that valve from performing its safety related function. Id. at 26-28.

19. The environmental extremes to which the ASCO valves tested by Isomedix were qualified include (a) a peak temperature of 346°F, to which temperature the valves were exposed for approximately three hours; (b) peak pressure of 110 psig; and (c) a chemical spray consisting of 3000 ppm boron buffered with sodium hydroxide to a pH value of 10. Id. at 36.

Testing by Franklin Research Center (FRC)

20. As reported in NUREG/CR-3424, in 1981 FRC initiated a testing program on ASCO solenoid valves under a contract from the NRC. Id. That testing program was not intended to be an environmental qualification testing program but to be a research program to test qualification methodology. Masciantonio, ff. Tr. 550, at 3-4, 11. The valves tested by FRC included two model A-16 valves, one model A-20, and one model A-21, all with ethylene propylene elastomers. FRC also tested a model A-6F valve, which is the same as the model A-6RF valves used at VEGP except that it has metallic rather than resilient seats. Baenteli et al., ff. Tr. 517, at 36.

21. Following functional tests, FRC artificially aged one of the model A-16 valves and the model A-20, A-21 and A-6F valves to simulate a four-year life at 140°F. Those valves were irradiated to a total

integrated dose of 50 megarads and then exposed to a temperature of 268°F for approximately fifteen days. The valves were cycled 2000 times over the thermal aging period while at that elevated temperature. The other model A-16 valve had been naturally aged by ASCO at 140°F for three years, without any radiation exposure. That valve had been cycled 2000 times at room temperature. Id at 36-37, 39. Following its artificial aging, the model A-21 valve was removed from the test program because of seat leakage. Id. at 38. Applicants concluded that the seat leakage encountered by FRC with the artificially aged model A-21 valve that it tested does not call into question the environmental qualification of that model valve for use at VEGP, as discussed in ¶ II.22.

22. The severity of the artificial aging process employed by Franklin was a primary cause of the A-21 valve seat performance in the FRC tests. The artificial thermal aging process employed by FRC imposed conditions on the elastomer parts of the valves that were far in excess of normal conditions or the standards for accelerated aging established by IEEE 323-1974. Id. at 37. Cycling at high aging temperatures is not a normal condition for the valves and presents a very severe challenge to elastomer parts. Id. at 44. In its test report, FRC acknowledged that its artificial aging process was overly severe. NUREG/CR-3424 at 2-64. In a separate Appendix to NUREG/CR-3424 describing the thermal aging analysis, one of the report's authors concludes that "it was inappropriate to cycle a solenoid valve containing elastomeric seals at ambient temperatures in excess of normal rated ambient temperatures

(140°F/60°C and 180°F/82°C for the valves discussed in this report)." Id. at C-1; Baenteli et al., ff. Tr.517, at 37-38. Because FRC's test conditions were not representative of conditions the A-21 valve might experience in a nuclear facility such as VEGP, the test results have no applicability to and cast no doubt upon the environmental qualification of the model A-21 valve for use at VEGP. Id. at 49-50.

23. All of the valves then underwent pressurization testing, vibration aging, resonance search, seismic testing, design basis event radiation exposure, and a simulated composite LOCA and MSLB exposure. Id. The ASCO model A-6F valve performed satisfactorily through all of the tests. The model A-20 valve functioned throughout the tests. In the functional testing following the completion of the LOCA/MSLB simulation, however, the model A-20 valve did experience seat leakage. No seat leakage had been observed prior to that point, including during the LOCA/MSLB simulation, and the seat leakage did not prevent the valve from being cycled. Id. at 40, 49. These results do not call into question the qualification of the model A-20 valve to the conditions to which it was tested in the Westinghouse/ASCO testing program because of the excessively severe artificial aging process used by FRC. Id. at 49.

24. The model A-16 valve that had been artificially aged could not be cycled properly between the first and second transients of the composite LOCA/MSLB simulation Prior to the start of the second transient, FRC was again able to cycle the valve, which continued to function until four days elapsed time into the second LOCA/MSLB simulation. At that time, the test valve cycled to the open position

(i.e., process cylinder pressurized) when energized but did not transfer back when de-energized. Further attempts to cycle the valve were unsuccessful. Id. at 41. As with the other test valves that FRC artificially aged, the differences in the performance of the artificially aged A-16 valve in the FRC tests and in the prior Westinghouse/ASCO tests can be attributed to differences in test procedures, particularly the overly severe artificial aging procedures used. Id. at 44.

25. The naturally aged model A-16 valve stopped cycling between the first and second LOCA/MSLB transients, began to function again, and continued to operate until 25.6 hours into the second transient. After that point no further cycling could be accomplished. Id. at 42. The Applicants attribute this failure to differences in the testing procedures used in the joint Westinghouse/ASCO testing program and in the FRC tests. The target peak temperature during the LOCA/MSLB simulations in both testing programs was 420°F. The actual temperature peaks reached in the Westinghouse/ASCO tests for the two transients were 440°F and 450°F. For the two transients in the FRC LOCA/MSLB simulation, the temperatures peaked at 450°F and 466°F. Thermocouple data from the test chamber in the Franklin test indicate that the surface temperature of the naturally aged model A-16 valve, which would lag behind the test chamber temperature, reached 410°F, substantially higher than the 350°F to 360°F temperatures reached by any other valve in the test chamber that had a thermocouple either inside its coil enclosure or taped to its body, including the other model A-16 valve.

The substantial difference in the temperatures reached by the two A-16 valves indicates that the mass flow rate and velocity of steam at each valve were different and that the valves in the test were not exposed to uniform conditions. When the valve reached a temperature of 410°F, the elastomer in the valve was well above its damage threshold and would degrade rapidly. Id. at 47-48.

26. With respect to the artificially aged valves in the FRC tests, the NRC Staff discounts their failure, concluding that those test results were inconclusive due to the severe preconditioning to which those valves were exposed. With respect to the naturally aged model A-16 valve, the NRC Staff decided that its failure in the FRC tests did call into question the results obtained with that valve during the joint Westinghouse/ASCO testing program. That model of valve, the NRC Staff concluded (IN 84-23, April 1984; IN 85-08, January 1985), was acceptable for use only under the environmental conditions to which it had been tested earlier by Isomedix. Id. at 42-43. Masciantonio, ff. Tr. 550, at 4, 13-14, 17.

27. In light of the NRC Staff's evaluation of the FRC test results, Westinghouse has modified the generic composite LOCA/MSLB temperature and pressure profile to which it considers the model A-16 valve to be qualified by reducing the peak temperature during each transient to 400°F. A thermal lag analysis performed by Westinghouse for the model A-16 valve, which analysis determines the temperature reached by the valve itself, has shown that upon exposure to the conditions shown in the modified Westinghouse LOCA/MSLB profile, the

valve itself would reach maximum temperature of 346°F that was reached by the model A-16 valve in the qualification testing program performed by Isomedix. Baenteli et al., ff. Tr. 517, at 48-49, also see ¶ 30, infra. The NRC Staff has reviewed the thermal lag analysis and concluded that the approach used to generate the derated Westinghouse generic LOCA/MSLB profile is reasonable and is acceptable as a means of establishing an environmental qualification level for the model A-16 valve. Masciantonio on 10.5, ff. Tr. 550, at 14-15. The Board has independently reviewed the Westinghouse analysis and finds it to be appropriate. We also observe that the only valve failures attributed to valve exposure to an unacceptably high temperature occurred in qualification tests deemed to be unacceptable. Thus the high temperature (340°F) allegation of this contention (¶ II.1, supra) is without merit.

Fitness of Valves for Use in VEGP

28. Having reviewed in the proceeding paragraphs the preoperational environmental testing programs undertaken to qualify certain models of ASCO valves, we turn now to expected conditions and functional requirements for those valves to assess their fitness for duty in the VEGP, based upon the test program results.

29. Applicants describe three duty environments at VEGP pertinent to the performance of ASCO valves: inside of containment, outside of containment and away from main steam isolation valves (MSIV), and outside of containment and near MSIVs. The maximum environmental extremes to which the ASCO valves located inside of the VEGP containment

might be subjected under accident conditions at VEGP are (a) a peak temperature of 400°F, (b) pressure of 50 psig, (c) radiation of 200 megarads total integrated dose, and (d) a chemical spray of 2000 ppm boron buffered with sodium hydroxide to a short term pH (less than 100 minutes) of 10.5 and a long term pH (more than 100 minutes from the beginning of the LOCA) of 8.5. Baenteli, et al., ff. Tr. 517, at 50. Most of the equipment rooms outside of the containment are subject to mild environmental conditions even following postulated design basis accidents. The harshest environment that would be experienced under accident conditions by ASCO valves outside of the containment, except in the MSIV areas, is a peak temperature of 250°F, a peak pressure of 3.5 psig, and radiation of 100 megarads total integrated dose. Id. at 51. The most severe temperature and pressure conditions to which safety related ASCO valves located outside of the containment might be exposed would occur in the MSIV areas. The conditions to which the Applicants have required safety related equipment located in the MSIV areas outside of the containment to be qualified are a peak temperature of 320°F, a peak pressure of 15 psig, and radiation of 50 megarads total integrated dose. The Applicants have recently determined, however, that the peak temperature in the MSIV areas outside of the containment could exceed 320°F in the event of a steam line break outside of containment that resulted in a steam generator tube bundle being uncovered, causing superheated steam to be released. Id. at 51-52.

30. The model A-16 ASCO solenoid valve is used in safety related applications at VEGP both inside and outside of the containment. One

A-16 valve is located in the MSIV area outside containment. It, however, performs no safety related function that could be compromised by a steam line or feed line break in the MSIV area. The A-16 valve has been shown to be environmentally qualified for use at VEGP either inside or outside of the containment by both the Westinghouse/ASCO and the Isomedix qualification testing programs as supplemented by a thermal lag analysis performed by Westinghouse and reported in WCAP-8687, Supp. 2 - H02A/H05A Addendum 2, Rev. 0, January 1985. That thermal lag analysis demonstrated that, for the modified Westinghouse LOCA/MSLB profile with a peak temperature of 400°F, the maximum temperature that would be reached by the model A-16 valve under LOCA/MSLB conditions would be below the maximum temperature of 346°F that was reached by the model A-16 valve under the Isomedix testing program. The temperature conditions to which the model A-16 ASCO valves located inside and outside of the containment at VEGP must be environmentally qualified are enveloped by the conditions profiled in Westinghouse's modified generic LOCA/MSLB profile, which envelops the Staff's accepted accident profile for VEGP. Id. at 54-56; Masciantoni, ff. Tr. 550, at 15.

31. The model A-21 ASCO solenoid valve is used in safety related applications at VEGP only in areas outside of the containment, including the MSIV areas. Baenteli, et al., ff. Tr. 517, at 56. For all safety related applications of the A-21 valve, the most extreme pressure and radiation conditions to which that valve might be subjected are enveloped by the conditions to which it was tested in the Isomedix testing program. The most extreme temperatures to which the A-21 valves

might be exposed at VEGP would occur in the MSIV areas as a result of superheat conditions following a main steam line break. For those model A-21 valves located in the MSIV areas at VEGP, Westinghouse has performed a thermal lag analysis using temperature profiles generated by Bechtel and based upon generic mass and energy release data developed by the Westinghouse Owners Group addressing the superheat issue. That analysis demonstrates that under the worst case conditions, the temperature of the model A-21 valves located in the MSIV areas would not exceed 332°F, which is significantly below the 346°F temperature to which those valves were qualified in the Isomedix tests. Id. at 56-57. Further evidence of the environmental qualification of the A-21 valve for use at VEGP was provided by the joint Westinghouse/ASCO testing program. Although the test valve representative of the model A-21 valve failed during the HELB environmental testing in the joint ASCO/Westinghouse qualification program, that failure did not occur until twelve days into the test sequence, a period which simulated in excess of a year of post-accident operation at VEGP. Id. at 56-57.

32. The model A-20 ASCO solenoid valve is used to perform safety related functions both inside and outside of the VEGP containment, including the MSIV areas. This model of valve has been shown to be qualified for use in the environmental conditions to which it might be exposed at VEGP by the joint Westinghouse/ASCO testing program and the Isomedix testing program. The conditions to which the valve was tested in the Westinghouse/ASCO program exceeded the most severe conditions to which that valve might be subjected at VEGP inside or outside of the

containment in areas other than the MSIV areas. For those model A-20 valves located in the MSIV areas outside containment, the thermal lag analysis performed by Westinghouse for model A-21 valves located in the MSIV areas establishes that the temperature of the ASCO solenoid valves in that area will not exceed 332°F, which is significantly less than the temperature of 346°F reached by those valves in the Isomedix tests. The model A-20 valve is similar in weight and has less surface area than the model A-21 valve. Therefore, it would not reach a peak temperature greater than the peak temperature of 332°F that the thermal lag analysis demonstrated might be reached by the model A-21 valve in the MSIV areas. Id. at 57-58.

33. The environmental qualification of the model A-6RF ASCO solenoid valve has been demonstrated by the joint Westinghouse/ASCO qualification testing program. No model A-6RF solenoid valves are used inside the containment or in the MSIV areas at VEGP. All of these valves are located inside the auxiliary building and are subject to a peak temperature of less than 250°F. Therefore, ASCO solenoid valve model A-6RF is qualified for use in its safety related applications at VEGP. Id. at 58-59.

34. The five specific issues identified by the Board in its denial of Applicants' summary disposition motion (listed at ¶ II.1, supra) are now addressed.

Issue (1)

35. The Applicants testified that the possibility of a failure of an ASCO solenoid valve at VEGP that might result in its associated

air-operated valve or damper not assuming a safe position cannot be eliminated completely. One example of such a failure would be a gross leak of instrument air across the solenoid valve seat that exceeded the exhaust capacity of the valve's exhaust port. This could prevent the associated air-operated valve or damper from attaining its safety related position. The testimony of the Applicants demonstrated, however, that VEGP systems are designed so that no single failure of an ASCO solenoid valve would jeopardize safe plant operation, and the environmental qualification testing performed on the ASCO solenoid valves provides assurance that common mode failures of those valves will not occur. Baenteli et al., ff. Tr. 517, at 60-65. The Staff stated that these tests were properly conducted in accordance with accepted standards, and all anomalies in valve performance were adequately addressed. The Staff further stated that a site audit will be conducted prior to licensing to verify that a record of environmental qualification in accordance with 10 CFR 50.49(j) exists and is maintained. Masciantonio, ff. Tr. 550, at 12, 17. We find that the foregoing adequately addresses valve failures, that no unsafe configuration will occur, and that Issue (1) is resolved in favor of Applicants.

Issue (2)

36. The testimony presented at the hearing demonstrated that for all safety related equipment, including the ASCO solenoid valves, the Applicants have specified in their equipment qualification program that equipment operability for a period of one year following a design basis

event must be demonstrated. That one year period of post-accident operability, however, greatly exceeds the interval for which safety related ASCO solenoid valves at VEGP would actually have to remain operable following the initiation of a design basis accident. The safety function performed by all of the ASCO solenoid valves used at VEGP is to de-energize, thereby venting the air operator of the associated process valve or damper. Once de-energized, the ASCO solenoid valves are not required to shift position again in response to any accident conditions. Those ASCO solenoid valves that are de-energized due to automatic safety signals will complete their safety related function within seconds. The other ASCO solenoid valves would be de-energized by remote manual plant operator action, which would occur within about thirty minutes after sufficient alarm or other indication of the occurrence of the initiating event or in response to plant emergency operating procedures. The de-energization of the ASCO solenoid valves would thus be complete within a few seconds (or at most within several minutes) after the initiation of the design basis event. Baenteli, et al., ff. Tr. 517, at 18-19.

37. The environmental qualification testing performed on the ASCO solenoid valves by Westinghouse/ASCO and Isomedix has established the capability of those valves to withstand accident conditions and continue to operate properly for the period in which they would have to perform their safety related function. In those testing programs the valves were aged to their end-of-lifetime condition for normal environments and then exposed to accident conditions. Following exposure to accident

conditions, the valves were required to continue functioning properly for a period that simulated several years of post-accident operation. Id. at 31, 33. This testing established that the valves would remain operable following an accident for a period greatly in excess of the time during which they might be required to perform their safety related function at VEGP. Id. at 18-19. In addition, as discussed in paragraph 44, infra, Applicants' maintenance and surveillance program will verify that in-service valve performance will be satisfactory. We find that Issue (2) is resolved in Applicants' favor because the bases for post-accident operability and in service availability at any arbitrarily specified time have been satisfactorily explained.

Issue (3)

38. The Applicants testified that moisture entered the solenoid housing of one of the model A-16 valves tested by Westinghouse/ASCO through the conduit nipple opening as a result of the test setup. ASCO does not supply a seal for the conduit nipple opening with its valves. Since the moisture problem originated from a test setup deficiency rather than from the valve itself, that problem does not evidence a potential quality control deficiency with ASCO solenoid valves. Id. at 26. Also, if a similar moisture problem were to occur with any ASCO solenoid valve used at VEGP, it could not affect that valve's ability to perform its safety related function, which is to vent the air operator of the associated air-operated process valve or damper. The design of the solenoid housing is such that the intrusion of moisture into the housing does not affect the ability of the solenoid core to shift into

its de-energized position. Because the ASCO solenoid valves utilized at VEGP perform their safety related function when the coil is de-energized, a valve's inability to shift position when energized to the minimum dc voltage specified, as occurred with the model A-16 valve in the joint Westinghouse/ASCO testing program, does not compromise the valve's ability to perform its safety related function. Id. at 26-28. We conclude that moisture within solenoid housings at VEGP does not compromise ASCO valve safety performance and find that Issue (3) has been properly disposed of in Applicants' favor.

Issue (4)

39. The Applicants testified that for its solenoid valves operating on direct current, ASCO specifies a nominal applied voltage of 125 volts (125 V dc), with an acceptable operating voltage range of 90 to 140 volts. For valves operating on alternating current, ASCO specifies a nominal voltage of 120 volts of 60 cycle alternating current (120 V ac), with an acceptable operating range of 102 to 132 volts. At VEGP, the power supplied to ASCO solenoid valves is designed to be either 124 V dc or 120 V ac, and the extreme voltage values expected on the VEGP electrical distribution system are within the acceptable operating voltage ranges specified by ASCO. Id. at 10-11.

40. ASCO's specifications require that the air supply to the solenoid valves be instrument quality air. The VEGP instrument air system provides a continuous supply of filtered, dry, oil-free compressed air that is of the quality recommended in the Instrument Society of America's Quality Standard for Instrument Air, ISA-S7.3. Id.

at 11. [The Board notes that elastomer integrity can be degraded if the qualify of instrument air is not maintained and if other than manufacturer's recommended solvents and lubricants are used in the cleaning and servicing of valves.] The operating pressure differential for the air supply must range between (a) the maximum differential pressure between the inlet and outlet sides of the valve against which the solenoid can safely operate and (b) the minimum operating pressure differential required for dependable operation. The range of acceptable operating pressure differentials specified by ASCO differs for each model of valve. The operating pressures for the ASCO solenoid valves at VEGP are within the acceptable operating pressure differential range specified by ASCO for each of the models of ASCO solenoid valves used at VEGP. Id. at 11-12.

41. After manufacture and assembly, ASCO subjects each valve to a factory acceptance test that verifies the valve's operability and seat integrity. To pass this test, valves with resilient seats must have no detectable seat leakage. The manufacturing tolerances set by ASCO, however, are not related to leakage rates that would affect valve performance. Id. at 12-13. The amount of seat leakage that would affect an ASCO solenoid valve's ability to perform its safety related function at VEGP, which is to vent the air operator of the associated process valve or damper, would depend upon several factors, including the size of the vent port in the solenoid valve, the resistance to air flow in the instrument piping between the vent port and the actuator pressure chamber in the air operator of the process valve, and the

residual pressure in the actuator pressure chamber. Using a conservative analysis, the Applicants have determined the maximum tolerable leakage rates for the ASCO solenoid valves used to perform safety related functions in the containment and MSIV areas at VEGP to be 3000 SCFH for the model A-16 valve, 75 SCFH for the A-20 valve, and the 555 SCFH for the A-21 valve. Id. at 14-17.

42. ASCO's installation and maintenance instructions for the four types of ASCO solenoid valves used in safety related applications at VEGP state that excessive leakage warrants inspection of the valve. At VEGP excessive leakage in the ASCO solenoid valves would be monitored through operation of and periodic testing of the associated process valve or damper. If, during normal operation or in-service testing, the process valve or damper fails to cycle or cycles sluggishly, then the ASCO valve would be checked. Id. at 13, 67.

43. The Applicants testified that while the seat leakage exhibited by the A-21 valve tested by FRC could have increased had it been subjected to the remaining aspects of the testing program, any additional test results would have had little meaning in light of the overly severe artificial aging to which the model A-21 valve was subjected by FRC. The excessive severity of that artificial aging process was a primary cause of the breakdown of the valve's elastomer material that produced the gross seat leakage found by FRC. Id. at 39. We find that ASCO's specifications are being met for ASCO valves at VEGP and that test duration during preoperational qualification is not a

cause for concern. Thus, Issue (4) has been addressed to our satisfaction.

Issue (5)

44. In their testimony, the Applicants described the manner in which the valve specimens used in the qualification testing were obtained. Those valves were procured from ASCO in the same manner as any valves supplied to a nuclear plant such as VEGP. The valves tested were built using the same production procedures and using the same materials as valves that would be supplied to the field. ASCO's quality assurance program, which has been audited by Westinghouse and other vendors, ensures that materials are not changed in the valves, that material suppliers remain the same, that identical production procedures are followed for every valve, that drawing changes are not made, and that design changes are not made. Everything that can be done to ensure that the valve tested is identical in design, materials, construction, and testing to the valves supplied to a nuclear facility such as VEGP is done. Cesarski, Tr. 537-38.

45. The Applicants also discussed the margins present in the qualification testing. The test conditions to which the test valves were exposed in the joint Westinghouse/ASCO testing program included margins in accordance with requirements of IEEE 323-1974 and 10 CFR 50.49(e)(8). The activation energy employed in establishing the length of the thermal aging portion of the environmental qualification program was the lowest activation energy for any of the materials in the valves. The test conditions selected for the remaining aging portions of the

program were appropriate for a service life of 40 years even though the qualified life of the valves tested was eight years or less. The LOCA/MSLB transients were applied twice in the design basis event portion of the testing program to provide margin as suggested by IEEE 323-1974. The actual peak temperatures reached during the LOCA/MSLB transients were 440°F and 448°F. The Westinghouse specified generic qualification requirement was only 420°F. The actual test pressure during the LOCA/MSLB transients reached a peak of 68 psig, while the Westinghouse specified generic qualification requirement was 57 psig. The valves were exposed to a total radiation dose of 2.05×10^8 rads, whereas the Westinghouse specified generic qualification requirement is 1.82×10^8 rads total integrated dose. Westinghouse specified that the valves be able to operate for one year under post-LOCA conditions. Under the conditions used in the Westinghouse/ASCO testing, 3.65 days simulated that one year of post-accident operation, whereas the test valves were kept under those conditions for 30 days, which simulated approximately eight years of post-accident operation. Baenteli, et al., ff. Tr. 517, at 30-31; Tr. 544-45.

46. The Applicants' testimony also demonstrates that additional margin exists between the most extreme conditions to which the ASCO solenoid valves might be exposed at VEGP and the conditions to which they are qualified. The most extreme conditions to which the Applicants require safety related equipment located inside the containment to be qualified are enveloped by the conditions to which those model solenoid valves located inside the containment, the model A-16 and A-20 valves,

have been exposed in qualification testing. Included in those extreme conditions to which the Applicants require equipment to be qualified are margins of in excess of 40°F for peak temperature, in excess of 15% for peak pressure, and in excess of 20% for radiation. Baenteli, et al., ff. Tr. 517, at 51. Similarly, for those valves potentially exposed to the most extreme environmental conditions outside of the containment, the model A-20 and A-21 valves located in the MSIV areas outside the containment, the maximum conditions to which those valves might be exposed are well below the extreme conditions to which those valves were tested and analyzed. Id. at 54. Thus margin exists both in the qualification testing itself and in the difference between the conditions for which the valves are environmentally qualified and the conditions to which they might be exposed at VEGP. Accordingly, we find that Issue (5) with respect to possible performance differences between tested valves and those to be installed at VEGP is resolved in Applicants' favor, since qualification test results are not invalidated by this consideration.

47. At the hearing, the Intervenors presented testimony on Contention 10.5 from Dr. Howard Deutsch, employed by the Georgia Institute of Technology as a Senior Research Chemist. While the record shows no reason to question the qualifications of Dr. Deutsch as a chemist, his testimony reflected nothing in his educational background, training, or work experience that related to the nuclear industry or the environmental qualification of equipment for use in a nuclear facility. Deutsch, ff. Tr. 371, at 1; Deutsch, Tr. 360-62. His lack of

involvement with subject matters relating to the contention under consideration leads us to give little weight to Dr. Deutsch's testimony in this proceeding. He repeated some of the anomalous valve behavioral results from the tests conducted on ASCO valves that are discussed earlier in this opinion, but he added no additional information; nor did he contradict information provided by Applicants and Staff. He did, however, raise two questions that, while outside the scope of the issues designated for hearing by the Board, were addressed by the Applicants.

48. The first question posed by Dr. Deutsch concerned the adequacy of testing of the ASCO solenoid valves at VEGP as part of the Applicants' maintenance and surveillance program, and whether continued operability of the valves would be adequately assured. The Applicants described generally the procedure by which the maintenance and surveillance program for safety related equipment has been developed at VEGP and discussed the preoperational and in-service testing that will be performed on ASCO solenoid valves and the associated process valves. This testing will verify the functionality of the ASCO solenoid valves and detect any significant degradation in valve performance. Baenteli, et al., ff. Tr. 517, at 65-68; Bockhold, Cesarski, Tr. 540-44. Our own review of the Applicants' proposed maintenance and surveillance program finds it to be satisfactory. (Also see ¶¶ II.B.12 and II.B.13, of our partial initial decision.

49. The second question raised by Dr. Deutsch related to the orientation of the ASCO solenoid valves when installed at VEGP. Dr. Deutsch stated that the orientation of the valves was important and

expressed concern that it had not been adequately considered by the Applicants. Deutsch, ff. Tr. 371, at 5. The Applicants testified that the orientation of the valves had been considered, and the only limitation placed by ASCO upon the physical orientation of the models of solenoid valves used at VEGP was that the model A-6RF valves must be mounted vertically. Those valves are in fact mounted vertically. Cereghino, Tr. 530.

50. We find nothing in the testimony of Dr. Deutsch that contradicts any of the findings on Contention 10.5.

51. The entire hearing testimony of Applicants and Staff on Contention 10.5 is uncontroverted by Intervenor's testimony. We find Applicants' and Staff's testimony to be credible and persuasive. Their evidence addressed to the Board's satisfaction the original contention's challenge as well as each of the litigible issues identified at paragraph II.1, supra. Thus we find that those models of ASCO valves proposed for safety related applications in the VEGP have been acceptably qualified environmentally and that all valves will be used in VEGP in a manner compatible with the parameters of testing.. Additional assurance of the adequacy of these valves will derive from an operational maintenance and surveillance program to be implemented by the Applicants. Accordingly, the Board finds that Contention 10.5 is without merit and that Applicants have prevailed.

Reopened Record

52. During its deliberations about this contention, the Board decided that certain matters seemed not to have been dispositively dealt

with in the evidence of record. For this reason, by letter of October 24, 1986 we apprised Applicants of our perceived need for additional information in affidavit form. In pertinent part, our letter stated as follows:

> For each valve, the testimony gives the following results:

Valve	Test Temperature	Thermal Lag Analysis	Testimony Comment
NP-8316	346°F	345°F	"Accepted by Staff" Id. at 55
NP-8320	346°F	332°F	"Significantly Less" Id. at 58
NP-8321	346°F	332°F	"Significantly Below" Id. at 57

> The Board is seeking to determine whether the cited temperatures provide meaningful margins that would provide confidence that these three valves have been satisfactorily qualified. Additionally, ASCO specification sheets provided as Exhibit F to the cited testimony give "working fluid" and "ambient" temperature values against which we are unable to judge the appropriateness of test conditions. If, during sustained periods of normal operation, the valves are subjected to temperatures significantly in excess of ASCO's recommendations, would this compromise their ability to function as required? More information is needed before the Board can complete its evaluation of Contention 10.5. For example, with respect to temperature margins, the precision or uncertainty of all cited temperatures is needed. With respect to the ASCO specification sheets, an explanation of why the specification temperatures are considered to be compatible with VEGP temperature conditions is also required.

(Citations above are to Applicants' testimony of record, Baenteli, et al., ff. Tr. 517 at 55-58.)

The Applicants responded on October 30, 1986 with the affidavit of S. J. Cereghino and W. V. Cesarski, both of whom appeared before us during the hearing. The nature of that response caused the Board, on

November 6, 1986, to issue an order reopening the record for the limited purpose of allowing us to consider information contained in Applicants' reply, together with any other information provided by the other parties in regard to Applicants' information. Subsequently, reply affidavits were received from Dr. Howard Deutsch, representing GANE, dated November 24, 1986; and from the Staff (A. Masciantonio), dated November 28, 1986. Applicants responded to the Deutsch submittal with affidavits by S. J. Cereghino and W. V. Cesarski and by Cereghino, Cesarski and George Bockhold, Jr. (a former witness) on December 5, 1986. After reviewing these materials, the Board on December 8, 1986 issued an order closing the record. We admit each of the referenced affidavits into the evidentiary record. For reasons discussed below, we decided that none of the information received into the reopened record merits altering our findings heretofore set forth regarding Contention 10.5.

53. The Board's inquiry of October 24, 1986 (excerpted above) addresses two areas of concern: the accuracy and adequacy of temperature margins (differences between qualification test temperatures and anticipated post accident temperatures at VEGP) for the three models of ASCO valves; and the matter of whether the manufacturer's specifications regarding ambient and working fluid temperatures for these valves will be met at VEGP. In our order of November 6, 1986 reopening the record we stated that the second of these two areas does not involve a significant safety issue and it is not considered further.

54. Regarding the concern about temperature margins, in Applicants' response of October 30, 1986 the affiants stated that

qualification test temperatures were measured by thermocouples capable of one degree accuracy and that temperature profiles and the temperature computed by thermal lag analysis were not assigned uncertainty values because they are conservative upper-bound values. October 28, 1986 Affidavit of Cereghino and Cesarski, at 4, 5, 8. Affiants further stated that subsequent to the hearing a Vogtle-specific post accident temperature profile was derived using the methodology of Appendix B to NUREG-0588. Id. at 3. This, they explain, yields a lower temperature profile than was cited in the hearing testimony wherein that temperature profile was based upon a generic Westinghouse analysis. From this Applicants concluded that all three valve types will operate, under worst conditions, at temperatures at least 20°F lower than the qualification test temperatures to which they were subjected, in comparison with the margin affiants state is recommended by IEEE Standard 323-1974, namely, 15°F. Id., passim.

55. In its November 28, 1986 submittal, Staff's affiant A. Masciantonio (also a hearing witness) stated that adequate temperature margins in excess of the IEEE recommendation (accepted by Staff) exist for all valves and detailed the situation for each of the three valves. With respect to valve model NP-8316, Staff stated that the 1°F margin in the Board's October 24, 1986 letter represented an incorrect interpretation of the hearing record. Staff explained why, when properly determined from hearing testimony, the margin (inside the containment) for that valve would be 48°F. As noted earlier (¶ II.30, supra) no model NP-8316 located near a main steamline isolation valve

(MSIV) outside of the containment is called upon to perform a safety related function. Regarding valve model NP-8320, the Staff explained its conclusion that the temperature margin is 21°F for its outside containment, MSIV area location. This is based upon a post hearing assessment by Applicants (approved by Staff) that the temperature to be encountered will be 399° versus the qualification temperature of 420°F. Staff's review and approval of the analysis leading to this expected 399°F temperature will be reported in a subsequent SER Supplement. For the model NP-8321 valve, located outside containment in an MSIV area, Staff relied upon its acceptance, noted in BN 86-19, of Applicants' thermal lag analysis showing a worst case maximum valve surface temperature of 326°F. When compared with the qualification test temperature of 346°F the margin was shown to be 20°F. All of these margins are greater than the Staff accepted margin of 15°F recommended in IEEE Standard 323-1974. Having not yet reviewed the Vogtle-specific downward revised containment temperature profile provided by Applicants' submittal (noted above), Staff neither accepted nor rejected it but held it to be unnecessary to its conclusion that the valves in question have been properly qualified. Staff advised that this revised profile will be reviewed but the results will not be available prior to license issuance. November 25, 1986 affidavit of A. Masciantonio, passim.

56. The November 24, 1986 affidavit of Dr. Deutsch, a hearing witness, addressed several matters:

(a) Board Notification BN 86-18 and BN 86-19;
(b) Several IE Information Notices;
(c) Safety-related versus important-to-safety considerations;

(d) A report "Impacts of Budget Cuts on NRC's Ability to Assure Safety", Victor Stello, Jr., Executive Director of Operations, dated April 30, 1986 (subsequently designated EDO report); and,
(e) Precision and uncertainty of temperatures.

These are summarized seriatim.

(a) Dr. Deutsch's observations regarding the two Board Notifications expressed concern about Staff's acceptance of Applicants' resolution of the matters raised by Staff in BN 86-18. Deutsch then reviewed the anomalous behavior of certain of these valves during testing. He stated that based on these results (we assume this to include the two Board Notifications as well as the test behavior anomalies) he "would not conclude with great certainty that the valves were fully qualified to 346°F." November 24, 1986 Affidavit of Howard Deutsch, 1-4.

(b) Several IE Information Notices relating to problems with ASCO valve field use were identified and related to specific conditions of usage. The Board was requested to find these valves to be unsuitable for use under either normal or accident conditions. Id., at 4-5.

(c) Dr. Deutsch expressed concern that Applicants have not given appropriate consideration to the applicable standard of "important to safety", presumably with respect to where and how the ASCO valves are to be deployed in the VEGP. Id., at 5-6.

(d) The EDO report was cited for two propositions: that anticipated budget cuts leave the future performance of equipment in a TMI-2 type of event significantly more uncertain and increases the risk to the public; and that such budget cuts place in question the

analytical approach used to compute the in-containment post accident temperature profile specific to Vogtle. Deutsch stated that the EDO report represents important infomation, new in the sense that it was not distributed to the parties and to the Board. Id., at 6-7.

(e) Finally, Dr. Deutsch characterized Applicants' response to the Board's question about temperature precision and uncertainty as inadequate and stated that the Staff found the methodology used to compute temperature profiles to be inadequate. He requested that the Board defer the granting of an operating license until such inadequacies are resolved. Id., at 7-8.

57. In one of its affidavit of December 5, 1986 responding to the Deutsch affidavit, Applicants' affiants Cereghino and Cesarski addressed only the Deutsch discussion of the EDO report. From their examination of the EDO report and the Deutsch affidavit affiants explained the reasons why they found no basis to change their conclusion that the valves have been properly qualified. Applicants submitted a separate affidavit of Cereghino, Cesarski and Bockhold in case the Board construed Dr. Deutsch's affidavit as a motion to reopen the record further. Applicants stated that this affidavit demonstrates Deutsch's comments to be untimely and lacking in significant safety issues that would affect the outcome of the proceeding. Applicants' response to Affidavit of Howard M. Deutsch, December 5, 1986 at 4-5.

58. The Board now addresses each of the above filings. Applicants' response to our inquiry about temperature uncertainties established that qualification test temperatures were measured using

thermocouples that are expected to be accurate to 1°F. The temperatures derived from thermal lag and temperature profile analyses represent conservative upper-bound values to which Applicants did not assign errors. This information satisfies the Board's uncertainty about the credibility of the temperature margins stated in Applicants' hearing testimony. The post hearing analysis of a Vogtle-specific post accident containment temperature profile lead Applicants to conclude that ASCO valves within the Vogle containment will experience lower temperatures and hence higher margins than were reported during the hearing, where the expected post accident containment temperature was based upon a Westinghouse generic analysis. From this we may take increased confidence that satisfactory margins will exist, even though (as noted below) the Staff has not yet had the opportunity to review the Vogtle specific containment temperature analysis. For those valves performing safety related functions outside of containment and near MSIVs, Applicants' post hearing analysis for Vogtle shows an expected temperature of 399°F compared with a qualification test temperature of 420°F. Thus the Board is satisfied that all margins will exceed the IEEE recommendation of 15°F.

59. Having reviewed the hearing record and the Staff's response to the Board's inquiry, we now are satisfied that we indeed erred in that inquiry where with respect to valve model NP-8316 we compared a test temperature of 346°F with a thermal lag temperature of 345°F (¶ II.51, supra). Staff explained that the appropriate margin for this valve is 48°F, based upon Applicants' hearing testimony that showed an expected

Vogtle peak temperature of 352°F and a test exposure temperature of 400°F. We are convinced of its correctness. Similarly, we concur in Staff's acceptance of Applicants' analysis of a 399°F temperature value in the MSIV area outside of the Vogtle containment leading to a 21°F margin assigned to valve model NP-8320 for which the environmental qualification test temperature was 420°F. Although not yet having reviewed Applicants' Vogtle-specific containment post accident temperature profile, Staff pointed to the hearing record to show that without taking credit for the lowered Vogtle-specific containment temperature profile, the model NP-8321 valve will have a margin of 20°F versus the IEEE recommended margin of 15°F. For these reasons we are convinced by Staff that our concerns about the size of temperature margins for the three valves identified in our inquiry are without foundation.

60. Items (a) through (e) of the Deutsch affidavit (identified at ¶ II.55, supra) are now discussed. In his treatment of (a) involving Board Notifications BN 86-18 and BN 86-19, we find no probative evidence as to why the Staff should not have accepted as it did Applicants'

response to the Staff's inquiry contained in BN 86-18.[3] (See our discussion of these extra record notifications in our Introduction, at 2-4.) Deutsch's review of the anomalous behavior of certain of the valves adds nothing, because each instance of an anomalous behavior has been explicitly disposed of in previous findings dealing with the hearing record. Hence we do not accept Deutsch's indefinite negative conclusion about valve qualification, further noting that, contrary to his statement, qualifications at temperatures other than 346°F also appear in the hearing testimony. Regarding prior IE Information Notices--item (b)--all such notices cited by Deutsch relate to conditions of usage and maintenance at other nuclear facilities. They comprise matters outside of the scope of Contention 10.5, since they do not relate to environmental qualification testing. Item (c) relates to whether Applicants have taken proper cognizance of items that are important to safety but not necessarily safety related. The contention as filed and litigated has been concerned with qualification of the valves to perform safety related functions. Now Intervenor seeks

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3 Applicants, to Staff's satisfaction, provided main steam line break temperature profiles calculated for the locations in the MSIV area and performed a thermal lag analysis to demonstrate that the surface temperature of ASCO valve model NP-8321 exposed to the calculated conditions was within the surface temperature enveloped by the Staff accepted qualification temperature for the valve. The Staff reviewed the methodology used in calculating the Vogtle specific environmental conditions resulting from a main line steam break in the MSIV area and found it to answer the questions Staff raised.

to introduce a new matter not previously identified as part of the litigated contention. We deem it to be outside of the scope of Contention 10.5 and it cannot be given further consideration in litigating this matter. Item (d) involves the EDO report on the anticipated impacts of budget cuts, which report we have reviewed, it having been submitted as an exhibit to one of the affidavits of December 5, 1986. The two excerpts from the EDO report quoted by Deutsch do not deal with existing regulation but with future research that would provide the basis for revisions to the rules and regulatory guides. They do not pertain to anything that would specifically question environmental qualification of the ASCO solenoid valves at VEGP. They are generic and conclusional in nature and we perceive in them no basis to challenge the adequacy of the qualification test program results. Finally, regarding item (e)--precision and uncertainty of temperatures--Deutsch faults Applicants' response as not being dispositive of the Board's concern. He stated that it is not sufficient to say the thermocouples used to measure test temperatures are capable of an accuracy of 1°F. This is a mere assertion without support and we give no credence to Deutsch's challenge. In addition, Deutsch stated that the Staff has found the methodology used to compute temperature profiles to be inadequate. We have looked for and found no such assessment by the Staff. Again we give no credence to this statement by Deutsch. Nothing in the Deutsch affidavit led the Board to construe it as a motion to reopen the record. If it were Intervenor's intention to do so, Intervenor would have had to comply with the requirements of 10

CFR 2.734, and, if the affidavit were intended to justify any late-filed contentions, Intervenor would have had to comply with additional applicable regulations. No such action was taken. We found it unnecessary to review the Cereghino, Cesarski and Bockhold affidavit. No basis was provided for the Board to inquire further.

61. Having reviewed all of the foregoing materials occasioned by our reopening the record, the Board finds as follows:

--The affidavits of Applicants and Staff convince us that temperature margins and uncertainties are acceptable and appropriate;

--The Deutsch affidavit is devoid of probative evidence that contravenes the information supplied by Applicants and Staff in response to our inquiry.

The Board concludes that none of the information supplied as the result of reopening the record merits altering any of our previous findings regarding Contention 10.5.

Conclusion

62. Applicants have assured that those models of ASCO valves to be employed at VEGP in safely related functions are environmentally qualified. Contention 10.5 is without merit.

III. CONCLUSIONS OF LAW

Based upon review of the entire record in this proceeding including the Findings of Fact and Conclusions of Law contained in the partial initial decision of August 27, 1986, the Board concludes that:

1. As to the contentions addressed in the proceeding, that there is reasonable assurance that, if operating licenses are granted to Applicants, that the activities authorized thereby can be conducted without endangering the health or safety of the public, will not be inimical to the common defense and security and will be conducted in compliance with applicable NRC regulations;

2. As a condition precedent to the issuance of any operating licenses to the Applicants, it first must be determined by appropriate authority that the changed information contained in Applicants' letter of September 18, 1986 to the Appeal and Licensing Boards, pertaining to XLPO insulation that contains vinyl acetate, does not lead to a conclusion inconsistent with that of this Board on Contention 10.1. That conclusion is that Applicants have provided adequate assurance that certain polymer materials to be employed in components of the VEGP that perform safety related functions are environmentally qualified

3. As authorized by 10 CFR 2.760(a), 10 CFR 50.57 and consistent with the condition in 2. above, the Director of Nuclear Reactor Regulations is authorized to issue to the Applicants, upon making requisite findings with respect to matters not embraced in the initial decisions, licenses authorizing operation of VEGP.

IV. ORDER

WHEREFORE, IT IS ORDERED, as permitted by 10 CFR 2.760(a), 10 CFR 50.57, and subject to the condition contained in Paragraph 2 of the Conclusions of Law, that the Director of Nuclear Reactor Regulations is authorized to issue to the Applicants, upon making requisite findings with respect to matters not embraced in the initial decisions, the licenses authorizing operation of VEGP.

Pursuant to 10 CFR 2.760(a), this initial decision will constitute the final decision of the Commission forty-five (45) days from the date of issuance, unless an appeal is taken in accordance with 10 CFR 2.762 or the Commission directs otherwise. (See also 10 CFR 2.764, 2.785 and 2.786).

Any party may take an appeal from this decision by filing a Notice of Appeal within ten (10) days after service of this decision. Each appellant must file a brief supporting its position on appeal within thirty (30) days after filing its Notice of Appeal (forty (40) days if the Staff is the appellant). Within thirty (30) days after the period has expired for the filing and service of the briefs of all appellants (forty (40) days in the case of the Staff), a party who is not an

appellant may file a brief in support of or in opposition to the appeal of any other party. A responding party shall file a single, responsive brief regardless of the number of appellants' briefs filed (See 10 CFR 2.762(c)).

THE ATOMIC SAFETY AND
LICENSING BOARD

Morton B. Margulies, Chairman
ADMINISTRATIVE LAW JUDGE

Gustave A. Linenberger, Jr.
ADMINISTRATIVE JUDGE

Dr. Oscar H. Paris
ADMINISTRATIVE JUDGE

Dated at Bethesda, Maryland
this 23 day of December, 1986.

APPENDIX

PERSONS PROVIDING TESTIMONY

NAME	POSITION	TR. LOCATION AND DATES OF AFFIDAVITS
For Applicants:		
George J. Baenteli	Staff Specialist, Instrument and Controls Group, Bechtel Power Corporation, Norwalk, California	517
George Bockhold, Jr.	General Manager, Plant Vogtle Nuclear Operations, Georgia Power Company, Waynesboro, Georgia	517; Affidavit of December 5, 1986
Stephen J. Cereghino	Nuclear Engineering Group Supervisor, Bechtel Power Corporation, Norwalk, California	517; Affidavits of October 30, and December 5, 1986
William V. Cesarski	Senior Engineer, Equipment Qualification Department, Plant Engineering Division, Westinghouse Electric Corporation, Pittsburgh Pennsylvania	517; Affidavits of October 30 and December 5, 1986
Harold J. Quasny	Equipment Qualification Supervisor, Bechtel Power Corporation, Norwalk, California	517
For NRC Staff:		
Armando Masciantonio	Mechanical Engineer, PWR-A Engineering Branch, Division of Licensing, Office of Nuclear Reactor Regulation, United States Nuclear Regulatory Commission, Washington, D.C.	550; Affidavit of November 28, 1986
For Intervenor GANE:		
Howard M. Deutsch	Senior Research Chemist, School of Chemistry, Georgia Institute of Technology, Atlanta, Georgia	371; Affidavit of November 24, 1986