

September 4, 1979

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSIONBEFORE THE ATOMIC SAFETY AND LICENSING APPEAL BOARD

In the Matter of)
) Doc. Nos. 50-338 OL
VIRGINIA ELECTRIC AND POWER)
COMPANY) 50-339 OL
)
) (Pumphouse Settlement
(North Anna Power Station, Units) and Turbine Missiles)
1 and 2)

VEPCO'S REPLY TO THE PROPOSED FINDINGS OF
INTERVENOR ARNOLD AND THE COMMONWEALTH OF VIRGINIA

This is the response of the applicant, Virginia Electric and Power Company (Vepco), to the Commonwealth of Virginia's Memorandum of Proposed Findings (Commonwealth Findings) and Intervenor Arnold's Memorandum of Proposed Findings Regarding Service Water Pumphouse Settlement (Intervenor Findings), both dated August 20, 1979. We will follow the organization of Mrs. Arnold's findings and address the findings of the Commonwealth in that context.

I. INTRODUCTION

The Introduction to the Intervenor Findings suggests that the recent change in the North Anna 1 and 2 technical specifications makes the power station less safe than before:

1145 275

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Since the technical specification change proposed by the Staff and Vepco allows for increased settlement of the pumphouse approaching the flexible limits of the service water piping system, it follows that implementation of the new technical specification will entail a greater risk to the health and safety of the public.

(Intervenor Findings at 2-3.) The fact of the matter is, however, that the new technical specification as well as the old is designed to require first reevaluation and then plant shutdown long before there can be an effect on the public health and safety. The new technical specification limits are based on the capabilities of the service water piping, whereas the former 0.15-foot limit was based on a prediction of settlement (see Vepco SWPH Testimony 16, 19), but in either case the design limits of the expansion joints may not be exceeded or even approached. In this sense the risk to the public has not increased at all.

The intervenor goes on to complain that the alleged greater risk is not counterbalanced¹ by additional

1/The intervenor's theory seems to be that the settlement limit of 0.15 foot (average settlement), which was based on a prediction of the behavior of the foundation saprolite and not on consideration of the limits of the piping, was at the utmost limit of risk that is acceptable under the Atomic Energy Act and the Commission's regulations; otherwise there would be no need to reduce the risk by "counterbalancing." The record shows, however, that the original 0.15-foot limit was so extremely conservative that a good deal of relaxation of it could occur without endangering the public (see, e.g., Tr. 354-55, Vepco SWPH Testimony 16, 19).

measures to ensure the integrity of the piping system (Intervenor Findings at 3). Vepco does not agree that "additional measures" have not been taken. To comply with the technical specification and to support its request for a technical specification change Vepco did a very conservative reanalysis (Vepco SWPH Testimony 18-19). The NRC Staff has done its own independent review and has imposed new requirements, such as the limit on the settlement of the exposed ends of the service water lines (Tr. 411) and a requirement of monthly monitoring of the flow from the horizontal drains (see Staff SWPH Testimony 45). Also, Vepco testified that over the past few months it had carefully reviewed the settlement monitoring program and had in early 1979 issued a surveying procedure document to define the responsibilities of the surveyor; additional guidance documents were in preparation (Vepco SWPH Testimony 53). It is simply not correct to view what has happened as nothing more than a relaxation of a technical specification limit.

II. VEPCO'S APPROACH TO ENSURING EXPANSION JOINT INTEGRITY

A. Detecting and Remedying Leaks in the Expansion Joints.

1. The Commonwealth's Proposal

Both the Commonwealth of Virginia and Intervenor Arnold are dissatisfied with the testimony that leaks in

the expansion joints, assuming they were to develop, would be detected and remedied. The Commonwealth says in its proposed findings that operator error must be avoided, and for that reason "reactor operators, shift supervisors, and other personnel should be required to complete an orientation and training program with respect to the specific instrument readings and other operational events which would indicate that there is a significant malfunction at the pump house" (Commonwealth Findings at 3).

The record shows, however, that any leak large enough to affect station operations would be detectable by changes in temperature and/or flow (Vepco SWPH Testimony 31, Tr. 183, 224), and that complete loss of service water would be detected "immediately" by low-flow alarms (Vepco SWPH Testimony 33). Also, the station manager testified that the operators are trained to deal with loss of service water flow:

[W]e do have what we call an abnormal procedure, an approved procedure, which is entitled "Loss of Service Water System," and there are several possible causes that you could have a loss of service water system of which one is a rupture of the service water pipe. . . .

The procedure in the control room is very handy in two forms to the operator that he can obtain relatively fast, and, of course, they are trained and retrained

in the use of all abnormal and emergency procedures. That's one of the specifics of the retraining and requalification program for licensed operators.

(Tr. 284-86 (emphasis added); see also Tr. 186-87.) Vepco knows of no evidence in the record that the North Anna operators are inadequately trained in this respect.

2. Visual Detection of Leaks

Vepco testified that leaks from the expansion joints of about 1,000 gpm or more, assuming they were to occur, would flood the expansion joint enclosure, overflow to the ground around the pumphouse, and alert the station operators on their rounds (Tr. 113, 224, 229, 249). The intervenor replies that "reliance" on visual detection of flooding is insufficiently reliable (Intervenor Findings at 5-6). She does not explain why she thinks direct observation is unreliable or cite any evidence, and as a matter of fact the evidence indicates that leaks would be detected by the operators (see, e.g., Tr. 248-49). Even if it were true that visual detection were unreliable, this would be immaterial, because the evidence shows that any leak large enough to affect system cooling capacity would be detectable by instruments (Vepco's SWPH Testimony 31, Tr. 226).

3. Failure Mechanism

Intervenor Arnold says that Vepco was "uncertain" as to the manner in which a pinhole leak might expand (Intervenor Findings 5, citing Tr. 222), but one of Vepco's witnesses testified that the small leaks would, given time and additional cycles, begin to propagate into a continuous circumferential crack (Tr. 240; see also Tr. 178-79, 281-82). The important point is, however, that in actual physical tests the pinhole leaks did not propagate even under conditions that exceeded the design limit by ten percent of the design cyclic lifetime (Vepco SWPH Testimony 29-30). Even if the pinhole leaks were to worsen into a complete circumferential break, tie rods would hold the joints together, and a substantial amount of water would continue to flow (Tr. 223, 298).

Mrs. Arnold also argues that Vepco and the NRC Staff were "largely ignorant" of the previous performance of expansion joints (citing Tr. 222-23, 379), but the applicant's witnesses testified that the joints are not of unusual design (Tr. 222, 241) or materials (Tr. 241) and, as noted above, that similar expansion joints have been subjected to actual physical tests (an "intense" testing program) by the manufacturer (Tr. 240-41, 247-48). An NRC Staff witness testified that he had experience with

similar expansion joints in other applications (Tr. 380).

Also, the Staff's written testimony says this:

Expansion joints are commonly employed in the piping systems of fossil fuel and petrochemical plants and the technology associated with the use of expansion joints is well known. The use of such joints is familiar to staff reviewers. . . .

(Staff SWPH Testimony 58.)

B. Settlement Monitoring

The above demonstrates that the intervenor's criticisms about the detection and remedying of leaks in the expansion joints are not supported by the record, but that demonstration is not crucial to this proceeding. The intervenor's preoccupation with the manner of failure of the expansion joints misses the point: Vepco's position is not so much that it will be able to correct the leaks when they occur, but rather that they will not occur at all (see Tr. 177-78). The monitoring program is designed to detect any additional settlement long before it reaches the point at which either the allowable movement of the expansion joints is exceeded or the service water piping is overstressed; that is the whole point of the technical specification provision that requires a special study if settlement reaches 75 percent of any technical specification limit (see Tr. 417-18; Staff SWPH Testimony

9, 1c).

The conservatism of this approach is well-established in the record. The reevaluation at the 75-percent point is the first line of defense, the 100-percent shutdown limit is the second line of defense, and the additional conservatism in the design of the expansion joints is the third line of defense. With the old technical specification (0.15-foot limit), settlement past the 75-percent mark (primarily due to the installation of the horizontal drains) was detected in March 1978 (Vepco SWPH Testimony 18, 50), over two years after the base date of December 1975, and the 100-percent limit had not been reached over a year later (id., Table 2). Vepco's testimony indicated that the rate of settlement should decrease in the future (see, e.g., Tr. 299). The settlement required to reach the point where the first minor expansion joint failures would occur is on the order of six times the settlement that has been observed since December 1975 (Vepco SWPH Testimony 30). Thus the applicant would have ample time after reaching the 75-percent mark to take any remedial action required (see Staff Testimony 42). The evidence indicates corrective action that could be taken if it became necessary (Vepco SWPH Testimony 27, Staff SWPH Testimony

58, Tr. 177-78, 197, 198-99).

Vepco did testify about the failure of the expansion joints, it is true, but that was in large part because the Appeal Board directed the Company to consider a "failure of the service water system" (Vepco SWPH Testimony 23, 27; ALAB-529, 9 NRC 155-56).² The simultaneous failure of more than one expansion joint is not a credible design basis event that must be designed for, as the intervenor's arguments might imply (Tr. 116, 181, 283, 378, 453-54). (Failure of one expansion joint, of course, is a design basis event (quite apart from the question of pumphouse settlement) and could be safely dealt with even if it were to occur during full-power operation (Tr. 283-85, 377-78, 454).)

C. Analysis and Testing of the Expansion Joints

The intervenor also addressed the monitoring program and the analysis of the expansion joints, but her

2/Thus Mrs. Arnold misses the mark with the argument in the footnote on page 3 of her proposed findings. There she argues that Vepco's "reliance" on the auxiliary service water pumps as a back-up is not well founded. She suggests that the mere fact that Vepco testified that the auxiliary service water pumps could be used as back-ups is evidence that the company lacks faith in the expansion joints (Intervenor Findings, footnote at 3). Mrs. Arnold might have been able to sustain this argument if Vepco had installed the auxiliary pumps solely because of pumphouse settlement but the record does not suggest such a thing.

arguments still are not supported by the record. She suggests, for example, that some sort of direct measurement of the expansion joints would be preferable to settlement monitoring (Intervenor Findings at 4). The evidence shows, however, that the applicant's approach is a reasonable one. Surveying to monitor performance is standard practice (Tr. 446), and the monitoring of settlement of the pumphouse and related points is a part of a much larger and well-established program of monitoring Class 1 structures at the North Anna site (Tr. 448). Because settlement monitoring has been performed for over seven years already, there is a depth of data on which to build and therefore a reason to continue the same approach in the future. Moreover, the expansion joints have protective covers that would make direct measurement of their movement difficult (Tr. 232). Finally, whatever else one can say about the monitoring program, the method chosen by the applicant is definitely conservative (Tr. 288).

This is not to say that the direct measurement approach would not work (see, e.g., Tr. 445, 448), only that the applicant's different approach will work as well. Intervenor Arnold says the settlement monitoring is "indirect and imprecise" (Intervenor Findings at 4), but

the record does not support her. The evidence is that the applicant is performing a Second-Order, Class II survey (Tr. 423; see also Tr. 84-85) and that the surveyors have been getting acceptable accuracy (Tr. 442, 443-44).

The intervenor also suggests that the analysis and testing of the expansion joints by their manufacturer are not reliable (Intervenor Findings at 5). But the evidence shows that the equivalent axial compression of the expansion joints is calculated using the rules and equations of the "Standards of Expansion Joint Manufacturers' Association" (Vepco SWPH Testimony 25), using computer codes that are proprietary to the Expansion Joint Manufacturers Association but that have been accepted by ASME (Tr. 237). The expansion joint manufacturer is a qualified Category I vendor (Tr. 231, 241, 314).

III. PAST MONITORING PERFORMANCE

A. 1977 Stone & Webster Surveys

Intervenor Arnold contends that the applicant's history of surveying constitutes a ground for concern (Intervenor Findings at 6). First, she argues that the failure of Vepco to react to Stone & Webster's survey data of August 1977 throws doubt on Vepco's ability to monitor and report the results in the future. The fact is,

1145 285

however, that neither Vepco nor the Stone & Webster Lead Geotechnical Engineer was aware of the Stone & Webster survey data at the time to which the intervenor refers (Tr. 160, 161, 165, 266-68, 272, 426). The NRC inspector concluded that there did not appear to be any significant differences in the handling and processing of Stone & Webster data of August 3, 1977, and later, when compared to the handling and processing of earlier Stone & Webster data (Staff SWPH Testimony, App. C, Summary of Inquiry at 9, ¶ e).

The Stone & Webster data were handled somewhat informally in any event (Tr. 266, 427), in keeping with their purpose, which was to aid in engineering evaluations (see Staff SWPH Testimony, App. C., "Details" at 4; Vepco SWPH Testimony 14; Tr. 153-54) and there is evidence that Stone & Webster was following "normal construction techniques" (Tr. 430-31). Vepco was relying instead on the more precise and formal surveying program of Moore, Hardee & Carrouth Associates, and the record shows that Vepco reacted in a timely and responsible manner when those data showed the 75-percent limit had been reached (see Vepco SWPH Testimony 18-19; Staff SWPH Testimony, App. C). Likewise, it is on the MH&C data that Vepcc will be relying in the future, and the record shows that the

1145 286

monitoring program and surveying procedures have strict requirements to ensure accurate surveying and prompt reporting (Vepco SWPH Testimony 53; Tr. 124-25, 413-14). Vepco's station manager testified that he will enforce the technical specifications (Tr. 277).

B. 1977 MH&C Data

Next Intervenor Arnold says (Intervenor Findings at 8-9) that the MH&C data from December 1976 through July 1977 should have alarmed the applicant. The three settlement figures to which the intervenor refers are the following:

<u>Date</u>	<u>Average SWPH Settlement (ft)</u>
12/06/76	0.031
3/03/77	0.061
7/11/77	0.063

(Staff SWPH Testimony, App. C, "Details" at 5.)

Intervenor Arnold points out that the second and third of these averages are about twice the first one.

These measurements by MH&C matched the pattern of settlement determined by the Stone & Webster surveyors (see Vepco SWPH Testimony, Fig. 7E), which indicated an increment of additional settlement immediately following the MH&C survey in December 1976.

This particular increment of settlement was not alarming to Vepco's experts because it was attributed to the filling of the reservoir and was therefore not at all unexpected, since it had been predicted (Tr. 163-65, 166; see also Vepco SWPH Testimony 13, Tr. 311). Intervenor Arnold notes that more frequent monitoring was in fact done before July 1977, but this is explained at least in part by the fact that MH&C's instructions from Vepco were to establish a data base by several surveys and to develop information on pumphouse behavior after the filling of the reservoir (Tr. 155-57). What is significant is that when the settlement reached 69 percent of the technical specification limit monthly surveys were undertaken, and a timely report was made when the 75-percent mark was reached (see Staff SWPH Testimony, App. C; Tr. 419, 447).

C. Delays in Receiving Data

Intervenor Arnold notes that in the past there were delays in Vepco's getting the settlement data from MH&C. The evidence shows that Vepco has revised the surveying procedures to ensure more prompt reporting and that the results in recent months have been satisfactory (Tr. 81, 125-28, 414; Vepco SWPH Testimony 53). The applicant is obligated to follow its internal procedures and subject to I&E enforcement (Tr. 414-15). Thus the

intervenor's proposal to include a seven-day requirement in the technical specifications is not supported by the evidence.

D. Establishing Survey Marks

Intervenor Arnold points out (Intervenor Findings at 10-11) that Vepco could have established survey marks on the expansion joints at a better time, but the time of establishing the survey marks has little bearing on the effectiveness of the present-day monitoring program. The evidence reveals that the settlement monitoring program at North Anna has been an evolving one (see, e.g., Tr. 422-23, 440). The crucial facts are that the survey points at the pumphouse are now in place, that they are being surveyed regularly, and that the technical specifications require that they be surveyed in the future.

IV. THE TECHNICAL SPECIFICATION LIMITS

Intervenor Arnold suggests that the Staff-imposed limit on differential movement between either corner of the north side of the pumphouse and the exposed ends of the pipes buried in the gravel filter portion of the dike fill (0.22 foot) (Staff SWPH Testimony 36) is not adequately conservative because it is based on the design allowable of the expansion joints for lateral offset.

The record shows, however, that the Staff's limit on differential settlement is conservative. First, the Staff assumed that the expansion joints had experienced settlement from December 1975 to July 1977, whereas the joints were actually not installed until August and October 1976 (Staff SWPH Testimony 36-38; Vepco SWPH Testimony, Fig. 7E, Tr. 89); thus the Staff has assumed that the expansion joints have experienced settlement for over half a year more than they have in fact. Second, the differential settlement from December 1975 to July 1977 was conservatively chosen as 0.03 foot, near the maximum settlement of the settlement points on the top of the dike (Staff SWPH Testimony 37, Tr. 397).

The intervenor's attempted comparison between Vepco's analysis and the Staff's is misplaced, for the two approaches are somewhat different; the differential settlement, on which the Staff bases its 0.22-foot limit, is only one of the components of the equivalent axial compression (see Tr. 93-94, 96-97). The applicant's witness agreed, however, that the Staff's approach is conservative. He testified that if the full three inches of lateral displacement across the joint were to occur and all the other motions that make up the equivalent axial compression were at their maximum allowable, the joints

would still not have exceeded their elastic limit (Tr. 320, 321, 324, 325). And even at the elastic limit the expansion joints are capable of withstanding more cycles than they will experience during the lifetime of the plant (Vepco SWPH Testimony 29).

Mrs. Arnold proposes that a limit on differential settlement less than the 0.22 foot be imposed (Intervenor Findings at 15, 17), not on any technical basis but rather, it seems, to provide a margin for error. But that is precisely the function of the 75-percent reporting requirement (see Tr. 417-18), and so the intervenor's concern has already been taken into account (see Tr. 439).

The intervenor argues that a limit on average settlement "only slightly greater" than 0.15 foot should be imposed (Intervenor Findings at 16, 17), despite the fact that the original 0.15-foot value was based on a prediction that did not take into account any lowering of the groundwater by a dewatering system (Vepco SWPH Testimony 13). She gives no reason why a limit on "total or absolute" settlement is necessary in addition to the various limits already imposed by the Staff. The Staff has explained the safety considerations behind each such limit (chiefly the goal of avoiding overstressing the service water piping), and the intervenor presents no new

safety considerations (see Intervenor Findings at 16). In fact, her proposal has no technical basis but is rather based on the intervenor's own idea of what is an acceptable margin of safety; the purpose is to "insure that the Staff will receive timely notice of the settlement and be in a position to take appropriate action" (Intervenor Findings at 16). But, again, that is the purpose of the 75-percent reporting requirement. The Staff itself feels that the existing technical specification is adequate to give it timely notice (see Staff SWPH Testimony 42). What is more, the settlement monitoring data are available to the Staff at any time (Tr. 272-74).

V. CONCLUSION

The proposals of the Commonwealth of Virginia and Intervenor Arnold for changing the technical specifications are not supported by the record.

Respectfully submitted,

/s/ James N. Christman
James N. Christman, Counsel
for Virginia Electric and
Power Company

1145 292

Of Counsel

Michael W. Maupin
James N. Christman
James M. Rinaca

Hunton & Williams
P.O. Box 1535
707 E. Main Street
Richmond, Virginia 23212

DATED: September 4, 1979

1145 293

CERTIFICATE OF SERVICE

I hereby certify that I have this day served Vepco's Reply to the Proposed Findings of Intervenor Arnold and the Commonwealth of Virginia upon each of the persons named below by first class mail, postage prepaid:

Secretary
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attention: Chief, Docketing and Service Section

Alan S. Rosenthal, Esquire
Atomic Safety and Licensing Appeal Board
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Michael C. Farrar, Esquire
Atomic Safety and Licensing Appeal Board
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dr. John H. Buck
Atomic Safety and Licensing Appeal Board
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Richard M. Foster, Esquire
1230 A Pearl Street
Denver, Colorado 80203

Anthony J. Gambardella, Esquire
Office of the Attorney General
11 South Twelfth Street, Room 308
Richmond, Virginia 23219

Daniel T. Swanson, Esquire
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

1145 294

Atomic Safety and Licensing Appeal Board
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

By /s/ James N. Christman
James N. Christman, Counsel
for Virginia Electric and
Power Company

DATED: September 4, 1979