UNITED STATES OF AMERICA NUCLEAR REGULATORY COMMISSION

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ATOMIC SAFETY AND LICENSING BOARD JAN 24 10:13

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 No. 50-424-0L 50-425-0L

(ASLBP No. 84-499-01-0L)

DS02

January 23, 1986

MEMORANDUM AND ORDER (Ruling on Motion for Summary Disposition of Contention 10.1 re: Dose Rate Effects)

Introduction

On July 31, 1985 the Applicants for an operating license for the Vogtle Electric Generating Plant (VEGP) filed a motion for the summary disposition of Contention 10.1 pursuant to 10 CFR 2.749. In this contention Joint Intervenors Campaign for a Prosperous Georgia and Georgians Against Nuclear Energy challenge the appropriateness of the methodology used to environmentally qualify certain polymer materials to be employed in components of the VEGP that perform safety related functions. On August 26, 1985 the NRC Staff (Staff) filed a response in support of Applicants' motion. No response has been received from Joint Intervenors. (We do not repeat here our prior discussion of the applicable standards governing summary disposition that appeared in our

8601270019 860123 PDR ADOCK 05000424 order of October 3, 1985 wherein Applicants' motion for summary disposition of Joint Intervenors' Contention 8 was addressed.) For the reasons discussed below we deny the instant motion.

Discussion

10 CFR Part 50, App. A, General Design Criterion 4 sets forth a requirement that components important to the safety of a nuclear power plant must be designed to accommodate the effects of and be compatible with the environmental conditions to which they will be subjected as the result of normal operatio... maintenance, testing and postulated accidents. 10 CFR 50.49 further addresses this matter for electrical equipment. Together, these regulations provide the backdrop for NRC's requirement that safety related components of a nuclear power plant must be environmentally qualified for plant service. Exposure to the radiation generated in a nuclear plant comprises one of the environmental conditions that plant components must be qualified to endure.

In their Contention 10.1 Joint Intervenors cite a Sandia National Laboratory (Sandia) report as establishing that certain polymer materials such as are found in electric cables (insulation and jackets), and in seals, O-rings and gaskets at VEGP will suffer a greater degradation from a lower rate of applied radiation dose than from a higher rate of applied radiation dose even though the integrated (total) doses in both cases are the same. (NUREG/CR-2157, "Occurrence and Implications of Radiation Dose Rate Effects for Material Aging Studies," June 18, 1981). The approximately forty-year service lifetime of a

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nuclear plant makes real time radiation aging of components impractical as a method of predetermining their deterioration with in-service age. For this reason, 10 CFR 50.49 permits the acceleration of radiation aging by exposing components to higher radiation dose rates than will be experienced during normal plant operation. The potentially higher doses associated with a design basis accident are not of concern in this context; such doses are of relatively short duration and their effects can be simulated without regard to dose rate implications. These matters give rise to Intervenors' concern that the total dose effects upon the aging of those polymer materials tested by Sandia have been understated as evidenced by the results of aging tests conducted by Sandia.

Applicants' motion for summary disposition of Contention 10.1, filed on July 31, 1985, is supported by a statement of eleven alleged material facts as to which there are no genuine issues, and by an affidavit of three affiants who are employees of the Bechtel Power Corporation, a contractor of Applicants. Affiants' professional qualifications are appropriate for the subject matter they address. We summarize now the points made by Applicants in support of their motion.

It is generally accepted industry practice to use dose rates on the order of 0.01 to 1.0 megarads (10⁶ rad) per hour for the purpose of accelerating the simulated effect of in-service radiation aging in a nuclear power plant radiation environment. Both the Institute of Electrical and Electronic Engineers (IEEE) and the American National Standards Institute (ANSI) recognize the need for awareness of

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accelerated aging effects. Specifically, IEEE 323-1974 states in pertinent part:

In determining the total required test radiation equivalent to that of service life, consideration shall be given to oxidation gas-diffusion effects [the dose rate effect mechanism in polymers].... Thus, to allow for these effects, a greater total dose than the service lifetime dose should be applied.

"Standard for Qualifying Class IE Equipment for Nuclear Power Generating Stations," IEEE 323-1974 (1974); see also ANSI N41.5-71.

It had been discovered in the Savannah River Plant K-reactor that polyethylene insulation degraded more than anticipated. Sandia postulated that the K-reactor polyethylene degradation might be due to dose rate effects (affiants state that there is no polyethylene used in safety related components at VEGP). The Sandia research effort reported in NUREG/CR-2157 addresses dose rate effects in four specific polymers: ethylene proplylene rubber (EPR), cross-linked polyolefin (XLPO), chloroprene (Neoprene), and chlorosulfonated polyethylene (Hypalon). Reviews by Westinghouse and by Bechtel have shown that at the VEGP there are safety related applications involving these four polymers. Proper equipment qualification tests must address the particular characteristics of each polymer for the function it must perform, <u>i.e.</u>, whether it is the mechanical or the electrical properties whose degradation might impair the performance of the safety related function. At VEGP, typical applications involve the following:

^o wire and cable insulation--EPR and XLPO

° cable jackets--Hypalon and Neoprene

- ° O-rings--EPR and Neoprene
- ° gaskets--EPR and Neoprene
- ° elastomer diaphragms--EPR and Neoprene

The Sandia effort tested EPR and XLPO insulation, and Hypalon and Neoprene jacketing, all obtained from actual electric cable samples. In these tests, only mechanical properties were examined and only the XLPO exhibited discernible dose rate effects at total doses below 10⁶ rads, which is in excess of the maximum total dose that equipment important to safety might incur over forty years of plant service under normal operating conditions. Applicants state that less degradation results from a smaller total dose than from a larger total dose. A built-in conservatism of the Sandia work on mechanical properties results from the fact that the jacket on a cable retards the exposure of the insulation to oxygen. Test results reported in NUREG/CR-2157 were derived from jacket and insulation materials stripped from cable and hence exposed to oxygen in the air. Because of radiation induced acceleration of oxidation, more severe effects could have resulted than might have been the case for materials not stripped from cable samples.

A more recent Sandia test program looked at the electrical properties of XLPO insulation and concluded that the mechanical degradation of this material does not prevent it from performing its required electrical function. ("Equipment Qualification Research Test of Electric Cables With Factory Splices and Insulation Rework Test No. 2," Sandia National Laboratories, NUREG/CR-2932, 2 Vols. (September 1982)). In this test, XLPO insulated electric cable was exposed to a relatively low dose rate (0.062 megarads per hour) for a total dose of 50 megarads. Then, after elevated temperature aging, the cable was exposed to an accident dose of 150 megarads at a rate of 0.77 megarads per hour. Despite severe degradation of mechanical properties, the cable performed its electrical function properly at all times. Applicants do not state, however, whether XLPO was the only polymer whose electrical insulation property was evaluated after exposure to radiation.

A total dose of 200 megarads is used to qualify cables for VEGP. This is about 20% higher than the calculated dose for 40 years of full power normal operation plus a design basis accident dose. None of the Sandia results has shown this margin to be insufficient to compensate for dose rate effects. Sandia concluded that the environmental qualification methodology employed by the nuclear industry to address polymer materials, including accelerated aging, is adequate despite the dose rate effect on the mechanical properties of XLPO.

Additionally, Applicants state that cable samples removed after five and after ten years of service from Duke Power's Oconee Nuclear Generating Unit No. 1 (commercial operation began in 1973) showed that there we wo evidence of more electrical or mechanical deterioration than would be expected in a non-nuclear environment. The average exposure rate for these samples was 0.65 rads per hour during operation and 0.12 rads per hour during shutdown, quite low in comparison with dose rates used by Sandia, but representative of commercial nuclear power plant normal operation. We note that Applicants are

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silent as to the significance of this ten year result in the face of an anticipated plant lifetime of approximately 40 years.

Because of the potential vulnerability of electric cables to mechanical stress following exposure to normal and accident environmental conditions, VEGP cables used in safety related applications have been stress tested following radiation degradation and have passed this test while energized at elevated voltages in excess of the voltages that will be imposed in plant service. We cannot determine from the materials before us what insulation and cable jacket materials were involved in the stress tested cables.

Applicants' affiants conclude that the Sandia studies and the cable life evaluation program at Duke Power Company demonstrate that the dose rate effects observed in NUREG/CR-2157 are insignificant with respect to the environmental qualification of equipment important to safety at VEGP. Counsel for Applicants concludes that there are no genuine issues of material fact to be heard and thus the motion should be granted. We are left to infer from the affidavit that other VEGP applications identified in the contention for the other polymers of concern are not suspect. Applicants' counsel touches briefly upon these other polymers without reference to the applications ident⁴, ied by the contention.

The Staff's response (of August 26, 1985) to the Applicants' motion for summary disposition of Contention 10.1 is supportive of that motion. Staff's response is supported by its critique of Applicants' statement of material facts not in issue, by its own statement of facts not in

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issue, and by the affidavit of an affiant whose professional qualifications we find to be satisfactory. Although the affiant felt it necessary to clarify the Staff's position with respect to two of the Applicants' statements of fact, he concluded that such clarification does not detract from Staff's position that Applicants' motion should be granted. Except as just noted, Staff's response does not explicitly disagree with the thrust of Applicants' motion. In acknowledging its awareness of the possibility of dose rate effects, Staff points out that Regulatory Guide 1.33, Revision 2, requires applicants for an operating license to develop and implement surveillance and maintenance procedures for detecting age-related degradation and to take corrective action before a safety problem develops. The Board's review of Regulatory Guide 1.33 Rev. 2 did not identify such specific guidance. Applicants have described their approach (to Staff) for complying with this requirement for VEGP. This approach has been reviewed by the Staff and found to be acceptable. Further, the Staff states that it will verify that such a surveillance effort is actually developed and implemented and that said effort will specifically address unanticipated age-related degradation of electric cable insulation. If Applicants' surveillance effort is indeed yet to be developed, as stated by Staff counsel and by Staff's affiant, we need to know what it is that Applicants have submitted and Staff has already reviewed and approved. Additionally, we note that Applicants' motion is silent on this matter.

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Staff Counsel and Staff's affiant are consistent in stating that, because of the Staff-imposed operational surveillance program, unanticipated radiation induced degradation effects of polymers in safety related components at VEGP will be detected before a safety problem can arise. From this, both conclude that Applicants' motion should be granted. Staff's conclusion, however, appears to be founded upon a guite different consideration than is Applicants' with respect to why Applicants' motion should be granted. Staff seeks to assure the Board that we may rely upon Staff for verification of the implementation of the surveillance program. Staff finds this situation similar to that involved with Contention 10.3, wherein the Board accepted Staff's stated intent to verify certain facts stated by Applicants. We construe the present situation to be different; here we are told by Staff about a requirement not addressed by Applicants, we are given no details about the requirement, and we are given no information about what has been approved to date.

Having reviewed all of the foregoing, the Board concludes that we do not have sufficient information to enable us to grant Applicants' motion, and that genuine issues of material fact remain to be heard. For the convenience of the parties, these issues are restated here:

- ^o The Board is unaware, from the information submitted, whether XLPO is the only polymer whose electrical insulation property was evaluated subsequent to radiation exposure.
- ^o Applicants have not stated what significance is to be derived from results of the Duke Power Company's cable surveillance program, vis-a-vis a 40 year service life in VEGP.
- The scope and results of the mechanical stress tests on prototype VEGP cables are not explained.

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- Applicants have not explicitly addressed the polymer applications other than cable jackets and insulation identified by Intervenors.
- Regarding the Staff-imposed operational surveillance program, about which Applicants are silent, the Board has been unable to identify from the materials before us what it is that Staff will require of Applicants, the nature of Applicants' submittal that has been approved by Staff, what is yet to be developed in satisfaction of Staff's requirement, and how and on what schedule the Staff will want said program to be implemented.
- The Staff's reliance upon a future operational surveillance program as justification for granting Applicants' motion rather than upon the efforts and accomplishments reported by the affidavit of Applicants is not satisfactorily explained.

We will require that these issues be addressed further during the forthcoming evidentiary session.

ORDER

Gwing to the existence of unresolved issues of material fact noted above, the Board denies Applicants' motion for the summary disposition of Contention 10.1 and the contention will be litigated as to the issues identified.

> THE ATOMIC SAFETY AND LICENSING BOARD

hang Morton B. Margulies, Chairman

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ADMINISTRATIVE LAW JUDGE

erger \$30,64 Gustave A. Linenberger, Jr.

ADMINISTRATIVE JUDGE

Dr. Oscar H. Paris

ADMINISTRATIVE JUDGE

Dated at Bethesda, Maryland this 23rd day of January, 1986.