UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of:	)	
	)	Docket No. 50-335 OLA
FLORIDA POWER AND LIGHT COMPANY	)	
	)	ASLBP No. 88-560-01-LA
(St. Lucie Plant, Unit No. 1)	)	

INTERVENOR'S RESPONSE TO LICENSEE'S MOTION FOR SUMMARY DISPOSITION OF INTERVENOR'S CONTENTION 6

I. LEGAL STANDARDS FOR SUMMARY DISPOSITION

Under both the Commission's and Federal Court Rules of Practice, "the burden of proof lies upon the movant for summary disposition, who must demonstrate the absence of any issue of material fact." Adickes v. Kress and Co., 398, U.S. 144, 157, Perry ALAB-443, supra, 6 NRC at 753. Again under both NRC and Federal Rules, "the record is to be reviewed in the light most favorable to the party opposing the motion." Dairyland Power Cooperative, 16 NRC 512, 519(1982) citing: Poller v. Columbia Broadcasting System Inc., 368 U.S. 464, 473(1962); Crest Auto Supplies Inc. v. Ero Manufacturing Co., 360 F. 2d, 896, 899 (7th Cir. 1966); United Mineworkers of America, Dist. 22 v. Ronoco, 314 F. 2d 186, 188 (10th Cir. 1963); Pennsylvania Power & Light Co. and Allegheny Electric Co-operative Inc. (Susquehanna Steam Electric Station, Units 1 and 2) LBP 81-8, 13 NRC 335, 337 (1981); Seabrook, LBP-74-36, supra, 6 NRC, supra, 7 AEC at 879.

"Because the proponent of a motion for summary disposition has the burden of demonstrating the absence of a genuine issue of material fact, it does not necessarily follow that a motion supported by affidavits will automatically prevail over an opposition not supported by affidavits. The Board must scrutinize the motion to determine whether the movant's

burder has been met." Carolina Power & Light Company and North Carolina Eastern Municipal Power Agency (Shearson Harris Nuclear Plant, Units 1 and 2) LBP-84-7, ASLBP No. 82-468-01-OL, 19 NRC 432 (1984).

Finally, for a contention to remain litigable, the Intervenors must present to the Board a sufficient factual basis, "to require reasonable minds to inquire further." Pennsylvania Power and Light Company and Allegheny Electric Cooperative Inc., (Susquehanna Steam Electric Station Units 1 and 2) ALAB 613, 12 NRC 317, 340 (1980).

II. INTERVENOR'S CONTENTION 6

The purpose of this response is to address Intervenor's Contention 6 which states:

> Contention 6: The proposed use of high-density racks designed and fabricated by the Joseph Oats Corporation is utilization of an essentially new and unproven technology.

1. The Quad Cities' study identified mechanical restraint as one possible contributing cause of gap formation in Boraflex panels. However, there is no certainty to this conclusion as they are not sure that the adhesive can even stand up to low level, radiation exposure. "From the outset it should be noted that the mechanisms for gap formation and gap growth described are preliminary as the extent of data currently available is limited. As such, any conclusions drawn from this material are preliminary and may change as more data relative to Boraflex behavior under irradiation is documented. ... experiments will probably be required to determine the causes for all effects noted." (Quad Cities, pg. 8-1).

2. In a testing program utilizing 2" x 2" Boraflex samples encapsulated in an essentially stress free manner the Point Beach study concluded,

"However, their(the Boraflex samples) physical integrity showed deterioration at doses of 1 x 10^{10} rads gamma and greater." (Point Beach, pg. 1)
It should also be noted that the temperatures in the Point Beach spent fuel pool were 70°-90° F. This is significantly less than the temperatures predicted for the spent fuel pool at St. Lucie Unit No. I. The Quad Cities study has indicated that water temperature may play a significant role in degradation of Boraflex.

4. Experimental irradiation programs conducted on Boraflex subsequent to the discovery of gaps at Quad Cites have shown that upon irradiation Boraflex undergoes shrinkage and hardens. As has been discusssed many times before, one, potential explanation for a contributing cause of gap formation may be mechanical restraint of the Boraflex panels. Many other factors are suspected as causing gap formation also.

5. The Quad Cities study clearly indicated that although there is no loss in Boron-10 content in the panels, "The shrinkage of Boraflex and subsequent formation of gaps in the Boraflex absorber panels results in a redistribution of the neutron poison material in the spent fuel storage racks. In the gap region, the absence of neutron absorber in one or more panels results in a net local increase in reactivity as well as an increase in the reactivity of the entire storage cell." (Quad Cities, pg. 9-0.) Also, all reactivity calculations in the Quad Cities study were done using a maximum fuel enrichment of 3.2 w/o U-235 and not 4.5 w/o U-235 or even 4.0 w/o U-235 as is presently utilized in St. Lucie I.

6. I am glad that in the manufacture of the St. Lucie I storage racks care was exercised to avoid excessive, mechanical restraint that might contribute to the formation of significant gaps in the Boraflex.

7. The neutron attenuation function at St. Lucie I will be achieved by the combined action of water and a widely used neutron absorbing material, Boraflex. However, the Quad Cities' study has shown that where gaps develop in the Boraflex a net local increase in reactivity results as well as an increase in the reactivity of the entire storage cell.

8. Boraflex is comprised of a polymeric silicone encapsulant entraining and fixing fine particles of boron carbide in a homogenous, stable matrix. The carbides are inherently stable. The silicones are clearly unstable. Quad Cities' study clearly detailed the scissioning of the polymer and the accompanying substitution of methyl groups resulting in two, different polymers. Both different from the first. The durability of these polymers when subject to long term, gamma radiation is unknown. Also, the carbon off gas reported in all studies is a result of the breakdown of the polymers.

9. The suitability of Boraflex as a long-term neutron absorber is highly questionable at this time. Much more information needs to be developed. "The data which are currently available relative to changes in physical and mechanical properties of Boraflex with increasing irradiation are somewhat limited." (Quad Cities, pg. 7-7). "From the outset it should be noted that the mechanisms for gap formation and gap growth described are preliminary as the extent of data currently available is limited. As such, any conclusions drawn from this material are preliminary and may change as more data relative to Boraflex behavior under irradiation is documented. Further experiments will probably be required to determine the causes for all effects noted." (Quad Cities, pg. 8-1). "Accordingly, it is possible that the rate of gap growth may slow at higher doses. Unfortunately, there is not currently available low dose data to support this contention." (Quad Cities, pg. 8-8)

In concluding, the Quad Cities' study states unequivocally, "This report describes the results of a preliminary assessment of Boraflex performance in the Quad Cities spent fuel storage racks. The results are considered preliminary since there are areas where data are not available. This is particularly true with respect to Boraflex shrinkage over the intermediate range of gamma exposures to which the Quad Cities racks have been exposed as well as the long term stability in the spent fuel pool environment. Accordingly, as additional data becomes available, the conclusions developed as a result of the preliminary assessment could change." (Quad Cities, pg. 10-1)

10. Radiation exposure tests of Boraflex at total equivalent doses of 10^{12} rads were performed at the University of Michigan, Ford Nuclear Reactor during 1979-1981. It is important to note that this is a measure of a cumulative exposure to both gamma and neutron radiation. In the spent fuel pool environment the would be almost exclusively the more destructive gamma radiation. This difference was also noted in the Quad Cities' study. "Accordingly, it must be noted that differences in irradiation environment exist between the test experiments and the Quad Cities spent fuel pool." (Quad Cities, pg. 6-1)

11. The results of these tests are brought into question in the Quad Cities' study. "The data is variable but the general trend is about 2-3% shrinkage in width and up to 8% in thickness. The accuracy of these measurements is not known but it is suspected that accurate dimensional measurements on small samples would be difficult." (Quad Cities, pg. 6-2) In evaluating the results of the Ford Nuclear REactor Test, the Quad Cities' study further qualifies the data by saying, "Since the physical dimension data may not provide a reliable indicator of the total extent of Boraflex shrinkage, the weight and specific gravity data from References 4,5, and 6 have been evaluated." (Quad Cities, pg.6-3)

11.a. The Quad Cities study casts additional doubt on the relevance of the Ford Reactor study. "Furthermore, uncertainties may be present owing to the extrapolation of test data from small test samples to a 152" length of Boraflex." (Quad Cities, pg. 8-6). Because of the difference between the test conditions and the pool environment, it is difficult to project long term integrity based on the test data. We have noted potential effects due to neutrons in the irradiation tests. As noted above, chemical effects may be important as well." (Quad Cities, pg. 8-10).

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12. Licensee's proposed surveillance program does not make sense in light of the results of the Point Beach study. Point Beach engaged in a surveillance program almost identical to the one proposed by the Licensee. However they stated, "We have concluded from the comparison of the two programs that the samples are not representative of the full-length Boraflex inserts." (Point Beach, pg. 2) They are amending their surveillance program in the following manner. "Since the samples do not appear representative of the full length Boraflex sheets and have limited value in predicting the onset of Boraflex degradation in the spent fuel racks, we will terminate the Point Beach surveillance program in REI-25..." (Point Beach, pg. 2) It should be noted that Point Beach plans to examine full-length Boraflex sheets on a periodic basis. St. Lucie Unit I spent fuel pool racks would not be able to be subject to this type of recommended surveillance.

13. Licensee's assertion that Boraflex may not receive a cumulative dose that exceeds 10^{12} rads gamma may be true. However, that is well past the point at which degradation of the material may occur according to both the Quad Cities' and Point Beach sudies. This degradation leads to gap formation and thus, increased reactivity. "However, their(Boraflex samples) physical integrity showed deterioration at doses of 1×10^{10} rads gamma and greater." (Point Beach, pg. 1) In addressing the concerns of Contention 3, Intervenor cites numerous other sources that indicate that severe degradation of the Boraflex material can occur prior to a cumulative exposure of 1×10^{10} rads gamma. In addition, Quad Cites raises the substantive issue that the greatest cemical degradation of the polymer may occur at low level

exposures. Lack of extant data on this issue makes any conclusion difficult.

14. We know that the Licensee is utilizing a new and different rack design in order to ameliorate the hypothesized effects of stress due to rack design. He admits as much in paragraph 27 of his Motion for Summary Judgement in discussing Contention 6. Licensee, in his original application for wxpansion of the spent fuel pool dated 12 June 1987, on page 6 of Attachment II, states that the vendor has constructed only 10 other racks of similar , not identical, design. We have no information on where these racks are in service or the length of time they have been in service and the performance of the racks and Boraflex in service.

15. Jospeh Oats Corporation has extensive experience in the manufacture of spent fuel storage racks using Boraflex panels. Unfortunately, their rack design and fabrication are considered significant causes of degradation in the neutron absorber in Quad Cities.

16. Intervenor wonders at what point an admittedly, "...direct adaptation of established technology...", becomes a new technology. Intervenor contends that if, as Licensee contends, that the method used to affix the Boraflex to the racks is the primary cause of gap formation, then a new method designed to avoid inflicting these same stresses on the panels is an essentially new method of affixing the panels and putting them in service. Where is the proof that this new method will not cause stress on the panels leading to gap formation? If I own an axe. The handle breaks and I buy a new plastic handle. Then the head breaks and I buy a new head. Do I still own the same axe?

17. Intervenor has extensively discussed the overwhelming lack of certainity that is revealed by the Quad Cities and Point Beach studies as to the exact cause of gap formation. The restraining effect of the adhesive may act as one contributing cause. "The long term stability of the dimethyl polysiloxane matrix which contains the B_4C powder in Boraflex cannot be projected at this time. The qualification program conducted by BISCO examined radiation effects and long term exposure to an aqueous environment separately. The combined effects after crosslinking saturates and scissioning predominates may likely depend on such factors as pool water chemistry, water temperature, and local flow conditions around the Boraflex panels." (Quad Cities, pr. 10-6). Obviously, other factors are also at work here.

18. If the Boraflex panels are allowed to undergo total, in-plane shrinkage, this may tend to promote isotropic shrinkage. Isotropic shrinkage is suspected of causing even larger gap formation in the Boraflex panels. "If for the moment it is assumed that volume changes are isotropic, this would correspond to a change in any dimension of the Boraflex sheet of 6.66%. For a sheet of Boraflex 152 inches long, this would correspond to a maximum gap of approximately 10 inches." (Quad Cities, pg. 8-5) However, this conjecture itself is qualified by introduction of a new variable that may effect Boraflex degradation. "Whether the Boraflex is isotropic or not may depend on the process used to manufacture the sheet material." (Quad Cities, pg. 8-8)

19. St. Lucie I storage racks are designed to provide complete, in-plane dimensional changes to the Boraflex. Whether they can achieve this remains to be proven. Intervenor contends that the Quad Cities racks were designed to

hold the Boraflex panels in place without any degradation due to stress. The manufacturer's best intentions are no guarantee of a satisfactory result. They are certainly no substitute for proof.

20. The driving mechanism of any Boraflex degradation is radiation induced changes in the chemical structure or the structural integrity of the Boraflex. Changes in Boraflex's chemical structure or structural integrity are significant only to the extent that they cause or result in the loss of boron or cause the formation of gaps and hence, reduce the effectiveness of the Boraflex in attenuating the reactivity. Intervenor finds Dr. Turner's statement in paragraph 39 of his affidavit wholly inadequate in light of the Quad Cities study.

21. Tests have confirmed no significant loss of boron in samples suffering exposure up to 10^{12} rads. However, the Quad Cities study clearly shows the changing of the essential, chemical structure of the polymer into two, new polymers long before a cumulative exposure of 10^{10} rads. "Data from gas evolution measurements as well as calculations of the dose required to crosslink all available sites suggests the crosslinking (and hence shrinkage) is probably complete at an exposure of 1 to 2 x 10^{10} rads." (Quad Cities, pg. 8-5) This crosslinking leads to degradation of the Boraflex, which leads to gap formation. "Long before the accumulation of this dose (10^{10} rads), the polymer will probably be severely changed and the G(XL) value will have changed." (Quad Cities, pg. 7-6).

22. The testimony and calculations of William Boyd at the Turkey Point proceedings indicate that with an initial enrichment of 4.5 w/o U-235 and with the presence of gaps in four panels of approximately four inches, the

limiting reactivity of 0.98 would be exceeded. See Figure 2 of attachment A. The Turkey Point racks in Region I had a center-to-center spacing of 10.6 inches and a Boron-10 density of 0.020 gm/cm^2. The racks at St. Lucie I have a center-to-center spacing of only 10.12 inches and a Boron-10 density of 0.020 gm/cm^2. Thus the calculations of Mr. Boyd would be relevant to these proceedings.

23. The conclusions of the Quad Cities study are quite clear. Very little information concerning the performance of Boraflex in service is available and many more questions remain. "Projections of the overall service life of Boraflex in a spent fuel pool environment are not possible at this time. The results of a larger program in which data from surveillance coupons from several U.S. plants is gathered and evaluated may provide some answers." (Quad Cities, pg. 8-11). There remains confusion as to the maximum, potential gap size. "The magnitude of the maximum gap size is difficult to project owing to primarily two factors. First, there is a lack of volume change data in the exposure range of 10^8 to 10^{10} rads. Second, it is not known whether the Boraflex manufacturing process causes shrinkage to be anisotropic." (Quad Cities, pg. 10-5).

24. The Atomic Safety and Licensing Board in their decision of 28 July 1988, regarding the Turkey Point reracking noted that, "The testimony of witnesses for both the applicant and the staff cited the Boraflex degradation that had occurred in the spent fuel storage racks at the Quad Cities nuclear facility. That degradation brought about, among other things, gaps (i.e. holes) in the Boraflex sheets incorporated into those racks. Whether such gaps will be experienced at Turkey Point remains to be seen. Should gaps develop,

however, they would have an effect upon the neutron absorption efficacy of the Boraflex sheets." (Attachment B, pgs. 8-9) The Board went onto state further that, "But, should the enrichment level be 4.5 weight percent, there will be much less room for confidence that any gaps at Turkey Point will not occasion the violation of the limit." (Attachment B, pg. 9).

25. The Board also made note of the testimony of staff witness, James Wing. "According to staff witness, Dr. James Wing, the mechanism causing gap formation remains undetermined." (Attachment B, pg. 9).

26. In conclusion, Intervenor contends that the Licensee has not met their burden of proof on this contention and that several issues of material fact remain on this contention. One, what is the anticipated service life of the Boraflex. Two, what are the essential mechanisms for gap formation. Three, has it been proven that no gaps will develop in the St. Lucie I panels. Four, what is the maximum gap size that can be expected. Five, what process of gap formation will allow criticality to exceed the required limits in either Region I or Region II. Six, if the construction method is different from previously used methods of construction, is it different enough that it constitutes a new and untested method of fabrication. If not, is it different enough that it will not cause the same problems that have been identified at Quad Cities.

Respectfully submitted,

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