

10-22-76

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

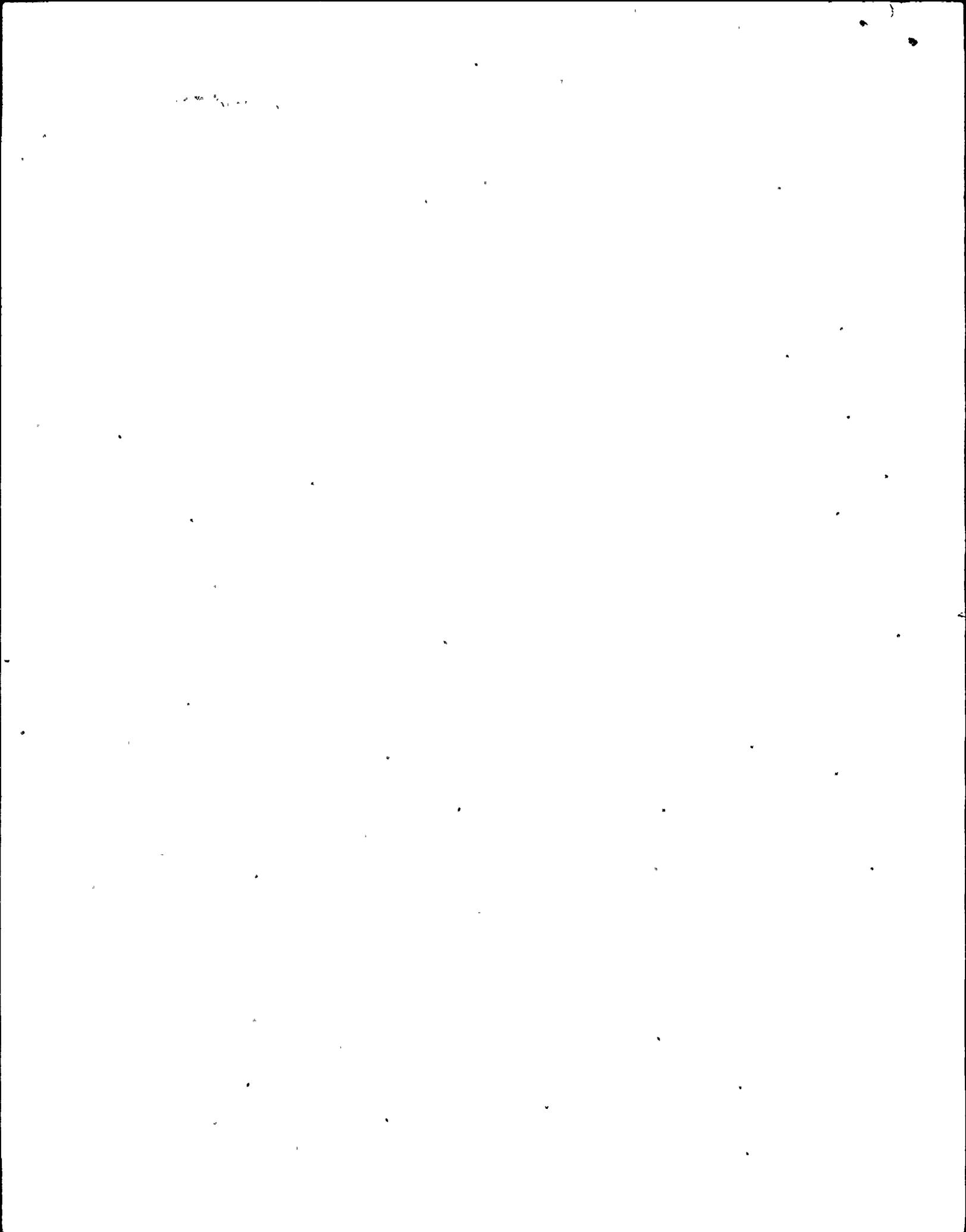
In the Matter of )  
PACIFIC GAS AND ELECTRIC COMPANY )  
(Diablo Canyon Nuclear Power Plant, )  
Units Nos. 1 and 2) )

Docket Nos. (50-275 O.L.)  
50-323 O.L.

INTERVENORS' SUPPLEMENTARY  
ANSWER TO NRC STAFF'S MOTION  
FOR SUMMARY DISPOSITION

On September 7, the Staff of the Nuclear Regulatory Commission moved this Board to dispose summarily of several environmental issues. These issues encompassed damage to marine biota, the economics of nuclear power generation, and radiation pollution, three issues relating to nuclear power over which responsible members of the scientific community have clashed in recent years.

The Staff's Motion for Summary Disposition was based upon Intervenor's Answers to Interrogatories submitted last summer before Intervenor obtained the assistance of any technical consultants. However, when the Staff submitted its Summary Disposition Motion, the Staff knew that Intervenor had retained counsel recently and were just beginning to obtain the assistance of technical consultants. By moving for Summary Disposition, the Staff apparently sought to cut off the three issues from consideration before responsible scientists acting

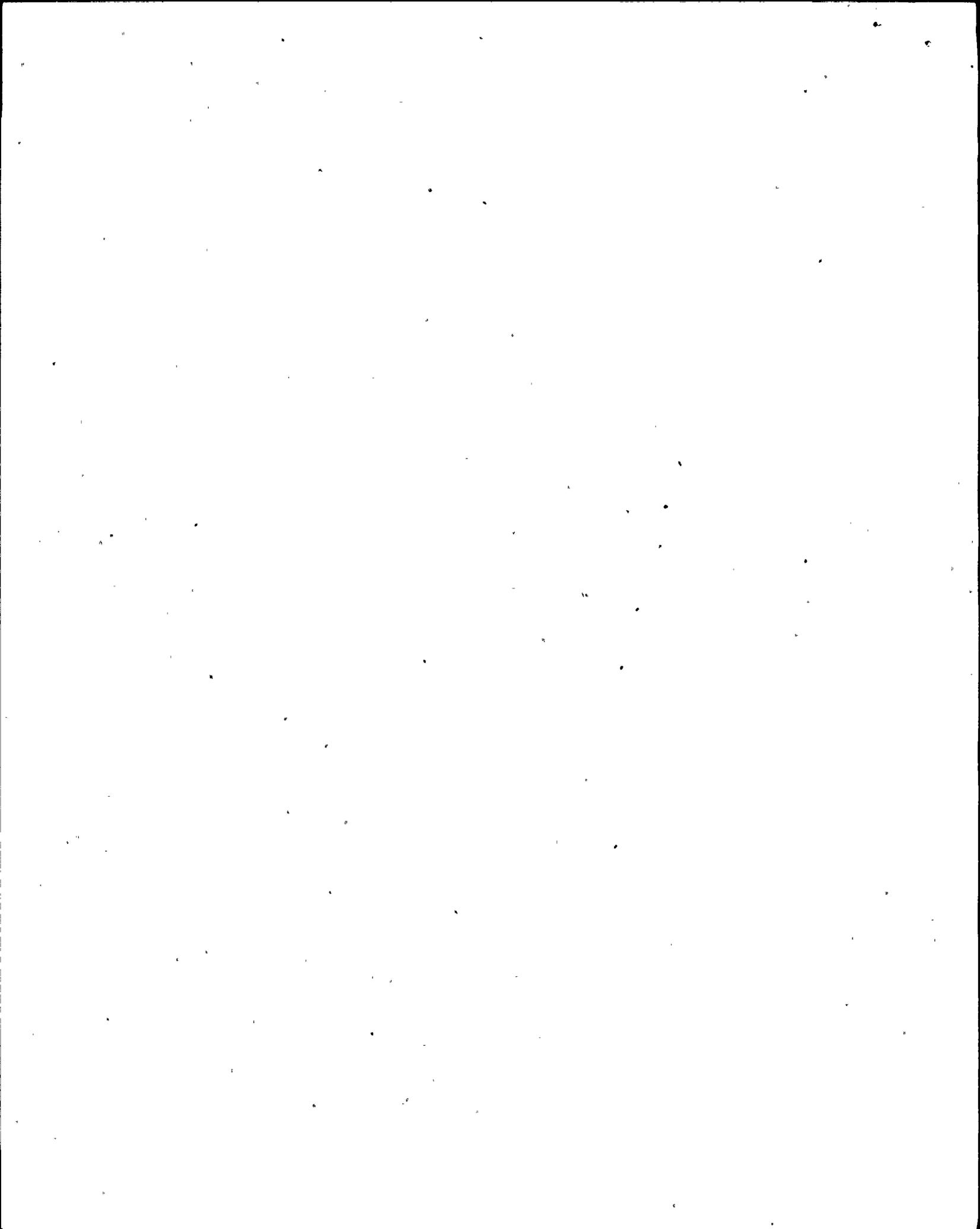


in Intervenors' behalf had sufficient time to review the voluminous technical evidence relevant to this case and bring informed scientific opinion supporting Intervenors' position to the attention of this Board.

On September 23, 1976, Intervenors answered the Staff's Motion for Summary Disposition based upon the limited technical review two of the Intervenors' recently retained experts had been able to conduct at that time. But even though Intervenors' two consultants only had a short time in which to conduct their technical review, Intervenors' September 23 Answer elucidated many material issues of fact between the Staff and Intervenors over the adequacy of the Staff's Final Environmental Statement. That answer and those affidavits demonstrated that Intervenors had marshalled considerable factual technical information to support their position that the Staff's FES underestimated important environmental impacts and, therefore, was inadequate.

Subsequently, this Board granted Intervenors additional time in which to answer the Staff's Motion for Summary Disposition. In response to the Board's grant of additional time, Intervenors are filing this Supplementary Answer.

Intervenors' Supplementary Answer provides additional scientific support for many of the material factual disputes between Intervenors and the Staff over the adequacy of the Staff's Final Environmental Statement illuminated in Intervenors' original Answer and also points out several additional issues of fact not delineated by Intervenors' original Answer. This Supplementary Answer elucidates these material issues by presenting



five new affidavits and a technical article by Intervenor's expert consultants, references to additional technical articles, and inferences of fact favorable to Intervenor.<sup>1</sup> In addition, Intervenor has filed Responses to Interrogatories in the past month which also point up several material issues of fact, as noted in later portions of this Supplementary Answer.

For the legal basis for this Supplementary Answer, we rely on the extensive discussion of summary judgment law appearing at pp. 4-25 of Intervenor's original Answer. We wish to re-emphasize that the legal principles and authority set forth in Intervenor's original Answer demonstrate that summary disposition is most difficult to obtain. The party moving for summary disposition bears the burden of establishing clearly and convincingly that no genuine disputed issues of fact exist between the parties in the proceedings. In contrast, the opposing party is to have all doubts as to the existence of factual disputes resolved in its favor and all plausible inferences from undisputed underlying facts that might themselves create factual issues drawn in its favor.

This Board's responsibilities under the National Environmental Policy Act caution against granting summary disposition of

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<sup>1</sup>We note at the outset that this Supplementary Answer and its accompanying affidavits oppose the Staff's Motion for Summary Disposition and the affidavits accompanying that Motion only. The Staff has sent testimony on the contentions at issue here to all parties. This testimony expands on some of the points made in the Staff affidavits. However, the Staff has not explicitly attempted to make testimony part of its Motion for Summary Disposition, nor has the Board indicated it will treat that testimony as such. Therefore, Intervenor has drawn this Supplementary Answer and supporting materials to address the Staff's Motion and affidavits, but not the later testimony.



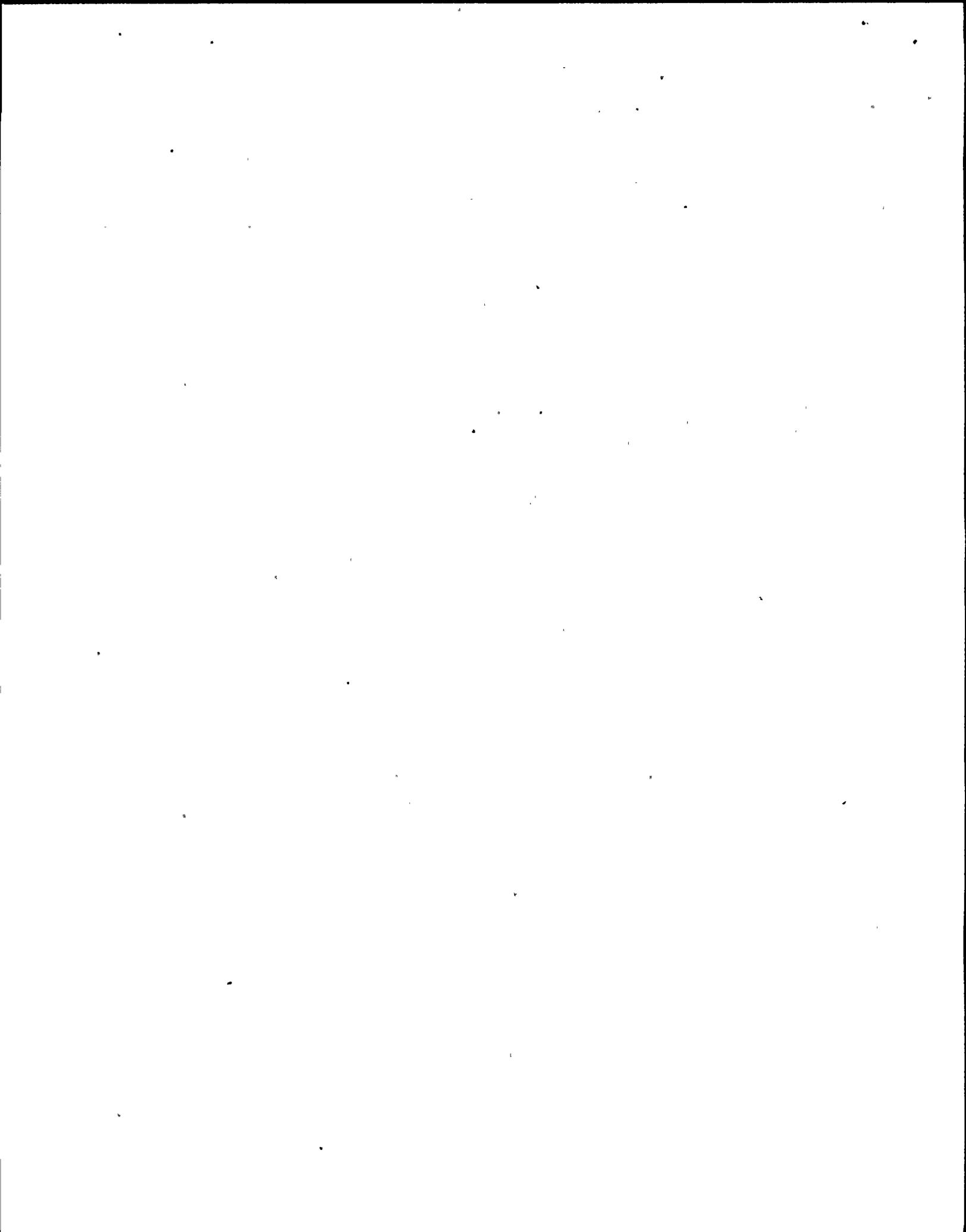
these environmental issues. The environmental hearings are designed to enable this Board to fulfill its responsibilities under the National Environmental Policy Act. These responsibilities include assessing all adverse environmental impacts (42 U.S.C. Section 4332 (2)(C)(i) and (ii)) and considering all costs and benefits of operating the Diablo Canyon nuclear plant (Calvert Cliffs v. AEC, 449 F.2d 1109 (D.C. Cir. 1971)) to the fullest extent possible. If the Board grants summary disposition too lightly, it will bar Intervenors' scientific consultants from bringing information that this Board must consider under NEPA to this Board's attention. Thus, an improper grant of summary disposition can also lead to an inadequate environmental evaluation under the National Environmental Policy Act.

The remainder of this Supplementary Answer explains how the accompanying affidavits and newly cited technical papers delineate several issues of fact between Intervenors and the Staff over the adequacy of the FES. This Answer takes up the environmental contentions in order, beginning with marine biota, moving to nuclear economics, and concluding with radiation emissions from normal operations of the Diablo Canyon plant.

#### I

THIS SUPPLEMENTARY ANSWER AND SUPPORTING AFFIDAVITS FURTHER DEMONSTRATE THE EXISTENCE OF GENUINE ISSUES OF MATERIAL FACT BETWEEN INTERVENORS AND THE STAFF AS TO THE ADEQUACY OF THE FINAL ENVIRONMENTAL STATEMENT'S ASSESSMENT OF ADVERSE ENVIRONMENTAL IMPACTS ON MARINE BIOTA

In its original Answer to the Staff's Motion for Summary Disposition, Intervenors presented materials which delineated



several issues of material fact as to environmental contentions 1.C. and 1.E.-J. By this Supplementary Answer, Intervenor present additional technical and factual material supporting its position that the Staff's FES deals inadequately with environmental impacts relevant to contentions 1.F. and 1.G.

Contention 1.F.

Contention 1.F. reads:

"1. Whether information developed subsequent to the Commission hearing in September 1973 demonstrates that the Staff's Final Environmental Statement adequately considers the extent or effect of the facilities' thermal plume on the environment, as to:

F. Impingement and entrainment of organisms."

The FES states, "field studies made by PG&E on its operating plants have not revealed significant mechanical or pressure related effects to entrained organisms," and concludes therefrom that only the effects of thermal change on entrained organisms need be addressed in the FES (FES Addendum p. 5-5). However, several respected scientific sources dispute this conclusion. Dr. James Enright of the Scripps Institute, an expert on marine biology who will testify for Intervenor at the environmental hearings, states that death of entrained organisms due to mechanical stress may be as high as seventy to one hundred percent. (See Affidavit of James Enright, p. 2). Studies done by A. S. Brooks, E. J. Carpenter, et al., and John R. Clark, and Kedl, et al., both found significant mortality of cooling-system-entrained organisms, including larval fish, zooplankton, and phytoplankton. (See Addendum to Affidavit



of Leslie M. Grimm, pp. 3-4.) This mortality was due not to thermal change, but to such forces as changes in pressure, friction, and collision with the machinery. The study presented by J. W. Icanberry, "Delayed Mortality of Entrained Copepods at Mono Bay Power Plant," which claimed insignificant mortality from entrainment, merely points up the conflict in current scientific opinion as to possible damage to entrained organisms, and shows a need for further extensive investigation into this area before the adverse effects of the Diablo Cove cooling system on marine life can be adequately evaluated.

Due to conflicts in technical literature and scientific opinion, and due to inadequate data, material factual disputes exist between Staff and Intervenor over the adequacy of the Staff's assessment of the effects of entrainment of organisms on the marine environment. Therefore, Staff's Motion for Summary Disposition of Contention 1.F. should be denied.

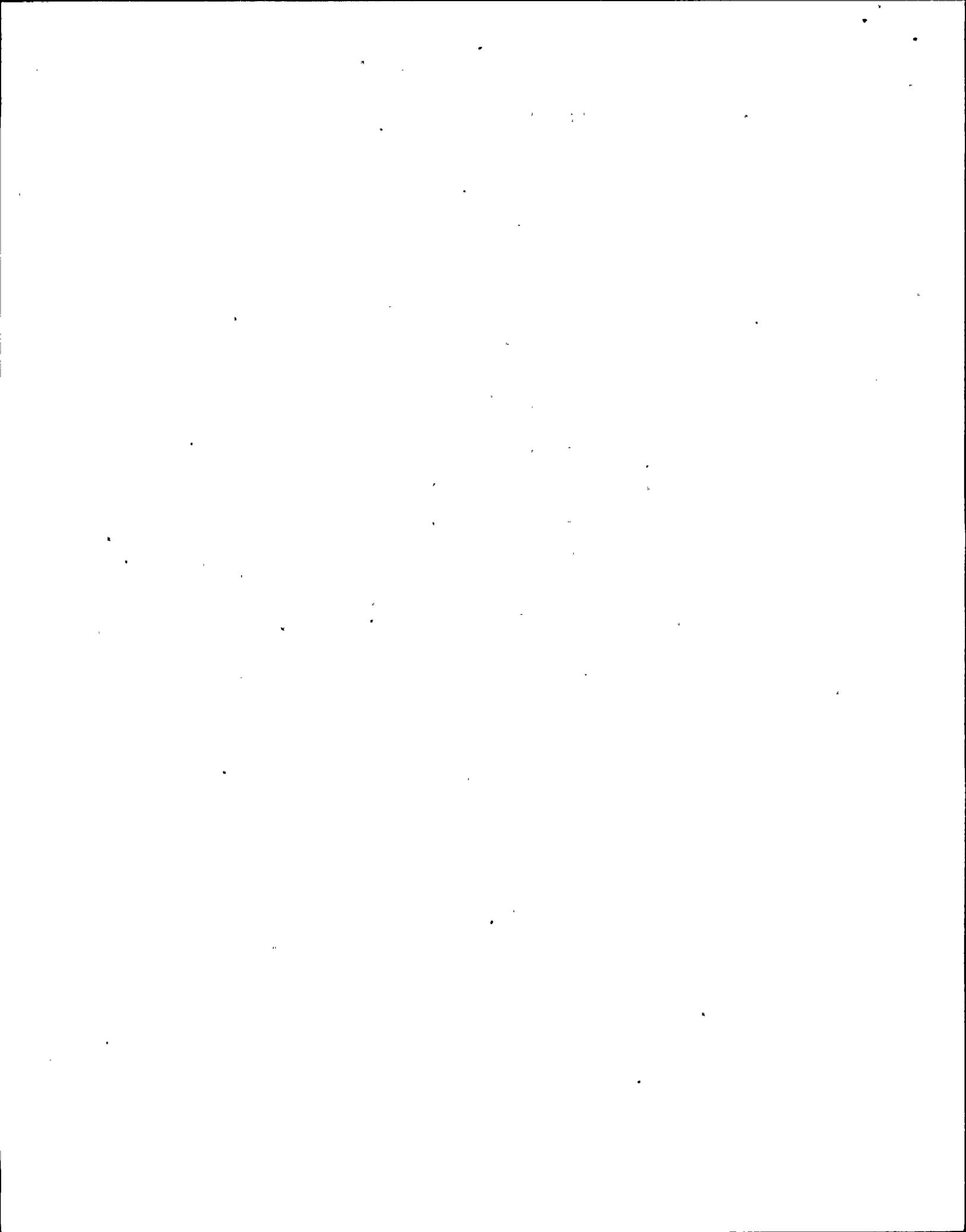
Contention 1.G.

Contention 1.G. reads:

"1.. Whether information developed subsequent to the Commission hearing in September 1973 demonstrates that the Staff's Final Environmental Statement adequately considers the extent or effect of the facilities' thermal plume on the environment, as to:

G. Species losses and regeneration of significant marine breeding areas including larval abalone."

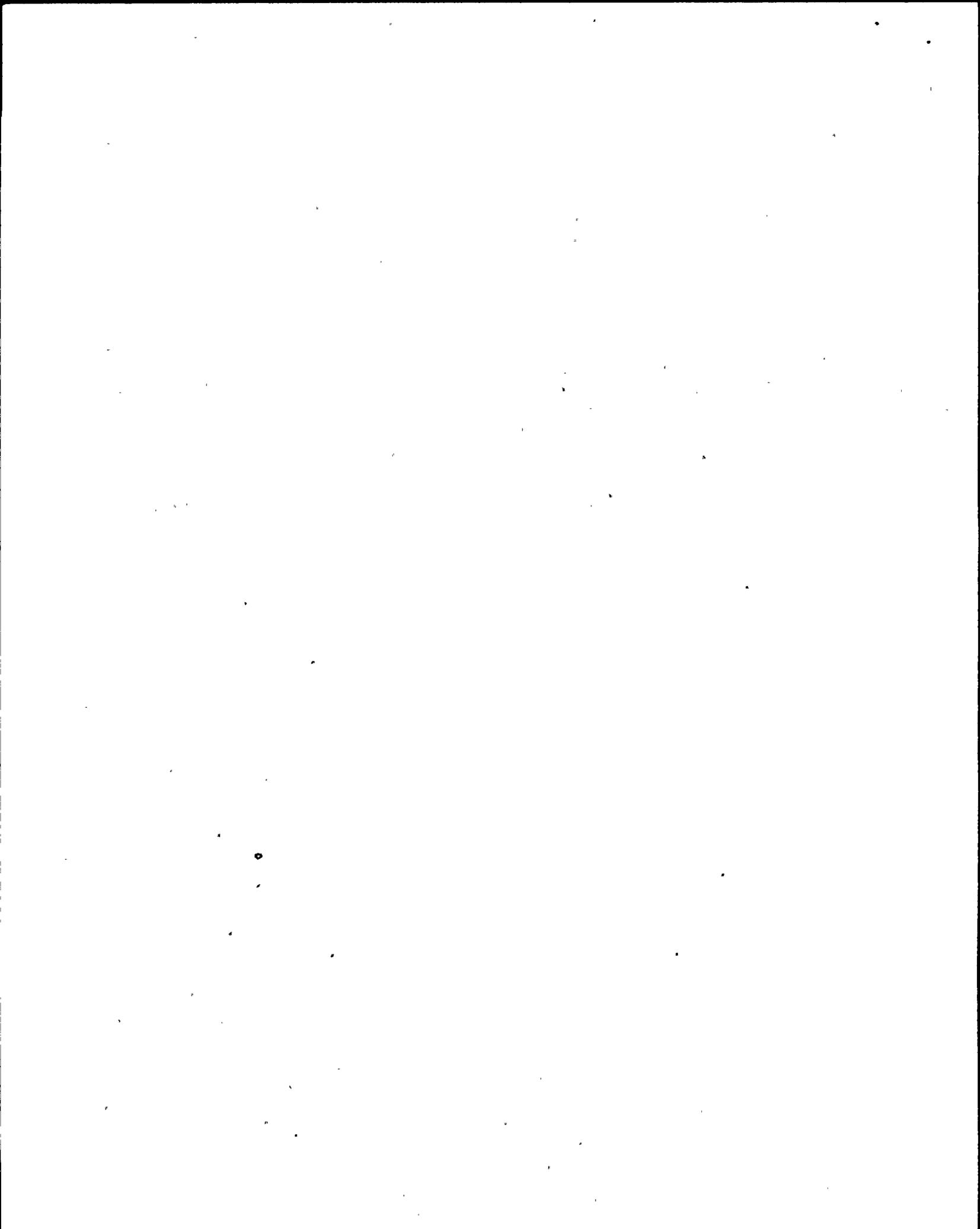
In his Affidavit, Dr. Enright states that nearly all near-shore animals have planktonic larvae (Enright Affidavit at p. 3). The death of large numbers of these larval animals through cooling-



system entrainment could cause a loss of many varieties of nearshore animals in the Diablo Cove area, particularly since the expected entrainment of the operating Units is so large. (See Affidavit of James Enright, p.2.) The California Department of Fish and Game, in a study of the Diablo coastal area, explained that the 13-mile Diablo reef area must "self-perpetuate" because of the reef's biological isolation and the non-migratory behavior of indigenous species. ("The Marine Environment in the Vicinity of Diablo Cove with Special Reference to Abalones and Bony Fishes," Burge and Schultz, Marine Technical Report No. 19, 1973, p. 12.) Therefore, any species loss would result in extremely slow recovery of the breeding areas in the vicinity of Diablo if recovery is possible at all. Possible species loss through the death of entrained larvae in the Diablo area has not been considered by the NRC Staff. For this reason alone, summary disposition of Contention 1.G. should be denied.

In addition, the long-term effects of residual chlorine in Diablo Cove waters has not been explored in the FES. (See Addendum to Affidavit of Leslie M. Grimm, p. 4.) Sublethal effects, such as reduced pumping action of oysters, have been found to result from residual chlorine concentrations which are one-tenth that predicted to occur periodically in Diablo Cove. The NRC Staff has not considered such sublethal effects of residual chlorine on the species of the Cove. Nor has it considered possible toxicity of chlorine to animals exposed for long periods to relatively low concentrations.

Due to lack of adequate data, and to conflicting technical



literature, material factual disputes exist between Staff and Intervenor as to the effect of discharge water on species loss, and regeneration of breeding areas. Therefore, Staff's Motion for Summary Disposition of Contention 1.G. should be denied.

## II

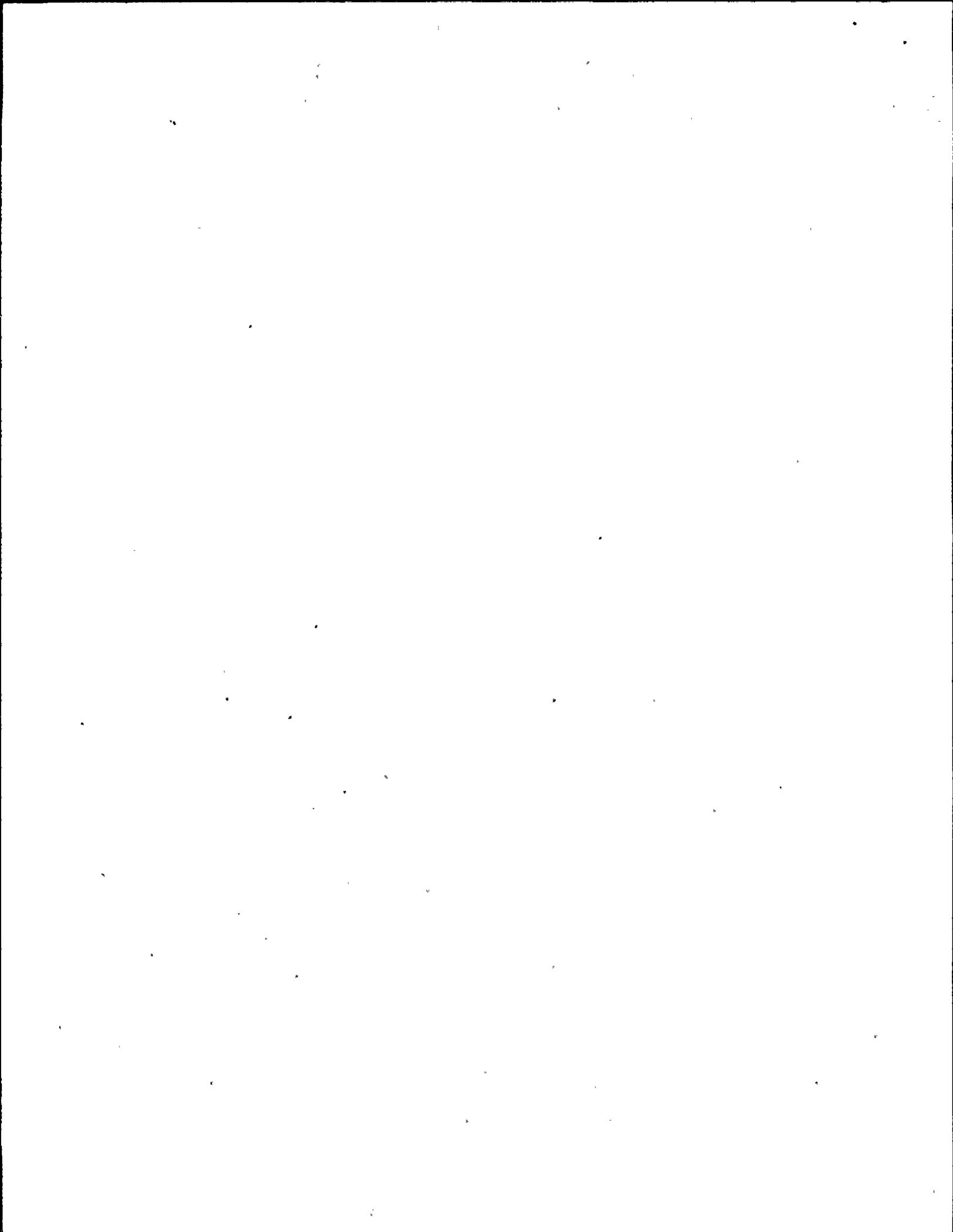
THIS SUPPLEMENTARY ANSWER AND A SUPPORTING AFFIDAVIT AND TECHNICAL ARTICLE FURTHER DEMONSTRATE THE EXISTENCE OF GENUINE ISSUES OF MATERIAL FACT BETWEEN INTERVENORS AND THE STAFF AS TO THE ADEQUACY OF THE FINAL ENVIRONMENTAL STATEMENT'S ASSESSMENT OF NUCLEAR FUEL SHORTAGES AND PLANT RELIABILITY

### A. Nuclear Fuel Shortages

In order for the Diablo Canyon nuclear generating station to provide its primary benefit of electrical power, nuclear fuel must be available throughout its operating life. The Staff and Intervenor differ strongly over the availability of fuel for the Diablo plant. In its motion for summary disposition, the Staff predicted no nuclear fuel shortages would occur. In their original answer, Intervenor cited several technical articles which indicated that a combination of limited uranium resources and poor nuclear fuel duty could cause a shortage of nuclear fuel before the end of the next decade, after only one-third of the expected operating life of the Diablo Canyon nuclear plant.<sup>2</sup>

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<sup>2</sup>Intervenor filed their original Answer for Contention 2.A. separately from their Answer for other Contentions. See "Intervenor's Answer to NRC Staff's Motion for Summary Disposition of Contention 2.A., Nuclear Fuel Shortages," dated September 15, 1976.



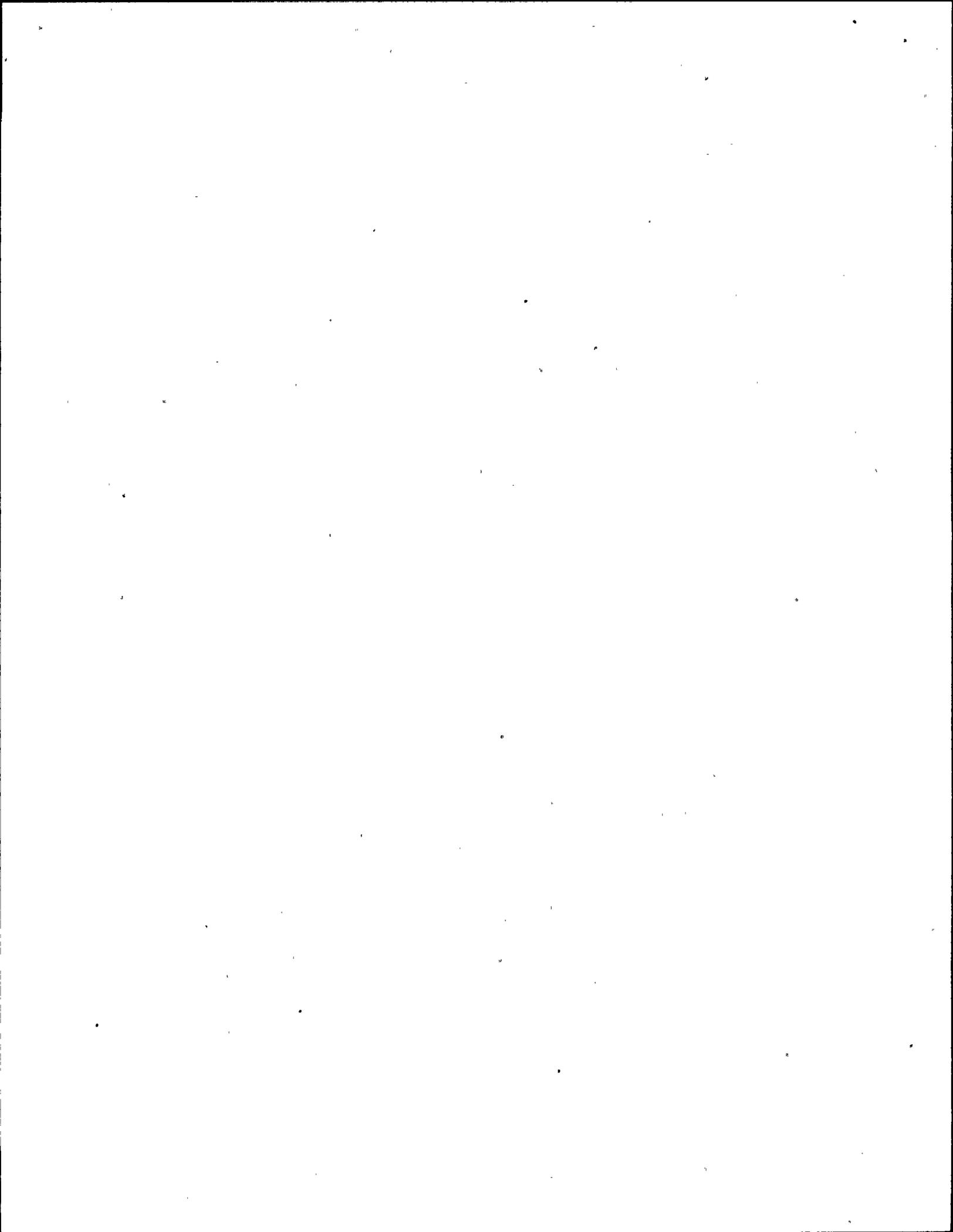
In these supplementary materials, Intervenors present a technical article by a scientist who will testify for them on fuel availability, Professor Michael A. Lieberman of the University of California at Berkeley.<sup>3</sup> In his article Professor Lieberman analyzes historical data of discoveries of known domestic uranium resources and makes predictions of the extent of additional resources based on this analysis of actual data. His conclusion stands in sharp contrast to that of Staff expert Hinkle who claimed that no nuclear fuel shortages should develop during Diablo's 30-year operating life (Hinkle Affidavit at p. 17). As Professor Lieberman put it:

" ... if the expansion of nuclear power proceeds as planned, a serious shortfall in uranium supply will develop during the late 1980's." (Lieberman article at p. 435).

In terms of numbers of short tons, Lieberman's estimate of the availability of fuel from high grade uranium ore by the early 1990's differs substantially from Staff affiant Hinkle. Hinkle estimates that at least all known and "probable" resources in the forward cost categories up to \$30 a ton will be available by 1990 (Hinkle Affidavit, pp. 14-16). These resources total 1.84 million short tons. In contrast, Professor Lieberman estimates that only 1.134 million short tons of resources in this \$30 forward cost category can be made available for use in nuclear reactors by 1992 (Lieberman article, p. 435).

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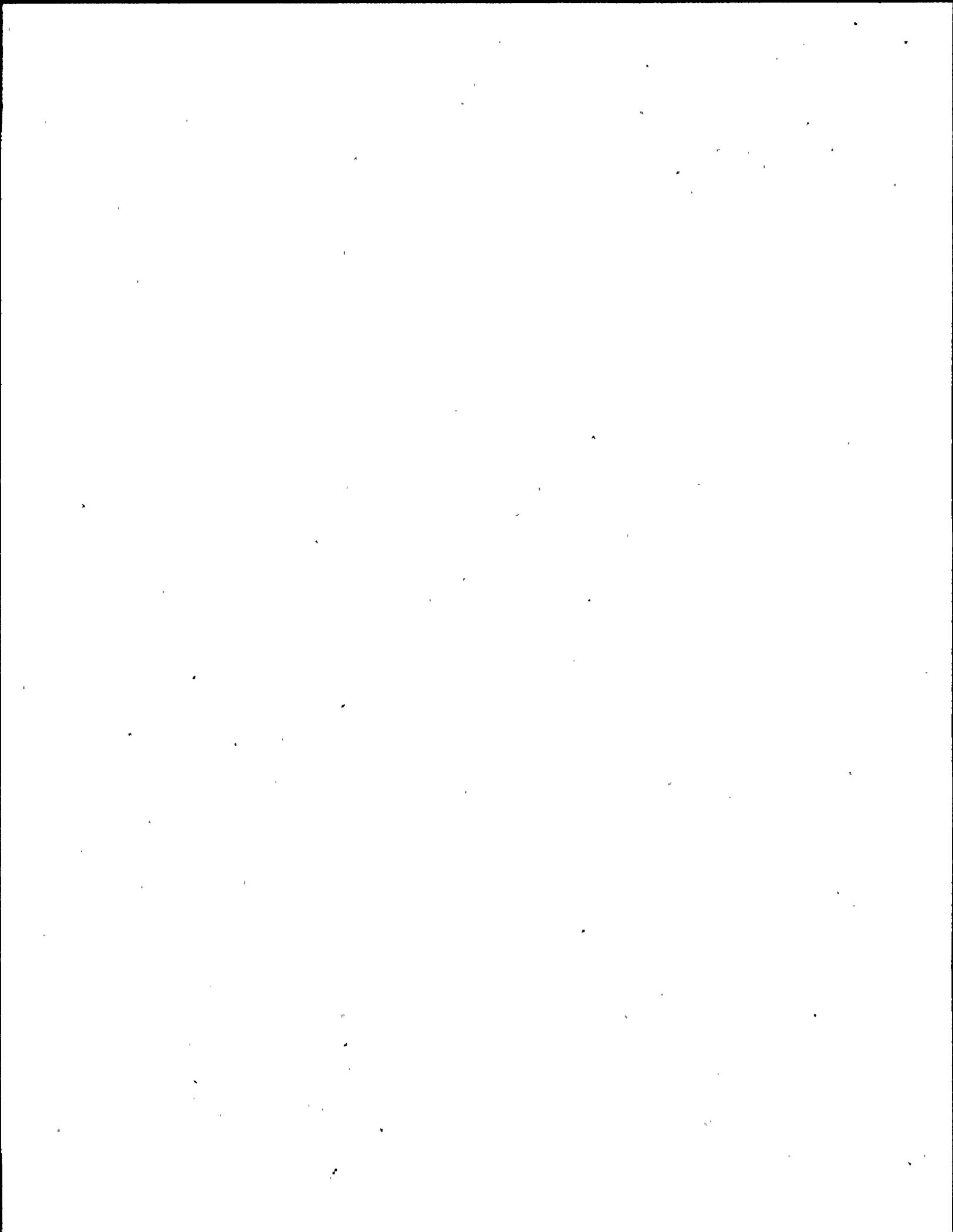
<sup>3</sup>Lieberman, "United States Uranium Resources -- An Analysis of Historical Data," Science, April 30, 1976, pp. 431-436.



These differing estimates are based upon several underlying factual disagreements between Hinkle and Lieberman. For example, Hinkle believes that all uranium resources in ERDA's "probable" but undiscovered category can be discovered, mined and processed into reactor fuel by 1990 (Hinkle Affidavit at pp. 15-16). In contrast, Lieberman asserts ERDA's undiscovered resource estimates "...are not based on any objective procedures that I can discern..." and that ERDA's procedures for making the undiscovered resource estimates "...may tend to produce large overestimates..." (Lieberman article at p. 435 and at p. 436, note 10).

Furthermore, a factual dispute exists between Hinkle and Lieberman over the availability of nuclear fuel from domestic medium grade uranium resources. Hinkle's talk of additional nuclear fuel available from uranium in the \$50 forward cost range and from dynamic market forces prompting discovery of new deposits when the price is right (Hinkle Affidavit, pp. 14 and 16) suggests that Hinkle expects middle grade ore deposits to provide nuclear fuel when the currently used high grade resources which fall in the \$30 or less forward cost categories are exhausted. But Lieberman notes that middle grade resources are not yet known to exist in the United States (Lieberman article at p. 431 and 436).

Thus the submission of Lieberman's article and this Supplemental Answer strengthens Intervenors factual case against summary disposition in several ways. Under the law of summary disposition and NEPA's mandate to this Board, the Board should deny the motion for summary disposition and hear Intervenors' technical factual case on the nuclear fuel shortage contention.



## B. Plant Reliability<sup>4</sup>

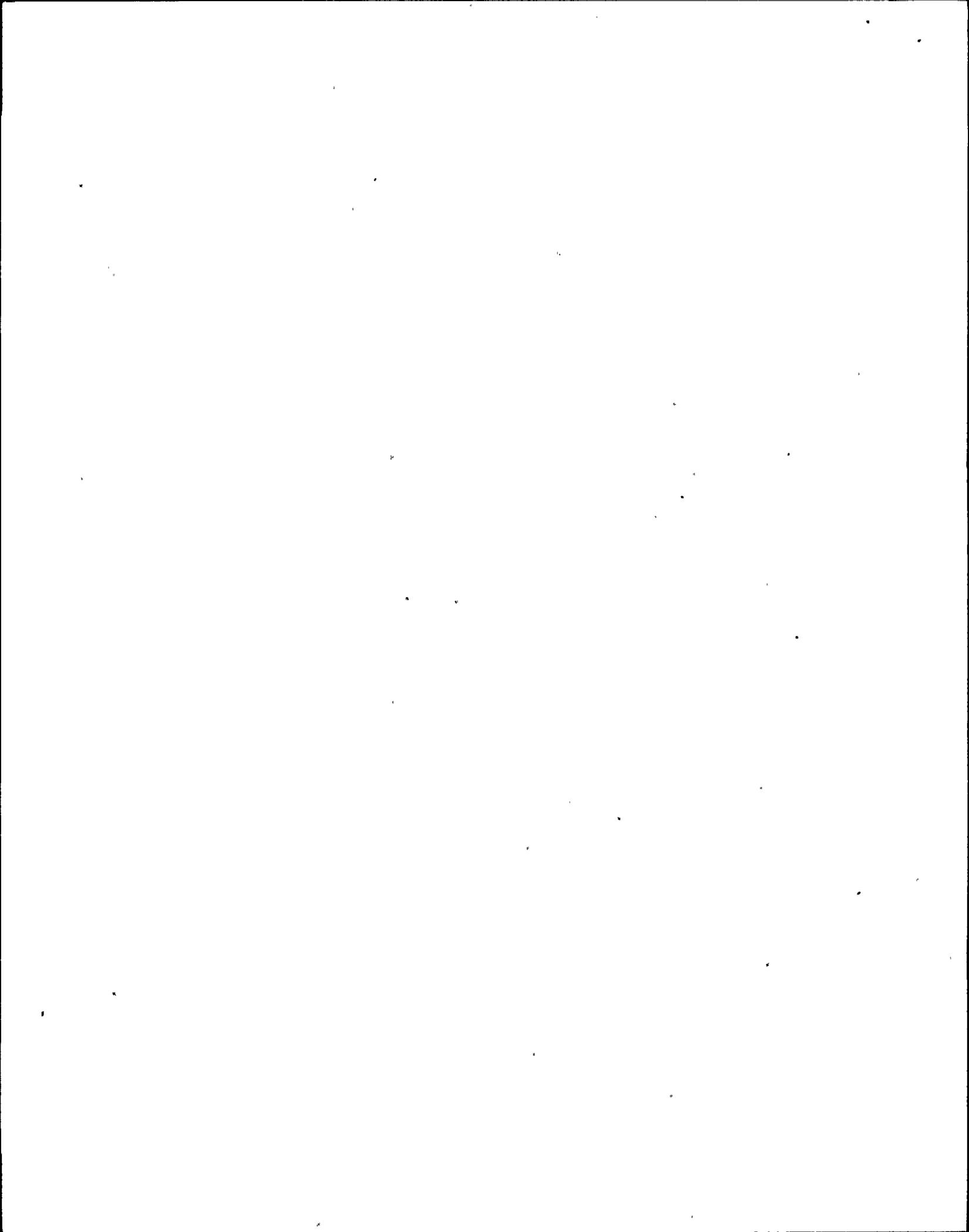
The plant reliability contention presents stark factual disputes between the Staff and Intervenors. These factual issues involve the primary benefit of the Diablo Canyon nuclear plant, the generation of electrical power. The essence of the dispute is that Intervenors contend the Diablo plant will generate less than 60% of the electricity the Staff claims it will generate over its expected 30-year operating life.

The most meaningful measurement of power plant performance is plant capacity factor. The capacity factor of any power plant is the ratio expressed as a percentage of the power actually generated and delivered over a particular period of calendar time as compared to the amount the plant theoretically could generate had it been operating at 100% of its designed capacity for that same period of time.

In its Final Environmental Statement, the NRC Staff predicted that the DCNGS will operate at a capacity factor of 80%. (FES at p. 13-8) In an affidavit supporting the Staff's Motion for Summary Disposition on the plant reliability issue, Staff expert Norman Hinkle admitted that Westinghouse reactors had operated to date at an average capacity factor of only 65%, but suggested that capacity factors for Westinghouse reactors should

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<sup>4</sup>Because the status of the plant reliability contention was unclear on September 23 when Intervenors filed their original Answer to the Staff's Motion for Summary Disposition, Intervenors presented no material on the issue at that time. This Answer, and the accompanying Affidavit of Dale Bridenbaugh, then, constitute Intervenors' Answer to the Staff motion on Contention 2.B.



improve significantly, perhaps to a 75-80% range (Hinkle Affidavit at pp. 19-21). Hinkle based his prediction of improvement on several factors including mitigation of technical and operational problems and the tendency for plant capacity to improve with plant age (Hinkle Affidavit at pp. 19-21). Hinkle admitted that large reactors such as those at Diablo have had lower capacity factors than the average for the nuclear industry, but he ascribes these lower factors solely to operational shakedown problems occurring in the first year or two of the plant's life (Hinkle Affidavit at p. 21).

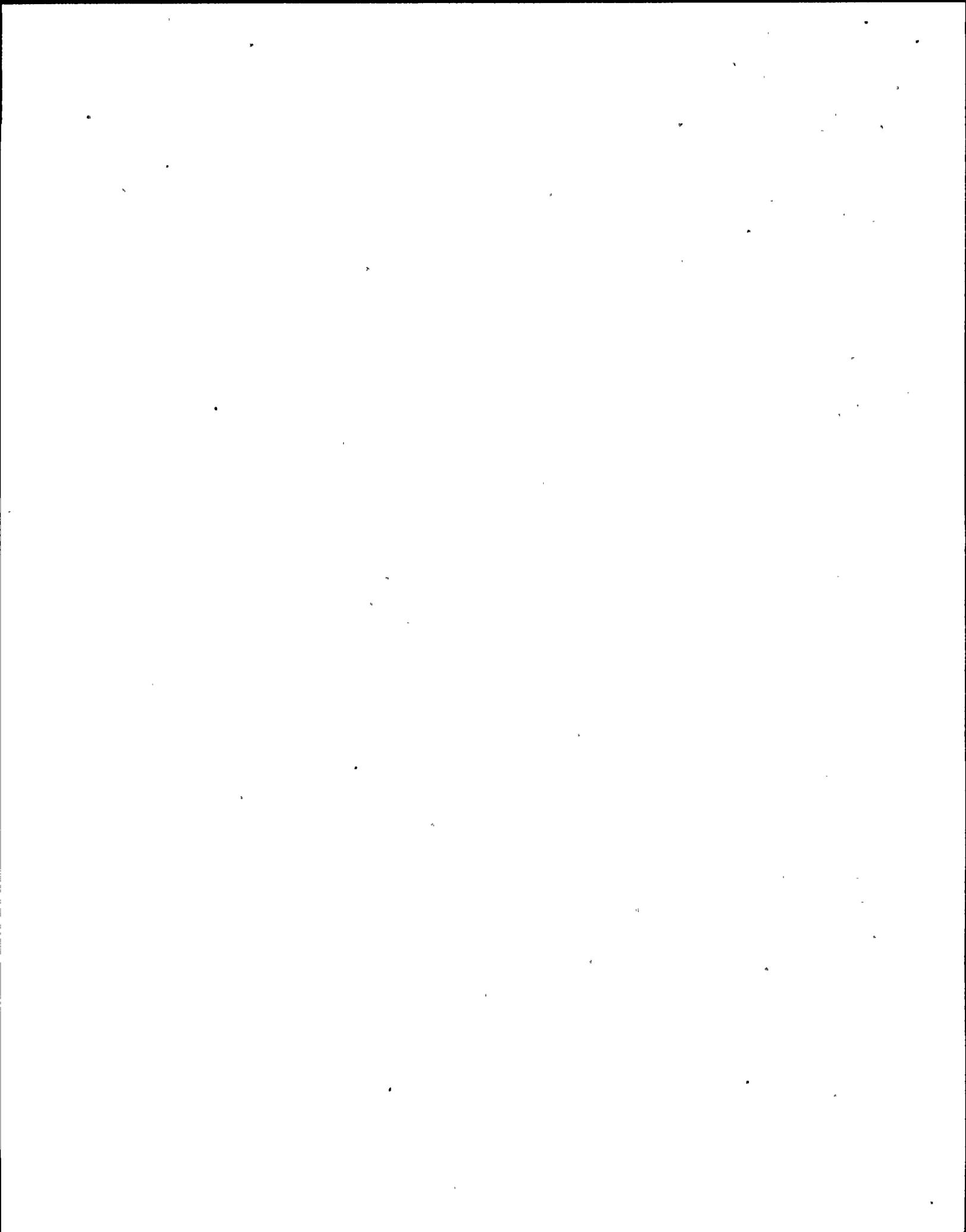
Intervenors take issue with all of the above positions of the Staff. Intervenors support their opposition with the accompanying Affidavit of Dale Bridenbaugh, responses to interrogatories<sup>5</sup> and technical studies cited in the Bridenbaugh Affidavit and below.

The essence of Intervenors' plant reliability contention is that plant malfunctions, various operational problems and even scheduled downtime will cause the capacity factor for the Diablo Canyon plant to be less than 50% over its anticipated operating life. Intervenors base this prediction of a less than 50% capacity factor on a study of actual PWR reactor performance discussed by Bridenbaugh (Bridenbaugh Affidavit at pp. 2-3).

In making this prediction, Intervenors dispute the points raised by the Staff's expert Hinkle relating to technical and

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<sup>5</sup>See "Supplementary Response of Scenic Shoreline Preservation Conference and John J. Forster to Staff Interrogatory 12 Pounded June 21, 1976," dated October 15, 1976.



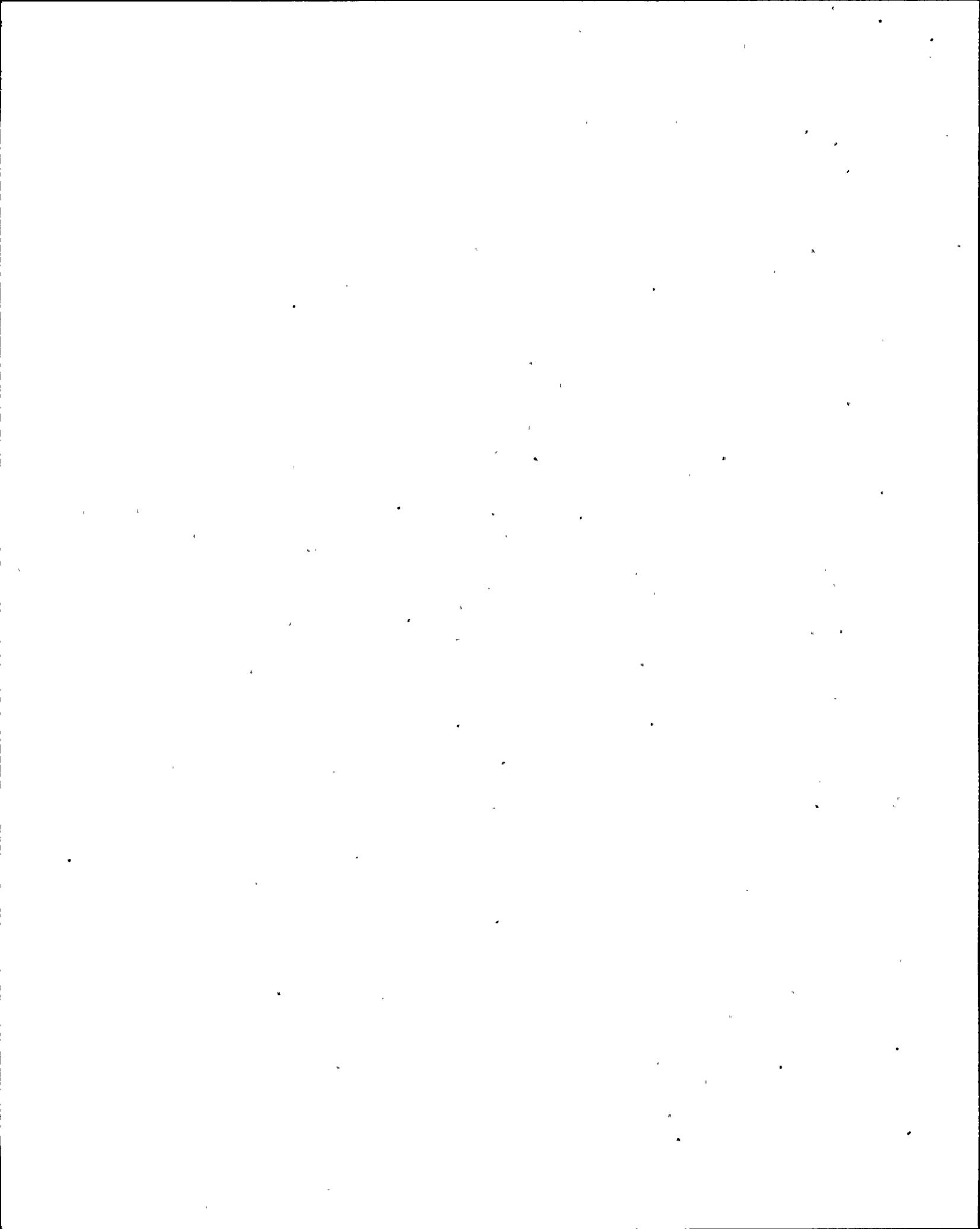
operational improvements, plant age, and plant size. First, Intervenor's expert Bridenbaugh, a mechanical engineer with considerable experience in nuclear power plant operations, provides several reasons for expecting no appreciable increase in capacity factors due to technical and operational improvements for nuclear power plants already on line or close to completion, including Diablo Canyon (Bridenbaugh Affidavit at pp. 4-6).

Second, Intervenor's strongly dispute Hinkle's assertion that annual capacity factors improve with the age of the plant. Technical studies by David Comey have shown that, while annual capacity factors improve over the first few years of a reactor's life, sometime during the seventh to eleventh year of operation annual capacity factor begins to decline sharply.<sup>6</sup> Bridenbaugh gives one explanation for this trend, explaining that as nuclear plants become older and more radioactive, forced and scheduled outages for repairs and maintenance become longer. (Bridenbaugh Affidavit at p. 6)

Third, Intervenor's contest Hinkle's assertion that the poor performance of large reactors in Diablo Canyon's size range is due solely to shakedown problems. While shakedown problems obviously have caused performance troubles, Bridenbaugh reports that the Center for Economic Policy's study of actual operating data concludes that larger reactor size alone, independent of any shakedown problems, causes lower capacity factors.

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<sup>6</sup> Comey, "Will Idle Capacity Kill Nuclear Power?" Bulletin of Atomic Scientists, November, 1974 and "On Cooking Curves," Bulletin of Atomic Scientists, October, 1975.



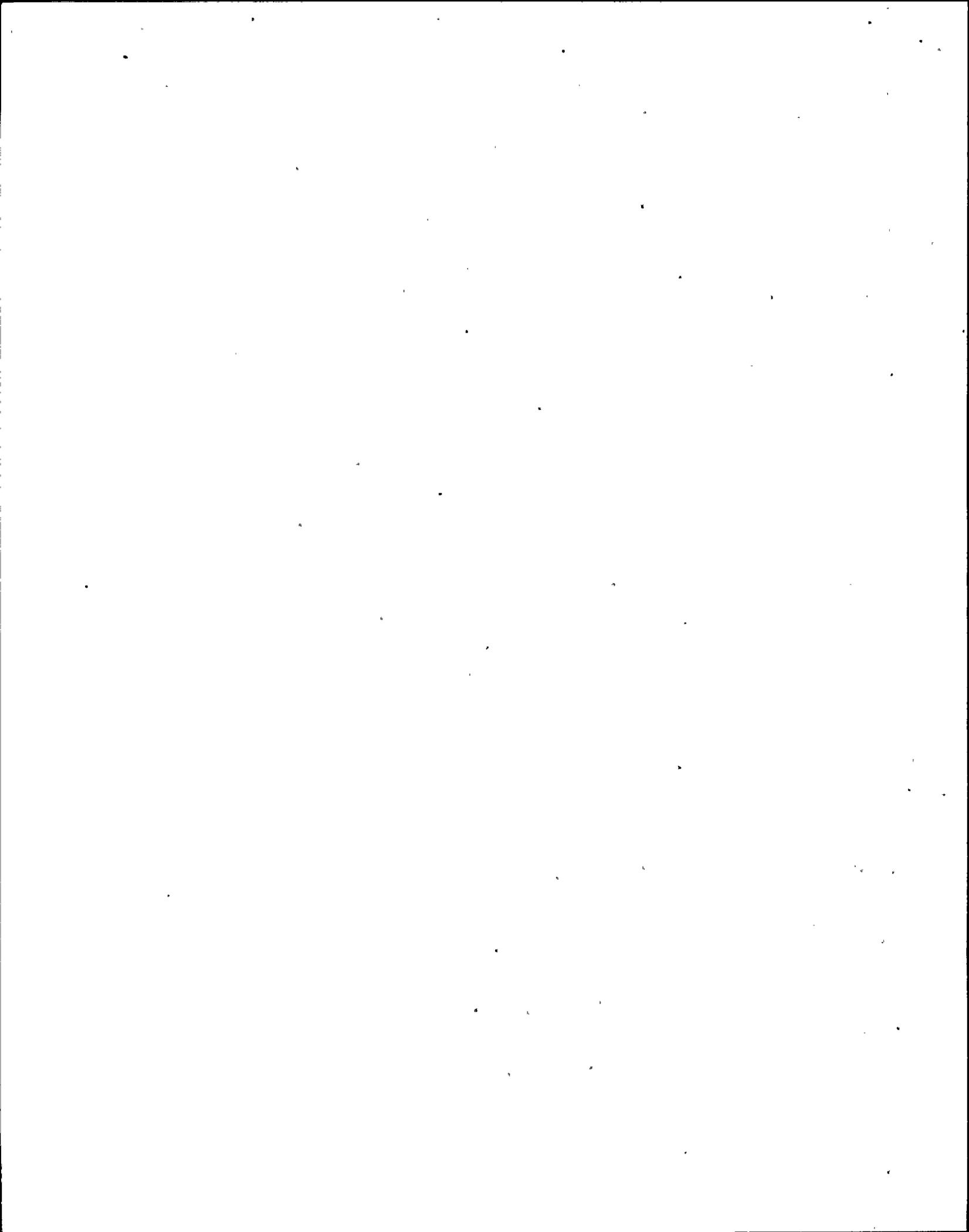
Intervenors, then, have several factual disputes with the Staff over the adequacy of Staff estimates of the benefit of electrical power the Diablo Canyon plant will produce during its operating life. Intervenors ground their position in these factual disputes over predicted capacity factor and the effects of technical improvements and plant size and age on capacity factor on actual operating data, responsible technical opinion, and technical studies. Any NEPA analysis that ignores such evidence, as does the Staff's, is clearly inadequate. Consequently, the Staff's motion for summary disposition of environmental Contention 2.B. should be denied.

### III

INTERVENORS' CASE IN ITS PRESENT STATE  
DEMONSTRATES THE EXISTENCE OF ADDITIONAL  
GENUINE FACT ISSUES AS TO THE RADIOLOGICAL  
CONTENTIONS

A. Additional Issue of Fact Relevant to Contentions  
4.A., 4.C., and 4.D.

Dr. Finston, in his attached Addendum to Affidavit of Roland Finston, indicates that performance of PWR's over the years shows that with increasing age of PWR plants such as the DCNGS, emissions releases into the environment increase. This conclusion can be reached by examining the emissions data for several PWR's in operation over the years. The Appendix I figures and the FES do not appear to have taken this fact into account in indicating dose levels over the years, and in this respect, the assumptions for the DCNGS reactors may be unduly optimistic. Because the Staff's calculations do not show that increasing emissions levels were taken into account, there is a genuine issue of fact as to



whether the FES has adequately considered the realistic effects of emissions levels on the food chain, on the population living around the DCNGS, and on the plant workers.

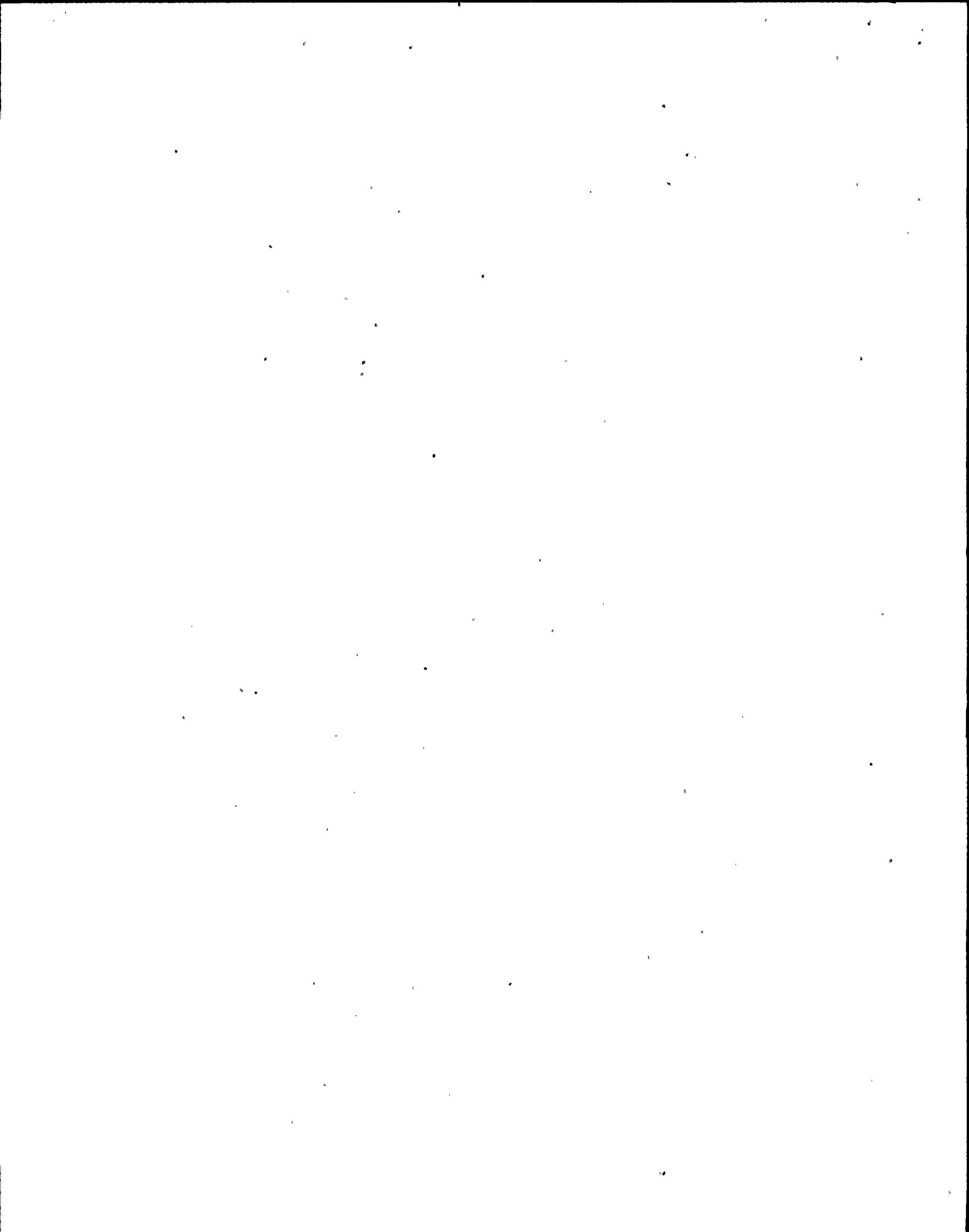
B. Low Level Emissions into the Food Chain.

Intervenors' experts have had some opportunity to evaluate the Appendix I emissions levels reported in Tables 1 and 2 in the Letter of Edward Ketchen to James Geocariss, dated September 21, 1976 (hereinafter "Letter"), and repeated in the Supplementary Testimony of Parsont and Boegli, undated.<sup>7</sup> The only basis provided Intervenors for the calculations in Appendix I was Regulatory Guide 1.109. If the Staff relied upon additional materials in calculating the values given in Tables 1, 2, and 3 of the Letter, Intervenors have not received such materials and thus renew all of the objections which they made in their first response to the Staff's Motion, at pp. 39-44.

Furthermore, the Addendum to the Affidavit of Roland Finston indicates that there appear to be two anomalies in the Staff's Appendix I calculations in light of reported data on actual nuclear plant operations. The first anomaly concerns the release of Tritium, H-3, which Table 2 of the Letter reported as 710 Ci/year/reactor. As the Addendum to Affidavit of Roland Finston

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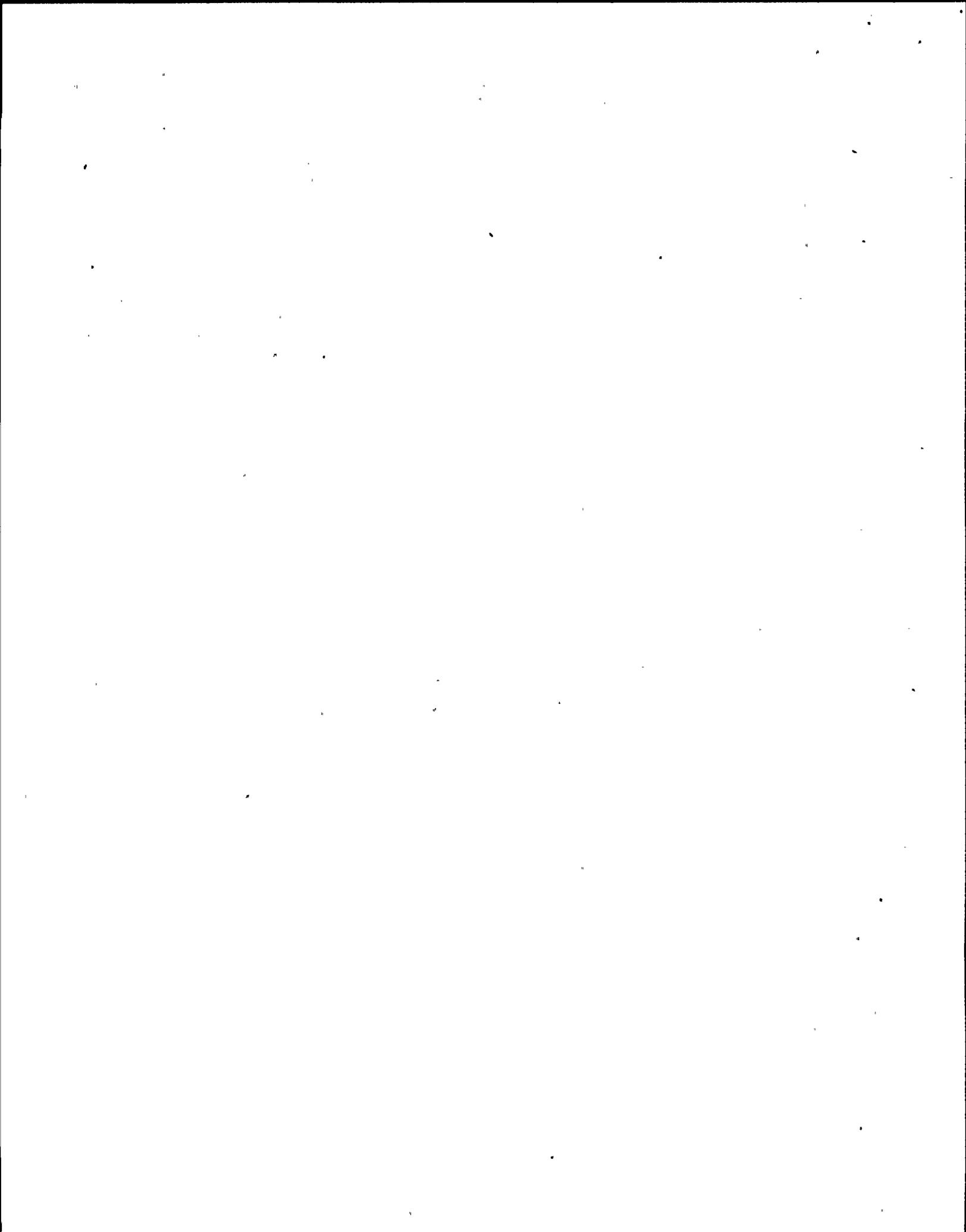
<sup>7</sup>It should be noted that the Testimony of Parsont and Boegli was considered by Intervenors in this Supplementary Answer only insofar as it was needed to adequately evaluate the emissions levels given in Appendix I. This response has not fully considered said testimony, since it was never explicitly made part of the Staff's Motion for Summary Disposition.



indicates, data from PWR units of similar size and manufacturer have been performing with much smaller H-3 releases. Releases from six reactors during the years 1973-74, according to a NRC study, have been averaging 1/20 as great as that estimated for the DCNGS units, normalized for rating (1000 MWatts) and capacity factor (100%). (All of the data was so normalized in order to give a realistic comparison of the release rates from the reactors.)

This overestimate of release has resulted in an overestimate of dose. Thus neither the Staff nor applicants have furnished a reason why this particular emissions level is as low as readily achievable, as required by 10 CFR Part 50, Appendix I. It is clear that lower emissions of H-3 have been achieved at similar reactors, and thus there is no apparent reason why these lower emissions could not be complied with at the DCNGS. The fact that the Letter (which is part of the FES) has given no explanation for why the H-3 levels are not as low as readily achievable could indicate a significant inadequacy in the FES. There is, then, a genuine issue of fact as to whether the FES has adequately considered the effect of the higher-than-average Tritium releases from the DCNGS on the environment.

The other anomaly in the low level releases reported in the Letter concerns the release of fission, corrosion and activation products to liquid effluents. Performance data for seven PWR's operating in the years 1973-74, again normalized to rating and capacity factor, show release six times greater than the figure estimated for the DCNGS units, which is 0.34 Ci/year/reactor. As the Addendum to Dr. Finston's Affidavit indicates, the six-fold



difference was calculated by averaging the releases at the seven PWR's, a range from 5.61 to 0.33 Ci/year/reactor, and by comparing it to the estimate given in Table 2 of the Letter. In fact, one PWR (Indian Point 2) released 30 times more fission, corrosion and activation products to liquid effluents than are estimated for the DCNGS. It would appear, then, that the estimate of 0.34 Ci/year/reactor is unrealistically low in comparison to other reactors whose emissions have been calculated. A realistic release value would, in turn, result in a realistic dose, which is needed to adequately assess the effect of low level emissions that the DCNGS will have on the food chain. Thus there is a genuine issue of fact, pointed up by the contrary conclusions of Drs. Finston, Parsont, and Boegli, that 0.34 Ci/year/reactor is the correct emissions level for fission, corrosion and activation products to liquid effluents from the DCNGS. If the estimate is wrong, then the FES has failed to adequately consider the additional correct emissions level on the food chain.

Intervenors also wish to remind the Board that its objections expressed in the original response to the Staff's motion regarding the inadequacy of the Staff's treatment of agency comments to the FES are very much alive. There is still some question as to whether the FES and subsequent materials incorporated therein have adequately treated the EPA's contention that radiation received via the milk pathway could result in an emission in excess of the allowable 5 mrem/year for any child younger than two years located within a 50-mile radius of the DCNGS. The full argument on this point is contained at pp. 44-46 of the Intervenors' first response.



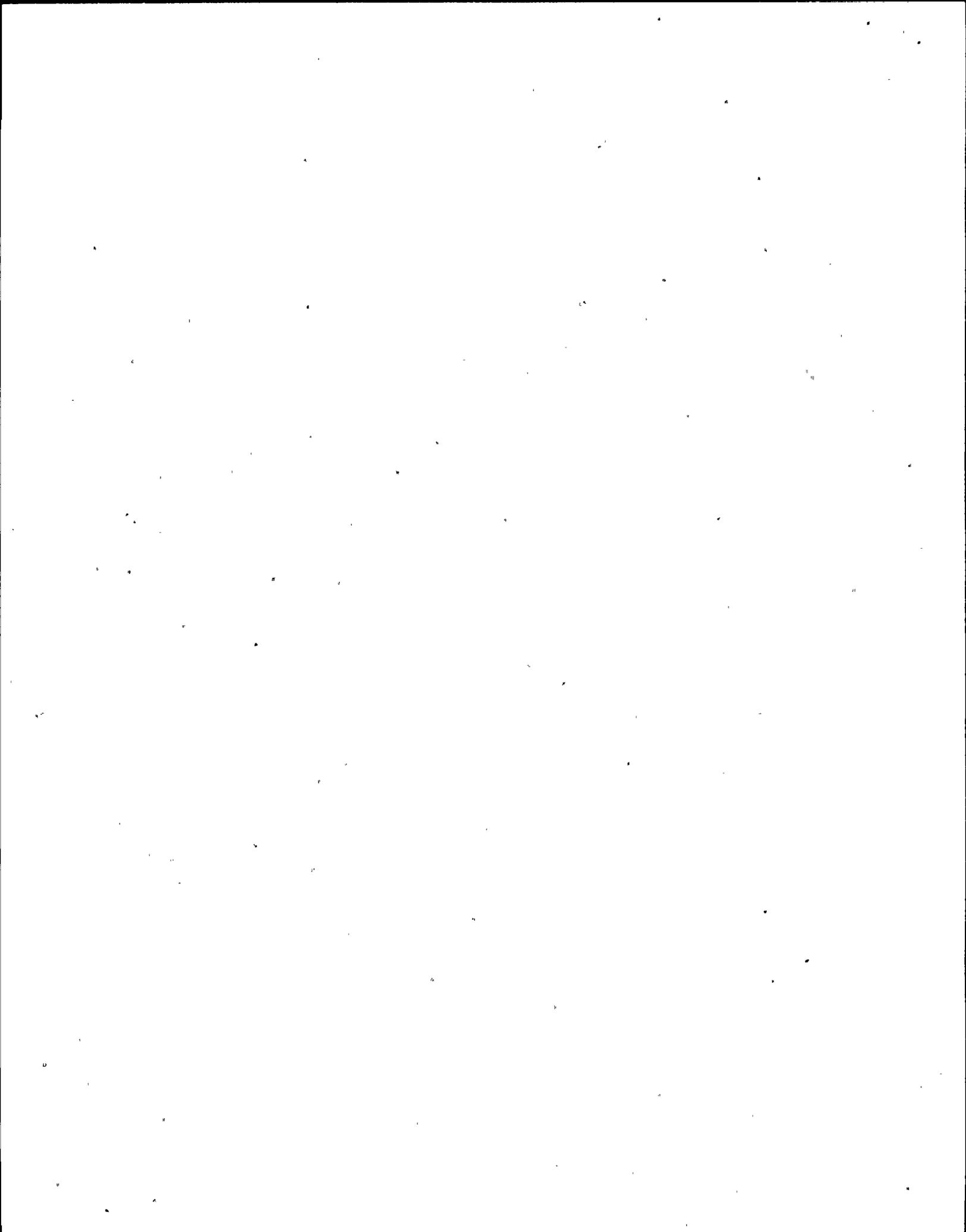
Two other shortcomings in the Staff's treatment of low level emissions on the food chain also exist. The first concerns the Staff's calculation of the total body dose for liquid effluents, given as 0.012 mrem/year/reactor in Table 3 of the Letter. In his Affidavit, Dr. Irving Lyon converted the values in Tables 1 and 2 of the Letter into mrem/year, summed them, and compared the sum with the total body dose for liquid effluents given in Table 3. The conversion from Ci/year/reactor to mrem/year was as follows:

$$\begin{aligned} & \text{Ci/year/reactor} \times 2 \text{ reactors} \times 1 \times 10^6 \text{ , Uci/Ci} \times F \text{ (mrem/,Uci)} \\ & = \text{mrem/year,} \end{aligned}$$

where F = Factor for calculating dose to man resulting from ingestion and external exposure, in mrem/,Uci. The calculated values are indicated in Table 1 to the Lyon Affidavit. The total body dose for liquid effluents was calculated at 112,275,013 mrem/year. Dividing that figure by the relevant population within a 50-mile radius of the DCNGS, 260,000, the annual dose per person in mrem could be calculated. Thus:

$$\begin{aligned} \text{Total body dose} &= 1.12 \times 10^6 \text{ mrem/year} / 2.6 \times 10^5 \text{ persons} \\ &= 430 \text{ mrem/year} \end{aligned}$$

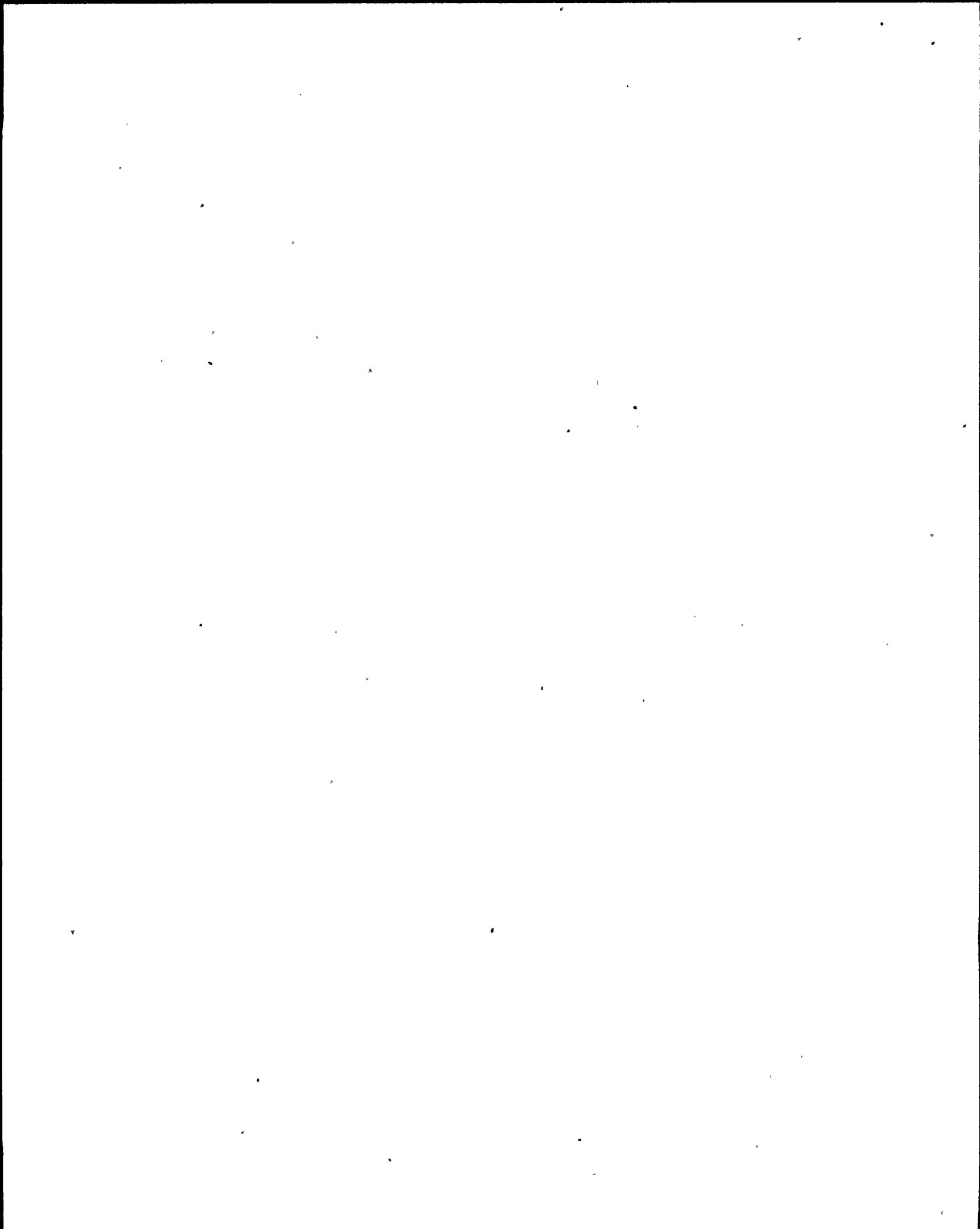
The Staff's contention that the total body dose for liquid effluents is 0.024 mrem/year/site must rest on the conclusion that there is a containment and/or dispersion of a major portion of the 430 mrem/year/person total body dose Dr. Lyon calculated. That portion of the 430 mrem/year which reaches the population, the Staff contends, is thus 0.024 mrem/year/person / 430 mrem/year/person, or 0.006%. This contention is equivalent to claiming that a containment and/or dispersion of 99.994% (100.000% - 0.006%) . Such a con-



tainment and/or dispersion appears to be unrealistic.

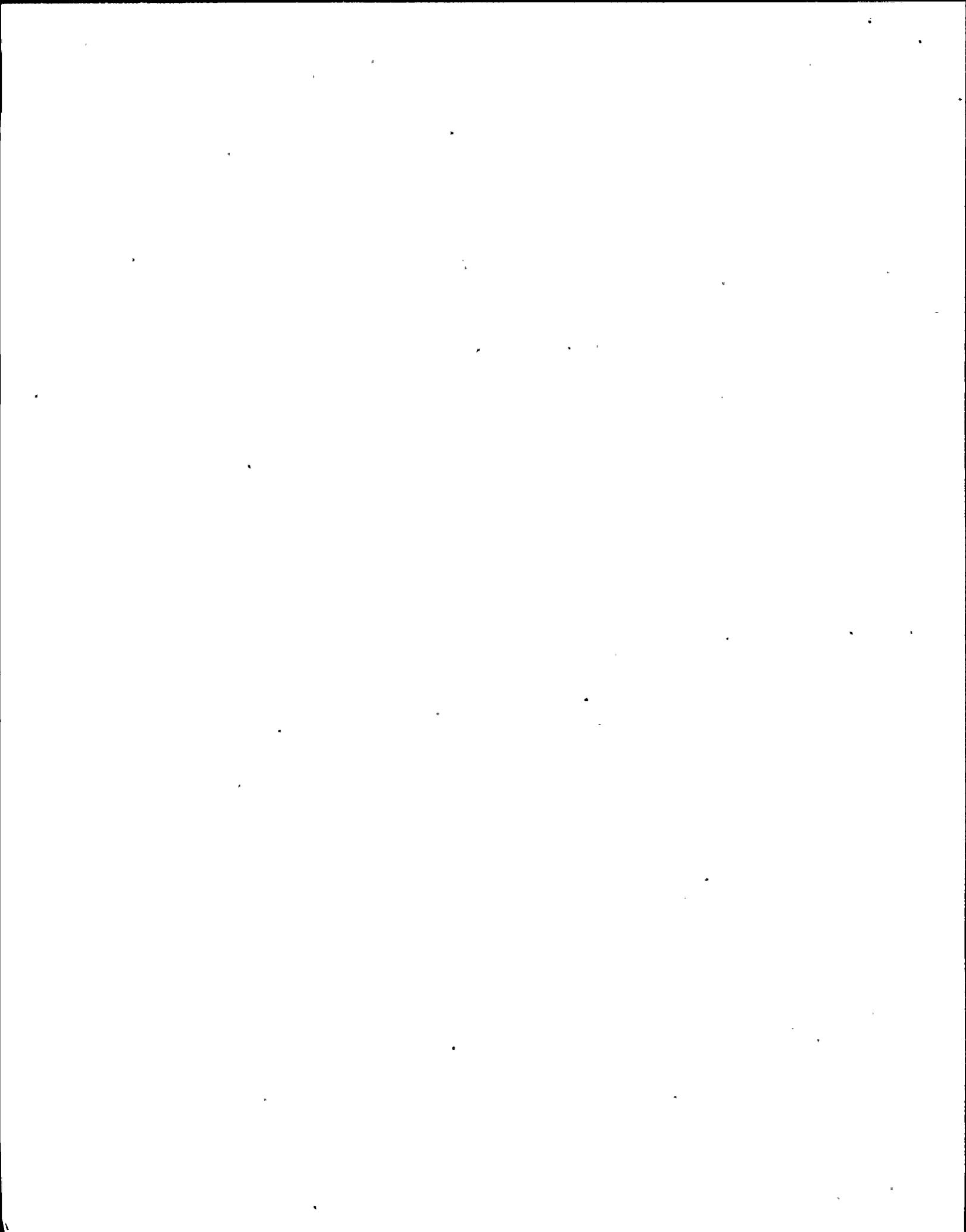
Factors which account for the 99.994% reduction in the calculated total body dose for liquid effluents obviously might exist, but the Staff has not provided an explanation of those factors in its Appendix I materials. It cannot, then, be said that the Staff's assessment as to the effect of low level emissions on the food chain is adequate without such an explanation. If indeed the reduction is due entirely to containment and/or dispersion, the Staff has not provided an adequate explanation of how that containment and/or dispersion results in only 0.006% of the calculated total body emissions for liquid effluents. A genuine issue of fact exists, then, as to whether the total body dose for liquid effluents, reported in Table 3 of the Letter as 0.012 mrem/year/reactor, is accurate.

The other shortcomings in the Staff's analysis of DCNGS low level emissions on the food chain concern the reporting of bioaccumulation factors. First, the bioaccumulation factors reported in Table 5.23 may be incorrect because they appear to assume uniformity of distribution within the entire volume body of an organism. Since this assumption is clearly questionable because many radionuclides discharged into the environment and known to accumulate in specific cells, tissues or organs. Therefore, these factors at best can yield only minimum rather than most probable estimates of dose. Moreover, the calculated factors differ markedly from comparable factors determined by the Staff for cesium, strontium iodine, and other radio-elements, as indicated in Paragraph 5 and Reference 1 of the Lyon Affidavit.



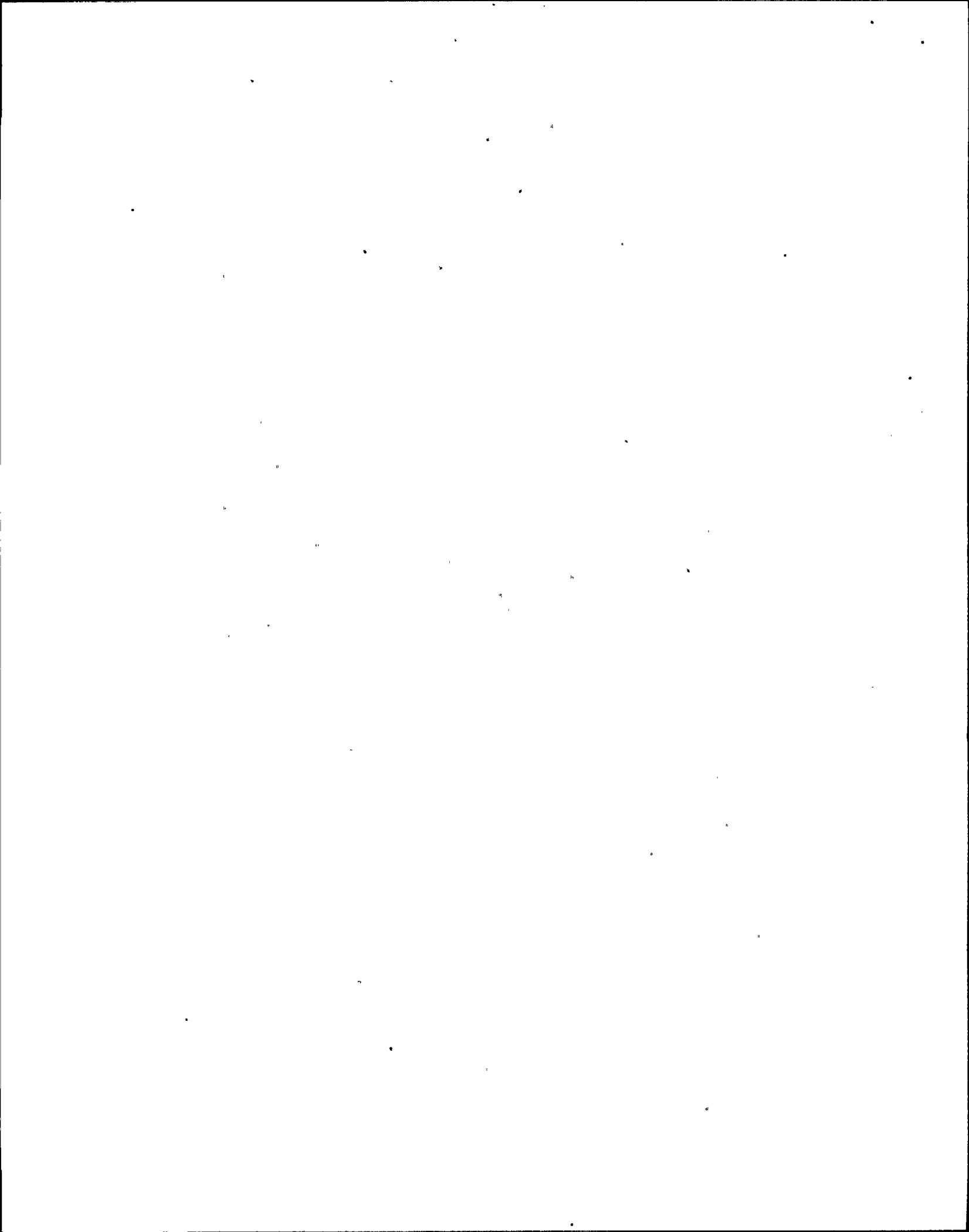
Second, the reported bioaccumulation factors appear to have failed to take into account the combined bioaccumulation factors resulting from organisms which have bioaccumulation factors eating other organisms which also have bioaccumulation factors. For example, from Table 5.23, the bioaccumulation factor for Cs-137 in waterfowl or shorebirds is given as 100. But if these birds eat fish which, in turn, have fed on crustaceans or mollusks, which have previously fed on algae, the overall accumulation factor for the birds at the top of this typical marine food chain would be  $10 \times 50 \times 30 \times 100$ , or 1,500,000. However, because non-radioactive potassium in sea water, about 0.38 g/kg of sea water acts as a major diluent for Cs-137, the net factor would be  $1,500,000/380$  ppm, or approximately 4,000. This value is comparable to a concentration of multiplication factor of 2,000 for Cs-137 reported in the flesh of freshwater mallard ducks (over the radiocesium in their food) on and around the Hanford Reservation in Washington state, and, therefore, is realistic for the same marine food chain at the DCNGS. A similar conclusion for radiostrontium is appropriate: the bioaccumulation factor for freshwater algae, 500, multiplied by the factor for mollusks (soft tissue), 100, divided by the calcium and strontium contents of sea water which act as diluents, 413 ppm, results in an overall accumulation in marine fish of approximately 125. This figure is more than six times greater than 20, the figure reported for Sr-90 in fish in the Staff's Table 5.23.

Because the bioaccumulation factors reported in the FES may have been erroneous, the FES may have inadequately assessed the impact of low level emissions at the DCNGS on the food chain.



Thus, the calculations and references presented in the Lyon Affidavit certainly demonstrate genuine issues of fact as to whether the Staff's materials have adequately assessed the impact of the low level emissions from the DCNGS on the food chain.

Finally, the fact that there are several variables which affect the calculation of the emissions levels, which variables themselves may be subject to wide margins of uncertainty, indicates that the Appendix I levels calculated for the DCNGS Units may be low by as much as a factor of 100. The Lyon Affidavit at Paragraph 8 explains these uncertainties and indicates the references which point them out. These uncertainties were not adequately explained or indicated in the levels provided in Tables 1 and 2 of the Letter. Therefore, the FES, as supplemented, has inadequately assessed the impact of low level emissions on the food chain.

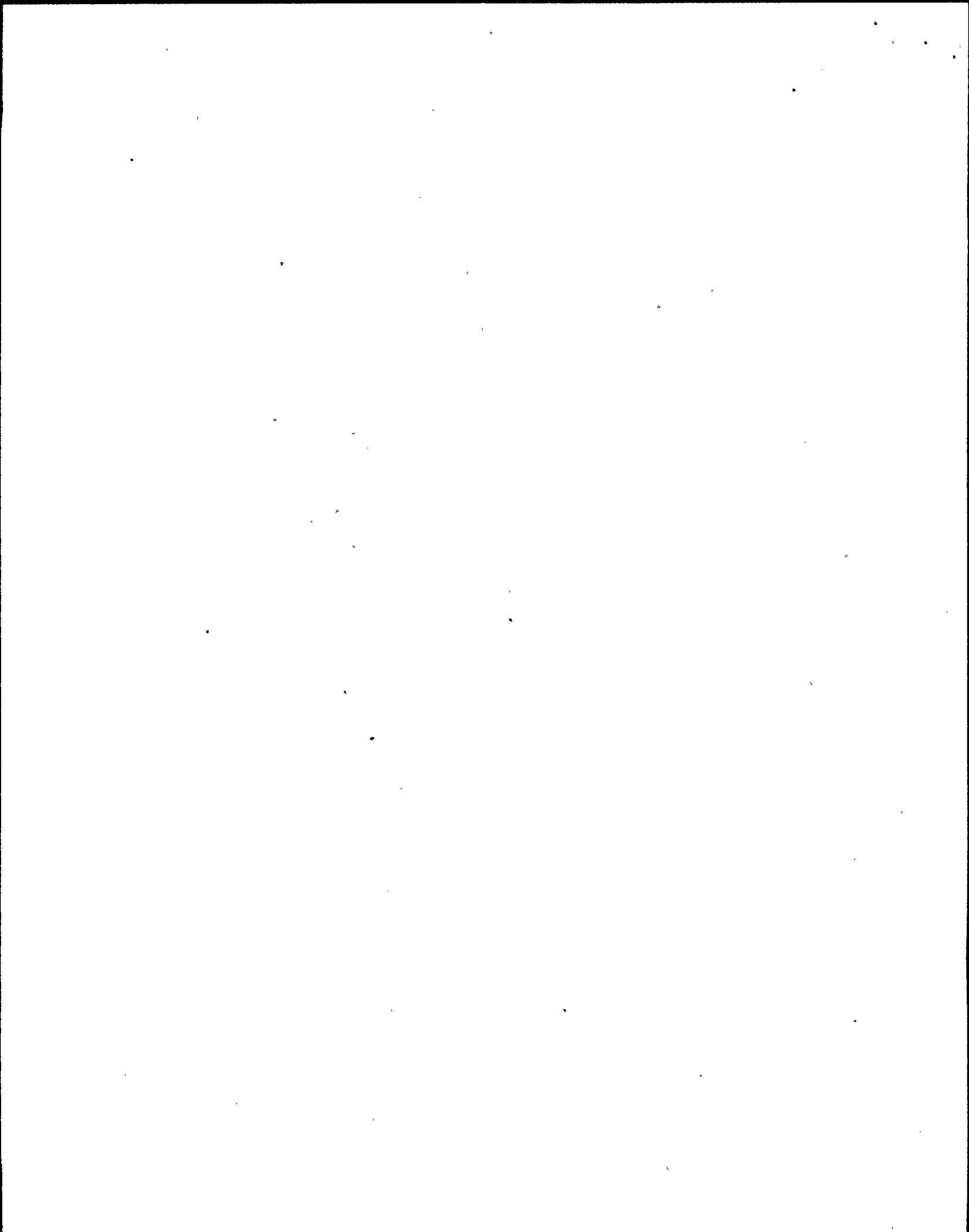


C. Somatic Effects of Low Level Emissions on the General Population.

As noted at the beginning of this section on radiological emissions, Intervenors assert that the Staff's failure to take into account increased emissions with reactor age demonstrates the inadequacy of the FES as to adverse impacts on the general population. Here, Intervenors make an additional point concerning a revision by the Staff of its Diablo Canyon population dose estimate to 0.3 man-rem/year (Letter, p.5) from the 3.7 man-rem/year previously reported (p.5-59 FES). The conclusion reached in the Intervenors' initial answer that the risk factor of  $1.3 \times 10^{-3}$  (p.52, initial Response) should be used to assess the somatic and genetic effects of low level emissions from the DCNGS on a population living within 50 miles of the DCNGS should be revised to read  $5.4 \times 10^{-4}$  (Addendum to Affidavit of Roland Finston, p. 6). With this revision, the supplemental Finston Affidavit still indicates significant differences of opinion between Dr. Finston and Dr. Goldman as to how the risk factor was arrived at. Because such differences exist, a genuine issue of fact also exists, and, therefore, the instant motion should be denied.

D. Somatic and Genetic Effects of Low Level Emissions at DCNGS on Plant Personnel

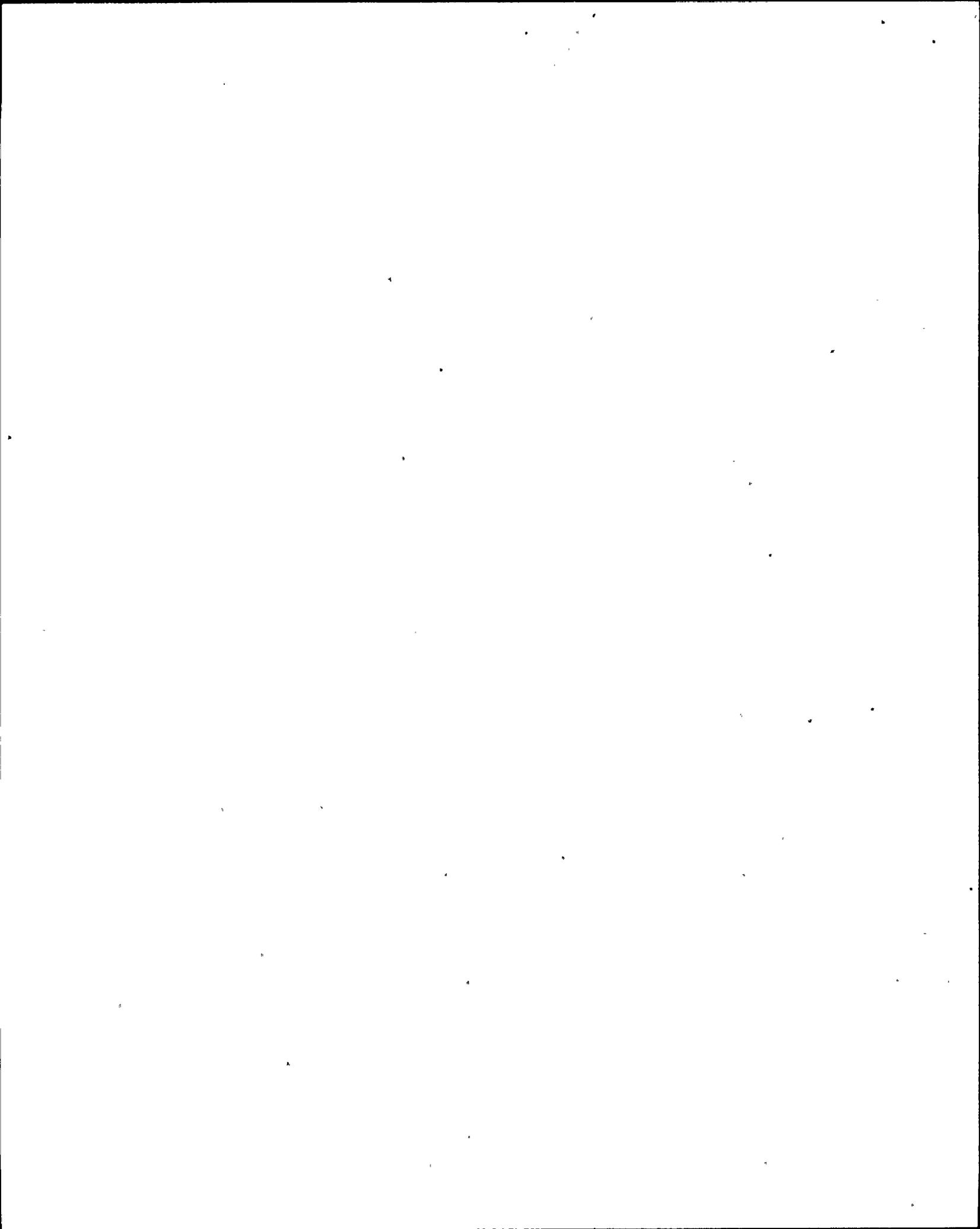
Intervenors renew all of their points noted in their initial Response as to the failure of the Staff to



correctly assess the effect of low level emissions on the plant workers at the DCNGS. The revision of the occupational exposure rate for plant employees from 1.3 man-rem/MWatt-year (p. 55, initial Response), to 1.45 man-rem/MWatt-year (p.6, Addendum to Affidavit of Roland Finston and Reference 7 therein) results in an annual dose contribution by DCNGS workers to the gene pool dose of 2700 man-rem/year. As in the initial response, the addition of 2700 man-rem/year to the background dose of 21,000 man-rem/year represents a twelve percent increase in the background dose. That addition is significant both as to the increased chances of cancer and genetic defects. But the FES and supplementary material have apparently failed to consider that increase.

Furthermore, the occupational dose of 2700 man-rem/year represents exactly a fifty percent increase in the genetically significant medical X-ray dose, as indicated in paragraph 10 of the attached Finston Affidavit. This increase merits serious consideration by the Staff in the FES. Yet nowhere therein is the correctly computed increase to the X-ray dose found. Therefore, a genuine issue of fact exists as to whether the FES has adequately considered the increase in background dose and increase in the genetically significant X-ray dose.

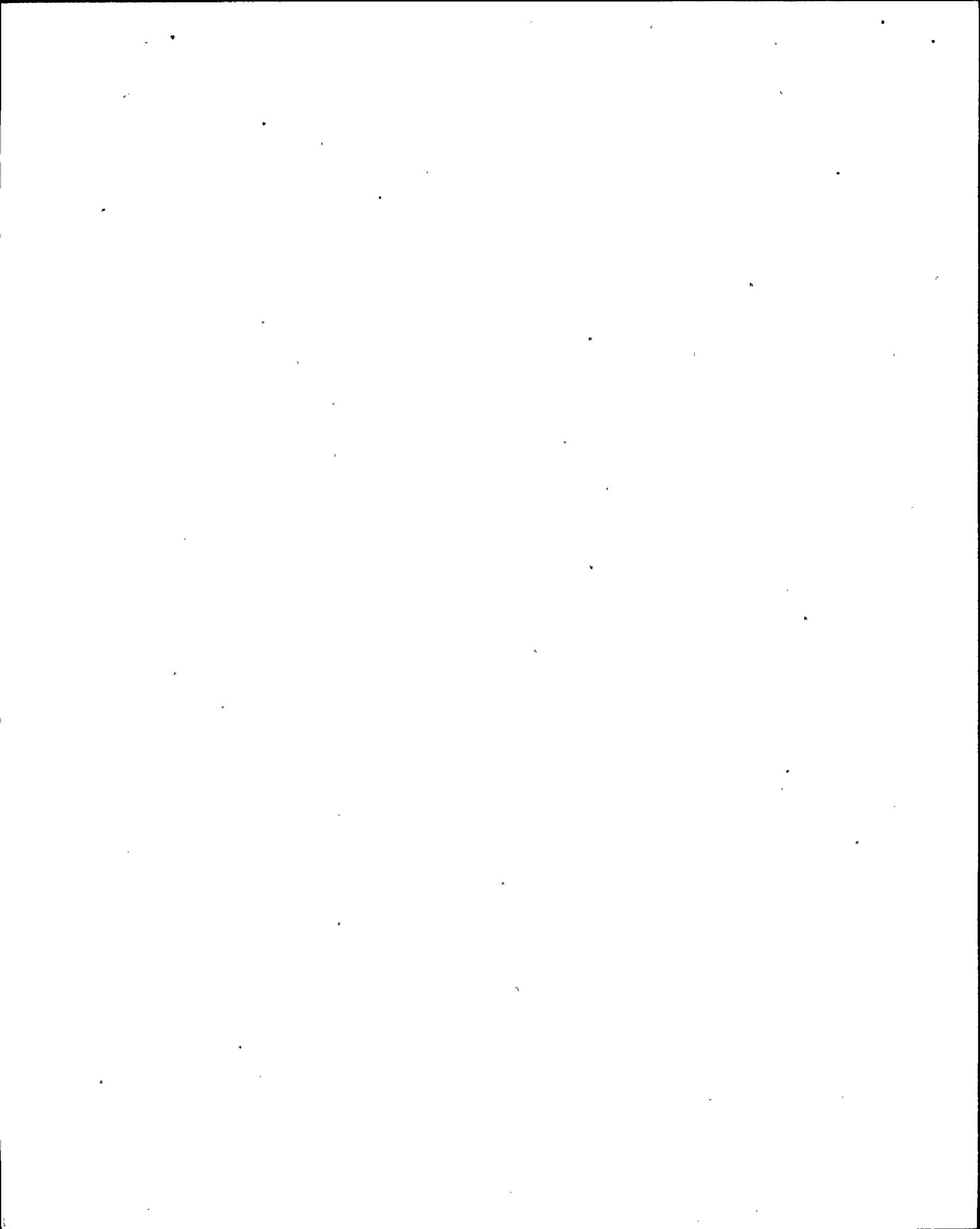
As Paragraph 11 of the attached Finston Affidavit shows, the correction of the occupational exposure from 2400 man-rem/year to 2700 man-rem/year results in 120 to 380 genetic "effects" per generation at equilibrium, in contrast



to the 20 "effects" proposed by Goldman. The increase in genetic disease could range from 0.5% to 2.5% due to the operation of the DCNGS, and these increased genetic effects are certainly significant enough to merit evaluation in the FES. Thus, a genuine issue of fact exists between the Staff and intervenors as to the number of "effects" per generation at equilibrium will result from the normal operation of the DCNGS, and thus the Staff motion should be denied.

As to the possibility of mental retardation from normal operation of the DCNGS, the Addendum to Dr. Finston's Affidavit indicates that the exposure rate of 1.5 to 3.0 rems/year experienced by 11% of reactor workers has caused a four-fold increase in the incidence of severe mental retardation and a statistically significant increased incidence of Down's syndrome. As was argued in intervenors' initial answer, the FES should consider the possibility of an increase in mental retardation in the FES in order to meet the test of adequacy.

Finally, as to health effects experienced by plant workers, the attached Finston Affidavit indicates that BEIR estimates can show that one additional death from delayed effects of radiation cancer will occur for each 6000 man-rem. Therefore, nine workers would be expected to have patent or occult lethal malignancies engendered in their bodies over a twenty year period of operation of the DCNGS. Intervenors contend with considerable factual support that the FES has not considered several increased risks of cancer among plant personnel due to normal operation



of the DCNGS. Therefore, the Staff's motion for summary disposition should be denied.

#### CONCLUSION

The five affidavits, numerous references to technical literature, and analysis Intervenor's submit as their supplementary answer clearly delineate many genuine issues of fact between Intervenor's and Applicant as to the marine biota, nuclear economics, and radiological emissions contentions at issue in these environmental proceedings. These supplementary materials, taken together with Intervenor's original answer and supporting affidavits, clearly demonstrate that if this Board fails to deny the Staff's Motion for Summary Disposition, the Board will exclude from the record in these proceedings responsible scientific testimony that this Board must consider pursuant to the National Environmental Policy Act. Therefore, under both the law of summary disposition and the mandate of NEPA, the Staff's Motion for Summary Disposition should be denied.

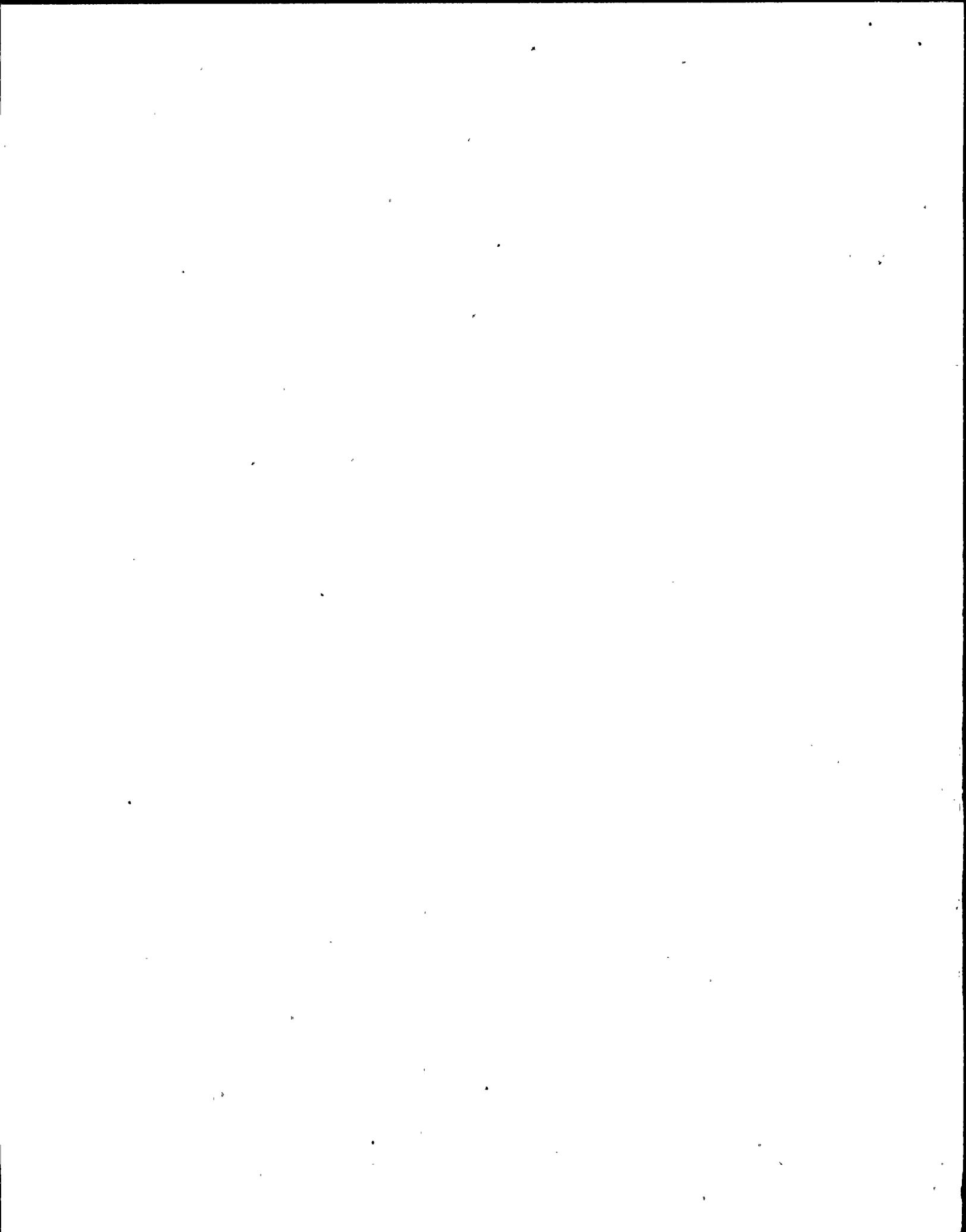
DATED: October 22, 1976

Respectfully submitted,

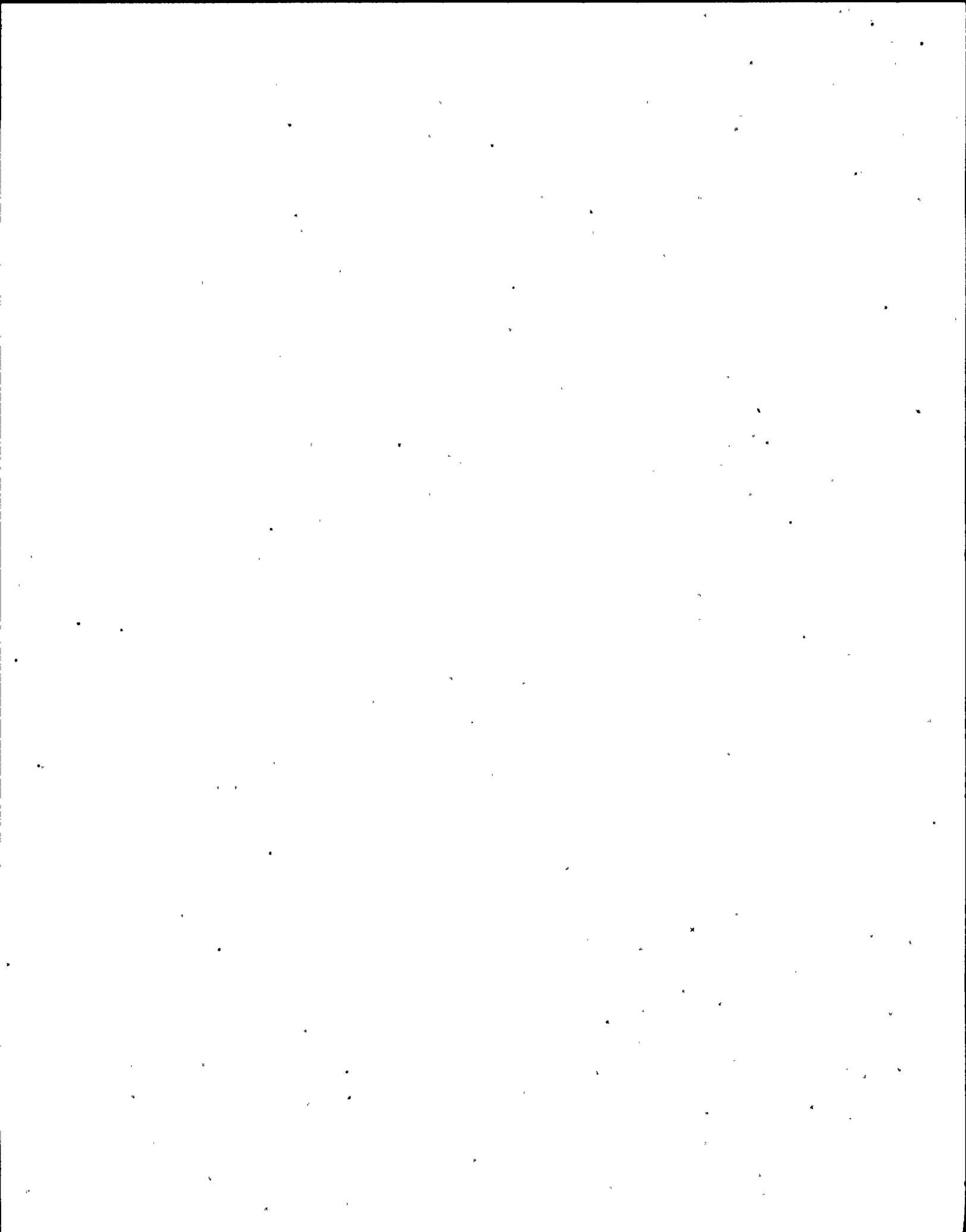
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Scenic Shoreline Preservation  
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Sandra Silver  
Ecology Action Club  
John J. Forster



INTERVENORS' SUPPLEMENTARY STATEMENT OF GENUINE  
ISSUES OF FACT BETWEEN STAFF AND INTERVENORS  
FOR ENVIRONMENTAL CONTENTIONS 1F AND 1G

Intervenors have the following additional factual disputes with the Staff over its factual assertions regarding the effect that the once-through cooling system will have on the marine environment:

Contention 1F

1. The Staff's assertion that mechanical stress due to entrainment of organisms in the cooling system will have an insignificant detrimental effect on entrained animals.

Contention 1G

1. The Staff's prediction that thermal changes and mechanical stress will result in insignificant losses of near-shore larval animals.

2. The Staff's prediction that any loss of larval animals will have no effect on the marine population in the Diablo nearshore area.

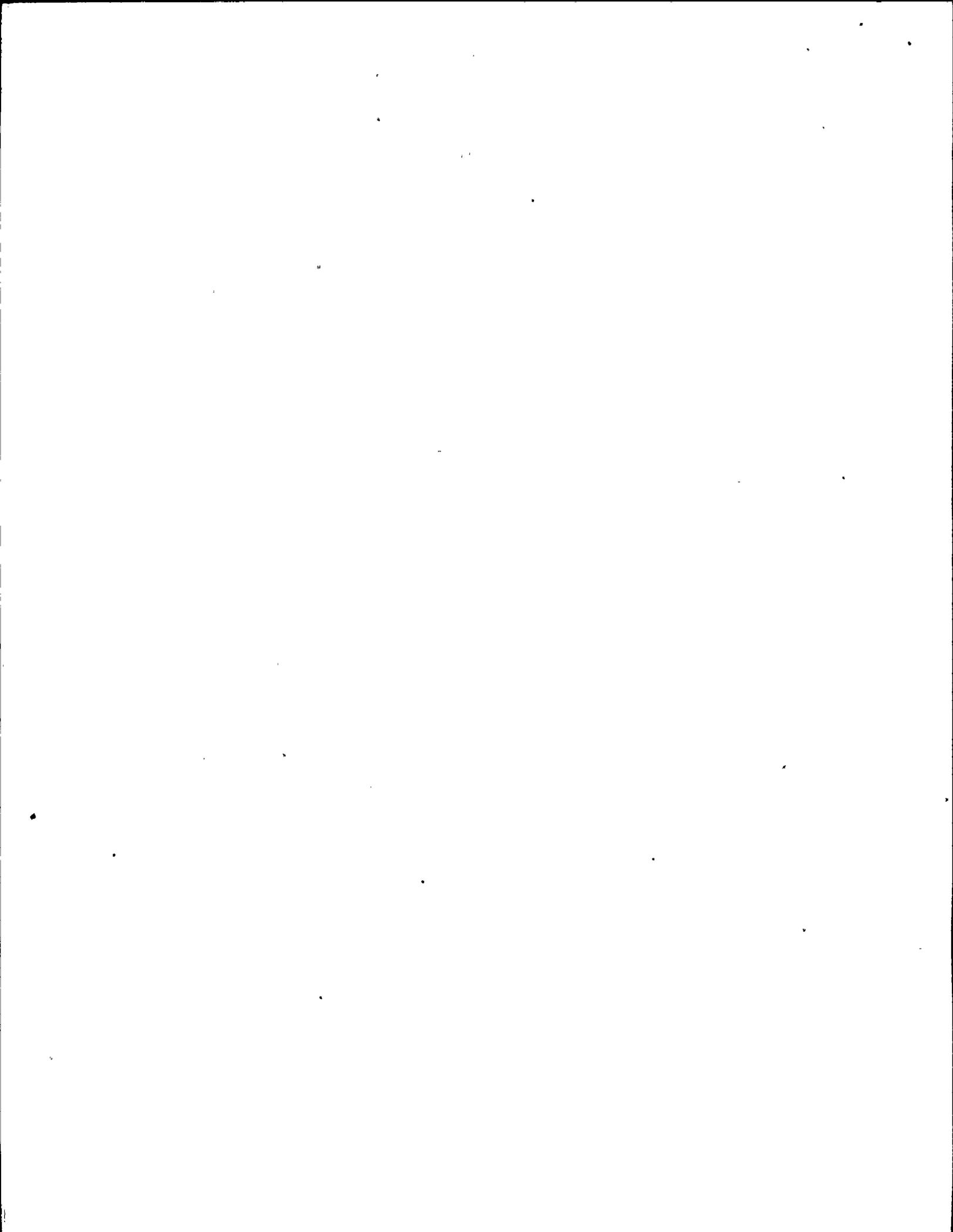
3. The Staff's prediction that residual chlorine from discharge waters will have insignificant lethal and/or sub-lethal impact on Diablo Cove species populations.

4. The Staff's prediction that thermal change will have no effect on species productivity through variations in productivity of phytoplankton caused by variations in temperature.

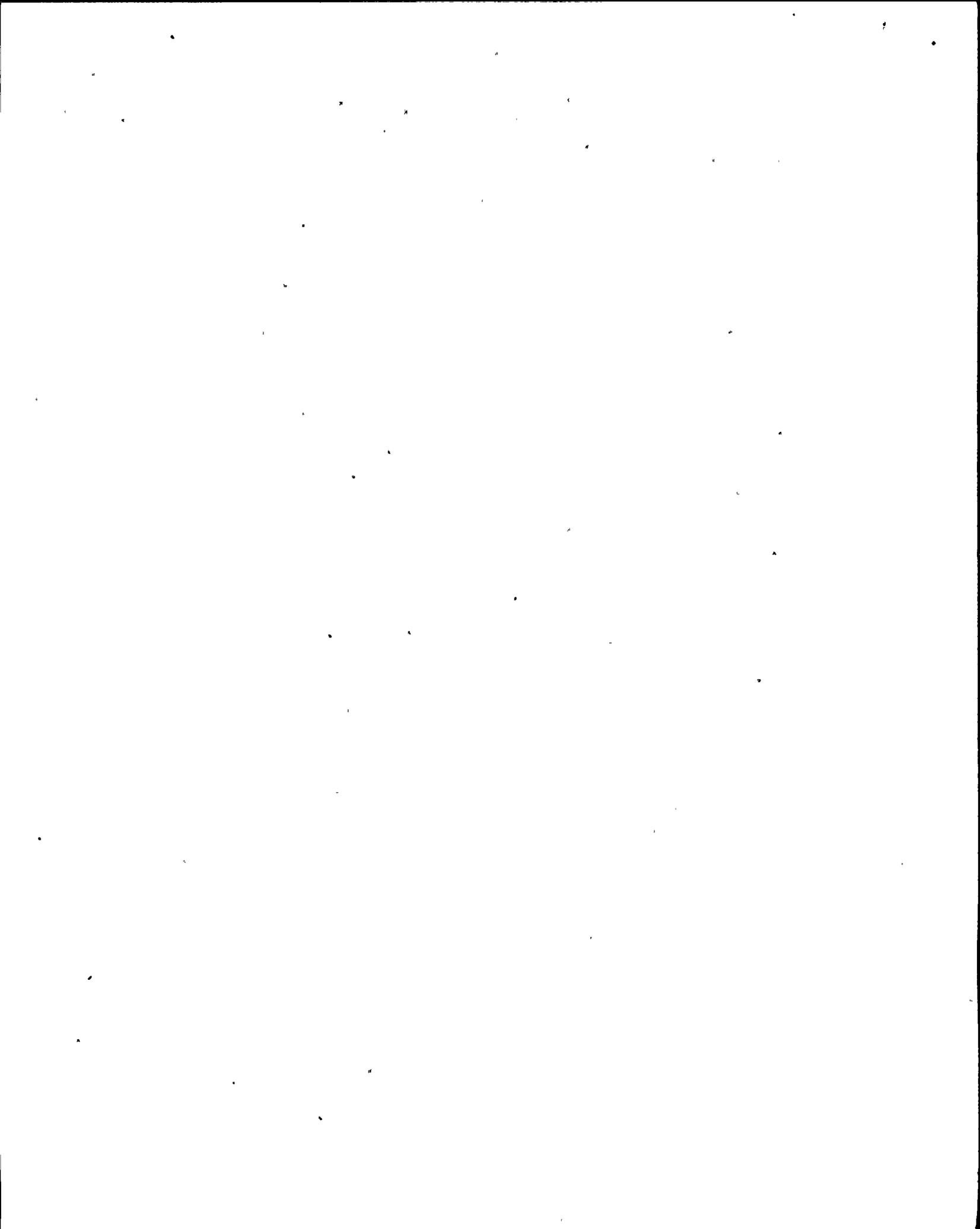
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Because Intervenors technical review of environmental impacts on marine biota is continuing, Intervenors reserve the right to supplement the above list of genuine issues of fact as their technical review progresses.



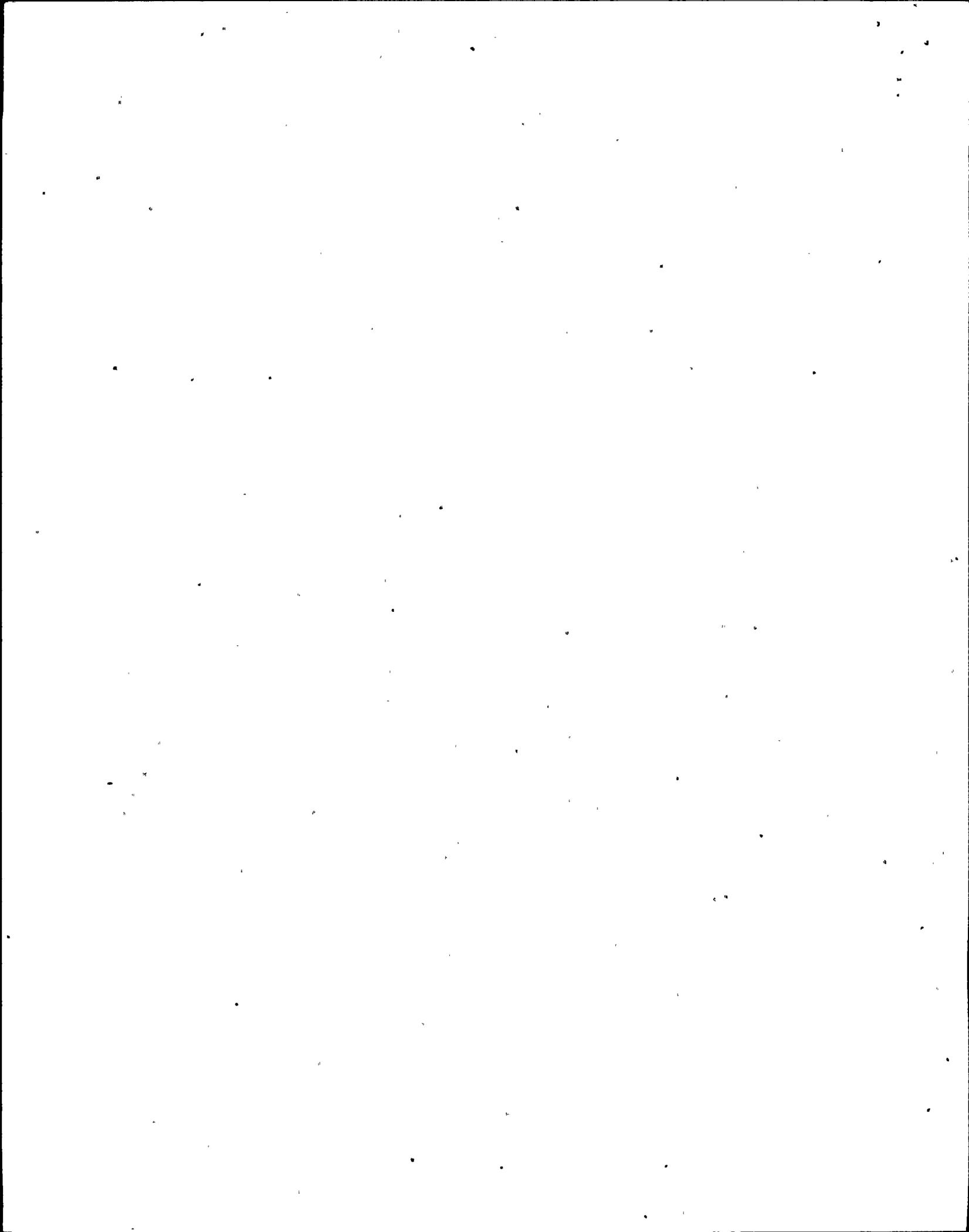
INTERVENORS' SUPPLEMENTARY STATEMENT OF  
GENUINE ISSUES OF FACT RELEVANT TO  
ENVIRONMENTAL CONTENTION 2A, NUCLEAR FUEL SHORTAGES

Intervenors have the following additional factual disputes with the Staff over the Staff's factual assertions regarding nuclear fuel shortages:

1. The Staff's assertion that all uranium resources in ERDA's "probable" resource category will be identified as actual resources and be available as nuclear fuel by 1990.

2. The Staff's assertion that domestic resources of middle grade uranium ore will be readily available to provide significant quantities of nuclear fuel by 1990.

Intervenors' technical consultants and research assistant on nuclear fuel supply are continuing their technical review of relevant data and studies, including the papers presented at a nuclear industry Grand Junction, Colorado seminar held only a few days ago. Consequently, Intervenors would like to reserve the right to supplement the list of factual disputes relevant to this contention as their technical review of material relevant to this contention continues.



INTERVENORS' STATEMENT OF GENUINE ISSUES OF FACT  
RELEVANT TO ENVIRONMENTAL CONTENTION 2B, PLANT RELIABILITY

Intervenors have the following factual disputes with the Staff over the Staff's factual assertions regarding plant reliability:

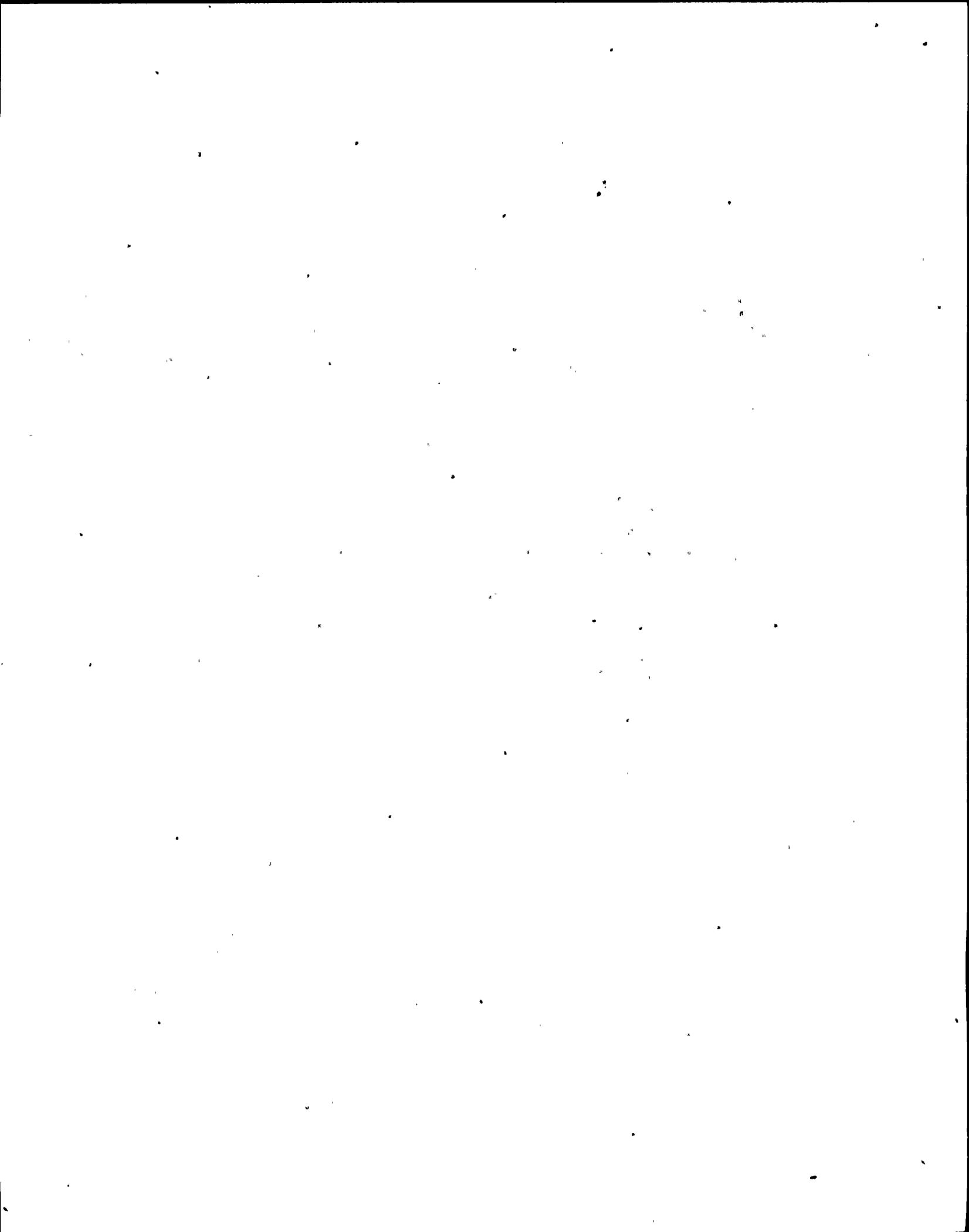
1. The Staff's estimate that the Diablo Canyon plant's capacity factor will average in the 75-80% range over its operating life.

2. The Staff's assertion that technical and operational improvements will increase Diablo Canyon's capacity factor significantly over actual capacity factors observed at other Westinghouse reactors in the past.

3. The Staff's assertion that capacity factor continually improves with age.

4. The Staff's assertion that reactor size has no independent negative effect on plant capacity factor.

Intervenors' technical consultants on plant reliability, capacity factor and related matters are continuing their technical review of relevant data and studies. Consequently, Intervenors would like to reserve the right to supplement the list of factual disputes relevant to this contention as their technical review continues.



INTERVENORS' SUPPLEMENTARY STATEMENT OF  
GENUINE ISSUES OF FACT BETWEEN STAFF  
AND INTERVENORS FOR ENVIRONMENTAL  
CONTENTIONS 4A, 4C, and 4D

For Contentions 4A, 4C, and 4D.

Intervenors have the following supplementary factual disputes with the Staff over its factual assertions regarding the effect of low level emissions from the DCNGS:

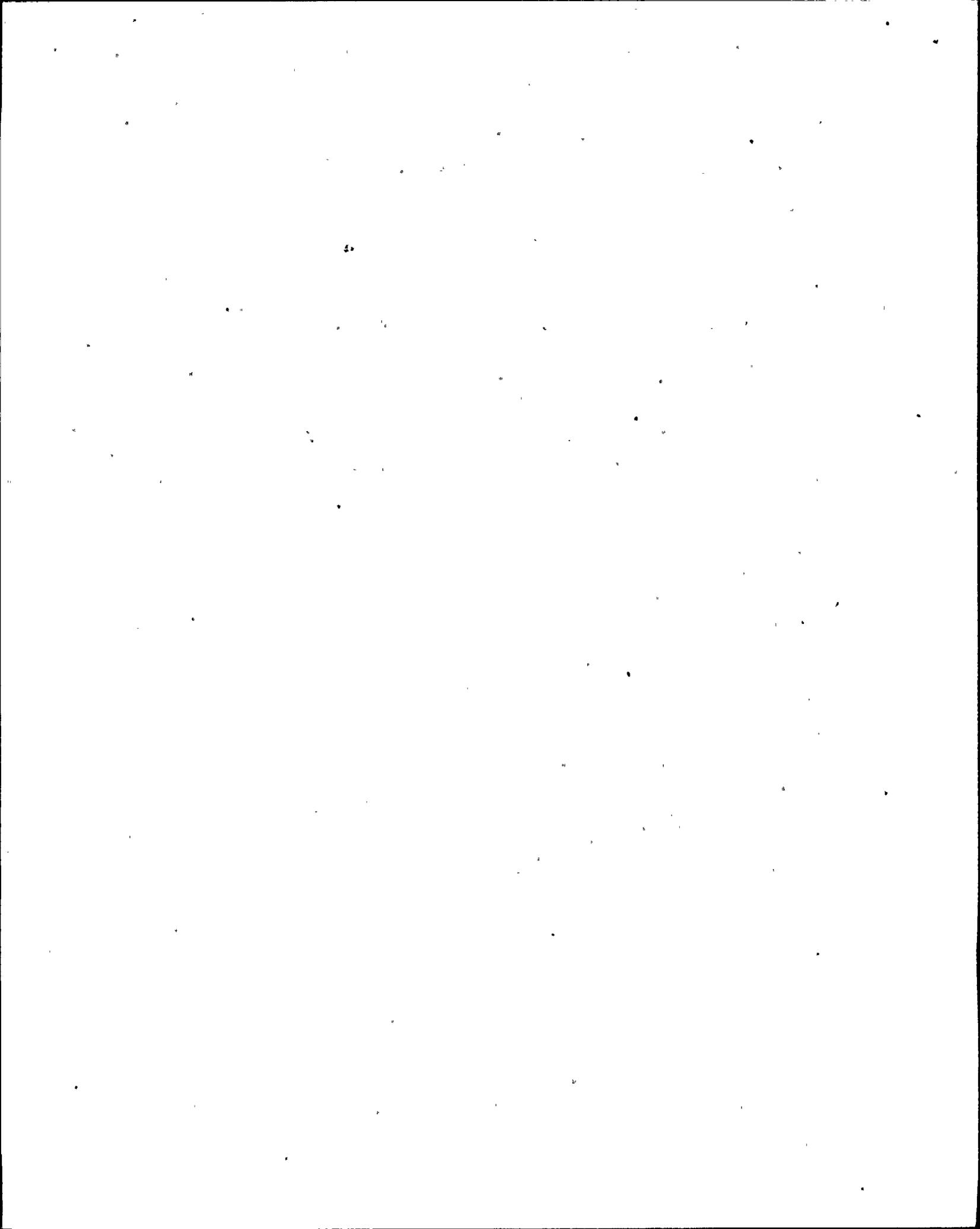
1. The Staff's failure to consider that emissions releases from PWR's such as the DCNGS increase with the age of such reactors, and the effect those increased emissions will have on the food chain, the population living within a 50-mile radius of the plant, and the plant workers.

Because Intervenors' technical consultants on radiological emissions are continuing their review of the data on low level radiological emissions which is available to them, Intervenors would like to reserve the right to supplement the list of factual disputes relevant to this contention as such factual disputes are discovered.

Contention 4A

Intervenors have the following supplementary factual disputes with the Staff over its factual assertions regarding the effect of low level emissions from the DCNGS on the food chain:

1. The Staff's estimate of the release of Tritium H-3.
2. The Staff's estimate of the release of fission and corrosion and activation products to liquid effluents.



3. The Staff's estimate of the total body dose for liquid effluents, apparently assuming a more than 99% containment and/or dispersion factor.

4. The Staff's estimate of bioaccumulation factors, and its failure to correctly account for the combining effect of organisms in the food chain which themselves have bioaccumulation factors.

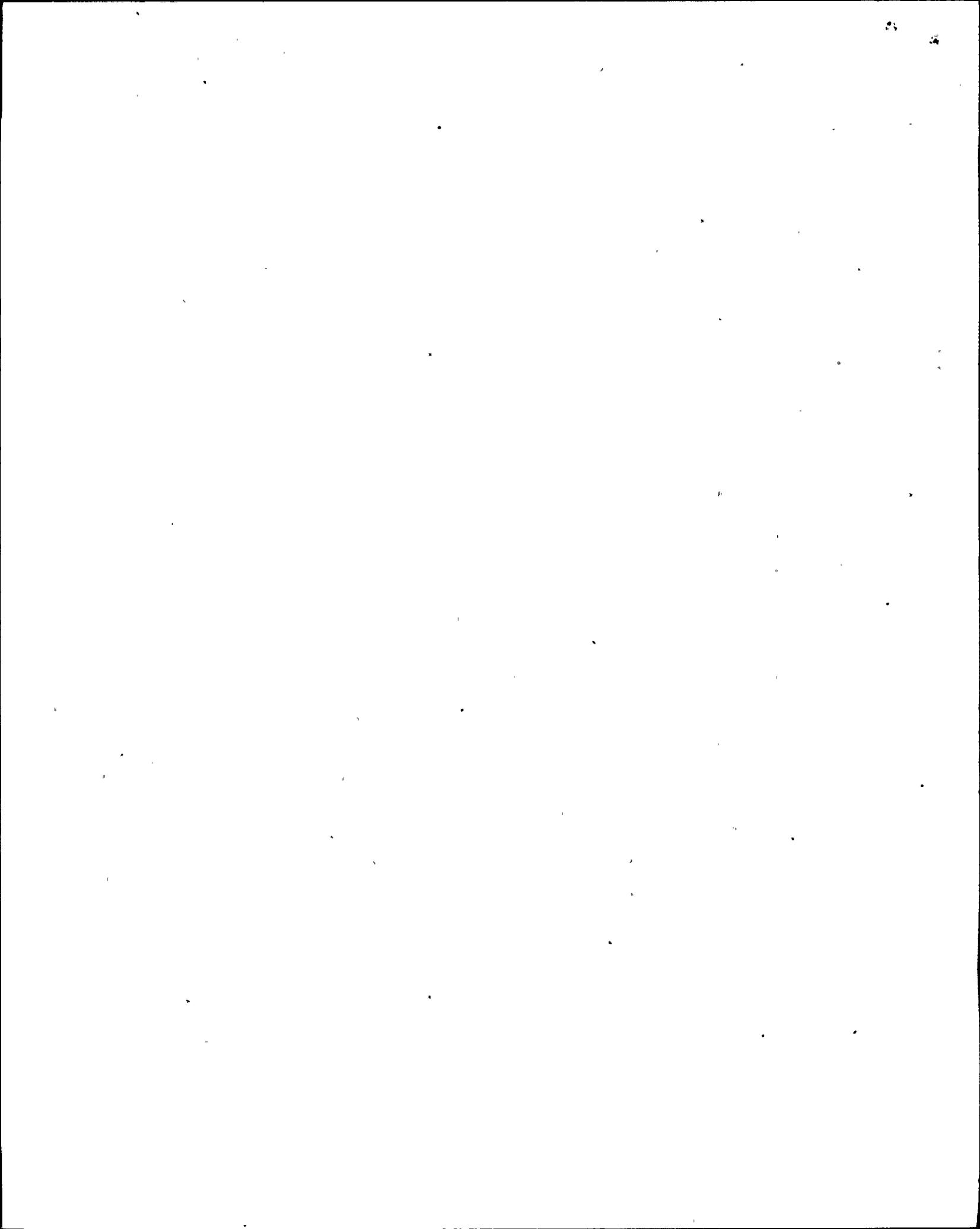
5. The Staff's apparent failure to account for several uncertainties which exist in the calculation of low level emissions rates and bioaccumulation factors.

Because Intervenors' technical consultants on radiological emissions are continuing their review of the data on low level radiological emissions which is available to them, Intervenors would like to reserve the right to supplement the list of factual disputes relevant to this contention as such disputes are uncovered.

#### Contention 4C

Intervenors renew all of the factual disputes they raised in their initial response, and note that they have revised their calculations as to the health and genetic effects of low level radiological emissions from the DCNGS on the population within 50 miles, based on a total body dose of 0.3 man-rem/year.

Intervenors' technical consultants on radiological emissions are continuing their review of the data on low level radiological emissions available to them, and would like to reserve the right to supplement the factual disputes relevant to this contention as they are



uncovered.

Contention 4D

Intervenors have the following supplementary factual dispute with the Staff over its factual assertions regarding the effect of low level emissions from the DCNGS on the plant workers:

1. The possibility that long-term exposure to plant workers will result in an increase in cancer among such workers.

Because Intervenors' technical consultants on radiological emissions are continuing their review of the data available to them, Intervenors would like to reserve the right to supplement factual disputes relevant to this contention as they are uncovered.

