

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD



In the Matter of)
LONG ISLAND LIGHTING COMPANY) Docket Nos. 50-516
(Jamesport Nuclear Power Station,) 50-517
Units 1 and 2))

COUNTY OF SUFFOLK'S PROPOSED SUPPLEMENTARY
FINDINGS OF FACT AND CONCLUSIONS OF LAW
RELATING TO THE HEALTH EFFECTS OF RADON-222
RELEASED BY THE URANIUM FUEL CYCLE

I. PROPOSED FINDINGS OF FACT

A. Pertinent Filings

1. By submission of a pleading dated April 20, 1978, NRC Staff moved the Hearing Board to reopen the record in these proceedings for the limited purpose of receiving into evidence five Staff affidavits which provided new estimates of radon-222 releases and the health effects resulting from such releases. Staff's action was prompted by an April 11, 1978, Nuclear Regulatory Commission amendment to Interim Table S-3 of 10 CFR, Part 51. See, 43 Fed. Reg. 15613 (April 14, 1978). The Commission's action amended Table S-3 to remove the value for releases of radon and to clarify that Table S-3 does not include health effects from the various effluents described therein.

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2. In its ruling entitled "Effective Clarifying Amendment to Table S-3 and Response to Petition for Rulemaking filed on behalf of the New England Coalition of Nuclear Pollution" (Docket No. PRM 51-1), the Commission explained the reasons for its action by acknowledging that the previous Table S-3 value for Radon-222 (74.5 curies per AFR) was incorrect and it did not include: a) estimates of radon released during uranium mining operation; b) estimates of releases of radon from interim tailing piles after the mill has shut down and during the ensuing period while the tailings pond is evaporating and before stabilization programs are completed; and c) estimates of releases of radon from stabilized mill tailings piles.

3. The affidavits submitted by Staff in support of its motion to reopen provided its assessments of the amount radon releases associated with each of the above operations and calculated the probable health effects resulting therefrom. On the basis of these affidavits, Staff there concluded that: (1) the wide gap between the health effects of the uranium and coal fuel cycles is not significantly narrowed by the addition of the increment from the aspects of uranium milling not previously considered; and (2) the impact from the higher levels of radon releases are insignificant compared to those due to radon contamination in natural background and the population doses from this source cannot be distinguished from

background. Staff's Motion, 2, 3. For these reasons, Staff asserted that the submitted affidavits "...provide an adequate basis to dispose of the radon matter and that, in the absence of a proffer of contrary evidence or of questions raised sua sponte by the Hearing Board, no further hearing need be held." Id., at 3, 4.

4. On May 1, 1978, the County of Suffolk (hereinafter County) opposed Staff's motion in a pleading entitled "County of Suffolk's Response to 'NRC Staff Motion to Reopen the Record on NEPA Issues (S-2)'". In its motion, the County argued that, contrary to Staff's conclusion: 1) the levels of radon and its daughters estimated by Staff to be released during the mining and milling operations and the releases of mill tailing piles after the period of active milling, are grossly understated; 2) the health consequences associated with such releases as estimated by Staff are grossly understated; and 3) the health consequences associated with such releases are so great that the costs of building Jamesport 1 and 2 far outweigh the benefits of going forward with such construction and certification of the plants is not in the public interest and must be denied. County's Response, 10.

5. On May 22, 1978, the County submitted a pleading entitled "Addendum to 'County of Suffolk's Response to NRC Staff Motions to Reopen the Record on NEPA Issues (S-3)'", and attached thereto the affidavit of Dr. Arthur R. Tamplin. Dr. Tamplin's affidavit provided support for the County's position as described in para. 4, supra, and consisted of estimates of the radiological impacts associated with the radon releases from the mill tailing piles that will result from the operation of the Jamesport reactors and the basis for those estimates. *

6. On June 1, 1978, the Hearing Board reopened the record in this case on the National Environmental Policy Act issues for the limited purpose of receiving new evidence on radon releases and on health effects resulting from radon as well as other gaseous and liquid effluents listed in Table S-3.**

* Dr. Tamplin's affidavit which has been received in evidence in this proceeding as Dr. Tamplin's direct testimony, consists of two separate reports, the first, a two-page document entitled "Th-230 Dosage and Cost/Benefit", and the second, a thirteen page document and a table, entitled "Biological Effects of Tailing Pile Emissions". For clarity, references made herein to Dr. Tamplin's direct testimony (hereinafter T.D.T.) shall refer to the latter document unless otherwise indicated.

** The Hearing Board issued a Partial Initial Decision (PID) on May 9, 1978, but retained jurisdiction over the Table S-3 matter. The PID is presently on appeal before the Atomic Safety and Licensing Appeal Board.

7. In lieu of a hearing, the parties agreed by stipulation (executed on July 27, 1978, and approved by the Hearing Board by order dated July 31, 1978), that the record compiled on radon-222 and associated health effects in Duke Power Company (Perkins Nuclear Station, Units 1, 2 & 3), Docket Nos. 50-488, 489, 490, would, subject to approval by the Hearing Board, be incorporated as evidence in the instant proceeding to the extent it was admitted in the Perkins hearing. The stipulation also provided for the taking of evidence of a deposition which was held on July 27, 1978. Said deposition included the testimony of Dr. Leonard Hamilton (Applicant), Dr. Reginald Gotchy, and Mr. Ralph Wilde (Staff), and Dr. Arthur Tamplin (County).

8. By order dated August 22, 1978, the Hearing Board closed the record in this case and on September 11, 1978, Staff submitted its proposed findings in a pleading entitled "NRC Staff's Proposed Supplementary Findings Relating to the Health Effects of Radon-222 Released By the Uranium Fuel Cycle in the Form of a Supplemental Initial Decision". As it did without benefit of a record, see page 3, supra, Staff again concluded that radon-222 releases and impacts are insignificant in striking a cost-benefit balance for the Jamesport plants.

9. The County adopts herein and makes a part hereof its previously-filed "County of Suffolk's Proposed Findings of Fact and Conclusions of Law" (July 30, 1977). The County therein demonstrated that Staff and the Applicant had vastly underestimated and made an inadequate analysis of not only the releases of radon and their associated health impacts (County's Findings of Fact, paras. 31.17-31.21, 31.47), but also the health effects attributable to the entire nuclear fuel cycle. (County's Findings of Fact, pp. 137-273). Thus, the fact that these hearings had to be held at all lends further credence to the County's findings on these issues and to its legal conclusions that Staff utterly failed in its responsibility to conduct a meaningful and adequate NEPA-required cost/benefit analysis (County's Conclusions of Law, pp. 464-76) and failed also to discharge its regulatory responsibilities, including fulfillment of the NEPA mandate to complete research and development essential to resolving uncertainties and unknowns which may endanger public health and safety. Thus, it is the County's position that its previously-filed findings of fact and conclusions of law require denial of the application by LILCO and NYSEG for a permit to construct Jamesport 1 and 2 (County's Conclusions of Law, pp. 457-63). The following findings of fact and conclusions of law on radon releases and their associated health effects, which demonstrate a serious underestimate of same by Staff and Applicant, add further weight to the County's position.

- B. The Evidence Demonstrates that the Releases of Radon Associated with the Operation of Jamesport 1 & 2, and the Health Effects Resulting Therefrom, Are So Substantial, or, In the Alternative, Are of Such an Uncertain Nature, That Costs of Constructing Said Plants Far Outweigh Any Asserted Benefits To Be Derived Therefrom
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1. The Testimony of Dr. Arthur R. Tamplin Demonstrates That Radon Releases and the Health Effects Resulting Therefrom Will Be Substantial and Were Grossly Underestimated by Staff and Applicant
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10. Dr. Arthur R. Tamplin appeared as an expert witness on behalf of the County of Suffolk. His testimony was placed in the record at the July 27, 1978 deposition held in connection with radon matter (Tr. 9327) and received in evidence by order of the Hearing Board dated August 22, 1978. Dr. Tamplin possesses impressive professional qualifications to testify on the issue of radon releases and the health effects resulting therefrom. He holds a Ph.D. in biophysics from the University of California at Berkeley, was a former group leader at Lawrence Livermore Radiation Laboratory where he spent some twelve years researching the area of the biological effects of radiation and radiation in the biosphere. During the period June 1967 to January 1969 he was a member of the AEC's Division of Biology and Medicine Committee on Space Nuclear Systems Radiological Safety, whose primary mission was to assess the hazards associated with plutonium releases (Bibliography of Arthur R. Tamplin, following Tr. p. 9326).

Since the time he left the Lawrence Livermore Laboratory he has been continually working in the area of the biological effect of radionuclides in man (Tr. 9234), and he has authored or co-authored over eighty scientific articles, reports and books in his area of expertise. Dr. Tamplin's expertise is unassailable, was not seriously challenged by either Staff or Applicant, and is entitled to decisive weight in this proceeding.

11. Dr. Tamplin testified that there is no safe level of radiation exposure. High dosages of radiation can be lethal, and at lower dosages radiation can induce cancer in the irradiated individuals and induce damage to their genetic material that could be transferred to their offspring and to future generations. Low dosage effects extend to those encountered in the anticipated day-to-day occupational exposure of employees, the medical uses of x-rays and radiation, and releases of radioactivity from the facilities of the nuclear power industry that result in exposure of the public at large. Dr. Tamplin, citing to various reputable scientific studies*, thus concluded that both experimental data and theoretical considerations indicate that any amount of radiation, no matter how small, must be

* See T.D.T., 1-2, and references cited on pp. 1-3.

considered as being harmful to man. (T.D.T., 1-2).

12. A report of The National Academy of Science's Committee on the Biological Effects of Ionizing Radiation (BEIR Report, dated November, 1972) presents the most recent estimates of the biological effects of radiation and concludes that based on a dosage of 1,000,000 man-rem there will result from 100-450 cases of induced cancer, and from 30-750 genetic effects. These estimates are based upon the linear hypothesis which assumes that in the low dose range (doses below which direct experimental evidence is available), the effects are directly proportional to the dose. (T.D.T., 2). However, Dr. Tamplin testified that even the high bound estimate given by the BEIR Report may significantly underestimate the true health effects, possibly by at least a factor of 10, because:

- 1) the higher risk model employed by the BEIR Report (ie. relative risk model) fails to account for the enhanced risk of cancer resulting from in utero exposure (T.D.T., 3-5); and
- 2) there is increasing scientific evidence which suggests that the linear hypothesis employed by the BEIR Report to develop its risk estimators significantly underestimate the health effects resulting from low dose/low rate irradiation. (T.D.T., 5-13).

2. The High Risk Estimate of the BEIR Report Fails to Consider Evidence Demonstrating Enhanced Cancer Risk Resulting from In Utero Exposure to Radiation

13. The high bound estimate of the BEIR Report is based on the relative risk model (ie based on radiobiological data which indicate that the rate of induction of various cancers is proportional to the spontaneous incidence rate), while the low bound estimate is based on the absolute risk model which averages the changing incidence rates into a single value. (T.D.T., 4).

14. Dr. Tamplin testified that although the relative risk model represents a biologically reasonable basis for extrapolating the presently available data on irradiated populations (which data base is not complete since it extends over a period of only 30 years - much less than the lifetime of the younger releases), he noted that the upper bound risk estimate of the BEIR Report improperly assumes that the risk associated with in utero exposure to radiation exposure extends only throughout the first ten years of life and not for the entire lifetime of one so exposed. (T.D.T., 4). But Dr. Tamplin pointed to considerable biological evidence which demonstrates that injury (physiological damage) received during in utero development and in childhood is reflected in decreased physiological

competence and increased mortality during adult life. Thus, there is a significant biological basis for assuming that the radiation injury incurred during in utero development and childhood will lead to an enhanced risk of cancer. Moreover, he cited to data on those irradiated in utero by the atom bombs which shows an increased mortality of such individuals after they reached ten years of age. * Finally, Dr. Tamplin expressed the view that in the next few decades more data will come in that will confirm this pattern of excess cancer in adult life resulting from in utero irradiation. (T.D.T., 5).

15. If the BEIR upper bound risk estimate included risk from in utero exposure to radiation extending throughout the lifespan of one so irradiated, as presently available scientific data indicates should be done, the BEIR risk estimate would double and would become 1,000 cancers per million person rem. (T.D.T., 4). Neither Staff nor Applicant accounted for the increased risk resulting from in utero irradiation in their health effects testimony.

* T.D.T., 5, referring to Hiro Kato, "Mortality in Children Exposed to A-Bombs While In Utero, 1945-1969", Journal of Epidemiology, Vol. 93, No. 6, pp. 435-42 (1971) (Tr. 9378-79).

3. The Linear Hypothesis Used by the BEIR Report to Arrive at its Risk Estimators Underestimates the Health Effects Caused by Low Dose/Low Dose Rate Irradiation

16. Dr. Tamplin cited to various scientific reports which concluded that the linear hypothesis in all likelihood underestimates the risks associated with low dose/low rate LET radiation. (T.D.T., 6, and references cited in nn. 11, 12). Other studies have shown that there are individuals in the population who are affected by orders of magnitude greater than other individuals and that this population heterogeneity with respect to radiation sensitivity causes the linear hypothesis to underestimate the risk at low doses. (T.D.T., 6-7, and references cited in nn. 13-15).

17. The most significant recent breakthrough in this area is a report by Mancuso, Stewart & Kneale entitled: "Radiation Exposure of Hanford Workers Dying From Various Causes", Health Physics, Vol. 33, No. 5, pp. 369-84 (Nov. 1977)). The Mancuso Report demonstrates a relationship between low dose occupational exposure and cancer, and in fact suggests a relationship that is 15 times larger than the upper bound estimate of the BEIR Report (ie. 6500 cancers per million person rem as opposed to 450) (T.D.T., 6-7, 10). Dr. Tamplin

testified that the Mancuso Report not only is confirmatory of previous scientific studies on this subject (T.D.T., 8, 9, and references cited in nn. 20-26), but has been buttressed by subsequent analyses. (T.D.T., 10, and references cited in nn. 27, 29). Dr. Tamplin thus concluded on the basis, of this scientific data, that the cancer induction rate for low dose/low dose rate irradiation is 900 to 9000 induced cancers per 1,000,000 person rem.

18. Dr. Tamplin also cited to scientific evidence demonstrating that the BEIR Committee underestimated by a factor of four the genetic effects caused by radiation. (T.D.T., 11, 12, and references cited in nn. 32-34). He referred to a study which showed that genetically-related diseases (ie., multifactorial diseases) are twice as frequent as estimated in the BEIR Report. (T.D.T., 13, and reference cited in n. 35). Thus Dr. Tamplin concluded that the genetic consequences of radiation are 800-6000 genetic effects per 1,000,000 man rem.

19. On the basis of all the foregoing scientific evidence, Dr. Tamplin testified that radon emissions associated with the facility lifetime of Jamesport will result in from 11,000 to 84,000 genetic effects and from 13,000 to 130,000 induced cancers for a total of from 24,000 to 214,000

health effects. (T.D.T., 13).

20. Dr. Tamplin also placed the radon emissions from mill tailing piles that will result from the operation of the Jamesport plants in cost/benefit terms. He calculated that over the anticipated 40 year life of the plants, the total dose commitment would be some 1.4×10^7 person-rem. He then used the Nuclear Regulatory Commission's suggested figures of 1000/per person rem and projected a cost of $\$1.4 \times 10^{10}$ over the lifetime of the reactor. * Dr. Tamplin concluded that these costs, which far exceed the costs of the reactors, and which are conservative calculations (ie. they do not include radon emissions from mining), would have to be borne by individuals who will receive no benefits from Jamesport's operation. (T.D.T., Thorium-230: Dosage & Cost/Benefit, 1-2).

21. Dr. Tamplin's testimony thus conclusively establishes that the health effects resulting from radon-emissions associated with the operation of the Jamesport plants will be substantial,

* The \$1,000 monetary value has been adopted by the NRC "...for use in a cost-benefit analysis of the need for additional radioactive effluent control systems to reduce population exposures (Sec. IID of Appendix I to 10 CFR, Part 50). See Fed. Reg., Vol. 43, No. 101, pp. 22253-54 (5/24/78). Inasmuch as the inquiry here also concerns the health effects caused by radiation exposures to the population resulting from the operation of Jamesport nuclear reactors, the County maintains that it is entirely appropriate to use this value to arrive at a numerical cost/benefit comparison in this proceeding.

that such effects have been vastly underestimated by Staff and Applicant, and that the costs of building Jamesport, as regards the probable health effects caused by radon emissions alone, far outweigh any asserted benefits to be derived therefrom. At a bare minimum, his testimony establishes that because there is such substantial controversy within the scientific community concerning the health effects caused by low-level ionizing radiation, and because also there is a new flow of scientific evidence and data supportive of his conclusion that such health effects are far greater than was previously thought, it would be an act of irresponsibility, and a violation of the commands of NEPA, to permit construction of Jamesport to go forward. Rather, in the absence of any demonstrated need for Jamesport, any licensing must await completion of research necessary to fully resolve this issue.

22. Staff erred in concluding that Dr. Tamplin's testimony given in this case was peripheral to the issues before this Board and/or repetitive of the testimony on the Perkins record (Staff's Supp. Findings, para. 5) both because of the obvious substantive merit of said testimony, as demonstrated by the foregoing findings of fact, and because of the vast professional expertise Dr. Tamplin brings to this subject.

Staff, by failing to substantively address Dr. Tamplin's testimony*, must be deemed to have admitted the facts presented by such testimony and to have waived its right to contest the above findings on reply. Moreover, the testimony of Staff's own witnesses revealed that the assumptions it made to arrive at radon health effects were not reasonably conservative assumptions, that the testimony failed to account for new scientific data on the issue of the health impacts at low dose/low dose rate radiation, and that said testimony fell far short of complying with NEPA's requirements of assessing the full impacts of the proposed action, weighing the alternatives thereto, and providing an adequate cost/benefit analysis thereof.

- C. The Evidence Demonstrates That Staff and Applicant Underestimated Radon-22 Releases and their Health Effects by Failing to Make Reasonably Conservative Assumptions Based on Available Scientific Evidence, Lacked Data to Make Supportable Judgments on Certain Aspects of the Issue, and that Staff's Testimony on this Subject Failed to Comply with the Requirements of NEPA

1. Radon Releases from Mining

* Staff's assertion that Dr. Tamplin's testimony was peripheral and/or repetitive of testimony in the Perkins record is belied by the scope and length of Staff's cross-examination of Dr. Tamplin. (Tr. 9357-9410). One can only assume that Staff was unable to invalidate any of the conclusions Dr. Tamplin reached on this issue given its failure to proffer any findings on its cross-examination of the County's witness.

23. Staff witness Wilde admitted that his testimony on the amount of radon emissions from mining activities per AFR (ie. 4,060 curies) was based on calculations relating to emissions from underground mines (Perkins Transcript, 2540, hereafter P.Tr.). Yet 50% of the uranium presently produced comes from open pit mining. (P.Tr. 2543). Wilde was not aware of any information or scientific data as to how much radon comes from open pit mining and therefore this question is still open. (P.Tr. 2544). Moreover, Wilde admitted that the reclamation of mines is not an area where the NRC has authority or responsibility and it would have to rely on state agencies or other federal agencies to enforce the reclamation of mines. (P.Tr. 2556).

24. Staff witness Lerohl admitted that the data base for mining is very limited and that in September, 1977, a program was underway to get more data on radioactive releases from both open pit and underground mines. (P.Tr. 2533, 2534). Lerohl also indicated that open pit measurements are quite complicated and required the development of new instrumentation. (P.Tr. 2533). Witness Wilde also agreed that the reclamation of mines is beyond NRC's scope of authority and could not state how, if at all, these mines would be secured in the future. (P.Tr. 2550).

25. Dr. Jordan, a member of the Perkins Hearing Board, stated that open-pit mines, unlike the underground mines, if allowed to remain open could continue to emit radon for very long periods of time and wondered whether such releases might not be very much larger than the 4,060 ci figure given in Staff's testimony. Dr. Jordan stated that radon releases from open-pit mines, if extrapolated into the future, may dwarf the figure given for radon releases from milling (P.Tr. 2550) and may constitute a large increase in the level of radon in the United States (P.Tr. 2557).*

26. As a result of these concerns identified in para. 24, supra, Dr. Jordan asked Staff to assume that the pits are going to remain open (ie., not be reclaimed or stabilized) and then to consider the amount of radon coming out of the pit as compared to that coming out of the tailing piles. (P.Tr. 2552). Wilde responded that there were two problems in making such a comparison: 1) there is no presently available data on the emanation rates for various types of materials that occur in open pit mines (P.Tr. 2554); and 2) the open pit mine consists of a much larger area (ie. a couple of square miles) than a tailings pile (ie. 125-150 acres). (P.Tr. 2555). Thus, Wilde admitted that he was unable to quantify the emissions from open pit mines to provide the kind of comparison requested by the Board (P.Tr. 2556-57).

* Earlier in the Perkins hearing Dr. Jordan made the following comment: "...But it would seem to me that there is some question that could now be raised legitimately concerning the amount of radon that will come out in the future from uranium mines in that they may be a continuing source and that the NRC does not have authority to control that (P.Tr. 2482).

27. At the request of Dr. Jordan, Wilde made a "back of the envelope calculation", which he reaffirmed in these proceedings (Tr. 9273-74), of the radon releases from open pit mines by relating such releases to background releases (P. Tr. 2557, 2610-13). Wilde estimated that an open pit mine would release 100 curies per year per AFR. Even assuming arguendo that this figure is correct, if the health effects resulting from such releases were integrated out over the lifetime of radon-222 and its daughters, as the County maintains should be done, see Findings, infra, paras. 28-35, the health effects resulting therefrom would far exceed Staff's estimates. Moreover, inasmuch as Dr. Tamplin's estimate of radon releases and health effects only included those associated with the tailing piles, his estimates actually understate the magnitude of the problem.

2. Radon Releases from Milling - The Integration Issue

28. Dr. Tamplin in his estimate of radon releases and health effects assumed: 1) a constant release rate of 200 curies per year for the two Jamesport reactors (which approximates Staff's estimates of 100 curies per AFR), because there are presently no regulations by which the NRC can enforce the stabilization of mill tailings piles and thus assure lower release rates (Tr. 9333), and 2) an infinite integration period (Tr. 9335),

with most of the significant effects occurring in the first 100,000 years (Tr. 9333). Staff witnesses on the other hand, assumed: 1) there would be complete stabilization of the tailings piles for the first hundred years (with a release rate of 1 curie per year), a gradual degradation of the piles for the next 400 years (with a release rate of 10 curies per year), and the piles would be uncovered for the next 500 years (with a release rate of 100 curies per year). (Tr. 2563, 2566, 2576, 9332); and 2) there was no defensible scientific basis for computing health effects beyond 1000 years (Tr. 9285).

29. There is no firm basis in the record for assuming that stabilization of mill tailing piles will occur. Staff witness Gotchy admitted that the NRC has set forth no position on long-term stabilization of tailings piles (P.Tr. 2405; see also, testimony of Goldman, P.Tr. 2335), nor are there any NRC regulations requiring that mill tailings be stabilized. (P.Tr. 2394). There are only licensing criteria is in the form of an NRC Branch Technical Position (Tr. 2394). Indeed, Staff Witness Black read from a speech given by Commissioner Galinsky which stated, in part:

"...Under the Atomic Energy Act, NRC regulatory authority begins at the point uranium is extracted from its ore, but because tailings associated with uranium milling were not regarded as materials that posed significant health risks, no special provision was made in the Atomic Energy Act for their direct regulation. The tailings, themselves, are

not currently materials whose possession is licensible by the NRC. NRC control over tailings is, therefore, indirect. Their disposal is a condition imposed on the mills' uranium possession license... The main difficulty is that present authority does not provide long-term regulatory control over tailings following final termination of mill operations and, therefore, uranium possession. This gap in authority makes it more difficult to provide uniform and effective solutions to long-term health problems." (P.Tr. 2585-86)

30. Perkins Board Member Jordan referred to an NRC Report entitled: "Assessment of Environmental Impacts in Agreement States" (April 20, 1978) which states that there are presently 22 inactive tailing piles that require remedial action to protect the public from long-term adverse environmental and health impacts and that as a consequence of inadequate control measures these inactive tailing piles, which have resulted primarily from milling for government users, have become a source of increasing concern. Finally the report states that more than half the uranium presently being produced is coming from mills not under direct NRC licensing. (P.Tr. 2477-78). Staff was unable to give any firm assurances that the 22 sites referred to in the above report would be stabilized, or used in reprocessing, but testified that it would depend on the economic incentives

involved. (P.Tr. 2480-81). Finally, Staff witness Miller admitted that a large number of mills are licensed by states under agreement with the NRC and these mills are not necessarily bound by the NRC Staff's criteria (P.Tr. 2451-52). There is presently only a recommendation that there be government ownership of mill tailing sites (P.Tr. 2454).

31. There is no basis in the record for assuming that mill tailing piles will be stabilized in such fashion as to achieve the release rates testified to by Staff. Dr. Tamplin's assumption on this issue (Tr. 9332-33) should be given controlling weight.

32. Staff witness Gotchy assumed a 1000 year cut-off for radon releases and health effects resulting therefrom even though he admitted that the physical process of radioactive decay goes well beyond 1000 years. (P.Tr. 2441).^{*} The 1000 year cut-off period simply represents Gotchy's judgment (Tr. 9275). Indeed, Staff witness Lerohl testified that there is no Staff position as to a preferred number. There have been some attempts to reach a concensus but none has been reached. Staff's most recent paper now being circulated has collected various opinions as to what should be the appropriate integration time for the release of radon from tailings piles and

^{*} Dr. Jordan noted during the Perkins hearing that Gotchy's suggestion that a nuclear fission economy might exist for only 500 years does not address the question of the length of time over which one should consider radon emissions because even though the life of the fission economy may be limited, the radon emissions will go on for the next 100,000 years. (P.Tr. 2581-82).

there has been a divergence of opinion on this issue. (P.Tr. 2569; see also, 2616-17).

33. Staff witness Gotchy was questioned during both the Perkins hearing (P.Tr. 2583-84) and at these proceedings (Tr. 9275-79) as to why there should be short-term treatment of mill tailings, whose effects admittedly go on for tens of thousands of years, when there is a federal policy aimed at isolating high and low-level wastes for periods ranging from 100,000 up to 500,000 years. Gotchy admitted that the concern over transuranic wastes is the radioactivity they possess and their long half-life. (Tr. 9278). Gotchy's justification for this divergence of treatment - that the high-level wastes are more manageable and not spread out in several million cubic yards of dirt (P.Tr. 2583-84; Tr. 9276) or that there has been no comparable attempt to assess release rates and their resulting effects on populations for transuranic wastes (Tr. 9279) - was totally unresponsive.

34. Gotchy admitted that if he calculated the health effects resulting from radon releases out to 100,000 years, using his own assumptions, the health effects would be at least comparable to those caused by the coal fuel cycle. (P.Tr. 2593). Yet Dr. Tamplin testified that there is no reason not to assess radon health effects out to 129,000 years since one can reasonably assume an average value for human population that far into the future. (Tr. 9365-66).

35. The evidence demonstrates that Staff's assumption of a 1000 year cut-off period for assessing radon releases and resulting health effects is arbitrary, that the NRC has no policy that would support such an assumption, that there is substantial disagreement over the issue of an appropriate time period within which to estimate radon health effects within the NRC itself, and that the 1000 year period is not reasonably conservative especially when viewed against the NRC policy regarding transuranic wastes and their radioactive by-products. Finally, Staff's failure to calculate radon releases and their health over the lifetime of said releases violates NEPA. The integration period assumed in Dr. Tamplin's testimony, on the other hand, complies with NEPA, since it takes full account of the radon health effects, is a reasonable and supportable assumption, and should be adopted by the Board.

3. Radon Releases From Mining and
Milling - The "Risk Estimators"
Issue

36. Dr. Tamplin testified that recent and scientifically supportable data demonstrate that previous estimates of the biological effects underestimate the risk presented by low dose/low dose rate irradiation, possibly by as much as a factor of ten. (T.D.T., 2-10). Staff witness Gotchy admitted that if these studies are correct (ie., the Mancuso and Bross studies),

which studies he acknowledged involved consideration of doses more in the range of what might be anticipated as doses from the nuclear power industry, it would increase his calculations of cancers caused by radon emissions associated with the operation of a nuclear plant by between a factor of 10 and 20. (P.Tr.2461-62).

37. Although Gotchy did not take account of the findings of the Mancuso Report in his calculations of radon health effects, he nevertheless agrees with an NRC Staff evaluation of the Mancuso Report* which finds that the Mancuso Report is suggestive of radiation effects more pronounced than previously thought. (Tr. 9292-93).

38. Both Staff witness Gotchy (Tr. 9293) and Applicant's witness Hamilton (Tr. 9249-51; P.Tr. 2272-73) claimed that they could not credit the Mancuso study as regards the present inquiry because it failed to control for the effect of age on incidence of cancer as a function of exposure, and thus they concluded that it is impossible to come out with a dose/effect relationship that would cause one to change the BEIR risk estimates. But Dr. Tamplin referred these witnesses to a table in the Mancuso

* "Summary of Staff Evaluation of Final Report No. 13", and reports by a consultant to the Staff on "Genetic Damage from Diagnostic Radiation and Leukemia from Low-Level Radiation Identification of Susceptible Children by Bross and Natarajan", identified at Tr. p. 9246.

Report (Mancuso Report, p. 376, Table 11) which tests for correlation between percentage of cancer and death and cumulative radiation dose after standardization for age at death. The dose is listed as a mean cumulative radiation dose for all workers, given in centirads, and breaks it down into various categories of dose starting with the control group (ie. unexposed population) and dose up to 500 centirads plus. The correlation which is done is a Spearman rank correlation which relates the cancer incidence to radiation dose. This is essentially a correlation between the incidence of cancer, and exposure category, with increasing dosages in each category. When one calculates the correlation coefficient for the entire grouping, the Table indicates a correlation between dose and incidence (within the dose ranges specified in the Table) that is significant at the 5% level. (Tr. 9296-97).

39. A paper by David Rubenstein of the Applied Statistics Branch of the Office of Management and Program Analysis of the NRC (which is Attachment 1 to the Staff Report referred to in para. 37, supra) comments on the validity of the analysis contained in Table 11 of the Mancuso Report and states: "These analyses are stratified, controlled by age and death and therefore are relatively invulnerable to confounding dose with this variable". (Tr. 9295) (Emphasis supplied). Dr. Gotchy agreed that this Table makes a valid point (Tr. 9295). In view of the

foregoing, and because Dr. Tamplin, who evidenced intimate familiarity with and understanding of the Mancuso Report and the methodologies employed therein, testified that mean doses were taken into account in the Report (Tr. 9397) and that it provides clear evidence of a relationship between low dose irradiation and cancer induction in excess of previous estimates (T.D.T., 7-10), the criticisms of Staff and Applicant are without foundation.

40. Staff witness Gotchy in calculating health effects used the risk estimates from WASH-1400 (which employed the absolute risk model) not the risk estimator from the BEIR Report which would produce the highest risk. (Tr. 9311-12). Yet Gotchy admitted that the NRC Staff study (referred to in paras. 37 and 39, supra), finds that previously-used risk estimators, including those used in WASH-1400, may in fact underestimate the risk. (Tr. 9322).

41. The testimony of Applicant's witness Hamilton is entitled to little weight in this proceeding. Both during this proceeding and at the Perkins hearing Dr. Hamilton's answers were often totally unresponsive to the questions posed and were wandering and discursive. Moreover, in his answers, Dr. Hamilton felt compelled to criticize the work product of other scientists

working in this field (P.Tr. 2643-59); Tr. 9248, 9254), in a manner which was suggestive of an extreme bias on his part. The thrust of Dr. Hamilton's testimony was that because the addition of radon-222 from the mining and milling of uranium adds such a small amount of radiation to the atmosphere, as compared to that resulting from natural background radiation, the entire issue is not one of significance. (Tr. 2278-79). Indeed, Dr. Hamilton stated: "I am frankly baffled to feel that anybody could consider this a hazard to be concerned about." (P.Tr. 2278; see also P.Tr. 2280). Yet Dr. Gotchy testified that the potential calculated health effects from radon-222 account for most of the impact of the entire fuel cycle and that such releases are the most important part of the radiological impact on populations, or have the greatest potential impact. (P.Tr. 2446). Moreover, Dr. Hamilton's justification for ignoring this issue, when viewed in terms of the total health effects resulting from background radiation, which have been estimated to cause between 40 and 50% of all human cancer*, is not only cynical, but obscures the true magnitude of the problem.

* See T.D.T., p. 10 and reference to a study by Victor Archer entitled: "Geomagnetism, Cancer, Weather and Cosmic Radiation", Health Physics, Vol. 34, pp. 237-47 (March, 1978); see also, P.Tr. 2468-70. Dr. Gotchy, although claiming that the Archer study was scientifically flawed, was not able to support his criticisms when questioned by Dr. Tamplin. (Tr. 9298-9301).

42. The testimony demonstrates that Staff and Applicant failed to consider important and scientifically supportable data which demonstrate that low-level radiation induces cancers and genetic effects at rates higher than previously assumed, that they failed to make reasonably conservative assumptions in their health effects testimony that would take account of such data, and that as a result of such errors and omissions, they grossly underestimated the health effects resulting from radon emissions attributable to the operation of the Jamesport plants.

4. Health Effects Resulting from Carbon-14 Emissions

43. Although not specifically addressed by testimony in these proceedings, the County demonstrated in its previously-filed findings of fact that the number of health effects due to carbon-14 alone is 1.5 per gigawatt-year if integrated over the full radioactive life of that radionuclide. (See County's Findings of Fact and Conclusions of Law, paras. 31.20-31.23, 31.61, 31.67; findings based on Co. Ex. 52). The testimony of Staff and Applicant failed to address these releases and their resulting health effects as required by the NRC's April 11, 1978 Amendment to Interim Table S-3 and for this reason also their testimony grossly

understates the health effects resulting from the operation of the Jamesport plants.

- D. Staff's Testimony on Radon-222 Releases and Health Effects Does Not Comply with NEPA Standards Since It Does Not Provide the Basis for Striking an Adequate Cost/Benefit Analysis and Does Not Constitute an Adequate Environmental Impact Statement Under Provisions of that Act
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44. The Commission document accompanying a March 10, 1977 revision to Table S-3 provides: "It is intended that with the inclusion of the environmental impacts from Table S-3, the Environmental Impact Statements for individual LWR's would set forth a full and candid assessment of the costs and benefits consistent with the legal requirements and the spirit of NEPA". (P.Tr. 2487). But Staff witness Scinto admitted that it does not presently have a definitive set of judgment criteria under which the Commission can promulgate regulatory guidelines and that such information is still being developed in a GEIS. (P.Tr. 2491). Indeed, Dr. Jordan of the Perkins Hearing Board noted that: "This (Staff's) testimony does not represent a concerted over-all Staff effort to address the radon question. ...It's a series of individuals giving their opinions as to what the health effects are, or what should be included". (P.Tr. 2489-90). The County demonstrated above that Staff's testimony, and the

conclusions reached therein, were based on their own judgment, and did not constitute a position taken by the NRC Staff, much less the Commission. Dr. Jordan found Staff's testimony to be lacking in consideration of alternatives and in consideration of the costs and benefits of such alternatives such as those involved in reducing the radon level to the criteria that has been proposed by Staff (P.Tr. 2488). Staff witness Rothfleisch admitted that neither WASH-1248 nor its precursor were considered to be, nor were they, documents that responded to the requirements of NEPA(P.Tr. 2503).

45. Staff's inability to explain or justify why it ascribed a total value of only 74.5 curies to radon releases in the previous Table S-3, when it knew that such releases were based only on wet tailings piles and the period of active milling (ie. 20 years), at the very least gives the Board cause to view Staff's present testimony with caution. (See discussion at P.Tr. 2510-2518).

46. The County has demonstrated above that Staff's testimony on radon releases and health effects, which does not constitute an EIS and was not circulated for agency comment and review pursuant to NEPA, underestimates said health effects because it fails to consider relevant and important scientific

data, and fails to make reasonably conservative assumptions (see, supra, paras. 10-43). Similarly, in its previously-filed findings, the County demonstrated that both Staff's and Applicant's testimony on coal health effects was seriously flawed, and that given the uncertainties and problems inherent in any attempt to assess such effects, there was no basis in the record for their conclusion that the health effects of the coal fuel cycle are substantially higher than those of the uranium fuel cycle. (County's Findings of Fact and Conclusions of Law, paras. 33.112-33.152(Applicant); paras. 33.153-33.161(Staff)). Indeed, at the Perkins hearing, Staff witness Gotchy admitted that because no one has calculated the long-term impacts of the coal fuel cycle, it is difficult to make a comparison of the two fuel cycles (Tr. 2594).

47. Based on all the foregoing findings, Staff's testimony, which does not constitute an EIS, fails to present the Board with an accurate or legally sufficient cost/benefit analysis of radon health effects associated with the operation of the Jamesport plants under NEPA and upon which it can justify their construction.

II. CONCLUSIONS OF LAW

48. The County, in its previously-filed findings of fact and conclusions of law (See, County's Findings of Fact and Conclusions of Law, pp. 1-35, 390-99) and in the appeal now pending before the Atomic Safety and Licensing Board, contends that there has been no demonstrated need for the Jamesport plants. In the absence of any demonstrated need, the Board need not even reach the issue of the plants' costs. Rather, failing a showing of need, the application must be (and should have been) denied.

49. Staff's testimony on radon releases and health effects fails to satisfy NEPA's procedural mandates with respect to the cost/benefit issues such testimony raises. It does not constitute an Environmental Impact Statement (EIS) and even if it did and were considered to be a supplemental EIS, it has not been circulated and subjected to agency comment and review as CEQ Guidelines (Sec. 1500.2(a)) require. See County's Conclusions of Law, paras. 49.6-16; see also NRDC v. Morton, 337 F. Supp. 170, 172 (3 ERC 1623) (D.D.C. 1971); NRDC v. Callaway, 524 F.2d 79, 91-92 (8 ERC 1273) (2d Cir. 1975); I-291 Y? Association v. Burns, 372 F. Supp. 223, aff'd. 517 F. 2d 1077 (2d Cir. 1975).

50. The evidence demonstrates that the magnitude of the health effects caused by radon releases associated with the operation of Jamesport 1 and 2 is so great, or, at a bare minimum, the uncertainty surrounding the magnitude of such health effects is so substantial, that NEPA requires completion of the research and development necessary to resolve that issue - a prerequisite to a decision to permit construction of Jamesport. This record is rife with testimony by Staff indicating that research in the area of the health effects attributable to radiation emitted during uranium mining and milling operations is incomplete and that new programs are underway to compile necessary and important data. In EDF v. Hardin, 325 F. Supp. 1401, 1403, (1 ELR 20207) (D.D.C. 1971) the court held that NEPA (42 USC 4332) makes completion of an adequate research program a prerequisite to agency action. It found that the adequacy of the research should be judged in light of the scope of the proposed program and the extent to which existing knowledge raises the possibility of potential adverse environmental effects. Thus, under NEPA, the NRC may not license the construction of the Jamesport plants until the necessary research (regarding radon releases and health effects) has been completed and the resulting data compiled and analyzed. EDF v. Hardin, supra; Brooks v. Volpe, 350 F. Supp. 269, 279-80 (W.D. Wash., 1972), aff'd 487 F.2d 1344 (9th Cir. 1973);

Concerned Citizens of Buck Hill Farms v. Grant, 388 F. Supp. 394 (W.D. Pa. 1975); EDF v. Corps. of Engineers, 492 F.2d 1123, 1130 (5th Cir. 1974).

51. Staff's cost/benefit analysis is defective under NEPA. First, Staff was required, but failed to assess the health impacts of radon emissions over the life of the radionuclide as was done by County witness Tamplin. See, NRDC v. NRC, 547 F.2d 633, 9 ERC 1149, 1153, n. 12 (D.C. Cir. 1976), rev. on other grounds sub. nom., Vermont Yankee Nuclear Power Corp. v. NRDC, 8 ELR 20288 (4/3/78) ("...the toxic life of the waste under discussion far exceeds the life of the plant being licensed. The environmental effects to be considered are those flowing from reprocessing and passive storage for the full detoxification period) (Emphasis supplied). Had Staff based its health effects estimates on the full life of radon-22, instead of assuming an arbitrary cut-off date of 1000 years, and even granting the validity of other highly questionable assumptions employed by Staff, it would have been forced to conclude that the health effects associated with the uranium fuel cycle substantially outweigh those of the coal fuel cycle. Staff's failure to extend its analysis out over the lifetime of the radionuclide involved constitutes error under NEPA and invalidates its cost/benefit analysis. Second, Staff failed to provide a numerical cost

evaluation and comparison of the health effects of radon releases (and releases of other radioactive effluents in the nuclear fuel cycle) with those resulting from the coal fuel cycle. But NEPA requires such a numerical weighing of a project's costs and benefits. (See County's Findings of Fact and Conclusions of Law, pp. 464-71, and case authorities cited therein.) Indeed, County witness Tamplin estimated the costs related to radon emissions resulting from Jamesport's operation and concluded that the costs associated therewith far exceed the cost of the plants themselves (See, supra, para. 20). Third, the evidence demonstrates that Staff, in its health effects testimony, failed to consider relevant scientific evidence which demonstrates that low-level radiation causes cancers and genetic effects at a rate far higher than was previously assumed, and that Staff failed to make reasonably conservative assumptions regarding radon releases and the health effects resulting therefrom. These errors and omissions precluded Staff from making the kind of realistic and finely-tuned balancing of the project's costs and benefits required by NEPA. NRDC v. Morton, 458 F.2d 827 (3 ERC 1558, 1561) (D.C. Cir. 1972); Chelsea Neighborhood Association v. U.S. Postal Service, 516 F.2d 378 (2d Cir. 1975); Calvert Cliffs' Coord. Comm. v. AEC, 449 F.2d 1109, 1113 (D.C. Cir. 1971).

52. The Hearing Board's failure to complete the cost/benefit analysis and balancing process before rendering its initial decision in this case violates NEPA since the Act does

not permit this type of incremental decision-making which biases the ultimate decision in favor of certification. See County's Findings of Fact and Conclusions of Law, pp. 478-82, and cases cited therein.

53. An agency's duty under NEPA to compare the project which it proposes to license to its alternatives, and to weigh the latter and their environmental effects, depends upon an accurate cost/benefit analysis of the project. Not only was the cost/benefit analysis here involved defective in the procedural sense, but on weighing and balancing Jamesport's costs and benefits, the Staff should have reached the substantive conclusion that a permit to construct Jamesport should not be issued at this time.

54. Based upon the findings of fact and conclusions of law herein presented, the costs of building Jamesport at this time outweigh its benefits. When these findings are considered together with the County's previously-filed findings of fact and conclusions of law, the case against certification becomes overwhelming. The application should be denied.

ORDER

Based on the foregoing Findings of Fact and Conclusions of Law, and on the basis of the County's previously submitted Findings of Fact and Conclusions of Law and pursuant to pertinent law, including, but not limited to the Atomic Energy Act, as amended, National Environmental Policy Act, Administrative Procedure Act, it is ORDERED:

1. The Director of Nuclear Reactor Regulation is directed to deny issuance of a construction permit to the Long Island Lighting Company and New York State Electric & Gas Corporation to construct Jamesport Nuclear Power Station Units 1 and 2.
2. This initial decision shall constitute the final decision of the Commission, subject to the review provided for under 10 CFR S. 2.760 et seq.

ATOMIC SAFETY & LICENSING
BOARD

Sheldon J. Wolfe, Esq.,
Chairman

Ralph S. Decker

Dated at this

E. Leonard Cheatum

____ day of _____

Respectfully Submitted,

COUNTY OF SUFFOLK

by: Irving Like
Irving Like, Special Counsel

200 West Main Street
Babylon, New York 11702

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD



In the Matter of)

LONG ISLAND LIGHTING COMPANY)

(Jamesport Nuclear Power Station,)
Units 1 and 2))

) Docket Nos. 50-516
) 50-517

CERTIFICATE OF SERVICE

I hereby certify that on September 26, 1978, copies of COUNTY OF SUFFOLK'S PROPOSED SUPPLEMENTARY FINDINGS OF FACT AND CONCLUSIONS OF LAW RELATING TO THE HEALTH EFFECTS OF RADON-222 RELEASED BY THE URANIUM FUEL CYCLE were sent to the following by first-class, postage pre-paid mail:

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