ENCLOSURE 2

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
CAROLINA POWER AND LIGHT COMPANY AND	)	Docket Nos. 50-400-OL
NORTH CAROLINA EASTERN MUNICIPAL	)	50-401-OL
POWER AGENCY	)	
	)	
(Shearon Harris Nuclear Power Station,	)	
Units 1 and 2)	)	

NRC STAFF TESTIMONY OF
EDWARD F. BRANAGAN, JR. ON JOINT CONTENTION II (e)

Q.1. Dr. Branagan, please state your name and affiliation.

A.1. My name is Edward F. Branagan, Jr. I am a Senior Radiobiologist in the Radiological Assessment Branch, Division of Systems Integration within the Office of Nuclear Reactor Regulation. A copy of my professional qualifications is attached.

Q.2. Dr. Branagan, what is the purpose of this testimony?

A.2. The purpose of this testimony is to address the remaining portion of Joint Contention II (e) which states:

Joint Contention II

The long term somatic and genetic health effects of radiation releases from the facility during normal operations, even where such releases are within existing guidelines, have been seriously underestimated for the following reasons:

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(e) The radionuclide concentration models used by Applicants and the NRC are inadequate because they underestimate or exclude the following means of concentrating radionuclides in the environment. . . radionuclides absorbed in or attached to fly ash from coal plants which are in the air around the SHNPP site. . .

Q.3. In regard to the remaining portion of Joint Contention II(e), what pathways are most likely to be of concern if radioactive particulates combined with coal fly ash to increase the size of the radioactive particulates?

A.3. The intervenor does not specify the particular pathways or body organs of concern. In my opinion, the primary pathway of potential concern would be exposure via inhalation of radioactive iodines and particulates (hereinafter referred to as iodines and particulates). This pathway constitutes the most direct means by which an individual could be exposed to radionuclides attached to coal fly ash. It is unlikely that radioactive noble gases would attach to coal fly ash to such an extent that they would present pathways of concern other than those already evaluated in the FES for several reasons. First, noble gases are very stable chemically and exhibit very low reaction rates under ambient conditions. Second, although the activity concentrations of radionuclides in coal fly ash have been measured, noble gases from nuclear power plants have not been detected in the coal fly ash (UNSCEAR, 1982,

Annex C). In the FES (pp. D-9 and 10), the dose to the critical organ (i.e., the thyroid) of the maximally exposed individual was estimated to be about 0.2 mrems/year from inhalation of iodines and particulates in gaseous effluents. Doses to all other organs of the maximally exposed individual were estimated to be less than 0.2 mrems/year from inhalation of iodines and particulates.

Q.4. Briefly describe the models used to estimate doses for the FES.

A.4. In licensing commercial nuclear power reactors, the NRC Staff uses mathematical models that characterize radionuclide movement in the environment to determine the radiological impact from nuclear power plant operations. These models are described in several NRC Regulatory Guides. Regulatory Guide 1.109 (USNRC 1977), entitled "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," provides models for calculating doses to the maximum hypothetical individual from exposure to radioactive airborne releases.

Q.5. Briefly describe the dose conversion factors that were used to estimate doses in the FES.

A.5. The dose conversion factors used to estimate doses in the FES from inhalation of iodines and particulates were taken from Appendix E of Regulatory Guide 1.109. The bases for the dose conversion factors in Regulatory Guide 1.109 are described in a document entitled "Age-Specific Radiation Dose Commitment Factors For a

One-Year Chronic Intake," NUREG-0172. (Hoenes, 1977). The equations for calculating internal dose conversion factors in NUREG-0172 were derived from those given in ICRP Publication 2, "Report of ICRP Committee II on Permissible Dose for Internal Radiation." (ICRP, 1959). The ICRP Committee II assumed that 75% of the particles that were inhaled would be deposited in the respiratory tract. (ICRP, 1959).

Q.6. How would dose estimates change if radionuclides became associated with fly ash?

A.6. The Staff has not determined the particle size distribution of fly ash from coal fired power plants. However, assuming that the fly ash and the iodines and particulates formed particles of an optimal size such that all of the inhaled particles were deposited in the respiratory tract (rather than the value of 75% assumed in ICRP, 1959), then the preceding dose estimates would increase by a factor of one-third. That is, the dose to the thyroid of the maximally exposed individual from inhalation of iodines and particulates would be increased from 0.2 mrems/year to about 0.3 mrems/year. These dose estimates are based on inhalation of iodines and particulates from the reactor and do not include exposure to naturally occurring radionuclides in coal fly ash.

Q.7. How would the revised dose estimates for the maximally exposed individual compare with the applicable dose design objectives in 10 CFR 50, Appendix I?

A.7. Assuming that the fly ash and the radioactive particles formed particles of an optimal size and increased the dose from the inhalation pathway, the dose to the maximally exposed organ from all pathways of exposure to radioiodines and particulates would increase from 4.6 mrems/year (FES, Table D-7 on p. D-10) to 4.7 mrems/year. The revised dose estimate would be less than one-third of the applicable dose design objective of 15 mrems/year per reactor to any organ from all pathways of exposure to radioiodines and particulates.

Q.8. What do you conclude with respect to the issue raised in the remaining part of Joint Contention II(e)?

A.8. I conclude that it is unlikely that the attachment of radioactive iodines and particulates to coal fly ash would increase the dose to the thyroid or any other organ to such an extent that the estimated doses would exceed the applicable dose design objectives in Appendix I of 10 CFR Part 50. Therefore, I conclude the risks of "long term somatic and genetic health effects of radiation releases from the facility during normal operations" have not been "seriously underestimated" by the Staff.

References

Hoenes, G. R., and J. K. Soldat, "Age-Specific Radiation Dose Commitment Factors for a One-Year Chronic Intake," Prepared by Battelle Pacific Northwest Laboratories for the U.S. NRC, NUREG-0172, November 1977.

International Commission on Radiological Protection, "Report of ICRP Committee II on Permissible Dose for Internal Radiation," ICRP Publication 2, Pergamon Press, New York, 1959.

United Nations Scientific Committee on the Effects of Atomic Radiation, UNSCEAR, "Sources and Effects of Ionizing Radiation," 1982.

USNRC, Regulatory Guide 1.109, "Calculation of Annual Doses to Man From Routine Releases of Reactor Effluents for the purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1, October 1977.

EDWARD F. BRANAGAN, JR.
OFFICE OF NUCLEAR REACTOR REGULATION

PROFESSIONAL QUALIFICATIONS

From April 1979 to the present, I have been employed in the Radiological Assessment Branch in the Office of Nuclear Reactor Regulation of the U.S. Nuclear Regulatory Commission (NRC). As a Senior Radiobiologist with the Radiological Assessment Branch, I am responsible for evaluating the environmental radiological impacts resulting from the operation of nuclear power reactors. In particular, I am responsible for evaluating radioecological models and health effect models for use in reactor licensing.

In addition to my duties involving the evaluation of radiological impacts from nuclear reactors, my duties in the Radiological Assessment Branch have included the following: (1) I managed and was the principal author of a report entitled "Staff Review of 'Radioecological Assessment of the Wyhl Nuclear Power Plant'" (NUREG-0668); (2) I served as a technical contact on an NRC contract with Argonne National Laboratory involving development of a computer program to calculate health effects from radiation; (3) I served as the project manager on an NRC contract with Idaho National Engineering Laboratory involving estimated and measured concentrations of radionuclides in the environment; (4) I served as the project manager on an NRC contract with Lawrence Livermore Laboratory concerning a literature review of values for parameters in terrestrial radionuclide transport models; and (5) I served as the project manager on an NRC contract with Oak Ridge National Laboratory concerning a statistical analysis of dose estimates via food pathways.

From 1976 to April 1979, I was employed by the NRC's Office of Nuclear Materials Safety and Safeguards, where I was involved in project management and technical work. I served as the project manager for the NRC in connection with the NRC's estimation of radiation doses from radon-222 and radium-226 releases from uranium mills, in coordination with Oak Ridge National Laboratory which served as the NRC contractor. As part of my work on NRC's Generic Environmental Impact Statement on Uranium Milling (GEIS), I estimated health effects from uranium mill tailings. Upon publication of the GEIS, I presented a paper entitled "Health Effects of Uranium Mining and Milling for Commercial Nuclear Power" at a Conference on Health Implications of New Energy Technologies.

I received a B.A. in Physics from Catholic University in 1969, a M.A. in Science Teaching from Catholic University in 1970, and a Ph.D. in Radiation Biophysics from Kansas University in 1976. While completing my course work for my Ph.D., I was an instructor of Radiation Technology at Haskell Junior College in Lawrence, Kansas. My doctoral research work was in the area of DNA base damage, and was supported by a U.S. Public Health Service traineeship; my doctoral dissertation was entitled "Nuclear Magnetic Resonance Spectroscopy of Gamma-Irradiated DNA Bases."

I am a member of the Health Physics Society.