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DOCKETED 01/09/01

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE COMMISSION

In the Matter of)	
)	
CAROLINA POWER & LIGHT COMPANY)	Docket No. 50-400-LA
)	
(Shearon Harris Nuclear Power Plant))	ASLBP No. 99-762-LA
)	

NRC STAFF OPPOSITION TO ORANGE COUNTY'S PETITION FOR REVIEW
AND REQUEST FOR IMMEDIATE SUSPENSION AND STAY OF THE NRC STAFF'S
NO SIGNIFICANT HAZARDS DETERMINATION AND ISSUANCE OF LICENSE
AMENDMENT FOR HARRIS SPENT FUEL POOL EXPANSION

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Counsel for NRC Staff

January 8, 2001

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INTRODUCTION

On December 22, 2000, the Board of Commissioners of Orange County (BCOC) filed a pleading entitled "Orange County's Petition for Review and Request for Immediate Suspension and Stay of the NRC Staff's No Significant Hazards Determination and Issuance of License Amendment for Harris Spent Fuel Pool Expansion." In accordance with the Commission's order of December 29, 1999, the NRC staff (Staff) hereby files its response in opposition to BCOC's petition and request.¹ As discussed below, the petition for review of the Staff's no significant hazards determination is barred by the Commission's regulations; there are no special circumstances which would cause the Commission to exercise its discretion to review the Staff's determination; and BCOC has not met the

¹ The Staff notes that BCOC's pleading is 20 pages in length, exclusive of affidavit and attachments. The Staff's response to BCOC's pleading is 13 pages. To the extent the Staff's response may violate Commission regulations for length of pleadings, the Staff requests Commission permission to file an overlong pleading. However, neither 10 C.F.R. § 2.786(b)(2), which limits a petition for review to 10 pages, nor 10 C.F.R. § 2.788(d), which limits a motion for stay to 10 pages, is directly applicable to the instant matter because the petition for review is not one permitted by the regulation and the request for a stay is not from a licensing board action.

criteria for the granting of a stay in this matter. Accordingly, the petition for review and motion for stay should be denied.

BACKGROUND

This matter arises from a license amendment request by Carolina Power and Light Company (CP&L) to expand fuel pool capacity at the Shearon Harris Nuclear Power Plant (Harris), by placing two additional fuel pools into service. The license amendment request was filed on December 23, 1998.² Thereafter, BCOC sought intervention, which was granted as to two technical contentions. LBP-99-25, 50 NRC 25 (1999). The matter proceeded to oral argument, pursuant to Subpart K (10 C.F.R. § 2.1101, et seq.), resulting in the denial of a hearing and resolution of the contentions in favor of the licensee. LBP-00-12, 51 NRC 247 (2000).

On December 15, 1999, the Staff issued an Environmental Assessment and Finding of No Significant Impact. 64 Fed. Reg. 71514 (Dec. 21, 1999). Thereafter, BCOC filed a motion for admission of late-filed environmental contentions, which was granted as to one contention. LBP-00-19, 52 NRC 85 (2000). On December 7, 2000, pursuant to Subpart K, oral argument was held as to the one environmental contention. The decision of the Licensing Board is pending.

On December 21, 2000, the Staff issued the final Determination of No Significant Hazards and the requested license amendment.³ On December 22, 2000, BCOC

² Letter to United States Nuclear Regulatory Commission from James Scarola, Vice President, Harris Nuclear Plant, Carolina Power & Light Co., December 23, 1998.

³ Letter from Richard Laufer, NRR, to James Scarola, CP&L, Shearon Harris Nuclear Power Plant, Unit 1 - Issuance of Amendment Re: Expansion of Spent Fuel Storage Capacity, December 21, 2000. (Exhibit 3).

requested that the Commission review the Staff's no significant hazards determination and stay the license amendment until the outcome of the adjudicatory proceeding below. On December 28, 2000, the Staff filed a Motion to Set Date for Filing of Responses to BCOC's pleading. On the same date, CP&L filed "Carolina Power & Light Company's Brief in Support of NRC Staff's Motion to Set a Date for Filing of Responses and Request for Clarification Regarding Orange County's December 22, 2000 Filing." On December 29, 2000, the Secretary issued an order setting a date for responses for January 8, 2001.

DISCUSSION

BCOC requests that the Commission review the Staff's no significant hazards determination and stay the license amendment until the outcome of the adjudicatory proceeding below. The Staff submits that the Commission should decline to review the Staff's no significant hazards determination and deny a stay of the license amendment.

1. The Petition for Review Should be Denied Because BCOC is Barred from Challenging the Staff's No Significant Hazards Consideration Determination

The Commission's regulations clearly and unequivocally prohibit the petition for review filed by BCOC. Pursuant to 10 C.F.R. § 50.58(b)(6):

No petition or other request for review of or hearing on the staff's significant hazards consideration determination will be entertained by the Commission. The staff's determination is final, subject only to the Commission's discretion, on its own initiative, to review the determination.

See also Pacific Gas & Electric Co. (Diablo Canyon Nuclear Power Plant, Units 1 and 2), CLI-86-12, 24 NRC 1, 4-5 (1986), *rev'd and remanded on other grounds, San Luis Obispo Mothers For Peace v. NRC*, 799 F.2d 1268 (9th Cir. 1986). Nor can BCOC obtain review "through the guise of an application for a stay of the Staff's finding." *Diablo Canyon*, CLI-

86-22, 24 NRC at 4. Moreover, there are no “special circumstances” that would compel the Commission to exercise its “inherent authority to exercise its discretionary supervisory authority to stay Staff’s actions.” *Id.* at 4-5. Therefore, the petition for review should be dismissed or denied.

2. The Exercise of the Commission’s Discretion to Review the Staff’s No Significant Hazards Consideration Determination is Not Warranted in this Case

BCOC requests that the Commission exercise its “inherent supervisory authority” and take discretionary review, pursuant to the standard set forth in 10 C.F.R. § 2.786(b)(4). The Staff submits that 10 C.F.R. § 2.786 is not applicable to this matter, because BCOC has filed an impermissible petition for review and because the petition is from a Staff action, not an action of a licensing board. If a petition for review of a particular action is prohibited by regulation, then the procedural rules governing the filing of petitions for review cannot be applicable to that prohibited petition.

Even if 10 C.F.R. § 2.786 is applicable, BCOC has not met the standard for discretionary review. First, there is no substantial question regarding a clearly erroneous finding of material fact or one that is in conflict with a finding as to the same fact in a different proceeding. BCOC has failed to demonstrate that the Staff made a clearly erroneous finding of material fact in making its final no significant hazards determination. Second, there is no necessary legal conclusion without legal precedent or contrary to established law involved in this case. Third, there is no substantial question as to the existence of a “substantial and important question of law, policy or discretion” regarding the final determination of no significant hazards. The Commission’s regulations permit the Staff to issue a license amendment upon a finding of no significant hazards, prior to completion of the hearing. The regulations further prohibit BCOC from challenging that finding before

the Commission. Any claim that this regulatory scheme is unlawful or against Commission policy is an impermissible attack on the Commission's regulations and should not be entertained by the Commission. The fact that BCOC is dissatisfied with the lawful action taken by the Staff is not grounds for granting discretionary review. Therefore, the petition for review should be denied.

3. The Standards for Stay Have Not Been Met

BCOC has requested the Commission to stay the issuance of the Harris license amendment until the Licensing Board has reached a decision in the pending Subpart K proceeding. Additionally, BCOC requests stay of the issuance of the amendment until completion of an EIS, should the Licensing Board determine that the NRC Staff is required to prepare an EIS. The Staff submits that BCOC has failed to establish that it is entitled to a stay and that the Commission should therefore deny this petition.

As noted above, the regulations clearly state that there is no right to appeal the Staff's no significant hazards determination. Additionally, a petitioner "cannot automatically obtain indirect review through the guise of an application for a stay of the Staff's finding." *Diablo Canyon*, CLI-86-12, 24 NRC at 5. The Commission, solely as a matter of its discretion, may review the Staff's action "due to the special circumstances" of a particular case. *Id.* BCOC has pointed to no special circumstances which would warrant Commission review of the Staff's no significant hazards determination. Therefore, the request for a stay should be denied.

Nevertheless, should the Commission decide to consider the request for a stay, the four factors specified in 10 C.F.R. § 2.788 should be considered: 1) whether the petitioners have demonstrated that they are likely to prevail on the merits; 2) whether there will be

irreparable harm to the petitioners if no stay is granted; 3) whether any other party will be harmed by a stay; and 4) where the public interest lies. *See Diablo Canyon*, CLI-86-12, 24 NRC at 5 (citations omitted). None of these factors favor granting the stay requested by BCOC.

a. Success on the Merits

BCOC asserts in its petition that it is likely to prevail on the merits because the NRC Staff has not satisfied the criteria in 10 C.F.R. § 50.92 for issuance of a no significant hazards determination. This assertion confuses BCOC's petition for review of the Staff's no significant hazards determination and the motion for a stay of the license amendment. As noted, under 10 C.F.R. § 50.58(b)(6), BCOC may not petition for Commission review of the no significant hazards determination, therefore whether its argument on the merits would be successful is without merit, since by regulation BCOC is prohibited from petitioning the Commission for review on the merits. The relevant issue on this factor is whether BCOC is likely to prevail on its assertion that the accident sequence postulated by its witness, Dr. Thompson, as EC-6 is not remote and speculative and requires preparation of an EIS.

BCOC makes a number of unsupported, and inaccurate, statements regarding the merits of the proceeding in front of the Licensing Board. BCOC identifies five points on which it believes it will succeed on the merits before the Licensing Board: 1) CP&L and the Staff prepared inadequate onsite radiation dose analyses; 2) the Staff unlawfully assumed in its radiation dose analyses that workers would receive greater than the 5 rem TEDE occupational dose limit; 3) CP&L and the Staff agree with BCOC that the probability of a fire in the spent fuel pools is 1.0; 4) the issuance of the NSHC and the license amendment

prior to the Licensing Board decision violates NEPA; and 5) the technical disagreements between the parties requires an evidentiary hearing before the Licensing Board. As explained below, the Staff believes that BCOC has failed to establish a strong likelihood of success on the merits of any of the above points.

The first point on which BCOC claims success is that CP&L completely failed to address onsite radiation doses that would be incurred as a result of the postulated accident sequence and that the Staff oversimplified onsite radiation doses. Petition at 7. Contrary to BCOC's assertion, CP&L did address onsite radiation doses in its brief, and in the supporting affidavits of Dr. Burns, Mr. Morgan, and Mr. DeVoe. Summary of Facts, Data, and Arguments on Which Applicant Proposes to Rely at the Subpart K Oral Argument Regarding Contention EC-6, at 57-60 citing Burns Affidavit at ¶ 17; Morgan Affidavit at ¶¶ 6-19; DeVoe Affidavit at ¶¶ 5, 6, 12. CP&L did perform onsite radiation dose calculations and submitted the results to the Licensing Board. It did not submit the actual calculations, because that level of detail was unnecessary. Parry Affidavit at ¶ 4. The documents submitted adequately address the onsite radiation doses, and provide much more detailed information than that provided by Dr. Thompson. For example, Dr. Thompson's report states that a person in the contaminated area the first day after release would receive a dose of 110,000 rem. Thompson Report §§ 4.4 and 4.5 and Appendix E. He reaches this number by assuming uniform deposition of a release over a 200 meter circle and that the material deposited will be 5% of the tellurium isotopes, 10% of the iodine isotopes, and 10% of the cesium isotopes. *Id.* He provides no support for why the deposition will occur in a uniform 200 meter circle around the plant site and for the amount of tellurium, iodine, and cesium that will be deposited.

In addition, in his supporting declaration, Dr. Thompson claims that the Staff and CP&L agree with BCOC that a fire in pools A and B would preclude actions needed to provide cooling and makeup to pools C and D because the fire would result in extreme doses to personnel. Thompson Declaration at ¶¶ 17. This is a meaningless statement. The point of the Licensing Board proceeding was to determine the probability of the fire starting in the spent fuel pools, not whether the fire could be stopped once it had already started. The relevant time period for personnel access to the makeup systems is before the fire starts, in order to prevent the fire. Based on his dose information, Dr. Thompson assumes that personnel access to the makeup systems will be precluded. However, the Staff's affidavit in support of the Staff's brief on EC-6 demonstrates that personnel access will not be precluded. The radiation dose analysis in the Staff's affidavit was prepared by Staff members with considerable experience in this type of analysis. Unlike Dr. Thompson, who assumes a uniform distribution, fails to account for each individual access point to the makeup systems, and uses generic dose information from a 1975 report, the Staff examined the doses at many possible access points, a number of potential radiation sources, the impact of ventilation systems on the habitability of the areas where actions must be taken, and used site-specific dose information from the FSAR for the Harris plant. Staff Affidavit at ¶¶ 155-217 (Exhibit 2). Thus, an evaluation of the evidence submitted by BCOC, CP&L, and the Staff indicates that BCOC has a very low likelihood of succeeding on the merits of this argument.

BCOC's second argument, asserted both in its petition and during the December 7, 2000 oral argument, is that the NRC relied upon a "legal fallacy" in assuming that workers could be exposed to "unlawful" radiation doses during the aftermath of a severe

accident. Petition at 7. BCOC asserts that the occupational radiation exposure limits of 5 rem TEDE per year, as set forth in 10 C.F.R. Part 20, should be the criterion for precluding post-accident access to restore SFP cooling or makeup. BCOC claimed that the use of an exposure limit of 25 rem TEDE in the Staff's analysis of the accident sequence was unlawful. But, as discussed below, the use of a 25 rem TEDE criterion is not unlawful and its use does not represent an unacceptable risk to the health of the exposed individual.

The Commission's regulations in Part 20, "Standards for Protection Against Radiation," establish standards for protection against ionizing radiation resulting from activities conducted under licenses issued by the NRC. The purpose of the regulations is to specify that the total dose to an individual not exceed the standards for protection against radiation established in Part 20. 10 C.F.R. § 20.1001(b). "However, nothing in this part shall be construed as limiting actions that may be necessary to protect health and safety."

10 C.F.R. § 20.1001(b). In enacting Part 20, the Commission stated:

It is the Commission's intent that the regulations be observed to the extent practicable during emergencies, but that conformance with the regulations should not hinder any actions that are necessary to protect public health and safety such as lifesaving or maintaining confinement of radioactive materials.

In this regard, the Commission notes that the Federal Guidance on occupational radiation exposure states that those dose standards only apply to normal operating conditions. The Commission believes that the dose limits for normal operations should remain the primary guidelines in emergencies. However, the Commission also recognizes that, in an emergency, operations that do not conform to the regulations may have to be carried out to achieve the high-priority tasks of worker, public, and facility protection. The purpose of the addition to this section is to assure licensees that their first priority should be to carry out those actions that are necessary to protect the public from radiation exposure, to perform lifesaving activities, to prevent or limit the spread of radioactive contamination or the release of radioactive materials to the environment, and to preserve an adequate margin of safety.

56 Fed. Reg. 23360, 23365 (May 21, 1991). Therefore, emergency radiation exposures greater than occupational limits necessary to protect the public health and safety cannot be considered unlawful since the regulation provides for these exposures.

The regulations governing emergency plans permit use of EPA Emergency Worker and Lifesaving Activity Protective Action Guides in determining the means for controlling radiological exposures. 10 C.F.R. § 50.47(b)(11). These emergency guidelines permit exposures of up to 25 rem TEDE under emergency conditions when needed to protect lives and large populations. Since the use of EPA guidelines is permitted, the use of these guidelines for establishing accessibility doses for this proceeding cannot be considered unlawful.

In evaluating the acceptability of nuclear power plant designs with regard to radiological protection during design basis accidents, the NRC routinely uses the 5 rem whole body dose as the design criteria. 10 C.F.R. Part 50, Appendix A; 10 C.F.R. § 50.34(f)(viii). These design criteria are not operational limits, but are criteria to be used for evaluating the ability of plant design to contend with design basis accidents. Since the event sequence postulated by BCOC in EC-6 is beyond the design basis, the plant design need not support maintaining worker exposure less than 5 rem TEDE.⁴

⁴ BCOC asserted in its submittal below that compliance with the 5 rem TEDE is assumed in the Final Environmental Statement (FES) for the Harris plant and that, having assumed regulatory compliance with Part 20 in the FES, the Staff would have no lawful basis for not assuming that the proposed expansion of the SFPs poses no cognizable risk of an accident because workers will be expected to incur unlawful radiation doses in order to minimize that risk. Detailed Summary of Facts, Data and Arguments and Sworn Submission on Which Orange County Intends to Rely at Oral Argument To Demonstrate the Existence of a Genuine and Substantial Dispute of Fact with the Licensee Regarding the Proposed Expansion of Spent Fuel Storage Capacity at the Harris Nuclear Power Plant at 33. The Staff agrees that the FES assumed that normal occupational radiation exposures would be in effect during normal operations.

BCOC's next argument is raised by Dr. Thompson in his declaration. Dr. Thompson claims that "[a] notable area of agreement is that Orange County, the NRC staff and CP&L agree that a loss of water from pools C and D, leading to partial or total exposure of the spent fuel to air, would inevitably cause a pool fire." Thompson Declaration ¶ 16. This statement misrepresents the NRC's position. The NRC Staff does not agree that the probability of a fire in the spent fuel pools is 1.0, but elected to assume conservatively that the probability of a fire is 1.0. The Staff did not specifically address the probability of a fire in pools C & D because it was able to demonstrate that the likelihood of the accident was sufficiently low even with the assumption that the probability of the fire was 1.0. Parry Affidavit at ¶ 9. Since the Staff's calculations determined that the probability of reaching the point of a pool fire was so low as to be remote and speculative, even if the probability of the fire is 1.0, the accident sequence remains remote and speculative.

BCOC next claims that the Staff's no significant hazards determination and issuance of the license amendment violates NEPA because NEPA requires federal agencies to examine the environmental consequences of their actions before taking the actions. The Staff examined the potential environmental impacts from the license amendment in the Environmental Assessment (EA), and made a finding of no significant impact (FONSI). 64 Fed. Reg. 71514 (Dec. 21, 1999). Although BCOC has challenged the EA and FONSI, no decision has been made that the Staff violated NEPA and the regulations do not prohibit the Staff from issuing a license amendment while a Licensing Board decision is pending. Because the Staff has met all NEPA procedural requirements and because the no

However, the NRC radiation protection standards in Part 20 clearly provide that these standards are not to prevent necessary actions during emergencies to protect the public health and safety.

significant hazards determination has been made, issuance of the license before completion of the proceedings below is not unlawful.

Finally, BCOC and Dr. Thompson repeatedly state that the issues raised in the Subpart K proceeding before the Licensing Board require an evidentiary hearing because there are areas of technical disagreement between the parties. The NRC Staff does not believe that an evidentiary hearing on EC-6 is necessary because the Licensing Board can resolve the issues by reviewing the parties' submittals, including the affidavits and supporting exhibits, and the transcript of the oral argument itself. An evidentiary hearing is not needed because further questioning of the witnesses would only serve to further demonstrate Dr. Thompson's lack of expertise and understanding and reinforce the unassailable conclusion that the information provided by the experts for the Staff and CP&L was accurate and their conclusion that the postulated accident sequence is remote and speculative is well-founded and supported with data, expert analysis and expert opinion, and therefore does not require the preparation of an EIS.⁵ See Parry Affidavit at ¶ 3.

BCOC's petition for a stay of the license amendment and Dr. Thompson's supporting declaration fail to demonstrate that BCOC has a likelihood of prevailing on the merits of the Licensing Board proceeding and that a further evidentiary hearing on Contention EC-6 is necessary.

b. Irreparable Injury

⁵ Although, at oral argument the Licensing Board questioned counsel for BCOC regarding any additional witnesses BCOC may call if the matter proceeds to hearing, the Staff submits that it is far from clear that additional discovery or the addition of other witnesses is contemplated in Subpart K. The Statement of Consideration for the Final Rule for Subpart K notes that "because discovery would precede the oral argument, there would ordinarily be no need for further discovery prior to the adjudicatory hearing." 50 Fed. Reg. 41662, 41664 (Oct. 15, 1985).

BCOC alleges irreparable injury in the form of the increased risk of a severe accident in the SFPs. According to BCOC and Dr. Thompson, the consequences from this increased risk include irreparable harm from radiation to the affected environment, persons who inhabit the affected environment, and persons who consume food and water from the affected environment. Petition at 18, Thompson Declaration at ¶ 4. They argue that these consequences will be as much as 2.5 times greater than the consequences from an accident with only the fuel in pools A and B. Petition at 19; Thompson Declaration at ¶ 7.

The Commission has held that irreparable injury is the “most crucial factor” in determining whether to grant a stay. *Public Service Co. of New Hampshire* (Seabrook Station, Units 1 and 2), CLI-90-03, 31 NRC 219, 258 (1990) (citations omitted). The Commission noted “[m]ere exposure to risk, however, does not constitute irreparable injury if the risk, as here, is so low as to be remote and speculative and any difficulty or expense in adopting necessary modifications is not an injury to . . . Intervenors.” *Pacific Gas & Electric Co.* (Diablo Canyon Nuclear Power Plant, Units 1 and 2), CLI-85-14, 22 NRC 177, 180 (1985).

The irreparable injury alleged by BCOC amounts to nothing more than exposure to risk of an accident sequence which, even under Dr. Thompson’s calculations, has a low probability of occurrence. Dr. Thompson raised the issue of an off-site release of contamination, claiming that the contaminated area could exceed the area of North Carolina. Thompson Declaration at ¶ 4. Any discussion of the off-site consequences of a release is beyond the scope of the proceeding before the Licensing Board.

Issuance of the license amendment prior to the Licensing Board decision on the environmental issue does not cause any injury to BCOC that cannot be reversed or

modified, if necessary. Although the license amendment is currently in effect, CP&L has stated that it will not be placing spent fuel in pool C until the middle of 2001, and not into pool D until 2016 or 2025. In the next few months, CP&L will be performing work on the pools and the systems to connect the pools and provide makeup. All of this work, up to and including the storage of spent fuel in pools C and D will meet all regulatory requirements for safety. None of this work is irreversible, and none of it causes an injury to BCOC or to the members of the public it represents. Should the Licensing Board require the preparation of an EIS, CP&L can halt work without any injury to BCOC.

c.

c. Harm to Other Parties

The NRC Staff will suffer no harm if a stay of the license amendment is granted. However, as recognized by Dr. Thompson in his supporting declaration, CP&L could be harmed by a delay in opening pools C and D if it eventually runs out of room for storing spent fuel from the Harris, Brunswick, and Robinson plants. Thompson Declaration at ¶ 13.

d. Public Interest

BCOC argues that the issuance of a stay of the license amendment is in the public interest, but provides no reason why the public interest lies with staying the license amendment. In fact, the public interest lies in expeditiously providing safe storage of spent nuclear fuel under appropriate NRC regulations.

CONCLUSION

Based upon the foregoing, the Staff respectfully requests that BCOC's petition for review of the Staff's no significant hazards determination be dismissed and the request for stay of the license amendment be denied.

Respectfully submitted,

Susan L. Uttal
Jennifer M. Euchner
Counsel for NRC Staff

Dated at Rockville, Maryland
This 8th day of January 2001

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)	
)	Docket No. 50-400-LA
CAROLINA POWER & LIGHT)	
COMPANY)	ASLBP No. 99-762-02-LA
)	
(Shearon Harris Nuclear Power Plant))	
)	

AFFIDAVIT OF GARETH W. PARRY IN SUPPORT OF NRC STAFF OPPOSITION TO
ORANGE COUNTY'S PETITION FOR REVIEW AND REQUEST FOR IMMEDIATE
SUSPENSION AND STAY OF THE NRC STAFF'S NO SIGNIFICANT HAZARDS
DETERMINATION AND ISSUANCE OF LICENSE AMENDMENT
FOR HARRIS SPENT FUEL POOL EXPANSION

Gareth W. Parry does hereby state as follows:

1. My name is Gareth W. Parry. I have been employed by the U.S. Nuclear Regulatory Commission (NRC) since 1996 as the Senior Level Advisor on Probabilistic Safety Assessment for the Division of System Safety and Analysis in the Office of Nuclear Reactor Regulation. My responsibilities are primarily to support the development of the use of risk assessment methods and results in regulatory processes associated with the operation of nuclear power reactors. Prior to working for NRC I worked for more than fifteen years for NUS, a consulting engineering company. While at NUS I participated in various capacities in the performance of more than 20 PRAs of nuclear power plants in the USA and also in Taiwan, Korea, Spain, the Czech Republic and the United Kingdom. I managed two full scale PRA projects, and contributed in a major way as task leader for several tasks in others. I contributed to the development of methods for the analysis of human reliability, common cause failures and uncertainty analysis as a contractor

to both NRC and also the Electric Power Research Institute, and have published a large number of papers in areas related to probabilistic risk assessment. I have a Ph.D. degree in Theoretical Physics from the Imperial College of Science and Technology, the University of London, England, and a Bachelor of Science degree in Physics also from Imperial College. I have more than 25 years of experience in the analysis of safety of nuclear reactors. My resume, including a list of publications is attached (Exhibit 1).

2. This affidavit draws upon the Affidavit of Gareth W. Parry, Stephen F. LaVie, Robert L. Palla and Christopher Gratton in Support of NRC Staff Brief And Summary of Relevant Facts, Data And Arguments Upon Which The Staff Proposes To Rely at Oral Argument on Environmental Contention EC-6 (Exhibit 2), and the NRC Staff's November 20, 2000 Brief and Summary filed before the Licensing Board below.⁶ The purpose of the affidavit is to address those technical issues that are raised in either the declaration of December 22, 2000 by Dr. Gordon Thompson regarding the potential for a severe accident at spent fuel pools C and D at the Harris Nuclear Power Plant⁷ or in the Board of Commissioners of Orange County's (BCOC) Petition for Review and Request for Immediate Suspension and Stay of NRC Staff's No

⁶ NRC Staff Brief And Summary of Relevant Facts, Data And Arguments Upon Which The Staff Proposes To Rely at Oral Argument on Environmental Contention EC-6, November 20, 2000 (Staff Brief and Summary).

⁷ Declaration of 22 December 2000 by Dr. Gordon Thompson Regarding the Potential for a Severe Accident at Spent Fuel Pools C & D at the Harris Nuclear Power Plant, December 22, 2000 (Thompson Declaration).

Significant Hazards Determination and Issuance of License Amendment for Harris Spent Fuel Pool Expansion,⁸ and with which the Staff disagrees.

3. BCOC relies heavily on the declaration filed by Gordon Thompson, who it claims is “a nuclear safety expert with extensive experience in the field of probabilistic risk assessment.” In paragraph 1 of his declaration, Dr. Thompson himself claims “extensive experience in assessing the hazards posed by nuclear facilities ... “. As discussed in Section IV B of the Staff Brief and Summary, the Staff does not consider Dr. Thompson to be expert in Probabilistic Risk Assessment, which is central to the arguments presented. In addition, Dr. Thompson has admitted that has little or no experience in the other disciplines relating to the analysis of the issues raised by EC-6. Staff Brief and Summary at 21-24. Specific statements made by Dr. Thompson and BCOC that the Staff considers to be incorrect or misleading are discussed in the following paragraphs.
4. BCOC’s claim that CP&L failed to address onsite radiation dose is misleading. Petition for Review at 7. CP&L did perform detailed onsite radiation dose calculations. See Summary of Facts, Data, and Arguments On Which The Applicant Proposes to Rely at the Subpart K Oral Argument Regarding Contention EC-6, at 57-60; Burns Affidavit at ¶ 17; Morgan Affidavit at ¶¶ 6-19; DeVoe Affidavit at ¶¶ 5, 6, 12.⁹ These calculations were an integral part of CP&L’s approach to

⁸ Orange County’s Petition for Review and Request for Immediate Suspension and Stay of the NRC Staff’s No Significant Hazards Determination and Issuance of License Amendment for Harris Spent Fuel Pool Expansion, December 22, 2000 (Petition for Review).

⁹ Summary of Facts, Data, and Arguments On Which The Applicant Proposes to Rely at the Subpart K Oral Argument Regarding Contention EC-6, November 20, 2000,

addressing the issue of accessibility. CP&L did not submit the actual calculations as part of its filing, but this level of detail was not necessary for the purposes of the Subpart K proceeding. BCOC describes the Staff's treatment of onsite radiation doses as oversimplified. The Staff's analysis in fact carefully took into account conditions within the plant to address habitability concerns inside the plant, and considered the impact of meteorological dispersion on site accessibility. BCOC, on the other hand, used an extremely simplistic and unrealistic assumption that radioactivity would be deposited evenly across the site.¹⁰

5. BCOC makes the assertion that "by adding to the electrical load and CCW heat load of existing Harris systems, activation of pools C and D will increase the burden of work on the Harris operators and thereby significantly increase the probability of accidents associated with the reactor's CCW and electrical systems and interruptions in cooling and electricity supply." Petition for Review at 10. This assertion is unsupported by any facts nor does BCOC provide a mechanism for an

and supporting affidavits.

¹⁰ Although beyond the scope of the environmental contention admitted below, Dr. Thompson raises the issue of off-site consequences in paragraph 4 of his declaration. He states: "The area of the affected environment, following a release from the Harris pools, could exceed the area of North Carolina." This is a misleading exaggeration. Most fission product deposition would occur within the first few miles from the site, and would be deposited preferentially in the direction of the wind at the time of the release. Beyond a distance of about 150 miles, persons would receive incrementally small doses (NUREG-1437, Vol 1, page 5-33). For such distances, the increase in fatal cancer risk would not likely ever be detected epidemiologically (see, for example, NUREG-1437, Vol 1 page 5-9). Dr. Thompson's claim appears to be based on a hypothetical and unrealistic assumption that the fission products are uniformly distributed in all directions. Such a scenario is unrealistic given actual meteorology and the physics of fission product transport and deposition.

increased probability. The increased heat load of 1MBTU/hr is a small fraction of the capacity of the CCW system and, as discussed in the Staff's SER (Exhibit 3) in section 3.2.2.3, the licensee has demonstrated that adequate excess thermal capacity exists in the CCW system to accommodate the additional heat load. BCOC's assertion is in contrast to Dr. Thompson's statement in paragraph 7 of his declaration that "activation of pools C and D would not significantly alter the probability of a pool fire at Harris". The Staff concurs with Dr. Thompson in this regard. Further, the staff believes that, because activation of pools C and D will provide additional ways to provide make-up to the spent fuel pools, as discussed in paragraphs 208 through 217 of the Staff's Affidavit (Exhibit 2), the probability of a pool fire is actually decreased.

6. In its petition, BCOC states that, as part of the subpart K proceedings related to environmental contention EC-6, Dr. Thompson "presented substantial and material evidence that the probability of an exothermic reaction in the spent fuel pools, leading to a massive release of radiation from the pools, is foreseeable, and may not be regarded as remote and speculative." Petition for Review at 6-7. In paragraph 8 of his declaration, Dr. Thompson suggests that "detailed analyses should be performed, to estimate the probability that events (of this kind) would lead to a pool fire". In paragraph 9 of his declaration, Dr. Thompson claims that "available analyses, although incomplete, indicate that the probability of a fire in pools C and D at Harris is comparable to the probability of a degraded-core accident at the Harris reactor with containment failure or bypass." Dr. Thompson fails to point out that the only analysis that reaches this conclusion is his own analysis.

7. In its affidavit, the Staff presented a bounding estimate of the frequency of spent fuel pool fires resulting from severe core damage accidents as $2E-07$ per year. The basis for the estimate is discussed in paragraphs 251 through 256 of the Staff's Affidavit. (Exhibit 2) CP&L also performed a detailed analysis which resulted in a somewhat lower but comparable frequency. The Staff and CP&L analyses both result in frequencies of fire in the spent fuel pools as a result of a severe core accident that are a factor of about 100 lower than that of a degraded-core accident with containment failure or bypass. These frequencies are so low as to be considered remote and speculative for purposes of NEPA.
8. With respect to the other events that could lead to a loss of water, which Dr. Thompson refers to in paragraph 6 of his declaration, with the exception of terrorism and sabotage, the Staff believes that the Draft Final Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants (TWG), February 2000 report provides a conservative bound of the probability of a SFP fire. The Staff believes that this is conservative because the system configuration and operating conditions at the operating Harris plant are such that the likelihood of a prolonged loss of cooling should be lower. Furthermore, the seismic contribution is based on a generic analysis which is intended to be bounding for most plants. Even with this conservative estimate, the total probability of a fuel pool fire is substantially lower than that for a severe reactor accident with containment failure. Specifically, based on the TWG report, cited in paragraph 257 of the Staff's Affidavit (Exhibit 2), the total frequency of a SFP fire is less than $3E-6/y$ for all events analyzed, with the largest contribution from large seismic events. TWG report at 29. The staff assessment of the probability of a severe reactor accident leading to a

SFP fire is about $2E-7$ per year. In contrast, the frequency of severe reactor accidents involving containment failure is on the order of $2E-5/y$ [the conditional probability of containment failure or bypass is .15 to .2 (Exhibit 2 at paragraph 66), and the core damage frequency (CDF) for Harris is estimated as $1.2E-04$ /reactor year (Exhibit 2 at paragraph 41), which is a factor of about 7 higher than the frequency of a spent fuel pool fire.

9. In paragraph 16 of his declaration, Dr. Thompson states: "A notable area of agreement is that Orange County, the NRC staff and CP&L agree that a loss of water from pools C and D, leading to partial or total exposure of the spent fuel to air, would inevitably cause a pool fire". As a point of clarification, in paragraph 29 of its affidavit, the NRC Staff said that "the consequence of the loss of most or all pool water is most likely an exothermic reaction of the fuel in the pools if the fuel is not so old that the decay heat can be removed by air cooling." The staff did not specifically address the probability of an exothermic reaction in pools C and D because it was able to demonstrate that the likelihood of the accident was sufficiently low even with the assumption that the probability of an exothermic reaction was 1. CP&L, stated in their affidavit, on page 61, that "it is highly unlikely that the spent fuel in pools C and D could sustain a zircaloy cladding exothermic reaction, even if a loss of most or all pool water through evaporation occurred."
10. In paragraph 17 of his declaration, Dr. Thompson correctly points out that the Staff and CP&L both focused on the timing of dryout of pools A and B as the limiting time for the sequence of events evaluated in response to environmental contention EC-6. However, while CP&L conservatively used an available time period of four days in their calculations, they estimated that the time was in fact on the order of 8 days.

Name: GARETH W. PARRY

EDUCATION

Ph.D., Theoretical Physics, Imperial College, London University, August 1972

B.Sc., Physics, Imperial College, London University, 1969

EMPLOYMENT HISTORY

U.S. Nuclear Regulatory Commission, 1996-present

NUS, 1980-1996

United Kingdom Atomic Energy Authority, 1975-1980

University of Durham, England, 1973-1975

International Centre for Theoretical Physics, Trieste, Italy, 1972-1973

USNRC - Position is that of Senior Level Advisor for Probabilistic Risk Analysis in the Division of System Safety and Analysis of the Office of Nuclear Reactor Regulation. Current responsibilities include advising the division director on the use of PRAs in the risk-informed regulation initiatives being pursued by NRC, reviewing PRA analyses performed in support of regulatory matters, and providing guidance to NRR staff in their uses of PRA techniques.

NUS - Project Manager in the Energy Risk and Reliability Department with particular interests in data analysis and parameter estimation, common cause failure analysis, external hazard analysis, human reliability analysis, and uncertainty analysis. Was a member of the project team performing a PSA for the VVER 1000, Temelin plant in the Czech Republic, with responsibility for data analysis, human reliability analysis, and external events analysis.

Participated in a number of Human Reliability Analysis (HRA) research projects, including, for EPRI, outlining an approach to developing an improved HRA methodology, and, for a utility client, defining and applying an approach to the analysis of errors of commission. Participated in the NRC-sponsored project to develop an improved HRA method, called ATHEANA, which includes a treatment of errors of commission. Was project manager for an EPRI project to provide guidelines for converting PRA results into accident sequences for training purposes. Has supported several utilities in performing Human Reliability analyses for IPEs and PRAs. Was a co-author of the SHARP1 report, which is an update of the Systematic Human Action Reliability Procedure (SHARP), and of a report presenting a cause-based decision tree approach to the estimation of cognitive error probabilities. Was an instructor at an EPRI-sponsored workshop on Human Reliability Assessment Issues and Methods, held in Charlotte in July 1990. Was NUS' project manager for the EPRI-sponsored Operator Reliability Experiments project. /

Was project manager for the Individual Plant Examination for External Events (IPEEE) support being provided by NUS to Cleveland Electric and Illuminating for its Perry plant, and to Baltimore Gas and Electric for its Calvert Cliffs plant. Was the project manager for the IPEEEs performed by NUS for the three nuclear stations operated by Carolina Power and Light, and was a participant in the IPEEE projects for Surry, North Anna, and Indian Point 2. Was Project Manager for the Limerick Generating Station Severe Accident Risk Assessment, which integrated the results of the previously performed Limerick PRA with

an external hazards risk study which addressed earthquakes, flooding, fires, tornadoes, transportation accidents, and turbine missiles, and a revised consequence and uncertainty analysis. Managed two projects estimating the frequency of damage to nuclear power plants resulting from extreme winds, and participated in a project for the Federal Emergency Management Agency on a feasibility study on the development of a methodology for comprehensive hazard analysis.

Managed the probabilistic risk assessment (PRA) project for the Peach Bottom Atomic Power Station to provide a base case model for the IPE submittal. Provided continuing support to Philadelphia Electric Company in the maintenance of their PRAs for Peach Bottom and Limerick. Managed a project to revise the event trees of the Limerick PRA model to incorporate the symptom-based emergency operating procedures, and to update the PRA and install it on the NUS PC-based software, NUPRA.

Has done extensive development work on the analysis of common cause failures. Was an author of the NRC/EPRI document "Procedures for Treating Common Cause Failures in Safety and Reliability Studies," and was coordinator of, and instructor at, a subsequent EPRI sponsored workshop. On behalf of IAEA conducted a seminar on common cause failure analysis for personnel at the Korea Advanced Energy Research Institute. Is a coauthor of an IAEA procedures guide for CCF analysis, and of a report providing an example application of data analysis for CCF model parameter estimation.

Has extensive experience in technology transfer. Managed the NUS support for the Almaraz PSA (Spain). Was Assistant Project Manager and Task Advisor for parameter estimation, uncertainty analysis, and external hazards analysis for the PRA performed by the Atomic Energy Council of the Republic of China (ROCAEC), under NUS guidance and supervision, for the Kuosheng BWR 6 Mark III reactor. Was a reviewer for and advisor to the ROCAEC in their performance of a PRA on the Maanshan PWR and the Chinshan PRA. Performed the same role for KOPEC in their performance of a PRA on the Kori units.

Was responsible for database development and uncertainty analysis for all of the PRAs performed by the Gaithersburg office of NUS including the Susquehanna (BWR) level 3 PRA, the level 2 PRA of the Ringhals 2 PWR, the level 1 PRA of Caorso, and the PRAs for Peach Bottom, Almaraz, and Kuosheng.

Was a member of a review group assessing Revision 4 of the BWR owners group Emergency Operating Procedure Guidelines with respect to their value in prevention and mitigation of severe accidents, a member of the QC team for the NRC-sponsored Risk Methods Integration and Evaluation Program (RMIEP) with responsibility for the parameter estimation and uncertainty analysis aspects, and a member of the QC team reviewing four level 1 PRAs performed as part of the NUREG-1150 Project. Has participated in reviews of several PRAs for a variety of clients. Was a member of the IAEA IPERS (International Peer Review Service) team for the Dodewaard (Netherlands) and Bohunice (Slovakia) PSAs. Was a member of a peer review group of the System Studies being performed by the Idaho National Laboratory for NRC (AEOD), and of an expert panel that reviewed the Quantitative Risk Analysis (QRA) of the Tooele Chemical Demilitarization Facility for the U.S. Army.

Was an Instructor of a course entitled "Issues in Reviewing and Evaluating a PRA," given to NRC staff as part of the NRC PRA training program. Was an instructor for EPRI and

MIT workshops on IPE methods. Was an instructor for a summer course on Human Reliability Analysis, and a two day course on Common Cause Failure Analysis, both given at the University of Maryland.

Was a principal author of Chapter 12, "Uncertainty and Sensitivity Analysis," of the NRC/Industry PRA Procedures Guide, NUREG/CR-2300, and was a member of the review group for Chapters 5 and 6, "Data Base" and "Quantification," of the guide.

United Kingdom Atomic Energy Authority - Was Project Officer for Safety and Reliability Directorate-funded work on post-accident heat removal for liquid-metal fast-breeder reactors. Investigated fundamental aspects of quantitative risk assessment methodologies. Main areas of activity were in use of statistics to quantify risk assessments, and reliability theory.

Completed projects included a review for the Commission of European Communities (CEC) on the characterization and evaluation of uncertainties in quantitative risk assessment, and the development of a technique for handling the time structure of failure and repair processes.

As a member of the Plate Inspection Steering Committee (PISC) sponsored by the NEA-CEC, was involved in the evaluation and interpretation of the results of trials designed to establish the reliability of a code of ultrasonic inspection, which is based on the ASME XI procedure for the inspection of welds in heavy section steel plate. Also, was a member of the program evaluation group which drew up a second PISC program, with special responsibility for the evaluation method.

University of Durham - Lectured in applied mathematics and carried out research theoretical high energy physics.

International Centre for Theoretical Physics - Performed research in theoretical high energy physics as a Royal Society Post-doctoral Research Fellow.

MEMBERSHIP

American Nuclear Society

PUBLICATIONS

Journal Publications

"An Approach for using Risk Assessment in Risk-Informed Decisions on Plant-specific Changes to the Licensing Basis" (with M. A. Caruso, M. C. Cheok, M. A. Cunningham, G. M. Holahan, T. L. King, A. M. Ramey-Smith, M. P. Rubin, and A. C. Thadani), Reliability Engineering and System Safety, Vol. 63, (1999), pages 231-242.

"Use of Importance Measures in Risk-Informed Regulatory Applications" (with M. C. Cheok and R. R. Sherry), Reliability Engineering and System Safety, Vol. 60, (1998), pages 213-226.

"The Characterization of Uncertainty in Probabilistic Risk Assessments of Complex Systems", Reliability Engineering and System Safety, special issue on aleatory and epistemic uncertainty, Vol. 54, (1996), pages 119-126.

"A Procedure for the Analysis of Errors of Commission During Non-Power Modes of Nuclear Power Plant Operation" (with J. Julius, E. Jorgenson, and A. Mosleh), Reliability Engineering and System Safety, Vol. 53, (1996), pages 139-154.

"A Procedure for the Analysis of Errors of Commission in a Probabilistic Safety Assessment of a Nuclear Power Plant at Full Power" (with J. Julius, E. Jorgenson, and A. Mosleh), Reliability Engineering and System Safety, Vol. 50, (1995), pages 189-201.

"Suggestions for an Improved HRA Method for Use in Probabilistic Safety Assessment", Reliability Engineering and System Safety, Vol. 49, (1995), pages 1-12.

"An Approach to the Analysis of Common Cause Failure Data for Plant-Specific Application" (with A. Mosleh and F. Zikria), Nuclear Engineering and Design, Vol. 150, p. 25, 1994.

"Common Cause Failures: A Critique and Some Suggestions," Reliability Engineering and System Safety, Vol. 34, 1991.

"On the Meaning of Probability in Probabilistic Safety Assessment," Reliability Engineering and System Safety 23 (1988), pp. 309-314.

Reports and Books

"A Technique for Human Error Analysis (ATHEANA)" (with S. Cooper, A. Ramey-Smith, J. Wreathall, D. Bley, W. Luckas, J. Taylor, and M. Barriere), NUREG/CR-6350, May 1996, US Nuclear Regulatory Commission.

"Process Description for ATHEANA: A Technique for Human Error Analysis", (lead author), Brookhaven National Laboratory Technical Report L-2415/95-2, December 30, 1995.

"Control Room Operations Research Project" (principal author), Electric Power Research Institute, EPRI TR-105380, December, 1995.

"PSA Applications Guide" (With D. True, J. Sursock, B. Putney, and K. Fleming), Electric Power Research Institute, EPRI TR-105396, August 1995.

"Chapter 9: Common Cause Failure Analysis", in *Cost-Effective Risk Assessment for Process Design*, edited by R. Deshotels and R. Zimmerman, McGraw Hill, 1995

"Model Uncertainty and Probability," in Model Uncertainty: Its Characterization and Quantification, A. Mosleh, C. Smidts, and C. Liu (editors), University of Maryland Center for Reliability Engineering Publication, 1995.

"Enhancements to Data Collection and Reporting of Single and Multiple Failure Events" (with D Whitehead, H. Paula, D. Rasmuson), NUREG/CR-5471, March 1993.

"Systematic Human Action Reliability Procedure (SHARP) Enhancement Project. SHARP 1 Methodology Report" (with D. Whitehead, A Spurgin, and G. Hannaman), EPRI-TR-101711, December 1992.

"Critique of Current Practice in the Treatment of Human Interactions in Probabilistic Safety Assessments," in Reliability and Safety Assessment of Dynamic Process Systems, T. Aldemir, N. Siu, and A. Mosleh (editors), Springer-Verlag Publishing, Berlin, 1994.

"An Approach to the Analysis of Operator Actions in Probabilistic Risk Assessment" (with A. Beare, A. Spurgin, P. Moeini, and B. Lydell), EPRI TR 100259, June, 1992.

"Guidelines for Conducting Common Cause Failure Analysis in Probabilistic Safety Assessment" (with S. Hirschberg), IAEA TEC-DOC 648, May, 1992.

"Nuclear Plant Reliability: Data Collection and Usage Guide" (with T. Morgan and C. Schwan), EPRI TR-100281, April 1992.

"Example Application of a Structured Procedure for Estimating Common Cause Failure Probabilities" (with A. Mosleh and T. Mankamo) draft IAEA document.

"A Cause Defense Approach to the Understanding and Analysis of Common Cause Failure" (with H. Paula), NUREG/CR-5460, April 1990.

"Operator Reliability Experiments Using Nuclear Power Plant Simulators" (with A. Spurgin, coauthor), EPRI NP-6937, July 1990, Vols. 1, 2, 3.

"Procedures for Treating Common Cause Failures in Safety and Reliability Studies" (with A. Mosleh, K. Fleming, H. Paula, D. Rasmuson, and D. Worledge), EPRI NP 5613/NUREG/CR-4780, Vol. 1, 1988, Vol. 2, 1989.

Conference Papers

"PSA Applications: Safety Goals and Acceptance Guidelines" (with M. A. Cunningham, G. M. Holahan, T. L. King, and J. A. Murphy) in proceedings of PSA '99, Washington DC, August 22-26, 1999, proceedings published by the American Nuclear Society, La Grange Park, Illinois, USA.

"Status of Risk Informed Regulatory Activities and Guidance Development at the U.S. NRC" (with G. M. Holahan, T. L. King, M. A. Cunningham, M. C. Cheok, and M. P. Rubin), presented at the International Topical Meeting on the Safety of Operating Reactors, San Francisco, October 11-14, 1998, proceedings published by the American Nuclear Society, La Grange Park, Illinois, USA.

"Uncertainty in PRA and its Implications for Use in Risk-Informed Decision-Making", presented at PSAM IV, New York City, September 14 - 18, 1998, proceedings published by Springer.

"Standardizing Human Reliability Analysis - Issues and Suggestions", presented at PSA '96, Park City, Utah, September 29 - October 3, 1996, proceedings published by the American Nuclear Society, La Grange Park, Illinois, USA.

"A Process for Application of ATHEANA - A New HRA Method" (with D. Bley, S. Cooper, J. Wreathall, W. Luckas, C. Thompson, A. Ramey-Smith, presented at PSA '96, Park City, Utah, September 29 - October 3, 1996, proceedings published by the American Nuclear Society, La Grange Park, Illinois, USA.

"An Improved HRA Process for Use in PRAs", (with M. Barriere and A. Ramey-Smith), presented at Probabilistic Safety Assessment and Management (PSAM) III, June 24-28 1996, Crete, Greece, proceedings published by Springer.

"Procedure for the Analysis of Errors of Commission during Non-power Operation", (with J. Julius, E. Jorgenson, and A. Mosleh), PSAM III, June 24-28 1996, Crete, Greece, proceedings published by Springer.

"The Need for, and Some Suggested Characteristics of, an Improved HRA Approach for Use in PSAs", Presented at an International Workshop on Human Reliability Models, August 22-24, 1994, Stockholm, Sweden.

"A Procedure for the Analysis of Errors of Commission in a PSA," presented at PSAM II, San Diego, CA, 1994.

"The Need for, and a Proposed Structure of, a Second Generation HRA Methodology," presented at PSAM II, San Diego, CA, 1994.

"The Meaning and Use of Probability in Probabilistic Safety Assessment", presented at PSAM II, San Diego, CA, 1994.

"Suggestions for an Improved Human Reliability Model for Use in Systems Analysis", presented at the 16th Reactor Operations International Topical Meeting, Long Island, N.Y., August 16-18, 1993.

"An Approach to the Parameterization of Judgement in the Analysis of Common Cause Failure Data" (with F. Zikria and A. Mosleh), presented at PSA '93, Clearwater Beach, Florida, January 26-29, 1993.

"Modeling of Dual Unit Interactions during a Loss of Offsite Power at Peach Bottom Atomic Power Station" (with G. Krueger), presented at PSA '93, Clearwater Beach, Florida, January 26-29, 1993.

"An Approach to the Analysis of Operating Crew Responses for Use in PSAs", (with A. Beare and A. Singh), presented at PSA '93, Clearwater Beach, Florida, January 26-29, 1993.

"An Approach to the Analysis of Operating Crew Responses using Simulation Exercises for use in PSAs", coauthor, presented at OECD/CSNI Workshop on special issues in PSA, Cologne, Germany, May 1991.

"An Approach for Assessment of the Reliability of Cognitive Response for Nuclear Power Plant Operating Crews" (co-author) in Proceedings of "Probabilistic Safety Assessment and Management," Beverly Hills, Calif., February 1991, Elsevier.

"Data Needs for Common Cause Failure Analysis" (coauthor), Proceedings of Probabilistic Safety Assessment and Management, Beverly Hills, Calif., February 1991, Elsevier.

"HRA and the Modeling of Human Interactions", (with B. Lydell), Proceedings of Probabilistic Safety Assessment and Management, Beverly Hills, Calif., February 1991, Elsevier.

"Common Cause Failure Analysis: Where Do We Go From Here?", presented at CSNI Workshop on Applications and Limitations of Probabilistic Safety Assessment, Santa Fe, N.Mex., September 1990.

"Use of Probabilistic Methods in Fire Hazards Analysis" (with Paul Guymer), in Fire Protection and Fire Fighting in Nuclear Installations, IAEA, Vienna, Austria, 1989.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE COMMISSION

In the Matter of)
) Docket No. 50-400-LA
CAROLINA POWER & LIGHT)
COMPANY) ASLBP No. 99-762-02-LA
)
(Shearon Harris Nuclear Power Plant))

CERTIFICATE OF SERVICE

I hereby certify that copies of "NRC STAFF OPPOSITION TO ORANGE COUNTY'S PETITION FOR REVIEW AND REQUEST FOR IMMEDIATE SUSPENSION AND STAY OF THE NRC STAFF'S NO SIGNIFICANT HAZARDS DETERMINATION AND ISSUANCE OF LICENSE AMENDMENT FOR HARRIS SPENT FUEL POOL EXPANSION" in the above-captioned proceeding have been served on the following through deposit in the NRC's internal mail system, or by deposit in the NRC's internal mail system, with copies by electronic mail, as indicated by an asterisk, or by deposit in U.S. Postal Service as indicated by double asterisk, with copies by electronic mail as indicated this 8TH day of January, 2001:

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