February 12, 1999

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
BEFORE THE NRC STAFF

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

DECLARATION OF DR. GORDON THOMPSON

I, Gordon Thompson, declare as follows:

A. Introduction

1. I am the executive director of the Institute for Resource and Security Studies (IRSS), a nonprofit, tax-exempt corporation based in Massachusetts. Our office is located at 27 Ellsworth Avenue, Cambridge, MA 02139. IRSS was founded in 1984 to conduct technical and policy analysis and public education, with the objective of promoting peace and international security, efficient use of natural resources, and protection of the environment.

2. This Declaration pertains to an application by Carolina Power and Light (CP&L) for an amendment to Facility Operating License No. NPF-63, which covers the Shearon Harris nuclear power plant. The staff of the Nuclear Regulatory Commission (NRC) has reviewed CP&L's application and proposes to determine that the amendment request involves no significant hazards consideration. The NRC has sought public comments on the proposed determination.[1] Through this Declaration, I offer comments on the NRC staff's proposed determination. I have prepared these comments pursuant to an agreement by IRSS to provide technical information and other services to Orange County, North Carolina.

B. My Professional Background

3. I received an undergraduate education in science and mechanical engineering at the University of New South Wales, in Australia. Subsequently, I pursued graduate studies at Oxford University and received from that institution a Doctorate of Philosophy in mathematics in 1973, for analyses of plasmas undergoing thermonuclear fusion. During my graduate studies I was associated with the fusion research program of the UK Atomic Energy Authority.

[1] Federal Register: January 13, 1999 (Volume 64, Number 8), pages 2237-2241.

4. During my professional career, I have performed technical and policy analyses on a range of issues related to international security, energy supply, environmental protection, and sustainable use of natural resources. Since 1977, a significant part of my work has consisted of technical analyses of safety and environmental issues related to nuclear facilities. These analyses have been sponsored by a variety of nongovernmental organizations and local, state and national governments, predominantly in North America and western Europe. Drawing upon these analyses, I have provided expert testimony in legal and regulatory proceedings, and have served on committees advising US government agencies. My CV is provided here as Attachment A.

C. Scope of My Review

5. In preparation of this Declaration, I reviewed the NRC's Federal Register notice for the proposed license amendment, the Final Safety Analysis Report for the Shearon Harris Nuclear Power Plant, the Final Environmental Statement related to the operation of Shearon Harris Nuclear Power Plant, Units 1 and 2 (NUREG-0972, October 1983), and CP&L's application for the proposed license amendment. I also reviewed various correspondence and technical documents relating to the propose license amendment and to risks of spent fuel storage, which are identified below.

6. The information that has been provided by the NRC and CP&L to date does not contain all of the detail that I would need to provide a complete, final statement about the hazards associated with the proposed license amendment. I would expect to review the full body of detailed evidence and present my final evaluation in the context of a hearing. However, even the limited information provided so far is adequate to permit me to identify serious safety concerns which preclude the NRC from making a "no significant hazards" determination. These issues should be addressed through the systematic, public process that a prior licensing hearing can provide.

D. The "No Significant Hazards" Standard

7. The NRC has stated its standard for determining that a license amendment request involves no significant hazards consideration.[2] The standard is met if operation of the facility in accordance with the proposed amendment would not: (1) involve a significant increase in the probability or consequences of an accident previously evaluated; or (2) create the possibility of a new or different kind of accident from any accident previously evaluated; or (3) involve a significant reduction in a margin of safety.

8. In my professional opinion, based on the preliminary evidence provided by the NRC and CP&L, operation of the Shearon Harris plant in accordance with the license amendment proposed by CP&L will violate all three of the conditions set forth in the preceding paragraph. Therefore, the NRC staff should reverse its position and should

[2] Ibid.

determine that CP&L's license amendment request does <u>not</u> involve no significant hazards consideration.

E. The License Amendment in Context - Spent Fuel Management at Harris

9. Before discussing my concerns about the safety implications of the proposed license amendment, I provide here some background information about spent fuel management at the Harris plant and CP&L's proposal to increase the spent fuel storage capacity at Harris. Unless specified otherwise, the information presented here is drawn from CP&L's license amendment application or from CP&L's Final Safety Analysis Report (FSAR) for the Harris plant.

10. The Harris plant features one pressurized-water reactor (PWR). The core of this reactor contains 157 fuel assemblies, with a center-center distance of about 8.5 inches. The Harris plant was to have four reactors but only one was built. A fuel handling building was built to serve all four reactors. This building contains four fuel pools (A, B, C, D), a cask loading pool and three fuel transfer canals, all interconnected but separable by gates. Pools A and B contain fuel racks. Pools C and D are flooded but do not contain racks. The cooling and water cleanup systems for pools C and D were never completed.

11. Pool A now contains six PWR racks (360 fuel assembly spaces) and three BWR racks (363 spaces), for a total pool capacity of 723 fuel assemblies. Pool B contains twelve PWR racks (768 spaces) and seventeen BWR racks (2,057 spaces), and is licensed to store one additional BWR rack (121 spaces), for a total pool capacity of 2,946 fuel assemblies. Thus, pools A and B now have a combined capacity of 3,669 fuel assemblies. The center-center distance in pools A and B is 10.5 inches for PWR fuel and 6.25 inches for BWR fuel.

12. Pools A and B store spent fuel from the Harris reactor and from CP&L's Brunswick plant and Robinson plant. The Brunswick plant has two boiling-water reactors (BWRs) while the Robinson plant has one PWR. Shipment of spent fuel from Brunswick and Robinson to Harris is said by CP&L to be necessary to allow core offload capacity in the pools at Brunswick and Robinson.

13. CP&L seeks an amendment to its operating license so that it can activate pools C and D at Harris. By activating these pools, CP&L expects to have sufficient spent fuel storage capacity for all four CP&L reactors (Harris, Robinson and the two Brunswick reactors) through the end of their current operating licenses.

14. CP&L plans to install racks in pool C in three campaigns (approximately in 2000, 2005 and 2014), to create 927 PWR spaces and 2,763 BWR spaces, for a total pool capacity of 3,690 fuel assemblies. Thereafter, CP&L plans to install racks in pool D in two campaigns (approximately in 2016 and at a date to be determined), to create 1,025 PWR spaces. Thus, the ultimate capacity of pools C and D will be 4,715 fuel assemblies. The center-center distance will be 9.0 inches for PWR fuel and 6.25 inches for BWR fuel.

15. The PWR racks in pools C and D have a smaller center-center distance than the racks in pools A and B (9.0 inches instead of 10.5 inches). This arrangement allows more PWR fuel to be placed in a given pool area but also means that PWR fuel in pools C and D is more prone to undergo criticality. In response, CP&L proposes to include in the Technical Specifications for Harris a provision that PWR fuel will not be placed in pools C and D unless it has relatively low enrichment and high burnup.[3]

F. Some Technical Safety Issues Raised By the Proposed License Amendment

16. CP&L's plan for the activation of pools C and D raises a variety of technical safety issues. This section of my Declaration describes some of those issues. Later parts of the Declaration relate these issues to the NRC's standard for a "no significant hazards" determination.

17. NRC regulations require that spent fuel storage pools must be cooled by safety grade cooling systems. When the Harris plant was designed, the intention was that pools C and D would be cooled by the component cooling water (CCW) system for the second unit of the Harris plant.[4] That unit was never built, and therefore the Unit 2 CCW system does not exist. In the absence of a second CCW system, CP&L plans to cool pools C and D by connecting their cooling systems to the CCW system of the first unit. This system already provides cooling to pools A and B and serves other, important safety functions. Attachment B provides supporting information.[5]. It should be noted that CP&L considered, but has not pursued, the option of cooling pools C and D by a new, independent system that could have had dedicated emergency diesel generators. Attachment C provides information in support of this point.[6] Three significant safety issues are raised by the fact that the spent fuel pool cooling arrangement originally designed for pools C and D of the Harris plant was not completed. These issues relate to the heat loading of the existing CCW system, the load on the existing emergency diesel generators, and the loss of some important quality assurance documentation for cooling piping at pools C and D.

18. Heat load. According to CP&L's license amendment application, the bounding heat load from the fuel in pools C and D will be 15.6 million BTU/hour.[7] At present, the CCW system cannot absorb this additional heat load. Thus, CP&L proposes to include in

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[3] License amendment application, Enclosure 5.

[4] The Harris pools have their own closed-circuit cooling systems, which can transfer heat to the relevant CCW system through heat exchangers.

[5] Attachment B is a portion of a set of viewgraphs (titled "Harris Spent Fuel Pool 'C' and 'D' Activation") shown by CP&L representatives during a meeting with NRC staff on 16 July 1998.

[6] Attachment C is an NRC staff memo about a meeting between CP&L representatives and NRC staff on 3 March 1998, together with a portion of a set of viewgraphs (titled "HNP Spent Fuel Pool 'C' and 'D' Activation") shown by CP&L during that meeting.

[7] License amendment application, Enclosure 7, page 5-16.

the Technical Specifications for Harris an interim provision that the heat load in pools C and D will not be allowed to exceed 1.0 million BTU/hour.[8] CP&L claims that an additional heat load of 1.0 million BTU/hour can be accommodated by the existing CCW system, and that the fuel to be placed in pools C and D will not create a heat load exceeding 1.0 million BTU/hour through 2001.

19. Apparently, CP&L contemplates a future upgrade of the CCW system, so that the CCW system can accommodate an additional heat load of 15.6 million BTU/hour from pools C and D. This contemplated upgrade is not described in the present license amendment application. Attachment C indicates that CP&L plans to perform the upgrade of the CCW system concurrent with a power uprate for the Harris reactor. Apparently, a 4.5 percent power uprate will be associated with steam generator replacement, and there will be a subsequent further power uprate of 1.5 percent. A chart in Attachment C shows that the projected CCW heat load, including the reactor power uprate and the use of pools C and D, will substantially exceed the capability of the present CCW system.

20. To summarize, CP&L's short-term plan (through 2001) for cooling pools C and D is to exploit the margin in the existing CCW system, so as to accommodate an additional heat load of 1.0 million BTU/hour. CP&L's longer-term plan is to upgrade the CCW system, in a manner not yet specified, so as to accommodate an additional heat load of 15.6 million BTU/hour. The CCW upgrade must also accommodate an increase in the rated power of the Harris reactor. Attachment B indicates CP&L's expectation that the design of the CCW upgrade will commence in mid-1999 and will be completed in early 2001, one year after pool C enters service.

21. In order to avoid exceeding the available margin in the existing CCW system while cooling pools C and D, CP&L may be obliged to require its operators to divert some CCW flow from the residual heat removal (RHR) heat exchangers during the recirculation phase of a design-basis loss-of-coolant accident (LOCA) event at the Harris reactor.[9] This raises a safety issue because, during the recirculation phase of a LOCA, operation of the RHR system is essential to keeping the reactor core and containment in a safe condition. Both CP&L and the NRC have identified the proposed additional heat load on the Unit 1 CCW system as an "unreviewed safety question," i.e., a safety question that has not been previously reviewed by the NRC Staff.[10] It should be noted in this context that exploitation of the margin in the existing CCW system may involve changes in design assumptions that include fouling factors and tube plugging limits. See Attachment C. The discussion of CCW capability which is provided in Enclosure 9 of CP&L's license amendment application is insufficient to determine the nature and significance of the assumptions made by CP&L.

22. **Backup diesel generators.** The cooling systems for pools C and D will draw electrical power from the electrical systems of the existing Harris plant. If electricity

[8] License amendment application, Enclosure 5.

[9] License amendment application, Enclosure 9.

[10] Ibid; Federal Register notice for this application.

supply to the cooling pumps for pools C and D is interrupted, the pools will heat up and eventually boil. CP&L says that pools C and D will begin to boil after a time period "in excess of 13 hours", assuming a bounding decay heat load of 15.6 million BTU/hour.[11] To prevent the onset of pool boiling in the event of a loss of offsite power, the Harris operators may be obliged to provide electrical power to pools C and D from the emergency diesel generators, which also serve pools A and B and the reactor. In the present license amendment application, CP&L does not address the ability of the emergency diesel generators to meet the additional electrical loads associated with pools C and D. CP&L does mention in the Harris FSAR the potential for connecting "portable pumps" to bypass the pool cooling pumps should the latter be inoperable.[12] However, the characteristics, capabilities and availability of such portable pumps are not addressed in the present license amendment application. Meeting the electrical load of pools C and D from the systems of the existing Harris plant is a safety issue because it could increase the probability of design-basis or severe accidents at the Harris reactor or at pools A through C.

23. **Lack of QA documents.** Activation of pools C and D will require the completion of their cooling and water cleanup systems, and the connection of their cooling systems to the existing CCW system. CP&L states that approximately 80% of the necessary piping was completed before the second Harris reactor was cancelled.[13] However, some of the quality assurance documentation for the completed piping is no longer available. Much of the completed piping is embedded in concrete and is therefore difficult or impossible to inspect. To address this situation, CP&L proposes an Alternative Plan to demonstrate that the previously completed piping and other equipment is adequate for its purpose.[14] Nevertheless, the cooling systems for pools C and D will not satisfy ASME code requirements. Attachment D provides supporting information.[15] Failure to satisfy ASME code requirements could increase the probability of design-basis or severe accidents at pools C and D.

G. The Degree of Hazard Posed by Spent Fuel Storage at Harris

24. The NRC and CP&L have performed and published site-specific analyses which provide information about potential severe accidents at the Harris reactor. However, to my knowledge neither NRC nor CP&L has performed any site-specific analysis which

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[11] License amendment application, Enclosure 7, page 5-8.

[12] Harris FSAR, page 9.1.3-4, Amendment No. 48.

[13] License amendment application, Enclosure 1, page 4.

[14] License amendment application, Enclosure 8.

[15] Attachment D is a portion of a set of viewgraphs (titled "10CFR50.55a Alternative Plan") shown by CP&L representatives during a meeting with NRC staff on 16 July 1998.

examines potential severe accidents affecting any of the Harris fuel pools, including pools C and D.

25. The NRC examined severe reactor accidents in its Final Environmental Statement for the Harris plant.[16] Site-specific consequence modelling was performed by the NRC for hypothetical accidents that released as much as 82 percent of the inventory of cesium isotopes in the reactor core. CP&L has submitted to the NRC an Individual Plant Examination (IPE) for the Harris plant.[17] In addition, CP&L has submitted a similar analysis (an IPEEE) for "external" initiating events.[18] The IPE and IPEEE studies examined the potential for severe reactor accidents that could release substantial amounts of radioactivity.

26. In the absence of similar studies for the Harris pools, one must perform scoping calculations to indicate the degree of hazard posed by spent fuel storage at Harris. The degree of hazard is important when one considers the relevance of a safety issue to a determination of "no significant hazards". If preliminary evidence about a safety issue suggests the potential for accidents with either high probability or large consequences, then the NRC staff should not make a determination of "no significant hazards".

27. The radioisotope cesium-137 is one important indicator of the hazard potential posed by a nuclear facility. This isotope has a half-life of 30 years, emits intense gamma radiation, and is released comparatively readily during severe accidents. The 1986 Chernobyl accident released about 90,000 TBq (27 kg) of cesium-137 to the atmosphere, which accounted for most of the offsite radiation exposure attributable to that accident. Official estimates indicate that this exposure will cause 50-100 thousand extra cancer fatalities worldwide over the next 70 years.[19]

28. The core of the Harris reactor contains 157 PWR fuel assemblies. At shutdown, this core contains about 155,000 TBq (47 kg) of cesium-137.[20] When a spent fuel assembly is discharged from the reactor, it will contain more cesium-137 than the average assembly at shutdown. CP&L plans an eventual, aggregate capacity in the Harris pools of 3,080 PWR assemblies and 5,304 BWR assemblies. Note that the cesium-137 content in each BWR assembly will be about one quarter the cesium-137 content in each PWR assembly,

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[16] NRC, Final Environmental Statement related to the operation of Shearon Harris Nuclear Power Plant, Units 1 and 2, NUREG-0972, October 1983.

[17] CP&L, Shearon Harris Nuclear Power Plant, Individual Plant Examination Submittal, Final Report, 31 August 1993.

[18] CP&L, Shearon Harris Nuclear Power Plant Unit No. 1, Individual Plant Examination for External Events Submittal, June 1995.

[19] Allan S Krass, Consequences of the Chernobyl Accident (Cambridge, Massachusetts: Institute for Resource and Security Studies, December 1991).

[20] NRC, Final Environmental Statement, page 5-50.

if both assemblies have been discharged for an equal period.[21] After discharge, the content of cesium-137 in a fuel assembly will decay exponentially with a half-life of 30 years.

29. As a simplified illustration, assume that all fuel assemblies in the Harris pools have been discharged for an equal period. Further assume that all four pools are full and contain 3,080 PWR assemblies and 5,304 BWR assemblies. The pools will then contain as much cesium-137 as 4,406 PWR assemblies. (3,080 ÷ 5,304 x 1/4 = 4,406) Note that 4,406 PWR assemblies represent 28 cores of the Harris reactor.

30. If an accident can be postulated that releases to the environment a significant fraction of the cesium-137 in the Harris pools, then it is clear that the consequences of this accident would be large. The offsite radiation exposure could be an order of magnitude larger than the exposure from the Chernobyl accident. Activation of pools C and D could lead to an accident which creates offsite radiation exposure as much as two times higher than the exposure that would arise from a similar accident involving only pools A and B.

H. Loss of Water from Spent Fuel Pools at Harris

31. Loss of water from one or more of the Harris pools could initiate a release to the environment of a significant fraction of the cesium-137 in the pools. This potential exists because the cladding of PWR or BWR fuel is a zirconium alloy which can react exothermically with air or steam. Thus, if the water in a fuel pool is removed and the fuel is partially or totally uncovered, one must be concerned about the possibility of a runaway air-zirconium or steam-zirconium reaction. Such a reaction could release cesium-137 and other radioisotopes from affected fuel into the fuel building. That building was not designed to contain radioisotopes released during a vigorous exothermic reaction in the pools, and it can be assumed that most of the volatile radioisotopes entering the building from the affected fuel would be released from the building as an atmospheric plume.

32. Several reports prepared by or for the NRC have examined the conditions under which a runaway zirconium reaction might occur.[22] However, these reports have concentrated almost entirely on a postulated condition of instantaneous, complete loss of water from a pool. Such a condition is unrealistic in any scenario which preserves the configuration of the spent fuel racks. If water is lost by drainage or evaporation and no makeup occurs, then complete loss of water will always be preceded by partial

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[21] The ratio of one quarter derives from the parameters shown in the license amendment application, Enclosure 7, page 5-15.

[22] Relevant reports include: V L Sailor et al, Severe Accidents in Spent Fuel Pools in Support of Generic Safety Issue 82, NUREG/CR-4982, July 1987; E D Throm, Regulatory Analysis for the Resolution of Generic Issue 82, "Beyond Design Basis Accidents in Spent Fuel Pools", NUREG-1353, April 1989; and R J Travis et al, A Safety and Regulatory Assessment of Generic BWR and PWR Permanently Shutdown Nuclear Power Plants, NUREG/CR-6451, August 1997.

uncovering of the fuel. If makeup is considered, the water level could fall, rise or remain static for long periods.

33. Partial uncovering of the fuel will often be a more severe condition than complete loss of water because, during partial uncovering, convective heat loss is suppressed by the residual water at the base of the fuel assemblies. As a result, longer-discharged fuel with a lower heat output may undergo a runaway steam-zirconium reaction during partial uncovering while it would not undergo a runaway air-zirconium reaction if the pool were instantaneously emptied.

34. I am aware of only one instance in which reports produced by or for the NRC address the hazard posed by partial uncovering, namely in a report prepared for the NRC by Sandia Laboratories and published in 1979.[23] Part of this report did address a situation of partial uncovering, but used a crude heat transfer model and neglected to consider the onset of a steam-zirconium reaction. Nevertheless, the report found (page 76) that "......an incomplete drainage can potentially cause a more severe heatup problem than a complete drainage, if the residual water remains near the baseplates". A portion of the 1979 Sandia report is provided here as Attachment E. An internal NRC memo mentions the consideration of partial uncovering in the 1979 Sandia report.[24]. Otherwise, it appears that the NRC has ignored the hazard posed by partial uncovering. This hazard was not reflected in the regulatory analysis whereby the NRC purportedly resolved Generic Issue 82.[25]

35. In a situation of falling water level, a fuel assembly might first undergo a runaway steam-zirconium reaction, then switch to an air-zirconium reaction as water falls below the base of the rack and convective air flow is established. In this manner, a runaway air-zirconium reaction could occur in a fuel assembly that is too long-discharged (and therefore produces too little heat) to suffer such a reaction in the event of instantaneous, complete loss of water. Conversely, a rising water level could precipitate a runaway steam-zirconium reaction in a fuel assembly that had previously been completely uncovered but had not necessarily suffered a runaway air-zirconium reaction while in that condition. The latter point is highly significant in the context of emergency measures to recover control of a pool which has experienced water loss. Inappropriate addition of water to a pool could exacerbate the accident.

36. The NRC's failure to consider partial uncovering of fuel should be borne in mind when one reviews NRC-sponsored reports that purport to address the hazard posed by water loss from a fuel pool. This hazard should be re-analyzed through detailed modelling. The modelling should consider both partial and complete uncovering and the

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23 Allan S Benjamin et al, Spent Fuel Heatup Following Loss of Water During Storage, NUREG/CR-0649, March 1979.

24 Internal NRC Memorandum from J T Han to M Silberberg, "Response to a NRR request to review SNL studies regarding spent fuel heatup and burning following loss of water in storage pool", 21 May 1984.

25 E D Throm, op cit.

transition from one of these states to the other. Also, the modelling should cover: (1) thermal radiation, conduction, and steam or air convection; (2) air-zirconium and steam-zirconium reactions; (3) variations along the fuel rod axis; and (4) radial variations within a representative fuel rod, including effects of the pellet-cladding gap. Experiments will probably be required to support and validate the modelling.

37. Until the problem of water loss is re-analyzed in this manner, there is no basis for determining when fuel has been discharged for a sufficiently long period that it will not suffer a runaway zirconium reaction in the event of water loss. If the problem were to be properly analyzed through validated models, such a determination could be made within some margin of error, but the determination should consider site-specific factors. For example, the detailed design of a rack might be an important site-specific factor.

38. No determination of this kind has been made for pools C and D at Harris, nor does the methodology now exist to make such a determination. In any case, there is nothing in the license amendment application and its proposed modifications to the Harris Technical Specifications which prohibits the placing of freshly discharged fuel in pools C and D. Reports previously prepared for the NRC concede that freshly discharged fuel can experience a runaway air-zirconium reaction in the event of complete water loss.

39. A variety of events, alone or in combination, could lead to partial or complete uncovering of spent fuel in the Harris pools. This class of events should be subjected to the kind of systematic analysis that is performed in an IPE and an IPEEE. Relevant events include: (1) an earthquake, cask drop, aircraft crash, human error, equipment failure or sabotage event that leads to direct leakage from the pools; (2) siphoning of water from the pools through accident or malice; (3) interruption of pool cooling, leading to pool boiling and loss of water by evaporation; and (4) loss of water from active pools into adjacent pools or canals that have been gated off and drained. Interactions with the Harris reactor should be considered. For example, a reactor accident might release radioactivity that precludes personnel access to the plant for purposes of maintaining or restoring pool cooling.

I. Increased Probability or Consequences of Accidents Previously Evaluated

40. The Federal Register notice of this license amendment application claims that the probability of a spent fuel assembly drop or a misloaded fuel assembly is not significantly increased if the license amendment is approved and pools C and D are activated. This claim is false, because activation of pools C and D will roughly double the total number of fuel handling operations to be conducted at Harris. Assuming that the general nature of fuel handling operations continues as before, the probability of a fuel assembly drop or misloaded fuel assembly, integrated over the entire period of the Harris operating license, will increase significantly, by a factor of two. This point has been made by David Lochbaum of the Union of Concerned Scientists, in a 22 January 1999 letter to the NRC Commissioners. A copy of his letter is provided here as Attachment F. If probability is integrated over the remaining period of the Harris operating license, rather than over its total duration, then activation of pools C and D will more than double the probability of a fuel assembly drop or a misloaded fuel assembly.

41. A spent fuel assembly drop or a misloaded fuel assembly are members of a broader class of accidents that could arise during the movement of fuel from other CP&L stations to Harris, and during fuel movement within Harris. This class of accidents will include design-basis accidents and severe accidents. Assuming that the general nature of fuel movement continues as before, the probability of accidents in this class, integrated over the entire period of the Harris operating license, will double if pools C and D are activated. If integrated over the remaining period of the operating license, the probability will more than double.

42. The PWR racks in pools C and D will be safe against criticality for a comparatively narrow range of fuel enrichment and burnup. Thus, assuming that the general nature of fuel movement continues as before, the probability of a criticality accident will be significantly increased if pools C and D are activated. This probability will increase on a per-movement basis, so it will more than double when integrated over the entire period of the Harris operating license. The consequences of a criticality accident may also be significantly increased.

43. Activation of pools C and D will add to the electrical load and CCW heat load of existing Harris systems. It will also add to the burden of work on the Harris operators. These effects will increase the probability of two categories of design-basis or severe accidents. First, they will significantly increase the probability of accidents associated with the Harris reactor, because the reactor's CCW and electrical systems and its operators will be under greater stress. Second, they will significantly increase the probability of accidents at the Harris pools that are attributable to interruptions in cooling and electricity supply and to increased operator stress. Also, the inability of cooling piping at pools C and D to meet ASME code requirements could significantly increase the probability of design-basis or severe accidents at these pools.

44. As mentioned in paragraph 24 above, to my knowledge there has been no site-specific analysis of severe accidents affecting any of the Harris pools. To the extent that such accidents have been previously evaluated, their consequences will be significantly increased by the activation of pools C and D. The fuel storage capacity of these pools will roughly double the storage capacity at Harris, creating the potential for a doubled inventory of radioactivity. Severe accidents could affect some or all of the Harris pools. As I have discussed in paragraph 30 above, the potential doubling of radioactivity in the pools could significantly increase the consequences of severe accidents.

J. Possibility of New or Different Kinds of Accident from any Accident Previously Evaluated

45. To my knowledge, there has been no site-specific evaluation of the probability or consequences of severe accidents at pools A and B at Harris. A variety of severe accidents are possible and should be subjected to the kind of systematic analysis that is performed in an IPE and IPEEE. The NRC has performed evaluations of accidents involving loss of water from fuel pools, generically and for sites other than Harris.

However, these evaluations are seriously deficient because they failed to consider partial uncovering of fuel. To summarize, at pools A and B there exists the possibility of new or different kinds of accident from any accident previously evaluated. The same possibility will exist at pools C and D if these are activated.

46. Provision of electrical power, including power from emergency diesel generators, and CCW service from the existing Harris plant to pools C and D could introduce the potential for design-basis or severe accidents that are new or different from any accident previously considered. The IPE and IPEEE studies performed for Harris did not address the provision of electrical power and CCW service to pools C and D. As an example of the potential for new or different accidents, the need to provide cooling to pools C and D will place increased stress on the CCW system, the emergency diesel generators, and the plant operators during a design-basis LOCA.

47. Severe accidents at some or all of the Harris pools could lead to offsite radiation exposure an order of magnitude larger than the exposure from the Chernobyl accident. Activation of pools C and D could significantly increase both the probability and consequences of such accidents. Thus, CP&L's proposed license amendment poses a "significant hazard" by any reasonable definition of that term.

J. Significant Reductions in Margins of Safety.

48. Activation of pools C and D will create an additional heat load on the existing CCW system. CP&L proposes to meet this load in the short term by exploiting the margin in the CCW system. In my professional opinion, the reduction in the CCW safety margin caused by the increased heat load is significant. Both the NRC and CP&L have also recognized that increasing the heat load on the CCW system constitutes an unreviewed safety question. The safety margin will be especially reduced if, during a LOCA, the operators must divert water from the RHR to the spent fuel pools. This will increase stress on the operators and create opportunities for human error.

49. As pools C and D become filled and the reactor receives a power uprate, the load on the CCW system will increase further. CP&L offers no assurance that the present margin of safety will be restored by upgrading the CCW system to accommodate these burdens.

50. CP&L proposes to activate pools C and D using cooling systems that will not satisfy ASME code requirements. This action could potentially cause a significant reduction in margins of safety for pool cooling. CP&L's Alternative Plan has not been subjected to any public scrutiny or rigorous review. It deserves, at the least, thorough consideration at a licensing hearing before the license amendment is issued.

51. CP&L proposes to provide electrical service to pools C and D from the existing (Unit 1) electrical system at Harris, having rejected the option of dedicated emergency diesel generators to serve pools C and D. The existing diesel generators already serve the safety systems in Unit 1 and spent fuel storage pools A and B. By adding pools C and D to the load carried by the Unit 1 diesel generators, CP&L would add stress on the diesel generators and on the plant operators. In the event of a loss of offsite power, these effects could significantly reduce the margin of safety at the Harris reactor and the fuel pools.

L. Environmental Review

52. As discussed above, the original design of the Shearon Harris plant called for cooling of spent fuel pools C and D by the Unit 2 CCW system. The FEIS for the operating license presumably based its conclusions on this design. I have seen no analysis by the NRC Staff, either in the 1983 FEIS or in a subsequent Environmental Impact Statement or Environmental Assessment, of the environmental impacts of altering the Shearon Harris design to provide for cooling of pools C and D by the Unit 1 CCW system.

M. Conclusions

53. From the preliminary evidence presented by the NRC and CP&L, I conclude that operation of the Shearon Harris plant in accordance with the license amendment proposed by CP&L will violate all three of the NRC's conditions for a determination of "no significant hazards." Therefore, the NRC staff should reverse its position and should determine that CP&L's license amendment request does <u>not</u> involve no significant hazards consideration.

54. The proposed license amendment raises serious safety concerns which deserve prior consideration at a licensing hearing.

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I declare, under penalty of perjury, that the foregoing facts provided in my Declaration are true and correct to the best of my knowledge and belief, and that the opinions expressed herein are based on my best professional judgment.

Executed on 12 February 1999.

G. R. Thompson

Gordon Thompson