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February 28, 2001

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE COMMISSION

In the Matter of	)	
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NORTHEAST NUCLEAR ENERGY COMPANY	)	Docket No. 50-423-LA-2 3
(Millstone Nuclear Power Station, Unit No. 3)	)	ASLBP No. 00-771-01-LA

CAROLINA POWER & LIGHT COMPANY'S BRIEF AMICUS CURIAE SUPPORTING AFFIRMANCE OF THE LICENSING BOARD DECISION IN LBP-00-26

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Pursuant to Commission Order,[1] Carolina Power & Light Company ("CP&L") submits its Brief Amicus Curiae Supporting Affirmance of the Licensing Board Decision in LBP-00-26 ("CP&L Amicus Brief"). CP&L respectfully submits that the Commission should reject any interpretation of Criterion 62 of the General Design Criteria ("GDC 62") that would prohibit taking into account fuel enrichment, burnup, and decay time limits in spent fuel pool criticality calculations.[2] The tortured interpretation of GDC 62 advanced by the Intervenors in this matter: (1) displays a lack of understanding of the "physical systems or processes" and concomitant "administrative measures" involved in each method of criticality control; (2) is inconsistent with the criterion's plain language and regulatory history; (3) is inconsistent with the Commission's regulations at 10 C.F.R. § 50.68; (4) would establish a subjective and standardless measure of

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1 Memorandum and Order, CLI-01-03, 53 NRC ___ (Jan. 17, 2001).

2 "Criticality in the fuel storage and handling system shall be prevented by physical systems or processes, preferably by use of geometrically safe configurations." 10 C.F.R. Part 50, Appendix A, Criterion 62.

licensee compliance for criticality control; (5) would produce results contrary to express Congressional intent for at-reactor site spent fuel storage; and (6) would reverse over twenty years of consistent interpretation and implementation by the NRC Staff and nuclear industry. The Commission should instead affirm the Licensing Board's decisions below[3] and explicitly endorse licensee credit in criticality calculations for fuel enrichment, burn-up, and decay limits.

I. BACKGROUND

On December 23, 1998, CP&L submitted a license amendment application to place spent fuel pools C and D in service at CP&L's Harris Nuclear Plant ("Harris Plant," or "Harris").[4] The Harris fuel handling building was originally designed and constructed with four spent fuel pools to support four nuclear units. However, Harris Units 2, 3 and 4 were canceled in 1981 and 1983. Spent fuel pools A, B, C and D, and the spent fuel pool cooling and cleanup system for spent fuel pools A and B were completed and licensed as part of the Harris fuel handling building. Harris is also licensed to receive and store spent fuel from CP&L's H. B. Robinson, Unit 2 and Brunswick Units 1 and 2. Beginning in 1989, spent fuel assemblies from Robinson and Brunswick have been regularly shipped to and stored at Harris in spent fuel pools A and B.

The Harris License Amendment Application and the need to expand Harris spent fuel storage result from the failure of the U.S. Department of Energy ("DOE") to begin taking delivery of spent fuel in 1998, as required by the contract between DOE and CP&L and by the

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3 Carolina Power & Light Company (Shearon Harris Nuclear Power Plant), LBP-00-12, 51 NRC 247 (2000); Northeast Nuclear Energy Company (Millstone Nuclear Power Station, Unit 3), LBP-00-26, 52 NRC 181 (2000).

4 Shearon Harris Nuclear Power Plant Docket No. 50-400/License No. NPF-63 Request For License Amendment Spent Fuel Storage (Dec. 23, 1998) ("Harris License Amendment Application").

Nuclear Waste Policy Act of 1982, as amended ("NWPA").[5] As contemplated by the NWPA, CP&L has taken steps to expand on-site reactor storage through the use of high-density fuel storage racks, placing the previously unused spent fuel pools C and D in service, and transhipment of spent fuel from its older plants to Harris.[6]

CP&L invoked 10 C.F.R. Part 2, Subpart K, expedited adjudicatory procedures after the Harris Licensing Board admitted two technical contentions proffered by Board of Commissioners of Orange County, North Carolina ("BCOC").[7] One of these technical contentions alleged that CP&L's spent fuel pool expansion would violate GDC 62 "by employing administrative measures which limit the combination of burnup and enrichment for PWR fuel assemblies" to be placed in Harris spent fuel pools C and D.[8] The Licensing Board considering a spent fuel pool expansion license amendment request by Northeast Nuclear Energy Company ("NNECO") for Millstone 3 admitted a similar contention regarding GDC 62 submitted by the Connecticut Coalition Against Millstone ("CCAM") and the Long Island Coalition Against Millstone ("CAM") (collectively "CCAM/CAM")[9] on February 9, 2000.[10]

On January 21, 2000, the Harris Licensing Board heard oral argument on whether to designate either of the two admitted technical contentions for an evidentiary hearing. The Board

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5 42 U.S.C. § 10101 et seq.

6 NWPA § 134(a).

7 Carolina Power & Light Company (Shearon Harris Nuclear Power Plant), LBP-99-25, 50 NRC 25, 40 (1999). Subpart K was added to 10 C.F.R. Part 2 to implement a Congressional mandate in the NWPA to encourage utilities to expand spent fuel storage capacity at reactor sites. H. R. Rep. No. 97-785 (1982) at 39.

8 Harris, LBP-99-25, 50 NRC at 35.

9 BCOC and CCAM/CAM will herein be collectively referred to as "Intervenors."

10 Northeast Nuclear Energy Company (Millstone Nuclear Power Station, Unit 3), LBP-00-02, 51 NRC 25 (2000).

determined that BCOC had failed to show that there was a genuine and substantial dispute of fact or law that could only be resolved by an evidentiary hearing, and disposed of both contentions in CP&L's favor.[11] BCOC sought interlocutory review of this decision, but the Commission rebuffed the petition as "prematurely filed."[12] On October 26, 2000, the Millstone Licensing Board denied CCAM/CAM's request for an evidentiary hearing on its GDC 62 contention.[13]

The Harris Licensing Board heard oral argument concerning a late-filed, admitted environmental contention on December 7, 2000, but has not yet issued its decision. The NRC Staff issued a final No Significant Hazards Consideration determination and the Harris spent fuel pool expansion license amendment on December 21, 2000, just a week short of two years after CP&L filed the Harris License Amendment Application.[14]

II. ARGUMENT

Intervenors initially asked the Commission to create an artificial distinction between "physical" and "administrative" criticality controls that is simply not found in any relevant rule or statute and is untenable as a practical matter.[15] Intervenors have eventually been forced to admit that this distinction does not even theoretically exist, because "any physical measure has

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11 Harris, LBP-00-12, 51 NRC at 282-283.

12 Carolina Power & Light Company (Shearon Harris Nuclear Power Plant), CLI-00-11, 51 NRC 297, 299 (2000).

13 Millstone, LBP-00-26, 52 NRC at 214.

14 65 Fed. Reg. 82,405 (2000). BCOC subsequently filed "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" (Dec. 22, 2000), which the Commission rejected, Memorandum and Order, CLI-01-07 (Feb. 14, 2001), and a "Petition for Review," Case No. 01-1073 (Feb. 16, 2001) in federal court seeking review of the License Amendment and No Significant Hazards Consideration decisions.

15 BCOC had originally contended that "GDC 62 prohibits the use of administrative measures." Orange County's Supplemental Petition to Intervene (Apr. 5, 1999) at 12.

some administrative component, and any administrative measure has a physical component."[16] While Intervenors position continues to evolve even during this appeal, they still assert that the NRC Staff and industry experts have wrongly interpreted GDC 62 for over twenty years. Intervenors contend that their purported expert, Dr. Gordon Thompson, has uncovered the true meaning of GDC 62.[17] Intervenors now argue that GDC62 requires an ad hoc evaluation of the nature of any "administrative" controls required by a proposed method of criticality control, despite the lack of any available standards or objective measure of compliance.[18] Two Licensing Boards have, not surprisingly, found this interpretation and approach to regulation not supported by any reasonable regulatory or statutory interpretation.

CP&L joins with NNECO in opposing Intervenors' reading of GDC 62 and Intervenors' conclusion that the phrase "physical systems or processes" prohibits "administrative systems and

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16 Connecticut Coalition Against Millstone and Long Island Coalition Against Millstone Brief on Review of LBP-00-26 (hereinafter "CCAM/CAM Brief") at 23; see also Orange County's Amicus Brief On Review of LBP-00-26 (hereinafter "BCOC Brief") at 5; Transcript of January 21, 2000, Hearing Before the Licensing Board (hereinafter "Harris Hearing Transcript") (excerpts attached as Exhibit 1) at 218-19.

17 It is no coincidence that the BCOC and CCAM/CAM contentions are essentially one and the same, as both groups rely on Dr. Gordon Thompson as their sole expert. The basis of Dr. Thompson's "expertise" is, however, open to question. The Harris Licensing Board politely found that Dr. Thompson's " expertise relative to reactor technical issues seems largely policy-oriented rather than operational." Harris, LBP-00-12, 51 NRC at 267 n.9. See also NRC Staff Brief and Summary of Relevant Facts, Data and Arguments Upon Which the Staff Proposes to Rely at Oral Argument on Technical Contentions 2 and 3 (Jan. 4, 2000) at 14-19; CP&L's "Summary of Facts, Data, and Arguments on Which Applicant Proposes to Rely at the Subpart K Oral Argument," Docket No. 50-400-LA (Jan. 4, 2000) (hereinafter "CP&L's Summary") (attached as Exhibit 2) at 55 n.122, 72-73. Undaunted by his lack of technical expertise, Dr. Thompson charged negligence by the NRC Staff in regulating implementation of GDC 62. Deposition of Gordon Thompson, Ph.D. (Oct. 21, 1999) (hereinafter "Thompson Dep.") (excerpts attached as Exhibit 3) at 169.

18 CCAM/CAM Br. at 22-25; BCOC Br. at 5-6.

processes" – at least sometimes. Intervenors' position has no support in nuclear physics or nuclear law.

A. GDC 62 Does Not Prohibit "Administrative Controls" In Criticality Control As Asserted By Intervenors; Rather It Requires The Use of "Physical Systems or Processes"

CP&L submits that a proper reading of GDC 62 distinguishes between "physical" and "non-physical" systems or processes of criticality control. Existing methods of criticality control in use in the nuclear industry do rely on "physical systems or processes." The criterion favoring "physical systems or processes" does not, however, prohibit concomitant "administrative controls." All "physical systems or processes" for criticality control are implemented using some "administrative controls."

1. The methods of criticality control in use in spent fuel pools today are physical systems or processes that have a physical effect on the neutron multiplication factor, or "k effective," in the spent fuel pool.

Every effective criticality method in use today involves, by necessity, a physical system or process.[19] This is because "[n]eutrons will not recognize, much less obey, procedures and other administrative measures alone."[20] As criticality is a measure of neutron multiplication, criticality control requires physical control of the neutrons in the fuel storage area. Thus, criticality control can only be achieved through physical measures that affect neutron multiplication. In practice, four methods of criticality control are available for implementation in commercial reactor spent fuel pools: (1) geometric separation of fuel; (2) solid neutron

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19 Affidavit of Stanley E. Turner, Ph.D., PE (Jan. 3, 2000) (hereinafter "Turner Affidavit") (attached as Exhibit 4) ¶ 9. CP&L relies on the insightful discussion of Dr. Stanley E. Turner for this section of the CP&L Amicus Brief. Dr. Turner has been performing criticality analyses since 1957. His credentials and expertise in this field are unmatched. See Id. ¶¶ 4-7, Att. A.

20 Id. ¶ 9.

absorbers; (3) soluble neutron absorbers; and (4) fuel reactivity.[21] Fuel reactivity, in turn, includes fuel enrichment and fuel burnup.[22] Each of these methods is briefly described below.

(a) Geometric separation

Geometric separation is a physical system or process that physically affects neutron coupling between assemblies in storage. Varying the physical spacing between individual fuel assemblies changes the neutronic coupling between fuel assemblies and, thus, the reactivity of the system. Geometric separation takes the physical form of steel racks with fixed locations establishing fixed, physical separation between fuel assemblies in storage.[23]

(b) Solid neutron absorbers

Solid neutron absorbers are a physical system or process that physically affects neutron absorption. Absorption of neutrons in solid neutron absorbers, also referred to as neutron "poisons," physically removes neutrons that could cause fission from the system, thereby decreasing system reactivity. Solid neutron absorbers take the form of fixed panels containing a solid isotope of Boron installed in the spent fuel storage racks during manufacture.[24]

(c) Soluble neutron absorbers

Soluble neutron absorbers are a physical system or process that physically affects neutron absorption. Similar to solid neutron absorbers, soluble neutron absorbers physically remove

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21 Id. ¶ 10.

22 Id. ¶¶ 14, 16, 17. Note that decay time was not an issue at Harris.

23 Id. ¶ 11. Intervenors admit that geometric separation is a "physical provision." Thompson Dep. at 51.

24 Turner Aff. ¶ 12. Intervenors admit that solid neutron absorbers are a "physical provision." Thompson Dep. at 51

neutrons that could cause fission, thereby decreasing system reactivity. Soluble neutron absorbers use a Boron isotope, in boric acid, which is dissolved in the spent fuel pool water.[25]

(d) Fuel enrichment

Fuel enrichment is a physical system or process that physically affects neutron production. Higher fuel enrichment results in a greater production of neutrons, increasing the reactivity of the system.[26]

(e) Fuel burnup

Fuel burnup is a physical system or process that physically affects neutron production. In the burnup process, uranium initially loaded in the fresh fuel process is converted, through nuclear fission and absorption processes, into fission products and transuranic nuclides. Fuel burnup, in a well-understood physical process, depletes the amount of uranium in the fuel, while at the same time replacing the uranium with many strong neutron absorbing elements. Thus, fuel burnup recognizes the actual physical contents of the nuclear fuel elements.[27]

2. Every physical system or process for criticality control is implemented using some administrative controls.

There is "no criticality control measure for fuel storage pools that can be implemented without some degree of administrative control."[28] Geometric separation requires administrative controls in the design, construction and installation of the spent fuel storage racks.[29] Solid

25 Turner Aff. ¶ 13. Intervenors admit that soluble neutron absorbers "invoke a physical principle." Thompson Dep. at 52.

26 Turner Aff. ¶ 16. Intervenors admit that fuel enrichment is a "physical characteristic." Thompson Dep. at 53.

27 Turner Aff. ¶ 17. Intervenors admit that fuel burnup is a "physical characteristic." Thompson Dep. at 53.

28 Turner Aff. ¶ 18.

29 Id. ¶ 19.

neutron absorber panels are likewise designed, constructed, and inspected pursuant to administrative controls.[30] Soluble boron in spent fuel pool water is manufactured, added, and inspected according to administrative controls.[31] Fresh fuel enrichment is designed, produced, inspected, and tracked according to administrative controls.[32] Fuel burnup is designed, produced, monitored, and tracked according to administrative controls.[33] Dr. Turner notes "[a]n interpretation that GDC 62 prohibits administrative measures to implement the physical systems or processes would render GDC 62 a nullity, because none of the available criticality control methods could comply with such an interpretation."[34]

Intervenors now admit that it is "true that any physical measure has some administrative component, and any administrative measure has a physical component."[35] Intervenors nevertheless claim that GDC 62 prohibits certain "administrative controls," but not others. The purported inability of the other parties or the Licensing Boards "to identify any non-physical criticality prevention measures that would be excluded by GDC 62" is cited as a basis for Intervenors' position.[36] In response, CP&L provides several examples of such prohibited "non-physical" criticality control methods below.

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30 Id. ¶ 20.

31 Id. ¶ 21.

32 Id. ¶ 23.

33 Id. ¶ 24.

34 Id. ¶ 29.

35 CCAM/CAM Br. at 23; See also BCOC Br. at 5 (discussing "Orange County's concession that there is some overlap between physical measures and ongoing administrative measures.")

36 CCAM/CAM Br. at 20; BCOC Br. at 6, 12.

Intervenors themselves identified that GDC 62 prohibits a purely procedural requirement that "criticality must be prevented."[37] This prohibition excludes, for example, sole reliance on license conditions or Technical Specifications prohibiting criticality. Therefore, GDC 62 would not allow the equivalent of a maximum core thermal power Technical Specification for spent fuel pool criticality without more. By way of contrast, there is a prohibition against exceeding the maximum thermal power limit, but there is no "physical system or process" to prevent increasing core thermal power above the Technical Specification limit (i.e., an operator can physically position control rods to achieve a core thermal power in excess of the limit). Thus there is no equivalent to the physical systems or processes of fuel rack spacing, burnup, or Boron concentration in the core thermal power case: it is strictly a "non-physical" control.

Licensees also cannot, pursuant to GDC 62, solely rely on operator observations to position fuel assemblies. Fuel racks cannot consist only of rails that require operators not to place fuel assemblies closer than the minimum spacing to prevent criticality (i.e., sole reliance on procedural direction to place assemblies "no closer than" some specified distance would be prohibited). Likewise, GDC 62 prohibits sole reliance on a procedural limitation on the total number of fuel assemblies to be placed in a spent fuel pool or sole reliance on observation of the nuclear response to placement of fuel assemblies. These non-physical methods of criticality control alone would be prohibited by GDC 62. In contrast, CP&L's criticality controls rely upon physical systems or processes with concomitant administrative controls pursuant to GDC 62, as discussed above.[38]

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37 CCAM/CAM Br. at 21.

38 See supra section A.1.

B. The Harris and Millstone Licensing Boards Correctly Found That Intervenors' Interpretation of GDC 62 Was Inconsistent With Its Plain Language, Its Regulatory History, Subsequent Commission Regulations On Criticality Control, and Over Twenty Years of NRC Staff Guidance and Safe Industry Practice

1. The Plain Language of GDC 62 supports the Licensing Boards' Decisions below.

The plain language of GDC 62 only distinguishes between "physical" and "non-physical" methods of criticality control and does not prohibit use of "administrative" controls. A plain reading of GDC 62 pursuant to the well-established principle of inclusio unis exclusio alterius[39] simply establishes that including "physical systems or processes" excludes only "non-physical systems or processes." CCAM/CAM incorrectly reads the inclusion of "physical" to require the exclusion of "administrative controls," rather than simply the exclusion of "non-physical" systems and processes.[40] BCOC also appears to join CCAM/CAM in claiming that GDC 62 excludes "administrative" controls.[41]

The Licensing Boards determined that Intervenors' reading of GDC 62 is based on words that are not found in the text of GDC 62. As with statutory construction, "interpretation of any regulation must begin with the language and structure of the provision itself."[42] While it is true

39 The inclusion of one is the exclusion of another.

40 CCAM/CAM Br. at 20, 22.

41 Compare the title of BCOC Br. § III.A., "LBP-00-12 Erroneously Concluded That There Is No Valid Basis for Distinguishing Between Physical and Non-Physical Systems and Processes for Criticality," with that of § III.B., "The Regulatory History of GDC 62 Shows That the Commission Intended to Preclude Reliance on Administrative and Procedural Measures for Criticality Protection." BCOC Br. at 5, 6 (emphasis added). These are substantively different concepts, as discussed and illustrated below.

42 Long Island Lighting Company (Shoreham Nuclear Power Station, Unit 1), ALAB-900, 28 NRC 275, 288 (1988) (citing 1A Sutherland, Statutory Construction § 31.06 (4th ed. 1984); Lewis v. United States, 445 U.S. 55, 60 (1980)), review declined, CLI-88-11, 28 NRC 603 (1988).

that the "plain meaning" of a statute or regulation can be discounted "to accommodate some Congressional purpose," at "the minimum, one advocating a departure from common usage bears the burden of demonstrating what the legislature sought to achieve thereby."[43] However, "it takes much more than bare assertion and imaginative statutory construction" to prevail over a plain reading of the text.[44] Intervenors have clearly ignored the long-standing admonition that a regulation's "interpretation may not conflict with the plain meaning of the wording used in that regulation."[45]

Indeed, Intervenors have gone far beyond mere interpretation and have created a detailed structure of "administrative controls" from whole cloth.[46] Intervenors base this extraordinary action on an "obvious distinction between measures that are fundamentally 'physical' and those that are fundamentally procedural or administrative."[47] They attempt to illustrate this "obvious distinction" by creating several categories of administrative controls (e.g., "one-time," "periodic," "ongoing"), none of which have any basis in regulation.[48] Intervenors' examples, however, do not identify any basis in the text for the elaborate scheme they read into GDC 62.

Intervenors claim that some "periodic" administrative controls are "comparatively straightforward" and, therefore, acceptable, but that "on-going" administrative controls are

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43 Public Service Company of Indiana (Marble Hill Nuclear Generating Station, Units 1 and 2), ALAB-459, 7 NRC 179, 199-200 (1978).

44 Id. at 200.

45 Shoreham, ALAB-900, 28 NRC at 288 (citations omitted); See also Turner Aff. ¶¶ 26-31.

46 Q. Does [GDC 62] say anything about administrative measures?
A. It – it does not.

Thompson Dep. at 144.

47 CCAM/CAM Br. at 20 (emphasis added); see also BCOC Br. at 5 ("there are fundamental differences between physical and administrative measures").

"inherently less reliable" and, thus, are unacceptable.[49] As to fuel racks, Intervenors state that "administrative controls may be stringent, but they will be applied on a one-time basis" and "on-going administrative controls will not be required."[50] Boral panels are acceptable to Intervenors, although "[p]eriodic inspections may be needed," because "these inspections will be comparatively straightforward."[51] However, measures, "such as inputting information into a computer system, and operating and maintaining equipment," would not be allowed because they "must be carried out throughout the period when criticality is possible."[52] Intervenors do not explain what the "distinction" is between "periodic" activities and activities "carried out throughout the period." Intervenors also fail to distinguish between (acceptable) "stringent" administrative controls,[53] and (unacceptable) administrative controls that must be implemented "with complete reliability" or "must be effective on each occasion." Finally, Intervenors' argue that in situ testing of the nuclear properties of Boral panels in an operational spent fuel pool is more "straightforward" than computer data entry. Intervenors fail to identify any basis for these arbitrary categorizations either in the text of the GDC 62 or any Commission regulation.

2. The Regulatory History of GDC 62 Supports the Licensing Boards Decisions Below.

Regulatory history reveals that administrative measures were included within the scope of GDC 62. CP&L's detailed discussion of the regulatory history of GDC 62 provided to the

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Footnote continued from previous page

48 CCAM/CAM Br. at 23-24.

49 Id. at 24-25.

50 Id. at 23.

51 Id.

52 Id. at 24.

53 Id. at 23-24.

Harris Licensing Board and the Licensing Board's analysis in agreement need not be repeated here.[54] However, it is important to recognize that the text of GDC 62 in the Commission's proposed rulemaking read as follows:

> Criticality in new and spent fuel storage shall be prevented by physical systems or processes. Such means as geometrically safe configurations shall be emphasized over procedural controls.[55]

The first sentence is absolute: all acceptable means of criticality control must be "physical systems or processes." The inclusion of "procedural controls" in the second sentence establishes that "procedural controls" are understood to be within the scope of "physical systems or processes" (i.e., it would be meaningless to emphasize that geometrically safe configurations were preferred over a prohibited function). It is not clear from this language alone whether "geometrically safe configurations" were preferred over all other methods or only over "procedural controls."

The Commission resolved this ambiguity in response to a comment on the draft rule.[56] A commenter requested the Commission to revise the second sentence to read, "Inherent means should be used where practicable."[57] The Commission did not adopt the commenter's specific language. However, the final rule incorporated revised text in a single sentence that required physical criticality controls "preferably by use of geometrically safe configurations."[58] By including only one method in the prioritization phrase, the Commission unambiguously indicated

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54 See Harris, LBP-00-12, 51 NRC at 256-60; CP&L's Summary at 35-43.

55 Proposed Rule, 32 Fed. Reg. 10,213, 10,217 (1967).

56 Letter from J. Flaherty (Atomics International) to Secretary, AEC, Sept. 25, 1967.

57 Id. at 4.

58 Commission's Final Rule with Statements of Consideration, 36 Fed. Reg. 3,255, 3260 (1971).

that "geometrically safe configurations" were preferred over all other methods, not just procedural controls. Significant to the instant issue, the Commission did not alter in any way the language that included procedural controls within the scope of "physical systems or processes."

3. Regulations at 10 C.F.R. § 50.68 establish the Commission's understanding that "administrative controls" are part of criticality control.

The promulgation and rulemaking history of 10 C.F.R. 50.68 clearly demonstrate that the Commission is aware of, and endorses, the use of administrative measures to implement criticality control.[59] For example, the final text of the rule refers to use of "plant procedures" and "administrative controls" for criticality control.[60] 10 C.F.R. § 50.68(b)(4) permits partial credit for soluble Boron and the use of limits on spent fuel reactivity as means of criticality control methods.[61] In the Statements of Consideration for the Direct Final Rule, the Commission noted that "[n]uclear power plant licensees have procedures and the plants have design features to prevent inadvertent criticality."[62] It is clear that 10 C.F.R. § 50.68, as adopted, acknowledges and permits the use of administrative controls to implement criticality controls in fuel storage pools.[63] Intervenors' interpretation of GDC 62 is in direct conflict with the Commission's recognition of procedural or administrative measures used in criticality control.

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59 See Harris, LBP-00-12, 51 NRC at 257, 260 and CP&L's Summary at 44-49 for the complete analysis of the regulatory history of this rule.

60 10 C.F.R. §§ 50.68(b)(1), (2), (3).

61 Turner Aff. ¶¶ 32-37.

62 62 Fed. Reg. 63,825 (1997).

63 Turner Aff. ¶ 37. It is a long-settled tenet of statutory construction that "[s]pecific terms prevail over the general in the same or another statute which otherwise might be controlling." Fourco Glass Co. v. Transmirra Products Corp., 353 U.S. 222, 228-29 (1957); see also Lawrence v. Staats, 640 F.2d 427, 432 (D.C. Cir. 1981) (citing cases).

4. NRC Staff guidance and methodology familiar to licensees support the interpretation of GDC 62 in the Licensing Board decisions below.

Intervenors' submittals make clear that they believe that GDC 62 imposes safety requirements that, in requiring "physical systems or processes," are unique and, therefore, GDC 62 has been misunderstood and misapplied for over twenty years.[64] This is simply not the case. Many nuclear industry regulations and guidance documents require or recommend "physical" systems or processes, with concomitant administrative measures, to control certain activities.

Examples of physical systems or processes commonly found in commercial nuclear power facilities include: security barriers, locked valves, high radiation area access controls, and certain design features. The physical protection of nuclear plants and materials is required by Commission regulations.[65] In particular, licensees must ensure that "access to vital equipment requires passage through at least two physical barriers."[66] Spent nuclear fuel must be stored "so that access to this material requires passage through or penetration of two physical barriers."[67] Entry into a vital area requires administrative compliance (e.g., proper access authorization) and removal of a physical barrier (e.g., operation of the lock via key or keycard). As a result, a person cannot simply walk through a security door into a vital area. However, egress from a vital area, although administratively controlled in the same manner as entry (i.e., keycard operation of the lock is procedurally required), is not typically prevented by a locking

64 See, e.g., CCAM/CAM Br. at 11-12; BCOC Br. at 20; Thompson Dep. at 168-70.

65 See generally, 10 C.F.R. Part 73, "Physical Protection of Plants and Materials."

66 10 C.F.R. § 73.50(b)(1) (emphasis added).

67 Id. § 73.51(d)(1) (emphasis added).

mechanism (i.e., a person can physically push open the door).[68] In other words, egress is controlled solely by an administrative control and not a physical system or process.

High and very high radiation area access is also controlled pursuant to Commission regulations. Licensees are required to install "control devices" that either reduce the level of radiation or energize conspicuous alarms, or to ensure high radiation areas have entryways "that are locked."[69] Harris implements this physical requirement through a procedure entitled, "Administrative Controls for Locked and Very High Radiation Areas."[70] Similarly, Harris has also designated certain plant valves as "locked" valves, which are controlled by specific operating procedures and are maintained in position by physical locking devices (e.g., padlocks, chains, blocking devices).[71] Once again, although administratively controlled by procedure, a person could not physically change the position of these valves, even if the applicable procedure was violated. Similarly, a single grapple refuel crane (physically impossible to lift more than one fuel bundle at a time) and mechanical "reach rods" used in the containment air locks (physically can open only one door at a time) prevent administrative mistakes from causing physical actions. These and other similar physical systems and process are found throughout nuclear facilities. Intervenors' unfounded assertions demonstrate a lack of basic knowledge of power plant operation.

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68 This door design allows quick egress of personnel in emergencies. Such an action would, however, set off a security alarm.

69 10 C.F.R. § 20.1601 (emphasis added).

70 Harris Administrative Procedure, AP-504, Revision 17.

71 Harris Plant Programs Procedure, PLP-702, "Generic Component Operational Guidance" §§ 4.1.2, 3.

NRC Staff Guidance and consistent safe implementation of CP&L's, the NRC Staff's and the nuclear industry's interpretation of GDC 62 is described in greater detail in Dr. Turner's affidavit.[72]

C. The Licensing Board's Interpretation of GDC 62 is Also Consistent With the Congressional Mandate in the Nuclear Waste Policy Act to Encouraged High Density Fuel Storage

At bottom, Dr. Thompson and Intervenors object to high density spent fuel storage.[73] High density fuel storage racks were explicitly contemplated in Congress' plan for spent fuel storage at reactor sites. In the NWPA, Congress recognized that there was a "national problem" with spent fuel storage and that "Federal efforts during the past 30 years to devise a permanent solution to the problems of civilian radioactive waste disposal have not been adequate."[74] To facilitate timely relief, Congress mandated action "to encourage utilities to expand storage capacity at reactor sites."[75] Congress went so far as to set up an expedited hearing process "to expand the spent nuclear fuel storage capacity at the site of a civilian nuclear power reactor, through the use of high-density fuel storage racks."[76]

The Harris and Millstone Licensing Boards reached correct results, fully consistent with the Congressional mandate in the NWPA. The Harris Licensing Board concluded that the

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72 Turner Aff. at ¶¶ 38-55.

73 See, e.g., CCAM/CAM Br. at 26 ("without addressing the legality of its conduct," the NRC Staff has "approved applications to increase spent fuel density"); BCOC Br. at 20 (under the Harris Board's ruling, "GDC 62 can provide no brake on the increasing industry trend" to high-density storage); Thompson Dep. at 148 ("nuclear power facilities do not wish to incur the additional expenditure incurred in creating dry storage").

74 NWPA §§ 111(a)(2), (3); 42 U.S.C. § 10131(a)(2).

75 H.R. Rep. No. 97-785 at 39.

76 NWPA § 134(a); 42 U.S.C. § 10154(a) (emphasis added).

Commission intended to permit processes in addition to geometric configuration and the associated administrative measures.[77]

Intervenors' interpretation of GDC 62 would not allow high density storage of spent fuel in reactor spent fuel pools. According to Intervenors, only two methods of criticality control are permissible pursuant to GDC 62: "One is physical separation, the other is physical inclusion of boron in the structure of the rack."[78] Limited to just these two methods of criticality control, high density storage of spent nuclear fuel would not be possible.[79] GDC 62 as interpreted by the Intervenors, would, therefore, prohibit a spent fuel storage expansion method explicitly contemplated by Congress in the NWPA. Congress and the Commission clearly intended to solve spent fuel storage problems, not create additional ones.

77 Under questioning by the Licensing Board at Oral Argument, BCOC conceded that "the Commission left the language [of GDC 62] general so that as technology developed – I would assume the Commission anticipated that technologies would be developed to address this problem. And they might include other things besides spacing or putting boron panels in the rack." Harris Hr'g Tr. at 244-45 (emphasis added).

78 Id. at 226.

79 As of January 2000, Dr. Turner was personally aware of 20 plants that rely on burnup credit to enable the expanded spent fuel storage contemplated by Congress. Turner Aff. ¶ 51; see also Harris Hr'g Tr. at 261-62.

III. CONCLUSION

For the foregoing reasons the Commission should affirm the Licensing Board decisions below and explicitly approve licensee credit in criticality calculations for fuel enrichment, burn-up, and decay limits.

Respectfully submitted,

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Dated: February 28, 2001

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE COMMISSION

In the Matter of	)	
	)	
NORTHEAST NUCLEAR ENERGY COMPANY	)	Docket No. 50-423-LA-~~2~~ 3
	)	ASLBP No. 00-771-01-LA
(Millstone Nuclear Power Station,	)	
Unit No. 3)	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of the foregoing "Carolina Power & Light Company's Brief Amicus Curiae Supporting Affirmance of the Licensing Board Decision in LBP-00-26," dated February 28, 2001, were served by electronic mail transmission, and that the document, with supporting Exhibits, was served by deposit in the United States mail, first class postage affixed, this 28th day of February, 2001, on the persons identified below.

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February 28, 2001

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE COMMISSION

In the Matter of	)	
	)	
NORTHEAST NUCLEAR ENERGY COMPANY	)	Docket No. 50-423-LA-~~2~~ 3
	)	ASLBP No. 00-771-01-LA
(Millstone Nuclear Power Station, Unit No. 3)	)	
	)	

EXHIBITS SUPPORTING CAROLINA POWER & LIGHT COMPANY'S BRIEF AMICUS CURIAE SUPPORTING AFFIRMANCE OF THE LICENSING BOARD DECISION IN LBP-00-26

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TABLE OF EXHIBITS

Exhibit Number	Description
1	Excerpts of the Transcript of the January 21, 2000, Hearing Before the Harris Licensing Board
2	CP&L's "Summary of Facts, Data, and Arguments on Which Applicant Proposes to Rely at Oral Argument on Technical Contentions 2 and 3 (Jan. 4, 2000)
3	Excerpts of the Transcript of the Deposition of Gordon Thompson, Ph.D. (Oct. 21, 1999)
4	Affidavit of Stanley E. Turner, Ph.D., PE (Jan. 3, 2000).

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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In the Matter of: :

CAROLINA POWER & LIGHT COMPANY : Docket No. 50-400-LA

(Shearon Harris Nuclear : ASLBP No. 98-762-02-LA

Power Plant) :

- - - - - - - - - - - - - - - - - -X

Third Floor Hearing Room, Room 3B-45
White Flint Building 2
U.S. Nuclear Regulatory Commission
11545 Rockville Pike
Rockville, Maryland
Friday, January 21, 2000

The above-entitled matter came on for hearing, pursuant to notice, at 9:30 a.m.

BEFORE:

THE HONORABLE G. PAUL BOLLWERK, Administrative Judge

THE HONORABLE DR. PETER S. LAM, Administrative Judge

THE HONORABLE FREDERICK J. SHON, Administrative Judge

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JUDGE BOLLWERK: All right.

MS. CURRAN: Okay.

JUDGE BOLLWERK: Any other questions from the Board?

[No response.]

JUDGE BOLLWERK: All right.

MS. CURRAN: Okay. I would like to start by addressing CP&L's argument which was made in its January 12th letter that Orange County has attempted to reformulate its contention by arguing that rather than constituting physical systems and processes, the measures the county is advocating are some form of alternative administrative procedures. CP&L appears to base this argument on a portion of Orange County's summary in which the county explained what the distinction is between -- the basic distinction between physical systems and processes in administrative measures.

In that discussion, which appears at pages 21 to 24 of Orange County's summary, Orange County, in part, responds to what I think was a question from the Board during the oral argument, which was -- Doesn't every physical system or process have some administrative component? And the answer is, yes, that there is, of course, if you are going to -- if you are going to build a rack that has a certain degree of spacing, it is administrative in nature for someone to design the rack and build it. But there is really distinctive difference between the kind and degree of administrative activity that is required to do that and the kind of administrative activity that is required to implement the kind of measures that are proposed by CP&L in this case.

So we have not changed the contention. We have merely clarified that there is a qualitative distinction between physical systems and processes and administrative measures, even though each of the involves to some degree a little bit of the other, but they are still quite distinct. So we have not amended or attempted to amend our contention without leave of the Board.

The first basis of Contention TC 2 boils down to a legal dispute about what is a physical system or process as the term is used in GDC 62. And I would like to address some of the arguments that are made by the other parties and just kind of go through them. I realize that the Board does not want me to repeat all our arguments, but to try to join the arguments of the other parties and illuminate as best I can what I think is the dispute and what is the answer.

I would like to point out first that there is some inconsistency in the staff's position. At first the staff says that fuel burnup, which is the chief measure relied on by CP&L for criticality prevention, is a physical process.

But then apparently realizing that the real question is how do you characterize the control of fuel burnup, the staff then admits that CP&L proposes to use administrative measures to verify that a fuel assembly has achieved the requisite degree of burnup, and this is also reflected in the affidavit of Dr. Kopp.

CP&L also concedes that what it is proposing to do involves administrative measures, but argues that, as a practical matter, every method available for spent fuel pool criticality prevention is a physical system or process that is implemented by some administrative measures.

CP&L then goes on to list five measures for criticality prevention and lists all as physical systems or processes that are implemented by some administrative measures. That is true but only up to a very limited point, and I think that if you go to the Orange County summary at pages 21 to 24, we set forth there the fundamental qualitative difference between what is a physical system or process and what is an administrative process.

Administrative measures require repeated human actions over a long period of time and, thus, are far more prey to human error. There is a significant distinction between the type of administrative action required for geometric separation and solid neutron absorbers than for soluble neutron absorbers or control of burnup.

In building a rack, after the rack is built to a certain specification, there is little or no administrative action that is needed after that to make sure that that rack functions as it is supposed to function to prevent criticality.

In contrast, where a licensee relies on control of burnup, every time fuel is moved in or out of the fuel pool, that requires some human action, some intervention by a human being to make sure that that action is being taken care properly. So that the fundamental nature of that action doesn't have to do so much with the characteristic of the fuel, but whether the human beings who are responsible for putting the fuel in the right places do their job properly. That is an administrative measure and that is the kind of measure that is not allowed by GDC 62.

JUDGE LAM: If I may interrupt, Ms. Curran.

MS. CURRAN: Yes.

JUDGE LAM: I think this is a key point in this contention. Now, the whole industry, according to the staff, has been using these type of administrative measures for the past 20 years. If your interpretation of GDC 62 is correct, and if the staff's statement is correct, are you saying the whole industry for the past 20 years was allowed to operate in violation of GDC 62?

MS. CURRAN: Yes, and I am not sure that it has been -- you could say that this has been going on uniformly for the last 20 years. What we have set forth in our summary is an evolutionary process that relates to the buildup in the inventory of spent fuel at nuclear power plants and the pressure on licensees to pack nuclear fuel into denser and denser configurations.

The original wording of GD 62 did not contemplate that particular contingency -- was not planning on that. The original guidance that was issued in 1978, several years after GD 62 -- GDC 62 came out, which was 1971, did not contemplate the kind of reliance on administrative measures that CP&L is proposing here and that the NRC staff has been approving in recent years.

So, in our view, and we have tried to set this out in our summary, there has been a movement, a slow and steady movement of the NRC staff away from the original guidance of GDC 62, the requirement of GDC 62, and the guidance of the 1978 Grimes letter.

JUDGE LAM: Thank you.

MS. CURRAN: I would also like to address a little further this issue of the history of the staff having approved, I believe the staff said that they have approved at least 50 of these applications that would rely on burnup credit.

Dr. Kopp, in his affidavit, says that the licensees have established ways to predict the burnup level in fuel, and that that has gotten more sophisticated over time. But what he doesn't address, which is very important, is whether there has been a systematic way of keeping track of licensee experience with administrative measures. And to our knowledge, the staff has not done this.

The staff has basically anecdotal information, some of which it provided to us and we cited in our Appendix B to our summary. But the staff has not made a systematic analysis of what is licensee experience in relying on administrative procedures for criticality control. And as our Appendix B shows, there have been instances of misplacement of fuel assemblies and, on occasion, there have been instances where a single error resulted in multiple misplacements of fuel assemblies. There has also been at least once instance of a problem with maintenance of soluble boron levels.

But these, again, are in anecdotal reports. We were not able to get any kind of systematic analysis of the staff of what is the history of licensee experience relying on these administrative measures.

I would like to talk about the history of GDC 62, which is very important, and each party has addressed it in their summaries. The staff and CP&L claim that the rulemaking history supports their view that GDC 62 allows the reliance on administrative measures. They put a lot of stock in a 1967 draft version of GDC 62, which I believe was then denominated 66.

That draft version proposed to required criticality prevention methods as follows: Criticality in new and spent fuel storage shall be prevented by physical systems or processes. Such means as geometrically safe configurations shall be emphasized over procedural controls.

In their view, the fact that procedural controls were mentioned in the same context as physical systems and processes indicates the Commission's intent to include procedures as part of physical systems and processes. But the really important thing to bear in mind with respect to this is that reference to procedures in connection with physical systems and processes has now disappeared, and that appears to have been taken out by the Commission in response to a particular comment by Oak Ridge National Laboratories on the proposed rule.

Oak Ridge said, "We do not understand the implication of," quote, "or processes," close quote, "at the end of the first sentence. Nor do we believe that it is practical to depend on procedural controls to prevent accidental criticality in storage facilities of power reactors." Hence, the last sentence of this criterion should be changed to read as follows: "Such means as geometrically safe configuration shall be used to ensure that criticality cannot occur." This letter is attached as Exhibit 13 to Orange County's summary.

CP&L is incorrect when it argues that ORNL requested the removal of the term "processes." ORNL merely asked the Commission for clarification, implicitly asked the Commission for clarification of what the term meant. This request was not granted by the Commission, but it is not the case that the Commission refused to delete the language.

CP&L also both claim that the Commission rejected ORNL's comment, but the Commission did respond to ORNL's implicit request -- the Commission did respond to ORNL's request to completely remove any reference to procedural measures as an acceptable means of criticality prevention. That is extremely important.

Now, whether, in the proposed rule, the Commission intended that procedures would be part of physical systems and processes, or whether the Commission didn't realize that the two terms were internally inconsistent, the important thing is that the Commission took the language out. It took out the reference to procedures when it promulgated the final rule.

It is also important to note that it is clear that GDC 62 intended by the use of the phrase "physical systems and processes" to restrict the scope of measures that would be allowed under GDC 62, that the term "physical systems and processes" has to mean something, some limited category of measures that doesn't include the whole universe of things one could do to prevent criticality. Otherwise, the Commission would have just said in GDC 62, criticality shall be prevented, period.

Neither CP&L, nor the NRC staff has explained what is excluded by this rule. As far as they are concerned, any measure for criticality prevention is permitted by GDC 62. They don't provide a single example of something that wouldn't be allowed. So, under their interpretation, the restriction of GD 62 -- GDC 62 to physical systems and process doesn't have any meaning.

JUDGE BOLLWERK: Let me ask, I guess, a variation on the point that you brought up. In terms of physical systems and processes, you said they haven't told you what is excluded. Maybe I can ask you what is included other than physical separation, at least the way you are reading it?

MS. CURRAN: There is two things that are permissible. One is physical separation, the other is the physical inclusion of boron in the structure of the rack.

JUDGE SHON: Ms. Curran, may I ask whether you make a distinction between, for example, boral and boroflex? There was a considerable amount of experience with boroflex a while ago in which it deteriorated and came out, and it would require someone to look every now and then, one way or another, to see whether it was still there. Boroflex is an inclusion of boron in the racks, but it certainly requires checking from time to time to make sure it is still there. Do you see what I mean?

MS. CURRAN: Yes. Yes.

JUDGE SHON: Do you consider that these two methods of introducing boron into the racks are, one of them, an administrative thing, and the other a solid reliable thing?

MS. CURRAN: Well, again, this gets back to the issue of, is anything ever purely physical? And the answer is no, there is always something that has to be done by a human being. But it is a question of degree, and the degree is significant. For any piece of equipment that is used in a nuclear power plant, periodic inspection of the integrity of the equipment is required, that is a given. But that doesn't take away from the fact that that physical thing is -- it is a thing, that it is engineered to be that way, and it is going to stay that way, and it doesn't depend for its functioning on continual human intervention.

Contrast that with putting boron in the pool, that requires a human being, or some human beings to constantly be adding boron to the pool, measuring the boron levels, it's a hundred percent clear, but I would infer from the way the rules are structured that the Commission wouldn't rule out additional opportunity for discovery if it, if it were needed.

JUDGE BOLLWERK: All right, let me go back to the first point again, one more time. You've mentioned that I guess the physical separation in the use of boral agents attached to the fuel racks are the two things that you feel fall within the interpretation that you've given it. If that were the case, why didn't the Staff or the Commission simply specify those two things if there wasn't anything else?

MS. CURRAN: Because, at the time that GDC-62 was promulgated, the most prevalent way of, of preventing criticality was spacing of the racks, of the -- you know, construction of the racks so that the assemblies would be spaced far apart. At that point, I think the technology for putting boral or boron panels in the racks may have been just beginning.

[Pause.]

MS. CURRAN: But it seems that -- okay, the Commission was well aware that spacing was the primary means of doing this. Then I think the Commission left the language general so that as technology developed -- I would assume the Commission anticipated that technologies would be developed to address this problem. And they might include other things besides spacing or putting boron panels in the rack.

[Pause.]

MS. CURRAN: All right. I think I've answered it.

JUDGE BOLLWERK: All right. Any questions from the other two Board members?

JUDGE SHON: Ms. Curran, I think your recent dissertation on the ANSI standard was a little different from the materials submitted earlier, in that it seems to me that you proposed a sort of a clincher -- that is that the standard requires that for Conditions 1, 2 and 3, one cannot take credit for boron, and that it is only for Conditions 4 and 5 that one may take such credit, and that Conditions 4 and 5 are associated with very, very rare events, far rarer than the misplacement of a fuel element, and that the applicant's own figure -- .9932 -- exceeds either allowable limit of .95 or .98, and therefore they in effect do not meet the standard. Is that correct?

MS. CURRAN: That's right. And we did, we did discuss the ANSI standard in Appendix A to our summary.

JUDGE SHON: I think in your summary you suggested that there was some vagueness as to what the conditions even meant, and now you seem to have quite a fuller grasp of what each one means.

MS. CURRAN: Well, this, this particular field of criticality analysis has many, many, many standards that are not all consistent. But, you know, in the crucible of preparing for oral argument, some things become quite, more clear. And it seemed to me that the purpose of this oral argument was to bring some of those things to the fore and crystallize them.

JUDGE SHON: Oh, yes. That's quite correct. Yes.

JUDGE LAM: Judge Shon, are you done?

JUDGE SHON: Yes.

JUDGE LAM: Ms. Curran, may I follow up with a question?

MS. CURRAN: Sure.

JUDGE LAM: With Judge Shon's remarks -- are you saying the applicant must meet the 0.95 effective standard, assuming misplacement of one fresh fuel bundle and absence, the total absence of boron? Is that what you're proposing?

MS. CURRAN: In order to be consistent with the requirements of the Grimes Letter and the ANSI standard, which, to which, both of which the CP&L has committed to comply, yes.

JUDGE LAM: Okay. Thank you.

JUDGE BOLLWERK: All right. At this point, it's 11 o'clock. Would you like to take a brief break before you begin, or do you want to launch into your --

MR. O'NEILL: I'm ready to roll.

JUDGE BOLLWERK: All right. Why don't we go ahead and do that then, and we'll see, when you're done, then where we're at and perhaps take a break at that point. Why don't you go ahead, sir.

MR. O'NEILL: Mr. Chairman, Judge Shon, Judge Lam, I'd like to respond and break up my presentation in the following respects.

First I'd like to address the substance of the last question that Judge Bollwerk asked, which is how we should deal with this contention. What should the Board be doing? It's the first time we've had this proceeding; I think it's appropriate to address that issue.

Second, I will address Basis 1.

Third, I will address the attempted expansion of Basis 2. And I'll ask Dr. Holloway, since he is a nuclear engineer qualified to do criticality analysis -- and I don't want to not take advantage of the opportunity to address the technical issues in the double contingency principle. He may be in a better position to answer any questions that the Board had on that area.

The reason we're here today is really because Congress told us to be here. They told us to be here in two respects. One, in the Nuclear Waste Policy Act of 1982, specifically in Section, 42 U.S.C. 10.154, Congress specifically recognized and encouraged the use of a number of methods for effectively expanding spent fuel storage at reactor sites, including "the use of high-density fuel storage racks" and "transshipment of spent nuclear fuel to another civilian nuclear power reactor within the same utility system.

Why did Congress do that? Congress did that because it did not pass legislation that had been proposed for over five years by the industry and others in Congress for a federal away-from-reactor central storage facility for spent nuclear fuel while awaiting the repository to be sited and constructed and operational. Congress understood it had the obligation; it assumed that obligation and said okay, with respect to spent fuel storage, utilities are gonna do it on-site. You're going to expand your on-site storage facility. That was a decision made by Congress.

Secondly, Congress said, we know that sometimes it is difficult to get through license amendment proceedings before the Nuclear Regulatory Commission, so we're going to create a new procedure and we're going to expedite those proceedings. And that led to Subpart K. So we're here because CP&L is running out of spent fuel storage because the Department of Energy has breached its contract, has failed to develop a repository, and Congress did not mandate away from reactor storage. They said to CP&L and every other utility, do whatever you can to do it on-site.

And, Congress said to the NRC, come up with regulations to do it in a more expeditious fashion. So that's what we're about today, is doing what Congress told us to do and electing a procedure that, that Congress had suggested was the appropriate way to do it.

Now, I'd like to address Judge Bollwerk's question as to what do we do with respect to these contentions. And to go back a little bit as to the history of the development of Subpart K and why the language is there the way we see it today. We submit that after oral argument, the Board can do one of two things with respect to each contention. One, it can designate any disputed issue of fact together with any remaining issues of law for resolution in an adjudicatory hearing. Or, it can -- and we say here, should -- dispose of any issues of fact or law not designated for resolution in an adjudicatory hearing. So those are the two choices that the Board has in this very different proceeding that we're engaged in.

The rules provide details of what must be included in the designation of an issue for resolution in an adjudicatory hearing. For those contentions that do not pass muster, for whatever reason -- and there's, as we've set out in some detail in our submittal, there's a four-pronged test that must be passed before the Board can designate an issue for resolution in an adjudicatory hearing. But regard to those issues not designated for resolution in an adjudicatory hearing, the presiding officer shall include a brief statement of the reasons for the disposition.

Now, we wrestled with, for some time, what does "dispose of" mean here? And we went back to the initial proposed rules, and the proposed Option 2, which was eventually adopted with a number of modifications. And the proposed rule would have required much more. The proposed rule in Option 2 would have required the Board to decide all issues of fact or law not designated for resolution in an adjudicatory hearing, setting forth fully the presiding officer's findings and conclusions with the reasons or basis for that. Now that is what originally was proposed.

The Edison Electric Institute, representing a number of electric utilities -- I think forty or so -- and others argued that this provision was inconsistent with the Nuclear Waste Policy Act. The Act did not call for formal findings and conclusions; the Act called for an expedited proceeding. And the Edison Electric Institute argued that the presiding officer should not be required to decide all issues not designed for adjudication. Perhaps issues determined to be insubstantial or inappropriate for resolution by adjudication.

EEI noted that the presiding officer may decide to simply dismiss such issues and refer them to the NRC Staff for non-adjudicatory resolution, like every other issue that the NRC looks at in connection with a license amendment proceeding that's not the subject of a contention. EEI advocated that the presiding officer's determination should merely be supported by an adequate statement of reason. Otherwise, EEI was concerned that this process could just drag on, inconsistent with what Congress the NRC to do.

Now EEI proposed that the section be revised to read, instead of "decide. . . ," "decide or dismiss all issues of law or fact not designated for resolution in an adjudicatory hearing, setting forth the reasons for such action. Instead of "decide or dismiss," the Commission decided to use the word "dispose." And we believe that there's no difference. Those are the two, the only two options you really have: decide the issue or dismiss the issue.

In the statement of considerations in the final rule, the Commission noted that five commenters had pointed out that there was no need for formal findings of fact and conclusions of law in the presiding officer's decision -- disposing of issues or designating them on the adjudicatory hearing. The Commission agreed and stated, "For issues not designated for adjudication, all that is required by the Administrative Procedure Act is a brief statement of the reasons for the denial of the request. Thus, the presiding officer may simply dispose of issues not designated for adjudication with an adequate explanation of the reasons why a hearing is not required."

Thus, it's clear that the Board need not decide each contention on the merits. All that is required is a brief statement of the reasons why hearing is not required. The Board must decide whether the contention meets the strict threshold for an adjudicatory hearing, and if the contention does not meet that strict threshold, we submit that the Board has considerable discretion either to decide an issue or dismiss it.

Now, with respect to Contention 2, our position is that it is in the interest of the parties, it's in the interest of the Commission or the Board to decide the pure legal issue before you on Contention 1, Basis 1. We don't think that the Commission's processes would be served any other way, although we note that it is clearly not permissible to hold an adjudicatory hearing on purely a legal issue, as we note in our brief. What evidence would we bring to bear? The Board made it quite clear is that this is purely a legal issue and there's been no dispute of that fact. Therefore, we would suggest that based on the arguments and based on the papers before the Board that the Board should decide this issue.

Step 1 would be to find that an adjudicatory hearing is not required because it involves a question of law. And Step 2 -- and by the way, the first criteria is to be a question of fact in dispute, and there's no question of fact in dispute. And Step 2 would be to issue a decision on the legal question. I guess the other alternative is the Board could elect, and has the power to elect or refer to the Commission for decision, but it would appear, given the amount of material that the Board has had a chance to digest, that it would not be in the interest of judicial economy just to pass the buck without issuing its decision.

On Basis 2, the fuel assembly misplacement analysis, presuming that we are here before this Board on the contention as admitted, we submit that this issue is moot. And as we will discuss, there is no genuine dispute of fact regarding whether a single fuel assembly misplacement could cause criticality. That is conceded by the BCOC, that the criticality analysis that was done demonstrates that it would not cause criticality. That's the contention. So we submit that this issue is really moot, and it could simply be dismissed. And in fact the NRC, of course, has performed a separate analysis, which indicates that you could fill the entire pool, you could fill the entire pool with fresh fuel and there would be no criticality. Now that, we submit, is what the Board should do with respect to Contention 2. And let me turn to address Contention 2, Basis 1.

Basis 1, In the contention as adopted that CP&L's proposed use of credit for burn-up to prevent criticality and pull C and D is unlawful. Because GDC 62 prohibits, prohibits, does not allow does not include a preference. Prohibits the use of administrative measures. Not some administrative measures all administrative measures. And the use of credit for burn-up is an administrative measure.

That's why this contention was admitted in the first place, because the board allowed as a legal contention that if you read GDC 62 and read it only that GDC 62 says criticality and the fuel storage and handling system shall be prevented by physical systems or processes preferably by the use of geometrically safe configurations. ECOC argued that burn-up credit was not a physical system or process.

Therefore we didn't meet GDC 62. Therefore, there was a contention because we could not have a, we were in violation of the law, because as Ms. Curran said at the pre-hearing conference what GDC 62 says is thou shall not use administrative control. That was the contention they admitted. That was the contention we ought to litigate.

As we went through the discovery process, and pressed Dr. Thompson in his deposition on isn't it true that administrative controls are required for every form of criticality control; he had to concede that was true. And, in deed, when we questioned Dr. Thompson and asked him isn't it really true that every form of criticality control involves a physical system or process. He had to concede that was true.

I submit to the board, there is nothing left to this contention. Because, you once you concede that, in fact, there is no commandment, that says thou shalt not use administrative control, but rather administrative controls are part of every physical system or process.

Then there was no basis for admitting this contention in the first place. So why are we here?

The new theory, having nothing to do with this contention except that it relates to the same matter, is well what this really means is that there are some physical systems or controls that are okay because the administrative measures are not as great as the other physical systems and controls in pertinent processes which require more ongoing administrative measures. That line, of course, is no where in GDC 62. This is made up whole cloth, this is almost an absurd contention, and sometimes the more absurd are more difficult to respond to.

But let's analyze that proposition is Judge Shon's questions starts to point out.

Well, how do you draw the line. Morale and boraflex is okay because somehow those administrative measures are less ongoing. As Judge Shon pointed out, not true. There is, in fact, more difficult inspections as an ongoing basis for certain licensees with boraflex then the administrative measures require to identify what fuel assembly is going to point "A" to point "B". So how does that fit into this construct of which administrative controls are okay and which administrative controls are not okay.

So we submit that the contention as admitted, the contention as admitted, has been conceded by BCOC. And now what Ms. Curran is doing is arguing a whole new contention, a different contention.

One that we submit that if we had an opportunity to address at the contention stage, we would kept out. Because there is simply no basis for that new construct that Dr. Thompson and Ms. Curran have come up with. Where is the basis for it?

What document would you point to say that these are okay and these are not okay. None.

So we now address though the totality of the argument which is okay, now having looked at our new contention is there any legal basis for prohibiting burn-up credit.

First of all, is that what the commission intended. I will not repeat what I believe is a careful discussion of the regulatory history of GDC 62.

We went through each of the subsequent drafts of GDC 62. And I believe demonstrated that in each case, the first sentence which said what was allowed, included procedural controls which was in the second sentence as one of the things that was a physical system or process.

So as you go through in each succeeding draft it's fairly clear that at all times, what the commission had in mind was allowing procedural controls or administrative measures, same thing, there is no difference there. And the only thing that happened when it was finalized, was in response to, not the Oak Ridge National Laboratory comment, but a separate comment that was not mentioned by Ms. Curran initially, and is in our filing. There was a clear preference for spacing not over procedural controls but over anything. And if you look at the SECY letter which we point out in our filing, it was clear that this was simply a clarification, not a dramatic shift.

So we believe that a careful reading of the regulatory history makes it very clear that the commission was not changing GDC 62 to eliminate procedural controls or administrative measures.

Where this contention falls off the face of the earth, however, is in looking at what the commission adopted in 10CFR50.68. Once again that is discussed, I believe carefully in our summary.

But to look at 50.68(b)4 which states, if no credit for soluble boron is taken the K effective or the spent fuel storage racks loaded with fuel of the maximum assembly reactivity. If you are analyzing reactivity, what are you analyzing? What are you taking credit for 1) enrichment 2) run of credit. There is no dispute that those of the components of reactivity.

So to the extent that the commission understands that in doing the analysis, you will look at maximum reactivity, you are looking at enrichment and burn-up credit. And of course those are physical systems and processes and of course it requires administrative controls.

So in adopting 50.68 and the companion section in 70.24 the Commission has endorsed what has been the practice of the staff for many years which is to certainly allow burn-up credit for criticality control.

Ms. Curran cited to the Big Rock case which she suggested that you should ignore. I note it is a atomic safety and licensing appeal board decision and there is two particular things that are note worthy in there.

One is that what was done here which was to endorse the use of a remotely controlled makeup line as part of a physical system with administrative measures that were deemed acceptable for criticality control suggest that the appeal board in a case in which this issue is actually raised certainly understood that GDC 62 allowed administrative measures or controls. And importantly, which Ms. Curran did not mention is that the appeal board in doing this analysis indicated that we agree with the licensing board the staff guidance and acceptance criterion for spent fuel pool criticality is entitled to considerable weight.

So while it is true that the staff is a party to this proceeding it is also true that as a matter of administrative law when interpreting a regulation you're interpreting GDC 62 that the staff's interpretation, in deed, the staff's interpretation for 20 years should certainly be given considerable weight and in deed, as Dr. Kopp indicated 50 licensees rely on burn-up credit for criticality control.

Let me summarize our response to the arguments by Ms. Curran on basis 1.

First, all methods of criticality control for spent fuel pools, including fuel enrichment and burn-up limits are physical systems or processes. The staff the applicant and Dr. Thompson agreed to that factual proposition.

Number two, all methods of criticality control for spent fuel pools including fuel enrichment and burn-up limits are implemented by using some administrative measures. All parties agree to that.

Three. Fuel assembly reactivity includes the effect of fuel burn-up. All parties agree to that.

The regulatory history of GDC 62 together with the Commission's statements of consideration and promulgating 10 CFR 50.68 establish that GDC 62 permits the use of administrative measures to implement physical systems or processes used for criticality control including reactivity which includes burn-up credit.

The NRC staff's consistent interpretation of GDC 62 should be accorded considerable weight. Particularly where it's interpretation is the only one that could be given practical meaning to GDC 62.

The position is BCOC here is made of whole cloth. It's not practical, it doesn't reflect an understanding of either the guidance documents the evolution of criticality control or what is in fact done within the industry and done in a safe manner.

Thus the Board should find as a matter of law that GDC 62 permits the use of administrative measures to implement criticality control methods. GDC 62 permits an applicant to take credit in criticality calculations for enrichment and burn-up limits in fuel and GDC 62 permits the use of administrative measures to implement these limits.

I would like to turn to, unless the Board would like to ask any questions on this part of this.

All right, Why don't we stop at this point.

JUDGE BOLLWERK: I just have one. I asked Ms. Curran a similar question from a different prospective. Given the way you are reading the regulation what does it exclude, if any thing in terms of utilities ability to.

MR. HOLLOWAY: The answer to that question is there are only a limited number of ways you control criticality.

Number 1 is spacing.

Number 2 is boron dilution.

Number 3 is solid boral neutron absorbers. Soluble neutron absorbers and reactivity which is enrichment or burn-up credit. That's the universe.

None of those are prohibited by GDC 62. In deed, if the Commission wanted to prohibit some method of criticality control they certainly could have done so.

There is a preference. A clear preference. Stated for spacing, but that preference now comes up against what Congress directed that we do today and why we have evolved which is for high density spent fuel storage racks.

High density spent fuel storage racks requires more than spacing to accomplish it and that's why we CPL and 50 other licensees have gone to high density racks which use among other things burn-up credit for criticality control.

So there is no prohibition of any of those means of criticality control and in deed, if the Commission wanted to do it, they would have said so and certainly two years ago they would have not passed 50.68 which permits reactivity as part of criticality control.

JUDGE BOLLWERK: All right, any other questions from anyone. All right, Mr. Hollaway.

MR. HOLLAWAY: Actually, I am going to address next the expansion of the basis two and then let Mr. Hollaway address contention to basis two.

As admitted, contention two, basis 2 provides that the use of credit for burn-up is prescribed because regulatory guide 1.13 requires that criticality not occur without two independent failures and one failure misplacement of a fuel assembly could cause criticality if credit for burn-up is used.

The Board clarifying this specifically stated the question: will a single fuel assembly misplacement involve in a fuel element of the wrong burn-up or enrichment cause criticality in the fuel pool or would more than one such misplacement or a misplacement coupled with some other error

January 4, 2000

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

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

SUMMARY OF FACTS, DATA, AND ARGUMENTS ON WHICH APPLICANT PROPOSES TO RELY AT THE SUBPART K ORAL ARGUMENT

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1.	Affidavit of S. Edwards	A	CP&L License Amendment Application (9 enclosures w/ supporting information)
		B	CP&L 4/30/99 (HNP-99-069), Response to RAI 1 (with enclosures 1, 3, 4, 7, 13, 14, 16, 17)
		C	CP&L 6/14/99 (HNP-99-094), Response to RAI 2 (with enclosure 1)
		D	CP&L 9/3/99 (HNP-99-129), Response to RAI 4 (with enclosure 1)
		E	CP&L 10/29/99 (HNP-99-172), Response to RAI 5 (with enclosures 1, 2, 3)
		F	CP&L 10/15/99 (HNP-99-156), Supplementary Response to Previous RAIs (with enclosure 1)
		G	Spent Fuel Pool Cooling and Cleanup System Description (SD-116) from the Harris Plant Operating Manual (Vol. 6 Part 2)
		H	Spent Fuel Pool Cooling and Cleanup System Schematic
		I	Harris Operating Procedure PLP-616, Fuel Handling Operations
		J	Harris Operating Procedure FHP-014, Fuel and Insert Shuffle Sequence
		K	Harris Operating Procedure FHP-020, Refueling Operations
		L	Harris Operating Procedure FHP-024, HNP Spent Fuel Handing Operations
		M	CP&L Nuclear Fuels Procedure NFP-NGGC-0021, Corporate Special Nuclear Material Accountability Plan

Exhibit No.	Exhibit Title	Attachment No.	Attachment Title
		N	CP&L Nuclear Fuels Procedure NFP-NGGC-0003, Procedure for Selection of Irradiated Fuel for Shipment in the IF-300 Spent Fuel Cask
		O	Harris Operating Procedure PLP-629, Reactivity Management Program, Attachment 6, Reactivity Management Controls, Spent Fuel Pool Activities
		P	Harris Operating Procedure CRC-001, SHNPP Environmental and Chemistry Sampling and Analysis Program (Chemistry Procedure for Control of Boron in Pool Water)
		Q	Engineering Service Request ("ESR") 99-00266, Evaluation of Units 2 and 3 Spent Fuel Pool Cooling Embedded Piping
		R	Special Plant Procedure ("SPP")-0312T, Temporary Procedure for Remote Visual Examination of Interior Welds and Surfaces of Embedded Unit 2 Spent Fuel Pool Cooling Piping for "C" and "D" Pools
		S	Hydrotest Report for a segment of the SFPCCS embedded piping that included field weld 2-SF-159-FW-518
		T	Hydrotest Report for a segment of the SFPCCS embedded piping that included field weld 2-SF-159-FW-519
2.	Affidavit of S. Turner	A	Resume
		B	10 C.F.R. Part 50 General Design Criterion ("GDC") 62, Prevention of criticality in fuel storage and handling
		C	10 C.F.R. § 50.68, Criticality accident requirements
		D	Reg. Guide 1.13, draft Revision 2, spent fuel storage facility design basis
		E	1978 Fuel Storage Guidance, Letter from Brian K. Grimes, NRC
		F	ANSI N 16.1-1975, Nuclear criticality safety in operations with fissionable materials outside reactors

Exhibit No.	Exhibit Title	Attachment No.	Attachment Title
		G	ANSI/ANS-8.1-1983 (revision to ANSI N 16.1-1975), Nuclear criticality safety in operations with fissionable materials outside reactors
		H	1998 Criticality Guidance, Memorandum from Laurance I. Kopp of the NRC Staff's Reactor System Branch
3.	Affidavit of E. Redmond II	A	Resume
		B	Harris Misplacement Analysis (PROPRIETARY)
		C	NRC Staff's Misplacement Analysis
4.	Affidavit of M. DeVoe	A	Resume
		B	Owner Review Comment Sheets for Harris Misplacement Analysis
5.	Affidavit of C. Griffin	A	QCI-19.1, Preparation & Submittal of Weld Data Report, Repair Weld Data Report, Tank Fabrication Weld Record & Seismic I Weld Data Report (Rev. 1)
		B	Weld Data Report ("WDR") for field weld FW-5
		C	Repair WDR for field weld FW-408 (included with the Deficiency and Disposition Report package No. 829)
6.	Affidavit of D. Shockley	A	CP&L ASME Quality Assurance Manual
		B	Hydrotest Report for a segment of the SFPCCs embedded piping that included field welds 2-SF-143-FW-512, -513, and -514
		C	Hydrotest Report for a segment of the SFPCCS embedded piping that included field welds 2-SF-1-FW-1, -2, -4, and –5

Exhibit No.	Exhibit Title	Attachment No.	Attachment Title
		D	Hydrotest Report for a segment of the SFPCCS embedded piping that included field welds 2-SF-144-FW-515, -516, and -517
		E	Deficiency and Disposition Report package No. 794
7.	Affidavit of W. T. Gilbert	A	Construction Procedure WP-115, Pressure Testing of Pressure Piping (Nuclear Safety Related)
		B	Hydrotest Report for a segment of the SFPCCS embedded piping that included field weld 2-SF-149-FW-408
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		D	Hydrotest Report for a segment of the SFPCCs embedded piping that included field welds 2-SF-143-FW-512, -513, and -514
		E	Concrete Placement Report for the internal wall of the spent fuel unloading building at elevation 281
8.	Affidavit of A. Moccari	A	Curriculum Vitae (includes Resume and List of Publications)
		B	5/12/99 Technical Report 99-90, Harris Nuclear Plant – Bacteria Detection in Water from the C&D Spent Fuel Pool Cooling Lines
		C	12/16/99 Technical Report 99-179, Harris Nuclear Plant – Bacteria Detection in a Deposit Sample and Chemical Analysis of Reddish-Brown Material from the C&D Spent Fuel Pool Cooling Lines
9.	Affidavit of G. Licina	A	Resume
		B	List of Publications
		C	Report No. SIR-99-127 Rev. 2, Evaluation of Embedded Welds in Spent Fuel Piping at Harris Nuclear Plant

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10.	Deposition of D. Lochbaum, with errata sheets		
11.	Deposition of G. Thompson, with errata sheets		
12.	Deposition of L. Kopp, with errata sheets		
13.	Letter from John J. Kearney, Senior Vice President, Edison Electric Institute, to Secretary of the Commission, dated February 17, 1984		
14.	NRC Inspection Report No. 50-400/99-12, dated December 28, 1999		
15.	NRC Correspondence on the GDC 62 Rulemaking: A. Press Release from the AEC on proposed GDC rulemaking (11/65) B. Comparison of drafts 10/20/66 and 02/06/67 C. Memorandum from ACRS providing comments on GDC rulemaking (02/67) D. AEC-R 2/57 – Note by the Secretary regarding proposed GDC (06/67) E. Letter from AEC to ACRS regarding review of proposed GDC (07/69) F. SECY-R 143 – Note by the Secretary regarding amendment to GDC (01/71)		
16.	Statements of Consideration for GDC 62: A. Proposed Rule (1967) B. Final Rule (1971)		
17.	Public Comments on GDC 62: A. Letter from Oak Ridge National Laboratory, Sept. 6, 1967 B. Letter from Atomics International, Sept. 25, 1967		
18.	NRC Correspondence on the 10 C.F.R. § 50.68 Rulemaking: A. SECY B. SRM and Commission Voting Records		

Exhibit No.	Exhibit Title	Attachment No.	Attachment Title
19.	Statements of Consideration and Public Comments for 10 C.F.R. § 50.68: A. Direct Final Rule B. Proposed Rule C. Public Comments on 10 C.F.R. § 50.68 Rulemaking (Letter from Northern States Power Co., Jan. 2, 1998) D. Withdrawal of Direct Final Rule E. Final Rule		
20.	NRC Correspondence on Reg. Guide 1.13 A. NRC Memorandum, Aug. 1979 – response to regulatory guide review request B. NRC Memorandum, Aug. 1981 – draft 1 of Reg. Guide 1.13 Revision 2 C. NRC Memorandum, Sept. 1981 – draft 1 of Reg. Guide 1.13 Revision 2		

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January 4, 2000

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

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

SUMMARY OF FACTS, DATA, AND ARGUMENTS ON WHICH APPLICANT PROPOSES TO RELY AT THE SUBPART K ORAL ARGUMENT

I. INTRODUCTION

Pursuant to the Board's Memorandum and Order (Granting Request to Invoke 10 C.F.R. Part 2, Subpart K Procedures and Establishing Schedule) dated July 29, 1999, as amended by the Board's Memorandum and Order (Extending Time for Written Summaries and Oral Argument) dated December 13, 1999, Applicant Carolina Power & Light Company ("CP&L") submits its "Summary of Facts, Data, and Arguments on which Applicant Proposes to Rely at the Subpart K Oral Argument" ("Applicant's Summary"). As required by 10 C.F.R. § 2.1113(a), attached as exhibits to Applicant's Summary are supporting facts and data in the form of sworn written affidavits.

This proceeding relates to CP&L's December 23, 1998 application for a license amendment to place spent fuel pools C and D in service at CP&L's Harris Nuclear Plant

("Harris Plant," "HNP," or "Harris"). The Harris Plant was originally planned as a four nuclear unit site (Harris 1, 2, 3 and 4). In order to accommodate four units, the Harris Fuel Handling Building was designed and constructed with four separate pools capable of storing spent fuel. Spent fuel pools A and B were originally intended to support Harris 1 and 4. Spent fuel pools C and D were originally intended to support Harris 2 and 3.

Harris 3 and 4 were canceled in late 1981. Harris 2 was canceled in late 1983. Spent fuel pools A, B, C and D and the spent fuel pool cooling and cleanup system ("SFPCCS") for spent fuel pools A and B were completed as part of the Fuel Handling Building, are described in the HNP Final Safety Analysis Report, and are licensed as part of the HNP. Construction on the SFPCCS for spent fuel pools C and D was discontinued after Harris 2 was canceled. By that time, all four spent fuel pools had been constructed, concrete had been poured, and the SFPCCS piping was installed, welded in place and embedded in reinforced concrete.

Harris 1 began commercial operations in 1987. In addition, HNP was licensed to accept spent fuel for storage from CP&L's other nuclear plants, H. B. Robinson Unit 2, and Brunswick Units 1 and 2. Beginning in 1989, spent fuel assemblies from Robinson and Brunswick have been regularly shipped to the Harris Plant and are stored in spent fuel pools A and B.

The December 23, 1998 license amendment request and the need to expand spent fuel storage at HNP result from the failure of the U.S. Department of Energy ("DOE") to begin taking delivery of spent fuel in 1998, as required by the contract between DOE and

CP&L and by the Nuclear Waste Policy Act of 1982, as amended. CP&L requested that the license amendment to allow placement of spent fuel in spent fuel pools C and D be issued no later than December 31, 1999. CP&L plans to begin loading spent fuel in pool C beginning in 2000. Delays would adversely impact CP&L's ability to maintain adequate spent fuel storage capacity and, with the loss of full core discharge capability at one or more of CP&L's nuclear plants, could lead to a forced shutdown condition.

Applicant invoked the Subpart K Procedures after the Board admitted Technical Contentions 2 and 3 proffered by intervenor Board of Commissioners of Orange County ("BCOC") in its Memorandum and Order (Ruling on Standing and Contentions) dated July 12, 1999. The Commission adopted 10 C.F.R. Part 2, Subpart K to implement a Congressional mandate for expedited licensing procedures designed to encourage utilities to expand spent fuel storage capacity at reactor sites.

Part II of Applicant's Summary describes the legislative and regulatory purpose requiring the strict threshold for an adjudicatory hearing in a Subpart K proceeding.

Part III summarizes Applicant's position on the application to the strict threshold to Technical Contentions 2 and 3.

Part IV addresses Technical Contention 2. First, we discuss Contention 2 as admitted and the new issues BCOC has raised that are outside the scope of the contention. Second, we brief the legal arguments which support the NRC Staff's consistent interpretation of General Design Criterion 62 since it was adopted in 1971 as allowing burnup credit for criticality control in spent fuel pools. Third, we summarize facts, data and arguments which demonstrate that a single fuel assembly misplacement could not cause criticality in Harris spent fuel pools C and D. Fourth, we summarize our arguments why BCOC cannot meets its burden of demonstrating an adjudicatory hearing must be held to dispose of Contention 2.

Part V addresses Technical Contention 3. First, we point out the clarification and narrowing of Contention 3 during discovery. Second, we summarize facts, data and arguments which demonstrate that CP&L's 10 C.F.R. § 50.55a Alternative Plan provides an acceptable level of quality and safety in the as constructed SFPCCS for spent fuel pools C and D. Third, we summarize facts, data and arguments which demonstrate that the SFPCCS embedded piping and field welds have not deteriorated due to corrosion or otherwise during the period between construction and today, are suitable for their intended purpose, and provide an adequate level of quality and safety. Fourth, we summarize our arguments why BCOC cannot meets its burden of demonstrating an adjudicatory hearing must be held to dispose of Contention 3.

Part VI states the actions requested of the Board by Applicant at the conclusion of oral argument.

Applicant's Summary is supported by nine sworn statements in the form of affidavits. In the remainder of this Introduction, we introduce each affidavit and its purpose.

Exhibit 1 is the Affidavit of R. Steven Edwards ("Edwards Affidavit"). Mr. Edwards has been employed by CP&L since 1982. He is presently the Supervisor, Spent Fuel Pool Project, and is responsible for commissioning and placing into service spent fuel pools C and D at the Harris Plant. Mr. Edwards first summarizes the background of the license amendment request and the information submitted in support of the application. He describes Harris Plant procedures, controls, physical conditions, physical constraints, and calculations that establish a single fuel assembly misplacement in HNP spent fuel pools C and D, involving a fuel element of the wrong burnup or enrichment, cannot cause criticality in the fuel pool. Next, he describes the basis for the 10 C.F.R. §50.55a Alternative Plan that provides assurance of acceptable quality and safety of the stainless steel piping that is part of the SFPCCS for spent fuel pools C and D -- notwithstanding the destruction of the weld data reports for the field welds in that piping. He then describes the measures set forth in the Equipment Commissioning Plan for spent fuel pools C and D to ensure that there has not been significant degradation of the components and piping in the SFPCCS that would affect their suitability for service. Mr. Edwards provides the results of additional inspections and tests to confirm the acceptable condition of the SFPCCS piping embedded in concrete. Finally, he discusses the insignificant impact on Harris Plant operations and safety in the highly improbable event of a failure of a weld in the embedded piping, and describes the counter-balancing hardship and unusual difficulty that would result if CP&L were required to commission spent fuel pools C and D without approval of the 50.55a Alternative Plan.

Exhibit 2 is the Affidavit of Dr. Stanley E. Turner, PE ("Turner Affidavit"). Dr. Turner is Senior Vice President and Chief Nuclear Scientist of Holtec International. Dr. Turner has four decades' experience in criticality safety analysis for nuclear power plants and has personally performed criticality analyses, and authored the related reports to support approximately 60 to 70 license amendment requests for spent fuel pool storage. In his affidavit Dr. Turner explains the physical systems or processes available as criticality control methods for spent fuel storage, and the administrative measures used to implement each method. He also discusses the NRC's regulations governing criticality control for spent fuel pools, including General Design Criterion 62 and 10 C.F.R. § 50.68. He addresses specific aspects of the NRC Staff's regulatory guidance concerning spent fuel pool criticality control, including the Double Contingency Principle and the implementation of burnup credit. He also provides information concerning the prevalence of the use of burnup credit for spent fuel pool criticality control at numerous sites across the country. Finally, he provides his review of the nuclear criticality analysis performed by the NRC Staff for this proceeding.

Exhibit 3 is the Affidavit of Dr. Everett L. Redmond II ("Redmond Affidavit"). Dr. Redmond is a nuclear engineer with Holtec International and one of Holtec's principal engineers responsible for performing nuclear criticality analyses for spent fuel storage systems. Dr. Redmond describes the misplacement analysis that he performed for Harris spent fuel pools C and D and summarizes its principal conclusions. He also provides his review of the nuclear criticality analysis performed by the NRC Staff for this proceeding.

Exhibit 4 is the Affidavit of Michael J. DeVoe ("DeVoe Affidavit"). Mr. DeVoe is a nuclear engineer, employed since 1984 by CP&L, who presently works in the Nuclear Fuel Services Unit of CP&L's Nuclear Fuels Management & Safety Analysis Section. He is responsible for performing the Owner's Review of the nuclear criticality analyses for Harris Nuclear Plant spent fuel pools C and D. His affidavit describes the CP&L review and confirmation of information in the fuel assembly misplacement analysis prepared by Dr. Redmond.

Exhibit 5 is the Affidavit of Charles H. Griffin ("Griffin Affidavit"). Mr. Griffin is a materials engineer employed by CP&L in its Corporate Nuclear Engineering Department. Mr. Griffin worked at the Harris Nuclear Plant as a Welding Engineer from 1978 through 1986, and was responsible for welding activities on piping during Harris Plant construction. Mr. Griffin attests to the quality of the welding program during the construction of the Harris Plant, specifically during the welding of the SFPCCS piping now embedded in concrete. In addition, he reviewed the videotapes pertaining to the visual inspection of the interior of the SFPCCS piping and welds, and reports on his evaluation of the condition and suitability for service of the welds that he reviewed in those tapes.

Exhibit 6 is the Affidavit of David L. Shockley ("Shockley Affidavit"). Mr. Shockley began work at the Harris Nuclear Plant in 1979 as a quality assurance ("QA") inspector, and continued in various QA-related activities at HNP through construction of Harris. He is now the Supervisor of Configuration Management at the Harris Nuclear

Plant. The purpose of his affidavit is first to describe briefly CP&L's QA Program and the implementation of the ASME N-Stamp Program during Harris construction, particularly as it applied to the installation of ASME Section III, Class 3 stainless steel piping. Mr. Shockley also confirms from personal knowledge the acceptability of certain field welds on the SFPCCS piping installed for spent fuel pools C and D.

Exhibit 7 is the Affidavit of William T. Gilbert ("Gilbert Affidavit"). Mr. Gilbert also began work at the Harris Plant as a QA inspector and has worked for CP&L at HNP since 1979. He has twenty years of experience in QA activities and presently is a Lead Auditor in the Procurement, Dedication & Vendor/Equipment Services Unit at HNP. Based on his extensive first-hand knowledge, Mr. Gilbert describes aspects of CP&L's QA Program and the implementation of the ASME N-Stamp program during Harris Plant construction, particularly as it applied to the installation of ASME Section III, Class 3 stainless steel piping. He also confirms from personal knowledge the acceptability of certain field welds on the SFPCCS piping installed for spent fuel pools C and D.

Exhibit 8 is the Affidavit of Dr. Ahmad A. Moccari ("Moccari Affidavit"). Dr. Moccari is a scientist specializing in corrosion. His Ph.D. in metallurgical engineering was awarded by Ohio State University. Dr. Moccari has been employed as a senior engineer by CP&L since 1982 at the Harris Energy and Environmental Center. In his affidavit, Dr. Moccari reports (1) the results of tests that he performed in May 1999 to determine whether nuisance bacteria were present in the water samples from the SFPCCS piping; (2) his observations and conclusions regarding the condition of the SFPCCS piping, based on his review of videotapes from a video camera inspection of the internals of the SFPCCS piping embedded in the concrete walls and floor of spent fuel pools C and D; and (3) the results of the tests he conducted to characterize the microbiological nature of the localized, reddish-brown deposits on field weld 2-SF-144-FW-517 in the SFPCCS piping.

Exhibit 9 is the Affidavit of George J. Licina ("Licina Affidavit"). Mr. Licina is a metallurgical engineer and is the leading expert on corrosion at Structural Integrity Associates, Inc. Mr. Licina has over 25 years' experience in evaluating environmental degradation of materials in power plant and other industrial environments, including all forms of corrosion and stress-corrosion cracking in aqueous environments, irradiation embrittlement, and Microbiologically Influenced Corrosion. CP&L asked Mr. Licina to provide a third-party independent review of the structural integrity and suitability for service of stainless steel piping in the SFPCCS for spent fuel pools C and D at the Harris Nuclear Plant. Mr. Licina's affidavit introduces his independent expert report which concludes that the information available today allows no reasonable doubt that the SFPCCS piping was properly installed, has suffered no significant degradation since installation that would shorten its expected service life, and can be expected to operate under its expected service conditions for its design service life without significant degradation.

Exhibit 10 is the transcript of the sworn deposition of BCOC's expert Mr. David Lochbaum.

Exhibit 11 is the transcript of the sworn deposition of BCOC's expert Dr. Gordon Thompson.

Exhibit 12 is the transcript of the sworn deposition of the NRC Staff's expert on criticality analyses Dr. Laurence Kopp.

Exhibits 13 through 20 are regulatory documents, described in the table of contents, and provided as exhibits for the convenience of the Board.

II. LEGISLATIVE AND REGULATORY PURPOSE REQUIRING THE STRICT THRESHOLD FOR AN ADJUDICATORY HEARING IN A SUBPART K PROCEEDING

Congress passed the Nuclear Waste Policy Act of 1982, 42 U.S.C. § 10101 et seq., in order to establish a federal program for funding and development of a permanent disposal repository for spent nuclear fuel and other high-level nuclear waste. See H.R. Rep. No. 97-785, pt. 1, at 32 (1982). Congress recognized that it would be many years before the permanent repository was ready to accept spent fuel. The Act therefore made provisions for interim storage of the spent fuel.[1] Congress determined that the operators of civilian nuclear power reactors have "primary responsibility" for interim storage of spent fuel, and that they should do so "by maximizing, to the extent practical, the

[1] Congress correctly anticipated the need to encourage interim storage of spent fuel. The Department of Energy ("DOE") has defaulted on its statutory obligation to complete the repository and begin accepting spent fuel by January 1998. Northern States Power Co. v. Department of Energy, 128 F.3d 754 (D.C. Cir. 1997). DOE has stated that it will not be ready to begin accepting spent fuel until 2010, at the earliest. Viability Assessment of a Repository at Yucca Mountain, DOE/RW-0508, 3 (December 1998). Thus, the need for expanded interim storage capacity at reactor sites is growing ever more acute.

effective use of existing storage facilities at the site of each civilian nuclear power reactor, and by adding new onsite storage capacity in a timely manner where practical." 42 U.S.C. § 10151(a)(1). Congress further declared that the purpose of the Act was to promote "the addition of new spent nuclear fuel storage capacity" at civilian reactor sites. Id. § 10151(b)(1). To that end, all federal agencies were directed "to encourage and expedite the effective use of available storage, and necessary additional storage" at reactor sites. Id. § 10152. Congress specifically recognized that several methods could be used for effectively expanding storage capacity, including "the use of high-density fuel storage racks" and "the transshipment of spent nuclear fuel to another civilian nuclear power reactor within the same utility system." Id. § 10154.

The Act also provided special expedited licensing procedures designed "to encourage utilities to expand storage capacity at reactor sites." H. R. Rep. No. 97-785, at 39. The new procedures require written submissions and sworn testimony on any contentions, along with oral argument on the issues. 42 U.S.C. § 10154(a). Following the oral argument, the Licensing Board must determine whether any of the contentions merits an adjudicatory hearing:

> (b) ADJUDICATORY HEARING. (1) At the conclusion of any oral argument ..., the Commission shall designate any disputed question of fact, together with any remaining questions of law, for resolution in an adjudicatory hearing only if it determines that —
>
> (A) there is a genuine and substantial dispute of fact which can only be resolved with sufficient accuracy by the introduction of evidence in an adjudicatory hearing; and

> (B) the decision of the Commission is likely to depend in whole or in part on the resolution of such dispute.

Id. § 10154(b). Congress reasoned that by "scoping" the issues in this manner, the time and expense of adjudicatory hearings could be avoided unless the issues were truly significant and capable of accurate resolution only through full-blown adjudicatory proceedings. H.R. Rep. No. 97-785, at 39, 82. It was recognized that the standards for an adjudicatory hearing were "extremely narrow." 128 Cong. Rec. S15,644 (daily ed. Dec. 20, 1982) (statement of Sen. Mitchell). Nevertheless, the narrow standards were judged necessary for a "streamlined regulatory process" that would "insure predictable and timely measures necessary to keep America's nuclear power plants in full operation without any threat of reduced operations or shutdown because of a failure by the Federal Government to provide for interim spent fuel management." 128 Cong. Rec. S4155 (daily ed. April 28, 1982) (statement of Sen. McClure).

The Commission implemented the Act's new procedures via a 1985 rulemaking that added Subpart K to the Commission's regulations. 50 Fed. Reg. 41,662 (1985). The regulations track the statutory language. Thus, an issue may be designated for an adjudicatory hearing *only* if (1) there is a genuine and substantial dispute of fact; *and* (2) the dispute can be resolved with sufficient accuracy only through introduction of evidence at an adjudicatory hearing; *and* (3) the Commission's ultimate decision is likely to depend in whole or in part on the resolution of the dispute. 10 C.F.R. § 2.1115(b).

Any issues not meeting this test are to be disposed of by the Licensing Board promptly after the oral argument. Id. § 2.1115(a)(2).[2]

In adopting the regulations, the Commission made it clear that the threshold for an adjudicatory hearing is strict:

> The Commission continues to believe that the statutory criteria are sufficient. As the Commission pointed out in connection with the proposed rules, the statutory criteria are *quite strict* and are designed to ensure that the hearing is focused exclusively on *real issues*. They are similar to the standards under the Commission's existing rule for determining whether summary disposition is warranted. *They go further, however, in requiring a finding that adjudication is necessary to resolution of the dispute and in placing the burden of demonstrating the existence of a genuine and substantial dispute of material fact on the party requesting adjudication.*

50 Fed. Reg. at 41,667 (emphasis added).

Accordingly, BCOC here bears the burden of demonstrating that it is entitled to an adjudicatory hearing. And the rules must be strictly applied to limit such hearings to real issues that can be decided only through formal adjudicatory procedures. *First*, there must be a dispute of fact. Pure questions of law obviously do not require an adjudicatory

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[2] The proposed rule would have required the Licensing Board to "decide" all issues not designated for an adjudicatory hearing. 48 Fed. Reg. 54,499, 54,505 (1983). The Edison Electric Institute and a group of interested utilities submitted comments challenging the proposed language requiring the Board to "decide" all issues, when in fact "dismiss" may be the more appropriate way to resolve certain issues. See Letter from John J. Kearney, Senior Vice President, Edison Electric Institute, to Secretary of the Commission (February 17, 1984) (attached as Exhibit 13). The NRC accommodated this comment in

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hearing and can be resolved by the Licensing Board on the briefs.[3] The only exceptions might be legal issues so interrelated with factual issues designated for a full hearing that they cannot be decided independent of the factual determination. Legal issues standing alone could never justify an adjudicatory hearing.

Second, the factual dispute must be genuine and substantial. If the dispute is genuine but peripheral or of secondary importance, then no hearing is warranted and the Licensing Board can resolve the issue on the basis of the sworn testimony and written submissions filed by the parties.

Third, even if the factual dispute is genuine and substantial, a hearing is still unwarranted unless it is the type of dispute that can be accurately resolved only with the traditional adjudicatory procedures, such as oral testimony from live witnesses subject to cross-examination. This might be the case, for example, if the issue turned primarily on the credibility of a particular witness. Most factual disputes, however, depend on technical or scientific issues that can be accurately decided on written submissions. Such issues are typically decided on the basis of plant records, scientific reports and other written materials that the Licensing Board itself can evaluate, drawing upon its own

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the final rule by using the term "dispose," which can include both "decide" and "dismiss."

[3] See 10 C.F.R. § 2.714(e) ("If the Commission or the presiding officer determines that any of the admitted contentions constitute pure issues of law, those contentions must be decided on the basis of briefs or oral argument according to a schedule determined by the Commission or presiding officer.")

technical expertise. The accuracy of the decision-making process would not be enhanced by cross-examination of live witnesses. In this sense, the Subpart K rules go beyond the usual summary disposition procedures, as the Commission pointed out. Under the usual summary disposition procedures, any genuine issue of material fact requires a hearing. 10 C.F.R. § 2.749. Under Subpart K, by contrast, Licensing Boards must dispose of genuine factual issues without a hearing if they are able to do so with sufficient accuracy.

Fourth, the resolution of the factual issue must be central to the ultimate decision in the case. The summary disposition rules simply require the factual issue to be "material." Id. § 2.749(d). The Subpart K rules could have used the same phrase but did not. Instead, they provide that a hearing may be held only if the Commission's decision "is likely to depend in whole or in part" on the resolution of the factual dispute. This is a stricter threshold than simple materiality. It implies that the factual issue must play a central role in the ultimate outcome of the case as a whole. Failing that, no adjudicatory hearing may be held.

This proceeding will be the first time the strict standards of Subpart K will actually be applied to a license amendment proceeding. Thus, we do not have the benefit of precedent in interpreting the Subpart K standards. However, applying these standards to the case at hand will not require careful line drawing. As will become abundantly evident, BCOC cannot meet its burden of showing that an adjudicatory hearing is warranted. To hold such a hearing in this case would surely thwart the congressional purpose of encouraging and expediting applications to expand spent fuel storage capacity at reactor sites.

III. SUMMARY STATEMENT OF THE RESULT OF THE APPLICATION OF THE STRICT THRESHOLD TO TECHNICAL CONTENTIONS 2 AND 3

For the reasons outlined in the remainder of the Applicant's Summary, the Board should dispose of Technical Contentions 2 and 3 as follows:

A. Technical Contention 2 – Criticality Control

1. Basis 1 – Legal Interpretation of General Design Criterion ("GDC") 62

The Board should decide BCOC's legal challenge to the NRC Staff's interpretation of GDC 62 based on the arguments made by the parties. A purely legal issue cannot require an adjudicatory hearing. For the reasons set forth in Section IV. B. infra, the NRC Staff's interpretation of GDC 62 should be affirmed.

2. Basis 2 – Fuel Assembly Misplacement Analysis

There is no genuine dispute of fact regarding whether a single fuel assembly misplacement could cause criticality. The Applicant has performed a supplemental criticality analysis that answers this question. Indeed, the NRC Staff has performed an analysis – one that is not required by NRC regulations and goes beyond the allegation in Contention 2 - which demonstrates the spent fuel storage racks for Harris spent fuel pools C and D will remain subcritical, even if *every* location in the spent fuel storage rack is assumed to be concurrently loaded with a misplaced fresh fuel assembly of the maximum possible reactivity. The contention is moot. The Board should dismiss it.

B. Technical Contention 3 – Spent Fuel Pool Cooling and Cleanup System Embedded Piping

1. 10 C.F.R. § 50.55a Alternative Plan to demonstrate adequate quality and safety of the embedded piping as constructed

Contention 3 has been narrowed during discovery to address only the piping and welds embedded in concrete, as part of the spent fuel pool cooling and cleanup system for spent fuel pools C and D. There is no genuine dispute of fact regarding whether American Society of Mechanical Engineers ("ASME") Code approved welding procedures, nondestructive examinations, hydrostatic testing, and quality assurance inspections were followed in the installation of the embedded piping during construction of the Harris Plant. BCOC has not challenged any aspect of the Piping Pedigree Plan, as part of the 50.55a Alternate Plan, to demonstrate adequate quality and safety of the embedded piping as constructed. The Board should dismiss this aspect of Contention 3.

2. Adequacy of the inspections and tests as part of the Equipment Commissioning Plan to demonstrate the embedded piping has not been subject to significant corrosion or other deterioration and to demonstrate adequate quality and safety of the embedded piping "as is"

BCOC no longer questions the adequacy of inspections and tests to determine the condition of the equipment and components of the spent fuel pool cooling and cleanup system for spent fuel pools C and D, other than the piping embedded in concrete. CP&L expanded its inspections and tests to include remote video camera inspection of all 15 embedded field welds and associated piping. This renders BCOC's original contention regarding the scope of the remote camera inspection moot. BCOC's continuing issues regarding the inspections and tests of the embedded piping and welds are not substantial, are not central to the decision of the NRC on the license amendment application, and do not require an adjudicatory hearing for disposition. There is no health or safety consequence or significant environmental impact that could result from a hypothesized leak in the embedded piping in any event. The record before the Board is more than sufficient to allow the Board to decide this aspect of Contention 3 without an adjudicatory hearing.

IV. TECHNICAL CONTENTION 2

A. Admitted Contention 2 and Other Issues Raised during Discovery

Contention 2, as admitted by the Board, alleges the following[4]:

> CONTENTION: Storage of pressurized water reactor ("PWR") spent fuel in pools C and D at the Harris plant, in the manner proposed in CP&L's license amendment application, would violate Criterion 62 of the General Design Criteria ("GDC") set forth in Part 50, Appendix A. GDC 62 requires that: "Criticality in the spent fuel storage and handling system shall be prevented by physical systems or processes, preferably by use of geometrically safe configurations." In violation of GDC 62, CP&L proposes to prevent criticality of PWR fuel in pools C and D by employing administrative measures which limit the combination of burnup and enrichment for PWR fuel assemblies that are placed in those pools. This proposed reliance on administrative measures rather than physical systems or processes is inconsistent with GDC 62.

The two Bases of Contention 2 that were admitted by the Board are discussed separately below.

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[4] Carolina Power & Light Co. (Shearon Harris Nuclear Power Plant), LBP-99-25, 50 NRC 25, 35 (1999) (Board's Ruling on Standing and Contentions).

Applicant also addresses below other issues that BCOC has attempted to raise during the course of discovery, which are beyond the scope of the admitted contention.

1. Basis 1 of Contention 2

a. Admitted Basis 1 – GDC 62 Prohibits Administrative Measures

Basis 1, as admitted by the Board, alleges the following[5]:

> CP&L's proposed use of credit for burnup to prevent criticality in pools C and D is unlawful because GDC 62 prohibits the use of administrative measures, and the use of credit for burnup is an administrative measure.

The Board specifically defined the litigable issue in Basis 1 as follows[6]:

> Does GDC 62 permit an applicant to take credit in criticality calculations for enrichment and burnup limits in fuel, limits that will ultimately be enforced by administrative controls?

Basis 1 presents a question of law regarding the legal interpretation of GDC 62.[7] To this end, the Board agreed to entertain legal arguments on this issue.[8]

The Board's definition of Basis 1 is unambiguous and does not require any clarification. In response to Basis 1, the Applicant demonstrates herein that GDC 62 permits the use of administrative measures to enforce criticality control methods, and

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[5] Id. at 35.

[6] Id. at 35.

[7] Id. at 35-36.

[8] Id. at 36.

thus fuel enrichment and burnup limits, which are ultimately enforced by administrative controls, are permissible under GDC 62.

b. Other Issues Raised by BCOC during Discovery Regarding GDC 62

During the course of discovery, BCOC has changed its position on Basis 1. Basis 1, as admitted, unambiguously maintains that "GDC 62 *prohibits* the use of *administrative measures*."[9] In fact, BCOC's stated position was "*thou shalt not use administrative measures* in showing compliance with this general design criterion."[10] In contrast, BCOC now admits that administrative measures *are permitted* under GDC 62. BCOC's new position is that there are *two classes* of administrative measures: those that are made over a finite time and those that are required on an ongoing basis. BCOC now maintains that GDC 62 permits administrative measures of the first type and prohibits administrative measures of the second type.

BCOC's new position has been stated during the sworn deposition of Dr. Gordon Thompson, the sole expert profferred by BCOC on Contention 2, in BCOC's Responses to Interrogatories, and in recent statements by Dr. Thompson to another licensing board. In his deposition, Dr. Thompson admitted under oath that no method of criticality control is purely physical and that every one requires some administrative measures to

[9] This accurately reflects BCOC's proposed contention, which states that "GDC 62 is quite clear that any measures relied on must be physical rather than administrative. There is no room in the criterion for flexibility or exception." Orange County's Supplemental Petition to Intervene at 12 (April 5, 1999).

[10] Harris Pre-Hearing Conf. Tr. at 96 (emphasis added).

implement.[11] BCOC thereafter admitted in its interrogatory responses that administrative measures are required for every criticality control method, including those methods BCOC admits are in compliance with GDC 62.[12] Dr. Thompson reiterated and clarified

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[11] After he had identified every available measure for criticality control in spent fuel storage pools, Dr. Thompson responded to the Applicant's deposition question as follows:

Q. Can you tell me which of the measures you've identified are purely physical and require absolutely no administrative measures to implement?

A. None of them are purely physical.

For instance, take spacing. Spacing achieves criticality control, provided the spacing is maintained correctly. If a rack were poorly designed and constructed so that it were physically weak and some event within the design basis, such as an earthquake or other action compressed the assemblies, then the physical provision would not have achieved its desired objective.

The distinction that I drew between, on the one hand, spacing and solid panels, and, on the other hand, boron credit and burn-up enrichment and enrichment credit is that in the first category, the physical provision is embodied in a - - an engineering construction that has no moving parts and does not rely upon the action of operators or machinery or the supporting services, such as electricity or - - or any other supporting requirement. The physical - - the physical principle is embodied in a - - a construction - - a construction that, once - - once constructed according to specifications, requires no further intervention or action to achieve its function.

The second category – namely, boron in the water or the burn-up and enrichment credit – does require ongoing actions in order to serve its required function of criticality control.

Thompson Deposition Transcript of October 21, 1999 ("Thompson Dep. Tr.") (Exhibit 11 at 53-55). Dr. Thompson thereafter described some of the administrative measures used to implement fixed-geometry storage racks. Id. at 55-56.

[12] BCOC answered Applicant's Interrogatory No. 2-12 as follows:

INTERROGATORY NO. 2-12: Do you admit that every criticality control measure requires some type of administrative controls for implementation? If not, explain in detail why each such criticality control measure does not require some type of administrative controls for implementation.

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this new position in his recent statements to the Licensing Board in the Millstone licensing proceeding.[13]

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RESPONSE TO INTERROGATORY NO. 2-12: The construction and installation of fixed-geometry fuel racks, with or without attached solid neutron-absorbing material, requires that certain human actions are performed correctly. After the racks are installed, no ongoing human action is required to prevent criticality when fuel is placed in the racks. By contrast, taking credit for soluble boron or fuel burnup as a means of criticality control involves ongoing human actions, and therefore does not satisfy GDC 62.

Orange County's Response to Applicant's Second Set of Discovery Requests at 6 (Oct. 27, 1999) ("BCOC's Interrogatory Responses"). BCOC's position throughout this proceeding has been that the use of fixed-geometry storage racks or solid neutron absorbers is in compliance with GDC 62. See, e.g., id. at 5-6 (Response to Interrogatory No. 2-10).

[13] See Millstone Pre-Hearing Conference Transcript at 138-42 (Dec. 13, 1999) (this document is available from the NRC's Public Document Room). In response to Judge Kelber's question that he was puzzled by the intervenor's interpretation that administrative measures are excluded by GDC 62, Dr. Thompson clarified his position as follows:

DR. THOMPSON: We'd say there are two classes of administrative measures: those that are made over a finite time and after having been made are no longer necessary; and in the second class, administrative measures that are required on an ongoing basis. The design and construction of a rack with fixed spacing between fuel assemblies requires actions of an administrative type to perform correctly. Once the rack is installed, no further ongoing administrative action of any kind is required to exploit the physical phenomena of separation of fuel assemblies. Similarly, the placement of boral plates around the cells in the rack requires administrative and quality control measures, up to the point when the rack is completed and installed. No further ongoing action is required.

In distinction to this category of administrative actions are those that are required on an ongoing basis. Taking credit for burn up and enrichment, the soluble boron and for decay time, all require ongoing administrative measures. Our research of the development of GDC 62 under the Atomic Energy Commission shows that - - very clearly that in the early versions of this criterion, there was a possibility for ongoing administrative actions and that this possibility was removed as the criterion involved and came to its present form. . . . this criterion in[] its present form . . . excludes administrative measures o[f] an ongoing type.

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It is well established that "the scope of a contention is determined by the 'literal terms' of the contention, coupled with its stated bases."[14] BCOC's new position, however, is not encompassed in the wording of Contention 2. It could potentially have been raised as the subject of a contention, but BCOC did not do so. The contention, both as proffered and as admitted, charged that no administrative measures were permitted under GDC 62. Nowhere in either the proposed contention, the prehearing conference, or the admitted contention is it stated that GDC 62 permits certain administrative measures and prohibits others.[15] The Applicant has never had an opportunity to challenge the admissibility of such a contention. Because this new position is not within the "'literal terms' of the admitted contention, coupled with its stated bases," any attempt by BCOC

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Millstone Pre-Hearing Conf. Tr. at 139-40. Requesting clarification, Judge Kelber asked:

JUDGE KELBER: Now, when I design [the fuel storage racks], that's one type of administrative control. Are you telling me now that that changes to a different type of administrative control after the rack is built?

Id. at 141. In response, Dr. Thompson first described the administrative controls required for storage racks, and then stated:

DR. THOMPSON: These are quite different in nature from the types of administrative actions that are needed to keep track of the burn up, enrichment combination that is used to take credit for burn up.

Id. at 141-42.

[14] Vermont Yankee Nuclear Power Corp. (Vermont Yankee Nuclear Power Station), LBP-88-25, 28 NRC 394, 396 (1988) (citing Public Service Co. of New Hampshire (Seabrook Station, Units 1 and 2), ALAB-899, 28 NRC 93, 97 (1988)).

[15] In fact, BCOC admits that if it had the opportunity to rewrite Contention 2, it would change some things, including providing a discussion of "the role of administrative measures in association with physical provisions for criticality." Thompson Dep. Tr. (Exhibit 11 at 113, 121).

to raise this new position should be rejected by the Board as going beyond the scope of the admitted contention.[16] The Applicant will demonstrate herein, however, that this new position is equally without support and would be decided in the Applicant's favor, if it had been raised in an admitted contention.

2. Basis 2 of Contention 2

a. Admitted Basis 2 – Single Fuel Assembly Misplacement

Basis 2, as admitted by the Board, alleges the following[17]:

> The use of credit for burnup is proscribed because Regulatory Guide 1.13 requires that criticality not occur without two independent failures, and one failure, misplacement of a fuel assembly, could cause criticality if credit for burnup is used.

The Board specifically defined the litigable issue in Basis 2 as follows[18]:

> Will a *single fuel assembly misplacement*, involving a fuel element of the wrong burnup or enrichment, cause criticality in the fuel pool, or would more than one such misplacement or a misplacement coupled with some other error be needed to cause such criticality?

The Basis was admitted based on the fact that the NRC Staff had recently sought further information regarding CP&L's position that "when account is taken for the boron present in the fuel pool water, a *single misplacement* cannot lead to criticality."[19] The Board

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[16] Vermont Yankee, LBP-88-25, supra, 28 NRC at 396.

[17] Harris, LBP-99-25, supra, 50 NRC at 36.

[18] Id. at 36 (emphasis added).

[19] Id. (emphasis added).

admitted this basis to permit further inquiry into whether the "required *single failure criterion* is met."[20] Basis 2 raises a question of fact regarding whether a single fuel assembly misplacement will cause criticality in the spent fuel pool.[21]

The Board's definition of Basis 2 is unambiguous and does not require any clarification. In response to Basis 2, the Applicant demonstrates herein, through a supplemental analysis performed in response to admission of this contention, that a single fuel assembly misplacement, with a fresh fuel assembly of the maximum permissible reactivity at Harris, will *not* cause criticality in spent fuel pools C and D.

b. Other Issues Raised by BCOC during Discovery Regarding Criticality Analysis

BCOC has raised additional issues during the course of discovery that go beyond the scope of the admitted Basis 2. Basis 2, as admitted, unambiguously maintains that "one failure, misplacement of a fuel assembly, could cause criticality if credit for burnup

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[20] Id. (emphasis added).

[21] Id. BCOC's own statements prior to admission of the contention, both in the proposed contention and the Pre-Hearing Conference, clearly demonstrate the this contention addressed a *single* fuel assembly misplacement. For example, in its proposed Contention 2, BCOC charged that the Applicant would not meet Reg. Guide 1.13 "because only *one failure* or violation, namely placement in the racks of PWR fuel not within the 'acceptable range' of burnup, could cause criticality." Orange County's Supplemental Petition to Intervene at 13 (emphasis added). BCOC specifically cited Reg. Guide 1.13's requirement to analyze "misplacement of a spent fuel assembly." Id. In the Pre-Hearing Conference, BCOC discusses Basis 2 as misplacement of a single fuel assembly. See, e.g., Harris Pre-Hearing Conf. Tr. at 91 ("misplacing a fuel assembly"), 92 ("A low burn up. A fuel assembly into the pool."), 93 ("if a low burnup assembly is mistakenly placed in the pool").

is used."[22] BCOC has acknowledged that this is the subject of Basis 2, as admitted by the Board.[23] BCOC apparently questions, however, the Board's authority to define the contentions it admits.[24] During discovery, BCOC conceded that the issue in Basis 2, as admitted in LBP-99-25, has been satisfactorily addressed, but then proceeded to identify new issues it would instead prefer to litigate in this proceeding. While it is unclear whether BCOC will raise any of these new issues in its filing, we summarize briefly here the facts, data and arguments upon which Applicant will rely if BCOC continues to press these new issues.

BCOC raised three additional issues during the course of discovery that exceed the scope of the admitted Basis 2. These three new issues have been stated in the deposition of BCOC's expert Dr. Gordon Thompson and in BCOC's Interrogatory Responses. First, BCOC asserts that the Applicant should also have evaluated the loss of all soluble boron in the pool water concurrent with the misplacement of a fuel

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[22] Harris, LBP-99-25, supra, 50 NRC at 36.

[23] Dr. Thompson admitted that the Board's Order admitting Basis 2 "could be construed as a statement by the Board that it wishes to be considered only one failure; namely, misplacement of the single fresh fuel assembly." Thompson Dep. Tr. (Exhibit 11 at 138).

[24] After again concurring that Basis 2, as admitted by the Board, involves a "single fuel assembly misplacement," Dr. Thompson charged that the Board's Order "wrongly excludes the possibility of a single failure leading to multiple misplacements." Id. at 191. "I believe that the Board has - - has not covered the universe of - - of errors and failures that it should have done." Id. Frustrated with the difference between the admitted contention and the new issues he would prefer to litigate, Dr. Thompson exclaimed "the extent to which the intervenor can challenge the Board on this sort of interpretation is beyond my competence." Id.

assembly.[25] Second, BCOC asserts that the Applicant should have evaluated the concurrent misplacement of multiple fuel assemblies, over and above the misplacement of a single fuel assembly.[26] Third, BCOC asserts that the Applicant should have analyzed the universe of scenarios involving two or more unlikely, independent, and concurrent postulated accidents that could result in criticality.[27]

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[25] Dr. Thompson asserted that the Applicant should have considered "fuel misplacements followed by boron dilution events or preceded by boron dilution events." Id. at 163. Dr. Thompson readily admitted that "misplacement of a single assembly and an insufficiency of boron would be two separate errors." Id. at 133. However, as will be shown later, BCOC also acknowledged that, even if it were shown to be legally required, this issue has already been satisfactorily addressed by the Applicant's supplemental criticality analysis. See id. at 186, 189.

[26] Dr. Thompson urged in his deposition that Applicant should have considered the "misplacement of multiple out-of-compliance assemblies." Thompson Dep. Tr. at 161-62. He charged that the Board wrongfully excluded multiple fuel assembly misplacements from Basis 2. Id. at 191. BCOC confirmed this new position in its responses to interrogatories, claiming that "the County would take the position that a single failure or violation could lead to misplacement of more than one fuel assembly." BCOC's Interrogatory Responses at 3-4 (Response to Interrogatory 2-4); see also id. at 5 (Response to Interrogatory 2-8 emphasis added; "one *or more* PWR fuel assemblies"). Dr. Thompson conceded that the misplacement of an entire pool full of fuel assemblies is not credible, and that he would only require that the number of fresh fuel assemblies normally present in the pool be considered. Thompson Dep. Tr. (Exhibit 11 at 164-65).

[27] BCOC's broadest new claim is that the Applicant is required to evaluate the "universe of possible unlikely, independent, concurring failures," including all scenarios involving two or more unlikely, independent, concurring failures. Id. at 133; see id. at 123-24, 127, 138, 188, 191-92, 195-96. Dr. Thompson charged that the admitted Basis 2 "has not covered the universe of - - of errors and failures that it should have done," id. at 191, and recommended that NRC require "a PRA type analysis of the criticality problem." Id. at 124. BCOC confirmed this new position in its responses to interrogatories, asserting that the Applicant should have addressed "the full set of potential events that could cause criticality in pools C and D at Harris." BCOC's Interrogatory Responses at 4 (Responses to Interrogatories 2-4 and 2-6). However, BCOC has narrowed its claim for this particular case, admitting that "the remaining universe of failures all involves misplacement of more than one assembly." Thompson Dep. Tr. (Exhibit 11 at 192).

All three of these new issues are outside "the scope of a contention [as] determined by the 'literal terms' of the contention, coupled with its stated bases."[28] These new issues are beyond the scope of Basis 2 because they attempt to raise new scenarios beyond a single fuel assembly misplacement. Basis 2 addresses the scenario of "one failure, misplacement of a fuel assembly."[29] Nowhere does Basis 2 address scenarios of "loss of soluble boron concurrent with misplacement of a fuel assembly" or "misplacement of multiple fuel assemblies." It is also clear that Basis 2 does not address the "universe" of scenarios involving two or more unlikely, independent, concurrent failures. These new issues are not encompassed in the wording of Contention 2, as admitted. They could potentially have been raised as the subject of a late-filed contention, but BCOC did not do so. The Applicant has never had an opportunity to challenge the admissibility of such a contention.

Because none of these three new issues are within the "'literal terms' of the contention, coupled with its stated bases," any attempt by BCOC to raise these issues should be rejected by the Board as beyond the scope of the admitted contention.[30] The Applicant will demonstrate in Section IV.C. infra, however, that all three of these new issues are, in any event, either moot, or would be decided in Applicant's favor if raised in an admitted contention.

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[28] Vermont Yankee, LBP-88-25, supra, 28 NRC at 396.

[29] Harris, LBP-99-25, supra, 50 NRC at 36.

[30] Vermont Yankee, LBP-88-25, supra, 28 NRC at 396.

B. Summary of Legal Argument Supporting the NRC Staff's Interpretation of GDC 62 as Allowing Administrative Measures to Enforce Fuel Enrichment and Burnup Limits for Criticality Control (Contention 2, Basis 1)

Contention 2, Basis 1 raises a question of law: Does GDC 62 permit an applicant to take credit in criticality calculations for enrichment and burnup limits in fuel, limits that will ultimately be enforced by administrative controls?[31] Basis 1 is founded on BCOC's adamant assertion that GDC 62 prohibits the use of any administrative measures.[32]

Criterion 62 of the General Design Criteria set forth in 10 C.F.R. Part 50, Appendix A, requires that: "Criticality in the fuel storage and handling system shall be prevented by physical systems or processes, preferably by use of geometrically safe configurations."

The NRC Staff has consistently interpreted GDC 62 to permit taking into account enrichment limits and burnup limits in fuel in criticality calculations, which necessarily require administrative controls. This interpretation of GDC 62 must be sustained for a number of reasons. First, as a practical matter, every method available for spent fuel pool criticality control is a physical system or process that is implemented by some administrative measure. BCOC's interpretation of GDC 62 would render the criterion a

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[31] Harris, LBP-99-25, supra, 50 NRC at 35.

[32] During the Pre-Hearing Conference, BCOC paraphrased GDC 62 as "thou shalt not use administrative measures in showing compliance with this general design criterion." Harris Pre-Hearing Conf. Tr. at 96.

nullity. Second, the regulatory history of GDC 62 shows that administrative measures have always been understood to be part of the physical systems or processes for criticality control. Third, the Commission's adoption of 10 C.F.R. § 50.68 (criticality accident requirements for spent fuel storage) explicitly contemplates and permits administrative measures, fuel enrichment limits and fuel burnup limits for criticality control. Fourth, the NRC Staff's consistent interpretation of GDC 62 over two decades, in its guidance documents and license amendment approvals, should be accorded considerable weight. Finally, BCOC's new and revised interpretation of GDC 62 – some administrative measures are permitted and some are not – simply highlights the absurdity and naivete of its original position, but is not before this Board.

1. Undisputed Relevant Facts that Inform and Support the Conclusions of Law

There are three relevant facts that inform the understanding of the Commission's regulations relevant to resolving this question of law. These facts provide the underpinnings for the NRC Staff's and Applicant's legal interpretation of GDC 62:

1. All methods of criticality control for spent fuel pools, including fuel enrichment and burnup limits, are physical systems or processes.

2. All methods of criticality control for spent fuel pools, including fuel enrichment and burnup limits, are implemented through the use of some administrative measures.

3. Fuel assembly reactivity includes the effects of fuel burnup.

Applicant establishes these three relevant facts through the positions of the NRC Staff, the Affidavit of Dr. Stanley E. Turner (Exhibit 2),[33] and BCOC's own admissions. They are not disputed.

2. As a Practical Matter, Every Method Available for Spent Fuel Pool Criticality Control is a Physical System or Process that is Implemented by some Administrative Measure

Every criticality control method involves, by necessity, a physical system or process.[34] This is because criticality control can only be achieved through physical measures that affect neutron multiplication.[35] Neutrons will not recognize, much less obey, procedures and other administrative measures alone.[36] Some physical measure is required to achieve criticality control.[37]

In practice, there are four methods available for criticality control in spent fuel storage pools: (1) geometric separation; (2) solid neutron absorbers; (3) soluble neutron absorbers; and (4) fuel reactivity.[38] Fuel reactivity is determined by three factors: (1) fuel assembly structure; (2) initial (or "fresh") fuel enrichment; and (3) fuel depletion (or

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[33] Dr. Turner has been evaluating criticality control systems since 1957, and employing GDC 62 since it was first promulgated, almost 30 years ago. Turner Affidavit (Exhibit 2, ¶¶ 6, 7, 27, Attachment A).

[34] Id. ¶ 9).

[35] Id.

[36] Id.

[37] Id.

[38] Id. at ¶ 10.

"burnup").[39] BCOC admits to this same list of available criticality control methods.[40] Each of these four criticality control methods is a physical system or process that has a physical effect on the neutron multiplication factor ("k-effective") in the spent fuel pool.[41]

- Geometric separation is a physical system or process that physically affects neutron coupling between assemblies in storage.[42]
- Solid neutron absorbers are a physical system or process that physically affects neutron absorption.[43]
- Soluble neutron absorbers are a physical system or process that physically affects neutron absorption.[44]
- Fuel enrichment, part of fuel reactivity, is a physical system or process that physically affects neutron production.[45]

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[39] Id. at ¶ 14.

[40] Dr. Thompson identified geometric spacing, solid neutron-absorbing material, soluble neutron absorber, and limits on burn-up and enrichment. Thompson Dep. Tr. (Exhibit 11 at 39-41).

[41] Turner Affidavit (Exhibit 2, ¶ 10).

[42] Id. at ¶11. BCOC admits this is a physical provision. See Thompson Dep. Tr. (Exhibit 11 at 51).

[43] Turner Affidavit (Exhibit 2, ¶ 12). BCOC admits this is a physical provision. See Thompson Dep. Tr. (Exhibit 11 at 51).

[44] Turner Affidavit (Exhibit 2, ¶ 13). BCOC admits this is a physical item. See Thompson Dep. Tr. (Exhibit 11 at 53).

- Fuel burnup, part of fuel reactivity, is a physical system or process that physically affects neutron production.[46]

All of these criticality control methods for spent fuel storage are physical systems or processes, consistent with the requirements of GDC 62.[47] Specifically, fuel enrichment limits and fuel burnup limits are physical systems or processes consistent with the requirements of GDC 62.[48] These two criticality methods are aspects of fuel reactivity, which is clearly a physical measure.[49]

As a practical matter, every one of the physical systems or processes for criticality control identified above is implemented using some administrative measures.[50]

- Geometric separation is implemented using administrative measures.[51]

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[45] Turner Affidavit (Exhibit 2, ¶ 16). BCOC admits this is a physical characteristic, property, or process. See Thompson Dep. Tr. (Exhibit 11 at 53). BCOC's Interrogatory Responses at 6-7 (Response to Interrogatory No. 2-14).

[46] Turner Affidavit (Exhibit 2, ¶ 17). BCOC admits this is a physical characteristic, property, or process. See Thompson Dep. Tr. (Exhibit 11 at 53). BCOC's Interrogatory Responses at 7 (Response to Interrogatory No. 2-15).

[47] Turner Affidavit (Exhibit 2, ¶ 28).

[48] Id. at ¶ 31.

[49] Id.

[50] Id. at ¶¶ 18, 29.

[51] Id. at ¶ 19. BCOC admits this fact. See Thompson Dep. Tr. (Exhibit 11 at 53, 55-56). In response to the Applicant's interrogatories, BCOC admitted that "[t]he construction and installation of fixed-geometry fuel racks, with or without attached solid neutron-

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- Solid neutron absorbers are implemented using administrative measures.[52]

- Soluble neutron absorbers are implemented using administrative measures.[53]

- Fuel enrichment, part of fuel reactivity, is implemented using administrative measures.[54]

- Fuel burnup, part of fuel reactivity, is implemented using administrative measures.[55]

While the type, degree, and timing of administrative controls vary for each of the physical systems or processes, it is a fact that every one of these physical measures for criticality control is implemented using some administrative measures.[56] No criticality

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absorbing material, requires that certain human actions are performed correctly." BCOC's Interrogatory Responses at 6 (Response to Interrogatory No. 2-12).

[52] Turner Affidavit (Exhibit 2, ¶ 20). BCOC admits this fact. See Thompson Dep. Tr. (Exhibit 11 at 54). BCOC's Interrogatory Responses at 6 (Response to Interrogatory No. 2-12).

[53] Turner Affidavit (Exhibit 2, ¶ 21). BCOC admits this fact. See Thompson Dep. Tr. (Exhibit 11 at 54-55).

[54] Turner Affidavit (Exhibit 2, ¶ 23). BCOC admits this fact. See Thompson Dep. Tr. (Exhibit 11 at 54-55).

[55] Turner Affidavit (Exhibit 2, ¶ 24). BCOC admits this fact. See Thompson Dep. Tr. (Exhibit 11 at 54-55).

[56] Turner Affidavit (Exhibit 2, ¶¶ 25, 30). Note that nothing in GDC 62 differentiates between physical systems or processes for criticality control based on the timing and duration of the administrative measures required to implement them. Id. at ¶ 30.

control methods can be implemented without some degree of administrative control.[57] In practice, therefore, GDC 62 encompasses criticality control by physical systems or processes that are implemented with the use of some administrative measures.[58] An interpretation that GDC 62 prohibits administrative measures to implement physical systems or processes for criticality control would render GDC 62 a nullity, because none of the available criticality control methods could comply with such an interpretation.[59] If this were the interpretation, GDC 62 would prohibit any method of criticality control.[60] The meaning given to GDC 62 must be consistent with the practical realities of implementing criticality control.

3. The Regulatory History of GDC 62 Reveals That Administrative Measures Were Always Understood to be Included in GDC 62

The regulatory history of GDC 62 reveals that the Commission has always understood that administrative measures were included within the scope of GDC 62.[61]

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[57] Id. at ¶ 18. BCOC acknowledges this fact as well. In Dr. Thompson's deposition, the following question and answer took place:

Q. Can you tell me which of the measures you've identified are purely physical and require absolutely no administrative measures to implement?

A. None of them are purely physical.

Thompson Dep. Tr. (Exhibit 11 at 53).

[58] Turner Affidavit (Exhibit 2, ¶ 29).

[59] Id.

[60] Id.

[61] The Applicant has assembled, and provided herein, from the regulatory history:

- Draft versions of GDC 62 prior to rulemaking, including:

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GDC 62 was promulgated by the Atomic Energy Commission ("AEC") through notice and comment rulemaking in the mid-1960's, and enacted as a final rule in 1971. The

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  - AEC Press Release H-252, "AEC Seeking Public Comment on Proposed Design Criteria for Nuclear Power Plant Construction Permits," Nov. 22, 1965 (with attached General Design Criteria for Nuclear Power Plant Construction Permits) ("1965 AEC Draft Criteria") (Exhibit 15A);
  - "Comparison of Drafts Dated October 20, 1966, and February 6, 1967 for General Design Criteria for Nuclear Power Plant Construction Permits," Feb. 6, 1967 ("Comparison of 10/66 and 2/67 Draft Criteria") (Exhibit 15B);
  - Memorandum from S. Hanauer (ACRS) to H. Etherington re: Review of New Draft General Design Criteria, Feb. 20, 1967 ("February 1967 ACRS Comments on Draft Criteria") (Exhibit 15C);
- Staff Memorandum recommending rulemaking (equivalent to a SECY), "Proposed Amendment to 10 CFR 50: General Design Criteria for Nuclear Power Plant Construction Permits," AEC-R 2/57, June 16, 1967 ("June 1967 Staff Memorandum Proposing Rulemaking") (Exhibit 15D);
- Commission's Proposed Rule with Statements of Consideration, 32 Fed. Reg. 10,213 (July 11, 1967) ("Proposed Rule") (Exhibit 16A);
- Public Comment on GDC 62, including:
  - Letter from W. Cottrell (Oak Ridge National Laboratory) to H. Price (AEC Staff), Sept. 6, 1967 ("ORNL Comment Letter") (Exhibit 17A);
  - Letter from J. Flaherty (Atomics International) to Secretary, AEC, Sept. 25, 1967 ("Atomics International Comment Letter") (Exhibit 17B);
- 1969 Revision to General Design Criteria, Letter from E. Case (AEC Staff) to S. Hanauer (ACRS) with attached "General Design Criteria for Nuclear Power Plants – July 15, 1969," July 23, 1969 ("1969 Revision to Proposed Criteria") (Exhibit 15E);
- Staff SECY Memorandum recommending final rule, "Amendment to 10 CFR 50 - General Design Criteria for Nuclear Power Plants," SECY-R-143, Jan. 28, 1971 ("January 1971 SECY Supporting Final Rule") (Exhibit 15F);
- Commission's Final Rule with Statements of Consideration, 36 Fed. Reg. 3,255 (Feb. 20, 1971) ("Final Rule") (Exhibit 16B).

original framers of GDC 62, as will be seen, understood "physical systems or processes" to encompass administrative measures.[62] However, the language of early drafts and the final criterion was, by design, cast in broad, general terms.[63] The first published version of GDC 62, issued for public comment in 1965, stated only that storage facilities "must be designed to prevent criticality."[64] This very broad language by itself indicates nothing about the implementation of criticality control.

By 1966, however, GDC 62 addressed methods for implementing criticality control. The October 1966 version of GDC 62 read:[65]

> Possibilities for inadvertent criticality must be prevented by engineered systems or processes to every extent practicable. Such means as geometric safe spacing limits shall be emphasized over procedural controls.

The purpose of the first sentence of GDC 62 is to identify the set of acceptable methods for criticality control. At this time it included "engineered systems or processes to every extent practicable." The second sentence of GDC 62 prioritizes the different methods for criticality control. At this time "geometric safe spacing limits" were emphasized over "procedural controls." It is essential to understand the different purposes of the two

[62] While the number of GDC 62 changed over time (e.g., first GDC 25, then GDC 61, then GDC 66, and finally GDC 62), Applicant herein consistently refers to this criterion as "GDC 62."

[63] The General Design Criteria are, by their very nature, cast in broad, general terms requiring additional interpretation. See Petition for Emergency and Remedial Action, CLI-78-6, 7 NRC 400, 406 (1978).

[64] 1965 AEC Draft Criteria at 8 (Exhibit 15A). At this time, GDC 62 was "Criterion 25."

sentences in this version, and subsequent versions, of GDC 62 – the first sentence sets the scope of acceptable methods, the second sentence prioritizes among methods. It is clear that the AEC Staff understood "engineered systems or processes" in GDC 62 to encompass "procedural controls." Procedural controls are one type of administrative measure.

By February 1967, GDC 62 had evolved to read:[66]

> Possibilities for criticality in new and spent fuel storage shall be prevented by physical systems or processes to every extent practicable. Such means as favorable geometries shall be emphasized over procedural controls.

The scope of acceptable measures for criticality control, as defined in the first sentence of GDC 62, had evolved to "physical systems or processes to every extent practicable." The only change to the second sentence was the terminology for the preferred method, "favorable geometries."[67] Since the first sentence defines the scope, it is clear that the AEC Staff understood "physical systems or processes" to encompass "procedural

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[65] See Comparison of 10/66 and 2/67 Draft Criteria at 18 (Exhibit 15B). The October 1966 version is obtained by backing out the revisions in the comparison.

[66] See Comparison of 10/66 and 2/67 Draft Criteria at 18 (Exhibit 15B). The February 1967 version is obtained by accepting the revisions in the comparison. By this time, GDC 62 was "Criterion 61."

[67] The wording "favorable geometries" was subsequently changed to "geometrically safe configurations," as it remains in its final form, in response to a comment from the Advisory Committee on Reactor Safeguards ("ACRS"). February 1967 ACRS Comments on Draft Criteria at 3 (Exhibit 15C).

controls," a type of administrative measure. The prioritization of methods in the second sentence still emphasized "such means as favorable geometries" over procedural controls.

The Staff proposed GDC 62 for Commission rulemaking in June 1967. The Staff recommended the following text for GDC 62 :[68]

> Criticality in new and spent fuel storage shall be prevented by physical systems or processes. Such means as geometrically safe configurations shall be emphasized over procedural controls.

The significant change in this revision was to drop the phrase "to every extent practicable" after "physical systems or processes." It is clear from the text, as proposed, that every criticality control method acceptable under GDC 62 must be a "physical system or process." Any methods mentioned in the second sentence, the prioritization sentence, must, of necessity, be encompassed in "physical systems or processes." The retention of "procedural controls" in the second sentence, the prioritization sentence, establishes that the AEC Staff understood "procedural controls," one type of administrative measure, to be encompassed in "physical systems or processes," within the meaning of GDC 62. The prioritization had not changed, geometric spacing was still emphasized over procedural controls.

The Commission adopted the AEC Staff's recommended wording in the proposed rulemaking for GDC 62. The text of GDC 62 in the Commission's proposed rule reads:[69]

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[68] June 1967 Staff Memorandum Proposing Rulemaking at 33 (Exhibit 15D). By this time, GDC 62 was "Criterion 66."

> Criticality in new and spent fuel storage shall be prevented by physical systems or processes. Such means as geometrically safe configurations shall be emphasized over procedural controls.

The first sentence is absolute. To meet GDC 62, a criticality control measure must fall within the scope of acceptable methods established in the first sentence. The Commission defined the scope of all acceptable means for criticality control as "physical systems or processes." The inclusion of "procedural controls" in the second sentence establishes that the Commission must have understood "procedural controls" to fall within the scope of "physical systems or processes," as it is defined in GDC 62. Therefore, physical systems or processes must be understood to include administrative measures. The prioritization in the second sentence remained unclear at that time. It was ambiguous as to whether "geometrically safe configurations" are preferred over *all* other methods, or *just* over "procedural controls." The phrase "[s]uch means as" further exacerbates this ambiguity.

The Commission received two public comments addressing GDC 62. The first public comment, from Oak Ridge National Laboratory, took issue with the Commission's acceptance of "procedural controls to prevent accidental criticality in storage facilities of power reactors."[70] To this end, the commenter requested the Commission to delete "processes" from "physical systems or processes" in the first sentence, and "procedural

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[69] Proposed Rule, 32 Fed. Reg. at 10,217 (Exhibit 16A).

[70] ORNL Comment Letter at 11 (Exhibit 17A).

controls" from the second sentence.[71] The Commission did not accept this comment. The final version of GDC 62 retains the terminology "physical systems or processes," and therefore, the Commission's understanding that procedural controls are included within the scope of GDC 62 was not changed.[72] The commenters' second change was incorporated as part of clarifying the prioritization in the second sentence of GDC 62, as discussed below.

The second public comment, from Atomics International, addressed the ambiguity in the prioritization established in the second sentence of GDC 62.[73] The commenter requested the Commission to revise the second sentence to read "Inherent means should be used where practicable."[74] In this way, the second sentence would address only one type of measure, "inherent means," and would state the Commission's intent that this is a preference, to be used "where practicable."[75] While it did not adopt the specific words offered by the commenter, the Commission did incorporate the commenter's intent. In the final rule, the Commission revised the prioritization sentence to state simply "preferably by use of geometrically safe configurations."[76] By including only one method in the prioritization sentence, the Commission indicated that "geometrically safe

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[71] Id.

[72] See Final Rule, 36 Fed. Reg. at 3,260.

[73] Atomics International Comment Letter at 4 (Exhibit 17B).

[74] Id.

[75] Id.

[76] Final Rule, 36 Fed. Reg. at 3,260.

configurations" were preferred over *all* other methods, not *just* over procedural controls.[77] The Commission also deleted the ambiguous phrase "such terms as" to further clarify its intent in prioritizing criticality control measures.[78] The prioritization in the second sentence (now second phrase) is still stated in terms of a preference, which does not itself rule any other measures out.

The Staff SECY paper recommending the final rulemaking lends support to the interpretation that the ORNL comment was rejected.[79] The ORNL comment, requesting that procedural controls no longer be permitted under GDC 62, would have made a very significant substantive change to the meaning and scope of GDC 62. In discussing the changes made between the proposed rule and the final rule, the SECY states that:[80]

> Most of the comments received were in the form of suggested improvements in language to facilitate understanding of the intent of the criteria, with few suggestions to change or delete many requirements. The more significant comments and our resolution of them [are discussed below].

The discussion of significant comments in the SECY does not discuss any of the text changes to GDC 62, indicating that the changes made to GDC 62 were not substantive,

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[77] The Commission also made the prioritization sentence, now reduced to just one preferred method, into a second phrase of the first sentence. This is just a change in grammar for brevity and clarity. It does not change the underlying construct of the two sentence (now two phrase) structures: the first sentence (phrase) establishes the set of acceptable measures for achieving criticality control; and the second sentence (phrase) prioritizes among the available measures.

[78] See Final Rule, 36 Fed. Reg. at 3,260.

[79] See January 1971 SECY Supporting Final Rule at 2-3 (Exhibit 15F).

but rather just improvements in language to facilitate understanding.[81] Certainly, a change of the magnitude requested by ORNL would have been discussed as a significant change, had it been made. Moreover, the change made to the second sentence, prioritization of the available measures, improved the language and facilitated understanding of the Commission's intent that geometrically safe configurations are to be preferred over all other methods.

In the Commission's final rule, GDC 62 reads:[82]

> Criticality in the fuel storage and handling system shall be prevented by physical systems or processes, preferably by use of geometrically safe configurations.

The phrase "shall be prevented by physical systems or processes" in the first sentence (now first phrase), identifying the set of available criticality control measures under GDC 62, remains unchanged from the proposed rule.[83] A review of the regulatory history of the text of GDC 62 reveals that the definition of "physical systems or processes" was never changed from its definition in the proposed rule. It has always included administrative measures.

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[80] Id.

[81] See id. at 3-6.

[82] Final Rule, 36 Fed. Reg. at 3,260. The final wording of GDC 62 had been developed by the AEC Staff by 1969. See 1969 Revision to Proposed Criteria (Exhibit 15E).

[83] Compare the Final Rule, 36 Fed. Reg. at 3,260 ("Criticality in the fuel storage and handling system shall be prevented by physical systems or processes," with the Proposed Rule, 32 Fed. Reg. at 10,217 ("Criticality in new and spent fuel storage shall be prevented by physical systems or processes"). The relevant language is identical.

4. The Commission's 10 C.F.R. § 50.68 Rulemaking Affirms that the Commission Permits Administrative Measures, Fuel Enrichment Limits, and Fuel Burnup Limits for Criticality Control

The Commission's promulgation of new regulations for criticality accident requirements for spent fuel storage squarely addresses and resolves the legal issue raised in Basis 1 of Contention 2. The Commission issued 10 C.F.R. § 50.68 in late 1998. The rulemaking history[84] and the new regulation itself clearly demonstrate that the Commission endorses the use of administrative measures to implement criticality control, and permits fuel enrichment limits and fuel burnup limits as methods of criticality control.

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[84] 10 C.F.R. § 50.68 was promulgated by the Commission through notice and comment rulemaking. For the Board's convenience, we have included as exhibits all the applicable documents for the Commission's 10 C.F.R. § 50.68 rulemaking:

- Staff memorandum SECY-97-155, "Staff's Action Regarding Exemptions from 10 CFR 70.24 for Commercial Nuclear Power Plants," SECY-97-155 (July 21, 1997) ("SECY-97-155") (Exhibit 18A);
- Commission's SRM and voting records approving SECY-97-155, "Staff Requirements – SECY-97-155," (August 19, 1997) and attached Commission Voting Record ("SRM and Voting Sheets") (Exhibit 18B);
- Commission's direct final rule, 62 Fed. Reg. 63,825 (1997) ("50.68 Direct Final Rule") (Exhibit 19A);
- Commission's proposed rule, 62 Fed. Reg. 63,911 (1997) ("50.68 Proposed Rule") (Exhibit 19B);
- Public comment on proposed rule, Letter from M. Voth (Northern States Power) to Secretary of NRC (Jan. 2, 1998) ("NSP Public Comment Letter") (Exhibit 19C);
- Commission's withdrawal of direct final rule, 63 Fed. Reg. 9,402 (1998) ("50.68 Direct Final Rule Withdrawal") (Exhibit 19D);
- Commission's final rule, 63 Fed. Reg. 63,127 (1998) ("50.68 Final Rule") (Exhibit 19E).

The 10 C.F.R. § 50.68 rulemaking identifies criticality control measures the Commission permits in compliance with GDC 62. The Staff memorandum (SECY-97-155) that initiated the rulemaking, specifically addresses GDC 62.[85] SECY-97-155 was reviewed and approved by the Commission.[86] The Commission's 50.68 Direct Final Rule explictly addresses GDC 62:[87]

> General Design Criterion (GDC) 62 in Appendix A to 10 CFR Part 50 reinforces the prevention of criticality in fuel storage and handling through physical systems, processes, and safe geometrical configuration. Moreover, fuel handling at power reactor facilities occurs only under strict procedural control.

10 C.F.R. § 50.68 addresses methods for preventing inadvertent criticality events at nuclear [power] plants licensees, which is the same purpose as GDC 62.[88] It is clear that the Commission understood it was discussing the same criticality control provisions as GDC 62 in its statements on 10 C.F.R. § 50.68.

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[85] SECY-97-155 (Exhibit 18A) at 3.

[86] SRM and Voting Sheets at 1 (Exhibit 18B).

[87] 62 Fed. Reg. at 63,826 (Exhibit 19A). The direct final rule was withdrawn pursuant to significant comments received on the proposed rule. See 63 Fed. Reg. at 9,402 (50.68 Direct Final Rule Withdrawal) (Exhibit 19D). The proposed rule was continued subject to standard notice and comment rulemaking provisions. Id. The proposed rule published in the Federal Register referred to the concurrently noticed direct final rule for substance. See 62 Fed. Reg. at 63,911 (50.68 Proposed Rule) (Exhibit 19B).

[88] 63 Fed. Reg. at 63,129 (50.68 Final Rule) (Exhibit 19E). The Commission stated that when these methods of criticality control are implemented, "the conditions which could lead to a criticality event are so unlikely that the probability of occurrence of an inadvertent criticality is negligible." 62 Fed. Reg. at 63,825 (50.68 Direct Final Rule) (Exhibit 19A). The Commission's safety assessments have concluded that "the

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The 10 C.F.R. § 50.68 rulemaking expressly acknowledges and permits the use of administrative measures to implement criticality control. SECY-97-155 states that "commercial nuclear power plants have *procedures* and design features that prevent inadvertent criticality," and "[t]he staff considers a fuel-handling accidental criticality at a commercial nuclear power plant to be extremely unlikely due to *administrative* and design controls.[89] In the statements of consideration for the Direct Final Rule, the Commission noted that "[n]uclear power plant licensees have *procedures* and the plants have design features *to prevent inadvertent criticality*."[90] None of these statements were withdrawn in the final rule.[91] Moreover, the final text of 10 C.F.R. § 50.68 includes "plant procedures" and "administrative controls" for criticality control.[92] 10 C.F.R. § 50.68, as adopted, acknowledges and permits the use of administrative controls to implement criticality control methods for fuel storage pools.[93] A review of the 10 C.F.R.

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likelihood of criticality [is] negligible." 63 Fed. Reg. at 63,127 (50.68 Final Rule) (Exhibit 19E).

[89] SECY-97-155 at 2-3 (Exhibit 18A) (emphasis added). SECY-97-155 also refers to "strict procedural control and supervision" and "administrative and design controls" (several times) as means for criticality control in fuel storage and handling. Id. at 3. The SECY was reviewed and approved by the Commission. See SRM and Voting Sheets at 1 (Exhibit 18B).

[90] 62 Fed. Reg. at 63,825 (50.68 Direct Final Rule) (Exhibit 19A) (emphasis added). On the same page, the Commission discusses GDC 62, immediately followed by statements regarding "strict procedural control" and "administrative controls" to prevent criticality. Id. at 63,826. The Commission did not modify these statements in the 50.68 Final Rule.

[91] See 63 Fed. Reg. at 63,127 (50.68 Final Rule) (Exhibit 19E).

[92] 63 Fed. Reg. at 63,130 (50.68 Final Rule) (Exhibit 19E).

[93] Turner Affidavit, ¶ 37 (Exhibit 2).

§ 50.68 rulemaking demonstrates that the Commission understands and permits the use of administrative measures to implement criticality control methods for spent fuel storage and handling.

As adopted, 10 C.F.R. § 50.68 explicitly acknowledges and permits the use of fuel enrichment limits as a criticality control method for fuel storage in pools. 10 C.F.R. § 50.68(b)(7) specifically permits the use of fuel enrichment limits for criticality control.[94] The Commission determined that a fuel enrichment limit addresses criticality concerns.[95] Fuel enrichment limits are implemented using administrative measures.

As adopted, 10 C.F.R. § 50.68(b)(4) specifically directs that "spent fuel storage racks loaded with fuel of the maximum fuel assembly reactivity" be considered for criticality control purposes. Spent fuel assembly reactivity, as stated in 10 C.F.R. § 50.68 (b)(4), includes the effects of fuel burnup, and thus implicitly permits the use of fuel burnup limits as a method of criticality control.[96] The Direct Final Rule, as proposed, would have required that spent fuel storage analyses be evaluated using "the maximum permissible U-235 enrichment."[97] The maximum U-235 enrichment represents fresh fuel, before it undergoes any burnup. One public comment specifically addressed this

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[94] See also discussion in Turner Affidavit, ¶¶ 36, 37 (Exhibit 2).

[95] Id. at 63,128.

[96] See Turner Affidavit, ¶¶ 35, 37 (Exhibit 2).

[97] 62 Fed. Reg. at 63,827 (50.68 Direct Final Rule) (Exhibit 19A) (the proposed 10 C.F.R. § 50.68(b)(4)).

issue.[98] The commenter requested that the phrase "maximum permissible U-235 enrichment" in proposed 10 C.F.R. § 50.68 (b)(4) be replaced by the phrase "maximum fuel assembly reactivity" because, in part, fuel assembly reactivity is comprised of a number of factors, of which enrichment is only one.[99] The NRC Staff's fuel storage criticality safety expert, Dr. Laurence I. Kopp, confirmed that fuel reactivity includes the effects of burnup.[100] BCOC's expert also admitted that fuel reactivity includes the effects of burnup.[101] Fuel assembly reactivity does include the effects of fuel burnup.[102] In the Final Rule, the Commission revised 10 C.F.R. § 50.68 (b)(4) to allow licensees to use "maximum fuel assembly reactivity," which includes the effects of fuel burnup, in place of "maximum permissible U-235 enrichment," in demonstrating criticality control.[103] As adopted by the Commission, 10 C.F.R. § 50.68, therefore, acknowledges and permits the use of fuel burnup as a method for criticality control in spent fuel storage,

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[98] NSP Public Comment Letter at 1 (Exhibit 19C).

[99] Id.

[100] Kopp Deposition Transcript of November 4, 1999 ("Kopp Dep. Tr.") attached hereto as Exhibit 12 at 40. Dr. Kopp's deposition transcript is included as Exhibit 12. In Dr. Kopp's deposition, the following question and answer took place:

Q. Dr. Kopp, in your opinion does the term "reactivity" include the effects of burnup?

A. Certainly burnup determines the reactivity of a fuel assembly.

Kopp Dep. Tr. at 40 (Exhibit 12).

[101] Thompson Dep. Tr. at 66 (Exhibit 11).

[102] Turner Affidavit, ¶¶ 14, 17, 35, 37 (Exhibit 2).

[103] 63 Fed. Reg. at 63,128, 63,130 (50.68 Final Rule) (Exhibit 19E).

and necessarily permits administrative measures to implement such criticality control methods for fuel pool storage.[104]

BCOC's legal position regarding GDC 62 is inconsistent with the Commission's pronouncements on criticality control as adopted in 10 C.F.R. § 50.68 in 1998.

5. NRC Staff's Determination that Fuel Enrichment and Burnup Limits Comply with GDC 62 Should Be Accorded Considerable Weight

The NRC Staff has consistently interpreted GDC 62 to encompass the use of fuel enrichment and burnup limits for criticality control. The Staff has also acknowledged that these criticality control methods require some administrative measures to implement. The Staff has implemented fuel enrichment and burnup limits for criticality control through generic guidance and case-by-case implementation in license amendment approvals over a period of almost 20 years.

The NRC Staff's guidance governing spent fuel pool criticality control permits the use of fuel enrichment and burnup limits, and outlines the administrative measures required to implement these methods. The NRC Staff initially permitted fuel enrichment and burnup limits for spent fuel pool criticality control through Reg. Guide 1.13, draft Revision 2 ("Reg. Guide 1.13"), issued in 1981.[105] Appendix A of Reg. Guide 1.13 provides specific guidance on the administrative measures used to implement fuel

[104] Turner Affidavit (Exhibit 2, ¶ 35, 37).

[105] A copy of Reg. Guide 1.13 (Rev. 2) is included as Attachment D to Exhibit 2 (Turner Affidavit). See Turner Affidavit (Exhibit 2, ¶ 49).

enrichment and burnup limits used for criticality control. Although Reg. Guide 1.13 (Rev. 2) was never issued in final form, the NRC Staff's practice of implementing its provisions for two decades demonstrates that it is *de facto* final NRC Staff guidance.

The NRC Staff has implemented its guidance permitting fuel enrichment and burnup limits in approving numerous license amendment requests to expand the capacity of spent fuel pool storage beginning in the early 1980's. BCOC acknowledges the NRC Staff's pattern and practice of approving fuel enrichment and burnup limits for spent fuel pool criticality control.[106] Dr. Turner has identified at least 20 nuclear power plants across the country where the Staff has approved the use of fuel enrichment and burnup limits as a criticality control method for spent fuel pool storage.[107] In approving each of these license amendments approvals, the NRC Staff made a case-by-case determination that fuel enrichment and burnup limits comply with GDC 62.[108] Each of these license

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[106] See Thompson Dep. Tr. at 172-75 (Exhibit 11).

[107] Turner Affidavit (Exhibit 2, ¶ 51). For examples of some recent approvals, see, e.g., 58 Fed. Reg. 28,050, 28,069 (1993) (Sequoyah); 59 Fed. Reg. 27,049, 27,703 (1994) (Salem); 61 Fed. Reg. 7,542, 7,566 (1996) (Comanche Peak); 63 Fed. Reg. 40,551, 40,566 (1998) (Waterford).

[108] For example, in approving the license amendment for Waterford, the Staff concluded that "General Design Criterion 62 . . . is met" by "burnup reactivity equivalencing" implemented using "enrichment versus burnup ordered pairs." See Letter from NRC to Entergy Operations and Enclosed Safety Evaluation at 2-3 (July 10, 1998) (Waterford) (PDR Nos. 9807140341, 347).

amendment approvals is founded on an extensive safety analysis by the Staff and a determination of compliance with all applicable NRC regulations, including GDC 62.[109]

The NRC Staff has confirmed its interpretation that fuel enrichment and burnup limits comply with GDC 62 in its most recent guidance document. The NRC Staff issued its new guidance memorandum on criticality control in 1998 ("1998 Criticality Guidance").[110] This new guidance effectively replaces Reg. Guide 1.13. The 1998 Criticality Guidance is intended to comply with GDC 62.[111] In addition to approving fuel enrichment and burnup limits, this document outlines the administrative measures required to implement these methods.[112]

The NRC Staff has established a long-standing pattern and practice of interpreting GDC 62 to include the use of fuel enrichment and burnup limits for criticality control in spent fuel pool storage. The NRC Staff has done so both through guidance documents and numerous case-by-case license amendment approvals involving detailed safety analyses.

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[109] As a condition precedent to approving these license amendments, the Staff is required to determine that all the General Design Criteria have been satisfied. 36 Fed. Reg. 3255, (1971).

[110] "Guidance on the Regulatory Requirements for Criticality Analysis of Fuel Storage at Light-Water Reactor Plants" (August 1998) ("1998 Criticality Guidance") (Attachment H to Exhibit 2). See Turner Affidavit, ¶ 50 (Exhibit 2).

[111] See 1998 Criticality Guidance (Attachment H to Exhibit 2) at 1.

[112] See Turner Affidavit, ¶ 50 (Exhibit 1).

The NRC Staff's interpretations of GDC 62 should be accorded "considerable weight."[113] When a General Design Criterion is being interpreted, the Commission has directed that where "there is conformance with regulatory guides, there is likely to be compliance with the GDC."[114] Of course, here the Staff's consistent interpretation over two decades has been recently endorsed by the Commission itself in adopting 10 C.F.R. § 50.68.

6. Summary of Undisputed Material Facts and Conclusions of Law Sustaining the NRC Staff's Interpetation of GDC 62 Permitting Fuel Enrichment and Burnup Limits for Criticality Control and the Administrative Measures Required to Implement Such Limits

Applicant's arguments for sustaining the NRC Staff's interpretation of GDC 62 can be summarized as follows:

- All methods of criticality control for spent fuel pools, including fuel enrichment and burnup limits, are physical systems or processes.[115]

- All methods of criticality control for spent fuel pools, including fuel enrichment and burnup limits, are implemented by using some administrative measures.[116]

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[113] Consumers Power Co. (Big Rock Point Nuclear Plant), ALAB-725, 17 NRC 562, 568 (1983) (finding made for the specific issue of *spent fuel pool criticality control*).

[114] Petition for Emergency and Remedial Action, CLI-78-6, 7 NRC 400, 406-07 (1978).

[115] See Turner Affidavit, ¶¶ 9, 10, 16, 17 (Exhibit 2); Thompson Dep. Tr. at 51, 53 (Exhibit 11); BCOC's Interrogatory Responses at 6-7 (Responses to Interrogatories No. 2-14, 2-15).

- Fuel assembly reactivity includes the effects of fuel burnup.[117]

- The regulatory history of GDC 62, together with the Commission's statements of consideration in promulgating 10 C.F.R. § 50.68, establish that GDC 62 permits the use of administrative measures to implement physical systems or processes used for criticality control.

- 10 C.F.R. § 50.68 establishes directly that the Commission permits both fuel enrichment limits and fuel burnup limits to be used for criticality control in spent fuel storage.

- The NRC Staff's consistent interpretation of GDC 62 should be accorded considerable weight, particularly where its interpretation is the only one that could give practical meaning to GDC 62.

Thus, this Board should find as a matter of law:

- GDC 62 permits the use of administrative measures to implement criticality control methods.

- GDC 62 permits an applicant to take credit in criticality calculations for enrichment and burnup limits in fuel.

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[116] See Turner Affidavit, ¶¶ 18, 23, 24, 25 (Exhibit 2); Thompson Dep. Tr. at 53-56 (Exhibit 11).

[117] See Turner Affidavit, ¶¶ 14, 16, 17 (Exhibit 2); Kopp Dep. Tr. at 40 (Exhibit 12); Thompson Dep. Tr. at 66 (Exhibit 11).

- ◆ GDC 62 permits the use of administrative measures to implement these limits.

These conclusions of law answer the legal question raised in Contention 2, Basis 1, as admitted. The Board should therefore decide the question of law in the Applicant's favor and rule that an adjudicatory hearing is not necessary for resolution of Contention 2, Basis 1.

7. New Position Raised by BCOC Cannot be Considered by the Board Except as an Implicit Admission that its Position in Contention 2, Basis 1, is Untenable

We turn briefly to the new position raised by BCOC during the course of discovery. This new position is not the subject of an admitted contention, and should be ignored by the Board. Indeed, BCOC's new position undercuts its legal arguments in Contention 2, Basis 1.

During the course of discovery, BCOC effectively abandoned its admitted Contention 2, Basis 1 that "GDC 62 *prohibits* the use of *administrative measures*."[118] BCOC has instead staked out a new position that administrative measures are *permitted* under GDC 62, but that only *some* administrative measures are allowed, while others are not.[119]

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[118] Harris, LBP-99-25, supra, 50 NRC at 35 (emphasis added).

[119] See Section IV.A.1.b., supra.

It is too late for BCOC to "plead in the alternative" at this stage.[120] It would be inappropriate for the Board to consider BCOC's new legal position, except to note that it highlights the absurdity of BCOC's interpretation in the admitted Contention 2, Basis 1.

There is absolutely nothing in the text of GDC 62 drawing a line between different types of administrative measures. Nothing in GDC 62 differentiates between physical systems or processes for criticality control based on the timing and duration of the administrative measures required to implement different physical systems or processes.[121] BCOC's sole expert on Contention 2, Dr. Thompson, now appears to understand that his original position is untenable. But his new interpretation of GDC 62 has no more support than his first try.[122] Dr. Thompson's new interpretation of GDC 62, as articulated during discovery and in another NRC licensing proceeding, would appear on its own to doom BCOC's admitted Contention 2, Basis 1.

C. Summary of Facts, Data and Arguments which Demonstrate that a Single Fuel Assembly Misplacement Could Not Cause Criticality in Harris Spent Fuel Pools C or D (Contention 2, Basis 2)

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[120] The appropriate procedural mechanism for BCOC to have raised a new question of law would be through a late-filed contention. See 10 C.F.R. § 2.714(a)(1). BCOC has not filed a late-filed contention on this new issue, nor addressed the five late-filed factors in 10 C.F.R. § 2.714(a)(1). Applicant would oppose admission of such a contention.

[121] Turner Affidavit, ¶ 30 (Exhibit 2).

[122] Dr. Thompson is on a steep learning curve. By his own admission, Dr. Thompson has no training or experience with criticality control systems, no experience with criticality control regulation, nuclear power plant licensing, nuclear power plant operations, or nuclear plants as a general matter. Thompson Dep. Tr. at 25-29, 110 (Exhibit 11). His knowledge in this area is limited to his reading pursuant to this proceeding and a handful of tours of fuel handling buildings, for an hour at a time. Id. at 27-28, 33-36.

1. Admitted Basis 2 – Single Fuel Assembly Misplacement

Basis 2 raises a question of fact: will a single fuel assembly misplacement, involving a fuel element of the wrong burnup or enrichment, cause criticality in Harris spent fuel pools C and D? The following material facts are required to dispose of Basis 2:

1. The Applicant has performed a criticality analysis of a single fuel assembly misplacement, involving a fresh fuel assembly with the maximum permissible reactivity at Harris, for the spent fuel storage racks in Harris pools C and D.

2. The criticality analysis demonstrates that a single fuel assembly misplacement, involving a fresh fuel assembly fuel element with the maximum permissible reactivity at Harris, will not cause criticality in Harris pools C and D.

The Board should dispose of Basis 2 in the Applicant's favor if these two material facts are answered in the affirmative.

Following the admission of Basis 2, the Applicant performed a supplemental analysis to evaluate the misplacement of a single fuel assembly in the spent fuel storage racks for Harris pools C and D.[123] The results of this analysis are documented in Holtec

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[123] Redmond Affidavit (Exhibit 3, ¶ 9); DeVoe Affidavit (Exhibit 4, ¶ 4). This analysis was performed even though the question had already been addressed through previous analyses by Holtec International ("Holtec") for another plant with similar spent fuel

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report no. HI-992283, Evaluation of Fresh Fuel Assembly Misload in Harris Pools C and D, Rev. 0, dated September 20, 1999 ("Harris Misplacement Analysis").[124] The Harris Misplacement Analysis performs a fuel assembly misplacement analysis specifically for the spent fuel storage racks for Harris pools C and D, using the specific fuel assembly characteristics and spent fuel storage rack designs for Harris spent fuel pools C and D.[125] The Harris Misplacement Analysis also addresses the additional scenario of misplacement of a fresh fuel assembly assuming no soluble boron in the pool water, which exceeds the NRC Staff's misplacement analysis requirements.[126]

The Harris Misplacement Analysis was performed by Dr. Everett L. Redmond II, a nuclear criticality analyst employed by Holtec.[127] Dr. Redmond had performed the original nuclear criticality analysis ("Harris Base Criticality Analysis") for the spent fuel

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storage racks and identical fuel to that used in the Harris analysis. Redmond Affidavit (Exhibit 3, ¶ 7); DeVoe Affidavit (Exhibit 4, ¶ 4). This previous analysis was the basis of the Applicant's statement in response to the proposed Basis 2 and its response to the Staff's RAI regarding the misplacement analysis. See Applicant's Answer to Petitioner BCOC's Contentions at 35-36; Redmond Affidavit (Exhibit 3, ¶ 8); Edwards Affidavit (Exhibit 1, ¶ 24). The Applicant's RAI response is included as Attachment C to Exhibit 1.

[124] The Harris Misplacement Analysis is included at Attachment B to Exhibit 3 (Redmond Affidavit).

[125] Redmond Affidavit (Exhibit 3, ¶¶ 10, 11, 15, 16); DeVoe Affidavit (Exhibit 4, ¶¶ 8, 9).

[126] Redmond Affidavit (Exhibit 3, ¶ 12). This additional analysis does, however, provide the analysis to render BCOC's first new issue moot.

[127] See Redmond Affidavit (Exhibit 3, ¶ 4).

storage racks in Harris pools C and D.[128] The Harris Misplacement Analysis uses the same analysis methodology, including the assumptions and modeling of the storage rack design and fuel assembly characteristics, as that developed for, and used in, the Harris Base Criticality Analysis.[129]

The Harris Misplacement Analysis evaluates the misplacement of a single fresh fuel assembly, of the maximum permissible enrichment at Harris, into a spent fuel storage rack that is otherwise loaded with fuel of the maximum permissible reactivity allowable under the burnup and enrichment curve.[130] The maximum reactivity fresh fuel assembly at Harris is a Westinghouse 15x15 Pressurized Water Reactor ("PWR") fuel assembly enriched to 5% (by weight) uranium-235.[131] The Harris Misplacement Analysis considered the presence of 2000 ppm of soluble boron in the pool water, as required by Harris operating procedures.[132] The analysis also evaluated criticality safety

[128] Redmond Affidavit (Exhibit 3, ¶ 13). The Harris Base Criticality Analysis is documented in Holtec report no. HI-971760, "Licensing Report for Expanding Storage Capacity in Harris Pools C and D." This analysis did not explicitly analyze a fresh fuel assembly misplacement event. Redmond Affidavit (Exhibit 3, ¶ 6). The Harris Base Criticality Analysis is part of the Harris License Amendment Request, which is included herein as Attachment A to Exhibit 1 (Edwards Affidavit).

[129] Redmond Affidavit (Exhibit 3, ¶¶ 13, 14, 15, 16, 17). Dr. Thompson could find no fault in the Harris Base Criticality Analysis and described this analysis as "a very carefully written, very presentable document that's in a high professional competence." Thompson Dep. Tr. (Exhibit 11 at 185).

[130] Redmond Affidavit (Exhibit 3, ¶ 16).

[131] Redmond Affidavit (Exhibit 3, ¶ 16); DeVoe Affidavit (Exhibit 4, ¶¶ 9, 10). This had already been determined in the Harris Base Criticality Analysis.

[132] Redmond Affidavit (Exhibit 3, ¶¶ 7, 11); DeVoe Affidavit (Exhibit 4, ¶ 10); Edwards Affidavit (Exhibit 1, ¶ 23).

assuming only 400 ppm of soluble boron was present in the pool water, to confirm CP&L's statements in its RAI response to the NRC Staff.[133] In addition, to demonstrate the robustness of criticality safety of the spent fuel storage racks for Harris pools C and D, the Harris Misplacement Analysis evaluated the limiting case of no soluble boron in the pool water at all.[134] While not considered a credible scenario, this analysis was performed to render moot any further discussion of the loss of soluble boron in this proceeding.

The methodology, assumptions, and results of the Harris Misplacement Analysis were reviewed and approved under the quality assurance requirements of both Holtec and CP&L. The analysis was verified and validated through the Holtec quality assurance process, which included an independent review and approval by another competent criticality analyst.[135] The analysis was also reviewed and approved by CP&L's Owner's Review process pursuant to CP&L's procedures.[136] These quality assurance reviews of the Harris Misplacement Analysis by qualified nuclear criticality analysts provides reasonable assurance that the results of the analysis are valid.

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[133] Redmond Affidavit (Exhibit 3, ¶¶ 7, 11); DeVoe Affidavit (Exhibit 4, ¶ 10).

[134] Redmond Affidavit (Exhibit 3, ¶ 12); DeVoe Affidavit (Exhibit 4, ¶ 10).

[135] Redmond Affidavit (Exhibit 3, ¶ 8).

[136] DeVoe Affidavit (Exhibit 4, ¶¶ 4-13). The CP&L Owner's Review determined that the input assumptions accurately reflected Harris fuel characteristics and spent fuel storage racks, and that the results were consistent with CP&L's nuclear criticality analysts' expectations. Id., ¶¶ 6, 8. The CP&L Owner's Review approved the Harris Misplacement Analysis with no adverse comments. Id., ¶¶ 11, 12, 13.

The results of the Harris Misplacement Analysis demonstrate that a single fuel assembly misplacement, involving a fuel element of the wrong burnup or enrichment, will not cause criticality in Harris spent fuel pools C and D.[137] The analysis demonstrates that the spent fuel storage racks, with the required 2000 ppm of soluble boron in the spent fuel pool water, will remain subcritical following the misplacement of a fresh fuel assembly with the maximum permissible enrichment at Harris, with a k-effective of 0.7783.[138] This is the analysis required to comply with the NRC Staff's guidance regarding a misplacement event.[139] The Harris Misplacement Analysis also demonstrates that the spent fuel storage racks will remain subcritical, with a k-effective of 0.9352, following a misplacement event assuming only 400 ppm of soluble boron is present in the spent fuel pool water.[140] This result confirms the response made by CP&L in its June 14, 1999 RAI response to the NRC.[141] Finally, the analysis demonstrates that the spent fuel storage racks for Harris pools C and D will remain subcritical following a fresh fuel assembly misplacement event even if no soluble boron (i.e., zero (0) ppm) is present in the spent fuel pool water, with a k-effective of 0.9932.[142]

[137] Redmond Affidavit (Exhibit 3, ¶ 20); DeVoe Affidavit (Exhibit 4, ¶ 10).

[138] Redmond Affidavit (Exhibit 3, ¶ 21); DeVoe Affidavit (Exhibit 4, ¶ 10).

[139] The analysis may take credit for the presence of soluble boron required by procedure to be maintained in the spent fuel pool water. Redmond Affidavit (Exhibit 3, ¶ 11).

[140] Redmond Affidavit (Exhibit 3, ¶ 22); DeVoe Affidavit (Exhibit 4, ¶ 10).

[141] Redmond Affidavit (Exhibit 3, ¶ 22). CP&L's June 14, 1999 RAI response is included herein as Attachment C to Exhibit 1 (Edwards Affidavit).

[142] Redmond Affidavit (Exhibit 3, ¶ 23); DeVoe Affidavit (Exhibit 4, ¶ 10); Edwards Affidavit (Exhibit 1, ¶ 26).

The supplemental criticality analysis performed in the Harris Misplacement Analysis, as documented in Attachment B of Exhibit 3, and supported by the sworn affidavits provided herein, provides the answers to the material facts required to dispose of the admitted Basis 2. The Harris Misplacement Analysis demonstrates in the affirmative that:

1. The Applicant has performed a criticality analysis of a single fuel assembly misplacement, involving a fresh fuel assembly with the maximum permissible reactivity at Harris, for the spent fuel storage racks in Harris pools C and D.[143]

2. The criticality analysis demonstrates that a single fuel assembly misplacement, involving a fresh fuel assembly fuel element with the maximum permissible reactivity at Harris, will not cause criticality in Harris pools C and D.[144]

Because these two materials facts are answered in the affirmative, and BCOC does not dispute them, the Board should dispose of Basis 2 in Applicant's favor.

2. Other Issues Raised by BCOC during Discovery Regarding Criticality Analysis

[143] See Redmond Affidavit (Exhibit 3, ¶¶ 7, 9, 10, 11, 15, 16); DeVoe Affidavit (Exhibit 4, ¶¶ 4, 8, 9, 10).

[144] See Redmond Affidavit (Exhibit 3, ¶¶ 20, 21, 22); DeVoe Affidavit (Exhibit 4, ¶ 10).

As discussed above, BCOC raised three additional issues during the course of discovery that exceed the scope of the admitted Basis 2:

1. The Applicant should have evaluated the loss of all soluble boron in the pool water concurrent with the misplacement of a fuel assembly.

2. The Applicant should have evaluated the concurrent misplacement of multiple fuel assemblies, over and above the misplacement of a single fuel assembly.

3. The Applicant should have analyzed the universe of scenarios involving two or more unlikely, independent, and concurrent events.

Each of these issues exceeds the scope of Basis 2, as admitted. In the event that BCOC attempts to raise these new issues, Applicant demonstrates below that each issue would be disposed of in the Applicant's favor, and, in any event, has been rendered moot by the supplemental criticality analyses performed by Dr. Redmond, Dr. Turner and the NRC Staff in this case.

a. BCOC's First New Issue

BCOC's first new issue alleges that the Applicant should evaluate the loss of all soluble boron in the pool water concurrent with the misplacement of a fuel assembly.

This analysis is not required under the Double Contingency Principle.[145] The Double Contingency Principle is sometimes called the Single Failure Criterion.[146] BCOC has admitted that the NRC Staff's definition of the Double Contingency Principle, as stated in Draft Regulatory Guide 1.13 ("Reg. Guide 1.13"), is consistent with the NRC's regulation of criticality control in GDC 62.[147] The Double Contingency Principle is defined in Reg. Guide 1.13 as follows:[148]

> At all locations in the LWR spent fuel storage facility where spent fuel is handled or stored, the nuclear criticality safety analysis should demonstrate that criticality could <u>not</u> occur without at least two unlikely, independent, and concurrent failures or operating limit violations.

Since the Double Contingency Principle is an NRC Staff development, the most appropriate way to determine its meaning is to inspect NRC Staff guidance.[149] The most

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145 The origin, meaning, and application of the Double Contingency Principle are addressed at length in the Affidavit of Stanley L. Turner, Ph.D., PE. Turner Affidavit (Exhibit 2, ¶¶ 38-45).

146 Id. at ¶ 38.

147 When it proposed Contention 2, BCOC addressed the Double Contingency Principle on page 1.13-9 of Reg. Guide 1.13, and then stated that "the language at page 1.13-9 [the Double Contingency Principle] is consistent with GDC 62." Orange County's Supplemental Petition to Intervene at 13.

148 Turner Affidavit (Exhibit 2, ¶¶ 39, 40). Reg. Guide 1.13 is included herein as Attachment D to Exhibit 2 (Turner Affidavit).

149 Even though the Double Contingency Principle (or Single Failure Criterion) is an NRC Staff development, in 10 C.F.R. § 50.68 the Commission effectively endorsed the use of the Single Failure Criterion for the evaluation of accident conditions in spent fuel storage pools. Turner Affidavit (Exhibit 2, ¶ 34).

recent published NRC Staff guidance ("1998 Criticality Guidance") defines the Double Contingency Principle as follows:[150]

> ABNORMAL CONDITIONS AND THE DOUBLE-CONTINGENCY PRINCIPLE
>
> The criticality safety analysis should consider all credible incidents and postulated accidents. However, by virtue of the double-contingency principle, *two unlikely independent and concurrent incidents or postulated accidents are beyond the scope of the required analysis*. The double-contingency principle means that a realistic condition may be assumed for the criticality analysis in calculating the effects of incidents or postulated accidents. For example, if soluble boron is normally present in the spent fuel pool water, the loss of soluble boron is considered as one accident condition and *a second concurrent accident need not be assumed.* Therefore, credit for the presence of the soluble boron may be assumed in evaluating other accident conditions.

(Emphasis added). The Double Contingency Principle, as defined by the NRC Staff, requires that the Applicant's criticality analysis consider separately each single unlikely, independent incident or credible accident condition.[151] There is no requirement under the Double Contingency Principle to evaluate two or more unlikely, independent, concurrent incidents or postulated accidents; such an analysis is beyond the scope of the required analysis.[152] The Double Contingency Principle has always been interpreted this way.[153] Applicant's criticality analysis for Harris, including the supplemental analysis in the

[150] Turner Affidavit (Exhibit 2, ¶ 41). The 1998 Criticality Guidance is included herein as Attachment H to Exhibit 2 (Turner Affidavit).

[151] Id. at ¶ 43.

[152] Id. at ¶¶ 43, 45.

Harris Misplacement Analysis, correctly implements the Double Contingency Principle.[154]

Loss of soluble boron is a highly unlikely (in fact, not credible) accident condition that is independent from a fuel misplacement event. A boron dilution event resulting in the loss of all soluble boron down to 400 ppm or less is not a credible event for Harris spent fuel pools C and D.[155] Harris operating procedures require that 2000 ppm of soluble boron be maintained in the spent fuel pools at all times.[156] There is no known credible mechanism to dilute the pool water from 2000 ppm of soluble boron down to 400 ppm, or less.[157] A fuel assembly misplacement is a highly unlikely event at Harris.[158] Boron dilution and fuel assembly misplacement are entirely unrelated and independent unlikely events.[159] In fact, BCOC admits that boron dilution and misplacement of a fuel assembly are two separate events.[160] As two separate unlikely independent events, the concurrent analysis of a boron dilution event and a fuel assembly misplacement event is not required

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[153] Id. at ¶¶ 42, 44.

[154] Id. at ¶¶ 46.

[155] Edwards Affidavit (Exhibit 1, ¶¶ 23-25).

[156] Id. at ¶ 22. A copy of the Harris operating procedure is included at Attachment P to Exhibit 1 (Edwards Affidavit).

[157] Edwards Affidavit (Exhibit 1, ¶¶ 24, 25); see also Turner Affidavit (Exhibit 2, ¶ 21).

[158] Edwards Affidavit (Exhibit 1, ¶¶ 14-20).

[159] Id. at ¶ 23.

[160] Dr. Thompson admits that "[a] misplacement of a single assembly and an insufficiency of boron would be two separate errors." Thompson Dep. Tr. (Exhibit 11 at 133).

under the Double Contingency Principle. BCOC's first new issue, therefore, requests the Applicant to perform an analysis that is not required. If considered by the Board at all, BCOC's first new issue should be disposed of in Applicant's favor.

Applicant's supplemental Harris Misplacement Analysis renders this discussion moot. Regardless of whether or not the Double Contingency Principle requires it, the Harris Misplacement Analysis evaluated the concurrent misplacement of a fresh fuel assembly combined with the loss of all soluble boron in the Harris spent fuel pools.[161] The Harris Misplacement Analysis demonstrates that the spent fuel storage racks in Harris pools C and D will remain subcritical following a fresh fuel assembly misplacement event, even if no soluble boron (i.e., zero (0) ppm) is present in the spent fuel pool water.[162] Thus, BCOC's first new issue, alleging that the Applicant should evaluate the loss of all soluble boron and the concurrent misplacement of a fuel assembly, has been demonstrated to be moot by the Harris Misplacement Analysis.

b. BCOC's Second New Issue

BCOC's second new issue alleges the Applicant should have evaluated the concurrent misplacement of multiple fuel assemblies, over and above the misplacement of a single fuel assembly. As in the first issue, BCOC's requested analysis is not required

[161] Redmond Affidavit (Exhibit 3, ¶ 12).

[162] Redmond Affidavit (Exhibit 3, ¶ 23); Edwards Affidavit (Exhibit 1, ¶ 26); Turner Affidavit (Exhibit 2, ¶ 48).

under the Double Contingency Principle. Moreover, as with the first issue, supplemental criticality analysis performed for this proceeding has demonstrated that this issue is moot.

As discussed above, the Double Contingency Principle, as defined by the NRC Staff, requires that the Applicant's criticality analysis consider separately each single unlikely, independent incident or credible accident condition.[163] There is no requirement under the Double Contingency Principle to evaluate two or more unlikely, independent, concurrent incidents or postulated accidents; such an analysis is beyond the scope of the required analysis.[164] Misplacement of a single fuel assembly at Harris is a highly unlikely event, and, in fact, has never occurred at Harris.[165] Because of procedural and physical limitations, each movement of an individual fuel assembly in the Harris spent fuel pools is a separate, independent event.[166] The concurrent misplacement of multiple fuel assemblies in the Harris spent fuel pools is not credible.[167] Therefore, multiple fuel assembly misplacements would require the occurrence of two or more unlikely, independent, and concurrent incidents or postulated accidents. As two or more separate unlikely independent events, multiple fuel assembly misplacement events are not required to be analyzed under the Double Contingency Principle. BCOC's second new issue, therefore, requests Applicant to perform an analysis that is not required. If

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[163] Id. at ¶ 43.

[164] Id. at ¶¶ 43, 45.

[165] Edwards Affidavit (Exhibit 1, ¶¶ 14-20).

[166] Id. at ¶¶ 12, 13.

[167] Id. at ¶¶ 21, 22.

considered by the Board at all, BCOC's second new issue should be disposed of in Applicant's favor.

Moreover, as with the first new issue, the supplemental Harris Misplacement Analysis performed for this proceeding renders this discussion moot. In response to BCOC's allegations of multiple fuel assembly misplacements, the NRC Staff performed a supplemental criticality analysis for this proceeding ("NRC Staff's Criticality Analysis").[168] Applicant's nuclear criticality experts, Dr. Stanley Turner and Dr. Everett Redmond II, have both reviewed and confirmed the methodology, assumptions, and results of the NRC Staff's Criticality Analysis.[169] The NRC Staff's Criticality Analysis evaluates the concurrent misplacement of an infinite number of fresh fuel assemblies of the maximum permissible reactivity at Harris.[170] Even BCOC admits that this assumption exceeds what needs to be considered.[171] The NRC Staff's Criticality Analysis demonstrates that the spent fuel storage racks in Harris pools C and D will

[168] Redmond Affidavit (Exhibit 3, ¶¶ 24-27); Turner Affidavit (Exhibit 2, ¶¶ 52-55). The NRC Staff's Criticality Analysis is included herein as Attachment C to Exhibit 3 (Redmond Affidavit).

[169] Redmond Affidavit (Exhibit 3, ¶¶ 25, 26); Turner Affidavit (Exhibit 2, ¶¶ 53-54). Dr. Turner also performed an independent analysis that confirms the results obtained by the NRC Staff. Turner Affidavit (Exhibit 2, ¶ 54).

[170] Consistent with the Double Contingency Principle, the analysis includes the 2000 ppm of soluble boron required to be in the spent fuel pool water pursuant to Harris operating procedures. Redmond Affidavit (Exhibit 3, ¶ 24); Turner Affidavit (Exhibit 2, ¶ 52).

[171] Dr. Thompson admitted that the misplacement of an entire pool full of assemblies has a low enough probability that it need not be considered. Thompson Dep. Tr. (Exhibit 11at 164-65).

remain subcritical following an infinite number of fresh fuel assembly misplacements.[172] Thus, the Harris spent fuel storage racks will remain subcritical even if every location in the spent fuel storage rack is assumed to be concurrently loaded with a misplaced fresh fuel assembly of the maximum permissible reactivity at Harris.[173] BCOC's second new issue, alleging that CP&L should evaluate the multiple fuel assembly misplacements, has been demonstrated to be moot by the NRC Staff's Criticality Analysis.

c. BCOC's Third New Issue

BCOC's third new issue alleges that Applicant should have analyzed the universe of scenarios involving two or more unlikely, independent, and concurrent events. As with the first two new issues, BCOC's requested analysis is not required under the Double Contingency Principle. There is no requirement to analyze the universe of two or more unlikely, independent, and concurrent incidents or postulated accidents that, taken all together, could result in criticality.[174] Moreover, in light of the many criticality analyses that Applicant has already performed, BCOC has admitted that the only missing scenario, from its "universe" of scenarios of two or more failures, is multiple fuel assembly misplacements.[175] BCOC's narrowing of the remaining universe of scenarios down to multiple fuel assembly misplacements renders the third new issue, in practical

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[172] Redmond Affidavit (Exhibit 3, ¶ 27); Turner Affidavit (Exhibit 2, ¶ 55).

[173] Id.

[174] Turner Affidavit (Exhibit 2, ¶ 45).

[175] Dr. Thompson admitted that the remaining "universe," for this particular case, includes only the assumption of multiple fuel assembly misplacements. Thompson Dep. Tr. (Exhibit 11 at 195-96).

effect, identical to the second issue. Just like the second issue, then, BCOC's request to analyze the misplacement of multiple fuel assemblies, which comprises two or more unlikely, independent, and concurrent errors, is not required to be analyzed under the Double Contingency Principle. If considered by the Board at all, BCOC's third new issue should be disposed of in Applicant's favor.

Moreover, as with the second new issue, the NRC Staff's Criticality Analysis renders BCOC's third new issue moot.[176] BCOC has admitted that the remaining universe of scenarios, for this particular case, is limited to multiple fuel assembly misplacements.[177] The NRC Staff's Criticality Analysis demonstrates that the spent fuel storage racks for Harris pools C and D will remain subcritical following an infinite number of fresh fuel assembly misplacements.[178] Thus, BCOC's third new issue has also been rendered moot by the NRC Staff's Criticality Analysis.

D. Intervenor BCOC Cannot Meet its Burden of Demonstrating an Adjudicatory Hearing Must Be Held to Dispose of Contention 2

1. Basis 1 is a Question of Law for which an Adjudicatory Hearing is Not Appropriate

The issue presented in Basis 1 is a question of law that does not require an adjudicatory hearing and can be decided on the written and oral legal arguments. The

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[176] Redmond Affidavit (Exhibit 3, ¶¶ 24-27); Turner Affidavit (Exhibit 2, ¶¶ 52-55).

[177] Thompson Dep. Tr. (Exhibit 11 at 195-96).

[178] Redmond Affidavit (Exhibit 3, ¶ 27); Turner Affidavit (Exhibit 2, ¶ 55).

Board admitted Basis 1 as "a question of law" to be addressed by "legal arguments."[179] The Commission has determined that issues of law should be decided on the basis of briefs and oral argument.[180] The only quasi-factual issues in Basis 1 are that all available methods of criticality control, including fuel enrichment and burnup limits, are physical systems or processes that are implemented using administrative measure, and that fuel assembly reactivity includes the effects of fuel burnup. However, these facts have been admitted by all parties, and therefore do not present any genuine and substantial dispute of fact. The underlying legal issue can and should be decided by the Board on the basis of the legal arguments in the parties' respective filings and during oral argument.[181]

2. Basis 2 Presents no Genuine and Substantial Dispute of Fact for an Adjudicatory Hearing

There is no dispute of fact regarding the material facts necessary for the Board to dispose of Basis 2. The only material facts required to dispose of Basis 2, as admitted by the Board, are that Applicant has analyzed criticality for a single fuel assembly fuel assemply misplacement in Harris spent fuel pools C and D, and that the criticality analysis demonstrates the misplacement will not cause criticality. BCOC has admitted that Applicant's supplemental Harris Misplacement Analysis satisfactorily answers these

[179] Harris, LBP-99-25, supra, 50 NRC at 35-36.

[180] See 10 C.F.R. § 2.714(e).

[181] These legal arguments are supported by numerous documents and sworn statements submitted with the filing.

questions.[182] Moreover, BCOC has repeatedly stated that it will not challenge the validity of the criticality calculations in the Harris Misplacement Analysis.[183] In any event, BCOC's sole expert for Basis 2, by his own admission, is not competent to challenge the nuclear criticality analyses.[184] Thus, there is no genuine and substantial dispute of fact regarding Applicant's demonstration that misplacement of a single fuel assembly will not cause criticality in Harris pools C and D. Therefore, Contention 2, Basis 2, should be dismissed.

The technical issues in Basis 2 can be accurately resolved based on the written submissions and attached technical reports, regardless of whether there is any dispute. The question of fact in Basis 2 is one of a technical nature - - will criticality occur in the Harris pools following a fuel assembly misplacement. The Applicant has submitted the

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182 In his sworn deposition, Dr. Thompson admitted that the Harris Misplacement Analysis "does address the question of a single fuel assembly misplacement . . . [a]nd this finding, this Holtec finding mentioned in Exhibit 18, does show . . . that a single misplacement still allows criticality safety without boron." Thompson Dep. Tr. (Exhibit 11 at 189). Dr. Thompson repeats this admission two other times. Id. at 139-40, 196.

183 Dr. Thompson repeatedly stated that BCOC will not challenge the validity of the Applicant's criticality calculations. Thompson Dep. Tr. at (Exhibit 11 183-85, 194). Dr. Thompson praised the Applicant's criticality analysis as "a very carefully written, very presentable document that's in a high professional competence." Id. at 185. In its response to interrogatories, BCOC stated that it "does not intend to challenge [Holtec's calculations] in this license amendment proceeding." BCOC's Interrogatory Responses at 4-5 (Responses to Interrogatories 2-6 and 2-7).

184 Dr. Thompson admitted that he is not competent to assess the criticality analysis that was performed. Thompson Dep. Tr. (Exhibit 11 at 24-25). He admitted that he has never performed any nuclear criticality analyses, has no training, education, or experience with nuclear criticality analysis, and does not anticipate doing so for this proceeding. See id. at 21-23, 25. Dr. Thompson confined his expertise to evaluating only the adequacy of the assumptions used in the analysis. Id. at 24-25.

criticality analysis report answering this question of fact. This criticality analysis, together with the sworn submittals attesting to the validity of its methodology and accuracy of its results, provides all that is required for the Board to dispose of Basis 2 with sufficient accuracy. A hearing on this matter would serve no purpose because BCOC has admitted it will not challenge the results of the criticality analysis, and its sole witness is not competent to do so, by his own admission. There is simply no need for a formal adjudicatory hearing to resolve with sufficient accuracy this technical question of fact in Basis 2.

The three new issues raised by BCOC during the course of discovery also would not warrant an adjudicatory hearing, even if they had been the subjects of an admitted contention. All three of these new issues have been rendered moot by the criticality analyses performed by Applicant and the NRC Staff in this proceeding. BCOC has admitted that Applicant's supplemental Harris Misplacement Analysis answers the first new issue, misplacement of a fuel assembly plus the loss of all soluble boron.[185] The NRC Staff's analysis of an infinite number of fuel assembly misplacements answers the second new issue, misplacement of multiple fuel assemblies. Moreover, BCOC has repeatedly stated that it will not challenge the validity of criticality calculations in this proceeding,[186] nor is it competent to do so.[187] For the third new issue, the "universe" of

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185 Dr. Thompson admitted that the Applicant's analysis demonstrated criticality safety in the event of misplacement of a fuel assembly with no soluble boron in the pool water. See Thompson Dep. Tr. (Exhibit 11 at 186, 189).

186 See Thompson Dep. Tr. (Exhibit 11 at 183-85, 194); BCOC's Interrogatory Responses at 4-5 (Responses to Interrogatories 2-6 and 2-7).

scenarios of two or more failures, BCOC has admitted that in this particular case the only missing scenario is multiple fuel assembly misplacements.[188] The issue of multiple misplacements is the same as the BCOC's second new issue, which is answered by the NRC Staff's analysis of infinite fuel assembly misplacements. Thus, even if they were the subjects of an admitted contention, these three new issues present no genuine and substantial dispute of fact. Moreover, as with Basis 2, these three new issues could be accurately resolved based on the written submissions and attached technical reports. While these three new issues should be rejected by the Board as beyond the scope of Basis 2, it is clear that there would be no need for a formal adjudicatory hearing to resolve with sufficient accuracy the technical questions presented by these new issues.

V. TECHNICAL CONTENTION 3

A. Clarification of the Scope of Contention 3 During Discovery

Contention 3, as admitted by the Board, alleges the following[189]:

> CP&L's proposal to provide cooling of pools C & D by relying upon the use of previously completed portions of the Unit 2 Fuel Pool Cooling and Cleanup System and the Unit 2 Component Cooling Water System fails to satisfy the quality assurance criteria of 10 C.F.R. Part 50, Appendix B, specifically Criterion XIII (failure to show that the piping and equipment have been stored and preserved in a manner that prevents damage or deterioration), Criterion XVI (failure to institute measures

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[187] See Thompson Dep. Tr. (Exhibit 11 at 23-25).

[188] Thompson Dep. Tr. (Exhibit 11 at 195-96).

[189] Harris, LBP-99-25, supra, 50 NRC at 36-37.

> to correct any damage or deterioration), and Criterion XVII (failure to maintain necessary records to show that all quality assurance requirements are satisfied).
>
> Moreover, the Alternative Plan submitted by Applicant fails to satisfy the requirements of 10 C.F.R. § 50.55a for an exception to the quality assurance criteria because it does not describe any program for maintaining the idle piping in good condition over the intervening years between construction [and] implementation of the proposed license amendment, nor does it describe a program for identifying and remediating potential corrosion and fouling.
>
> The Alternative Plan submitted by Applicant is also deficient because 15 welds for which certain quality assurance records are missing are embedded in concrete and inspection of the welds to demonstrate weld quality cannot be adequately accomplished with a remote camera.
>
> Finally, the Alternative Plan submitted by Applicant is deficient because not all other welds embedded in concrete will be inspected by the remote camera, and the weld quality cannot be demonstrated adequately by circumstantial evidence.[190]

Contention 3 was clarified and narrowed in scope through the discovery process, both during the sworn deposition of Mr. David Lochbaum, the sole expert proffered by BCOC on Contention 3, and in BCOC's Interrogatory Responses. Specifically, Mr. Lochbaum agreed that the scope of the Contention 3 is limited to those components of the Harris SFPCCS for spent fuel pools C and D where an exception is sought by CP&L from the ASME Code requirements and where both an internal and external inspection is

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[190] This final alleged deficiency in the Alternative Plan is now moot. CP&L inspected by remote camera inspection all 15 embedded field welds in the SFPCCS piping for spent fuel pools C and D. See Edwards Affidavit (Exhibit 1, ¶ 36). Copies of the videotapes for all remote camera inspections, including a re-inspection of one weld to determine the nature of certain reddish-brown deposits, were provided to counsel for BCOC.

not possible.[191] Here, the 50.55a Alternative Plan, submitted as part of CP&L's license amendment request[192], provides an alternative to satisfy the intent of the ASME Code requirements for field welds in SFPCCS piping, for which certain quality documentation had been destroyed.[193] Mr. Lochbaum conceded that the SFPCCS heat exchangers, pumps, and accessible piping (i.e., the SFPCCS piping not embedded in concrete and thus subject to re-inspection and nondestructive examination) are not at issue in Contention 3.[194] Nor were any issues regarding SFPCCS heat exchangers, pumps, or accessible piping raised in BCOC's Interrogatory Responses.[195] The only issue now before the Board in Contention 3 is the condition of the SFPCCS piping and 15 field welds embedded in concrete.[196] BCOC disputes: (1) the condition of the embedded welds in 1983 when construction of the SFPCCS was abandoned with the cancellation of

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[191] Lochbaum Deposition Transcript of October 14, 1999 ("Lochbaum Dep. Tr.") at 81-87 (attached hereto as Exhibit 10.)

[192] The license amendment request is Attachment A to Exhibit 1 and the 50.55a Alternative Plan is Enclosure 8 to Attachment A.

[193] Edwards Affidavit (Exhibit 1, ¶ 27, 30-32).

[194] Lochbaum Dep. Tr. (Exhibit 10 at 83-87).

[195] See BCOC's Interrogatory Responses relating to Contention 3.

[196] "Q. The only thing that this contention addresses, is it not true, is the embedded piping and embedded welds? A. The way it's worded, that's correct." Lochbaum Dep. Tr. (Exhibit 10 at 86-87).

Harris Unit 2[197]; and (2) whether there has been corrosion damage or deterioration to the embedded welds or piping between 1983 and 1999.[198]

B. Summary of Facts, Data and Arguments which Demonstrate that CP&L's 10 C.F.R. § 50.55a Alternative Plan Provides an Acceptable Level of Quality and Safety in the Spent Fuel Pool Cooling and Cleanup System for Harris Nuclear Plant Spent Fuel Pools C and D as Constructed

There are three subparts to the first paragraph of Contention 3, which alleges CP&L's proposed license amendment request to place the SFPCCS in service to enable storage of spent fuel in spent fuel pools C and D "fails to satisfy the quality assurance criteria of 10 C.F.R. Part 50, Appendix B": (1) specifically Criterion XIII (failure to show that the piping and equipment have been stored and preserved in a manner that prevents damage or deterioration), (2) Criterion XVI (failure to institute measures to correct any damage or deterioration), and (3) Criterion XVII (failure to maintain necessary quality records to show that all quality assurance requirements are satisfied).

It is undisputed that subsequent to cancellation of Harris 2 in December 1983, the piping for the Unit 2 SFPCCS has not been maintained as part of the licensed HNP, and therefore was not subject to the requirements of the plant's 10 C.F.R. Part 50, Appendix B, QA Program. The SFPCCS piping was not stored or placed in lay-up pursuant to Criterion XIII. It was not subject to the HNP Corrective Action Program. A

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[197] The condition of the piping with vendor's welds as of 1983 is not at issue because the vendor quality documentation for the piping spools that are embedded in concrete were not destroyed. Edwards Affidavit (Exhibit 1, ¶ 30).

[198] See Lochbaum Dep. Tr. (Exhibit 10 at 89-90).

number of piping isometric packages (including weld data reports ("WDR") for field welds) for field installation of the completed portion of the SFPCCS were discarded and are not available.[199] As a result, quality records required by the ASME Code, Section III, are no longer available for certain large bore welds in the completed SFPCCS piping.[200]

However, once construction on the Harris Unit 2 SFPCCS is completed and the system and spent fuel pools C and D are commissioned and placed in service, the SFPCCS must meet the requirements of 10 C.F.R. Part 50, Appendix B. The 50.55a Alternative Plan addresses the existing situation where HNP is no longer under construction, CP&L no longer maintains its ASME N-Stamp certification program, and certain quality documentation was discarded concerning field welds. Under the circumstances, 10 C.F.R. §50.55a permits an alternative demonstration of an acceptable level of quality and safety in construction.[201]

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[199] Edwards Affidavit (Exhibit 1, ¶ 27), Attachment A, Lic. Amend. App., Encl. 8, at 3.

[200] Id. at 3, 5. The accessible field welds have been reexamined, including nondestructive examination ("NDE"), and substitute WDRs for the 22 accessible field welds have been created to address the ASME Code requirements on quality documentation. As noted previously, the accessible piping and field welds are not subject to challenge by Contention 3. The 15 embedded field welds cannot be reexamined pursuant to the original ASME Code requirements.

[201] 10 C.F.R. § 50.55a(e)(1) by its terms does not require CP&L to meet the requirements for Class 3 components in Section III of the ASME Code for the SFPCCS, because the construction permit for the HNP was docketed prior to May 14, 1984. Nevertheless, CP&L had, however, committed to design and construct the spent fuel pools and SFPCCS (Quality Group C Components) to Section III, Class 3 requirements at the time of construction. This commitment was reflected in the Safety Evaluation Report issued by the NRC for the operation of Harris Units 1 and 2. CP&L has not sought to back

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There are two issues addressed in CP&L's 50.55a Alternative Plan: (1) development of Supplemental Quality Assurance ("QA") requirements for the commissioning of the SFPCCS for spent fuel pools C and D to augment CP&L's Corporate QA Program, in order to address construction QA requirements that were part of the Harris ASME Code QA Program during construction at HNP; and (2) the missing QA documentation for the SFPCCS piping field welds.

BCOC has not challenged the adequacy of the Supplemental QA requirements as an alternative to ASME N-Stamp certification. The licensed and operating portion of the HNP, including spent fuel pools A and B and the Unit 1 SFPCCS, was subject to the Harris ASME Code QA Program during construction and has been subject to the CP&L Corporate QA Program during operations. BCOC has not challenged the HNP ASME Code QA Program in effect at the time of construction.[202] BCOC does not dispute the efficacy of the present CP&L Corporate QA Program. BCOC does not argue that once

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away from that commitment in connection with the commissioning of the SFPCCS for spent fuel pools C and D.

[202] The only facts presented by BCOC which border on an attack of the HNP Quality Assurance Program are the presentation of four NRC inspections reports from 1981 in the "Declaration of David A. Lochbaum, Nuclear Safety Engineer, Union Of Concerned Scientists, Concerning Technical Issues And Safety Matters Involved In The Harris Nuclear Plant License Amendment For Spent Fuel Storage," dated March 31, 1999, which found minor deficiencies in construction quality control. When questioned during his deposition: "Do you have an opinion on the quality of the QA organization and its effectiveness during the construction at the Shearon Harris plant?" Mr. Lochbaum replied: "You know, in my declaration, there were some inspection reports cited noting some problems of quality assurance, but I wouldn't – that wouldn't lead me to believe that

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the SFPCCS is placed in service, CP&L will be unable to successfully meet the requirements of the CP&L Corporate QA Program and 10 C.F.R. Part 50, Appendix B, including Criteria XIII, XVI, and XVII. CP&L has described in detail the Supplemental QA Requirements that have been imposed on the completion of construction and commissioning of the SFPCCS for spent fuel pools C and D.[203] BCOC has not found fault with the Supplemental QA Requirements.

BCOC's "dispute" regarding the efficacy of the 50.55a Alternative Plan in addressing the missing documentation has never been articulated without reference to concerns regarding subsequent deterioration of the SFPCCS piping between construction and today. The best Mr. Lochbaum could articulate during his deposition was the following:

> For the embedded welds, we have an issue that the original quality assurance requirements are not met. The alternative plan is the alternative to meeting the code, and we contend that that's not an adequate – an equal replacement.[204]

In addition, BCOC's response to a very specific interrogatory does not find specific fault with the 50.55a Alternative Plan:

> **INTERROGATORY NO. 3-4.** Describe in detail why BCOC contends CP&L's Alternative Plan submitted

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the quality assurance program at Shearon Harris was deficient or had a programmatic breakdown." Lochbaum Dep. Tr. (Exhibit 10 at 129-130).

[203] See Edwards Affidavit (Exhibit 1, ¶¶ 27-29, Attachment B, Enclosure 17).

[204] Lochbaum Dep. Tr. (Exhibit 10 at 89).

> pursuant to 10 C.F.R. §50.55a does not "provide an acceptable level of quality and safety?
>
> **<u>RESPONSE TO INTERROGATORY NO. 3-4:</u>** The aggregate of the responses to these interrogatories, along with the responses to the questions during the deposition of Orange County's expert witness David Lochbaum on October 14, 1999, describe in detail why Orange County contends that CP&L's Alternative Plan is deficient. Orange County points out that since this contention was filed, CP&L has taken actions which implicitly demonstrate CP&L's concurrence, such as locating previously missing weld data records, expanding the scope of remote video examination of embedded welds to include all 15 welds, and analyzing the chemistry of the water in the Unit 2 spent fuel cooling system piping.

The "aggregate of the responses" to the other interrogatories is no more illuminating.[205]

The acceptability of the embedded welds in 1983, when Harris 2 was canceled and construction of the SFPCCS for spent fuel pools C and D was abandoned, has been demonstrated by the implementation of a "Piping Pedigree Plan." This Plan is part of the 50.55a Alternative Plan to address the missing weld data reports and includes an exhaustive review of available QA documentation, additional inspections, and interviews with personnel who were involved in installation and quality inspections of the embedded SFPCCS piping and welds. Overwhelming evidence is available to provide reasonable assurance that the field welding of the SFPCCS piping was performed pursuant to the ASME Code approved welding procedures and the welds were inspected and tested to ensure that the welds met Code requirements pursuant to the ASME Code QA Program. The results of these reviews, inspections, and interviews are described in considerable detail in the Edwards Affidavit (Exhibit 1, ¶¶ 30-32), Shockley Affidavit (Exhibit 6, ¶¶ 4-16), Gilbert Affidavit (Exhibit 7, ¶¶ 4-14), and Griffin Affidavit (Exhibit 5, ¶¶ 4-11). Shockley, Gilbert, and Griffin all speak to the quality of the welding of the SFPCCS piping and the QA inspections from first-hand knowledge. They provide direct sworn statements of the existence of the missing QA documentation at the time of construction.

Stripped to its essence, Contention 3 is not about "inadequate quality assurance." Rather, BCOC's discussion surrounding Contention 3 and the Lochbaum Declaration address what they perceive to be deficiencies in the Equipment Commissioning Plan (which is incorporated in the Supplemental QA Requirements). Specifically, BCOC faults the 50.55a Alternative Plan for (1) "failing to describe a program for identifying and remediating potential corrosion and fouling;" (2) attempting to demonstrate weld quality by use of a remote camera; and (3) in any event, not even looking at all of the embedded welds.

We address in the next section each alleged deficiency in CP&L's Equipment Commissioning Plan in inspecting for any corrosion or other degradation that might have occurred between the time of construction and today. In the remainder of this section, we list material facts, which are not in dispute and which demonstrate that the SFPCCS embedded piping and 15 field welds were installed in accordance with the ASME Code approved welding procedures, NDE examinations, hydrostatic testing, and ASME Code

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[205] See BCOC's Interrogatory Responses, 3-1 through 3-7.

QA inspections. We rely on these facts to demonstrate reasonable assurance of an "acceptable level of quality and safety" for the SFPCCS embedded piping and field welds, as constructed.[206]

1. The SFPCCS for spent fuel pools C and D was constructed to the same exacting standards pursuant to the same ASME Code QA Program as was the SFPCCS for spent fuel pools A and B and the rest of Harris Plant.[207]

2. The installation of piping, welding and concrete placement was accomplished at all four spent fuel pools more or less contemporaneously, using the same pool of construction personnel, welders, supervisors, engineers, and QA inspectors, and ANI inspectors.[208]

3. Harris Nuclear Plant has operated the SFPCCS for spent fuel pools A and B successfully since startup.[209]

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[206] While this test from 10 C.F.R. §50.55a(a)(3)(i) is easily met in this case, CP&L actually need not show more than that required by the alternate test: "compliance with the specified requirements of this section would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety." 10 C.F.R. § 50.55a(a)(3)(ii); see Edwards Affidavit (Exhibit 1, ¶ 50) regarding the hardship that would be presented by the failure to approve the 50.55a Alternative Plan.

[207] See Edwards Affidavit (Exhibit 1, ¶ 31), Shockley Affidavit (Exhibit 6) and CP&L's ASME Code QA Manual (Attachment A to Exhibit 6).

[208] See Edwards Affidavit (Exhibit 1, ¶ 31); Griffin Affidavit (Exhibit 5, ¶ 8); Shockley Affidavit (Exhibit 6, ¶ 15).

[209] See Edwards Affidavit (Exhibit 1, ¶ 31).

4. Documentation for field welds joining pipe spools in the SFPCCS was contained on WDRs, which provided a record of all ASME Code required attributes pertinent to a given weld. Data such as joint and piece identification, filler material identification, weld procedure, welder identification and NDE requirements were all specified and documented on the WDR, and generally the WDR constituted the only permanent documentation for this information. Construction procedures required each WDR to be prepared by weld engineering personnel as part of work package preparation, and to be reviewed by both QA inspectors and the ANI prior to its release to the field. Subsequent to weld performance, each completed WDR would be reviewed again by QA inspectors and the ANI to verify that all requirements were met. WDRs were collected as part of piping isometric packages, which were compiled and stored pending system completion for N-Stamp review.[210]

5. Failure to complete the WDRs for the field welds in the embedded piping would have required a complete breakdown of the welding procedures and processes and the QA procedures and processes. As attested to directly by Charles Griffin, David Shockley, and Tommy Gilbert, there was no such

[210] Id; Griffin Affidavit (Exhibit 5, ¶¶ 5-6).

breakdown of the ASME Code welding program nor of the ASME Code QA Program at the Harris Plant.[211]

6. Available construction era information conclusively supports that the WDRs for the 15 field welds in the SFPCCS did exist at the time of construction and were satisfactorily completed. The most direct QA documentation pertaining to this conclusion is found in the hydrostatic test ("hydrotest") records for embedded spent fuel pool piping. Procedural requirements for conducting the hydrotest included a review by QA inspectors of all weld documentation associated with the piping being tested. Accordingly, the QA inspector performed a review of the WDR for each field weld within the test boundary, verifying that each WDR was completed, reviewed and approved, including the ANI's review. In addition, the hydrotest procedure required that each field weld be individually inspected for leakage while at test pressure, providing additional assurance as to the completion and quality of these welds. Hydrotest records are on hand for 13 of the 15 embedded field welds, and

[211] See Griffin Affidavit (Exhibit 5, ¶ 8); Shockley Affidavit (Exhibit 6, ¶ 15); Gilbert Affidavit (Exhibit 7, ¶ 14).

additional QC documents indirectly confirm that the remaining two field welds were also hydrotested.[212]

7. Several of the QA inspectors actually performing document reviews and hydrotest inspections associated with embedded SFPCCS piping are still employed by CP&L. Two such individuals readily attest that, to the extent indicated by their signature on the hydrotest records, they positively and personally confirm that the WDRs for eleven of the field welds within the test boundary did exist and were satisfactorily completed, and that each such weld was closely inspected as part of the hydrotest effort. They are also confident that the WDRs for the other four welds also were properly prepared and reviewed prior to the hydrotest. [213]

8. Concrete Placement Reports (commonly referred to as Concrete Pour Cards) have been retrieved for spent fuel pools C and D and those sections of the Fuel Handling Building that includes the embedded SFPCCS piping. As part of the QA review prior to a concrete pour, the QA inspector confirmed that all required QA documentation for piping that would be embedded in concrete was in the QA package and was complete

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[212] See Edwards Affidavit (Exhibit 1, ¶ 31, Attachments S and T); Shockley Affidavit (Exhibit 6, ¶¶ 10-15, Attachments B, C, D and E); Gilbert Affidavit (Exhibit 7, ¶¶ 6-10, Attachments B, C and D).

[213] See Shockley Affidavit (Exhibit 6 at ¶¶ 15-16); Gilbert Affidavit (Exhibit 7 at ¶ 10); Edwards Affidavit (Exhibit 1, ¶ 32).

– including vendor records for the piping spools, WDRs for the field welds, NDE records and hydrotest reports. The signatures by the QA inspectors on the Concrete Pour Cards verifies that QA documentation for the SFPCCS piping and field welds, including the missing WDRs, was reviewed and verified for completeness again prior to pouring concrete.[214]

9. A copy of a WDR was found for one of the 15 embedded field welds.[215] A Repair Weld Data Report was located for another one of the 15 embedded field welds.[216] The Repair WDR is one indication that the ASME Code QA Program was being implemented properly: deficiencies were identified and corrected to ensure compliance with the Program.

10. The NRC Staff performed a formal special team inspection at the HNP on November 15-19, 1999. The purpose of the inspection, in part, was "to assess the implementation of the construction quality assurance program in construction of the C and D spent fuel pools." The NRC Staff concluded that CP&L "had a comprehensive program to control, inspect, and document welding at the time of original [plant] construction in accordance with Section III of the ASME Boiler and Pressure Vessel

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[214] See Gilbert Affidavit (Exhibit 7, ¶¶ 11-13, Attachment E); Shockley Affidavit (Exhibit 6, ¶ 9).

[215] See Griffin Affidavit (Exhibit 5, ¶ 5, Attachment B).

[216] Id. at ¶ 5, Attachment C.

Code, and NRC requirements."[217] Thus, the NRC inspection confirmed CP&L's own review. The NRC inspectors reviewed NRC Inspection Reports which documented inspection of construction activities at HNP by NRC Region II inspectors between 1978 and 1983. These inspection reports document over 50 separate inspections for this period for items related to the welding program and/or piping installation. The minor violations noted would not be cited under the current NRC reactor inspection program and were typical of what would be expected for oversight of a large construction project.[218] This review of construction-era inspection reports again confirms the overall quality of the Harris construction ASME Code welding program.

These undisputed facts provide verification that WDRs did exist for each of the embedded field welds, that each WDR was fully completed, reviewed and accepted, and therefore, that these field welds were completed in full compliance with ASME Code construction requirements. The 50.55a Alternative Plan demonstrates that, as constructed, the SFPCCS for spent fuel pools C and D met ASME Code requirements, and, therefore, absent significant deterioration of the SFPCCS since construction, provides an acceptable level of quality and safety.

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[217] NRC Inspection Report No. 50-400/99-12, dated December 28, 1999 (Exhibit 14 at 2).
[218] Id. at 26.

In the next section, we address the implementation of the Equipment Commissioning Plan, which included inspections and testing to determine the extent, if any, of deterioration of the SFPCCS since construction.

C. Summary of Facts, Data and Arguments which Demonstrate that the SFPCCS Stainless Steel Piping and Welds Have Not Significantly Deteriorated Due to Corrosion or Otherwise During the Period of Time Between Original Construction and Today, Are Suitable for Their Intended Purpose, and Provide an Adequate Level of Quality and Safety

BCOC disputes that the Equipment Commissioning Plan is sufficient to determine the condition of the embedded SFPCCS piping. In response to the interrogatory question -- Does the Equipment Commissioning Plan adequately address BCOC's concerns relating to the failure to store and preserve all the equipment and components of the Spent Fuel Cooling System pursuant to the requirements of 10 C.F.R. Part 50, Appendix B? -- BCOC responded as follows:

> No. The Equipment Commissioning Plan fails to provide for inspection of all the equipment and components of the Unit 2 spent fuel cooling system. For example, the original Equipment Commissioning Plan relied on a remote camera inspection of the interior portions for some of the welds in the embedded piping. Orange County's expert witness will be reviewing recent CP&L changes to the original plan which now suggest that all embedded field welds have been inspected. As another example, Orange County contends, as detailed in the responses to Interrogatory Nos. 3-2 all parts, 3-3 all parts, and 3-7 all parts that the remote camera inspection and associated activities did not adequately

> determine the interior surface of the embedded piping to be absent of material degradation.[219]

Contention 3, as admitted, objected to the remote camera inspection and the original plan to inspect fewer than all 15 embedded field welds. In response to interrogatories, BCOC also alleged (1) that the remote camera inspection viewed only the field welds and not the piping; (2) CP&L failed to analyze the surface film observed on the inside of the piping and welds; and (3) an inspection, engineering evaluation, or analysis should have been performed regarding the potential for contaminants to affect the external surface of the embedded piping.[220] BCOC contends that an inspection effort, providing more meaningful results than simple remote camera inspection, would include ultrasonic evaluations or other non-destructive examination techniques.[221]

There are no genuine issues in dispute regarding inspection and testing of equipment and components of the SFPCCS for spent fuel pools C and D, other than the embedded piping and welds. Mr. Lochbaum conceded as much. BCOC has not raised

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[219] BCOC Response to Interrogatories, Interrogatory No. 3-1.

[220] Id., Interrogatory No. 3-2.

[221] Id., Interrogatory No. 3-3. On the other hand, BCOC's sole expert on Contention 3, David Lochbaum, stated in his deposition that his concerns would be satisfied by "a complete visual inspection of the interior piping surfaces, all of the welds of the embedded portions, and some evaluation, analysis or inspection of the exterior piping surfaces." Lochbaum Dep. Tr. (Exhibit 10 at 218-219). When pressed on what an "evaluation, analysis or inspection of the exterior piping surfaces" could entail (since the piping is embedded in concrete), Mr. Lochbaum stated "some walkdown of, was there any history of spills or anything that would have gotten into the concrete or around where these pipes came through walls that could have been an external contaminant, an inspection of where it went into the pipe, into the walls and out of, things like that, that

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one specific concern regarding the accessible piping and welds (that have been re-inspected) or other components, such as the heat exchangers, pumps, strainers or skimmers.[222]

The final allegation of Contention 3, as admitted, is moot. BCOC complained that not all of the 15 embedded welds would be inspected by remote camera. CP&L modified its Equipment Commissioning Plan and inspected all 15 embedded welds.[223]

With respect to the remaining concerns raised by BCOC regarding the inspection and testing of the embedded piping, the material facts set forth in the remainder of this section are not in dispute and demonstrate that the condition of the embedded piping and welds are very good. An analysis of each of the indications observed during the remote camera inspection, chemical and microbiological analyses of the water inside the SFPCCS piping, an analysis of the reddish-brown deposit observed on the piping and weld surfaces, an analysis of the structural integrity of the piping, and an analysis of the suitability of the "as is" embedded piping to perform its intended function all confirm that the embedded piping will provide an adequate level of quality and safety and there is

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would have given me some basis for saying that there was not, or no apparent indications of an external contaminant source." Id. at 219-220.

[222] See Section V.A. supra; Lochbaum Dep. Tr. (Exhibit 10 at 83-87).

[223] Edwards Affidavit (Exhibit 1, ¶¶ 36-37, 44-46, Attachment Q). CP&L inspected all fifteen of the embedded welds and associated piping by remote camera and even pressure washed and re-inspected a field weld with observed reddish-brown deposits in order to be in a position to answer every question pertaining to the suitability of the SFPCCS piping for its intended purpose.

reasonable assurance that public health and safety, and the environment will be protected with the operation of spent fuel pools C and D with the SFPCCS.

The implementation of the Equipment Commissioning Plan and the results of the tests and inspections are described in the Edwards Affidavit (Exhibit 1, ¶¶ 33-48 and Attachments B, E, Q, and R); Moccari Affidavit (Exhibit 8 and Attachments B and C); Griffin Affidavit (Exhibit 5, ¶¶ 9-10); and Licina Affidavit (Exhibit 9 and Attachment C). Applicants rely on the sworn facts set forth in these affidavits, including the following material facts that are not in dispute:

1. An Equipment Commissioning Plan was developed as part of the "Supplemental Quality Assurance Requirements for the Design Change Packages Associated with the Completion of the Units 2 & 3 Spent Fuel Pool Cooling System."[224] The Equipment Commissioning Plan prescribes a set of criteria to ensure that the components and equipment in the SFPCCS will meet the requirements of Appendix B to 10 C.F.R. Part 50 and is capable of performing their intended function in the completed design. The Equipment Commissioning Plan includes physical inspections and testing to verify that the lack of controlled storage conditions and regular maintenance has not caused any condition affecting quality, including damage from personnel, introduction of foreign

[224] Edwards Affidavit (Exhibit 1, Attachment B, Enclosure 16, § 5.2).

material, scavenging of parts, corrosion, fouling, aging, or radiation exposure.[225]

2. The tests and inspections included testing of the water in the SFPCCS piping, a complete walk-down and visual inspection of all accessible piping, welds, components and equipment, re-inspection of all accessible welds, testing the weld filler material in the accessible welds, a visual inspection with a high-quality video camera of the segments of the embedded SFPCCS piping with field welds, and taking a sample and testing the composition of a deposit on one of the welds.[226] In addition, records were reviewed and the surface of the spent fuel pool walls and concrete in which the SFPCCS piping is embedded was inspected for any evidence of outside chemical attack to the external surface of the embedded piping.[227]

3. The water, which has been in the SFPCCS piping under extended lay-up conditions, was subject to chemical analysis by HNP Chemists and microbiological analysis by Dr. Ahmad Moccari, a scientist specializing in corrosion studies and working for CP&L at its metallurgical laboratories. The chemical analysis revealed that the water in these lines was of high

[225] See Edwards Affidavit (Exhibit 1, ¶ 33).
[226] See Edwards Affidavit (Exhibit 1, ¶ 34).
[227] Id. at 47.

purity (consistent with that in the spent fuel pools themselves). Nuisance bacteria capable of causing microbiologically induced corrosion ("MIC") were not detected. In general, there were low levels of microbiological activity in the water samples for the SFPCCS piping. The results of this testing indicates a highly unlikely potential for chemically or microbiologically induced corrosion to have occurred during extended lay-up.[228]

4. All of the fifteen embedded field welds and associated SFPCCS piping runs were inspected using a high-resolution camera fitted to a pipe crawler. The inspection included welds on six of the eight embedded cooling lines connected to spent fuel pools C and D. The remaining two lines have only approximately 6 feet of embedded pipe each, with no embedded field welds. All of the lines inspected were 12" diameter, type 304 stainless steel piping.[229]

5. The video camera was able to take high quality pictures of everything on the inside of the SFPCCS piping – longitudinal welds, circumferential welds, and the piping's inside surfaces. The camera work was very professional. The light clearly illuminated the surfaces examined. Areas

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[228] See Moccari Affidavit (Exhibit 8, ¶¶ 7-10, 22, Attachments B and C); Edwards Affidavit (Exhibit 1, ¶ 35, Attachment Q, §§ 3.4.3.1 - 3.4.3.2).

[229] See Edwards Affidavit (Exhibit 1, ¶ 36).

of interest were inspected from a number of different angles as the camera moved back and forth over the same surface. The videotapes emphasized the welds in the embedded sections of the piping, both longitudinal (from the original fabrication of the piping) and circumferential (where lengths of piping are connected), but the videotapes also showed the interior surface between circumferential welds as the camera moved through the piping. The images were very clear. Reviewers could even see machine marks left from the time the pipe was manufactured.[230]

6. A team of experts from various disciplines reviewed the videotapes from the remote camera inspections. Generally, the inspection results were very good. The welds in question were never subject to volumetric examination by Code requirements, and were sufficiently far from the open end of the pipe at the time of welding that an internal visual examination would not have been performed. Some general discoloration of the welds and portions of the internal surfaces of piping was noted, reddish-brown deposits were observed on welds and the piping, incomplete melting of consumable inserts was noted on two welds, and shallow linear indications were observed on a weld and on the longitudinal

[230] See Moccari Affidavit (Exhibit 8, ¶ 11); Edwards Affidavit (Exhibit 1, ¶ 44).

seam of one of the adjacent pipe spools. Each indication was recorded and evaluated.[231]

7. Inspection of field weld FW-517 found three locations having a localized deposit of reddish-brown material at the field weld. Samples of this material were removed by fitting the head of the inspection camera with an arm and swab, and using pan and tilt manipulations to collect material directly from the locations of interest. Any remaining deposits were removed with high-pressure water and the surface was re-inspected with the remote camera.[232] After a careful review of the area underneath the deposits, Dr. Moccari could not conclusively identify any surface discontinuities.[233] Mr. Licina identified what "appeared to be two small pits" underneath the deposits.[234] Both Dr. Moccari and Mr. Licina agreed any such small pits could have no impact on the integrity of the piping.[235]

8. Dr. Moccari tested the sample of the reddish-brown deposit to determine whether any bacteria present were aggressive enough to cause MIC. Three separate tests confirmed that no bacteria capable of causing material

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[231] See Edwards Affidavit (Exhibit 1, ¶¶ 36-44, Attachment Q); Moccari Affidavit (Exhibit 8, ¶¶ 11-12, 17-22); Licina Affidavit (Exhibit 9, ¶¶ 12, 15, 21-22, 25, 28, Attachment C).

[232] See Edwards Affidavit (Exhibit 1, ¶ 38); Moccari Affidavit (Exhibit 8, ¶ 12).

[233] Moccari Affidavit (Exhibit 8, ¶ 17, Attachment C at 5).

[234] Licina Affidavit (Exhibit 9, ¶ 21).

degradation due to MIC were present in the deposit sample from the SFPCCS piping weld.[236] An elemental analysis of the deposit material was performed using a scanning electron microscope. This analysis determined that the deposit material is primarily composed of iron oxide. This material is very similar in appearance to the iron oxide which is introduced to the spent fuel pools by way of spent fuel transshipment from CP&L's other nuclear plants. This iron oxide neither results from, contributes to, or is otherwise associated with corrosion or degradation in the SFPCCS piping.[237]

9. Some of the reddish-brown film observed on the piping was removed by high-pressure water and the filtered residue was analyzed by Dr. Moccari. Dr. Moccari used a scanning electron microscope with an energy dispersive x-ray spectrometer attachment to determine the elemental composition of the reddish-brown material from the SFPCCS piping. A x-ray diffractometer was then used to identify the chemical compounds present. The scanning electron microscope/energy dispersive spectrometer showed that the reddish-brown material consists primarily of

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[235] Id. at ¶¶ 22-23; Moccari Affidavit (Exhibit 8, ¶ 22).

[236] Moccari Affidavit (Exhibit 8, ¶¶ 12-15).

[237] See Edwards Affidavit (Exhibit 1, ¶ 38, Attachment Q, Attachment 3); Moccari Affidavit (Exhibit 8, ¶ 16).

iron and oxygen (most likely iron oxide) with lesser and varying amounts of silicon, aluminum, carbon, calcium, chromium, nickel, sodium, magnesium, nickel, potassium, zinc, and chlorine. X-ray diffraction analysis of the deposit sample showed this sample to consist primarily of iron oxide (a mixture of hematite (α-Fe_2O_3) and lepidocrocite ($FeOOH$)) and possibly graphite. Apart from the iron oxides, however, the deposits appear to be largely particulate in structure, including small fragments of what appears to be stainless steel. The presence of these particulates and small metallic fragments suggests that the deposits do not reflect corrosion of the piping at the welds. Rather, the weld itself appears to have acted as a site at which crud has simply accumulated.[238]

10. The typical field weld joint of the SFPCCS piping incorporated a consumable insert, with the ends of the pipe spools being prepped at the vendor facility for use with this configuration. The purpose of a welding consumable insert is to serve as a consumable retainer and filler metal during completion of a weld joint root pass (first welding pass). By design, the root pass of the weld would consume the insert while fusing both ends of the pipe together. A number of welds had locations where small portions of the insert could be discerned, indicating that it was not fully consumed by the root pass. Generally, these incidences of

[238] See Moccari Affidavit (Exhibit 8, ¶ 16).

unconsumed insert were limited to several very small areas where a small portion of the insert could be discerned. Notably, to the extent that could be discerned by closely reviewing multiple camera angles, inspection of these areas of unconsumed insert indicates that these pieces of insert material are completely fused around the edges.[239]

11. Unconsumed inserts are typically the result of welder technique with this particular condition limited to the weld root pass. It is not an unusual condition. Unlike some welding flaws, such as hot cracking and piping porosity, which could possibly extend into subsequent weld layers, once the root pass is completed, subsequent weld passes are unaffected by an unconsumed insert condition. Unconsumed insert materials could typically be detected by visual observation of the pipe inside diameter surface (if accessible) or by conducting volumetric NDE examinations like radiography. However, consistent with ASME Code requirements, the final inspection requirements for these ASME Code Class 3 SFPCCS weld joints were a final visual exam and a liquid/dye penetrant examination of the weld joint outside diameter surface. Therefore the final inspections and NDE for these weld joints would not have detected indications such as these regions of unconsumed insert in the root pass, unless the weld inside

[239] See Edwards Affidavit (Exhibit 1, ¶ 39); Griffin Affidavit (Exhibit 5, ¶ 9); Licina Affidavit (Exhibit 9, ¶¶ 12-13).

diameter surface had been accessible for local visual observation during plant construction.[240]

12. The indications of unconsumed weld insert identified by camera inspection of the embedded field welds were evaluated and determined not to represent a challenge to piping integrity or otherwise affect its suitability for the intended service. The indications were determined to be relatively insignificant imperfections which are to some degree expected on field welds such as FW-516, which was only subject to surface examination and does not lend itself to internal visual examination. ASME Section III, Subsection ND design rules for vessels specifically recognize the potential for imperfections in welds which are not subject to volumetric examination, and provide compensation when necessary by a reduction in joint efficiency based on the type and extent of NDE performed. Although this consideration regarding joint efficiency does not directly apply to the embedded SFPCCS piping, it does demonstrate that the ASME acknowledges that minor imperfections will exist in welds of this nature which are not subject to volumetric examination. Based on these considerations and the additional discussion in the Report of Structural Integrity Associates, Inc., pertaining to structural integrity, the

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[240] See Edwards Affidavit (Exhibit 1, ¶ 40); Griffin Affidavit (Exhibit 5, ¶ 9).

indications of incomplete fusion identified on these embedded field welds were deemed acceptable with no rework / repair.[241]

13. A small linear indication (approximately ½" long) was observed extending out of the seam weld on the pipe spool above field weld FW-515 and into the counter-bored region adjacent to this weld. This indication did not appear to originate in the field weld itself, nor did it have the appearance of being corrosion related. The corrosion mechanisms which could possibly cause cracking in the Type 304 Stainless Steel spent fuel pool cooling lines are very unlikely due to a lack of the aggressive conditions (chemistry and temperature) which might initiate them. Further, the line is not exposed to cyclical loading or thermal variations, which might induce fatigue cracking. Edwards Affidavit (Exhibit 1, ¶ 42, Attachment Q, § 3.4.4); Licina Affidavit (Exhibit 9, ¶¶ 25–26, Attachment C at 5-6 – 5-7).

14. At this point, the specific cause for the linear indication in the seam weld adjacent to field weld FW-515 cannot be conclusively determined. What can be said is that an external visual and liquid penetrant examination was completed of this field weld after its construction, and that the indication of interest would have been identified if it extended to the exterior surface

[241] See Edwards Affidavit (Exhibit 1, ¶ 41, Attachment Q, §3.4.2 and attachment 2); Griffin Affidavit (Exhibit 5, ¶ 10); Licina Affidavit (Exhibit 9, ¶ 13, Attachment C at 5-1
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of the piping. Subsequently, this field weld was subjected to and successfully completed hydrostatic testing and additional close visual inspection prior to the concrete pour. These examinations and tests provide conclusive evidence that the indication is not a through-wall crack and will not result in leakage. Structural Integrity Associates was asked to provide an expert independent evaluation of the implications of the indication on the structural integrity of the piping. Their conclusion, based on critical flaw size analysis and consideration of the potential mechanisms for crack propagation, is that the indication does not pose any challenge to piping integrity, nor is there any reason to suspect that the indication might propagate beyond its existing condition.[242]

15. The overall good condition of the piping is not surprising because it is constructed of high-quality stainless steel, that is otherwise resistant to corrosion and cracking, and it has been maintained in a wet lay-up condition that is very benign. It has not been subject to extreme temperatures, pressure or other stresses. It would have been quite surprising to observe any degradation in the SFPCCS piping under these conditions. Structural Integrity Associates ("SIA") evaluated all of the

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[242] Edwards Affidavit (Exhibit 1, ¶ 43, Attachment Q, § 3.44); Licina Affidavit (Exhibit 9, ¶¶ 25-26, Attachment C at 5-3 – 5-4).

possible causes of degradation in stainless steel piping and found that the conditions necessary for the degradation of such piping were absent from the conditions in the SFPCCS piping. Structural Integrity Associates also noted that the SFPCCS piping was very conservatively designed for its intended operating conditions. The 0.375 inch wall thickness is approximately 30 times the minimum wall thickness required for the actual service pressure; the stainless steel piping has a design rating of 150 psi and will have a maximum service pressure of about 25 psi.[243]

16. A significant portion of the SFPCCS piping which connects to the spent fuel pools C and D is accessible, and subject to the same flooded conditions as the embedded piping. Importantly, these accessible portions are also the low points in this piping, and would be where any corrosion problems would be expected to evidence themselves. Since there has been no leakage or degradation identified with regard to this accessible SFPCCS piping, there was no reason to suspect degradation of the embedded SFPCCS piping.[244]

17. The remote camera inspections show that the SFPCCS piping and welds embedded in concrete are in very good condition, show negligible degradation during the 17 years since construction (approximately 10 of

[243] Edwards Affidavit (Exhibit 1, ¶ 45); Licina Affidavit (Exhibit 9, ¶¶ 9, 17 - 20).

[244] Edwards Affidavit (Exhibit 1, ¶ 46).

which were in essentially wet lay-up), and have no credible source of contamination that could adversely affect the outside of the SFPCCS piping embedded in concrete. Furthermore, Structural Integrity Associates found that even if some corrosion or imperfections in welds or cracks in the piping did exist, it would have no effect on the structural integrity of the SFPCCS or on its suitability for service.[245]

18. Even in the highly improbably event that a weld were to fail or a pinhole leak occurred in the embedded SFPCCS piping, there would be no impact on public health or safety, the environment, or plant operations. The piping is embedded in reinforced concrete; there is no way for a leak to result in a loss of water that even approaches the normal evaporation rate of the pools; there is no leak pathway to the environment; and there is an entirely redundant piping run to provide cooling to each spent fuel pool.[246] In the worst case failure of a SFPCCS piping weld (the failure of a weld in the accessible piping outside the concrete), the level in the spent fuel pools cannot fall below the suction and discharge openings in the pools. Thus the spent fuel would remain covered with water.[247]

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[245] Edwards Affidavit (Exhibit 1, ¶ 48, Attachment Q, attachment 2): Licina Affidavit (Exhibit 9, ¶ 28, Attachment C at 6-2 – 6-3).

[246] Edwards Affidavit (Exhibit 1, ¶ 49).

[247] Id.

The implementation of the Equipment Commissioning Plan with regard to the embedded SFPCCS piping has been thorough and provides reasonable assurance that no degradation has occurred to this piping that would affect its structural integrity or render it unsuitable for the intended function. CP&L has demonstrated that the SFPCCS provides an acceptable level of quality and safety in the commissioning of spent fuel pools C and D.

D. Intervenor BCOC Cannot Meet its Burden of Demonstrating an Adjudicatory Hearing Must Be Held to Dispose of Contention 3

The facts and data submitted to the Board on Contention 3 are comprehensive and permit a well-reasoned and supported decision by the Board on the present condition of the embedded SFPCCS piping.

While there may be a genuine issue in dispute regarding the appropriateness of the remote camera inspection, it is not a substantial dispute. Indeed, CP&L has done exactly what BCOC's sole expert on Contention 3 said would be acceptable: "a complete visual inspection of all of the interior piping surfaces, all of the welds of the embedded portions, and some evaluation, analysis or inspection of the exterior piping surfaces."[248]

A hearing would be particularly inappropriate here because there is no suggestion that BCOC could offer credible testimony adverse to the sworn statements of fact and expert opinions set forth in the affidavits upon which CP&L relies on Contention 3. Mr. Lochbaum was forthright in disclaiming expertise in the disciplines relevant to the condition of the SFPCCS piping and welds. Mr. Lochbaum admits to no experience as a construction engineer.[249] He has never had any responsibility for welding at a nuclear power plant.[250] He has never welded materials himself, never had responsibility as a welding engineer, and never performed NDE of welds or supervised NDE examiners.[251] Mr. Lochbaum has not served on ASME Code committees nor has he been responsible for QA/QC inspectors at a nuclear plant.[252] He admitted that he was not an expert in material science, nor an expert in corrosion of materials at a nuclear power plant, nor an expert in stress analysis.[253] Mr. Lochbaum is not a expert in the causes of degradation of stainless steels, nor was he familiar with the kind of stainless steel, its diameter, and thickness of the SFPCCS piping.[254] He was not familiar with the weld process used for the SFPCCS field welds.[255] Mr. Lochbaum had not initially requested copies of the videotapes of the remote camera inspections of the SFPCCS piping and welds because he

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[248] Lochbaum Dep. Tr. (Exhibit 10 at 218-219).

[249] Id. at 38.

[250] Id.

[251] Id. at 40-41.

[252] Id. at 41.

[253] Id.

[254] Id. at 43.

[255] Id. at 44.

was not in a position to testify whether the condition of the piping and welds "was good, bad or indifferent."[256]

Notwithstanding BCOC's allegations to the contrary, both the embedded piping and welds were inspected by the remote camera, the reddish-brown deposit on the piping and weld surfaces was analyzed and an analysis was performed regarding the potential for contaminants to affect the external surface of the embedded piping.

The facts and opinions of CP&L's affiants have been tested by the NRC Staff inspectors and the results of the NRC's independent review of documents and interviews are reported in a detailed inspection report.[257] The NRC Staff's independent review corroborates the facts presented by CP&L. The Board can readily decide this issue on the basis of the facts, data, and expert opinions before it.

Importantly here, the resolution of the factual issue regarding the condition of the SFPCCS piping is not central to the ultimate decision on the license amendment request. There is no credible scenario, even assuming a complete failure of a weld in the embedded piping, that significant water covering the spent fuel could be lost from the pool. The suction and discharge openings of the SFPCCS into the spent fuel pool are near the top of the pool. The spent fuel would remain covered under any scenario. Also, there is a redundant piping line for each spent fuel pool, thus the cooling function to the

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[256] Id. at 111.

[257] See NRC Inspection Report No. 50-400/99-12 (Exhibit 14).

spent fuel pool would not be lost.[258] A failure of a weld in the embedded SFPCCS piping might at worst cause a minor cleanup issue for CP&L. It could in no way be inimical to the common defense and security, or to the health and safety of the public, or have a significant impact on the environment.

Under the circumstances, BCOC has an insurmountable burden to demonstrate a hearing is necessary.

VI. ACTIONS REQUESTED OF THE BOARD

Applicant CP&L respectfully submits that, at the conclusion of oral argument, the Board should:

1. Decide Contention 2, Basis 1, based on the written legal arguments and oral arguments. The NRC Staff's interpretation of GDC 62 and administrative controls, including burnup credit, should be sustained.

2. Dismiss Contention 2, Basis 2, as moot. BCOC has admitted that the Harris Criticality Analysis demonstrates that a single fuel assembly misplacement will not cause criticality in the fuel racks in spent fuel pools C or D. The new issues raised by BCOC should be rejected as outside the scope of Contention 2 as admitted. In any event the criticality analyses performed by Dr. Redmond, Dr. Turner and by the NRC Staff demonstrate

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[258] See Edwards Affidavit (Exhibit 1, ¶ 49).

that the new issues are moot as well. BCOC has admitted that it is not in a position to challenge the results of criticality analyses.

3. Dismiss Contention 3, as it relates to the "as constructed" condition of the SFPCCS piping for spent fuel pools C and D. BCOC has not to date offered one specific challenge to the efficacy of the ASME approved welding procedures and ASME Code QA program which governed the installation of the SFPCCS piping. There is no credible rejoinder to the abundant direct and indirect evidence that the missing WDRs were prepared and they document that the SFPCCS piping field welds were properly performed, inspected, passed NDE, passed hydrotest, and met ASME Code requirements.

4. Decide Contention 3, as it relates to the "as is" condition of the SFPCCS piping for spent fuel pools C and D. The tests and inspections carried out pursuant to the Equipment Commissioning Plan demonstrate conclusively that there has been no significant corrosion or other deterioration to the SFPCCS piping. To the extent that BCOC continues to raise a genuine issue in dispute, it is not substantial, it is not central to the ultimate decision on the license amendment request, and it certainly can be disposed of with sufficient accuracy without a hearing.

Respectfully submitted,

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Dated: January 4, 2000

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

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

CERTIFICATE OF SERVICE

I hereby certify that copies of the foregoing "Summary Of Facts, Data, And Arguments On Which Applicant Proposes To Rely At The Subpart K Oral Argument," dated January 4, 2000, with the Table of Contents, Exhibit Table of Contents, and Table of Authorities was served on the persons listed below by U.S. mail, first class, postage prepaid, and by electronic mail transmission, this 5th day of January, 2000.

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* by mail only

William R. Holloway

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

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

DEPOSITION OF GORDON THOMPSON, PH.D.

DISK ENCLOSED

At Raleigh, North Carolina
October 21, 1999
9:40 AM to 4:14 PM
Reported by: Melody L. Rife, RPR

COPY

APPEARANCES

For the Applicant, Carolina Power & Light Company:

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Also Present:

Messieurs Michael Devoe, John Caves, Richard Laufer, and Laurence Copp

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EXAMINATIONS

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Q. Are the statements in here truthful?
A. Yes.
Q. This states that you have a Ph.D. in applied mathematics?
A. Correct.
Q. What does that relate to?
A. The work was in the -- the theory of high-temperature plasmas. So it could be considered theoretical physics, but it happened to be done through the math faculty.
Q. Can you tell me what courses you have taken in fission reactor engineer?
A. None.
Q. Can you tell me what courses you've taken in fission reactor criticality control?
A. None.
Q.- Okay. What training have you had in fission reactor criticality analysis?
A. None.
Q. Are you an expert in fission reactor criticality analysis?
A. For the purpose of this proceeding, yes.

Q. On what basis do you state that?
A. My contribution to the -- to this proceeding relies on my basic expertise in scientific principles and analytic principles and my general experience with engineering in general and nuclear plant engineering in specifics.
Q. So when you assert that you're an expert in fission reactor criticality analysis, that would be in the general scientific principles attendant to criticality?
A. The brief that -- to which I will -- that -- my contribution to Orange County's brief will rely upon expertise that I possess.
Q. Could you answer my question?
THE WITNESS: Could you read it back?
(Thereupon, the question beginning on page 21, line 10, was read by the court reporter)
A. Yes, and on the application of those principles to the contention.
Q. Okay.

Tell me what criticality analysis codes you have run yourself.
A. I have not run any, as such.
Q. Okay. Can you tell me what training you've had in running criticality analysis codes?
A. None.
Q. Okay. What codes are used to perform fission reactor criticality analysis?
A. Codes that are identified in the CP&L application and in the subsequent correspondence, response for the request for additional information.
I don't remember the names of those codes. And I should say as a point of clarification that I don't expect to run or seek to have run any of those codes in connection with this proceeding.
Q. Okay, so you have not run any criticality analyses yourself for this proceeding?
A. Correct, and do not anticipate doing so or having this done.
Q. Okay. Are you competent to evaluate the

results of a criticality analysis?
A. Yes.
Q. If you've never been trained in running the codes, have not run the codes yourself, how can you evaluate whether the analysis itself is correct?
A. In evaluating an analysis, there are two primary aspects to the evaluation. One is to -- given the assumptions on the line analysis, to assess the analysis that was performed pursuant to those assumptions. The other aspect is to examine the assumptions and assess whether those assumptions are sufficient to address the issues that might be of concern in connection with criticality.
I -- in the course of this proceeding, I will expect to confine my assessment primarily and perhaps totally to the assessment of assumptions and their adequacy.
Q. So you've identified two aspects here. The first one is sufficiency of the

assumptions --
A. Right.
Q. -- second is given those assumptions, the analysis itself.
A. Correct.
Q. You believe that you're competent to address the sufficiency of the assumptions; is that correct?
A. Yes.
Q. Do you have the expertise to address the second part, whether -- given those assumptions are valid, that the analysis done after it is in fact correct and valid?
A. Not without doing a lot of studying. As of this moment, no, I am not competent to do that.
Q. Okay. Do you anticipate doing that?
A. Not over the time frame of this proceeding.
Q. Okay.
Dr. Thompson, are you licensed as a nuclear power plant operator?

A. No.
Q. Have you ever been licensed as a nuclear power plant operator?
A. No.
Q. Have you been trained to operate a nuclear power plant?
A. No.
Q. Have you been an engineer at a nuclear power plant?
A. No.
Q. Have you ever implemented procedures at a nuclear power plant?
A. No.
Q. Have you ever written procedures for a nuclear power plant?
A. No.
Q. Have you ever worked at a nuclear power plant?
A. No.
Q. Are you an expert in nuclear power plant operations?
A. No.
Let me -- let me correct that frame.

I have performed studies and presented testimony relating to the safety of nuclear facilities, including nuclear power plants; and in the course of those studies and preparing those testimonies, I have become expert in operational matters pertinent to the analyses and testimony. So in that limited sense, I am an expert in operations. It's a very circumscribed sense.

Q. Okay. Could you define what those areas are that you got the limited expertise in?

A. Let's take the present proceeding and Contention 2. I'm now familiar in a general sense with the configuration of the Harris Fuel Building and its equipment, and in a general sense, with the procedures used to manage fuel. I may acquire additional knowledge on these matters prior to the filing.

Q. You say you're familiar in a general sense.

MS. CURRAN: Excuse me. Before we go

on with the next question, I'd like to take a short break.

DR. HOLLAWAY: I'd like to finish the next couple questions that go directly to the question that he just responded to and I'd be happy to take a break, if that's okay.

MS. CURRAN: Okay.

Q. You said you're familiar in a general sense with the equipment at the Harris plant. What is that familiarity based on?

A. Based on -- I think I said the fuel handling building.

Q. Fuel handling building.

A. To date, that's based on review of the FSAR and other documents provided by CP&L and deciphers of yesterday.

Q. Okay. When you state --

A. -- and --

Q. Oh.

A. Correction -- and with some additional information obtained from the deposition yesterday of Mr. Devoe.

Q. Okay.

You state you're familiar in a general sense with the procedures for the fuel handling building. What's that based on?

A. Again, the same data source that I just described.

Q. Okay.

A. Data set.

Q. Your familiarity is just in a general sense, it is not from actual application?

A. That's correct. Nor would I claim to be familiar with all of the procedures used in fuel management at Harris.

Q. Okay. And even the ones that you've read or heard about, you have not actually applied yourself.

A. Correct, correct.

Q. Have you seen them applied?

A. No.

Q. Okay.

DR. HOLLAWAY: Diane, if you'd like to take a break, it will be fine.

MS. CURRAN: Okay.

DR. HOLLAWAY: How long do you want?

MS. CURRAN: Five minutes.

(Thereupon, a break was taken at 10:05 AM, with proceedings recommencing at 10:12 AM)

THE WITNESS: I'd like to clarify one of my previous statements. Is that okay?

DR. HOLLAWAY: Yes; go ahead.

THE WITNESS: You asked about my expertise in nuclear plant operations.

DR. HOLLAWAY: Yes.

THE WITNESS: And I stated that I have performed many studies and presented numerous pieces of testimony pertaining to the safety of nuclear facilities. This goes back into the 1970's. So I've become familiar with details of numerous facilities, nuclear power plants and other nuclear facilities, in several countries. And I have always taken pains to acquire the necessary familiarity with the details of the design and operation of each facility in order to support whatever claim I made in my study or testimony.

DR. HOLLAWAY: Okay.

THE WITNESS: And that's typically not the same as the -- as the level of operational familiarity that one would require as an operator or manager of such a facility. It's a sufficiency of knowledge and expertise to support whatever claim about safety is made in the study or testimony.

And in this proceeding, I will expect to meet the same standard, that any claim that I make will be supported by sufficient expertise and familiarity with the design and procedures and operational characteristics of the Harris plant.

DR. HOLLAWAY: Okay.

Q. Your ability to speak on these issues I gather would depend on what the specific issue was?

A. I -- yes, with the clarification that I have on various occasions become --

acquired knowledge and expertise that I didn't -- did not possess up to that point --

Q. Okay.

A. -- in the realm of nuclear safety.

Q. Your familiarity with design and operations of a facility, outside of your description of time in the fuel handling building, would be based on reports you've read, documents you've read; is that correct?

A. And on applications of general physical principles.

Q. Okay. When you say "application of general physical principles," you're talking about theoretical application, not physically doing things, is that correct, yourself physically doing things?

A. I -- yes.

Q. Okay. And you say your expertise would not be the same as an operator or manager of a nuclear power plant. I presume that would include workers, technicians, et cetera that are actually working at the facility.

A. Yes.

Each -- each such person has a particular realm of expertise, and there's only so much you can do in one life.

But I emphasize that I'm always very careful to support my claims and findings with knowledge about the underlying -- about relevant matters underlying those findings.

Q. That's certainly laudable.

How much time did you spend in the Harris Fuel Handling Building?

A. The site visit lasted about two hours, I recall; so maybe an hour in the building.

Q. Okay. Does that hour in the building make you an expert on the fuel handling building?

A. It mostly confirmed the general understanding I obtained from the FSAR.

Q. Okay; layout of where things were, et cetera.

A. Right.
Q. Okay. Have you been in other fuel handling buildings at other facilities?
A. Darlington; Main Yankee; Dukovany; and TMI, Unit 2.
Q. Where is the Darlington plant located?
A. Canada, in the province of Ontario.
Q. Okay. Is that a pressurized water reactor like Harris?
A. No.
Q. TMI, Unit 2; when were you there?
A. In the '79-80 period. I don't recall exactly. 1- -- 1980.
Q. It was after 1979.
A. Yeah.
Q. What type of reactor is Main Yankee?
A. PW- -- it -- I don't recall the vendor.
Q.- And what were you doing in the fuel handling building there and for how long?
A. It was a site visit in connection with an intervention by the State of Maine.
Q. What year was that?
A. I think 1981.

Q. How long were you in that fuel handling building?
A. Maybe an hour.
Q. Dukovany; what type of reactor is that?
A. Czech Republic, for PWR units, Russian design.
Q. Russian design?
A. Soviet design.
Q. Okay. Is there an acronym that that goes by?
A. The -- the Russian for PWR is VVR.
Q. VVR?
A. Any pressurized water reactor.
Q. Okay.
What were you doing in the fuel handling building there?
A. I was representing the investor, Vienna, which in turn represented the Chancellor's Office of Austria, which was concerned about safety of fuel management at Dukovany, which is a neighboring country.
Q. What year were you there?
A. 1992.

Q. How long were you in the fuel handling building?
A. In about an hour.
Q. Okay.
You mention that part of your expertise is based on sitting in on Mr. Devoe's deposition yesterday; is that correct?
A. That's a contribution to it, yes.
Q. Okay.
A. The contribution to my knowledge, rather than expertise.
Q. Very good. How long were you in that deposition?
A. I'd guess about two hours.
Q. And did what you learned in Mr. Devoe's deposition substantially increase your knowledge on these issues?
A. No; it was a comparatively minor increase in knowledge. There were lots of loose ends left unresolved.
Q. Can you approximate, I guess percentage-wise? Is it, like, a fifty

percent increase in knowledge?
A. Oh, no; much less.
Q. One percent?
A. Less.
Q. Less than one percent?
A. Hard -- hard to say, but small. I --
Q. Okay. I mean --
A. It's not a matter that's susceptible to numerical estimate.
Q. But it's less than fifty percent?
A. Yes.
Q. Okay; less than twenty-five percent?
A. Probably, but I wouldn't give a number on that.
Q. Okay.
You have stated that you will address and do understand assumptions that go into criticality analysis.
A. Correct.
Q. Okay. Even if you don't actually do the criticality analysis yourself --
A. Correct.
Q. -- the assumptions you can address.

A. Correct.

Q. Okay.

Referring to your curriculum vitae, which is a lot of pages, on page 1 it addresses sponsors and tasks.

A. Correct.

Q. Aside from the Orange County, North Carolina, which I understand to be the present proceeding, which of these dealt with your evaluation of assumptions used in criticality analysis?

A. None of these so far.

Q. Okay.

On page 4 your CV lists publications. Aside from the first one, which is this proceeding, which of these publications address assumptions used in criticality analysis?

A. None so far.

Q. On page 8 there are expert presentations and testimony?

A. Correct.

Q. Which of these address assumptions used in

criticality analysis?
A. None.
Q. Okay.
Can you explain to me how criticality is controlled for fission reactor fuel in a spent fuel pool?
A. It can be controlled by the spacing of the fuel assemblies; by the placement of neutron-absorbing material, such as boral, between fuel assemblies; by the addition of boron to the water surrounding the fuel assemblies; and by confining placement of fuel assemblies to those which meet some specified combination of enrichment and burn-up. Those are four possible options for controlling criticality in fuel that is placed in a rack.
Q.- Okay. Can you describe for me the history of development of criticality control methods for spent fuel pools?
A. In the early years of United States nuclear industry, pools employed low-density racks; and the spacing in

practical importance, the fifth was tech spec limits on enrichment and -- is that right? Is that the fifth?

A. Yes. And just to clarify --

Q. Okay.

A. -- the -- the -- in this proceeding, the -- the four are really relevant to the Orange County's concerns.

Q. Okay.

Can you tell me, of the measures you've identified, which of those measures are physical?

A. Spacing, geometric configuration of the rack is a physical provision. I wouldn't call it a process; but a physical provision would be the design and construction of a rack, with a certain spacing.

Q. Okay.

A. Yeah.

The presence of neutron-absorbing solid panels could also be regarded as a physical provision.

The reliance upon burn-up and enrichment credit is not a physical provision, because although the suppression of -- although the -- because -- let me get this straight.

Reliance upon burn-up and enrichment credit is not a physical provision because it involves administrative actions which, if correctly executed, invoke a physical principle. So -- so this provision combines within it a set of administrative requirements and actions which, if executed, invoke a physical principle which achieves criticality control.

The same can be said of boron, taking credit for boron in the water.

Q. Okay. If these administrative actions are implemented correctly, is criticality control achieved?

A. Assuming the supporting analysis, the criticality analysis, is performed correctly and administrative measures are performed correctly, yes.

Q. Is soluble boron put in the water a physical item?
A. The -- the boron is a physical item. I'd reiterate my previous statement that the taking credit for boron in criticality control is not a physical provision.
Q. Is the enrichment of fuel a -- a physical characteristic of the fuel?
A. Yes.
Q. Is the burn-up of the fuel a physical characteristic of the fuel?
A. Yes.
Q. Can you tell me which of the measures you've identified are purely physical and require absolutely no administrative measures to implement?
A. None of them are purely physical.
For instance, take spacing. Spacing achieves criticality control, provided the spacing is maintained correctly. If a rack were poorly designed and constructed so that it were physically weak and some event within the design basis, such as an

earthquake or other action compressed the assemblies, then the physical provision would not have achieved its desired objective.

The distinction that I drew between, on the one hand, spacing and solid panels and, on the other hand, boron credit and burn-up enrichment and enrichment credit is that in the first category, the physical provision is embodied in a -- an engineering construction that has no moving parts and does not rely upon the action of operators or machinery or the supporting services, such as electricity or -- or any other supporting requirement. The physical -- the physical principle is embodied in a -- a construction -- a construction that, once -- once constructed according to specifications, requires no further intervention or action to achieve its function.

The second category - namely, boron in the water or the burn-up and enrichment

credit - does require ongoing actions in order to serve its required function of criticality control.
Q. You talked about with physical separation, that so long as seismic events or poor construction quality did not make the racks collapse, they would be okay; is that correct?
A. Assuming analysis is correct and construction is correct, yes.
Q. Okay. An analysis would demonstrate that it would withstand, let's say, a seismic event; is that correct?
A. Analysis can demonstrate that if performed correctly.
Q. Okay. And construction of the racks, how is that done who does that?
A. The racks would be typically constructed by a vendor, and there would be quality control provisions to verify that the racks were built as specified.
Q. Okay; they would be constructed by people, human beings?

A. Yes.
Q. But you would verify that the racks were built to construction by inspection, by QA procedures, QA control?
A. Correct.

MS. CURRAN: Bill, I'm going to ask for that break again.

I didn't -- it wasn't really a break for me.

DR. HOLLAWAY: This would probably -- I am still in the middle, but it's probably a fine time; so go ahead.

How much time do you need? Ten minutes? Five minutes? Ten minutes?

MS. CURRAN: Yeah, that would be great.

Ten minutes?

THE WITNESS: Yeah.

MS. CURRAN: Okay, ten minutes.

DR. HOLLAWAY: Okay, sure.

(Thereupon, a break was taken at 10:45 AM, with proceedings recommencing at 10:55 AM)

DR. HOLLAWAY: Back on the record.
Q. Dr. Thompson, have you ever written any regulations for fission reactor criticality control?
A. No.
Q. Have you ever written any regulatory guides for fission reactor criticality control?
A. No.
Q. Have you ever written any regulations or regulatory guides for any fission reactor issues?
A. No.
Q. Have you ever implemented NRC regulations at a nuclear power plant?
A. No.
Q. Have you ever implemented reg guides at a nuclear power plant?
A. No.
Q. Have you ever worked as a licensing engineer for a nuclear power plant?
A. No.
Q. You are not an attorney, are you?

A. Correct.
Q. And you have not been an attorney.
A. Correct.
Q. You are a physicist, as I understand it. Is that correct?
A. Well, my resumé says that I'm a consulting technical and policy analyst.
Q. Very good.
Are you an expert in criticality control regulation?
A. I will have sufficient expertise to support the part of the brief on this contention.
Q. What is your answer to my question?
A. That question can't be given an accurate yes or no answer.
Q. Why is that?
A. Because the word "expert" is open to interpretation. When you say are you expert in a certain activity, that question is not a straightforward yes or no question, it's open to interpretation.
Q. By who?

A. I interpret that question as not being susceptible to a yes or no answer.
Q. Do you put yourself forth as an expert in criticality control regulation?
A. Sufficient to support a brief, our brief, yes.
Q. I take it that's some aspect of criticality control regulation?
A. Yes, yes.
Q. What aspect would you hold yourself forth as an expert in criticality control regulation?
A. The -- in interpreting the -- the language of GDC 62 and analyzing the various interpretations of that which have been made over the years by the NRC staff.
Q. And what do you assert makes you competent to interpret GDC 62?
A. General knowledge of the nuclear industry and nuclear safety and physical principles of nuclear safety.
Q. Okay.
Dr. Thompson, what's your role in

burn-up credit would be prohibited flatly by the wording of GDC 62; and I believe that's what Attorney Curran is driving at in this statement.

Q. Okay.

DR. HOLLAWAY: Let me ... (examining documents).

Ask the court reporter to mark as Exhibit --

MR. O'NEILL: Twelve -- thirteen.

DR. HOLLAWAY: -- 13 an excerpt from 10 CFR, specifically the beginning of Appendix A to Part 50, General Design Criteria, and Criterion 62.

(Thereupon, Thompson Exhibit No. 13 was marked for identification)

Q. It states: "Criterion 62, Prevention of criticality in fuel storage and handling."

A. Could you bear with me for a moment, please?

Q. Oh; I apologize.

A. I have it, yes. Go ahead.

Q. "Criterion 62, Prevention of criticality in fuel storage and handling. Criticality in the fuel storage and handling system shall be prevented by physical systems or processes, preferably by use of geometrically safe configurations."

What do you understand the scope of this criterion to be? What does it address?

A. Fuel storage and handling at nuclear power plants. I believe this covers just nuclear power plants. And it would cover fresh and spent fuel at all times when present in the nuclear power plant.

Q. And what is your interpretation of "shall be prevented by physical systems or processes"? Isn't it that no administrative measures shall be permitted? Is that correct?

A. Yes.

Q. Does it say anything about administrative measures?

A. It -- it does not.

Q. What do you think it means when it says "preferably by use of geometrically safe configurations"? What's the word "preferably" mean?

A. "Preferably" means when possible.

Q. Would you take it from that that things besides geometrically safe configurations would be allowable under this?

A. Only if there's no way of achieving this criticality safety otherwise.

Q. But there would be things other than that that would fit under here, hence the word "preferably"?

A. I -- I would interpret that the word "preferably" was inserted here to cover contingencies where geometric safety cannot be provided and some other option could be developed.

And given that interpretation of "preferably," I would argue that the -- it is possible to use a rack configuration, which is geometrically safe and does not require the taking of burn-up credit and that that's -- because that is a possible alternative and indeed was the option that was used until this decade, I would argue that the word "preferably" requires the prohibition of burn-up credit.

Q. The word "preferably" requires the prohibition of burn-up credit; is that your position?

A. My interpretation of "preferably" is that you use geometrically safe configurations where this is -- where this can be done and that -- the only circumstances in which a configuration that is not geometrically safe might be permitted by this criterion is when no alternative exists.

Q. You talked about the alternatives that one could possibly use earlier today. Which of those criticality control measures would fit within GDC 62, in your opinion?

A. The rack spacing and the presence of neutron-absorbing panels between assemblies would both satisfy the geometrically safe configuration component of this criterion.

Q. And the other two, I take it -- you tell me what those are again.

A. Boron -- boron in the water and burn-up credit would not satisfy the requirement for geometry safety.

Q. Is your interpretation of this -- do you believe it's clear and unambiguous?

A. I believe it is.

Q. There's no room for reasonable disagreement on this matter?

A. I have stated my interpretation of the language, and I can't answer to interpretation by another person.

Q. Do you -- do you believe there are other interpretations that are reasonable, in your opinion?

MS. CURRAN: Objection. That question is very vague.

DR. HOLLAWAY: Okay.

Q. Hypothetically, if one were to argue that physical systems or processes that require some administrative control to implement were included under this, would you, in your opinion, state that that's an unreasonable interpretation of this?

A. Yes. Yes, I would.

Q. Okay; and what is your basis for that, the text itself?

A. The text itself, and in application to spent fuel pools in 1999, the fact that there is no necessity to use a non-geometrically safe configuration, there is no necessity to rely upon administrative measures.

The reliance upon administrative measures is different by cost considerations, that nuclear power facilities do not wish to incur the additional expenditure incurred in creating dry storage and that they intend to maximize the occurrence of spent fuel pools, and that they are weakening the level of the control that I believe is considered in the frame by the GDC 62. So that practical set of considerations and the practical language I believe prohibit administrative measures.

Q. In your opinion, is it the cost issue that you believe is what violates this or is it regardless of cost?

A. The fact that there is no physical necessity to take burn-up credit in a spent fuel pool, that the -- there is a licensed form of storage - namely, dry storage - that would allow every licensee to run their reactors and use their fuel pools without relying on burn-up credit, the only possible reason that I can think of why the licensees do not do this is to save money.

Q. Would dry storage costs comply with this criterion as written, in your opinion?

A. I do not know at this point about the role of burn-up credit in cask licensing, and that's a point I need to inform myself about.

Q. What about -- what about this Castor cask you've been talking about? You sounded familiar with that one. Would that satisfy this?

A. I repeat. At present I don't know the license provisionships on burn-up credit in any of the dry storage technologies.

I would say that there is a qualitative difference in the potential for criticality incidents in casks in dry storage and the pool storage.

Q. What is that difference?

A. The -- if -- if a dry storage technology is not geometric and safe but relies upon burn-up credit, the criticality accident would occur at a time of loading or unloading of the storage vessel in the cask loading pit of the fuel handling building. That's a delimited set of circumstances where this might occur.

In a pool, there is a longer period and a greater variety of circumstances that might lead -- that could potentially lead to a criticality event.

Q. You talked about a qualitative difference

between pools and casks with respect to criticality control; is that correct?
A. Correct, with respect to the potential for -- the potential of a criticality accident if both required burn-up credit to be taken for criticality control.
Q. And as I take it, foundation for that thesis is the fact that the fuel sits in the pools all the time?
A. Right.
Q. And in the cask, it's only when it's loaded.
A. Correct.
Q. If spent fuel does not go critical when it's moved, does anything change while it sits there?
A. No.
Q. Can you turn to Exhibit -- Exhibit 12.
A. (Complies).
Q. On page 18 is stated Basis 1. Now assuming again that the Board's decision represents the contention, Basis 1 states: "CP&L's proposed use of credit for burn-up

paragraph 11 on page 7?
A. Yes.
Q. Will you turn to page 1.13-13.
A. (Complies).
Q. Paragraph 4.5 discusses how fuel burn-up determination should be made; is that correct?
A. It does.
Q. Go to the next page, 1.13-14.
A. (Complies).
Q. Section 6 is called Credit for Burn-up in Storage Rack Design; is that correct?
A. Yes.
Q. And is it your understanding that this section is how one implements burn-up and enrichment limits with storage -- spent fuel pool storage racks?
A.- Yes.
Q. Dr. Thompson, you've stated and you believe, as I understand it, that your interpretation of GDC 62 is -- is very specific and clear and not subject to other reasonable interpretations. Is that

correct?
A. Yes.
Q. But this Reg. Guide 1.13, dated December 1981, is a staff -- NRC staff document approving the use of burn-up credit in spent fuel pool storage racks; is that correct?
A. That's correct.
Q. In doing this, in implementing this regulatory guide, do you believe the NRC staff is simply negligent or intentionally breaking the law?
A. I would assume negligence.
Q. Can you tell me your understanding of the purpose of a regulatory guide, Dr. Thompson?
A. My understanding is that these -- these guides are to help licensees abide by the regulations, and if a licensee conforms to the regulatory guide, that the staff will typically recommend the granting of the license in question.
Q. Is it your position that a regulatory

guide such as this would represent the NRC staff's interpretation of what's required to comply with the regulations?

A. That's my understanding of what it's intended for.

I would mention that this one (indicating) is a draft for comment.

Q. It's a draft for comment, you say.

A. That's what it says on the front.

Q. Are you aware of whether or not this Regulatory Guide, Proposed Revision 2, has ever been implemented or used as the basis to approve any licensee applications?

A. It's been referred to repeatedly, and I assume it is the basis upon which the staff has recommended the granting of license amendments for burn-up credit.

DR. HOLLAWAY: Ask the court reporter to mark as Exhibit --

MR. O'NEILL: Fifteen.

THE COURT REPORTER: Fifteen.

DR. HOLLAWAY: -- 15 a letter from Chandu Patel to Charles Dugger

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

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

AFFIDAVIT OF STANLEY E. TURNER, Ph.D., PE

COUNTY OF PINELLAS	)	
	) ss:	
STATE OF FLORIDA	)	

I, Stanley E. Turner, being duly sworn, do on oath state as follows:

EXPERIENCE AND QUALIFICATIONS

1. I am the Senior Vice President and Chief Nuclear Scientist of Holtec International ("Holtec"). I have been employed by Holtec since 1987, shortly after the formation of Holtec. I have also supplied the nuclear analyses used by Holtec's principal and founder, Dr. Krishna P. Singh, before the formation of Holtec, beginning about 1981. My business address is 138 Alt. 19 South, Palm Harbor, Florida, 34683.

2. Holtec is a diversified energy technology company working for the electric power industry both in the United States and in many countries around the world. Holtec performs the majority of its work for nuclear power plants. Holtec develops and markets turnkey equipment for the nuclear power industry. Holtec performs all of the design and engineering, obtains necessary governmental regulatory approvals, effectuates

manufacturing, and performs on-site installation, testing, and commissioning into service of the products it sells. Holtec currently employs over 40 professional employees. A large number of Holtec's employees hold graduate degrees from prestigious national and international universities, with approximately 30 percent holding Ph.D.'s in science and engineering.

3. Holtec designs and markets both wet storage and dry storage systems for spent fuel storage and transport. Holtec's expertise in spent fuel storage system development and supply includes expertise in solid mechanics, heat transfer, nuclear physics, and nuclear components fabrication. One of Holtec's principal business areas is the design and installation of spent fuel storage racks for the expansion of wet storage capacity at nuclear power plants. Holtec's capability in these projects includes all of the design, analysis, and licensing reports required to obtain approval and implementation of the spent fuel storage rack capacity expansions. Holtec has a practically 100% market share in wet storage expansion. Holtec has completed turnkey projects for wet pool spent fuel storage capacity expansion in over 50 spent fuel pools in nuclear plants around the world.

4. I am Holtec's Chief Nuclear Scientist responsible for all nuclear analyses performed by Holtec. Included in my role as Senior Vice President and Chief Nuclear Scientist is responsibility for all nuclear criticality analyses for spent fuel storage systems.

5. I received my Ph.D. in Nuclear Chemistry from the University of Texas in 1951. I have been elected to the academic honor societies of Sigma Pi Sigma, Phi

Lambda Epsilon, Blue Key, and Sigma Xi. I have been a registered Professional Engineer in the field of Nuclear Science for over 25 years. I am, and have been, a member of several Standards Committees in the American Nuclear Society ("ANS"). I have been a member of the ANS Standards Committee on Nuclear Criticality Safety since 1975. I am an Elected Fellow of the American Institute of Chemists. A copy of my resume is included as Attachment A to this affidavit.

6. I have been performing nuclear criticality analyses since 1957. Since 1987, I have been the Chief Nuclear Scientist for Holtec. Prior to that, from 1977 to 1987, I was the Senior Consultant for the Southern Science Office of Black & Veatch Engineers-Architects. Prior to that, from 1973 to 1977, I was a Senior Consultant for NUS Corporation. Prior to that, from 1964 to 1973, I was the Vice President for Physics for Southern Nuclear Engineering, Inc. Prior to that, from 1957 to 1964, I was a Senior Reactor Physicist for General Nuclear Engineering. Every one of these positions has included, among other things responsibility for nuclear criticality safety for reactor core operations as well as for new and spent fuel storage.

7. In my four decades of work on nuclear criticality safety, I have both developed methods for assessing nuclear criticality safety and performed the analyses to demonstrate criticality safety. I have developed nuclear analysis techniques used in criticality safety analyses. I have performed the detailed calculations to benchmark the KENO5a and MCNP4a computer codes that are widely used for criticality safety analyses. I have developed and written computer codes to generate input for nuclear criticality safety analyses. I have also performed numerous nuclear criticality safety

analyses. I have performed numerous calculations of spent fuel fission product inventories using the CASMO2E, CASMO3, CASMO4, ORIGEN, ORIGEN-II, and ORIGEN-S codes. I have performed numerous criticality safety analyses for wet spent fuel storage rack installations, dry cask storage, and transportation casks. I have personally performed criticality safety analyses, and authored the related reports, to support approximately 60 to 70 license amendment requests for spent fuel pool storage.

8. I make this affidavit to explain the physical systems or processes available as criticality control methods for spent fuel storage, and the administrative measures used to implement each method. I also discuss, and provide my understanding of, the NRC's regulations governing criticality control for spent fuel pools, including General Design Criterion 62 (10 C.F.R. Part 50, Appendix A) and 10 C.F.R. § 50.68. I address specific aspects of the NRC Staff's regulatory guidance concerning spent fuel pool criticality control, including the Double Contingency Principle and the implementation of burnup credit. I also provide information concerning the prevalence of the use of burnup credit for spent fuel pool criticality control in numerous sites across the country and overseas. Finally, I provide my review of the nuclear criticality analysis performed by the NRC Staff for this proceeding.

PHYSICAL SYSTEMS OR PROCESSES AVAILABLE FOR CRITICALITY CONTROL IN SPENT FUEL POOLS

9. Every criticality control method involves, by necessity, some physical system or process. Criticality control can only be achieved through physical measures that affect the neutron multiplication factor ("k-effective"). This is achieved through controlling the production, absorption, and leakage of neutrons. All of these are physical

measures. Neutrons will not recognize, much less obey, procedures and other administrative measures alone. Some physical measure is required to achieve criticality control.

10. There are a limited number of means available to control criticality of fuel assemblies stored in spent fuel pools. In practice, the four methods available are: 1) geometric separation; 2) solid neutron absorbers; 3) soluble neutron absorbers; and 4) fuel reactivity. These methods are physical systems or processes which have a physical effect on the neutron multiplication factor, or "k-effective," in the spent fuel pool.

11. Geometric separation is a physical system or process. Geometric separation physically affects neutron coupling between assemblies in storage. Wider spacing of the individual fuel assemblies neutronically decouples the fuel assemblies and thus decreases reactivity of the system. Geometric separation takes the form of steel racks installed in the spent fuel storage pool with fixed locations and fixed separation between the fuel assemblies in storage.

12. Solid neutron absorbers are a physical system or process. Solid neutron absorbers physically affect neutron absorption. Absorption of neutrons in the solid neutron absorbers, also referred to as neutron "poisons," remove neutrons from the system, which eliminates neutrons that could cause fission and thus decreases reactivity of the system. Boron, and specifically the isotope Boron-10, is the standard absorbing element used in solid neutron absorbers. Solid neutron absorbers take the form of fixed panels with solid boron that are installed in the spent fuel storage racks during their manufacture.

13. Soluble neutron absorbers are a physical system or process. Just like solid neutron absorbers, soluble neutron absorbers physically affect neutron absorption. Absorption of neutrons in the soluble neutron absorbers, also referred to as neutron "poisons," remove neutrons from the system, which eliminates neutrons that could cause fission and thus decreases reactivity of the system. Boron, and specifically the isotope Boron-10, is the standard absorbing element used in soluble neutron absorbers. Soluble neutron absorbers take the form of soluble boric acid dissolved in the spent fuel pool water.

14. Fuel reactivity is a physical system or process. Fuel reactivity physically affects the production, absorption, and leakage of neutrons. Fuel reactivity is determined by three factors: 1) fuel assembly structure; 2) initial (or "fresh") fuel enrichment; and 3) fuel depletion (or "burnup"). All three of these factors must be taken into account to determine fuel reactivity.

15. Fuel assembly structure, part of fuel reactivity, is a physical system or process. Fuel assembly structure physically affects the reactivity of the assemblies. The spacing of fuel rods within the fuel assembly structure determines neutron interactions, which physically affect reactivity of the system. The materials in the fuel assembly structure also act as neutron absorbers, which physically affect the reactivity of the system. Fuel-assembly structure takes the form of fuel (usually uranium dioxide) in metal cladding, as well as grid spacers, tie rods, and end fittings.

16. Fresh fuel enrichment, part of fuel reactivity, is a physical system or process. Fresh fuel enrichment physically affects neutron production. Higher fresh fuel

enrichment results in greater production of neutrons, which increases reactivity of the system. Fresh fuel enrichment is usually described in terms of weight percent of the fissile isotope Uranium-235, out of the total Uranium in the fuel, prior to loading into the reactor core and undergoing power operations.

17. Fuel burnup, part of fuel reactivity, is a physical system or process. Like fresh fuel enrichment, fuel burnup physically affects neutron production. In the burnup process, uranium initially loaded in the fresh fuel is converted, through the nuclear fission and absorption processes, into fission product nuclides and transuranic nuclides. Higher fuel burnup inherently results in lower production of neutrons, which decreases reactivity of the system. The fuel burnup process depletes the amount of fissile Uranium-235 in the fuel, while at the same time replacing the Uranium with fission products and transuranics that are, in many cases, strong neutron absorbers. While some fissile Plutonium-239 and Plutonium-241 are generated during fuel burnup, the combined quantity of fissile Uranium and fissile Plutonium decreases with increasing burnup. Fuel burnup, including the depletion of Uranium and thus the decrease in reactivity, is a well understood physical process. Fuel burnup takes into account the actual physical contents of the nuclear "fuel" material, which includes unburned fissile Uranium-235, non-fissile Uranium isotopes, fission products, and transuranics (including fissile Plutonium-239).

EVERY PHYSICAL SYSTEM OR PROCESS FOR CRITICALITY CONTROL IS IMPLEMENTED USING SOME ADMINISTRATIVE CONTROLS

18. Each of the physical systems or processes, identified above as physical measures for criticality control, requires some administrative controls for implementation. I know of no criticality control measure for fuel storage pools that can

be implemented without some degree of administrative control.

19. Spent fuel storage racks used for geometric separation are designed, constructed, and inspected according to procedural controls. The effect of the spent fuel storage racks on criticality is verified using validated computer codes. Administrative controls are used to ensure that the storage racks are constructed to match the approved design. Fabrication quality, including items such as manufacturing tolerances, is assured through the use of quality control inspections required by administrative controls. The storage racks are installed in the spent fuel pool pursuant to administrative controls, such as inspections, to ensure the racks are properly assembled and positioned.

20. Solid neutron absorber panels installed in the storage racks are likewise designed, constructed, and inspected according to procedural controls. The effect of the solid neutron absorber panels on criticality safety in the design phase is verified using computer codes validated under approved QA procedures. Administrative inspections are used to ensure that the proper amount of boron neutron absorber is loaded into each panel, and that the boron is uniformly distributed within the panel. Administrative controls, including fabrication inspections, are used to ensure that the storage racks are constructed to conform to the approved design. The solid neutron absorber panels are installed in the storage racks pursuant to administrative controls, such as inspections, to ensure the panels are properly located.

21. Soluble boron used in the spent fuel pool water is manufactured, added, and inspected according to procedural controls. The effect of the soluble boron neutron absorber on criticality safety is verified using computer codes validated under approved

QA procedures. The soluble boron is initially installed in the spent fuel pool water pursuant to administrative controls, such as tests and inspections, to ensure that the proper amount of soluble boron is installed. Once installed, it is very difficult to effectively dilute the soluble boron. The soluble boron control system is very slow and any operator error would quickly be detected and corrected weeks before dilution reached a significant level. Massive accident conditions postulate flooding the pool with many thousands of gallons of water. Such large quantities of water flowing over the storage pool floor, into and down stairwells, would be readily detectable long before the soluble boron concentration would be reduced to an undesirable level. Following initial installation, administrative controls, such as regular periodic testing, are used to verify that the level of soluble boron remains consistent with the approved design and that any credible dilution accidents would be detected and corrected on a timely basis.

22. Fuel assembly structure is also designed, constructed, and inspected according to procedural controls. The effect of the fuel assembly structure on criticality is verified using validated computer codes. Administrative controls are used to ensure that the fuel assembly structure is constructed to conform to the approved design. Fabrication quality, such as manufacturing tolerances, is assured through the use of quality control inspections according to administrative controls. The loading of the fuel pellets into the fuel assembly structure is monitored and inspected pursuant to administrative controls. Proper fuel assembly design and manufacture are also important to in-core power operation.

23. Fresh fuel enrichment is designed, produced, inspected, and tracked

according to procedural controls. The effect of the fresh fuel enrichment on criticality is verified using validated computer codes. Administrative controls are used to ensure that fresh fuel enrichment is produced to no more than the level permitted in the approved design. Enrichment quality, such as production tolerances, is assured through the use of quality control inspections required by administrative controls. The fresh fuel enrichment in different fuel assemblies is tracked using administrative controls such as material control and accounting (MC&A) procedures and related databases for control of special nuclear material. Administrative controls for MC&A track the movements, location, and fuel characteristics, including fresh fuel enrichment, of all fuel assemblies throughout their entire history at the reactor sites.

24. Fuel burnup is an inherent consequence of power operation in the reactor core. It is designed, produced, monitored, and tracked according to procedural controls. The effect of the fuel burnup on criticality is verified using validated computer codes. Administrative controls are used to ensure that fuel burnup is produced to no less than the level permitted in the approved design with conservative allowances for tolerances. Fuel burnup is verified through the use of in-core reactor power monitors used to measure the rate of fission, and therefore fuel burnup, in the reactor core. These records are developed and retained according to administrative controls. The fuel burnup is used to determine the fuel contents using verified and validated computer codes. The fuel burnup in different fuel assemblies is tracked using the material control and accounting (MC&A) procedures and related databases for control of special nuclear material. Administrative controls for MC&A track the movements, location, and fuel characteristics, including

fuel burnup, of all fuel assemblies throughout their entire history at the reactor sites.

25. While the type. degree, and timing of administrative controls vary for each of the physical systems or processes, it is a fact that every one of these physical measures for criticality control is implemented using some administrative controls.

NRC's Regulations Governing Spent Fuel Pool Criticality Control

General Design Criterion 62

26. The first NRC regulatory requirement governing spent fuel pool criticality control is General Design Criterion 62, "Prevention of criticality in fuel storage and handling" ("GDC 62"). This regulation was added to Appendix A of 10 C.F.R. Part 50 in 1971. A copy of GDC 62 is included as Attachment B to this affidavit. GDC 62 is one of the 64 general design criteria for nuclear power plants in Appendix A to 10 C.F.R. Part 50. GDC 62 reads as follows:

> *Criterion 62 – Prevention of criticality in fuel storage and handling.* Criticality in the fuel storage and handling system shall be prevented by physical systems or processes, preferably by use of geometrically safe configurations.

27. I have read, and am familiar with, the provisions of GDC 62. I have implemented the provisions of GDC 62 for over 28 years, since it was initially promulgated in 1971. I have also worked with the NRC Staff, during this same time period, to implement GDC 62 in light water spent fuel storage technologies developed to meet the requirements for expanded spent fuel storage since the mid-1970's.

28. GDC 62 requires that all spent fuel pool criticality control measures must be physical systems or processes. As I stated above, the four methods available in

practice for criticality control in spent fuel pool storage - - 1) geometric separation; 2) solid neutron absorbers; 3) soluble neutron absorbers; and 4) fuel reactivity, including 4.1) fuel assembly structure, 4.2) fresh fuel enrichment, and 4.3) fuel burnup - - are all physical systems or processes.

29. Also as I stated above, every one of these physical measures for criticality control requires some type of administrative controls to implement. In my 28 years of experience with GDC 62, I have always understood GDC 62 to encompass criticality control by physical measures that are implemented with the use of some administrative controls. As a practical matter, there can be no other way to interpret GDC 62. An interpretation that GDC 62 prohibits administrative measures used to implement the physical systems or processes would render GDC 62 a nullity, because none of the available criticality control methods could comply with such an interpretation. If this were the interpretation, GDC 62 would prohibit any method of criticality control.

30. The four different physical measures available for spent fuel pool criticality control do require different types, degrees, and timing of administrative controls for implementation. For example, the administrative controls required to implement geometric separation and solid neutron absorbers all occur before the storage racks are initially loaded with fuel, while the administrative controls attendant to soluble neutron absorbers and fuel reactivity occur both before the racks are initially loaded as well as after. However, this is a difference only in timing and duration of the administrative measures. Nothing in GDC 62 differentiates between physical systems or processes for criticality control based on the timing and duration of the administrative

measures required to implement the physical measures.

31. Specifically, fuel enrichment limits and fuel burnup limits are physical systems or processes consistent with the requirements of GDC 62. These two measures are aspects of fuel reactivity, which is clearly a physical measure.

10 C.F.R. § 50.68

32. The other NRC regulatory requirement governing spent fuel pool criticality control is 10 C.F.R. § 50.68, "Criticality Accident Requirements." This regulation supplements GDC 62 and defines the accident condition that is not specifically addressed in GDC 62. 10 C.F.R. § 50.68 was added to Part 50 in 1998 (a copy is included as Attachment C). 10 C.F.R. § 50.68 requires that the storage pool be evaluated for the accident condition which assumes the loss of all soluble boron. Though 10 C.F.R. § 50.68 does not address every postulated accident, it does address the most serious accident (loss of soluble boron), without describing conditions that might cause such an accident. The requirement is relevant to this proceeding, and requires that the storage racks remain subcritical should all soluble boron be lost.

33. 10 C.F.R. § 50.68 acknowledges and permits partial credit for soluble boron as a criticality control method for fuel stored in pools. 10 C.F.R. § 50.68(b)(4) specifically permits partial credit for soluble boron to establish an acceptable safety margin below criticality. Thus, 10 C.F.R. § 50.68 confirms the use of soluble boron as a criticality control method for spent fuel storage racks. The use of soluble boron for criticality control is just like the use of fuel burnup limits for criticality control. Both are physical measures that are implemented through administrative controls that apply prior

to initial use of the storage racks, and continue to apply during spent fuel pool operations.

34. 10 C.F.R. § 50.68 supplements and provides a practical interpretation of GDC 62 with regard to accident conditions. 10 C.F.R. § 50.68 has the effect of endorsing the single failure criterion (defined as loss of soluble boron) and does not require the evaluation of other unlikely, independent, and concurrent accidents (Double Contingency Principle).

35. 10 C.F.R. § 50.68 implicitly acknowledges and permits the use of limits on spent fuel assembly reactivity as a criticality control method for fuel stored in pools. 10 C.F.R. § 50.68(b)(4) specifically directs that "spent fuel storage racks loaded with fuel of the maximum fuel assembly reactivity" be considered for criticality control purposes. As discussed above, spent fuel assembly reactivity includes the effects of fuel burnup (as well as fuel structure and initial fuel enrichment). 10 C.F.R. § 50.68(b)(4) does not restrict the assessment of fuel reactivity to only fresh fuel enrichment.

36. 10 C.F.R. § 50.68 acknowledges and permits the use of fresh fuel enrichment limits as a criticality control method for fuel storage in pools. 10 C.F.R. § 50.68(b)(7) specifically permits the use of a limit on fresh fuel reactivity which includes burnup and enrichment as a criticality control method for fuel storage.

37. 10 C.F.R. § 50.68(b) acknowledges and permits the use of administrative controls, including plant procedures, to implement criticality control methods for fuel stored in pools. 10 C.F.R. § 50.68(b)(1) specifically endorses the use of plant procedures to implement geometric separation of fuel assemblies. 10 C.F.R. § 50.68(b)(4) specifically permits the use of soluble boron for criticality control, which requires

administrative controls to implement. 10 C.F.R. § 50.68(b)(4) specifically permits spent fuel assembly reactivity to be used in criticality control. Fuel reactivity includes the effects of fuel burnup, which requires administrative controls to implement. 10 C.F.R. § 50.68(b)(7) specifically permits the use of enrichment limits for criticality control, which requires administrative controls to implement.

NRC STAFF'S REGULATORY GUIDANCE CONCERNING CRITICALITY CONTROL

DOUBLE CONTINGENCY PRINCIPLE

38. The NRC Staff's regulatory guidance for implementing criticality control methods specifically endorse the Double Contingency Principle. The Double Contingency Principle (sometimes called the Single Failure Criterion) was originally issued in the ANSI Standard ANSI N 16.1-1975. It was later endorsed by the NRC Staff in the Staff's 1978 guidance letter to all power reactor operators, in Reg. Guide 1.13, and in the Staff's 1998 guidance memorandum (as discussed below).

39. The Double Contingency Principle is defined in Section 1.4 of Appendix A to Draft Revision 2 to Regulatory Guide 1.13, issued in 1981 ("Reg. Guide 1.13," included as Attachment D to this affidavit). While Reg. Guide 1.13 was never formally issued in final form, its provisions concerning criticality control, and specifically credit for burnup, have been implemented in the nuclear industry and by the Staff over the past 18 years in approving spent fuel storage rack license amendment requests for dozens of nuclear power plants across the country (I discuss these later in this affidavit). In this sense, though not formally issued in final form, the Staff's actions using Reg. Guide 1.13 as a basis in approving license amendments made it, through practice, final regulatory

guidance.

40. Reg. Guide 1.13, Appendix A, Section 1.4 defines the Double Contingency Principle as follows:

> At all locations in the LWR spent fuel storage facility where spent fuel is handled or stored, the nuclear criticality safety analysis should demonstrate that criticality could not occur without at least two unlikely, independent, and concurrent failures or operating limit violations.

The Double Contingency Principle, as defined in Reg. Guide 1.13, is a Staff term established in Staff guidance. It's definition can be determined through a review of Staff statements regarding the term and Staff actions implementing it. One significance of the Double Contingency Principle in the present proceeding is that, where the loss of soluble boron is evaluated as the principal accident condition (as specified in 10 C.F.R. § 50.68), it is not necessary to consider the simultaneous occurrence of other unlikely and independent accidents.

41. The Double Contingency Principle is also stated in other relevant NRC Staff guidance documents. The Double Contingency Principle was first formally adopted by the Staff in the 1978 generic letter from Brian K. Grimes of the Staff's Division of Operating Reactors to all power reactor licenses ("1978 Fuel Storage Guidance," included as Attachment E to this affidavit). In Section 1.2 of the 1978 Fuel Storage Guidance, the Staff adopts the Double Contingency Principle by reference to an industry ANSI standard, stating:

> The double contingency principle of ANSI N 16.1-1975 shall be applied. It shall require two unlikely, independent, concurrent events to produce a criticality accident.

The ANSI standard, ANSI N 16.1-1975, referenced by the NRC Staff provides the original definition of the Double Contingency Principle. A copy of ANSI N 16.1-1975 is included as Attachment F to this affidavit. Section 4.2.2 of ANSI N 16.1-1975 defines the Double Contingency Principle as follows:

> Double Contingency Principle. Process designs should, in general, incorporate sufficient factors of safety to require at least two unlikely, independent, and concurrent changes in process conditions before a criticality accident is possible.

The definition of Double Contingency Principle in Section 4.2.2 remained unchanged when ANSI N 16.1-1975 was revised into ANSI/ANS-8.1-1983 in 1983. A copy of ANSI/ANS-8.1-1983 is included as Attachment G to this affidavit.

The Staff provided further elucidation of its Double Contingency Principle in the Staff guidance on fuel storage criticality control issued in the 1998 memorandum from Laurence I. Kopp of the Staff's Reactor Systems Branch ("1998 Criticality Guidance," included as Attachment H to this affidavit). The 1998 Criticality Guidance has been approved by the Staff and made available to all licensees as guidance on implementing criticality control for fuel storage. Section 3 of the 1998 Criticality Guidance defines the Double Contingency Principle as follows:

> ABNORMAL CONDITIONS AND THE DOUBLE-CONTINGENCY PRINCIPLE
>
> The criticality safety analysis should consider all credible incidents and postulated accidents. However, by virtue of the double-contingency principle, two unlikely independent and concurrent incidents or postulated accidents are beyond the scope of the required analysis. The double-contingency principle means that a realistic condition may be assumed for the criticality analysis in calculating the effects of incidents or postulated accidents. For example, if soluble boron is normally present in the spent fuel pool water, the

> loss of soluble boron is considered as one accident condition and a second concurrent accident need not be assumed. Therefore, credit for the presence of the soluble boron may be assumed in evaluating other accident conditions.

The 1998 Criticality Guidance is the Staff's most recent, and most thorough, statement of the definition of the Staff's Double Contingency Principle.

42. I have been employing the Double Contingency Principle in performing criticality analyses for spent fuel storage racks for over 20 years. I have implemented the Double Contingency Principle for dozens of license applications since it was first developed. I have always understood the Double Contingency Principle to have the same meaning regardless of the document in which it appears. While the wording used in each of the documents above is slightly different, the meaning of the Double Contingency Principle in each is the same. The most recent Staff guidance on this issue, the 1998 Criticality Guidance, is the most simple, unambiguous, and easy to understand explanation of the Double Contingency Principle. It's meaning, however, is the same as that in the prior Staff guidance documents and in ANSI N 16.1-1975.

43. In all cases, the Double Contingency Principle is implemented by evaluating criticality for the expected, realistic conditions in the spent fuel storage pool, plus one unlikely, independent incident or postulated accident. The plethora of unlikely, independent accidents are not required to be analyzed concurrently. Instead, accident conditions are analyzed one at a time to develop a series of criticality results, one for each separate credible unlikely, independent accident condition. Under the Double Contingency Principle, an evaluation assuming two or more unlikely, independent, and

concurrent postulated accidents is beyond the scope of the required analysis. Only credible incidents or postulated accidents are required to be considered.

44. I have been involved with dozens of licensing applications involving the Double Contingency Principle before the NRC Staff. In my experience, the Staff has always interpreted the Double Contingency Principle this way.

45. There is no requirement in the Double Contingency Principle for applicants to demonstrate that criticality will occur with two or more unlikely, independent and concurrent incidents or accident conditions. The purpose of the Commission's criticality control regulations is to prevent criticality from occurring. It would be contrary to the Commission's purpose, and would serve no useful regulatory purpose, to define and evaluate the universe of possible scenarios of multiple concurrent accident conditions in which criticality might occur. The Double Contingency Principle clearly does not require this to be done.

46. In this case, the universe of scenarios to be evaluated under the Double Contingency Principle is the set of unlikely, but credible, independent incidents or postulated accidents that could have an adverse effect on criticality control. Of the four physical measures used for criticality control at Harris, two - - loss of the storage racks and loss of the solid neutron absorbers in the storage racks - - are not credible and need not be analyzed. The loss of control over fuel reactivity, including fuel enrichment and fuel burnup limits, through misplacement of a fuel assembly is highly unlikely, but hypothetically possible. The loss of soluble boron is so unlikely that it is probably not credible (particularly a total loss of soluble boron), but can be analyzed for completeness.

Thus, in addition to the expected conditions, two scenarios should be evaluated for Harris spent fuel pools C and D under the Double Contingency Principle: 1) expected conditions with misplacement of a fuel assembly; and 2) expected conditions with loss of soluble boron. Both of these scenarios have been analyzed by the Applicant, and both have been demonstrated to be subcritical within the regulatory limits.

47. My understanding of the Double Contingency Principle is based on over 20 years of actual experience implementing the Double Contingency Principle in NRC licensing actions, and working with the NRC Staff in implementing criticality safety and employing the Double Contingency Principle.

48. The Applicant's criticality control analysis in this case, with the addition of a supplemental analysis of two independent and concurrent accidents (the fuel assembly misplacement analysis, included as Attachment B to Exhibit 3, the Affidavit of Everett L. Redmond II, Ph.D.), confirms that, even for multiple accident conditions, the storage racks remain subcritical.

IMPLEMENTATION OF LIMITS ON FUEL BURNUP

49. The NRC Staff's guidance governing spent fuel pool criticality control permits the use of fuel burnup limits as a method for criticality control, and outlines the administrative measures required to implement fuel burnup limits. Fuel burnup was initially addressed by Staff regulatory guidance in the Reg. Guide 1.13 (Rev. 2), which is included as Attachment D to this affidavit. Appendix A of Reg. Guide 1.13 provides instructions on how to implement credit for burnup as a method for criticality control. Specifically, sections 4 and 6 address the administrative measures used to implement and

verify fuel burnup limits as a criticality control method.

50. The NRC Staff issued a new guidance memorandum in 1998 on criticality control for fuel storage that effectively replaces Reg. Guide 1.13 ("1998 Criticality Guidance," included as Attachment H to this affidavit). Like Reg. Guide 1.13, the 1998 Criticality Guidance permits the use of fuel burnup limits as a method for criticality control, and outlines the administrative measures required to implement fuel burnup limits. Sections 1, 2, and specifically 5.A.5 address the administrative measures used to implement fuel burnup limits as a criticality control method.

PREVALENCE OF BURNUP CREDIT

51. The use of burnup credit as a criticality control method for spent fuel pool storage is prevalent throughout the nuclear industry in this country and abroad. License amendments using burnup credit for spent fuel storage were approved beginning in the early 1980's. The need for burnup credit as a method for criticality control has become even more acute following the Department of Energy's failure to meet its obligation to begin accepting spent nuclear fuel beginning in 1998. I am aware of at least 20 nuclear power plants that currently use burnup credit as a criticality control method for their spent fuel pool storage. The following list identifies these 20 plants where burnup credit is used, along with the approximate year of license approval:

	Plant	Year
1.	V.C. Summer	1983
2.	Braidwood	1983
3.	Diablo Canyon	1986
4.	St. Lucie 1	1987
5.	Byron	1987

6.	Indian Point 2	1989
7.	San Onofre	1989
8.	TMI 1	1991
9.	D.C. Cook	1991
10.	Zion	1991
11.	Maine Yankee	1992
12.	Sequoyah	1993
13.	Fort Calhoun	1993
14.	ANO 1 & 2	1994
15.	Salem	1994
16.	Beaver Valley	1994
17.	Comanche Peak	1994
18.	Haddam Neck	1996
19.	Vogtle	1998
20.	Waterford	1998

NRC STAFF'S CRITICALITY ANALYSIS

52. In November, 1999, the NRC Staff performed for this proceeding an independent nuclear criticality analysis of multiple accidents involving fuel assembly misplacements. The Staff's criticality analysis was performed by Tony P. Ulses, a nuclear engineer in the NRC Staff's Reactor Systems Branch. This analysis is documented in the NRC Staff's November 5, 1999 memorandum and report, which is included as Attachment C to Exhibit 3, the Affidavit of Everett L. Redmond II, Ph.D. The Staff's analysis assumes the concurrent misplacement of an infinite number of fresh fuel assemblies of the maximum permissible reactivity. The Staff's analysis utilized boundary conditions that are reflective in the x, y, and z directions, which models and infinite array of fresh fuel assemblies. The analysis includes the effects of the soluble boron required to be present in the spent fuel pools pursuant to plant operating procedures. This analysis is not required under the Double Contingency Principle in the

Staff's regulatory guidance, since even two fresh fuel assembly misplacements are two independent, unlikely, concurrent events. The NRC Staff's analysis of an infinite number of concurrently misplaced fresh fuel assemblies of the maximum possible reactivity is far beyond what is considered a credible event for analysis purposes.

53. I have reviewed the NRC Staff's November 5, 1999 memorandum and report on its misplacement criticality analysis. I am familiar with the analysis methodology, assumptions, and computer codes used in the Staff's analysis. Based on my review, I have determined that the Staff modeled the most reactive fresh fuel assemblies permissible at Harris and the spent fuel storage racks to be used for those assemblies in Harris spent fuel pools C and D. The Staff's analysis concluded that the spent fuel storage racks will remain subcritical, with a calculated k-effective of 0.98. The Staff's analysis assumed that the k-effective bias from manufacturing tolerances is not larger than 1%. I am familiar with the manufacturing tolerances applicable to these spent fuel storage racks, and I confirm that the bias from these manufacturing tolerances is less than 1%.

54. I have performed an analysis similar to the Staff's analysis, using computer codes that I would normally use in storage rack design and analysis. My result is in complete agreement with that obtained in the Staff's analysis. Based on my independent analysis, my familiarity with the Staff's analysis, and my four decades of experience performing nuclear criticality analyses, I confirm the results of the nuclear criticality analysis performed by the NRC Staff. The results of the analysis are consistent with my expectations based on my knowledge of the spent fuel storage rack designs,

fresh fuel assembly characteristics, analytical methods, and calculations.

55. The NRC Staff's analysis (and my own confirming calculation) demonstrates that the spent fuel storage racks for Harris spent fuel pools C and D will remain subcritical, even if every location in the spent fuel storage rack is assumed to be concurrently loaded with a misplaced fresh fuel assembly of the maximum possible reactivity at the Harris Nuclear Plant. While this analysis is not required under the Staff's Double Contingency Principle, the NRC Staff's criticality analysis of an infinite number of fresh fuel assembly misplacements demonstrates that the issue of multiple fuel assembly misplacements is moot with respect to the spent fuel storage racks in Harris pools C and D.

I declare under penalty of perjury that the foregoing statements and my statements in the attached report are true and correct.

Stanley E. Turner
January 3, 2000

State of Florida
County of Pinellas

Subscribed and sworn to before me this
3rd day of January, 2000
FL DL T656-785-26-323-0
exp. 9/3/04

Vilma T. Brower

My commission expires

VILMA T. BROWER
MY COMMISSION # CC 589563
EXPIRES: October 7, 2000
Bonded Thru Notary Public Underwriters

STANLEY E. TURNER, Ph.D., P.E.

SENIOR VICE PRESIDENT AND CHIEF NUCLEAR SCIENTIST
HOLTEC INTERNATIONAL

EDUCATION

University of Texas
Ph.D. in Nuclear Chemistry (1951)

University of South Carolina
B.S. in Chemistry (1945)

Georgia Institute of Technology (1943-44) (1946-47)

PROFESSIONAL EXPERIENCE

HOLTEC INTERNATIONAL
Palm Harbor, Florida

1987-1997	Chief Nuclear Scientist
1997-Present	Senior Vice President and Chief Nuclear Scientist

SOUTHERN SCIENCE OFFICE OF BLACK & VEATCH ENGINEERS – ARCHITECTS
Dunedin, Florida

1977-1987	Project Manager/Senior Consultant

NUS CORPORATION
Dunedin, Florida

1973-1977	Senior Consultant

SOUTHERN NUCLEAR ENGINEERING, INC.
Dunedin, Florida

1964-1973	Vice President, Physics

GENERAL NUCLEAR ENGINEERING
Dunedin, Florida

1957-1964	Senior Reactor Physicist/Project Manager

SOCONY-MOBIL RESEARCH LABORATORY
Dallas, Texas

1952-1957	Research Scientist

U.S. NAVY RADIOLOGICAL DEFENSE LABORATORY
San Francisco, California

1951-1952	Physicist

PROFESSIONAL CERTIFICATIONS

Registered Professional Engineer (Nuclear)– Florida (1974-Present)

PROFESSIONAL SOCIETY MEMBERSHIPS/ACTIVITIES

Elected Fellow, American Institute of Chemists
Member, ANS Standards Committee 8.17 on Nuclear Criticality Safety (1975-Present)
Chairman of ANS 5.3 (Failed Fuel Consequences (1981-1995)) and 5.4 (Fission Product Release (1978-Present))
Formerly a member of the ANS 5 Committee with oversight on ANS 5.1, Decay Heat.

ACADEMIC HONORS

Sigma Pi Sigma, Phi Lambda Epsilon,
Blue Key, Sigma Xi

CONTINUING EDUCATION COURSES OFFERED TO PRACTICING GRADUATE ENGINEERS

1. Union Electric Company, St. Louis, Missouri: Use of CASMO and KENO Codes in criticality safety analysis.

2. Southern California Edison Company, San Clemente, California: Use of CASMO and KENO Codes in criticality safety analysis.

DRY AND WET SPENT FUEL STORAGE TECHNOLOGY

- Developed nuclear analysis techniques for criticality safety analyses.
- Performed criticality safety analyses for numerous wet spent fuel storage rack installations.
- Performed criticality analyses of numerous fuel designs under normal and accident conditions for the HI-STAR 100 shipping cask and HI-STORM storage cask.
- Performed detailed benchmark calculations for KENO5a and MCNP4a computer codes.
- Developed and wrote CELLDAN Computer Code to prepare input for NITAWL-KENO5a calculations.
- Supervised calculations with the QAD Point Kernal Code for gamma ray shielding.
- Performed numerous calculations of fission product inventories using ORIGEN, ORIGEN-II, and ORIGEN-S (ORIGEN-ARP) Codes.
- Participated in the development of Holtec's thermal evaluation methodologies for wet storage systems.
- Author of numerous reports on dry and wet storage facilities.
- Designed equipment for and supervised Blackness Testing at numerous power plants and performed measurements on Boraflex and Boral surveillance coupons.
- Performed R&D programs on Holtite-A neutron absorber materials and on HI-COAT coatings.
- Performed wet chemical analyses of Boral samples.