UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE COMMISSION

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

NRC STAFF RESPONSE TO "CONNECTICUT COALITION AGAINST MILLSTONE AND LONG ISLAND COALITION AGAINST MILLSTONE BRIEF ON REVIEW OF LBP-00-26" AND "ORANGE COUNTY'S AMICUS BRIEF ON REVIEW OF LBP-00-26"

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INTRODUCTION

Pursuant to 10 C.F.R. § 2.786(d) and the Commission's "Memorandum and Order," dated January 17, 2001,[1] the staff of the Nuclear Regulatory Commission (Staff) hereby responds to the "Connecticut Coalition Against Millstone and Long Island Coalition Against Millstone Brief on Review of LBP-00-26" (CCAM/CAM Brief), and "Orange County's Amicus Brief on Review of LBP-00-26" (BCOC Brief), both dated February 7, 2001. CCAM/CAM and Orange County urge reversal of the Atomic Safety and Licensing Board's (Board) initial decision in *Northeast Nuclear Energy Co.* (Millstone Nuclear Power Station, Unit No. 3), LBP-00-26, 52 NRC 181 (2000). For the reasons set forth below, the Staff submits that General Design Criterion 62 (GDC 62) permits a licensee to take credit in criticality calculations for fuel enrichment, burn-up, and decay time limits, and that the Board's decision regarding GDC 62 in LBP-00-26 should be affirmed.

SUMMARY OF ARGUMENT

The central issue in this proceeding is whether General Design Criterion (GDC) 62 permits the use of credit for enrichment, burnup, and decay time to maintain subcriticality in spent fuel pools. GDC 62 provides:

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[1] *Northeast Nuclear Energy Co.* (Millstone Nuclear Power Station, Unit No. 3), CLI-01-03, 53 NRC ___, slip op. (Jan. 17, 2001).

> *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.

10 C.F.R. Part 50, Appendix A, GDC 62. Nothing in GDC 62 prohibits the use of administrative measures to control the physical systems or processes referenced in that criterion. Similarly, nothing in GDC 62 indicates an intent to prohibit a certain set of administrative measures - "on-going" measures - or to differentiate "ongoing" from "one-time" administrative measures. Finally, nothing in the history of GDC 62 prohibits the use of such administrative measures, the Staff's consistent practice has been to allow licensees to rely, in part, upon such measures to satisfy that criterion, and the Commission has authorized the use of such controls relating to the prevention of criticality in spent fuel pools.

STATEMENT OF THE CASE

I. Procedural History of the *Millstone* Proceeding

On March 19, 1999, Northeast Nuclear Energy Company (NNECO) submitted a license amendment application by which it sought to increase the storage capacity of its spent fuel pool at Millstone Unit 3 by adding racks. On February 9, 2000, the Board granted the requests of the Connecticut Coalition Against Millstone (CCAM) and the Long Island Coalition Against Millstone (CAM)(collectively, Intervenors) to intervene in a proceeding on that application and admitted three of their contentions, Contentions 4, 5, and 6.[2] In Contention 6, which is the only contention now under Commission review, the Intervenors raised a legal issue as to the meaning of GDC 62. As admitted, Contention 6 asked:

> Does GDC 62 permit a licensee to take credit in criticality calculations for enrichment, burnup, and decay time limits, limits that will ultimately be enforced by administrative controls?

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[2] *Northeast Nuclear Energy Co.* (Millstone Nuclear Power Station, Unit No. 3), LBP-00-02, 51 NRC 25, 41 (Feb. 9, 2000).

LBP-00-26, 52 NRC at 202. Pursuant to 10 C.F.R. § 2.1113, the parties filed summaries of the relevant facts, data, and arguments upon which they proposed to rely at oral argument on the admitted contentions.[3]

II. The *Millstone* Board's Decision in LBP-00-26

On October 26, 2000, the Board issued LBP-00-26, in which it denied the Intervenors' request for an evidentiary hearing on the basis of there being no genuine and substantial dispute of fact to be resolved in an evidentiary hearing and terminated the proceeding. LBP-00-26, 52 NRC at 214. In doing so, the Board noted that the Intervenors had treated Contention 6 as a question of law, and went on to resolve that contention on the merits. *Id.* at 202-213.

In resolving Contention 6, the Board concluded that the types of controls that NNECO would use in implementing the proposed amendment are "inherently comprehended within the phrase 'physical systems and processes' that appears in GDC 62." *Id.* at 212. The Board noted that the Intervenors read GDC 62 as expressing a preference for what the Intervenors call "one-time" controls, but held that GDC 62 expressed a preference for geometrically safe configurations, and not a prohibition of such controls. *Id.* at 213. The Board also found that there is no basis for differentiating between one type of administrative control and another. *Id.* at 212. Therefore, the Board held that GDC 62 does not bar the types of administrative measures that NNECO seeks to use. In doing so, the Board adopted the same legal conclusion that a different Atomic Safety and Licensing Board presiding over a *Shearon Harris* proceeding reached with respect to a similar

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[3] *See* "NRC Staff Brief and Summary of Relevant Facts, Data and Arguments Upon Which the Staff Proposes To Rely At Oral Argument on Contentions 4, 5, and 6," dated June 30, 2000 (Staff Summary); "Summary of Facts, Data and Arguments On Which Northeast Nuclear Energy Company Proposes To Rely At The Subpart K Oral Argument," dated June 30, 2000; "Detailed Summary Of Facts, Data And Arguments And Sworn Submission On Which Connecticut Coalition Against Millstone And Long Island Coalition Against Millstone Intend To Rely At Oral Argument To Demonstrate The Existence Of A Genuine And Substantial Dispute Of Fact With The Licensee Regarding The Proposed Expansion Of Spent Fuel Storage Capacity At The Millstone Unit No. 3 Nuclear Power Plant," dated July 3, 2000 (CCAM/CAM Summary).

contention raised in that proceeding. *Id.*, *citing Carolina Power & Light* (Shearon Harris Nuclear Power Plant), LBP-00-12, 51 NRC 247, 255-69 (2000).

LBP-00-12 is not before the Commission on review.[4] Although one contention admitted in the *Harris* proceeding is very similar to Contention 6, the decision in that proceeding rests on a somewhat different basis than the Board's decision in LBP-00-26. Because the decision in *Harris* resolves an issue virtually identical to that presented in Intervenors' Contention 6, the Staff describes the *Harris* decision below.

III. The *Shearon Harris* Proceeding

On December 23, 1998, Carolina Power & Light Company (CP&L) filed an application for a license amendment, pursuant to 10 C.F.R. § 50.90, for the Shearon Harris Nuclear Power Plant (Harris). CP&L sought approval to increase spent fuel storage capacity by adding rack modules to two spent fuel pools ("C" and "D") and placing the two pools into service. To prevent criticality in the Harris spent fuel pools, CP&L proposed to take credit for initial enrichment and burnup, but did not propose to take credit for decay time, as NNECO proposed at Millstone. The Atomic Safety and Licensing Board (*Harris* Board) granted the petition to intervene of the Board of Commissioners of Orange County, North Carolina (BCOC), and admitted two of BCOC's technical contentions for litigation. *Carolina Power & Light Co.* (Shearon Harris Nuclear Power Plant), LBP-99-25, 50 NRC 25, 38 (1999). One of those contentions, Contention TC-2, Basis 1, is similar to CCAM/CAM's Contention 6. Contention TC-2, Basis 1, states:

> 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.

LBP-00-12, 51 NRC at 250.

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[4] *See Carolina Power & Light Co.* (Shearon Harris Nuclear Power Plant), CLI-00-11, 51 NRC 297, 300 (2000).

On May 5, 2000, the *Harris* Board issued a Memorandum and Order denying a hearing on the technical contentions. *Carolina Power & Light Co.* (Shearon Harris Nuclear Power Plant), LBP-00-12, 51 NRC 247, 282 (2000). With respect to GDC 62, the *Harris* Board determined that "there is no clear-cut demarcation to differentiate the administrative and nonadministrative aspects of the criticality control procedure/processes at issue [in Contention TC-2] so as to place them either inside or outside [the label of 'physical systems or processes']." *Id.* at 259. Accordingly, the *Harris* Board analyzed the legislative history of GDC 62. The Board noted that one commenter on GDC 62, as proposed in 1967, did not believe it practical to rely on procedural controls in preventing criticality in reactor storage facilities, and had, therefore, suggested deleting a reference in a proposed version of GDC 62. *Id.* The Board observed, however, that the Commission (AEC) had not adopted that comment in promulgating GDC 62, and concluded that the administrative measures encompassed by the reference remained permitted by the final of version GDC 62. *Id.* at 260. The *Harris* Board added that the recent agency adoption of 10 C.F.R. § 50.68, regarding criticality accident requirements, the longstanding Staff interpretation embodied in draft Regulatory Guide 1.13,[5] and prior decisions of the Commission's adjudicatory panels on criticality-related matters[6] further supported its conclusion. *Id.*

IV. The Commission's Decisions in CLI-00-11 and CLI-01-03

On January 17, 2001, the Commission issued CLI-01-03, in which it granted the Intervenors' petition for review of LBP-00-26 with respect to admitted Contention 6, set a schedule for the parties in this and the *Harris* proceeding to submit briefs, and directed the parties to address the

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[5] U.S. Nuclear Regulatory Commission, Draft Regulatory Guide 1.13, "Proposed Revision 2 to Regulatory Guide 1.13, 'Spent Fuel Storage Facility Design-Basis,' " Dec. 1981.

[6] The *Harris* Board referred to decisions in two proceedings cited by the Staff, namely, *Consumers Power Co.* (Big Rock Point Nuclear Plant), ALAB-725, 17 NRC 562, 564-65, 571 (1983), and *Florida Power & Light Co.* (St. Lucie Nuclear Power Plant, Unit 1), LBP-89-12, 29 NRC 441, 454-56, *aff'd on other grounds*, ALAB-921, 30 NRC 177 (1989). LBP-00-12, 51 NRC at 258.

question "whether GDC 62 permits a licensee to take credit in criticality calculations for fuel enrichment, burn-up, and decay time limits." CLI-01-03, 52 NRC ___, slip op. at 7. In particular, the Commission noted that the *Harris* Board reached the same conclusion as the *Millstone* Board. *Id.* at 6. The Commission also noted that the conclusion with respect to GDC 62 in *Millstone* has the potential to be raised in the *Harris* proceeding, and permitted the parties in *Harris* to file *amicus curiae* briefs, should they choose to do so. *Id.* at 7. As will be set forth below, the Staff submits that GDC 62 does permit licensees to take credit in criticality calculations for these items, and that LBP-00-26 should be affirmed.

ARGUMENT

In their brief, the Intervenors argue that the *Millstone* Board's decision in LBP-00-26 rests on three asserted errors: (1) It deprives words of their meanings; (2) it relies on an arbitrary and inappropriate selection of one dictionary definition of the word "processes"; and (3) it fails to recognize the obvious distinction between measures that are fundamentally "physical" and those that are fundamentally procedural or administrative.[7] CCAM/CAM Brief at 19-20.

BCOC, for its part, first argues, similarly to the Intervenors, that the interpretation of GDC 62 adopted in LBP-00-12 and LBP-00-26 deprives the word "physical" of any meaning in that criterion. BCOC Brief at 6. BCOC also focuses on the *Harris* Board's view of the rulemaking history of GDC 62, arguing that that Board ignored significant events in that history. *Id.* at 6-7. BCOC also

[7] Although irrelevant to whether GDC 62 allows for administrative controls, the Intervenors first argue that General Design Criteria set minimum requirements. CCAM/CAM Brief at 18. The Intervenors quote the Commission for the proposition that GDC "are intended to provide engineering goals rather than precise tests or methodologies by which reactor safety [can] be fully and satisfactorily gauged." *Id.*, n.22, citing *Petition for Emergency and Remedial Action*, CLI-78-6, 7 NRC 400, 406 (1978). The Intervenors, however, turn the quoted language on its head. Through its proposed interpretation of GDC 62, the Intervenors and BCOC would require licensees to use "precise . . . methodologies," *i.e.,* geometric separation and (perhaps) neutron absorbing materials, to prevent criticality in spent fuel pools. *Id.* at 11-16, 26-27; Tr. of Oral Argument in *Harris* at 226. As stated in CLI-78-6, however, the GDC provide "engineering goals," and do not set such precise requirements.

asserts that the *Harris* Board mistakenly found support for its ruling in the Commission's adoption of 10 C.F.R. § 50.68 (*id.* at 12), and draft RG 1.13 *(id.* at 17).[8]

I. The Board Decisions Do Not Ignore Or Read Out Words In GDC 62

Both the Intervenors and BCOC assert that the Boards' decisions amount to leaving the word "physical" out of GDC 62, and conclude that all measures to prevent criticality would be permitted under such a reading. CCAM/CAM Brief at 20-21; BCOC Brief at 5-6. Both BCOC and the Intervenors, however, admit that any physical measure has some administrative component, and any administrative measure has a physical component. CCAM/CAM Brief at 23; BCOC Brief at 5-6. As explained below, what both BCOC and the Intervenors misapprehend, and what causes their argument to fail, is the physical nature of enrichment, burnup, and decay time limits on spent fuel assembly placement in spent fuel pools.

The physical nature of enrichment, burn-up, and decay time in preventing criticality in spent fuel pools is evident from their definitions, as well as the definitions of associated terms such as "criticality" and "reactivity." The Staff has provided definitions of these terms in the Attachment to this pleading. As set forth below, GDC 62, read in light of the definitions of the terms "enrichment," "burnup," and "decay time," permits their use to prevent criticality in spent fuel pools.

As set forth in detail in the Attachment, criticality can occur in an array of LWR fuel only if sufficient fissile material is available in a near-optimum geometry and a moderator (water) is present. Affidavit of Drs. Laurence I. Kopp and Anthony C. Attard (Kopp/Attard Affidavit), ¶ 9.[9] This statement identifies three elements necessary for criticality in an array of LWR fuel: (1) the

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[8] The *Millstone* Board explicitly disclaimed any reliance on the Staff's longstanding interpretation of GDC 62, which is embodied in draft RG 1.13, and on 10 C.F.R. § 50.68. LBP-00-26, 52 NRC at 212-13. Notwithstanding the *Millstone* Board's disclaimers, the *Harris* and *Millstone* decisions reach the same conclusion regarding GDC 62, and the Commission invited *amicus* briefs from the *Harris* parties. Accordingly, the Staff will address these arguments as well.

[9] The Kopp/Attard Affidavit is attached to the Staff Summary. *See* Staff Summary at 10.

availability of sufficient fissile material; (2) configuration of that material in a near-optimum geometry; and (3) the presence of a moderator. Every one of these three items is physical. Enrichment, burnup, and decay time limits, as defined in the Attachment, determine the availability of fissile material in the array (item (1)), and are, therefore, physical processes for preventing criticality. *See id.* ¶¶ 10, 36, 37. The *Millstone* Board in LBP-00-26 correctly recognized that enrichment, burnup, and decay time limits have this physical character, and that GDC 62 permits licensees to take credit for them. LBP-00-26, 52 NRC at 212. The *Millstone* Board also correctly noted that GDC 62 expresses a preference for control of the second item, geometry, but that this preference does not forbid the use of other means for preventing criticality in spent fuel pools. *Id.* at 213. The Intervenors' and BCOC's argument regarding the definition of the term "processes" in GDC 62 and their conclusion that GDC 62 exclusively requires, rather than merely prefers, geometrically safe configurations is simply incorrect, and LBP-00-26 should be affirmed.

II. The Intervenors' Dictionary Definition of "Processes" Is Unavailing

In LBP-00-26, the *Millstone* Board stated that "the term 'process,' used as a noun, means 'an artificial or voluntary progressively continuing operation that consists of controlled action or movements systematically directed toward a particular result or end[.]' " LBP-00-26, 52 NRC at 212 (footnote omitted). The Board defined the result or end as adequate criticality control. *Id.* The *Millstone* Board reasonably believed the use of known enrichments, burnups, and decay times of particular spent fuel assemblies in conjunction with controlled placement of those assemblies in specific regions of a spent fuel pool, as proposed by NNECO, to be "controlled action or movements systematically directed toward" this end. Therefore, the Board concluded that NNECO's proposal amounted to a "process" under this definition. *Id.*

The Intervenors quibble with the *Millstone* Board's choice of definitions, and proffer their own, which they assert results in a different conclusion. CCAM/CAM Brief at 21-22. The

Intervenors offer one definition of process as "a particular method or system of doing something, producing something, or accomplishing a specific result" (*id.* at 21), and another as:

> A series of actions, motions, or operations **definitely conducing to an end,** whether voluntary or involuntary; progressive act or transaction; **continuous operation or treatment**; a method of operation or treatment, esp. in manufacture; as, the process of vegetation or decomposition; a chemical process; a process or reasoning; a process of making steel.

Id. at 22 (emphasis in CCAM/CAM Brief). The Intervenors identify the installation of low-density racks or neutron absorbing panels as a process "definitely conducing to an end," that would remain "in continuous operation or treatment," but simply assert that the measures proposed by NNECO "would be surplusage." *Id.* The Intervenors' argument in this regard fails for the simple reason that the measures for preventing criticality in spent fuel pools through control of enrichment, burnup, and decay time also are "definitely conducing to an end," and would remain "in continuous operation or treatment," as set forth below. The Intervenors' proffered definition, therefore, does not invalidate the *Millstone* Board's decision, but supports it.

First, as explained above, it is ineluctable that limiting the quantity of fissile material in an array of spent fuel below a specified amount will prevent criticality in that array. Thus, these measures, which limit the amount of fissile material available "definitely conduce" to the end of preventing criticality in the spent fuel pool. Second, once a licensee places a fuel assembly in any particular region in its spent fuel pool based on enrichment, burnup, and decay time, those physical characteristics of fuel remain "in continuous operation or treatment" to prevent criticality. The option of placing a fuel assembly in a particular region of a spent fuel pool based on decay time does not become available until some definite time after the fuel assembly is permanently removed from the reactor. Nonetheless, this in no way limits the "continuous operation" of decay time to prevent criticality once a fuel assembly is placed in a particular region of a spent fuel pool based on its decay time. In view of the above, the Intervenors' proffered definition fails to undercut the

Millstone Board's decision in LBP-00-26, and, to the contrary, provides good reason to affirm that decision.

III. GDC 62 Does Not Proscribe The Use Of "Ongoing" Administrative Controls

The Intervenors state that GDC 62 calls for a distinction between "physical systems and processes" and "other non-physical systems and processes." CCAM/CAM Brief at 22. The Intervenors, however, define this distinction in terms of so-called "one-time" administrative controls assertedly permitted to employ neutron absorbing materials to prevent spent fuel pool criticality, as opposed to "ongoing" administrative controls purportedly associated with the use of enrichment, burnup, and decay time limits for the same purpose. *Id.* at 22-25. Giving the example of Boral panels attached to spent fuel racks, the Intervenors assert the presumptive acceptability of one-time administrative controls to ensure proper design, fabrication, and installation. *Id.* at 23. The Intervenors distinguish so-called "one-time" controls from "continuing actions by human beings . . . such as inputting information into a computer system, and operating and maintaining equipment." *Id.* at 24. The Intervenors argue that such continuing actions are necessary to implement the assertedly "ongoing administrative controls," proposed at Millstone. *Id.*

Intervenors' argument should be rejected for the simple reason that nothing in GDC 62 or any other regulation prohibits the use of "ongoing" administrative measures to prevent criticality in a spent fuel pool, nor does any regulation distinguish between "one-time" and "ongoing" administrative controls as suggested by the Intervenors. As discussed above, initial enrichment and burnup are physical characteristics of individual spent fuel assemblies and do not change. As is also explained above, reactivity worth of a spent fuel assembly decreases with increasing decay time, and this is also a physical process for preventing spent fuel pool criticality. In light of these considerations, and contrary to Intervenors arguments, placement of spent fuel assemblies in particular regions of spent fuel pool racks based on enrichment, burnup, and decay time is akin to the Intervenors' example of the design, fabrication, and installation of neutron-absorbing

materials in spent fuel racks. Such placement does not require implementation on a "continuous, ongoing" basis. The *Millstone* Board made no error in rejecting the Intervenors' arguments in this regard, and LBP-00-26 should be affirmed.[10]

IV. The *Harris* Board Correctly Interpreted The Rulemaking History of GDC 62

BCOC argues that the *Harris* Board misinterpreted the rulemaking history of GDC 62, and erroneously concluded that this history shows that GDC 62 encompasses the administrative measures proposed in *Harris*. BCOC Brief at 12. As set forth below, BCOC's argument is incorrect. Before analyzing BCOC's argument, the Staff summarizes the history of GDC 62, and sets forth its interpretation of that history.

A. Rulemaking history

The AEC added the General Design Criteria to Part 50 in 1971. The AEC went through an extensive process in drafting, redrafting and clarifying the GDC, resulting in proposed criteria in June, 1967. Memorandum from W.B. McCool to Atomic Energy Commission, Staff Summary, Exh. 22. On July 11, 1967, the Commission formally published this version of the proposed GDC for comment. "General Design Criteria for Nuclear Power Plant Construction Permits," 32 Fed. Reg. 10,213, Staff Summary, Exh. 23. That version of the proposed GDC included Criterion 66, which provided: "*Prevention of Fuel Storage Criticality.* 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." *Id.* at 10,216. Because the second sentence clearly contemplated the use of means such as geometrically safe configurations *and procedural controls* to prevent criticality, the statement in the first sentence that "criticality . . . shall be

[10] In addition, GDC 62 applies to fuel handling systems, as well as fuel storage systems. While the fuel handling systems may move only one fuel assembly at a time, administrative controls must be used, for example, to prevent temporary storage of multiple assemblies in close proximity. To adopt the Intervenors' reading of GDC 62, *i.e.*, that it does not allow the use of the administrative controls proposed by NNECO to prevent criticality, would undermine the requirements to prevent criticality applicable to fuel handling, and should be rejected.

prevented by physical systems or processes" cannot be read to prohibit procedural or administrative controls.

The AEC received numerous comments on this proposed rule making, many of which contained suggestions for changes in the GDC. The AEC received only two comments regarding proposed GDC 66. William B. Cottrell, Director of the Nuclear Safety Information Center at Oak Ridge National Laboratory (ORNL), submitted a comment stating:

> [w]e [do not] believe that it is practical to depend upon 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 configurations shall be used to insure that criticality cannot occur."

Letter to H.L. Price, AEC, from W.B. Cottrell, NSIC, Staff Summary, Exh. 24, at 11. The second comment was received from J.J. Flaherty on behalf of Atomics International. Letter, J.J. Flaherty to Secretary, U.S. Atomic Energy Commission, Staff Summary, Exh. 30. This comment suggested that the second sentence of the proposed criterion be replaced with "Inherent means should be used where practicable."

B. The Rulemaking History Does Not Support BCOC's Interpretation of GDC 62

Although there are no available staff documents discussing these comments, it is apparent that the Staff and the Commission did not agree with Oak Ridge that procedural controls should be prohibited, since the AEC did not adopt the suggested language. Rather, the AEC adopted the "preferably by use of geometrically safe configurations" language. *See* Status Report on General Design Criteria, Staff Summary, Exh. 25; Kopp/Attard Aff. ¶ 34; Comparison of Published Criteria (July 11, 1967) and Revised Criteria (July 15, 1969), Staff Summary, Exh. 26; Kopp/Attard Aff. ¶ 34. Moreover, although the specific word changes suggested in the Atomics International letter were not incorporated in the final criterion, the AEC did incorporate their intent by stating that the use of geometrically safe configurations (inherent means) was the preferred method. The Staff again revised the criteria and the Commission adopted them as published in February of 1971.

In promulgating GDC 62, the AEC did not change the part of the draft Criterion 66, as published in 1967, that stated "criticality . . . shall be prevented by physical systems or processes." That language, as set forth above, does not preclude the use of administrative controls. The clause adapted from the second sentence proposed in 1967 and added to that unchanged language, that criticality be prevented "preferably by use of geometrically safe configurations," is, by its own terms, a statement of *preferred* means for preventing criticality. It does not preclude licensees from using administrative controls to aid in satisfying GDC 62.

BCOC argues that the change from a February 18, 1967 version of GDC 62 (then numbered 61) to the June 16, 1967, version (then numbered 66), involved an error by the AEC. BCOC Brief at 11-12. Specifically, BCOC asserts that the AEC erred in removing the phrase "to every extent practicable" as a qualifier to "physical systems or processes," and leaving in the sentence "[s]uch means as geometrically safe configurations shall be emphasized over procedural controls." BCOC appears to believe that the AEC intended to remove the use of procedural controls from the February 1967 version of the proposed GDC but failed to do so in the June 1967 revision. *Id.*

BCOC's analysis does not withstand scrutiny because BCOC ignores the fact that ORNL and Atomics International were commenting on the GDC as proposed, and both commenters clearly understood the GDC, as proposed, as allowing for procedural or administrative controls on criticality in spent fuel pools. Further, BCOC has not identified anything that would indicate that the AEC itself believed it had made an error in the proposed GDC. To reject the use of procedural controls would have required the AEC to use language such as that proposed by ORNL. The AEC's decision not to do so preserved the option of using procedural controls to prevent spent fuel

pool criticality, although these were not the preferred option.[11] Accordingly, BCOC's argument should be rejected.

C. The Staff's Practice Supports the *Harris* Board's Decision

The Staff's consistent practice, as approved by the Commission's adjudicatory panels, supports the view that GDC 62 does not prohibit the use of administrative controls, ongoing or otherwise, to prevent criticality.

Nearly every means to prevent criticality, and, in fact, just about every system or process in a plant has some administrative control associated with it, whether it is a surveillance, limiting condition of operation, testing, or some other administrative control. BCOC objects to the use of credit for enrichment, burnup, or decay time, asserting that verification in selecting the placement of spent fuel assemblies in the spent fuel pool is an on-going administrative control. However, because human action is necessary to move fuel between the reactor and fuel storage facilities, it is inescapable that administrative controls on fuel movement must be used to ensure that the physical measures for preventing criticality are properly employed. Kopp/Attard Aff. ¶ 15. Moreover, the enrichment, burnup, and decay of the fuel are themselves physical processes. *Id.*, ¶ 36, 37. In addition, the Staff has been authorizing the use of credit for burnup in selecting fuel assemblies for locations in spent fuel racks for eighteen years or more. *See id.*, ¶ 39. There has never been a report of a criticality accident in any spent fuel pool. *Id.*, ¶ 15, 40. Moreover, NNECO has been taking credit for burnup in the Millstone 3 spent fuel pool for several years with no adverse consequences.

In addition, the Staff has approved administrative controls to prevent criticality in spent fuel pools in amendments litigated before the Commission's adjudicatory panels. *See, e.g., Consumers Power Co.* (Big Rock Point Nuclear Plant), ALAB-725, 17 NRC 562 (1983). *Big Rock Point*

[11] As set forth above, BCOC's interpretation would not make sense in the context of fuel handling, which is also governed by GDC 62. *See* note 10, *supra*.

concerned the use of a makeup line, a physical system, to maintain water level in the spent fuel pool at that facility. *Id.* at 571. In its decision, the Appeal Board identified the makeup line as "remotely controlled." *Id.* at 564-65, 571. Such remote control is an administrative measure that allows plant operators to manage the operation of this system.

Moreover, at least one Atomic Safety and Licensing Board has accepted administrative measures to control the placement of fuel assemblies in spent fuel pools. *See Florida Power & Light Co.* (St. Lucie Nuclear Power Plant, Unit 1), LBP-89-12, 29 NRC 441 (1989), *aff'd on other grounds*, ALAB-921, 30 NRC 177 (1989). The intervenor in that proceeding raised the following criticality contention[12] regarding misplacement of a fuel assembly:

> The mechanisms which prevent the erroneous insertion of a fuel assembly into a storage cell such that the prescription of Standard Review Plan ("SRP") Section 9.1.2, Part III.2.b., that it not be possible for "a fuel assembly . . . (to) be inserted anywhere other than a design location," have not been demonstrated[.]

St. Lucie, LBP-89-12, 29 NRC at 454. The spent fuel pool was divided into two regions. Only fuel assemblies that had reached the required burnup could be stored in Region 2; but it was possible to "insert an assembly with less than the requisite burnup in Region 2." *Id.* at 455. The *St. Lucie* Licensing Board referenced Staff guidance, which allowed for administrative controls, with written procedures to prevent misplacement, and described Florida Power and Light's (FPL) administrative controls to assure proper placement of fuel assemblies. *Id.* The *St. Lucie* Board held that:

> the foregoing procedures and restraints used in the handling of fuel assemblies in the spent fuel pool are adequate to provide reasonable assurance that fuel will be stored in the prescribed areas of the pool. The procedures satisfy the guidelines of SRP 9.1.2 and will ensure against improper storage of fuel assemblies.

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[12] *See Florida Power & Light Co.* (St. Lucie Nuclear Power Plant, Unit 1), LBP-88-27, 28 NRC 455, 473-75 (1988).

Id. at 456 (footnote omitted)0. Clearly, the Board in *St. Lucie* recognized that administrative controls are permissible to prevent criticality in a spent fuel pool.[13]

V. The *Harris* Board Did Not Err In Finding That 10 C.F.R. § 50.68 Supports Its Ruling

BCOC argues that its interpretation is consistent with 10 C.F.R. § 50.68. BCOC Brief at 12-17. The statements BCOC quotes from the Statements of Consideration for Section 50.68, however, do not support its view. As explained below, section 50.68 is consistent with the *Harris* Board's interpretation of GDC 62.

In 1998, the Commission issued a final rule on criticality monitoring requirements in Part 50. 10 C.F.R. § 50.68. Section 50.68 provides that licensees may elect to comply with the criteria in that regulation, rather than choosing to comply with 10 C.F.R. § 70.24, which requires the use of a criticality monitoring system. In proposing the rule, the Commission stated:

> The [NRC] is amending its regulations to provide light-water nuclear power reactor licensees with greater flexibility in meeting the requirement that licensees authorized to possess more than a small amount of special nuclear material (SNM) maintain a criticality monitoring system in each area where the material is handled, used, or stored. This action is taken as a result of the experience gained in processing and evaluating a number of exemption requests from power reactor licensees and NRC's safety assessments in response to these requests that concluded that the likelihood of criticality was negligible.

"Proposed Rule, Criticality Accident Requirements," 62 Fed. Reg. 63,911 (1997). The final rule included a similar statement. "Final Rule, Criticality Accident Requirements," 63 Fed. Reg. 63,127 (1998). Responses to comments in the notice of issuance of the final rule explicitly demonstrate

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[13] Other proceedings have involved the application of GDC 62. *See e.g., Florida Power and Light Co.* (Turkey Point Plant, Units 3 & 4), Nos. 50-250-OLA-2; 50-251-OLA-2, 1999 NRC LEXIS 13381, at *13396-98 (March 25, 1987)(unpublished)(use of burnup). While this proceeding did not involve any dispute over the meaning of GDC 62, and the decision is obviously not dispositive, it is nonetheless illustrative of the Staff's practice regarding the use of administrative controls to prevent criticality in spent fuel pools. It involved precisely the same means for preventing criticality that is at issue here: credit for burnup. *Id.*

that the Commission was aware of licensees' use of administrative controls to prevent criticality in spent fuel pools. *Id.* at 63,128.

Section 50.68(b) specifies eight criteria. The criteria in Sections 50.68(b)(2), (3), and (4) discuss credit for soluble boron in the fuel pool water. Section 50.68(b)(2) provides:

> The estimated ratio of neutron production to neutron absorption and leakage (k-effective) of the fresh fuel in the fresh fuel storage racks shall be calculated assuming the racks are loaded with fuel of the maximum fuel assembly reactivity and flooded with unborated water and must not exceed 0.95, at a 95 percent probability, 95 percent confidence level. This evaluation need not be performed if administrative controls and/or design features prevent such flooding or if fresh fuel storage racks are not used.

10 C.F.R. § 50.68(b)(2). In establishing this criterion, the Commission clearly approved the use of administrative means to prevent boron dilution events (flooding with unborated water) to prevent criticality.[14] *See also* 10 C.F.R. § 50.68(b)(3).

Similarly, 10 C.F.R. § 50.68(b)(4) addresses credit for soluble boron relating to spent fuel storage racks, and reads:

> If no credit for soluble boron is taken, the k-effective of the spent fuel storage racks loaded with fuel of the maximum fuel assembly reactivity must not exceed 0.95, at a 95 percent probability, 95 percent confidence level, if flooded with unborated water. If credit is taken for soluble boron, the k-effective of the spent fuel storage racks loaded with fuel of the maximum fuel assembly reactivity must not exceed 0.95, at a 95 percent probability, 95 percent confidence level, if flooded with borated water, and the k-effective must remain below 1.0 (subcritical), at a 95 percent probability, 95 percent confidence level, if flooded with unborated water.

10 C.F.R. § 50.68(b)(4).

As this regulation indicates, the Commission is aware of and has approved the use of administrative controls in conjunction with physical systems and processes as means of preventing criticality in spent fuel pools. Likewise, the use of administrative controls to prevent flooding with

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[14] The Intervenors include the use of soluble boron as an impermissible administrative measure. CCAM/CAM Brief at 20. Section 50.68 clearly shows this position to be in error.

unborated water and optimum moderation of fresh fuel has also been approved. These methods would fit into the Intervenors' definition of "on-going" administrative measures (CCAM/CAM Brief at 20); yet, as noted above, they have been approved by the Commission. Since the Commission has approved the use of administrative controls to control boron concentration to prevent criticality in spent fuel pools, it is clear that the Commission does not believe that the use of administrative measures in conjunction with physical controls violates GDC 62.

Finally, the portions of the Statements of Consideration that BCOC quotes include the following statements:

> Nuclear power plant licensees have **procedures** and the plants have design features to prevent inadvertent criticality. . . . Further, the fresh fuel storage array and the spent fuel pool are in most cases designed to prevent inadvertent criticality, even in the presence of an optimal density of unborated moderator. Inadvertent criticality during fuel handling is precluded by limitations on the number of fuel assemblies permitted out of storage at the same time. In addition, 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**. Therefore, the NRC considers a fuel-handling accidental criticality at a commercial nuclear plant to be extremely unlikely. The NRC believes the criticality monitoring requirements of 10 CFR 70.24 are unnecessary as long as design **and administrative controls** are maintained.

"Criticality Accident Requirements," 62 Fed. Reg. 63,825-26 (Dec. 3, 1997)(emphasis added). These statements are inconsistent with BCOC's argument that GDC 62 prohibits the use of administrative controls to prevent criticality in spent fuel pools. That argument should be rejected.

VI. Neither The *Millstone* Nor the *Harris* Board Relied on Staff Guidance

BCOC argues that Staff guidance has no binding effect, and that Staff guidance might somehow have had an effect on the *Harris* Board's decision. BCOC Brief at 17-19. The *Harris* Board itself noted that Staff guidance is not dispositive, and only considered the Staff guidance as

an additional factor lending support to the Board's interpretation of GDC 62. LBP-00-12, 51 NRC at 260. The Board did not make any error in this regard.[15] *See* note 8, *supra*.

ANSWER TO COMMISSION QUESTION

The Commission has directed those persons submitting briefs in response to CLI-01-03 to address the question of whether GDC 62 permits a licensee to take credit in criticality calculations for fuel enrichment, burn-up, and decay time limits. CLI-01-03, 53 NRC ___, slip op. at 7. As explained above, enrichment, burn-up, and decay time limits are associated with physical processes or properties that define the reactivity worth of spent fuel assemblies stored in spent fuel pools. Since these physical processes determine, in part, whether an array of spent fuel assemblies stored in a spent fuel pool will be a critical array, GDC 62 permits licensees to take credit for them in criticality calculations. The Staff submits that this is true, notwithstanding that associated administrative procedures may be necessary to employ these physical means of preventing spent fuel pool criticality. This is based on the necessity to use administrative procedures to employ physical systems or processes, as explained in the Argument set forth above. As discussed above, nothing in the CCAM/CAM Brief or the BCOC Brief is to the contrary.

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[15] Both the Intervenors and BCOC raise issues that are not relevant to whether GDC 62 prohibits the use of administrative controls to prevent criticality in spent fuel pools. For example, the Intervenors complain that NNECO might plan to store spent fuel from Millstone Unit 2 in the Millstone Unit 3 pool at some future time. CCAM/CAM Brief at 5, n.1. The Intervenors have raised this grievance before. CCAM/CAM Summary at 3, n.1. NNECO is not currently authorized to store spent fuel from Unit 2 in the Unit 3 pool, and has not requested an amendment that would authorize it to do so. The application that is the subject of this proceeding does not include any such request.

There are several other instances in which BCOC and the Intervenors raise such irrelevant matters. *See, e.g.*, BCOC Brief at 17, n.26 (discussing 10 C.F.R. § 72.124); CCAM/CAM Brief at 6 (discussing "additional complexity" of NNECO proposed criticality controls at Millstone). While there is no need for the Staff to respond to these issues, the Staff does not accept the assertions and unidentified predicates embedded in such matters raised by BCOC and the Intervenors.

CONCLUSION

For the reasons set forth above, the Commission should affirm the *Millstone* Board's decision in LBP-00-26 with respect to Contention 6.

Respectfully submitted,

Robert M. Weisman **/RA/**
Counsel for NRC Staff

Dated at Rockville, Maryland
this 28th day of February, 2001.

ATTACHMENT

DEFINITIONS

"Criticality" is the achievement of a self-sustaining nuclear chain reaction. Affidavit of Drs. Laurence I. Kopp and Anthony C. Attard (Kopp/Attard Affidavit), ¶ 6.[1] The chain reaction proceeds as atoms of a fissile material absorb slow (thermal) neutrons and split (fission) into new light atoms (*i.e.*, fission products) and additional neutrons that, in turn, interact with additional fissile atoms. *Id.* Neutrons resulting from fission have high energy and are called "fast" neutrons. *Id.* Fast neutrons are not readily captured in U-235, the fissile material originally present in fresh fuel. Rather, a neutron must lose energy and "slow down," or become "thermalized" (a thermal neutron), in order to be readily captured in U-235 and cause fission. *Id.*

In order for fast neutrons to slow down, they must collide with, and transfer energy to, atoms. *Id.*, ¶ 7. This process is called "moderation." *Id.* A light element (such as hydrogen) is an effective moderator because the mass of its nucleus is on the same order as that of a neutron. *Id.* Therefore, upon initial collision, the neutron imparts most of its energy to the hydrogen nucleus and becomes thermalized. *Id.* Water, with its high hydrogen content, is the moderator in a light water reactor (LWR) such as Millstone. *Id.*

After being created through fission, during the process of moderation, and after reaching thermal energy levels, a neutron may undergo several events. *Id.*, ¶ 8. It may be absorbed by nonproductive capture in the fuel, the moderator, or the structural materials. *Id.* It may leak from the reactor system and either be reflected back into the system or be lost. *Id.* Finally, it may be absorbed by the U-235, cause fission, and produce more fast neutrons. *Id.*

[1] The Kopp/Attard Affidavit is attached to the Staff Summary. *See* Staff Summary at 10.

When the process continues on its own, the system of atoms of fissile material is said to be "critical." *Id.*, ¶ 9. The measure of criticality is the effective neutron multiplication factor, k-effective, or k_{eff}. *Id.* The multiplication factor is the ratio of the rate of neutron production to neutron loss due to fission, nonproductive capture, and leakage. *Id.* Criticality is achieved when k_{eff} is equal to 1.0. *Id.* When k_{eff} is less than 1.0, the system is "subcritical." *Id.* Criticality can only occur in an array of LWR fuel if sufficient fissile material is available in a near-optimum geometry and a moderator (water) is present. *Id.* No array of LWR fuel can achieve criticality without water moderation present in the array. *Id.* Well-developed mathematical models (equations) exist in present-day computer codes and are used to compute k_{eff}. *Id.*

"Reactivity" is defined as $(k_{eff} -1)/k_{eff}$. *Id.*, ¶ 10. As the Atomic Safety and Licensing Board indicated in the *Shearon Harris* proceeding, reactivity is generally considered to be a property of an entire array of fuel, such as spent fuel stored in a spent fuel pool. *Carolina Power & Light Co.* (Shearon Harris Nuclear Power Plant), LBP-00-12, 51 NRC 247, 260, n.6 (2000). Individual fuel assemblies are said to have "reactivity worth." *Id.* Reactivity worth is determined by a spent fuel assembly's physical design, its initial (fresh) "enrichment," which is the weight percent of U-235 to total uranium in the assembly, and fuel depletion or "burnup." Kopp/Attard Aff. ¶ 36. The initial enrichment of a fuel assembly is a physical process consisting of manufacturing an assembly containing a specified weight percent of U-235. Kopp/Attard Aff. ¶ 36.

When fuel is irradiated in a reactor as a result of operation and power generation, the reactivity of the fuel decreases over the design life of the fuel assembly. *Id.*, ¶ 10. This reduction of reactivity with irradiation is called "burnup." *Id.* Burnup is caused by the change in fissile content of the fuel (*i.e.*, depletion of U-235 and production of Pu-239 and other fissile actinides), the production of actinide absorbers, and the production of fission product neutron absorbers. *Id.* Before each reactor operating cycle, a licensee performs a reload analysis that predicts the burnup of each fuel assembly during the cycle. *Id.* These calculations are confirmed during the cycle by

measurements of various operating characteristics, such as boron concentration and power distribution. *Id.* After every operating cycle (typically 1 to 2 years), approximately 1/3 of the fuel in a reactor is removed because its reactivity is too low to effectively contribute to power generation in the reactor environment. *Id.* This irradiated (or spent) fuel is generally placed in a spent fuel pool at the reactor site and is replaced in the reactor by fresh (unirradiated) fuel. *Id.*

"Decay time" is an extension of the burnup process and includes the time an assembly has been discharged from the reactor and resides in the storage pool. *Id.*, ¶ 37. Spent fuel decay time results in the radioactive decay of fissile isotopes in the spent fuel (e.g., U-235) to non-fissile (or non-productive) neutron absorbing isotopes. *See* Kopp/Attard Aff. ¶ 37. Thus, the additional decay while cooling in the spent fuel pool further reduces the reactivity worth of a spent fuel assembly. This loss in reactivity worth due to decay time allows a reduction in the minimum assembly burnup needed to meet the reactivity requirements and typically is applicable to older fuel assemblies that have been stored in the spent fuel storage racks for a period of years. *See id.*

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE COMMISSION

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

CERTIFICATE OF SERVICE

I hereby certify that copies of "NRC STAFF RESPONSE to 'CONNECTICUT COALITION AGAINST MILLSTONE AND LONG ISLAND COALITION AGAINST MILLSTONE BRIEF ON REVIEW OF LBP-00-26' AND 'ORANGE COUNTY'S AMICUS BRIEF ON REVIEW OF LBP-00-26'"" in the above-captioned proceeding have been served on the following through deposit in the NRC's internal mail system, or by deposit in the NRC's internal mail system with copies by electronic mail, as indicated by an asterisk, or by deposit in the U.S. Postal Service as indicated by a double asterisk, with copies by electronic mail as indicated, this 28th day of February, 2001:

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