UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
NORTHEAST NUCLEAR ENERGY CO.	)	Docket No. 50-336-OLA
	)	(Spent Fuel Pool Design)
(Millstone Nuclear Power Station,	)	
Unit No. 2)	)	

AFFIDAVIT OF JOHN R. GUERCI

I, John R. Guerci, being duly sworn, hereby state as follows:

1. I am employed by Northeast Utilities Service Company (NUSCo) as the Supervisor of the Nuclear Analysis Section.

2. My business address and phone number are:

   Northeast Utilities Service Company
   P.O. Box 270
   Hartford, CT 06141
   (203) 665-5791

3. I am responsible for managing all nuclear analysis activities for Northeast Utilities nuclear plants, including fuel storage criticality. A copy of my complete resume is attached to this Affidavit.

SPENT FUEL POOL

4. As authorized by NRC License Amendment 158, the Millstone Unit No. 2 (Millstone 2) Spent Fuel Pool comprises three regions with two different types of storage cells. Regions A and B, which were the subject of Amendment 158, consist of spent fuel storage racks that contain Boraflex as a neutron absorbing ("poison") material and have a center-to-center distance between storage locations of 9.8 inches. Region C consists of racks that do not contain boron poison materials. Region C was unaffected by Amendment 158; it is licensed based on a criticality analysis different from the Amendment 158 analysis for Regions A and B in issue in this proceeding.

5. Region A is designed to store up to 224 fuel assemblies. These assemblies are qualified for storage in this region based on adequate assembly average burnup determined for each initial fuel enrichment (reactivity credit for burnup). The burnup versus enrichment limit is specified in the Millstone 2 Technical Specifications. No storage locations are required to be blocked in Region A.

6. Region B is designed to store up to 120 new fuel assemblies with an initial enrichment of up to 4.5 weight percent (w/o) U-235. Region B can also be used to store burned or spent fuel whose enrichment is below the initial enrichment limit of 4.5 w/o. (Fuel, without burnable absorbers, and of the same

enrichment, becomes less reactive as it accumulates burnup.) Fuel assemblies in Region B are stored in a three-out-of-four array with cell blocking devices installed to prevent inadvertent placement or storage of a fuel assembly in the fourth (blocked) location.

7. Illustrations of the arrangement of the Millstone 2 Spent Fuel Pool before and after Amendment 158 are provided in the attached Figure 1 and Figure 2.

8. The Boraflex panels within the cell walls in Regions A and B, and the soluble boron in the pool water (with a concentration typically greater than 1720 ppm), each assure the criticality safety of the racks under all normal conditions. Under normal conditions, the K_{eff} (effective neutron multiplication factor) is less than 0.75, which is substantially below the NRC acceptance criteria of 0.95. This K_{eff} value of 0.75 includes (1) the effect of the upper bound for conservatively modeled Boraflex gaps, (2) assumed uncertainties (95% probability at a 95% confidence level), and (3) assumes that the racks in all Regions (including Region C) are filled with fuel of the highest permissible reactivity.

9. The spent fuel rack design, including the Boraflex panels in Regions A and B, the loading pattern, and the burnup and enrichment limitations, also assure a K_{eff} less than 0.95 in the

event of <u>either</u> the loss of all the soluble boron <u>or</u> the loss of all Boraflex. Again, the K_{eff} is maintained assuming applicable uncertainties (95% probability at a 95% confidence level). The K_{eff} for the spent fuel pool also is maintained within the maximum 0.95 for all required design basis accidents.

10. Specifically, under the accident condition of the loss of all the soluble boron (a condition required to be evaluated under NRC guidelines), the <u>maximum</u> K_{eff}s for Regions A and B are calculated to be less than 0.95. These analyses assumed the presence of Boraflex with conservative assumptions described below regarding the gaps in the Boraflex panels. Again, however, it is worth emphasizing that the postulated loss of all soluble boron is very conservative. Although not required, the soluble boron concentration in the pool is typically maintained above 1720 ppm and is checked weekly. The technical specifications require that the soluble boron concentration be maintained above 800 ppm during fuel movement.

11. The purpose of the Boraflex material in Regions A and B is to allow for the storage of more reactive fuel (i.e., fuel with a higher initial enrichment or a lower burnup) than was allowed in the previous racks that did not contain Boraflex. (Note that the Boraflex racks were licensed prior to Amendment

158.) Administrative procedures are in place at Millstone 2 to ensure that the appropriate enrichment and/or burnup limits are met prior to the placement of fuel in the spent fuel pool. The cell blocking devices in Region B are used to provide positive controls and ensure that fuel assemblies are placed in a three-out-of-four pattern, as specified by the analyses.

CRITICALITY ANALYSES

12. The Region A and B criticality analyses supporting Amendment 158 were performed by Dr. Stanley Turner of HOLTEC International. Dr. Turner's analysis addressed the consequences of observed Boraflex degradation.

13. Dr. Turner's Amendment 158 analysis uses a three-dimensional NITAWL-KENO-5a model with the 27-group SCALE (Standardized Computer Analysis for Licensing Evaluations) cross-section set. NITAWL-KENO-5a is a standard method of criticality analysis, accepted by NRC and industry, used for most storage rack analyses. As discussed by Dr. Turner in his Affidavit, the KENO code utilizes Monte Carlo techniques to solve the Boltzman transport equation. The criticality analyses assume that Regions A and B (and indeed Region C) are fully loaded, in the approved configurations, with the most reactive fuel allowed and with a conservative upper bound on the size and number of gaps.

14. In his August 1992 and March 1993 affidavits ("declarations") filed in this proceeding, Dr. Kaku largely takes issue with the use of diffusion theory as a basis for the new criticality calculations. However, contrary to Dr. Kaku's concern, the Amendment 158 criticality analysis is not based on diffusion theory; therefore, his assertions regarding the adequacy of that approach are irrelevant.

CONTENTION 1

15. In the course of my duties as Supervisor of Nuclear Analysis, I was responsible for overseeing and coordinating the review of the criticality analyses performed by Dr. Turner in support of Amendment 158. I concur with the methods and modelling techniques used by Dr. Turner as appropriate for this type of analysis.

16. As discussed by Mr. Betancourt and Dr. Turner in their Affidavits, the Amendment 158 criticality analyses are based upon a highly conservative assumption regarding the condition of the Boraflex panels. These assumptions conservatively bound the actual measured Boraflex conditions as determined by extensive Blackness testing. My group worked closely with Dr. Turner and Mr. Betancourt to develop the appropriate conservative model for the condition of the Boraflex. The analysis assumes a conservatively postulated maximum gap size of 4 percent of span to exist in all Boraflex panels.

17. With respect to benchmarking, Dr. Turner describes in his Affidavit the benchmarking he used for his model. His approach is, based upon my experience, an acceptable approach for this type of problem. He has utilized industry available data to benchmark KENO for this application.

18. Dr. Kaku's August 1992 and March 1993 affidavits question the number of neutron histories used in the Amendment 158 criticality analysis. As described more fully by Dr. Turner in his Affidavit, the KENO output includes a cumulative listing of the K_{eff} and the statistical uncertainty associated with neutron histories. Therefore, it is possible to observe the approach to convergence in the calculation. For the Millstone 2 configuration, convergence is typically attained after approximately 125,000 neutron histories. However, in order to minimize statistical uncertainty and to assure convergence, at least 500,000 neutron histories were accumulated in all calculations to support Amendment 158. A check calculation of the design basis case was also made with 1,250,000 neutron histories with no significant difference from that at 500,000 histories.

19. The basic calculations supporting Amendment 158 use the 27-group SCALE cross-section library, which was benchmarked to critical experiments as discussed in Dr. Turner's Affidavit. A check calculation was made by Dr. Turner utilizing a 218-

group library. The results of this calculation confirmed the 27-group calculation, and resulted in a slightly lower calculated K_{eff}, but within the 95% confidence limits. Dr. Turner has confirmed that the analysis is appropriate.

20. As stated by Dr. Turner in his Affidavit, a vertical buckling term is not used in the Amendment 158 criticality analysis. On the contrary, a full three-dimensional analysis was performed which inherently models any axial leakage of neutrons. Dr. Kaku's observations in his original affidavit regarding use of that term are irrelevant to Amendment 158.

ADDITIONAL OBSERVATIONS AND CONCLUSIONS

21. License Amendment 158 addressed errors discovered in the original license submittal for Regions A and B (authorizing the Boraflex racks) as well as the observed degradation (gaps) in the Boraflex material. The analyses performed by HOLTEC for NUSCo employ standard industry practice with respect to the modelling of the spent fuel pool and the methods chosen. The regulatory requirements for such analyses have been developed by the NRC and industry experts to insure very conservative designs and to provide a sufficient safety margin under normal and accident conditions.

22. There are many additional conservative assumptions incorporated into the criticality analyses used to support the

design of the Millstone 2 Spent Fuel Pool. Some of the significant conservative assumptions are:

- The analyses assume that the racks are fully filled with the most reactive fuel allowed by the Technical Specifications;
- Calculational and mechanical uncertainties (tolerances) are included in determining the maximum reactivity;
- The Boraflex density increase resulting from shrinkage is not credited;
- The analyses neglect radial neutron leakage and assume an infinite array of storage cells;
- The highest possible water density of 1.0 gm/cc, corresponding to a temperature of 39°F, was used in the analyses. Any increase in temperature or decrease in water density would result in a lower reactivity.
- Fuel spacers (a neutron absorber) were neglected for additional conservatism, as were all non-fuel bearing components presently stored in the Millstone Spent Fuel Pool occupying a storage location that would otherwise be

used for fuel (these components do not contribute to reactivity);

- The analysis assumes that there is no soluble boron in spent fuel pool under normal conditions.

23. I have reviewed Dr. Kaku's affidavits filed in this proceeding in August 1992 and March 1993. His affidavits do not provide any facts that alter my conclusion that the Amendment 158 criticality analysis is technically appropriate and conservative for its intended application. The Amendment 158 analysis is a valid application of the SCALE package for the Millstone 2 Spent Fuel Pool.

24. The information above is true and correct to the best of my knowledge and belief.

John R. Guerci

Sworn and subscribed to before me this 5 day of May, 1993

Notary Public

December 31, 1997
My commission expires:

RESUME

NAME:	JOHN R. GUERCI
EMPLOYER:	NORTHEAST UTILITIES SERVICE COMPANY (NUSCO)
TITLE:	SUPERVISOR, NUCLEAR ANALYSIS SECTION
EDUCATION:	B.S., Nuclear Engineering, Minor in Economics, 1974, Rensselaer Polytechnic Institute Master's Degree, Nuclear Engineering, 1975, Rensselaer Polytechnic Institute

WORK EXPERIENCE:

1988 to Present:	**NUSCO, Supervisor, Nuclear Analysis Section** Responsible for managing all nuclear analysis activities for NU's nuclear plants, including: CY reload engineering, plant RE support, software and methods maintenance, fuel management, core follow, and fuel storage criticality.
1985 to 1988:	**NUSCO, Supervisor, Reload Analysis Section** Responsible for reload design for CY. Developed and implemented a technology transfer plan for nuclear analysis methods.
1981 to 1985:	**NUSCO, Senior Engineer, Reactor Performance Section** Responsible for coordination of MP2 reactor engineering activities including: vendor reload design, site RE support, fuel mechanical design, and NRC interface.
1978 to 1981:	**NUSCO, Engineer, Nuclear Analysis Section** Set up CY and MP1 design models in support of nuclear analysis activities.
1975 to 1978:	**NUSCO, Associate Engineer, Reactor Engineering** Responsible for coordination of MP2 reactor engineering activities. Worked on-site during initial startup.

PROFESSIONAL ASSOCIATIONS:

Member of CY Nuclear Review Board
Member of American Nuclear Society (ANS)

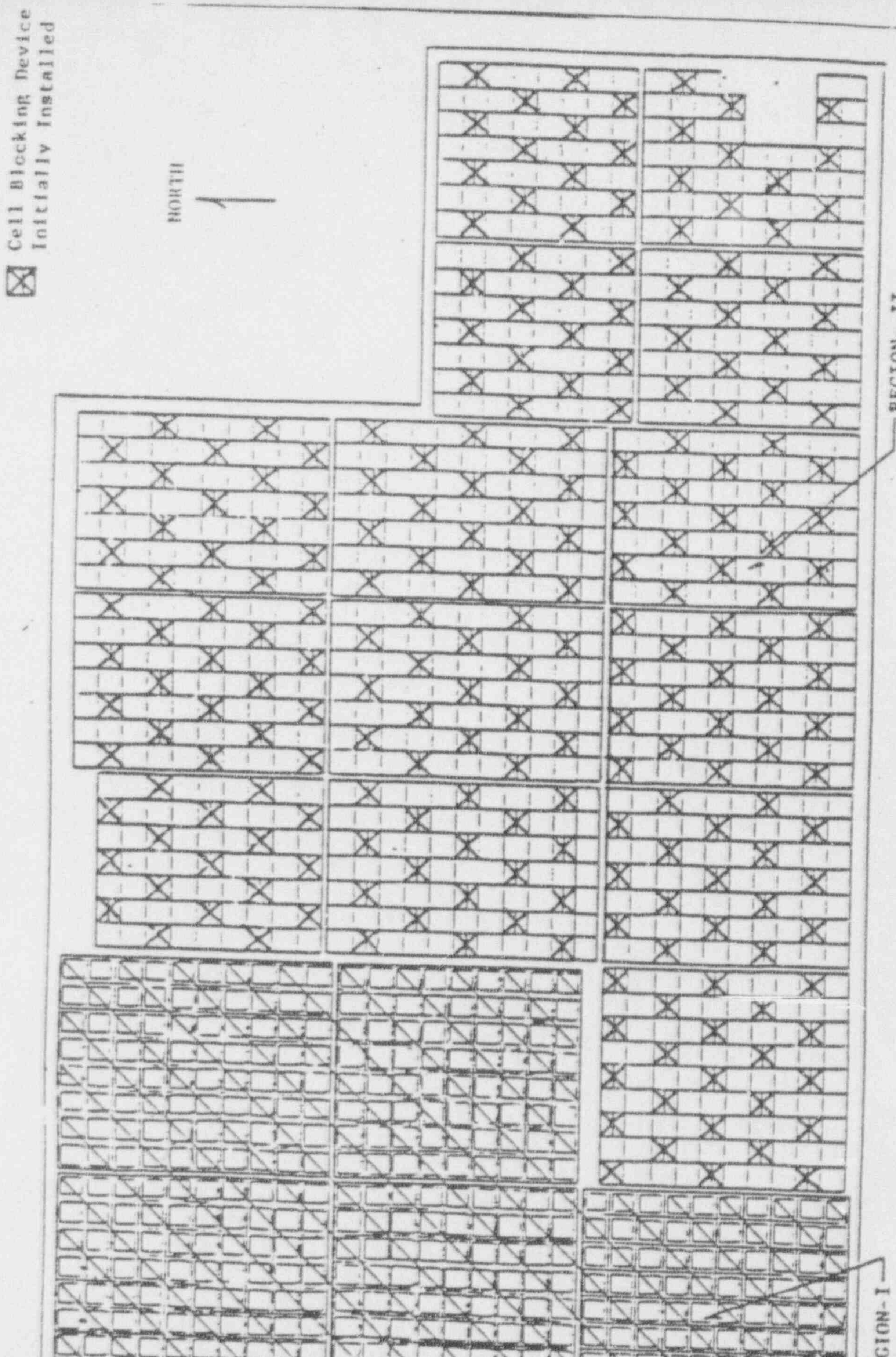

FIGURE 1

SPENT FUEL POOL ARRANGEMENT

BEFORE AMENDMENT 158

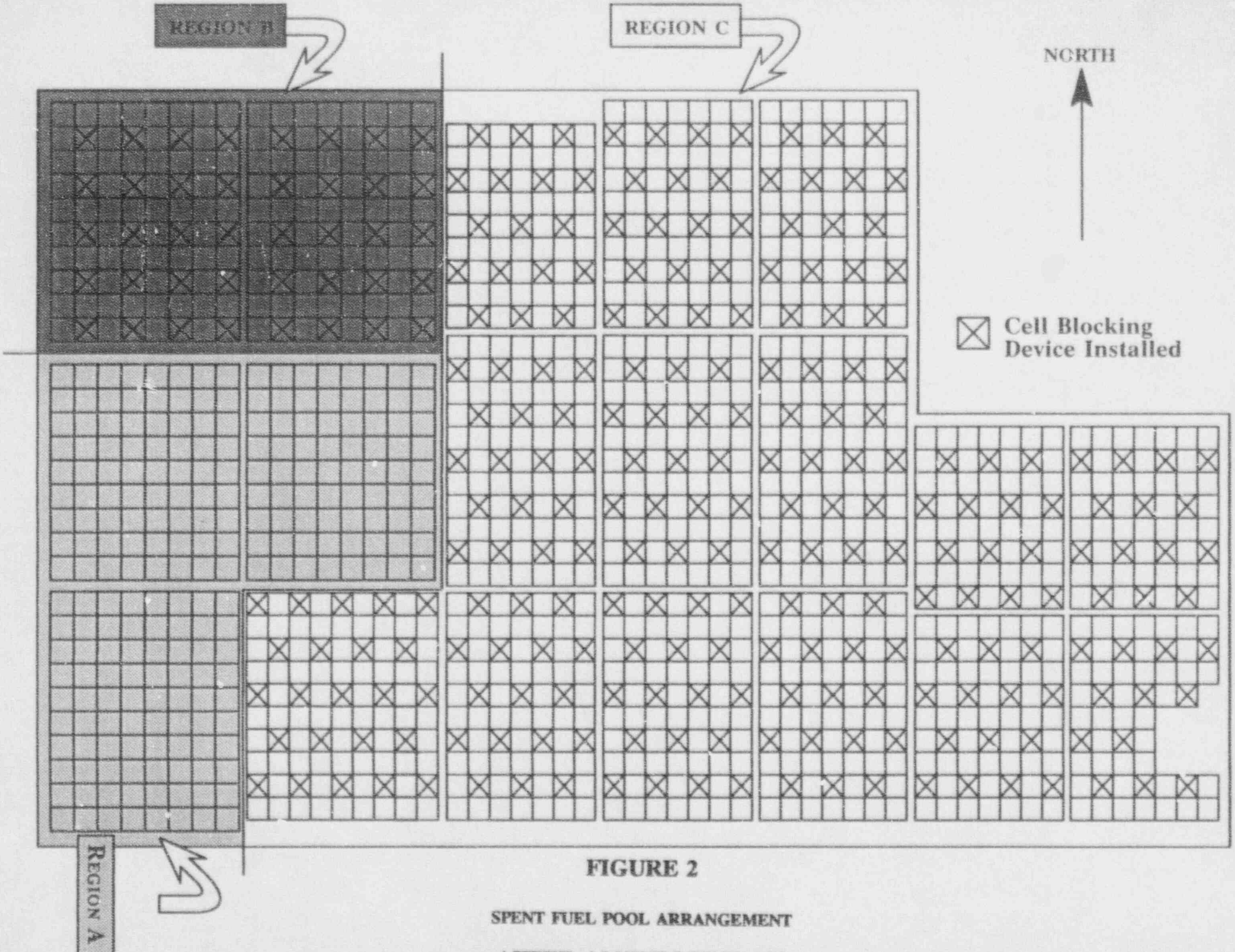

FIGURE 2

SPENT FUEL POOL ARRANGEMENT

AFTER AMENDMENT 158